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The Aftermarket Performance of Initial Public Offerings in Pakistan

Muhammad Zubair Mumtaz,[*] Zachary A. Smith[**] and Ather Maqsood Ahmed[***]

Abstract

This paper estimates the aftermarket performance of initial public offerings (IPOs) listed on the Karachi Stock Exchange. The evidence confirms that IPOs generate statistically significant abnormal returns in the short run, which indicates that underwriters initially underprice IPOs when analyzed using a short time horizon. However, when using longer time horizons to estimate abnormal performance, the results indicate that IPOs underperform in the long-run. There is an apparent dislocation between the initial valuation set by underwriters and the premium paid by the market for these new issues. The market sentiment that causes this temporary disequilibrium eventually fades and the market reprices the newly issued shares. We conduct an extreme bounds analysis to test the sensitivity and robustness of 16 explanatory variables in determining the long-term performance of unseasoned newly issued shares. The results indicate that the long-term investment ratio, industry affiliation, market-adjusted abnormal returns, financial leverage, return on assets, IPO activity period, the aftermarket risk level of unseasoned issues, and the post-issue promoter's holdings variables significantly affect IPOs' aftermarket performance. Theoretically, the overreaction hypothesis, ex-ante uncertainty hypothesis and window-of-opportunity hypothesis best explain IPOs' aftermarket performance in this study.

Keywords: Initial public offering, underpricing, underperformance, extreme bounds analysis.

JEL classification: G14, G23, G32.

1. Introduction

Questions pertaining to how initial public offerings (IPOs) behave over short and longer time horizons have generated considerable debate.

[*] School of Social Sciences and Humanities, National University of Sciences and Technology, Islamabad.
[**] Donald R. Tapia School of Business, Saint Leo University, United States.
[***] School of Social Sciences and Humanities, National University of Sciences and Technology, Islamabad.

The literature indicates that underwriters seem to underprice IPOs in the short run and that they underperform over longer time horizons. Researchers have constructed empirical as well as theoretical explanations to account for these anomalies. The consensus is that companies initially underprice their shares to promote goodwill for seasoned equity offers.

Ritter and Welch (2002) find that the results of empirical studies are extremely sensitive to the methodology used to identify abnormal performance and the time horizon examined. Therefore, a broadly accepted theory of longer-term underperformance remains elusive. Generally, investors experience short-term abnormally positive performance when participating in unseasoned equity issuance and are exposed to longer-term underperformance (Jenkinson & Ljungqvist, 2001). However, IPOs' short- and long-run performance can vary from country to country.

The underpricing of IPOs has been a pervasive phenomenon for decades. Banerjee, Dai and Shrestha (2011) find evidence of IPO underpricing in 36 countries; they report that underpricing is universal, but that the level of underpricing varies from country to country. Loughran, Ritter and Rydqvist (1994) give evidence of underpricing in 25 countries and argue that initial underpricing is lower in developed countries than in developing countries. This is particularly true for Asian markets (Moshirian, Ng & Wu, 2010).

Examining longer-term underperformance, Ritter (1991) argues that, on average, IPOs underperform over a three-year period following issuance. Some studies have questioned the methodological and conceptual frameworks used to identify abnormal performance. Ritter (1991) applies and consequently devises different methodological approaches to overcome these shortcomings.[1] Unfortunately, there is no consensus on which methodology provides the best estimate of longer-term underperformance (see Fama, 1998; Loughran & Ritter, 2000).

In terms of IPOs' longer-term performance in developing markets, Sohail and Nasr (2007) report significantly negative market-adjusted abnormal returns (MAAR) over the one-year period following the initial offering in the Pakistani market. Sahoo and Rajib (2010) find that Indian IPOs underperform over the one-year period following the issuance of unseasoned equity shares, although investors who purchase the shares on the offering date benefit from abnormally positive performance.

[1] See, for instance, Barber and Lyon (1997) and Lyon, Barber and Tsai (1999).

The performance of Pakistani IPOs over a longer time horizon is relatively unexplored. Accordingly, we examine the three-year performance-adjusted, size-based, matched-firm benchmark after listing, using a sample of 57 firms during the period 2000–10 to investigate whether IPOs generate abnormal performance over the short and long run.

To test the sensitivity and robustness of the explanatory variables used to determine IPOs' longer-term performance, we conduct an extreme bounds analysis (EBA). We find that the average initial underpricing of IPOs was 32 percent over this time horizon, which implies that investors earned abnormal excess returns by participating in the new issues at the offering price and selling them at the listing price. Explanations for underpricing include information asymmetry, ex-ante uncertainty, underwriters' prestige, and signaling, but there is little agreement on whether a single hypothesis properly explains this phenomenon (Ritter & Welch, 2002).

The study uses four different methods to test the robustness of IPOs' longer-term performance: (i) buy-and-hold abnormal returns (BHAR), (ii) cumulative abnormal returns (CAR), (iii) the Fama and French (1993) model, and (iv) the Carhart (1997) model using a size-based, matched-firm benchmark index. We find that newly issued shares underperform against their respective benchmarks over the three-year period post-listing. However, the observed pattern of underperformance is not always statistically significant and the results are susceptible to the methodology used to identify abnormal performance (Fama, 1998). A comprehensive analysis of longer-term IPO performance would also examine the factors used to explain the underperformance.

This study, therefore, applies the EBA technique to identify robust predictors of longer-term performance. The variables selected as indicators of longer-term performance include (i) long-term investment, (ii) industry effects, (iii) financial leverage, (iv) MAAR, (v) the IPO activity period, (vi) the rate of return on total assets (ROA), (vii) the aftermarket risk level of the IPO, and (viii) post-issue promoters' holding (PIPH).

The remaining paper is structured as follows. Section 2 provides an overview of the IPO literature. Section 3 describes the IPO market in Pakistan. Section 4 discusses the research methodology and Section 5 describes the data and variables used. Section 6 examines the empirical results. Section 7 concludes the study with some policy implications.

2. Overview of the IPO Literature

This section outlines the theoretical, empirical and Pakistan-specific literature on IPOs.

2.1. Theoretical Aspects

The current literature on IPO pricing and performance focuses on two broad themes: short-run and long-run abnormal performance. A number of theories account for short-term performance. Rock (1986) presents the "winner's curse" hypothesis, which assumes that asymmetric information causes underpricing. The study segregates investors into informed and uninformed cohorts. To determine the appropriate value to place on an individual firm as well as a potential offer price, informed investors attempt to obtain information on the new issue and are cognizant of the cost of that information. In comparison, uninformed investors estimate firm value without the information available to informed investors because they lack the resources to obtain this information. Informed investors participate only in those issues that underwriters tend to underprice, which creates the impression that attractive IPO stocks may be oversubscribed.

The information asymmetry hypothesis, in relation to investors in newly issued IPOs, suggests that uninformed investors may invest in overpriced issues and obtain negative returns (Ritter & Welch, 2002) – referred to as the "winner's curse." The signaling hypothesis (Welch, 1989) indicates that firms deliberately underprice their issues against the value of the company to "leave a good taste in investors' mouths" (Ibbotson, 1975). Subsequently, these firms issue seasoned equity offerings at higher prices.

The ex-ante uncertainty hypothesis is related to information asymmetry and emphasizes the investment risk faced by prospective investors. In the presence of ex-ante uncertainty, the offering price will be too low, thereby increasing the level of oversubscription. IPO stocks are intentionally underpriced to reduce the possibility that the underwriter might fail to allocate the entire issue. Moreover, underpricing correlates positively with the ex-ante uncertainty. The ownership dispersion hypothesis posits that issuers deliberately underprice securities to generate more demand and attract a large number of small shareholders (Ritter, 1991). This dispersed ownership may increase the liquidity of the firm. Prior studies have documented a negative relationship between promoters' holding and underpricing.

This study also examines longer-term post-IPO pricing behavior to gauge whether investors are better off holding onto IPOs over a longer time horizon. In this context, Jenkinson and Ljungqvist (2001) argue that investors' returns deteriorate the longer they hold onto IPO stocks. There is evidence supporting the idea that IPOs underperform over longer time horizons when measured against standard benchmarks (see Ritter, 1991; Loughran & Ritter, 1995). Conversely, Brav and Gompers (1997) and Smith (2008) have developed matched-firm techniques based on size, industry affiliation and book-to-market ratios to reduce the potential bias inherent in gauging abnormal performance.

Most studies argue that IPOs suffer from longer-term price underperformance and that the magnitude of underperformance decreases if researchers use standard benchmarks to estimate abnormal performance. The results of longer-term performance depend on the methodology used to gauge abnormal performance (see Eckbo, Masulis & Norli, 2000; Loughran & Ritter, 1995; Gompers & Lerner, 2003). Jenkinson and Ljungqvist (2001) point out that the evidence for longer-term performance is controversial and inconclusive.

Longer-term IPO performance is explained by different hypotheses. The impresario or fads hypothesis states that the process of IPO issuance does not instantly determine the value of new stocks. The overvaluation of shares, therefore, implies abnormal excess returns earned by investors at the start of market trading (Aggarwal & Rivoli, 1990). When investors earn excess returns on the listing day, this consequently corrects the overpricing and results in lower returns over the longer term.

The divergence-of-opinion hypothesis argues that optimistic and pessimistic investors evaluate newly issued shares differently. Given the surge of information that occurs when newly issued shares enter the market, investors' expectations will diverge to the extent of generating a price correction (Miller, 1977).

Under the window-of-opportunity hypothesis, investors will expect IPOs issued during a period of high trading volume to be overvalued compared to other IPOs because young firms without adequate growth prospects are more likely to issue shares. This overvaluation fails to justify the valuation, and stock prices adjust quickly to their fundamental value. Further, this theory indicates that periods of high issuance may be correlated with the lowest subsequent returns in the longer run (Loughran & Ritter, 1995).

