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Long-Run Pricing Performance of Initial Public Offerings (IPOs) in Pakistan

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Abstract:

This study investigates the long-run pricing performance of 90 IPOs listed on the Karachi Stock Exchange from 1995 to 2010. This study finds evidence that IPOs show signs of underpricing and underperform over three years after listing; however, the observed pattern of underperformance is not always statistically significant. The equal-weighted buy-and-hold abnormal returns and calendar-time analysis confirm the significance of the IPO underperformance over the three year period after listing on the exchange. Extreme bounds analysis is used to test the sensitivity and robustness of twenty six explanatory variables in determining the IPO underperformance. The results reveal that the robust predictors of IPO underperformance include underpricing, financial leverage, age of the firm and oversubscription for buy-and-hold return calculations and underpricing, hot activity period, post issue promoters' holding, issue proceeds and aftermarket risk level for cumulative abnormal return calculations. Moreover, the fads hypothesis and the window of opportunity hypothesis are applied to explain long-run IPO performance.

Keywords: Initial Public offerings, Underperformance, Extreme Bounds Analysis

1. INTRODUCTION

A cursory review of the literature related to IPO pricing and performance has typically focused on two generic time horizons: (A) Short-term and (B) Long-term. In studies of short-term IPO perfor-

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mance, researchers have found that IPOs are significantly underpriced [Ibbotson (1975); Ritter (1984)]. The focal point of this study is to examine IPO performance over the second horizon or to examine whether IPOs underperform their respective benchmarks over longer-term time horizon. Ritter (1991) documented the existence of IPO underperformance up to three to five years after listing.

Researchers have attempted to estimate the long-term post-IPO performance using event- and calendar-time methodologies, but their findings are inconclusive [e.g., Agarwal, *et al.* (2008); Loughran and Ritter (1995); Omran (2005)]. Nevertheless, the empirical evidence, in terms of long-run IPO performance, seems to be less concrete when compared against studies of shorter-term abnormal performance and the reasons for this are as follows: (a) long-term pricing behaviour causes researchers to have reservations about aftermarket efficiency [Ritter (1991)]; (b) to exploit the underpricing and performance, investors would have to rely on actively trading Strategies; and (c) there a substantial variations in the results of the underpricing if researchers use different methodologies to detect abnormal performance. Considering above areas of concern, there has been a long standing debate about the magnitude of the long-term abnormal performance in the IPO research.

Ritter and Welch (2002) argued that the results of long-term abnormal performance are highly sensitive to the methodology applied for identification of abnormal performance and the time horizon examined. A generally accepted theory, thus, remains elusive to researchers. Empirical research for measuring post-IPO performance in emerging markets is limited when compared against developed countries. Preliminary studies, Sohail and Nasr (2007) took initiative to gauge one-year performance of IPOs in Pakistan and found the existence of underperformance. Subsequently, Rizwan and Khan (2007) analyzed IPO performance for two years after listing and documented that the IPOs produced negative abnormal returns. In India, Sahoo and Rajib (2010) investigated the three-year performance of 92 IPOs and reported that there was an existence of underperformance after adjusting for the benchmark's index return up to one-year after listing but not thereafter. Accordingly, we employed both the event- and calendar-time

methodologies to detect long-term abnormal IPO performance over a three-year period from 1995 to 2010.

This study finds that IPOs underperform over the sized based matched firm index over a three-year period after listing their shares for public trading. The EBA technique is used to identify the true predictors of IPO underperformance and the researcher found that: underpricing, financial leverage, age, oversubscription and affiliation with the textile industry a statistically significant predictors of long-term IPO underperformance using the Buy-and–Hold Abnormal Returns (BHAR) methodology and underpricing, hot activity period, aftermarket risk level of the IPO, issuer proceeds, post issue promoters' holdings, affiliation with the technology and communication, engineering and other industries are statistically significant predictor of long-term IPO underperformance using the CAR methodology.

2. LITERATURE REVIEW

Long-term post-IPO pricing behaviour has been examined to analyze whether or not the investors are better off to hold on to IPOs in a longer window over 3- or 5-year. Jenkinson and Ljungqvist (2001) argued that investors' returns deteriorate if they hold on IPO stocks for a longer period. In support thereof, the researchers have provided empirical evidence that IPO underperform in long-term when measured against standard benchmark [Ritter (1991); Loughran and Ritter (1995)]. Conversely, Brav and Gompers (1997) and Zachary (2008) developed matching-firm techniques considering size, industry affiliation and book-to-market so as to reduce the potential biases for gauging abnormal performance.

Most of the studies argued that IPOs suffer long-term price underperformance because the magnitude of underperformance is lower as compared to standard benchmark used therefor. The results of long-term IPO performance depend on the methodology used to examine abnormal performance [see, Eckbo, *et al.* (2000); Loughran and Ritter (1995); Gompers and Lerner (2003)]. Jenkinson and Ljunqvist (2001) pointed out that the evidence of long-term performance is controversial because of researchers contrasting reporting results.

2.1 Theoretical Aspects

To explain long-term IPO performance, different theoretical explanations have been advanced. First, impresario or fads hypothesis explains the process of IPO issuance which does not instantly determine the value of new stocks. Overvaluation of shares, therefore, implies abnormal excess returns earned by the investors at the start of market trading [Aggarwal and Rivoli (1990)]. This hypothesis elaborates that investors earn excess returns on listing day which consequently correct overpricing resulting lower returns in long-term. Second, divergence of opinion hypothesis argues that optimistic investors may participate in the IPOs. The value of IPO shows ambiguity about the existence of variation in views with regard to optimistic and pessimistic investors. Because of surge of information, the disagreement of expectations reduces which results in price correction [Miller (1977)]. Third, window of opportunity hypothesis describes that IPOs during high trading periods are more expected to be overvalued as compared to other IPOs because of issuance of shares by young firms without having growth prospectus. This overvaluation fails to justify the valuation and stock prices are adjusted quickly with real valuation. Further, it reflects that high activity periods may be correlated with the lowest returns in long-term [Loughran and Ritter 1995)].

Fourth, entrenchment theory describes the relationship between the company control and long-term underperformance. Morck, *et al.* (1988) argued that ownership's control affects the risk of management entrenchment. High effect of entrenchment represents that IPO stocks underperform significantly in the long-term [Mazzola and Marchisio (2003)]. Fifth, agency cost elaborates the conflict of interest between managers and shareholders [Jensen and Meckling (1976)]. This assumes that long-term underperformance is the result of agency cost but when a firm issues a large number of shares, it reduces the shareholdings of the management. Hence, it may affect to maximize earning options and inflate agency cost. Consequently, this model explains the poor operating performance of post-IPO.

2.2 Empirical Evidences

Empirical findings argued that the abnormal performance depends on the methodology employed [Jenkinson and Ljungqvist (2001)]. Using the sample of 1,526 IPOs in the US market during the period 1975–1984, Ritter (1991) found that IPOs underperform significantly against matched-firm benchmark based on the size and industry affiliation in the 3-year period following the listing. Levis (1993) found the evidence of long-term underperformance considering 712 UK IPOs over 3-year period from 1980–1988. Hwang and Jayaraman (1995) investigated the long-term pricing performance of 182 Japanese IPOs over 3-year following the listing. They documented that both the value- and the equal-weighted CAR were significantly at 16.44% and-14.98%. Likewise, Espenlaub, *et al*. (2000) indicated that the sensitivity of long-term performance depends on the selection of empirical method. As noted by Canina, *et al.* (1998), the benchmark index is not an appropriate measure to investigate abnormal performance which creates survivorship, rebalancing and skewness biases. According to Lyon, *et al.* (1999), these biases could be eliminated by developing matched-firm benchmark considering size and/or book-to-market. The skewness problem can also be eliminated using bootstrapping test statistics. Gomper and Lerner (2003) measured the abnormal performance of 3,661 IPOs in US market over 5-year after listing during 1935–1972. In event-time BHARs, they found existence of underperformance while in CARs and calendar time strategies, it disappear i.e., no abnormal performance. To analyze the Canadian market, Kooli and Surat (2004) used 445 IPOs over the 5-year during the period 1991–1998, wherein the evidence of underperformance was found. They reported that observed pattern was not statistically significant sequentially as it depend on the choice of methodologies used. Their findings support the hot issue market and the fads hypothesis. Bessler and Thies (2007) analyzed 218 German IPO concluding that long-term performance relies on the benchmarks employed. Goergen, *et al.* (2007) found underperformance over the 3-year considering 240 UK IPOs during the period 1991–1995. Further, they found that the level of underperformance of small firms is more than the large firms. The study of Belghitar and Dixon (2012) provided

evidence of underperformance over 3-year using 335 UK IPOs during the period 1992–1996. Gounopoulos, *et al.* (2012) studied 254 Greek IPOs from 1994–2002 and found overperformance in first two years but not thereafter. A glimpse of past studies related to IPO underperformance is presented at Table 1.

In case of emerging markets, long-term post-IPO performance has been investigated by many researchers. Ahmad-Zaluki, *et al.* (2007) analyzed 454 Malaysian IPOs during 1990–2000 periods. They reported significant overperformance when event-time CARs and BHARs estimated using market benchmark but not upon matching-firms benchmark. The results of Fama-French (1993) three-factor model and value-weighted schema reported the non-existence of overperformance. In the Pakistani market, Sohail and Nasr (2007) studies one-year performance of 36 IPOs from January, 2000 to April, 2005 after listing and reported the average market adjusted CARs and BHARs at -19.67% and -38.10% respectively. Sehgal and Singh (2007) analyzed ten-year performance of 438 Indian IPOs during 1992–2006 and found that underperformance exist up to 3-year but not thereafter. Sahoo and Rajib (2010) documented underperformance of 92 Indian IPOs persisting up to one-year. It thereafter disappears during the sample period 2002–2006. Further, they found no evidence of underperformance over three-year following the offering date. Chen, *et al.* (2011) studied the performance of 934 Chinese IPOs from 1996–2005 over the 3-year period following the listing. Using equal-weighted BHAR, they found significant over performance but not for value-weighted BHAR. Further, no evidence is found regarding over performance/ underperformance applying CARs or calendar-time techniques. Prior research highlighted various explanatory variables which caused long-term IPO underperfor mance. To find the determinants through regression analysis, almost all the studies postulate that a few variables are significant while others are insignificant. In order to overcome the problem and identify the true predictors, few empirical studies have used the EBA method to examine the robustness of the explanatory variables. In this research, we use the EBA technique to find the influencing factors of long-term IPO underperformance.