Finally, the entrenchment theory describes the relationship between who controls the company and its long-term underperformance. Morck, Shleifer and Vishny (1988) argue that ownership control of a firm influences the risk associated with management entrenchment. If this risk is high, then it is likely that the new issues will underperform significantly in the long term (Mazzola & Marchisio, 2003).

2.2. Empirical Evidence

There has been a great deal of academic interest in identifying the magnitude of underpricing experienced by firms that initially offer their shares to the public. The absolute levels of the average discrepancy between what firms receive for their newly issued shares and what they end up trading on the first day warrants further exploration of this phenomenon. We provide some examples from the literature below.

Reilly and Hatfield (1969) report underpricing of 11 percent in the US. Liu and Ritter (2010) find that the level of underpricing in the US was 12 percent during 2001–08. Data from the UK yields an underpricing level of 19 percent from 1989 to 2007 (Chambers & Dimson, 2009). Banerjee et al. (2011) find that the average underpricing in 11 Asian countries ranged from 12.94 percent in Singapore to 57.14 percent in China.[2] Hahl, Vahamaa and Aijo (2014) report average underpricing of 15.62 percent for a sample of 67 Finnish IPOs for the period 1994 to 2006. Jewartowski and Lizinska (2012) find an average underpricing level of 13.95 percent in a study of 186 Polish IPOs from 1998 to 2008. Agathee, Sannassee and Brooks (2012) document underpricing of 13.14 percent for 44 Mauritian IPOs for 1989–2005. Abu Bakar and Uzaki (2012) find an underpricing level of 35.87 percent in a study of 476 Malaysian IPOs. Adjasi, Osei and Fiawoyife (2011) report underpricing of 43.10 percent for a sample of 77 Nigerian IPOs. Samarakoon (2010) finds underpricing of 33.50 percent for 105 Sri Lankan IPOs, and Sahoo and Rajib (2010) report underpricing of 46.55 percent in a study of 92 Indian IPOs.

Empirical studies of longer-term performance attempt to model price behavior after listing (see Table 1). The question typically proffered by researchers is whether it is beneficial for investors to hold onto IPOs for longer periods after their initial offering. Empirical studies show that

[2] They find the following levels of underpricing: 12.94 percent in Singapore, 17.25 percent in Taiwan, 19.15 percent in Thailand, 22.21 percent in Hong Kong, 25.01 percent in India, 31.18 percent in Malaysia, 45.14 percent in Japan, 45.50 percent in the Philippines, 52.25 percent in Indonesia, 54.57 percent in the Republic of Korea and 57.14 percent in China.

abnormal performance depends on the methodology employed (see Jenkinson & Ljungqvist, 2001). Using 1,526 US IPOs during 1975–84, Ritter (1991) shows that they significantly underperformed against their matched-firm benchmark based on size and industry affiliation in the three-year period following the listing. Levis (1993) finds that IPOs in the UK underperformed against a number of relevant benchmarks in the three-year period following their listing.

Table 1: Longer-term IPO performance in the literature

Study	Period	Sample size	Country	Abnormal returns (%)	Underperformance up to
Thomadakis, Nounis and Gounopoulos (2012)	1994–2002	254	Greece	-16.12	36 months
Belghitar and Dixon (2012)	1992–96	335	UK	-14.00	36 months
Jewartowski and Lizinska (2012)	1998–2008	142	Poland	-22.62	36 months
Sahoo and Rajib (2010)	2002–06	92	India	41.91	36 months
Chi, McWha and Young (2010)	1991–2005	114	New Zealand	-27.81	36 months
Chorruk and Worthington (2010)	1997–2008	141	Thailand	-25.39	36 months
Chi, Wang and Young (2010)	1996–2002	897	China	9.60	36 months
Sohail and Nasr (2007)	2000–05	36	Pakistan	-38.10	12 months
Rizwan and Khan (2007)	2000–06	35	Pakistan	-23.70	24 months
Goergen, Khurshed and Mudambi (2007)	1991–95	240	UK	-21.98	36 months
Ahmad-Zaluki, Campbell and Goodacre (2007)	1990–2000	454	Malaysia	-2.01	36 months
Drobetz, Kammermann and Wälchli (2005)	1983–2000	53	Switzerland	-173.46	120 months
Kooli and Suret (2004)	1991–98	445	Canada	-20.70	60 months
Gompers and Lerner (2003)	1935–1972	3,661	US	-33.40	60 months
Ritter and Welch (2002)	1980–2001	6,249	US	-23.40	36 months
Espenlaub, Gregory and Tonks (2000)	1985–92	588	UK	-21.30	60 months
Allen, Morkel-Kingsbury and Piboonthanakiat (1999)	1985–92	143	Thailand	10.02	36 months
Ritter (1991)	1975–84	1,526	US	-29.10	36 months
Levis (1993)	1980–88	712	UK	-22.96	36 months

Hwang and Jayaraman (1995) measure the performance of 182 Japanese IPOs over a three-year period and conclude that the value-weighted CAR is significantly positive (16.44 percent) while the equal-weighted CAR is significantly negative (–14.98 percent). Lyon et al. (1999) argue that researchers could remove biases by developing a matched-firm benchmark based on size and/or the book-to-market ratio. Gompers and Lerner (2003) examine the five-year performance (post-listing) of 3,661 US IPOs from 1935 to 1972. They argue that underperformance persists when using event-time BHAR, but disappears when using CAR and calendar time analysis (i.e., the capital asset pricing and Fama–French models); they report no abnormal performance in longer-term studies. Kooli and Suret (2004) investigate the five-year post-IPO performance of 445 Canadian IPOs during 1991–98 and find evidence of underperformance in the long run. They argue that this longer-term behavior can be explained by "hot markets" and the fads hypothesis.

2.3. Prior Studies in the Pakistani Context

A handful of studies have examined the short-run underpricing of IPOs. Sohail and Nasr (2007) document an average underpricing of 35.66 percent, using 50 IPOs listed on the Karachi Stock Exchange (KSE) from 2000 to 2005. Rizwan and Khan (2007) analyze 35 IPOs from 2000 to 2006 and find an underpricing level of 36.48 percent. Kayani and Amjad (2011) examine 59 IPOs and report an average initial underpricing of 39.87 percent from 2000 to 2010. In another study, Afza, Yousaf and Alam (2013) report underpricing of 28.03 percent after analyzing 55 IPOs from 2000 to 2011. Mumtaz and Ahmed (2014) study short-run underpricing using 75 IPOs from 2000 to 2011, and find that they exhibit initial underpricing of 30.30 percent, on average.

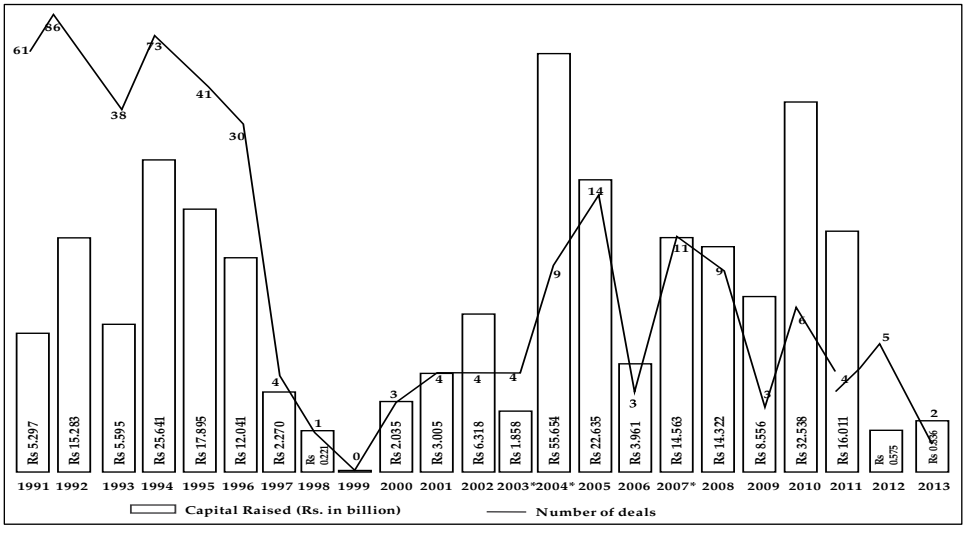
To gauge longer-term performance, Sohail and Nasr (2007) study the one-year performance of 36 IPOs from 2000 to 2005, and report the average market-adjusted CARs and BHARs at –19.67 and –38.10 percent, respectively. In another study, Rizwan and Khan (2007) analyze the two-year performance of 35 IPOs using the BHAR methodology and document negative returns of –23.68 percent.

3. Pakistan's IPO Market

While the market for IPOs in Pakistan is limited, companies find it more appropriate to issue their shares through the IPO process and generate funds from the public. Over the last 15 years, Asian markets have

been more likely to access the IPO market to raise capital. China is considered the leading country in which investors attract funds by issuing unseasoned equity shares, followed by India. However, Pakistan is also an emerging country in this context. Figure 1 illustrates annual IPO activity in Pakistan during the period 1991 to 2013.

Figure 1: Annual IPO activity in Pakistan, 1991 to 2013



* excluding 3rd offer for Sale of shares of National Bank of Pakistan in 2003, Offer for Sale of shares of (i) M/s Sui Southern Gas Co. Ltd. & (ii) M/s Pakistan international Airlines Corp. Ltd. In 2004 and 2nd Offer of Shared of OGDCL shares in 2007 which were already listed.
Source: Securities and Exchange Commission of Pakistan

With the advent of liberalization in 1991, a number of reforms were introduced in Pakistan's capital market. At this stage, IPO issuance increased and privately held companies issued shares to diversify ownership, raise funds for investment and create an exit strategy for mature firms. Earlier, the Corporate Law Authority (CLA) had been set up in 1986 with the objective of monitoring the corporate sector to ensure transparency and compliance with laws. To make the IPO process rigorous and competitive, the CLA was abolished and an independent commission set up. The Securities and Exchange Commission of Pakistan (SECP) was established in 1997 through the Securities and Exchange Commission of Pakistan Act. The SECP began its operational functions on 1 January 1999 with the objective of carrying out the reform program envisaged for Pakistan's capital market. After this, the process of issuing IPOs became more rigorous and efficient as companies were allowed to float their shares and raise funds from the public.