Table 1. IPO Underperformance – Glimpse of Past Studies

Study	Period	Sample	Country	Abnormal Returns (%)	Underperfo-rmance up to months
Gounopoulos *et al*. (2012)	1994-2002	254	Greece	-16.12	36
Belghitar and Dixon (2012)	1992-1996	335	UK	-14.00	36
Jewartoski and Lizinska (2012)	1998-2008	142	Poland	-22.62	36
Su, *et a*l. (2011)	1996-2005	936	China	8.60	36
Sahoo and Rajib (2010)	2002-2006	92	India	41.91	36
Chi, WcWha and Young (2010)	1991-2005	114	New Zealand	-27.81	36
Chorruk and Worthington (2010)	1997-2008	141	Thailand	-25.39	36
Chi, Wang and Young (2010)	1996-2002	897	China	9.60	36
Sohail and Nasr (2007)	2000-2005	36	Pakistan	-38.10	12
Rizwan and Khan (2007)	2000-2006	35	Pakistan	-23.70	24
Goergen *et al.* (2007)	1991-1995	240	UK	-21.98	36
Ahmad-Zaluki et al. (2007)	1990-2000	454	Malaysia	-2.01	36
Drobetz *et al.* (2005)	1983-2000	53	Switzerland	-173.46	120
Kooli and Surat (2004)	1991-1998	445	Canada	-20.70	60
Gomer and Lerner (2003)	1935-1972	3661	USA	-33.40	60
Ritter and Welch (2002)	1980-2001	6249	USA	-23.40	36
Espenlaub *et al*. (2000)	1985-1992	588	UK	-21.30	60
Allen, *et al*. (1999)	1985-1992	143	Thailand	10.02	36
Ritter (1991)	1975-1984	1526	USA	-29.10	36
Levis (1993)	1980-1988	712	UK	-22.96	36

With regard to determinants of the long-term performance, researchers have identified different variables that significantly influence varying with the country-specific analyses, sample size, and time period. In a seminal paper, Kooli, L'her and Suret (2006) argued that underpricing, financial firms and analysts' long-term forecast of earnings growth are caused long-term IPO performance in the Canadian market. In the UK market, Goergen, *et al.* (2007) postulated that underpricing, percentage of equity at offering and average three years earnings before listing are influencing factors. Cai, Liu and Mase (2008) indicated that three-year underperformance in Chinese IPO is affected due to offer size, underpricing, oversubscription and growth rate in earnings using the CAR and the BHAR methodologies. Sahoo and Rajib (2010) found that Indian IPO market is affected due to underpricing, offer size, leverage, and timing of issue. Chen, *et al.* (2011) argued that the signaling and ex-ante uncertainty hypothesis support long-term underperformance but not the divergence of opinion hypothesis. They concluded that EPS, offer size, aftermarket risk, seasoned equity offerings are impacting factors of IPOs in Chinese market. Belghitar and Dixon (2012) identified that underpricing is a critical determinant to gauge three-year underperform

ance. Gounopoulos, *et al.* (2012) pointed out that activity period of IPO and ownership retention are important factors in determining long-term underperformance. For divergence of opinion hypothesis, the study of Jewartowski and Lizinska (2012) supported three year underperformance. Zarafat and Vejzagic (2014) argued that underpricing, offer size and book-to-market are affected the 3-year underperformance in the Malaysian IPO market.

3. DATA AND EMPIRICAL METHODOLOGY

In this study, we pooled data from a variety of sources to produce the most accurate reflection of the population. The potential sources that we used to obtain data are the Securities and Exchange Commission of Pakistan (SECP), Karachi Stock Exchange (KSE) database, and financial websites (The News, DAWN and Business Recorder). The goal of this study was to identify all IPOs went public in the 16-year period from January, 1995 to December, 2010. For the 1995 to 1998 period, we collected prices of stocks from the daily quotations of the Karachi Stock Exchange. The firm related characteristics are gathered from IPO prospectus and stock prices are collected through KSE database. After searching through the preceding resources for pricing and other relevant data, if we were unable to obtain the data using the identified resources, we decided to drop the IPOs from the analysis and therefore, final sample includes 90 IPOs. We used this sample for the analyses conducted on long-term IPO performance. In long-term analyses, monthly abnormal IPO performance is examined over the period of three-year.

Empirical findings argue that the results are highly sensitivity depending on the methodology used [(Eckbo, *et al*. (2000); Gompers and Lerner (2003)]; therefore, researchers do not rely on the single methodology. Hence, we employ both event- and calendar-time strategies to examine the long-term abnormal IPO performance over a period of 36 months. The relationship of long-term performance is examined on issue proceeds, initial returns and hot and cold activity periods. To identify the true explanatory variables of long-term abnormal IPO performance, we tested them through the EBA technique.

Initially, Ritter (1991) found that IPOs significantly underperform in long-term as compared to the benchmark. Empirical findings support this argument that IPOs outperform on the initial trading day because underpricing is a short-term phenomenon for decades. However, if investors hold on IPOs for a longer period, the prime object is to earn abnormal returns persistently as a result of which Ritter rejects the hypothesis of market efficiency. Many researchers attempted to measure long-term IPO performance using generic methodologies along with simulations as the results are highly sensitive to the choice of method. Thus, the researchers do not agree on a single methodology. The variations in the results occur due to: (1) which benchmark is employed; (2) selection of study period; and (3) statistical inferences are biased.

3.1 Buy-and-Hold Abnormal Returns

Barber and Lyon (1997) argued that BHARs measure investors' experience in a precise manner. Under this approach, the abnormal returns are compounded over a specific time period. Since this methodology truly captures an investor's experience, thus, it is considered as one of the important techniques to measure the abnormal performance [Mitchell and Stafford (2000)]. To measure the long-term IPO performance, we examined the BHAR comparing the sized based matched firm index computed by the market capitalization. Abnormal returns are measured over a period of 36 months excluding initial day returns. According to Loughran and Ritter (1995), BHAR is used to examine the performance of event firm *i* at time period *T* as:

$$BHR_{i,T} = \left[\prod_{t=1}^{T}(1 + R_{i,t}) - 1\right] \quad \ldots (1)$$

Following Ritter (1991) and Barber and Lyon (1997), the BHAR for event firm *i* at time *t* adjusted for a sized based matched firm benchmark is calculated as:

$$BHAR_t = \left[\prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{mf,t})\right] \quad \text{... (2)}$$

where,

$R_{i,t}$: monthly return of IPO firm *i* at time *t*;

$R_{mf,t}$: monthly return of sized based matched firm benchmark; and

T : time period for which the BHARs is measured describing returns are compounded where investors buy stock at first trading day and hold it until 3-year anniversary[1].

To test the significance that the equal- and value-weighted BHAR is equal to zero, Lyon, Barber and Tsai (1999) suggested the skewness adjusted *t*-statistics. It is computed as under:

$$t = \sqrt{n} \times \left(S + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6n}\hat{\gamma}\right) \quad \text{... (4)}$$

$$S = \frac{\overline{BHAR}_T}{\sigma(BHAR_t)} \text{ and } \hat{\gamma} = \frac{\sum_{i=1}^{n}(BHAR_i - \overline{BHAR})^3}{n\sigma(BHAR_t)^3} \quad \text{... (5)}$$

where,

$\overline{BHAR}_T$: Sample mean buy-and-hold abnormal returns

$\sigma(BHAR_t)$: Standard deviation of abnormal returns

N : Event firms in the sample

$\hat{\gamma}$: An estimate of the coefficient of skewness. Adjusted *t*-statistics is used to overcome skewness problem.

To test the mean monthly buy-and-hold abnormal equal to zero, hypothesis 1 is developed:

$$H_{0:} \quad \overline{BHAR}_{1-36\,month} = 0$$

$$H_{1:} \quad \overline{BHAR}_{1-36\,month} \neq 0$$

[1] During the return estimation period, delisted firms have excluded from the sample.

3.2 Cumulative Abnormal Returns

This method accumulates the monthly abnormal returns of IPOs over a particular time period. To detect the abnormal returns, we examined the CAR methodology using sized based matched firm index over the period of 36 months. The abnormal returns ($AR_{i,t}$) for event firm *i* initiating in period *t* is computed as:

$$AR_{i,t} = \left[R_{i,t} - \frac{1}{n} \sum_{t=1}^{n} R_{mf,t} \right] \quad \ldots (6)$$

where $R_{i,t}$ = the event firm's *i* monthly return at time *t* and $R_{mf,t}$ = the sized based matched firm's return of the subsequent period. Following Lyon, Barber and Tsai (1999: p. 192), the τ-period cumulative abnormal return ($CAR_{i\tau}$) for firm *i* commencing in period *s* is measured as:

$$CAR_{i\tau} = \sum_{t=s}^{s+\tau} \left[R_{i,t} - \frac{1}{n_t} \sum_{t=s}^{s+\tau} R_{mf,t} \right] \quad \ldots (7)$$

CAR is estimated from the first trading price and the cumulative mean return of sized based matched firm benchmark[1] for month 1 to 36. Since CAR is less skewed than BHAR, conventional *t*-statistics provides well specified results. Ritter (1991) suggested following *t*-statistics and computed as:

$$t_{CAR_{1,t}} = CAR_{1,t} \times \sqrt{\frac{n_t}{t \times var + 2(t-1) \times cov}} \quad \ldots (8)$$

where,

n_t	:	event firms trading in each month
Var	:	the mean of variations over 36-month of the $AR_{i,t}$
Cov	:	the first order auto-covariance of the AR_t series

[2] $w_i = 1/n$ (equal-weighted) and $w_i = MV_i/\Sigma_i MV_i$ (value-weighted) where MV_i denotes market value (outstanding shares x listing price) of the event firm *i*.

Aggregate abnormal returns are tested to find that mean cumulative abnormal is equal to zero over the period of 36-month. Thus, we developed hypothesis 2:

$$H_{0:} \quad \overline{CAR}_{1-36\,month} = 0$$

$$H_{1:} \quad \overline{CAR}_{1-36\,month} \neq 0$$

3.3 Comparing the BHAR and CAR methodologies

The BHARs and CARs methodologies are two different techniques that researchers have used to gauge abnormal performance. The BHAR methodology emphasizes the returns that the investor would receive if they participated in each of the offerings and roll their proceeds to each subsequent offering and the CAR methodology indicates what the average experience of the investor was. Barber and Lyon (1997) and Lyon, Barber and Tsai (1999) argue that BHARs accurately mimic investors' returns but the CARs do not reflect the abnormal returns for an investor buying the event firms and shorting the benchmark over the full horizon. Mitchell and Stafford (2000) also concluded that the buy-and-hold strategy is only one of many possible investment strategies. After comparing both the methods, Barber and Lyon (1997) provided evidence that CARs are biased estimator of BHARs. When the benchmark index is used, CARs are seriously affected due to a new listing bias which results in an overstatement of the CAR's significance level. In contrast to the biases in CARs, Barber and Lyon (1997) further argue that BHARs are mostly affected by the periodic rebalancing of the benchmark portfolios. This bias arises because the market index or another matched portfolio changes its composition when firms list and delist whereas the composition of the event portfolio remains constant.