During 2000–11, 79 IPOs took place with paid-up capital of PRs 181.456 billion. In Pakistan, companies use two methods to issue shares to the public: (i) the fixed price method and (ii) the book-building process. Under the fixed price method, the offer price is set at par or at a premium by the issuer on the basis of a valuation of companies' financials. Under the book-building mechanism, the issuer gathers pricing information from institutional investors and individual investors with a high net worth through a bidding process in order to build interest in investment in the company's shares. In Pakistan, IPOs are normally issued under the fixed price method whereas only five IPOs have been issued through the book-building mechanism.

4. Research Methodology

The literature shows that most studies have used different benchmarks to measure abnormal returns (see Lyon et al., 1999; Drobetz et al., 2005). The results of studies of longer-term abnormal returns as they relate to IPO performance are extremely susceptible to the methodology used to identify abnormal performance. There is little consistency in terms of the methodology applied to measure abnormal returns and, therefore, no consensus on the magnitude of long-term underperformance. Fama (1998) postulates that anomalies in abnormal performance as portrayed in earlier studies do not clearly establish that the anomalous behavior found in event studies is valid. He suggests that a theory that explains both over-reaction and under-reaction does not exist.

The extensive debate on evaluating longer-term abnormal performance in event studies has led to three important critiques: (i) the use of biased benchmarks, (ii) the selection of the time period for which researchers evaluate IPO stocks and benchmark returns, and (iii) issues pertaining to the rationality of statistical inferences when significance levels may be biased.

Event studies (see Ball & Brown, 1968; Fama, Fisher, Jensen & Roll, 1969) and calendar time studies (see Mitchell & Stafford, 2000; Hou, Olsson & Robinson, 2001) were developed to examine market efficiency. The event study methodology is the most popular method for measuring the short-term and long-term performance of IPOs using different time horizons and event windows (see Ritter, 1991; Bradley, Jordan & Ritter, 2003). Lyon et al. (1999) argue that researchers should apply the calendar time approach to projects that experience correlation of their sample returns because there is an overlap in the estimation period.

Researchers have used both methods to analyze IPO performance in empirical studies, and determine whether there is evidence of positive or negative returns over specific time horizons. Moreover, academics have rigorously debated whether the methodologies used over the last decade to conduct event studies and identify abnormal performance have improved.

This study examines the short-run and longer-term performance of IPOs. Where most other studies have examined long-term performance over a two-year period, using the benchmark index as a proxy for normal performance, we test for longer-term abnormal performance using four different methods to capture how IPOs behave over a three-year time horizon. We apply both the event and calendar time approaches to analyze and compare abnormal returns. In addition, we determine the robust predictors that affect longer-term IPO performance using EBA.

To construct a proxy for normal performance, we matched each issuing firm to a nonissuing firm, based on a list of all firms listed on the KSE each December that had not issued any stock within the last three years. These firms were then ranked by their market value (see Loughran & Ritter, 1995). To select the matched-firm benchmark, we chose the firm with a market value closest to, but higher than, that of the issuing firm as its matched firm. Firms that delisted their shares during the three-year period were not selected as matched firms. We also chose not to match firms by industry affiliation because some industries did not have enough firms to apply the industry and market capitalization filter and to avoid industry-wide misevaluation.

4.1. Estimation of Underpricing

Following other studies (e.g., Berk & Peterle, 2015; Laokulrach, 2015), the underpricing of unseasoned new issues is measured through the initial return on stock *i* at the close of the first trading day. The MAAR is computed for stock *i* using the benchmark index (KSE)[3] at the first closing market price as follows:

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[3] The raw return $R_{i,1}$ for stock *i* at the close of the first trading day is calculated as $R_{i,1} = \left({P_{i,1}}/{P_{i,0}}\right) - 1$ where $R_{i,1}$ is the return on stock *i* at the close of the first trading day, $P_{i,1}$ is the price of stock *i* at the end of the first closing market price and $P_{i,0}$ is the offer price of stock *i*. The market return is obtained from the benchmark index and computed as $R_{m,1} = \left({I_{m,1}}/{I_{m,0}}\right) - 1$ where $R_{m,1}$ is the market return on the first trading day, $I_{m,1}$ is the value of the market index at the close of the first trading day for stock *i* and $I_{m,0}$ is the value of the market index on the offering date for stock *i*.

$$MAAR_{i,1} = 100 \times \left\{\left[\frac{(1+R_{i1})}{(1+R_{m1})} - 1\right]\right\} \quad (1)$$

The sample mean $MAAR_{i,1}$ at the end of the first trading day is measured as $MAAR_{i,1} = \frac{1}{n}\sum_{i=1}^{n} MAAR_{i,1}$. We test the null hypothesis that the mean MAAR ($MAAR_{i,1}$) is equal to 0. To test the hypothesis, the t-statistic is computed as $t = \frac{(MAAR_{i,1})}{s/\sqrt{n}}$ where s is the standard deviation of $MAAR_{i,1}$ for n number of firms.

4.2. Buy-and-Hold Abnormal Returns

Lyon et al. (1999) argue that BHAR measures investors' experience precisely. This makes it one of the preferred methods in the literature to gauge abnormal performance during a specific period (Mitchell & Stafford, 2000). We measure abnormal returns over a period of 36 months starting from the closing price on the first day of trading. Following Berk and Peterle (2015) and Barber and Lyon (1997), the BHAR for firm *i* at time *t* adjusted by size, based on the matched-firm benchmark index is computed as follows:

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

where $R_{i,t}$ is the monthly return of the event firm *i* at time *t* and $R_{mf,t}$ is the return of the size-based matched-firm benchmark over the corresponding period. T is the time period for which we calculate the BHAR, that is, the return an investor would have obtained using a buy-and-hold strategy, purchasing the stock on the listing day and holding it until the stock's three-year anniversary.[4] The mean BHAR[5] for period *t* is defined as:

$$Mean\ BHAR_T = \sum_{i=1}^{n} w_i BHAR_{i,t} \quad (3)$$

To test the statistical significance of whether the mean BHAR is equal to 0, Lyon et al. (1999) suggest using skewness-adjusted t-statistics, which we calculate as follows:

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

[4] Firms delisted during the return estimation period are not included in the sample.

[5] In the case of equal-weighted, $w_i = {}^{1}/_{n}$ and in the case of value-weighted, $w_i = {}^{MV_i}/_{\Sigma_i MV_i}$, where MV_i is the market value of IPO firm *i* (the number of shares outstanding multiplied by the closing market price on the first day of trading).

where

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

where $BHAR_t$ is the sample mean BHAR, $\sigma(BHAR_t)$ is the cross-sectional sample standard deviation of abnormal returns and n is the number of sample firms. $\hat{\gamma}$ is an estimate of the coefficient of skewness. We use skewness-adjusted t-statistics to cope with the problem of skewness as the critical values of conventional t-statistics are inappropriate in this case.

4.3. Cumulative Abnormal Returns

The abnormal returns ($AR_{i,\tau}$) for firm i starting in period s are computed as:

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

where $R_{i,t}$ is the monthly return of event firm i at time t and $R_{mf,t}$ is the return of the size-based matched-firm benchmark for the corresponding period. The τ-period CAR ($CAR_{i\tau}$) for firm i beginning in period s is calculated as follows (Lyon et al., 1999):

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

We calculate the CAR based on the newly issued IPOs' performance from the first closing market price and compared against the cumulative mean benchmark-adjusted matched-firm return[6] for months 1 to 36. Since the CAR is less skewed than the BHAR, conventional t-statistics yield well-specified test statistics. To test the statistical significance of the CAR, Ritter (1991) defines the t-statistics for the CAR in month t, $CAR_{1,t}$ as follows:

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

[6] The mean-adjusted return through the benchmark on a portfolio of *n* stocks for the event month is measured on the basis of equal-weighted and value-weighted. In the case of equal-weighted, $w_i = {}^{1}/_{n}$ while for value-weighted, $w_i = {}^{MV_i}/_{\Sigma_i MV_i}$ where MV_i is the market value of IPO firm *i* (the number of shares outstanding multiplied by the closing market price on the first day of trading).

where n_t is the number of IPO firms trading in each month, *var* is the average of the cross-sectional variation over 36 months of the $AR_{i,\tau}$ and *cov* is the first-order auto-covariance of the AR_t series.

4.4. Calendar Time Approach

The calendar time approach is carried out using the Fama–French (1993) three-factor model and the Carhart (1997) four-factor model. The return on a portfolio comprises the IPO firms issued within the last three years from the first closing market price. Applying Fama and French (1993), the return on this portfolio is used to estimate the following regression:

$$R_{pt} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + s_i SMB_t + h_i HML_t + \epsilon_{it} \quad (9)$$

where R_{pt} is the equal-weighted or value-weighted return on the IPO portfolio in month t, R_{ft} is the three-month treasury bill rate in month t, R_{mt} is the return on the value-weighted index (KSE-100) in month t, SMB_t is the return on a value-weighted portfolio of small stocks minus large stocks in month t and HML_t is the return on a value-weighted portfolio of high book-to-market stocks minus low book-to-market stocks in month t. β_i, s_i and h_i stand for the loadings of the portfolio on each factor: the market, SMB (size) and HML (book-to-market) ratio. The term α_i is an intercept, which we use to investigate the null hypothesis that the mean monthly excess return is equal to 0.

The Carhart (1997) model extends the Fama–French model to strengthen portfolio returns as well as the risk-adjusted abnormal return earned on the portfolio. The model is written as:

$$R_{pt} - R_{ft} = \alpha_i + \beta_i\left(R_{mt} - R_{ft}\right) + s_i SMB_t + h_i HML_t + w_i WML_t + \epsilon_{it} \quad (10)$$

where SMB_t and HML_t are defined above and the winner-minus-loser term (WML_t) is the momentum factor added by the Carhart model. WML is calculated by ranking all the firms by their 11-month stock returns and subsequently taking the average return of the top third (high past returns) minus the average return of the bottom third (low past returns). The intercept of the model reflects the average monthly abnormal return.

The regressions are estimated using Newey–West heteroskedasticity and autocorrelation standard errors to calculate the t-statistics for the regression coefficients. To estimate the parameters of the calendar time approach, we gather data on 80 non-IPO firms listed on the

stock market and divide them into three groups. We segregate the first and last third of this sample, covering 27 firms each and their returns based on the SMB, HML and WML criteria.

4.5. Extreme Bounds Analysis

The EBA technique is used to determine the robust predictors that affect longer-term IPO performance. This method reduces the ambiguity in selecting and determining only those variables that affect longer-term performance. These determinants are typically based on the following regression:

$$BHAR_i \text{ or } CAR_i = \alpha_0 + \sum_{j=1}^{n} \alpha_j X_{ji} + \varepsilon_i \quad (11)$$

where $BHAR_i$ and CAR_i are the equal-weighted BHAR and CAR, respectively, of firm i over the period of 36 months, and X_{ji} is the jth explanatory variable of firm i. EBA is applied to a linear regression that explains longer-term performance. The model is described as follows:

$$BHAR_i \text{ or } CAR_i = \alpha_0 + \sum_{j=1}^{n} \delta_i X_{ji} + \beta Q_i + \sum_{j=1}^{m} \gamma_i Z_{ji} + \varepsilon_i \quad (12)$$

where X is an important explanatory variable(s), as identified by prior studies, that is included in every regression (also known as a free variable). Q is the variable of interest whose robustness we test, and Z is a potentially important variable.

The purpose of the EBA is to examine the robustness of the value of the coefficient of the variable of interest, Q. A large number of regressions are required to run an EBA and the free variables are included in every regression, whereas we select the variable of interest Q and the set of Z variables from a predetermined pool. This exercise of conducting exhaustive regressions for each variable of interest gives us the highest and lowest values of βthat cannot be rejected at a particular significance level. In a set of regressions, if the value of the coefficient has the same sign and its extreme value remains statistically significant, then it is called a "robust" variable, otherwise the variable is treated as "fragile."

Researchers have applied the EBA technique to a diverse set of projects to test the robustness and sensitivity of the explanatory variables that truly influence the dependent variable. The empirical literature indicates that EBA can be used to identify the determinants of: (i) IPO underpricing (see Mumtaz & Ahmed, 2014), (ii) the emergence and

survival of democracy (see Gassebner, Lamla & Vreeland, 2013), (iii) R&D investment (see Wang, 2010), (iv) foreign direct investment (see Moosa & Cardak, 2006), (v) corruption (see Seldadyo & de Haan, 2006), (vi) stock prices in the Kuwait Stock Exchange (see Al-Deehani, 2005), (vii) regional trading arrangements (see Ghosh & Yamarik, 2004) and (viii) productivity growth (see Hwang & Wang, 2004).

4.6. Determinants of IPOs' Longer-Term Performance

While the empirical literature identifies the explanatory variables that influence longer-term IPO performance, what is important is to select only the robust variables. Therefore, we use the EBA technique to find the true determinants of longer-term IPO performance. More importantly, this technique has not been used in empirical studies to do so. The possible explanatory variables that determine longer-term performance can be written as follows:

$$BHAR_i \quad \text{or} \quad CAR_i = \alpha_0 + \beta_1 LT_i + \beta_2 INDUSTRY_i + \beta_3 LDel_i + \beta_4 FinLev_i + \beta_5 FSize_i + \beta_6 Risk_i + \beta_7 MAAR_i + \beta_8 Time + \beta_9 PIPH_i + \beta_{10} MktRet + \beta_{11} OSize_i + \beta_{12} Sub_i + \beta_{13} EPS_i + \beta_{14} Age_i + \beta_{15} ROA_i + \beta_{16} MktVol + \epsilon_i \quad (13)$$

where $BHAR_i$ and CAR_i represent the 36-month equal-weighted BHAR and CAR, respectively, based on the size-based matched-firm benchmark. *LT* is the long-term investment ratio, *INDUSTRY* is a dummy variable equal to 1 for the financial sector and 0 otherwise, and *LDel* is the listing delay between the offering and listing dates. *FinLev* is the firm's financial leverage prior to the IPO, *FSize* is firm size measured by the firm's total assets, *Risk* is the aftermarket risk level of the IPO and *MAAR* represents the MAAR on the first day of listing. *Time* is a dummy variable: if the IPO is issued during a hot period, it is equal to 1 and 0 otherwise. The remaining variables include the PIPH (post-issue promoters holding), *MktRet* (the market return measured on the KSE-100 value-weighted index over the three-month period prior to the IPO), *OSize* (issue proceeds), *Sub* (oversubscription), earnings per share (EPS), *Age* (the firm's age prior to the IPO), *ROA* (the rate of return on total assets) and *MktVol* (market volatility).

5. Data and Description of Variables

During the sample period of January 2000 to December 2010, 73 Pakistani IPOs listed their shares on the KSE. Of these, four IPOs were delisted and 12 had to be dropped from the sample for lack of data. The final sample comprised 57 IPOs (78 percent of the total). We collected

statistics pertaining to these IPOs from their prospectuses as well as the opening and closing prices for the newly issued companies. Data on the KSE-100 index was collected from the KSE website and T-bill rates from the State Bank of Pakistan website.

The Appendix gives a detailed description of the variables used in this study. When employing the EBA technique, the goal is to choose the X, Q and Z variables mentioned in equation 13 that can cause longer-term performance. We have identified the X variables as fixed variables; these are used in every regression and considered important determinants of longer-term IPO performance, based on the theoretical and empirical literature.

Out of 16 variables, two X variables – the long-term investment ratio and industry effects – are selected as fixed variables and used to estimate long-run performance under the buy-and-hold strategy. The MAAR and IPO activity period are selected as X variables when using the CAR method. We select the Q and Z variables from the remaining 14 variables. Each of these 14 variables is a variable of interest Q whose robustness is tested. For a given Q variable, three Z variables are selected from the other 13, yielding 4,004 regressions (286 regressions for each variable of interest). In total, we run 16,016 regressions to determine the explanatory variables of IPO underperformance with regard to BHAR and CAR.

Table 2 gives the descriptive statistics for the sample 57 IPOs. The two dependent variables include the BHAR and CAR. The independent variables include the long-term investment ratio (*LT*), financial leverage (*FinLev*), the MAAR, market return (*MktRet*), PIPH, ROA and market volatility (*MktVol*), denoted in percentage terms. Firm size (*FSize*) and offer size (*OSize*) are estimated in PRs million. The listing delay (*LDel*) is scaled in days and the age of the firm (*Age*) in years. Risk is measured by the standard deviation of post-listing price behavior. EPS is measured in PRs per share and the oversubscription ratio (*SUB*) is represented by the number of times.

Table 2: Descriptive statistics for 57 KSE-listed IPOs, 2000–10

Variable	Mean	Median	Min. value	Max. value	SD
BHAR	-32.73	-22.56	-289.85	349.57	105.32
CAR	-17.91	-15.43	-239.07	208.85	103.28
LT	5.85	0.00	0.00	78.89	14.51
LDel	42.44	39.00	9.00	87.00	12.76
FinLev	22.66	16.32	0.00	77.08	22.60
FSize	29,452.14	1,416.47	10.06	562,915.76	94,373.54
Risk	8.80	3.22	0.57	85.61	15.83
MAAR	31.96	12.54	-34.59	315.88	63.49
PIPH	65.34	73.79	16.70	95.00	19.39
MktRet	0.06	0.11	-0.64	0.72	0.26
OSize	711.21	250.00	40.00	8,107.50	1,243.47
Sub	2.88	1.21	0.01	18.69	3.97
EPS	0.87	0.05	0.00	5.79	1.78
Age	11.21	6.00	0.00	66.00	14.12
ROA	8.95	5.07	0.00	72.60	12.09
MktVol	1.46	1.30	0.78	2.89	0.77

Source: Authors' calculations.

The data for the dependent variables consists of the 36-month equal-weighted BHAR and CAR. The average BHAR and CAR are –32.73 percent and –17.91 percent, respectively. The median BHAR and CAR are –22.56 percent and –15.43 percent, respectively. We can see that the level of underperformance is higher when using the BHAR method.

Among the independent variables, the mean value of the long-term investment ratio is 5.9 percent with a maximum value of 78.9 percent and a standard deviation of 14.5 percent. The mean listing delay is 42.4 days and the median delay is 39 days. The mean value of financial leverage is 22.7 percent, with a median of 16.3 percent and a maximum of 77.1 percent, which implies that the average IPO firm does not have a high debt burden before going public. The mean value of firm size is PRs 29,452 million, ranging from PRs 10 million to PRs 562,916 million. By eliminating the three largest firms, the average firm size decreases to PRs 8,750 million with a standard deviation of PRs 17,057 million. The mean value of aftermarket risk is 8.8, with a maximum value of 85.6 and a median of 3.2.

The average MAAR on the first day of trading is 32.0 percent with a median abnormal return of 12.5 percent. Overpricing and underpricing range from 34.6 to 315.9 percent, showing a large fluctuation in the

performance of the sample IPOs. The average market return is 0.1 percent with a median return of 0.1 percent, indicating a nominal market return prior to the IPO. The mean offer size is PRs 711.2 million. The lowest and highest offer sizes are PRs 40 million and PRs 8,107 million, respectively. The large variation in offer size indicates diversification among the IPOs in this sample in terms of market capitalization. The average PIPH is 65.3 percent with a median value of 73.8 percent.