3.4 Calendar-time Approach

Brav, Geczy and Gompers (2000) and Brav and Gompers (1997) used the Fama-French 3-factor model to examine the abnormal returns of event firms on calendar-time portfolio. Mandelker (1974) employed the variations of this portfolio method. These variations are captured

using methods of calendar-time portfolio: (a) Fama-French (1993); and (b) Carhart (1997). The calendar-time approach has some benefits than the BHARs and CARs methodologies. Among sample firms, this approach eradicates the issue of cross-sectional reliance as the returns are compiled into single portfolio. Additionally, this method provides dynamic results in case of non-random samples.

3.4.1 The Fama-French Three-Factor Model

This model is employed to measure the excess return earn on the portfolio. Therefore, the return on a portfolio is composed of event firms excluding initial day returns that are issued within last three-year. To estimate the calendar-time return on the single portfolio, following regression is computed:

$$R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + \epsilon_i \quad \ldots (9)$$

where, R_{pt} is the portfolio return in month *t* calculated through equal- and value-weighted methods, R_{ft} is 3-month treasury bill rate in month *t*, R_{mt} is the return on the KSE-100 Index in month *t*, SMB_t is the return on a value-weighted portfolio of small minus large stocks in month *t* and HML_t is the return on a value-weighted portfolio of high minus low book-to-market stocks in month *t*. Large and small size stocks are segregated by top and below 30% market capitalization respectively. Likewise, high and low value stocks are classified as top and bottom 30% BM respectively. β_i, s_i and h_i denote the loadings of the portfolio on each factor; the market, SMB (size) and HML (value measured by BM). α_i is an intercept examining the null hypothesis, i.e., average monthly ab-normal return equals to zero. We estimate OLS using the Newey-West procedure [Newey and West (1987)] for removing the problems of heteroskedasticity and autocorrelation consistent standard errors.

3.4.2 The Carhart Four-Factor Model

The Carhart (1997) extends the Fama and French model. The Carhart four-factor model, thus, estimates the following regression:

$$R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + w_i WML_t + \epsilon_i \quad \ldots (10)$$

where, WML_t is the winner minus loser relating to the momentum factor. It is measured by classifying all firms as per stock returns of previous 11 months followed by average returns of top 1/3 stocks (high returns) minus the average returns of bottom 1/3 stocks (low returns). The intercept shows monthly abnormal returns earned on the portfolio and estimated through the Newey-West HAC standard errors

The abnormal returns obtained from the Fama-French and the Carhart models are tested using the hypothesis 3:

$$H_{0:} \quad Abnormal\ returns\ on\ portolio\ using\ FF\ and\ Carhart_{1-36\ month} = 0$$

$$H_{1:} \quad Abnormal\ returns\ on\ portolio\ using\ FF\ and\ Carhart_{1-36\ month} \neq 0$$

3.5 Determinants of Long-term IPO Performance

Prior research ascertained different explanatory variables which affected the long-term IPO performance. In a regression analysis, it is vital to identify robust determinants that truly influence IPO underperformance. Hence, we analyze the determinants of long-term underperformance using the EBA technique to select the robust predictors. The purpose is aimed to mitigate the uncertainty for selection of those factors that influence the long-term underperformance. The EBA technique can be described as

$$BHAR_i \text{ or } CAR_i = \alpha_0 + \sum_{j=1}^{n} \delta_i X_{ji} + \beta Q_i + \sum_{j=1}^{m} \gamma_i Z_{ji} + \varepsilon_i \quad \ldots (11)$$

where, X is an important variable(s) used in every regression, the robustness of Q is tested and Z is a prospective essential variable. Under this method, thousands of regressions are regressed to enquire that variable of interest maintains the same sign and its extreme values remains statistically significant. It will, thus, be a robust variable otherwise a fragile one.

Explanatory variables that may influence long-term IPO underperformance can be presented in following equation:

$$BHAR_i \text{ or } CAR_i = \alpha_o + \beta_1 UP_i + \beta_2 Industry_i + \beta_3 Sub_i + \beta_4 FinLev_i + \beta_5 Risk_i + \beta_6 Age_i + \beta_7 LT_i + \beta_8 P/BV_i + \beta_9 PSO_i + \beta_{10} ROA_i + \beta_{11} Hot_i + \beta_{12} PIPH_i + \beta_{13} FSize_i + \beta_{14} OPrice_i + \beta_{15} EPS_i + \beta_{16} OSize_i + \beta_{17} Mkt\_ret_i + \beta_{18} Mkt\_vol_i + \beta_{19} LDel_i + \epsilon_i \quad \ldots (12)$$

where,

BHAR and *CAR*		The equal-weighted buy-and-hold abnormal return and cumulative abnormal return adjusted sized matching-firms over the 36-month period;
UP	–	Underpricing i.e. market adjusted abnormal return on listing day;
Industry	+/–	Banks, other financial institutions, fuel and energy, chemicals, technology and communication, cement, engineering, textiles and other industries are used as dummy variables;
Sub	+	Oversubscription ratio which is defined as number of shares demanded by number of shares offered;
FinLev	+	Financial leverage of firm prior to IPO. It is derived as long-term debt to total assets;
Risk	+	Aftermarket risk level of the IPO. It is calculated as standard deviation of post-issue pricing of first 245 trading days;
Age	–	Age of event firm prior to listing. It is scaled as the difference between year of establishment and going public;
LT	–	Long-term investment ratio estimated by long-term investment to total assets;
P/BV	–	Offer price divided by book value;
PSO	–	Proportion of shares offered to the general public;
ROA	–	Rate of return on assets. It is estimated as net income by total assets;
Hot	–	A dummy variable if IPO is issued in hot activity period, it is classified as 1 and 0 otherwise;
PIPH	–	Post issue promoters' holding. It is measured through shares retained by promoters' group divided by total number of shares issued;

FSize	–	Firm size measuring by natural logarithm of total assets;
Oprice	–	Offer price which is natural logarithm of issue price;
EPS	–	Earnings per share is obtained by net income to number of shares outstanding;
OSize	–	Issue proceeds are obtained by logarithm of number of shares issued times offer price;
Mkt_vol	+	Standard deviation of market return over 3-month prior to IPO;
Mkt_ret	+	Market return estimated on KSE-100 index over 3-month prior to IPO; and

To find the determinants using BHARs and CARs, this study considered twenty-six variables, out of which two *X*-variables are selected as fixed used in each regression while from the rest of twenty-four variables, *Q* and *Z* variables are selected. Each of remaining twenty-four variables is chosen as the variable of interest *Q* of which robustness is examined. Three *Z*-variables are chosen from the rest of twenty-three, giving 42,504 regressions (1,771 regressions for each *Q*-variable) and in total 85,008 regressions.

Table 2 presents descriptive statistics of 90 IPOs issued from 1995 to 2010. Dependent variables include buy-and-hold abnormal returns (BHARs) and cumulative abnormal returns (CARs). Independent variables comprise underpricing (UP), oversubscription ratio (Sub), financial leverage (FinLev), aftermarket risk level of IPO (Risk), firm's age (Age), long-term investment ratio (LT), offer price to book value (P/BV), proportion of shares offered (PSO), rate of return on assets (ROA), post issue promoters' holding (PIPH), size of the firm (FSize), offer price (OPrice), earnings per share (EPS), issue proceeds (OSize), market return (mkt_ret), market volatility (mkt_vol) and listing delay (LDel). INDUSTRY (banks, other financial institutions, fuel and energy, technology and communication, cement, engineering, textiles, chemicals and others) and Hot activity period are considered as dummy variables.

Table 2. Descriptive Statistics of Variables

Variable	Mean	Median	Min. Value	Max. Value	S. D.	Skewness	Kurtosis
BHAR	-17.53	-18.21	-172.53	84.61	53.92	-0.61	0.55
CAR	-23.16	-22.14	-227.30	221.01	79.56	0.28	0.80
UP	15.27	5.30	-39.14	107.10	34.21	1.29	0.89
Sub	2.76	1.07	0.01	28.51	5.32	3.47	12.74
FinLev	17.22	4.69	0.00	78.00	22.04	1.12	0.10
Risk	4.73	3.77	1.27	19.34	3.15	2.50	7.33
Age	7.57	3.50	0.00	66.00	11.08	2.98	10.65
LT	4.51	0.00	0.00	52.52	12.05	2.77	6.62
P/BV	1.31	1.00	0.46	6.14	0.92	3.37	13.08
PSO	32.06	27.02	2.50	100.00	19.71	0.92	1.37
ROA	1.84	0.00	-12.54	26.73	4.93	2.30	9.71
PIPH	54.55	50.34	0.00	95.00	22.01	5.43	34.60
FSize	14,120	665	0.00	562,915	66,214	7.25	56.44
OPrice	20.12	10.00	10.00	235.00	29.30	5.43	34.60
EPS	2.06	0.00	-4.93	28.10	4.73	3.28	12.71
OSize	446.17	150.00	17.00	8,107.50	959.90	6.17	46.44
Mkt_ret	-2.11	0.30	-42.63	26.46	16.34	-0.21	1.15
Mkt_vol	1.40	1.28	0.79	2.91	0.46	-0.71	1.13
LDel	60.23	53.00	9.00	211.00	30.56	1.76	5.78

The returns of equal-weighted BHAR and CAR are estimated over the period of 36-month. Average and median BHAR and CAR are -17.53% and -18.21% and -23.16% and -22.14% respectively illustrating that the underperformance in BHAR is lower than CAR. IPOs are underpriced by 15.27% on average with a median underpricing of 5.30%. Overpricing and underpricing range between 39.14% and 107.10%. Oversubscription is 2.76 times on average and median value is more than one indicating that IPOs are slightly over subscribed. On average, financial leverage is 17.22% and the highest value is 78%. Small ratio of financial leverage interprets that IPO firms do not borrow huge financing before going public.