By holding a high percentage of equity in the post-IPO period, promoters illustrate their confidence in the IPO firms. The IPOs are subscribed by a factor of 2.9 on average, and the median value suggests that the oversubscription rate is more than 1, with a standard deviation of 3.9, showing negligible oversubscription. The average EPS ratio is PRs 0.9, that is, every share of the IPO firms earns PRs 0.9. This ratio is low, indicating that firms prior to IPO were unable to earn a profit. On average, the age of the firm is 11.2 years with a median age of 6.0 years. The mean ROA is 8.9 percent with a maximum value of 72.6 percent and a median value of 5.1 percent. This indicates that, prior to the IPO, firms' ROA was very low. Market volatility seems very low – just 1.5 percent on average – showing a small variation in market returns.

6. Empirical Results

This section examines IPO underpricing, firms' BHAR and CAR, and their issue proceeds and initial returns in the context of longer-term performance.

6.1. Underpricing of IPOs

We examine the underpricing of IPOs to evaluate the abnormal excess returns obtained by investors if they participate at the offering price and sell the newly issued shares on the first day of trading after listing. Table 3 summarizes the initial returns of 57 IPOs during the sample period 2000–10. The analysis shows that the average raw return was 36.7 percent and the average market return (KSE-100 index) was 4.7 percent on the first day of trading after listing. This reflects that, on average, Pakistani IPOs are underpriced by 32.0 percent. This is statistically significant using an α of 1 percent, which implies that abnormal excess returns are earned on the first day of trading.

This study, therefore, rejects the null hypothesis that the average initial MAAR is equal to 0. This finding is consistent with prior studies, for

example, Sohail and Nasr (2007), Sahoo and Rajib (2010), Samarakoon (2010) and Otchere, Owusu-Antwi and Mohsni (2013). Firms dealing in financial services are underpriced by 31.7 percent (t-statistic = 2.66) relative to 32.1 percent (t-statistic = 2.80) for nonfinancial firms.

The median underpricing is reported at 12.5 percent on the first day of listing, which is significant at the 1 percent level. The standard deviation of the sample IPOs is 63.5 percent. The MAAR variable ranged from –34.6 to 315.9 percent. The considerable spread between the maximum and minimum values confirms that there are large fluctuations in initial performance and hence the perceived underpricing. The skewness value shows that the mean is greater than the median, which indicates that returns are positively skewed. The excess kurtosis variable is different from 0, which suggests that stock price returns are not normally distributed.

Of the sample of 57 IPOs, 22 (39 percent) produced short-term negative returns when compared against the market, which indicates that the listing price is below the offer price. If we exclude the IPOs that produced negative MAARs, the average underpricing or initial MAAR reaches 60.0 percent on the first day of trading, which is higher than what international evidence has suggested (see Adjasi et al., 2011). The observed underpricing may be a short-term effect: eventually, the market "takes back" this initial premium it pays for the unseasoned IPO (Ritter and Welch, 2002).

Table 3: Underpricing of sample IPOs

Average raw return	36.7%
Average market return	4.8%
Mean	32.0%
t-statistic	3.801***
Median	12.5%
z-statistic	4.107***
Minimum value	-34.6%
Maximum value	315.9%
Standard deviation	63.5%
Skewness	2.318
Kurtosis	6.893

Note: The underpricing is measured from the first closing market price over the sample period. For stock i at the close of the first trading day, this is computed as $MAAR_{i,t} = 100 \times \left\{\left[\frac{(1+R_{i,t})}{(1+R_{m,t})} - 1\right]\right\}$ where $R_{i,t}$ denotes the raw return and $R_{m,t}$ the market return.
The z-statistics for the median are for the Wilcoxon rank-sum test. *** = significant at 1% level.
Source: Authors' calculations.

6.2. Buy-and-Hold Abnormal Returns

The BHAR evaluates the change in wealth that investors experience by passively investing on the initial day, holding their newly issued shares for a specified period. A positive BHAR indicates outperformance and a negative BHAR indicates underperformance relative to the chosen proxy. Table 4 presents the equally weighted and value-weighted BHAR for the 57 IPOs included in this study over months 1 through 36, following the listing of the unseasoned equity shares, using the size-based matched-firm benchmark.

The results for the equal-weighted BHAR reveal significant IPO underperformance. From this, it appears that IPOs underperform relative to their size-based matched-firm benchmark. An initial investment in the new issues would have resulted in a loss of 26.3 percent (t-statistic = –4.08) by the end of month 12, and 23.0 percent (t-statistic = –2.39) and 32.7 percent (t-statistic = –2.31) by the end of months 24 and 36, respectively.

The underperformance of IPO firms relative to the matched firms based on market capitalization is statistically significant in all 36 months except for the sixth month of trading, where the BHAR was -7.8 percent (t-statistic = –1.41). This indicates that, if investors bought the IPOs on the first trading day and held them for up to three years, they would have incurred significant underperformance relative to the benchmark. This result is consistent with those found in Chi, Wang and Young (2010) and Boissin and Sentis (2014).

On a value-weighted basis, the BHAR results reflected significant underperformance in the first two months, which illustrates that IPOs underperform in the short run. For example, their performance relative to the size-based matched-firm benchmark was -11 percent (t-statistic = –0.98) after 12 months. However, in the long run, IPOs actually outperformed their benchmark by 7.7 percent each in month 24 (t-statistic = 0.40) and month 36 (t-statistic = 0.42). Hence, there is no statistically significant evidence of underperformance or over-performance in the long run when using value-weighted benchmarks. Even without a significant result, we believe that this finding is consistent with earlier findings such as Kooli and Suret (2004) and Chen, Bangassa and Brookfield (2011).

Table 4: Aftermarket BHAR for sample IPOs

	Equal-weighted				Value-weighted			
Month	$BHAR_{i,t}$	$BHAR_{mf,t}$	$BHAR_T$	$t(BHAR_T)$	$BHAR_{i,t}$	$BHAR_{mf,t}$	$BHAR_T$	$t(BHAR_T)$
1	-4.8%	1.8%	-6.7%	(-2.75)**	-5.7%	5.8%	-11.2%	(-2.02)*
2	-8.8%	2.3%	-11.1%	(-3.44)***	-9.5%	1.8%	-11.3%	(-1.77)*
3	-8.9%	1.9%	-10.8%	(-3.54)***	-6.7%	5.9%	-12.6%	(-1.23)
4	-7.3%	1.8%	-9.1%	(-2.55)**	-4.6%	3.2%	-7.7%	(-0.91)
5	-5.6%	5.5%	-11.1%	(-2.74)**	3.3%	16.1%	-12.8%	(-1.00)
6	-1.5%	6.4%	-7.8%	(-1.41)	14.6%	8.5%	6.1%	(0.38)
7	-7.7%	7.1%	-14.9%	(-1.97)*	6.6%	10.6%	-4.0%	(-0.31)
8	-9.4%	6.9%	-16.2%	(-2.05)*	-1.3%	1.8%	-3.1%	(-0.26)
9	-9.2%	12.3%	-21.5%	(-2.80)**	0.1%	-2.0%	2.1%	(0.21)
10	-7.3%	15.5%	-22.8%	(-3.10)***	-2.9%	-0.4%	-2.5%	(-0.16)
11	-7.5%	17.7%	-25.2%	(-3.50)***	-11.5%	4.0%	-15.5%	(-1.40)
12	-5.5%	20.8%	-26.3%	(-4.08)***	-10.5%	0.6%	-11.0%	(-0.98)
13	-4.5%	20.8%	-25.3%	(-3.39)***	-6.9%	-2.1%	-4.7%	(-0.38)
14	-5.6%	20.7%	-26.3%	(-3.90)***	-5.9%	-2.0%	-3.9%	(-0.31)
15	-8.2%	17.0%	-25.2%	(-3.55)***	-8.2%	-8.3%	0.1%	(0.04)
16	-11.8%	18.3%	-30.1%	(-4.16)***	-12.0%	-16.5%	4.5%	(0.46)
17	-8.7%	22.8%	-31.5%	(-3.72)***	-3.7%	-8.0%	4.3%	(0.37)
18	-6.6%	26.2%	-32.8%	(-3.92)***	-0.9%	-3.4%	2.5%	(0.21)
19	-7.7%	27.5%	-35.2%	(-4.51)***	9.6%	7.4%	2.2%	(0.14)
20	-4.8%	26.7%	-31.4%	(-3.78)***	5.6%	0.9%	4.6%	(0.27)
21	-5.9%	25.8%	-31.7%	(-3.87)***	-6.1%	-5.1%	-0.9%	(-0.05)

	Equal-weighted				Value-weighted			
Month	$BHAR_{i,t}$	$BHAR_{mf,t}$	$BHAR_T$	$t(BHAR_T)$	$BHAR_{i,t}$	$BHAR_{mf,t}$	$BHAR_T$	$t(BHAR_T)$
22	-2.7%	26.3%	-28.9%	(-3.37)***	4.4%	-4.0%	8.4%	(0.50)
23	1.5%	25.3%	-23.8%	(-2.75)**	9.9%	-3.8%	13.6%	(0.77)
24	1.7%	24.6%	-22.9%	(-2.39)**	10.6%	2.9%	7.7%	(0.40)
25	-0.4%	24.3%	-24.7%	(-2.63)**	8.9%	0.0%	8.9%	(0.49)
26	4.3%	26.4%	-22.1%	(-2.12)**	10.8%	0.2%	10.6%	(0.56)
27	4.7%	26.9%	-22.2%	(-2.38)**	12.2%	0.4%	11.8%	(0.56)
28	4.5%	28.4%	-23.9%	(-2.56)**	11.9%	0.7%	11.2%	(0.53)
29	6.0%	30.0%	-23.9%	(-2.33)**	13.3%	-1.0%	14.2%	(0.71)
30	6.7%	32.1%	-25.3%	(-2.41)**	8.2%	-3.2%	11.3%	(0.57)
31	8.5%	39.1%	-30.5%	(-2.69)**	11.9%	-0.2%	12.2%	(0.55)
32	11.3%	42.1%	-30.8%	(-2.74)**	8.7%	-1.2%	9.9%	(0.48)
33	14.0%	42.4%	-28.4%	(-2.52)**	9.5%	-4.24%	13.7%	(0.68)
34	15.2%	48.5%	-33.3%	(-2.73)**	9.1%	-2.6%	11.7%	(0.56)
35	13.3%	44.2%	-30.9%	(-2.39)**	2.1%	-6.1%	8.2%	(0.43)
36	16.4%	49.1%	-32.7%	(-2.31)**	2.5%	-5.2%	7.7%	(0.42)

Note: $BHAR_t$ 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 the returns of IPO firm i and its matching firm respectively.