Aftermarket risk depicts the average value of 4.73% with a standard deviation of 3.15% showing the lesser fluctuations in post-issue pricing behaviour. Average age of the firms is 7.57 years. Seven firms having more than 25 years of age and by eliminating them, the average

age would be 4.92 years approaching close to median age of 3.50 years. The mean LT is 4.51% with a standard deviation of 12.05% describing that small proportion of long-term investment is made by IPO firms. P/BV is 1.31 times on average with the highest value of 6.14. Average PSO is 32.06% with a median value of 27.02% elaborating that most of the firms offer small proportion of shares to the general public. On an average, ROA is 1.84% while maximum value is 26.73%. This implies that IPO firms earned minimal income prior listing. Average PIPH is 54.55% with a median value of 50.34%. The mean value of F Size is PKR 14,120 million having standard deviation of PKR 66,214. By removing three largest firms, the average F Size decreases to PKR 3,866 million with a standard deviation of PKR 8,258 million.

The mean O Size is PKR 446 million. The lowest and the highest offer size are PKR 17 and 8,108 million respectively showing large variations in the sample due to inclusion of diversified IPOs. O Price per share is PKR 20.12 on average. Mkt_ret seems negative on average but with a small volatility in market returns. The mean and median listing delay is 60 and 53 days respectively. This large delay in days indicates uncertainty on the part of investors. Each firm earned PKR 2.06 per share on average representing meager income obtained by firms prior to IPO.

4. EMPIRICAL FINDINGS

4.1 Buy-and-Hold Abnormal Returns

BHARs predict the investors' experience in a precise manner [Barber and Lyon (1997)]. This method is based on the buy-and-hold investment strategy and measured by the geometric method. A positive BHAR reflects outperformance while a negative BHAR represents underperformance of IPOs. Table 3 examines the equal- and value-weighted BHARs for 1-36 month period after the listing. The result of the equal-weighted BHAR exhibits that IPOs significantly underperform over the period of three-year. Average 12-month BHAR shows that a zero investment in IPOs would have incurred a loss of -19.0% (*t*-statistics = -4.43). At the end of 24-month, average BHAR underperform by -15.3% (*t*-statistics = -2.88). Over a 36-month window, underper-

formance significantly increases to -24.2% (*t*-statistics = -4.07). This explains that, on average, purchasing of IPOs by the investors on the listing day and holding over a 3-year period can obtain significant negative abnormal returns. This finding is in accordance with that of Kooli *et al.* (2006) wherein they found significant negative abnormal returns over a period of 36-month adjusted for the matched-firm benchmark using 141 Canadian IPOs from 1986–2000.

When KSE-100 Index is employed as a market benchmark, IPO firms underperform in long-run. Average BHAR is obtained to be -28.0% (*t*-statistics = -4.71), -40.1% (*t*-statistics = -5.19) and -48.9% (*t*-statistics = -4.53), at the end of 12-, 24- and 36-month. In all the event windows, negative abnormal returns are highly significant at the 1% level. This indicates that IPO firms are not performing better than the market index resulting in generation of new listing and rebalancing biases. With an increase in time horizon, the results of BHARs show upsurge in negative abnormal returns which explain that benchmark index is performing better as opposed to sample IPOs in long-term. This finding is in line with the study of Cai, *et al.* (2008) whereby investors obtained significant negative returns over the period of 3-year using 335 Chinese IPOs from 1997–2001.

The results of the value-weighted BHARs demonstrate that IPO firms obtained less return as compared to sized based matched firm index. However, IPOs significantly underperform in the first 2-month period representing the intermediate underperformance but thereafter it provides no evidence of under or over performance over the 36-month period. At the end of 12 months, level of underperformance exists at -15.2% (*t*-statistic = -1.41). The underperformance reduces to -7.4% (*t*-statistic = -0.39) but improves later on to -19.8% (*t*-statistic = -1.61) at the 24- and 36-month respectively. Consistent with Chen, *et al.* (2011) in which they analyzed 936 Chinese IPO over the period of three-year and found that in the first 3-month, the results of value-weighted BHAR are significant but afterward no evidence of under or over performance is found. The value-weighted BHAR adjusted for benchmark index reports the underperformance of -33.1% (*t*-statistics = -2.19), -28.9% (*t*-statistics = -1.25) and -65.6% (*t*-statistics = -3.94) at the end of 12-, 24- and 36-month periods.

Table 3. Aftermarket Buy-and-Hold Abnormal Return (BHAR) of 90 IPOs, 1995-2010

Month	Equal-weighted				Value-weighted			
	$BHAR_{i,t}$	$BHAR_{mf,t}$	$BHAR_T$	t($BHAR_T$)	$BHAR_{i,t}$	$BHAR_{mf,t}$	$BHAR_T$	t($BHAR_T$)
1	-0.058	0.019	-0.077	(-4.15)***	-0.088	0.047	-0.135	(-2.43)**
2	-0.097	0.026	-0.123	(-4.86)***	-0.136	0.012	-0.148	(-2.26)**
3	-0.092	0.011	-0.103	(-3.71) ***	-0.087	0.054	-0.141	(-1.27)
4	-0.114	-0.010	-0.104	(-3.67) ***	-0.085	0.005	-0.090	(-1.09)
5	-0.110	0.018	-0.128	(-3.94) ***	-0.025	0.037	-0.062	(-1.04)
6	-0.123	0.009	-0.132	(-3.76) ***	-0.058	0.040	-0.099	(-1.11)
7	-0.154	-0.006	-0.149	(-4.20) ***	-0.019	0.060	-0.079	(-0.72)
8	-0.197	-0.026	-0.171	(-5.10) ***	-0.114	-0.034	-0.080	(-0.90)
9	-0.201	0.004	-0.205	(-5.80) ***	-0.143	-0.065	-0.078	(-0.67)
10	-0.188	0.014	-0.202	(-5.57) ***	-0.157	-0.071	-0.086	(-0.73)
11	-0.202	0.010	-0.212	(-5.92) ***	-0.227	-0.034	-0.193	(-1.59)
12	-0.172	0.018	-0.190	(-4.43) ***	-0.237	-0.085	-0.152	(-1.41)
13	-0.175	0.016	-0.191	(-4.14) ***	-0.235	-0.083	-0.152	(-1.57)
14	-0.186	-0.001	-0.185	(-4.15) ***	-0.221	-0.080	-0.142	(-1.40)
15	-0.175	-0.017	-0.157	(-3.12) ***	-0.244	-0.148	-0.096	(-0.74)
16	-0.204	-0.023	-0.181	(-3.58) ***	-0.301	-0.240	-0.061	(-0.57)
17	-0.205	-0.022	-0.183	(-3.26) ***	-0.235	-0.177	-0.058	(-0.52)
18	-0.208	-0.017	-0.190	(-3.55) ***	-0.222	-0.143	-0.079	(-0.55)
19	-0.211	-0.033	-0.177	(-3.56) ***	-0.175	-0.069	-0.106	(-0.55)
20	-0.208	-0.013	-0.195	(-3.91) ***	-0.211	-0.077	-0.134	(-0.88)
21	-0.207	-0.022	-0.184	(-3.63) ***	-0.237	-0.112	-0.126	(-0.75)
22	-0.205	-0.050	-0.156	(-3.00) ***	-0.175	-0.115	-0.060	(-0.33)
23	-0.186	-0.066	-0.121	(-2.32)**	-0.146	-0.125	-0.021	(-0.07)
24	-0.203	-0.050	-0.153	(-2.88)**	-0.124	-0.050	-0.074	(-0.39)
25	-0.207	-0.053	-0.153	(-3.07) ***	-0.161	-0.087	-0.074	(-0.48)
26	-0.197	-0.048	-0.149	(-2.78)**	-0.166	-0.085	-0.081	(-0.51)
27	-0.196	-0.053	-0.143	(-2.95) ***	-0.142	-0.085	-0.057	(-0.30)
28	-0.211	-0.053	-0.158	(-3.37)***	-0.160	-0.087	-0.073	(-0.43)
29	-0.216	-0.034	-0.182	(-3.55)***	-0.164	-0.095	-0.069	(-0.41)
30	-0.207	-0.019	-0.187	(-3.36)***	-0.214	-0.110	-0.104	(-0.63)
31	-0.197	0.009	-0.206	(-3.60)***	-0.183	-0.083	-0.100	(-0.51)
32	-0.179	0.024	-0.203	(-3.68)***	-0.227	-0.096	-0.131	(-0.83)
33	-0.172	0.030	-0.202	(-3.78)***	-0.239	-0.124	-0.115	(-0.75)
34	-0.164	0.058	-0.222	(-3.91)***	-0.264	-0.103	-0.160	(-1.16)
35	-0.186	0.049	-0.235	(-4.16)***	-0.323	-0.135	-0.188	(-1.43)
36	-0.175	0.067	-0.242	(-4.07)***	-0.330	-0.132	-0.198	(-1.61)

Note: Sample covers 90 IPOs issued on KSE from 1995 to 2010 representing equal- and value-weighted BHAR for 1-36 month after listing. $BHAR_t$ is computed as $BHAR_t = \left[\prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{mf,t})\right]$ where $R_{i,t}$ and $R_{mf,t}$ are returns of event firm *i* and its sized based matched firm index respectively at time period *t*. The *t*-statistics are shown in parentheses. *** and ** indicate statistical significant at the 1 and 5% level respectively.

4.2 Cumulative Abnormal Returns

Table 4 reports the equal- and value-weighted cumulative abnormal returns for 1-36 month period after listing. The equal-weighted

CARs represent that IPOs underperform over the three-year period. Average underperformance is statistically significant in all the event windows except on the 22-, 29- and 32-trading month. For example, IPOs underperform by -19.9% (*t*-statistic: -2.00), -18.6% (*t*-statistic: -1.96) and -23.2% (*t*-statistic: -2.37) after the 12-, 24- and 36-month periods respectively. This demonstrates that IPO firms perform slightly better than sized based matched firm index during the period from 22 to 31-month wherein the underperformance deteriorates. Using benchmark index, the average CAR is found to be -27.3% (*t*-statistic: -2.74), -36.3% (*t*-statistic: -3.85) and -36.3% (*t*-statistic: -3.71) at the end of 12, 24 and 36-month respectively. This shows that IPO firms are unable to compete benchmark index.

The results of value-weighted CARs show that IPOs underperform over the sample period and found the statistical significance in most of the cases. For instance, underperformance reflects at -24.6% (*t*-statistic: -2.48) after one-year and -18.9% (*t*-statistic: -1.99) after two-year. On the third-year window, the value-weighted CAR is reported at -23.4% (*t*-statistic: -2.40) explaining that IPOs obtained significant negative abnormal returns if investing on the listing date and holding on up to three-year. This evidence is consistent with prior studies [e.g., Ahmad-Zaluki, *et al*. (2007)]. The results of value-weighted CAR employing benchmark index reflect that IPOs significantly underperform at -43.6% (12-month), -26.8% (24-month) and -51.4% (36-month).