To test the null hypothesis that the BHAR is significantly different from 0, we employ skewness-adjusted t-statistics (Lyon et al., 1999). The t-statistics are given in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.

Source: Authors' calculations.

6.3. Cumulative Abnormal Returns

Table 5 gives the equal- and value-weighted CAR for the 36-month period after listing for the 57 IPOs issued between 2000 and 2010, based on the size matched-firm benchmark. The results of the equal-weighted CARs reveal that IPOs underperformed against their benchmark over the sample period. The level of underperformance is significant in most cases, but this significance deteriorates at the end of month 23. For instance, CAR is -27.4 percent (t-statistic = –1.82) after 12 months, and -16.3 percent (t-statistic = –1.15) and -17.6 percent (t-statistic: = –1.67) after months 24 and 36, respectively (see Chen et al., 2011).

The value-weighted CAR illustrates that IPOs underperform over the sample period; however, this underperformance is rarely statistically significant. The value-weighted CAR is -22.8 percent (t-statistic = –1.52) after 12 months and -19.3 percent (t-statistic = –1.37) after 24 months. The value-weighted CAR in month 36 is –22.5 percent, which is significant at a 5 percent level, illustrating that Pakistani IPOs incur negative abnormal returns if the new issues are held over a period of three years.

In conclusion, the BHAR and CAR results on the basis of the equal- and value-weighted benchmarks demonstrate that evidence of longer-term performance depends on the method used to measure abnormal returns. The equal-weighted BHAR values suggest that IPOs underperform significantly as do the equal-weighted CAR values, but these are rarely significant over the 36-month period. The value-weighted BHAR shows that IPOs underperform up to month 13, but not thereafter. In addition, the results of the value-weighted CAR explain that IPOs underperform in the long run.

Table 5: Aftermarket CAR for sample IPOs

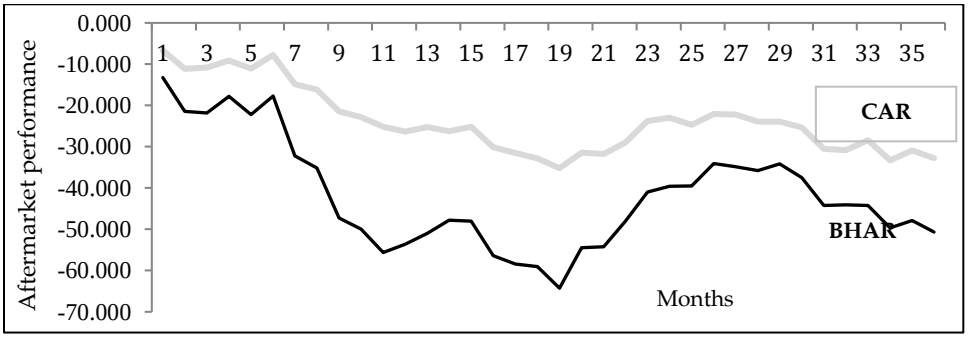
	Equal-weighted				Value-weighted			
Month	AR_t	$t(AR_T)$	CAR_T	$t(CAR_T)$	AR_t	$t(AR_T)$	CAR_T	$t(CAR_T)$
1	-6.6%	(-2.39)**	-6.6%	(-2.39)**	-11.2%	(-3.20)***	-11.2%	(-4.07)***
2	-3.8%	(-1.79)*	-10.3%	(-3.49)***	-0.4%	(-0.14)	-11.7%	(-3.94)***
3	-0.7%	(-0.30)	-11.0%	(-2.73)**	-0.2%	(-0.06)	-11.8%	(-2.93)***
4	2.4%	(1.21)	-8.7%	(-2.22)**	4.2%	(2.21)**	-7.6%	(-1.96)*
5	-2.4%	(-1.04)	-11.1%	(-2.11)**	-2.8%	(-0.54)	-10.4%	(-1.99)*
6	1.2%	(0.45)	-9.9%	(-1.52)	6.7%	(1.05)	-3.7%	(-0.58)
7	-7.5%	(-2.99)***	-17.4%	(-2.62)**	-6.0%	(-1.15)	-9.8%	(-1.48)
8	-1.6%	(-0.80)	-19.0%	(-3.33)***	0.9%	(0.12)	-8.8%	(-1.56)
9	-6.8%	(-2.85)**	-25.8%	(-3.59)***	-0.1%	(-0.02)	-8.9%	(-1.25)
10	-1.3%	(-0.72)	-27.1%	(-4.63)***	-2.6%	(-1.09)	-11.5%	(-1.99)*
11	-3.4%	(-1.87)*	-30.5%	(-5.07)***	-13.9%	(-2.37)**	-25.5%	(-4.29)***
12	3.1%	(0.72)	-27.4%	(-1.82)*	2.7%	(0.79)	-22.8%	(-1.52)
13	1.7%	(0.82)	-25.7%	(-3.49)***	7.9%	(3.49)***	-14.9%	(-2.05)*
14	4.2%	(1.53)	-21.5%	(-2.09)**	4.5%	(2.43)**	-10.4%	(-1.02)
15	-1.4%	(-0.68)	-22.9%	(-2.89)**	-0.7%	(-0.07)	-11.2%	(-1.42)
16	-3.5%	(-2.17)**	-26.3%	(-4.11)***	4.8%	(0.31)	-6.4%	(-1.01)
17	-0.6%	(-0.13)	-26.9%	(-3.76)***	-3.0%	(-0.21)	-9.5%	(-1.34)
18	0.6%	(0.37)	-26.3%	(-3.56)***	-5.4%	(-1.97)*	-14.9%	(-2.05)*
19	-2.8%	(-1.27)	-29.1%	(-3.00)***	-6.7%	(-1.92)*	-21.6%	(-2.25)**
20	6.0%	(1.80)*	-23.0%	(-1.53)	1.2%	(0.31)	-20.4%	(-1.36)
21	0.6%	(0.34)	-22.5%	(-2.72)**	-2.9%	(-0.49)	-23.3%	(-2.96)***
22	3.4%	(1.12)	-19.0%	(-1.32)	6.6%	(0.75)	-16.7%	(-1.16)
23	1.8%	(0.91)	-17.2%	(-1.78)*	4.7%	(1.21)	-11.9%	(-1.25)
24	0.6%	(0.21)	-16.6%	(-1.18)	-7.4%	(-1.62)	-19.3%	(-1.37)
25	1.8%	(0.83)	-14.8%	(-1.39)	4.5%	(2.24)**	-14.8%	(-1.40)
26	2.8%	(1.14)	-12.0%	(-0.95)	0.5%	(0.25)	-14.3%	(-1.13)
27	-0.7%	(-0.38)	-12.7%	(-1.37)	2.1%	(1.77)*	-12.1%	(-1.33)
28	0.8%	(0.52)	-11.9%	(-1.45)	1.6%	(1.52)	-10.5%	(-1.31)
29	1.7%	(0.72)	-10.2%	(-0.80)	2.1%	(1.12)	-8.4%	(-0.67)
30	-1.9%	(-1.11)	-12.1%	(-1.27)	-4.6%	(-1.05)	-13.0%	(-1.38)
31	-1.6%	(-1.00)	-13.7%	(-1.53)	-1.9%	(-1.34)	-14.9%	(-1.68)
32	0.4%	(0.20)	-13.3%	(-1.06)	-2.9%	(-0.79)	-17.8%	(-1.43)
33	-2.5%	(-1.37)	-15.8%	(-1.48)	2.2%	(2.77)**	-15.6%	(-1.47)

	Equal-weighted				Value-weighted			
Month	AR_t	$t(AR_T)$	CAR_T	$t(CAR_T)$	AR_t	$t(AR_T)$	CAR_T	$t(CAR_T)$
34	-0.6%	(-0.27)	-16.4%	(-1.29)	0.5%	(0.17)	-15.1%	(-1.20)
35	-0.6%	(-0.26)	-16.9%	(-1.30)	-3.6%	(-0.98)	-18.7%	(-1.45)
36	-0.9%	(-0.54)	-17.9%	(-1.70)	-3.8%	(-2.87)**	-22.5%	(-2.16)**

Note: The τ-period CAR for IPO firm i beginning in period s is calculated as $CAR_{i\tau} = \sum_{t=s}^{s+\tau}\left[R_{i,t} - \frac{1}{n_t}\sum_{t=s}^{s+\tau} R_{mf,t}\right]$ where $R_{i,t}$ is the return of event firm i and $R_{mf,t}$ is the benchmark return of size-based matching firms. n is the number of observations.
To test the null hypothesis that the CAR is significantly different from 0, we employ $t_{CAR_{1,t}} = CAR_{1,t} \times \sqrt{\frac{n_t}{t \times var + 2(t-1) \times cov}}$ (Ritter, 1991). The t-statistics are given in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.
Source: Authors' calculations.

Figure 2 represents the equal-weighted BHAR and CAR values (for size-matched firms), which underperform their matched-firm benchmark over the 36-month period. The level of underperformance is estimated to be greater when researchers use the BHAR methodology, illustrating significantly negative abnormal returns.

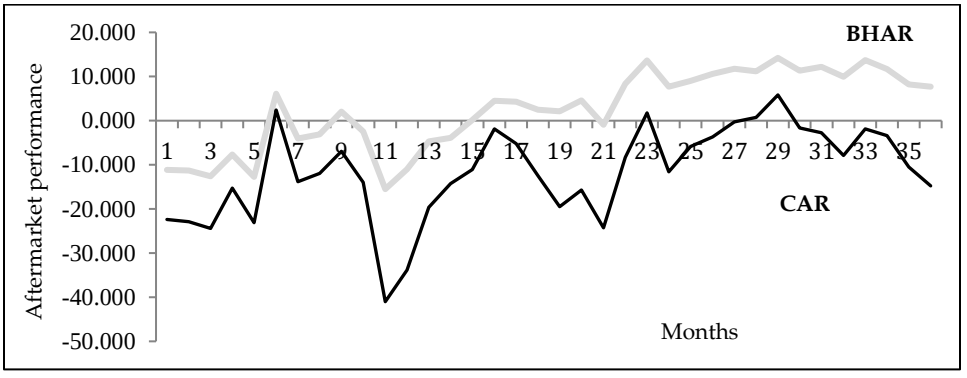
Figure 2: Equal-weighted aftermarket performance of IPOs measured using the BHAR and CAR methods



Note: The figure depicts the benchmark-adjusted mean BHAR and CAR, starting from the first day and ending with the third anniversary.

Figure 3 presents the performance of the value-weighted BHAR and CAR (for size-matched firms) using different event windows. The results provide evidence that when using the CAR methodology IPOs underperform a value-weighted matched-firm benchmark; when using the value weighted BHAR methodology, we obtained a statistically insignificant performance result. Again, the results imply that long-run performance depends on the method used to measure abnormal returns.

Figure 3: Value-weighted aftermarket performance of IPOs measured using BHAR and CAR methods



Note: The figure depicts the benchmark-adjusted BHAR and CAR, starting from the first day and ending with the third anniversary.

6.4. Issue Proceeds and Longer-Term Performance

To investigate the effect of issuer proceeds on longer-term performance, we classify all 57 IPOs into size quartiles based on gross proceeds. The equal-weighted BHAR is presented in Table 6, showing that the IPOs in three of the four groups exhibit longer-term underperformance over three years.

Table 6: Issue proceeds and longer-term performance

Gross proceeds (quartiles)	N	$BHAR_T$	$t(BHAR_T)$	CAR_T	$t(CAR_T)$
< PRs 150 mn	14	-79.2%	(-3.65)***	-66.5%	(-2.59)**
PRs 151 mn–250 mn	15	10.4%	(0.37)	20.3%	(0.82)
PRs 251 mn–675 mn	14	-46.0%	(-1.92)*	-0.9%	(-0.05)
> PRs 675 mn	14	-19.1%	(-0.84)	-27.4%	(-2.00)*
Small size	29	-32.9%	(-1.43)	-21.6%	(-1.21)
Large size	28	-32.6%	(-1.99)*	-14.1%	(-1.22)

Note: The table gives the equal-weighted BHAR and CAR over 36 months after listing based on the size-matched firm benchmark. All IPOs are distributed into size quartiles by market capitalization. PRs 150 million, PRs 250 million and PRs 675 million are used as cut-offs closest to the first, median and third quartile values, respectively. The small group pertains to firms with a market capitalization value of less than PRs 250 million.
***, ** and * = significant at the 1, 5 and 10% level, respectively.
Source: Authors' calculations.

The BHAR increases as the gross proceeds are increased. Firms that have the highest gross proceeds (> PRs 675 million) generate a BHAR of –19.1 percent (t-statistic = –0.84); those with the lowest gross proceeds (< PRs 150 million) generate a BHAR of –79.2 percent (t-statistic = –3.65). This evidence supports the ex-ante uncertainty hypothesis because issues yielding the lowest gross proceeds underperform significantly. Table 6 also documents the equal-weighted CAR for each size group, illustrating that IPOs underperform over the sample period with the exception of issue proceeds ranging from PRs 151 million to PRs 250 million, which seems to be an exception to the more general trend.

6.5. Initial Returns and Longer-Term Performance

It is vital to mention that the longer-term performance of IPOs is influenced by the magnitude of the initial returns. Generally, it is argued that the highest initial-day returns may have the lowest aftermarket performance. From Table 7, when reviewing the results of the BHAR calculation it seems as though IPOs that are underpriced (i.e. IPOs that produce higher MAARs over the short-run) underperform less over the long-run (Ritter, 1991) when compared against overpriced IPOs (i.e. IPOs that produce lower MAARs over the short-run). The CAR results with respect to initial returns seem to be the opposite of the BHAR results. Specifically, IPOs that initially generated lower short-run MAARs obtained a CAR of –22.1 percent and IPOs that initially generated higher short-run MAARs obtained an average long-run CAR of –52.0 percent by not fully exploiting the market's over-optimism at the time of the offering (see Ibbotson (1975); Tinic (1988); Ritter (1991)).

Table 7: Initial returns and longer-term performance

Initial returns	N	$BHAR_T$	$t(BHAR_T)$	CAR_T	$t(CAR_T)$
IR < 0%	22	-69.6%	(-3.02)**	-22.1%	(-2.03)*
1% < IR < 25%	12	18.5%	(1.61)	29.8%	(0.86)
26% < IR < 55%	11	-23.9%	(-0.44)	-24.4%	(-0.87)
IR > 56%	12	-24.5%	(-1.23)	-52.0%	(-3.73)***

Note: The table gives the equal-weighted BHAR and CAR over 36 months after listing based on the size-matched firm benchmark. IR = initial MAAR.
***, ** and * = significant at the 1, 5 and 10% level, respectively.
Source: Authors' calculations.

6.6. Calendar Time Approach

Table 8 gives the regression results for the Fama–French three-factor model (Panel A) and the Carhart four-factor model (Panel B). The dependent variables are the equal- and value-weighted monthly excess returns of the IPO portfolio. The independent variables are market excess returns, size, the book-to-market ratio and the momentum factor.

Table 8: Long-run calendar time portfolio regressions

Panel A: Fama and French (1993) three-factor model

	Dependent variable: equal-weighted IPO portfolio returns		Dependent variable: value-weighted IPO portfolio returns	
Variable	**Coefficient**	**t-test**	**Coefficient**	**t-test**
Intercept	-0.068	-1.90*	-0.105	-14.25***
$R_m - R_f$	0.366	0.90	0.139	2.01*
SMB	-0.177	-3.12***	-1.015	-47.11***
HML	0.044	0.45	0.011	0.25
Adj. R^2	0.124		0.982	
F-stat.	12.49***		1,941.70***	

Panel B: Carhart (1997) four-factor model

	Dependent variable: equal-weighted IPO portfolio returns		Dependent variable: value-weighted IPO portfolio returns	
Variable	**Coefficient**	**t-test**	**Coefficient**	**t-test**
Intercept	-0.034	-0.85	-0.118	-12.44***
$R_m - R_f$	0.579	1.39	0.096	1.19
SMB	-0.135	-2.82***	-1.031	-41.97***
HML	0.010	0.10	0.018	0.50
WML	-0.389	-2.09**	0.213	3.78***
Adj. R^2	0.170		0.985	
F-stat.	11.29***		1,688.78***	

Note: The Fama-French three-factor model is estimated as $R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + \epsilon_{it}$ and the Carhart four-factor model is defined as $R_{pt} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + w_i WML_t + \epsilon_{it}$ where R_{pt} is the equal- or value-weighted return of the IPO portfolio in month t, R_{ft} is the three-month treasury bill rate in month t, R_{mt} is the return on the value-weighted market index (KSE-100) in month t, SMB_t is the return on a value-weighted portfolio of small minus large stocks in month t, HML_t is the return on a value-weighted portfolio of high minus low book-to-market stocks in month t, and WML_t is the average return on a value-weighted portfolio of winner minus loser stock for the past 11 months in month t.

Large and small stocks = the top 30 and bottom 30 percent of market capitalization, respectively. High and low book-to-market ratios = top and bottom 30 percent, respectively. Winners and losers = top and bottom one-third average return over the past 11 months, respectively.

The t-statistics are based on Newey–West heteroskedasticity and autocorrelation consistent standard errors. *, ** and *** = significant at the 1, 5 and 10% level, respectively.

Source: Authors' calculations.

Panel A presents the negative coefficients of the intercepts in both regressions, which are significant at the 10 and 1 percent levels, respectively. These results indicate that IPOs underperform over the three-year period subsequent to issuing unseasoned equity shares and after controlling for market, size, book-to-market and momentum factors. The excess market return $(R_m - R_f)$ in both regressions illustrates that IPO stocks are subject to a much lower level of systematic risk, while in the value-weighted three-factor regression, $R_m - R_f$ is marginally significant at the 10 percent level; however, the economic significance of this coefficient shrinks from 0.336 to 0.139 indicating that the systemic component of IPO returns is modest. Both models indicate a stronger negative association with the size (SMB) factor, which suggests that large firms experience greater returns than small firms. The coefficient of HML is positive but insignificant. An interesting element of the results from panel A and warrants further consideration is the idea that the patterns of returns generated from the IPOs do not seem to adhere to modern portfolio theory and they seem to have very small levels of systemic risk associated with those return series. Therefore, further analysis is required to attempt to determine the true determinates of IPO performance and in the next section we will examine this issue.

Panel B reports that the coefficients of abnormal returns (the intercepts) are negative in both the regressions, and that the IPOs underperform significantly at the 1 percent level when using value-weighted returns over a period of three years. Again, the systematic risk in both regressions is very small, but has an insignificant effect. The coefficient of SMB is significantly negative in both regressions, which illustrates that firms with a large market capitalization earn higher returns than small firms. As far as HML is concerned, high B/M firms yield better returns than small B/M firms. In addition, WML is significant in both regressions. The value-weighted Carhart model shows that winners obtain higher returns than losers.