In conclusion, the results of long-term abnormal IPO performance depend on the methodologies used to measure abnormal returns. Both the BHAR and CAR in the light of equal- and value-weighted schema posit that event firms obtain less return as compared to sized based matched firm index and benchmark index. During the examination of 36-month, the equal-weighted BHAR and CAR significantly underperform. In value-weighted BHAR, IPOs significantly underperform only in first two-month but find no evidence of under or overperformance thereafter. Further, the results of value-weighted CAR incur negative abnormal returns which are significant in most of the cases over the period of three-year.

Table 4. Aftermarket Cumulative Abnormal Return (CAR) of 90 IPOs, 1995-2010

Month	Equal-weighted				Value-weighted			
	ARt	*t(ARt)*	*CARt*	*t(CARt)*	*ARt*	*t(ARt)*	*CARt*	*t(CARt)*
1	-0.077	(-4.40)***	-0.077	(-4.40)***	-0.135	(-4.13)***	-0.135	(-7.67)***
2	-0.044	(-2.58)**	-0.121	(-5.03)***	-0.019	(-0.54)	-0.154	(-6.38)***
3	0.027	(1.40)	-0.094	(-2.78)**	0.023	(0.63)	-0.130	(-3.86)***
4	0.001	(0.06)	-0.093	(-2.95)***	0.045	(3.07)***	-0.085	(-2.71)**
5	-0.029	(-1.85)*	-0.122	(-3.49)***	0.037	(0.66)	-0.049	(-1.40)
6	-0.010	(-0.60)	-0.132	(-3.29)***	-0.041	(-1.05)	-0.090	(-2.26)**
7	-0.021	(-1.03)	-0.153	(-2.79)**	-0.001	(0.04)	-0.091	(-1.66)
8	-0.026	(-1.70)	-0.179	(-4.18)***	-0.002	(-0.02)	-0.093	(-2.17)**
9	-0.046	(-2.68)**	-0.225	(-4.31)***	-0.050	(-0.65)	-0.143	(-2.75)**
10	0.013	(0.65)	-0.212	(-3.28)***	-0.003	(-0.19)	-0.146	(-2.27)**
11	-0.019	(-1.50)	-0.231	(-5.42)***	-0.136	(-2.11)**	-0.282	(-6.64)***
12	0.032	(1.13)	-0.199	(-2.00)*	0.036	(1.11)	-0.246	(-2.48)**
13	-0.008	(-0.46)	-0.207	(-3.22)***	-0.011	(-0.83)	-0.257	(-4.01)***
14	0.019	(1.14)	-0.188	(-3.05)***	0.034	(1.55)	-0.223	(-3.63)***
15	0.008	(0.41)	-0.180	(-2.48)**	-0.021	(-0.16)	-0.244	(-3.36)***
16	-0.024	(-1.79)*	-0.204	(-3.85)***	0.036	(0.21)	-0.208	(-3.93)***
17	-0.008	(-0.52)	-0.212	(-3.21)***	0.144	(0.40)	-0.064	(-0.97)
18	-0.005	(-0.35)	-0.218	(-3.30)***	-0.060	(-2.11)**	-0.123	(-1.87)*
19	0.017	(0.87)	-0.201	(-2.34)**	-0.088	(-3.07)***	-0.211	(-2.46)**
20	-0.015	(-0.63)	-0.216	(-1.97)*	-0.020	(-0.48)	-0.231	(-2.11)**
21	0.008	(0.47)	-0.209	(-2.85)**	-0.012	(-0.23)	-0.243	(-3.32)***
22	0.028	(1.23)	-0.180	(-1.66)	0.079	(0.85)	-0.164	(-1.51)
23	0.030	(1.72)*	-0.151	(-1.83)*	0.043	(1.04)	0.121	(-1.47)
24	-0.036	(-1.84)*	-0.186	(-1.96)*	-0.068	(-1.35)	-0.189	(-1.99)*
25	0.016	(0.87)	-0.170	(-1.83)*	0.048	(2.42)**	-0.141	(-1.53)
26	0.023	(1.41)	-0.147	(-1.78)*	0.000	(-0.01)	-0.142	(-1.72)*
27	0.003	(0.24)	-0.144	(-2.06)**	0.023	(1.71)*	-0.118	(-1.70)
28	0.001	(0.08)	-0.143	(-1.73)*	-0.002	(-0.18)	-0.121	(-1.46)
29	-0.012	(-0.64)	-0.155	(-1.58)	0.005	(0.24)	-0.116	(-1.19)
30	-0.004	(-0.23)	-0.158	(-1.78)*	-0.033	(-0.65)	-0.149	(-1.67)
31	-0.003	(-0.19)	-0.161	(-2.17)**	-0.012	(-0.80)	-0.160	(-2.16)**
32	0.011	(0.65)	-0.150	(-1.62)	-0.033	(-0.77)	-0.193	(-2.09)**
33	-0.037	(-2.72)**	-0.187	(-2.39)**	0.005	(0.61)	-0.188	(-2.40)**
34	-0.018	(-1.16)	-0.205	(-2.30)**	-0.023	(-0.75)	-0.211	(-2.38)**
35	-0.034	(-2.54)**	-0.239	(-3.03)***	-0.028	(-0.69)	-0.239	(-3.04)***
36	0.007	(0.43)	-0.232	(-2.37)**	0.005	(0.39)	-0.234	(-2.40)**

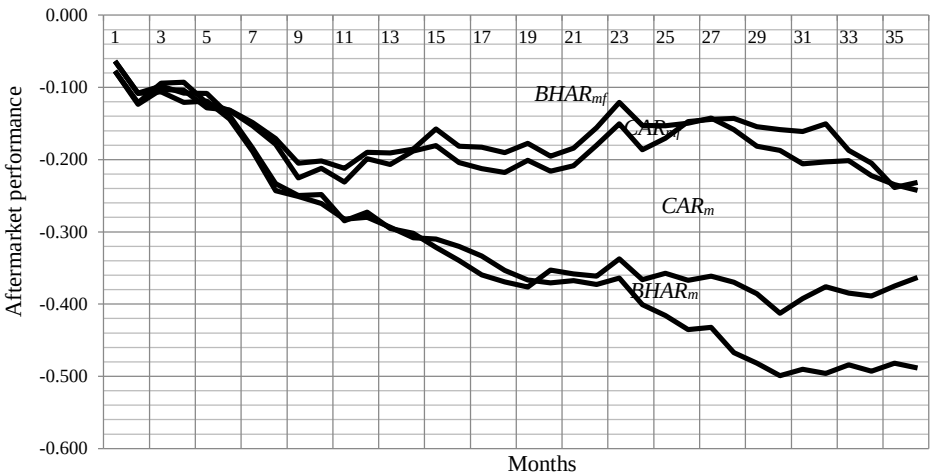
Note: Sample covers 90 IPOs issued on KSE from 1995 to 2010 representing equal- and value-weighted CAR for 1-36 month after listing. The *t*-statistics are shown in parentheses. ***, ** and * indicate statistical significant at the 1, 5 and 10% level, respectively.

Graphically, the BHARs and CARs can be presented for 1-36 months after the listing of 90 IPOs issued during the sample period:

Figure 1 demonstrates that both the equal-weighted BHARs and CARs adjusted for sized based matched firm index and benchmark index significantly underperform over the period of 36-month. When the abnormal returns are adjusted through sized based matched firm index,

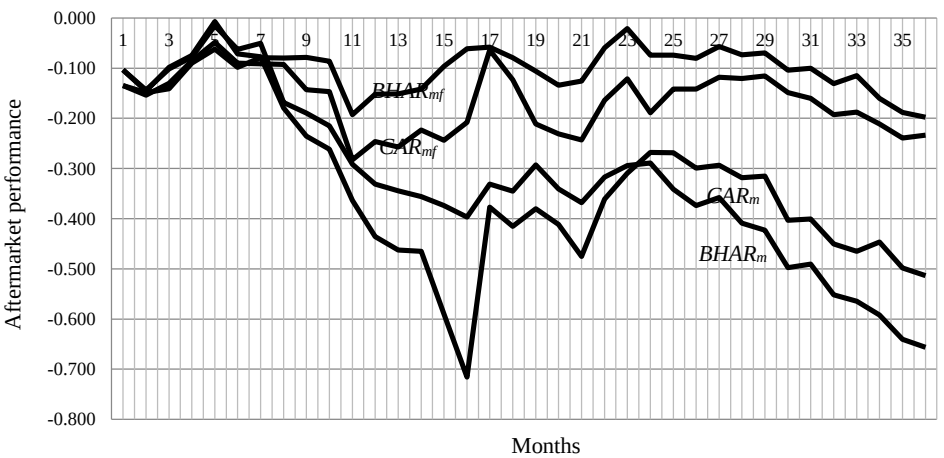
underperformance is lower as compared to benchmark index. Higher underperformance in case of benchmark index is attributed to new listing and rebalancing biases. Similar to equal-weighted methodologies, abnor-

Figure 1. Aftermarket Performance of IPO Using the Equal-Weighted BHAR and CAR Methodologies.



Note: The sample covers 90 IPOs issued on KSE during the period 1995–2010 depicting mean BHAR and CAR adjusted by sized matching-firm and benchmark index for 1-36 month period. $BHAR_{mf}$ describes BHAR adjusted sized matching firm benchmark and $BHAR_m$ shows BHAR adjusted benchmark index.

Figure 2. Aftermarket Performance of IPOs Using Value-Weighted BHAR and CAR Methodologies



Note: The sample covers 90 IPOs issued on KSE during the period 1995–2010 depicting BHAR and CAR adjusted by sized matching-firm and benchmark index for 1-36 month period. $BHAR_{mf}$ describes BHAR adjusted sized matching firm benchmark and $BHAR_m$ shows BHAR adjusted benchmark index

mal returns adjusted by benchmark index is also higher than sized based matched firm index using value-weighted schema (Figure 2). However, it can be inferred that observed pattern of underperformance is not always statistically significant. In nutshell, it is argued that the magnitude of underperformance is lower when the abnormal returns are adjusted for sized based matched firm index which supports the earlier findings [Ang and Zhang (2004); Lyon, *et al.* (1999); Barber and Lyon (1997)].

4.3 Discussion of Long-Term Performance in Comparing the Prior and Current Researches

Table 5 presents a comparison of the equal-weighted BHAR and CAR results which are compared to prior studies of long-run abnormal IPO performance. Panel A reports the results of the long-run abnormal performance when researchers used the benchmark index. Sohail and Nasr (2007) measured the one-year performance and found that investors obtained negative returns of –38.10% using BHAR methodology and –19.67% when employing the CAR methodology. In another study, Rizwan and Khan (2007) analyzed the two-year performance using the BHAR methodology and documented negative returns of –23.68%. They also determined that IPOs generated an underperformance of -11.26% over the period of one-year. This study examines three-year long-run IPO performance using the equal- and value-weighted BHAR and CAR methodologies. For comparison purposes, the results of only the equally-weighed BHARs and CARs are reported. Using the benchmark index, this study finds that the level of underperformance increased over the three-year period when the BHAR is employed. Whereas the level of underperformance identified using the CAR methodology increases over the first two-years but remains constant in the third-year. Lyon, Barber and Tsai (1999) argued that the results of longer-term analyses are affected due to rebalancing, survivorship, and skewness biases when the benchmark index is used. To overcome these biases, this study formulated a sized based matched firm index and subsequently found that IPOs underperform relative to sized matching firms; however, the level of underperformance is lower (Panel B).

Table 5. Comparison of Findings between Prior and Current Studies

Study	Period	IPOs	BHAR			CAR		
			1-year	2-year	3-year	1-year	2-year	3-year
Panel A: Benchmark Index								
Sohail and Nasr (2007)	2000-05	36	-38.1% (-4.62)***	-	-	-19.7% (-1.82)*	-	-
Rizwan and Khan (2007)	2000-06	35	-11.3% (-0.78)	-23.7% (-1.26)	-	-	-	-
Present study	1995-10	90	-28.0% (-4.71)***	-40.1% (-5.19)***	-48.9% (-4.53)***	-27.3% (-2.74)**	-36.3% (-3.85)***	-36.3% (-3.71)***
Panel B: Sized based matched-firm index								
Present study	1995-10	90	-19.0% (-4.43)***	-15.3% (-2.88)**	-24.2% (-4.07)***	-19.9% (-2.00)*	-18.6% (-1.96)*	-23.2% (-2.37)**

***, ** and * indicate statistical significance at 1, 5 and 10% level.

4.4 Industry Clustering and Long-Term Abnormal IPO Performance

To add further depth to the analysis of long-term abnormal performance, the IPOs are evaluated on the basis of industry classification. Table 6 demonstrates the results test of the longer-term performance of firms that issued shares within the bounds of the study based upon industry affiliation using equal-weighted BHAR and CAR methodologies over a 36-month examination period. When the results of equal-weighted BHARs are evaluated, it is observed that IPOs obtain less return when compared to matching the firm's return on the basis of market capitalization in all the cases except the engineering and chemicals and pharmaceutical sectors. The textile sector (–57.3%) performed the worst, which was followed by the technology and communications (–42.7%) sectors; however, the chemicals and pharmaceuticals (15.1%) and engineering (7.5%) sectors yielded positive returns over the 36-month period. While examining the equal-weighted CAR, the banking industry (–50.1%) followed by the other sectors (–44.8%) categories produced negative returns; however, engineering (85.2%) and technology and communication (38.3%) registered positive

returns in three year period following the IPO using the CAR methodology.

4.5 Issue Proceeds and Long-Term Abnormal IPO Performance

Effect of issue proceeds on long-term abnormal IPO performance is examined by segregating the sample into size quartiles formed on the basis of gross proceeds. The results of equal-weighted BHAR exhibit that IPOs underperform over 36-month period in all groups (Table 7).

Lowest gross proceeds (<Rs.84m) depicts average BHAR of -35.3% (*t*-statistic: -2.96) and the highest gross proceeds (>Rs.450m) presents -27.7% (*t*-statistic: -2.35) illustrating that underperformance in the lowest proceeds is more than highest proceeds over 36-month examination period.

This indicates that small-size firms may have high risk as well as provision of less published information for the investors before going public. Thus, volatility of stock prices for small firms is more due to the fact that institutional investors have the ability to buy at large to manipulate the prices thereby resulting into uncertainty and speculation in future prices. On average, small size issues underperform (-25.5%, *t*-statistics = -3.09) slightly more than large size issues (-23.0%, *t*-statistics = -2.66). Table 7 reports the equal-weighted CAR describing underperformance in all the cases over 36-month period. Among others, issue proceeds ranging from Rs.85m to Rs.150m show low level of underperformance (-7.2%).

The quantum of long-run underperformance in small size issues (-16.3%, *t*-statistics = -1.01) is less than large size issues (-30.0%, *t*-statistics = -2.72), however, large size issues significantly underperform. This illustrates that small firms take more risk and subsequently their underpricing would be higher but eventually the excess returns diminish over a period of time thereby reducing the long-run performance of IPOs.

Table 6. Industry Clustering and Long-Term Performance

Industry	IPOs	*BHAR*				*CAR*			
		IPO Return		Sized matched firm Avg. return	Avg. Abnormal returns	IPO Return		Sized matched firm Avg. return	Avg. Abnormal returns
		Average	Median			Average	Median		
1. Financial institutions	10	-0.232	-0.364	-0.097	-0.285	0.084	0.128	-0.043	0.130
2. Fuel and Energy	11	-0.160	-0.298	0.041	-0.200	0.102	0.071	0.073	-0.018
3. Banks	10	-0.415	-0.462	-0.075	-0.340	-0.381	-0.306	-0.255	-0.501*
4. Textiles	10	-0.493	-0.560	0.081	-0.573**	-0.209	-0.350	1.112	-0.329
5. Investment Cos.	9	0.280	-0.372	0.396	-0.116	-0.138	-0.084	-0.101	-0.258
6. Tech. and Comm.	7	0.048	-0.192	0.475	-0.427	0.502	0.200	0.430	0.383
7. Chem.and Pharm.	7	-0.238	-0.459	-0.389	0.151	-0.133	-0.249	-0.318	-0.252
8. Cement	7	0.324	-0.743	0.560	-0.236	-0.208	-0.783	0.194	-0.328
9. Engineering	2	0.768	0.768	0.693	0.075	0.972	0.972	0.793	0.852***
10. Others	17	-0.514	-0.629	-0.229	-0.134*	-0.522	-0.576	-0.076	-0.448**
Total	90	-0.175	-0.399	0.067	-0.242***	-0.112	-0.103	0.120	-0.232**

Based on the industry classification, 90 IPOs are allocated into 10 industries. Then, 36-month abnormal return based on equal-weighted BHAR and CAR is calculated relative to sized based matching firms. The table reports number of IPOs in each industry, the average and median industry return and the corresponding average return of sized based matching firms measuring equal-weighted BHAR and CAR. Financial institutions include: leasing (6 Nos.) and insurance (4 Nos.). The last row provides these statistics for the full sample. ***, ** and * represent significance at 1, 5 and 10% level.

Table 7. Issue Proceeds and Long-Term Performance

Gross Proceeds Quartile	*N*	*BHART*	*t(BHAR$_T$)*	*CAR$_T$*	*t(CAR$_T$)*
< Rs.84 million	22	-0.353	(-2.96)**	-0.258	(-1.18)
Rs.85 million – Rs.150 million	23	-0.161	(-1.42)	-0.072	(-0.31)
Rs.151 million – Rs.450 million	22	-0.181	(-1.37)	-0.378	(-2.04)*
> Rs.450 million	23	-0.277	(-2.35)**	-0.225	(-2.02)*
Small size	45	-0.255	(-3.09)***	-0.163	(-1.01)
Large size	45	-0.230	(-2.66)**	-0.300	(-2.72)**
Small – Large		-0.025	(-0.19)	0.137	(1.94)*

Note: Sample covers 90 IPOs issued on KSE from 1995 to 2010. It demonstrates equal-weighted BHARs and CARs over 36-month after listing based on sized matching-firm. All IPOs are segregated on the basis of size quartiles. Rs.84 m, Rs.150 m and Rs.450 m are used as cut-offs points to first, median and third quartile values, respectively. Small group relates to firms of which issue sizes are less than Rs.150 m. ***, ** and * indicate statistical significance at the 1, 5 and 10% level, respectively.

4.6 Initial Returns and Long-Term Abnormal IPO Performance

It is imperative to examine the relationship between initial day returns and longer-term IPO performance. Table 8 reports the results of equal-weighted BHAR whereby overpriced IPOs underperform less than underpriced IPOs, which is contrary to earlier findings. Interestingly, the underperformance of both underpriced and overpriced IPOs are statistically significant. Generally, it may happen that lower the underpricing more the chances to deteriorate the IPO performance. The results of equal-weighted CAR show that overpriced IPOs underperform more than underpriced IPOs which is line with prior findings. The level of underperformance in overpriced IPOs is statistically significant leading to an impression that overpriced IPOs would underperform more in the long-run.

Table 8. Initial Returns and Long-Term IPO Performance

Initial Return	*N*	*BHAR$_T$*	*t(BHAR$_T$)*	*CAR$_T$*	*t(CAR$_T$)*
IR < -8.80%	22	-0.402	(-3.25)***	-0.628	(-4.95)***
-8.79% < IR < 5.25%	23	-0.057	(-0.49)	0.007	(0.04)
5.26% < IR < 28%	22	0.002	(0.01)	0.051	(0.23)
IR > 28%	23	-0.509	(-4.37)***	-0.361	(-1.46)

Note: Sample covers 90 IPOs issued on KSE from 1995 to 2010. The relationship is depicted between initial day returns and long-run performance using the equal-weighted BHAR and CAR over 36-month after listing comparing sized based matched firm index. IR – initial returns (i.e., initial market adjusted abnormal returns). *** indicates significance at the 1% level.

4.7 Long-Term Abnormal IPO Performance of Hot and Cold IPOs

The firms going public during hot activity period underperform more than those issued in cold period. Poor performance of hot IPOs in long-term is attributed to market timing where market optimism prevails resulting IPOs are overvalued. Subsequently, market determines the true value of IPOs which causes underperformance. Helwege and Liang (2004) defined 'hot' by number of IPOs in the offering month and found that IPO floated during hot activity period are performed worse than cold period.

Table 9. Long-Term Performance of Hot and Cold IPOs

Type of Issues	*N*	$BHAR_T$	$t(BHAR_T)$	CAR_T	$t(CAR_T)$
Hot issues	70	-0.216	-3.54***	-0.259	-2.29**
Cold issues	20	-0.336	-2.01*	-0.136	-0.75
Sample	90	-0.242	-4.07***	-0.232	-2.37**

Note: Sample covers 90 IPOs issued on KSE from 1995 to 2010. Long-run performance of hot and cold IPOs is observed using the equal-weighted BHAR and CAR adjusted for sized based matched firm index over 36 month after listing. ***, ** and * represent significance at the 1, 5 and 10% level, respectively.

Table 9 reports mean stock return of post-listing three-year BHAR and CAR for 90 IPO firms from 1995 to 2010 segregated by hot/ cold issues. Hot activity period is defined as $\geq$5 IPOs are issued in a year. From the results of mean BHAR, it appears that issues in hot period underperform less than cold period. However, underperformance in both periods is statistically significant. This finding does not corroborate the earlier studies [e.g., Helwege and Liang (2004)]. But this result is consistent with Ljungqvist, *et al.* (2006) and Trauten, *et al.* (2007) because large IPOs underperform less or small number of IPOs issued in different years. When mean CAR is used to examine the long-run performance of hot or cold issues, it is observed that hot issues underperform more than cold issues [Helwege and Liang (2004); Agathee, Brooks and Sannassee (2012)].

4.8 Calendar-time Approach

Table 10 presents the regression results using calendar-time approaches, i.e., the Fama-French model (Panel A) and the Carhart model (Panel B). Equal- and value-weighted monthly excess returns of the portfolio are the dependent variables while the excess market returns, size, book-to-market and momentum factors are considered as independent variables.

Panel A exhibits negative coefficient of intercepts in both the regressions. This clearly infers that IPO underperform over the period of three years when controlled through the market, size and value factors. When equal-weighed method is employed, the mean α is -28.0% and *t*-statistic shows monthly abnormal return as statistically significant. In case of equal-weighted, IPOs underperform by -18.0% (t-statistics = -16.13) indicating the significance of monthly abnormal return. Systematic risk (β) in case of equal-weighted portfolio is -0.20 as opposed to 0.06 in value-weighted portfolio. Negative β represents negative returns obtained by equal-weighted portfolio relative to market returns (significant at 5%) while positive β describes the value-weighted portfolio getting nominal returns than market returns by reducing the underperformance. The coefficient of *SMB* is negative in both the regressions as large firms are obtaining higher returns than small firms. This finding is in contrast to earlier findings [e.g., Chen, *et al.* (2011)]; because in developing markets large firms may attain more risk and subsequently acquire high returns. *SMB* in value-weighted portfolio is statistically significant. *HML* is positive in both equations elaborating that firms with high *BM* ratio may obtain higher returns relative to small *BM* ratio – insignificant effect [Ahmad-Zaluki, *et al.* (2007)].

Panel B depicts the results of the Carhart model wherein the coefficient intercepts are negatively representing that IPOs significantly underperform over the period of three-year using equal- and value-weighting schema. The systematic risk is negative in equal-weighted portfolio while it is positive in value-weighted portfolio. However, β in both regressions are statistically insignificant. Similar to the Fama-French model as described above, *SMB* is negative and *HML* is positive in both the equations. The coefficients of *SMB* and *HML* are significant

in value-weighted portfolio. *WML* is introduced by the Carhart that captures the momentum factor measuring winners (high returns) minus losers (low returns). In both the equal- and value-weighted portfolios, *WML* is positive showing that winners are obtaining higher returns than the losers. In addition, *WML* is statistically significant in value-weighting portfolio.

Table 10. Long-run Calendar-Time Portfolio Regressions

Panel A: Fama-French (1993) Three-Factor Model

	Dependent variable: Equally weighted IPO portfolio returns		Dependent variable: Value-weighted IPO portfolio returns	
Variable	Coefficient	*t*-test	Coefficient	*t*-test
Intercept	-0.280	-33.41***	-0.180	-16.13***
R_m–R_f	-0.203	-2.69**	0.060	0.96
SMB	-0.035	-0.16	-1.028	-44.19***
HML	0.090	0.40	0.034	1.56
Adj. R^2	0.187		0.991	
F-stat.	2.41*		4835.84***	

Panel B: Carhart (1997) Four-Factor Model

	Dependent variable: Equally weighted IPO portfolio returns		Dependent variable: Value-weighted IPO portfolio returns	
Variable	Coefficient	*t*-test	Coefficient	*t*-test
Intercept	-0.324	-12.50***	-0.115	-12.60***
R_m–R_f	-0.104	-1.17	0.035	0.48
SMB	-0.220	-0.86	-1.056	-26.93***
HML	0.230	0.89	0.059	-1.79*
WML	1.070	1.73*	0.109	1.32
Adj. R^2	0.272		0.991	
F-stat.	2.80**		3713.99***	

Note: Long run performance of 90 IPOs is investigated by calendar-time strategies from 1995 to 2010. The Fama-French (1993) model is estimated as: $R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_iSMB_t + h_iHML_t + \epsilon_{it}$ and the Carhart (1997) model is defined as: $R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_iSMB_t + h_iHML_t + w_iWML_t + \epsilon_{it}$. where R_{pt} = IPO portfolio return in month *t*, R_{ft} = 3-month t-bill rate, R_{mt} = return on KSE-100 index, SMB_t = portfolio return of small minus large size stocks, HML_t = portfolio return of high minus low value stocks, and WML_t = average portfolio return of winner minus loser stock. Large and small size stocks are segregated by top and below 30% market capitalization respectively. High and low value stocks are classified as top and bottom 30% BM respectively. Winners are losers are explained as top and bottom ⅓ average return of past 11 months. The *t*-statistics are based on the Newey-West HAC standard errors. ***, ** and * represent statistical significance at the 1, 5 and 10% level, respectively.

4.9 Determinants of Long-term Underperformance

To examine the determinants of long-term underperformance, EBA technique is used to test the sensitivity as well as robustness of the explanatory variables. The dependent variables comprise 36-month equal-weighted BHAR and CAR. The sensitivity results are presented below.

4.9.1 Some Preliminary Results

Using BHAR as the dependent variable, the preliminary regression includes the underpricing (UP) and financial leverage (FinLev) as *X*-variables. The regression can be specified as:

$$BHAR = \underset{(-2.63)}{-0.2000} - \underset{(-1.74)}{0.2886\,UP} + \underset{(1.61)}{0.4120\,FinLev} \quad \ldots(13)$$

Equ. (13) is estimated by the OLS method, Adj. $R^2 = 0.0382$, no. of IPOs = 90 and *t*-value are shown in parentheses. It appears that underpricing is the significant variable of long-term underperformance. Employing CAR as the dependent variable, *X*-variables include UP and hot activity period (Hot). The regression can be presented as:

$$CAR = \underset{(-1.93)}{0.3467} - \underset{(-2.18)}{0.5137\,UP} - \underset{(-3.33)}{0.6426\,Hot} \quad \ldots(14)$$

Adj. $R^2 = 0.1152$, no. of IPOs = 90, and *t*-value are shown in parentheses. Equ. (14) shows that UP and Hot are significantly affecting the long-term underperformance of IPOs.

4.9.2 Results of Basic Models using BHAR

To investigate the determinants of long-term underperformance, the 36-month equal-weighted BHAR is used as the dependent variable while the age of the firm (Age), oversubscription (Sub), proportion of shares offered (PSO) and Industry (Technology and Communication and Textiles) are considered as the *Q*-variables. Regression I (Table 11) presents the estimation results with all the *Z*-variables. The results show that the FinLev is the only significant factor from the *X*-variables which indicates that higher financial leverage will distort the financial health of the firm. However, no variable is statistically significant from the *Q*- and *Z*-variables. There exists a negative association between long-term investment ratio (LT) and underperformance which implies that long-term investment shows a modest signal towards an improvement of the firm's performance. Size of firm (FSize) and issue proceeds (OPrice)

demonstrated a negative relationship with underperformance; however, these findings support the ex-ante uncertainty hypothesis. The Mkt_vol variable produced a negative sign, which indicates that the higher volatility in post-issue pricing results in a lower level of underperformance. Prior to listing, high EPS reflects the window dressing of pre-IPO earnings through discretionary reporting of accruals [Teoh, *et al.* (1998)]; therefore, it documents that there is a negative association with post-IPO returns. Industries like banks, other financial institutions, engineering, chemicals, fuel and energy, cement and other have no effect on long-term underperformance.

Regression II exhibits the estimation results without *Z*-variables indicating that both X-variable, i.e., UP and FinLev are statistically significant. The coefficient of underpricing is negative and significantly affects long-run IPO returns [Ritter (1991); Kooli, L'her and Suret (2006); Kutsuna, Smith and Smith (2009)], which corroborates the signaling hypothesis. This implies that the higher initial returns produced consequently poor long-term performance, which indicates that the investors' initial expectation fails to continue in the following years. It can also be interpreted as excessive mispricing caused by information asymmetry which subsequently is corrected in the aftermarket.

The results also support the overreaction or fads hypothesis. The coefficient of financial leverage is positively significant at the 1% level (Sahoo and Rajib, 2010). This confirms that financial leverage creates uncertainty due to high debt servicing which leads to lower financial performance.Conversely, the low financial burden firms may underperform less because they have minor obligations to fulfill. The age of the firm is inversely proportional to long-term underperformance and significant at 10% level [Carter, *et al.* (1998); Goergen, Khurshed and Mudambi (2002)]. This illustrates that older firms perform much better than younger firms [Ritter (1991)] beacuse they have more resources to allocate efficiently to obtain positive returns resulting in lower underperformance. The coefficient of oversubscription is positively significant at 10% level [Omran (2005)], which implies that the initial enthusiasm fails to continue and this results in poor aftermarket performance. There exist a negative and insignificant relationship between PSO and underperformance, which emphasizes that the floatation

of a large proportion of shares will lower the underperformance because a diversified shareholder base may improve the firm's performance. Two industries (i.e., Technology and Communications and Textiles) pass the sensitivity tests and are included in the *Q*-variables. Both industries negatively affected the long-run IPO returns. The evidence of the negative return in textile sector is statistically significant at 1% level showing the existence of long-run underperformance over 36-month period.

Regression 1 shows that R^2 is 0.2914 and the adjusted R^2 is 0.0000. This implies that by adding the explanatory variables, the value of R^2 increases but insignificance of all the variables except FinLev, some variables pulls the effect of the others which converted adjusted R^2 into zero. The Adj. R^2 is 0.1907 in regression II indicating that most of the variables are significant. Thus, the EBA technique robustly identifies the true predictors of the explanatory variables.

4.9.3 Results of Basic Models using CAR

To examine the determinants of long-run underperformance, 36-month equal-weighted CAR is used as the dependent variable whereas the underpricing (UP) and hot activity period (Hot) are considered as the *X*-variables. Aftermarket risk level of the IPO (Risk), issue proceeds (OSize), offer price to book value (P/BV), post issue promoters' holding (PIPH) and technology and communications, engineering and other industries are considered as the *Q*-variables. Table 12 describes the estimation results of basic model including with and without *Z*-variables.

Regression III shows that the OSize, PIPH, technologies and communication and engineering industries are significant determinants while Risk, P/BV and Other have insignificant effect from the *Q*-variables. Negative relationship of LDel is observed contrary to earlier finding opposing to ex-ante uncertainty hypothesis. Then Mkt_ret is inversely proportion to underperformance which is contrasting earlier result. EPS, FinLev ROA and Mkt_vol are showing positive relationship with underperformance.

Table 11. Estimation Results of Benchmark Models – BHAR as Dependent Variable

Regression	With Z-variables (I)	Without Z-variable (II)
Constant	1.3001 (0.72)	0.0755 (0.62)
X-variables		
UP	-0.3828 (-1.67)	-0.4718 (-2.35)**
FinLev	0.5944 (1.70)*	0.6981 (2.50)**
Q-variables		
Age	-0.0766 (-0.81)	-0.1197 (-1.95)*
Sub	0.0166 (1.11)	0.0167 (1.72)*
PSO	-0.1470 (-0.23)	-0.2310 (-0.88)
Technology and Communication	-0.3246 (-0.90)	-0.3330 (-1.31)
Textiles	-0.6226 (-1.88)	-0.4281 (-2.84) ***
Z-variables		
Ldel	-0.2734 (-1.56)	
LT	-0.6211 (-0.85)	
FSize	-0.0058 (-0.40)	
Risk	0.3847 (0.17)	
Hot	-0.0183 (-0.10)	
Mkt_ret	-0.7162 (-1.48)	
Mkt_vol	-12.0548 (-0.78)	
EPS	-0.0099 (-0.51)	
ROA	0.5171 (0.28)	
P/BV	0.0142 (0.12)	
OSize	0.0107 (0.13)	
OPrice	-0.0297 (-0.12)	
Banks	-0.0443 (-0.13)	
Other financial institutions	-0.0427 (-0.13)	
Engineering	0.0872 (0.17)	
Chemicals	0.0120 (0.04)	
Fuel and energy	0.0279 (0.09)	
Cement	-0.3890 (-1.03)	
Other	-0.2236 (-0.62)	
Adj. R^2	0.0000	0.1190
R^2	0.2914	0.1907
F-value	0.95	2.36**

Note: The table presents estimated results of the benchmark models with all *Z*-variables (regression I) and without Z variables (regression II) using 90 IPO issued on KSE from 1995 to 2010. Dependent variable is three-year equal-weighte buy-and-hold abnormal returns adjusted sized matching-firm in both regressions. Independent variables are defined a follows: UP = underpricing, FinLev = financial leverage, Age = age of the firm, Sub = oversubscription, PSO = proportio of shares offered, Industry = industry a dummy variable (i.e. technology and communications, textiles, banks, other financia institutions, engineering, chemicals, fuel and energy, cement and other), Ldel = listing delay, LT = long-term investmer ratio, FSize = size of the firm, Risk = aftermarket risk level of the IPO, Hot = a dummy variable taking 1 for IPOs issue in hot activity period and 0 otherwise, Mkt_return = market return, Mkt_vol = market volatility, EPS = earnings per share ROA = rate of return on assets, P/BV = offer price to book value, Osize = issue proceeds and OPrice = offer price. The t values are shown in parentheses. ***, ** and * represent significance level at the 1, 5 and 10% respectively.

Table 12. Estimation Results of Benchmark Models – CAR as Dependent Variable

Regression	With Z-variables (III)	Without Z-variables (IV)
Constant	4.5150 (2.17)*	1.9736 (1.57)
UP	-0.3399 (-1.21)	-0.3535 (1.69)*
Hot	-0.3670 (-1.66)	-0.4085 (-1.99)*
Q-variables		
Risk	4.6194 (1.59)	4.7291 (2.18)**
OSize	-0.2261 (-2.21)**	-0.1395 (-2.07)**
P/BV	-0.2026 (-1.32)	-0.1263 (-0.90)
PIPH	1.2925 (2.63)**	1.3331 (4.09)***
Technology and Communications	0.8516 (1.99)*	0.6258 (3.13)***
Engineering	1.2358 (2.00)*	0.9486 (5.84)***
Other	-0.5275 (-1.21)	-0.4636 (-1.88)*
Z-variables		
Ldel	-0.3305 (-1.60)	
LT	-0.4672 (-0.51)	
FSize	0.0051 (0.28)	
Sub	-0.0198 (-1.03)	
Age	-0.0410 (-0.35)	
Mkt_ret	-0.2020 (-0.33)	
Mkt_vol	0.4236 (0.02)	
EPS	0.0092 (0.37)	
ROA	3.0404 (1.32)	
FinLev	0.4789 (1.12)	
OPrice	0.0641 (0.22)	
Cement	0.0347 (0.08)	
Banks	0.3990 (0.94)	
Other financial institutions	0.5326 (1.41)	
Fuel and energy	0.2141 (0.57)	
Chemicals	0.3767 (0.90)	
Textiles	-0.1445 (-0.36)	
Adj. R^2	0.2322	0.2888
R^2	0.4565	0.3607
F-value	2.04**	5.02***

Note: The table presents estimated results of the benchmark models with all *Z*-variables (regression I) and without *Z*-variables (regression II) using 90 IPO issued on KSE from 1995 to 2010. Dependent variable is three-year equal-weighted buy-and-hold abnormal returns adjusted sized matching-firm in both regressions. Independent variables are defined as follows: UP = underpricing, FinLev = financial leverage, Age = age of the firm, Sub = oversubscription, PSO = proportion of shares offered, Industry = industry a dummy variable (i.e. technology and communications, textiles, banks, other financial institutions, engineering, chemicals, fuel and energy, cement and other), Ldel = listing delay, LT = long-term investment ratio, FSize = size of the firm, Risk = aftermarket risk level of the IPO, Hot = a dummy variable taking 1 for IPOs issued in hot activity period and 0 otherwise, Mkt_return = market return, Mkt_vol = market volatility, EPS = earnings per share, ROA = rate of return on assets, P/BV = offer price to book value, Osize = issue proceeds and OPrice = offer price. The *t*-values are shown in parentheses. ***, ** and * represent significance level at the 1, 5 and 10% respectively.

Table 13. Summary of EBA Tests

	Sign	Regression II	Regression IV
		Robust/ Fragile	
X-variable			
Underpricing	–	Robust	Robust
Financial leverage	+	Robust	-
Hot activity period	–	-	Robust
Q-variable			
Age of the firm	–	Robust	-
Oversubscription	+	Robust	-
Proportion of shares offered	–	Fragile	-
Technology and Communication	–	Fragile	Robust
Textiles	–	Robust	-
Aftermarket risk level of IPO	+	-	Robust
Issue proceeds	–	-	Robust
Offer price to book value	–	-	Fragile
Post issue promoters' holding	+	-	Robust
Engineering	+	-	Robust
Other	–	-	Robust
Weighted R^2		0.1703	0.2909
Weighted Alpha		0.0690	2.3967

Note: The robustness of the variables is assumed at the significance level of 10%.

Regression IV reports that both the *X*-variables (UP and Hot) are statistically significant. Hot activity period is influenced negatively long-term underperformance and significant at 1% level. This finding supports the window of opportunity hypothesis [Helwege and Liang (2004)]. Flotation of IPOs during hot activity period produces less aftermarket return which results to inflate long-term underperformance [Sahoo and Rajib (2010)]. Except P/BV, all the variables are significantly affecting long-run underperformance from the *Q*-variables. The coefficient of Risk is positively related to underperformance showing that higher risk in post-IPO pricing behaviour caused higher underperformance [Sahoo and Rajib (2010)].

The coefficient of OSize is negatively significant at 10% level supporting the ex-ante uncertainty hypothesis [Chong, *et al.* (2010)]. This elaborates that large offer size require large size funds to be used for managing business activities as well as exploring new opportunities for effective management of funds resulting lower underperformance. The relationship between P/BV and underperformance is negative exhibiting overoptimistic growth for IPOs. PIPH and underperformance

are positively correlated and significant at 1% level which is in contrast to earlier finding [Sahoo and Rajib (2010)].

Small post issue promoters' holding reflects diversified ownership which may effectively manage the business activities reflecting lower underperformance. Affiliation with the technology and communication, engineering and other industries significantly influenced long-run underperformance.

A comparison of the results of regressions considering with and without *Z*-variables explains that applying statistical test economic theory does not provide a complete set of variables as to which are to be held constant. The EBA technique is more effective to obtain accurate results in identifying the explanatory variables.

4.9.4 Results of Sensitivity Analysis

Sensitivity analysis of *X*- and *Q*-variables is examined to inquire whether or not they are robust and fragile. Out of seventeen *Z*-variables, three are chosen as regressors in each regression – a total of 1,771 forms are tested. The objective of the sensitivity analysis is to identify variables being significant at 10%. The results of sensitivity analyses are reported in Table 13.

The results of regression II show that underpricing, financial leverage, age of the firm, oversubscription and textile industry while in regression IV underpricing, hot activity period, aftermarket risk level, issue proceeds, post issue promoters' holding, affiliation with technology and communications, engineering and other industries are the robust variables in determining long-term underperformance.

5. SUMMARY AND CONCLUSIONS

The long-term IPO performance was investigated over the period of three-years after listing from January 1995 to December 2010. A sample of 90 IPOs were chosen to measure abnormal returns using the event- and calendar-time approaches to detect abnormal performance. The level of underperformance identified using the adjusted benchmark index is higher when compared against the size-based matched firm approach. The findings of the Fama-French three factor model and the

Carhart four factor models confirm the evidence of long-run underperformance over 36-month period.

This study also uses the EBA technique to identify the robust predictors of long-term underperformance. The advantages of employing EBA method is to eliminate the ambiguity of selecting variables that truly influence dependent variable. The following determinants of long-term underperformance are found in terms of the equal-weighted BHAR: (a) IPO Underpricing, (b) Financial leverage, (c) Prior age of the firm, (d) Oversubscription, and (e) Textile industry. In addition, the study identifies the robust predictors of long-run underperformance using the equal-weighted CAR, which are: (a) IPO Underpricing, (b) Hot activity period, (c) Aftermarket risk level of the IPO, (d) Issue proceeds, (e) Post issue promoters' holdings, (f) Technology & Communication, (g) Engineering and (h) Other industries. The empirical findings support the argument that the results are consistent with the fads hypothesis, the ex-ante uncertainty hypothesis, and the window of opportunity hypothesis, which explicitly states that the enthusiasm for investing in new issues reduces as time progresses.

In conclusion, Pakistani IPOs underperformed their respective benchmarks over the three-year period of which the results are highly sensitive to the techniques used to detect abnormal performance.

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