6.7. Determinants of IPOs' Longer-Term Performance

To identify the determinants of longer-term performance, the EBA technique is used to test the robustness and sensitivity of the explanatory variables. The sensitivity results are summarized below.

6.7.1. Some Preliminary Results

In estimating the X variables for BHAR, the preliminary regression includes the long-term investment ratio (*LT*) and industry effects (*INDUSTRY*). The regression indicates the importance of the X variables' influence over long-term underperformance in the sample period. The dependent variable is the 36-month equal-weighted BHAR. The regression is presented as:

$$BHAR = \underset{(2.13)^{**}}{-0.0099} \underset{(2.68)^{***}}{-0.0708\,LT} \underset{(1.74)^{*}}{+0.0137\,INDUSTRY} \quad (14)$$

Equation (14) is estimated using ordinary least squares (OLS). The adjusted R^2 term is 0.1015, the number of observations is 57 and the t-values are presented in parentheses. The results of the equation reveal that the long-term investment ratio and industry effects are significant at the 1 and 10 percent levels, respectively.

The preliminary CAR regression comprises MAAR and the IPO activity period (*Time*) as X variables. The dependent variable is the 36-month equal-weighted CAR. The regression is specified as:

$$CAR = \underset{(-2.26)^{**}}{-0.5542} \underset{(-1.61)}{-0.3229\,MAAR} \underset{(-2.98)^{***}}{-0.8552\,Time} \quad (15)$$

The adjusted R^2 is 0.1670, the number of observations is 57 and the t-values are presented in parentheses. Equation (15) explains the significance of *Time* at the 1 percent level, showing that it is an important determinant of longer-term underperformance. ***, ** and * indicate significance at the 1, 5 and 10 percent level.

6.7.2. Results of Basic Model Without Z Variables

Two regressions excluding the Z variables are tested to examine long-term IPO performance. In both regressions, two different variables are considered X variables. Regression I includes the long-term investment ratio (*LT*) and industry effects (*INDUSTRY*) and regression II includes the MAAR and the IPO activity period (*Time*) as X variables. The listing delay (*LDel*), financial leverage (*FinLev*), size of the firm (*FSize*) and aftermarket risk level (*Risk*) are used in regression I, whereas ROA, *Risk*, *LT* and PIPH are included in regression II as Q variables.

Table 9 estimates the basic models for regressions I and II. First, the adjusted R^2 of regressions I and II were 0.1858 and 0.3593, respectively, which indicates that they explain some of the variation in the BHAR. Second, the X variables in both regressions are statistically significant, showing that the variables are important determinants of IPO performance.

Table 9: Estimation results for benchmark models without Z variables

Regression I		**Regression II**	
Constant	-0.1206 (-1.51)	Constant	-0.0013 (-0.22)
X variables		*X variables*	
LT	-0.0794 (-3.83)***	MAAR	-0.0095 (-2.17)**
INDUSTRY	0.0174 (2.03)**	Time	-0.0273 (-2.34)**
Q variables		*Q variables*	
LDel	0.0063 (0.54)	ROA	-0.1109 (-4.31)***
FinLev	0.0231 (1.75)*	Risk	0.0008 (6.45)***
FSize	0.0037 (1.50)	PIPH	0.0373 (2.60)**
Risk	0.0002 (0.91)	LT	-0.0348 (-1.46)
Adj. R^2	0.1858	Adj. R^2	0.3593
F-value	5.37***	F-value	14.61***

Note: The two cross-sectional OLS regressions are $BHAR_i = \alpha_0 + \beta_1 LT_i + \beta_2 INDUSTRY_i + \beta_3 LDel_i + \beta_4 FinLev_i + \beta_5 FSize_i + \beta_6 Risk_i + \epsilon_i$ and $CAR_i = \alpha_0 + \beta_1 MAAR_i + \beta_2 Time_i + \beta_3 ROA_i + \beta_4 Risk_i + \beta_5 PIPH_i + \beta_6 LT_i + \epsilon_i$ where the dependent variables are the three-year equal-weighted BHAR (regression I) and CAR (regression II) based on the size-matched firm benchmark.

The independent variables include *LT* (long-term investment ratio), *INDUSTRY* (dummy variable = 1 for firms in the financial sector and 0 otherwise), *LDel* (listing delay), *FinLev* (financial leverage), *FSize* (size of the firm), *Risk* (aftermarket risk level of the IPO), MAAR (on the first trading day), *Time* (dummy variable = 1 for firms issued an IPO in a high-activity period and 0 otherwise), ROA and PIPH.

The t-values are shown in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.

Source: Authors' calculations.

In regression I, the long-term investment ratio at the time of issuance has a negative and statistically significant relationship with the long-term BHAR, which is in line with the previous studies (e.g. Cai, Liu & Mase (2008). In addition, we document a positive relationship between the industry variable which is coded as a binary variable taking on a '0' if the IPO is in an industry other than finance and a '1' if it is associated with the finance industry. The results of this study provide conflicting evidence in relation to the finance industry's impact on IPO performance and find a positive and statistically significant relationship between an affiliation in the finance industry and longer-term performance.

Continuing the analysis of the results presented in regression I, we find that the only Q variable that has a statistically significant impact on long-run IPO performance is the firm's use of financial leverage. Therefore, the listing delay, offer size, and after market risk variables have an insignificant effect on long-run IPO performance when using the BHAR methodology. The financial leverage variable (*FinLev*) has a positive and statistically significant relationship with the long-run BHAR. This indicates that firms with higher financial leverage will have more resources to expand their business activities, which increases the performance of IPO firms; firms with lower financial leverage prior to listing may limit their resources and this eventually reduces their performance over the long-run (Eckbo & Naroli, 2005; Hoechle & Schmid, 2007). This finding supports the ex-ante uncertainty hypothesis.

Turning to the results presented in Table 9, regression II, we find that both of the *X* variables have a statistically significant impact on long-run IPO performance. The MAAR and Time variables have negative relationships with the long-run CAR. We will explain these effects in the subsequent paragraphs.

In section 6.1, we examined whether IPOs were underpriced using the MAAR or market adjusted abnormal return method, a methodology that is used to detect whether the aggregate IPOs' returns were significantly different from the market's returns. The raw returns for the IPOs were 36.7 percent and the average return on the market was 4.7 percent; therefore, we estimated that IPOs were initially underpriced by 32.0 percent. The level of perceived underpricing increases as the MAAR increases because researchers, companies, and markets question why the underwriters and the company would accept an offer for their company at a 32 percent discount to what the company is actually worth on the next day. This is what has been referred to as leaving money on the table (Loughran & Ritter, 2002).

As indicated in regression II in Table 9, the relationship between the MAAR variable and the long-term CARs is both negative and statistically significant. As the initial MAAR increases the results indicate that three years later the CAR decreases all other things constant. Therefore, as the initial MAAR decreases the researchers expect that the CAR will increase. This finding supports empirical evidence and is somewhat intuitive. It is hard for companies that initially achieve significantly positive returns to sustain those valuations and they retreat over the long run to the initial value set by the company and the underwriters. This reversion to the initial price level or the negative relationship between initially positive MAARs and longer-term negative CARs leads some investors to question whether these issues are

actually underpriced or if investors overreact to the hype created by these IPOs or the fads that might generate unwarranted public interest, which eventually diminishes as the excitement over the IPO fades.

The second X variable was the IPO activity period (*Time*) which has a negative and significant effect on the long-run CAR. This illustrates that when firms go public during a high-activity period their long-term CAR is lower when compared against firms that issue their shares in low-activity periods. This result makes practical sense and is in line with empirical research on IPO pricing and performance. There is a growing body of IPO literature that indicates that firms attempt to time their IPOs and issue their company's shares when the valuations of IPOs are elevated. If a company issues shares when markets are willing to pay a premium for their company they will likely experience difficultly maintaining that valuation when the market reverts to valuations that are in line with historic norms. This result is in line with the window-of-opportunity hypothesis (Helwege & Liang, 2004; Kooli, L'Her & Suret, 2006; Sahoo & Rajib, 2010).

In Table 9, among the Q variables, the significant determinants are ROA, aftermarket risk level, and PIPH. There is a negative relationship between the ROA prior to listing and IPO performance. This implies that as the IPO firm's ROA prior to issuance increases, their long-run performance decreases. The aftermarket risk level of the IPOs positively affects the aftermarket performance. This implies that there is a positive relationship between the post issuance volatility experienced in a newly issued IPO and the performance of the IPO (Sahoo & Rajib, 2010). The higher post-issue pricing behavior leads to higher volatility thereby increasing the CAR. Post issue promoters' holding (PIPH) significantly affects aftermarket performance, which suggests that as the promoters hold a higher proportion of shares the performance of IPOs increases (Thomadakis et al., 2012; Brau, Couch & Sutton, 2012). Finally, in Table 9, the listing delay, the size of the firm and the aftermarket risk level in regression I, and the long-term investment ratio in regression II are insignificant. In summary, financial leverage in regression I and ROA, aftermarket risk level and PIPH in regression II are considered as important determinants of IPO performance from the Q variables.

6.7.3. Results of Basic Model with All Z Variables

Table 10 reports the results of the basic model with all Z variables included. The results can be described in regard to the basic model without the Z variables: both the X variables in regression I (long-term investment

ratio and industry effects) and one of the X variables in regression II (IPO activity period) are significant. In terms of the Q variables the ROA, Risk and the Long-Term investment variables have a statistically significant effect on long-run performance when we use the CAR methodology. Among the Z variables, the age of the firm is the only significant variable that affects aftermarket performance (see regression II). This finding is contrary to earlier evidence. No other variable has a significant effect on the level of IPO performance in regressions I and II.

Table 10: Estimation results for benchmark models with all Z variables

Regression I		**Regression II**	
Constant	-0.1303 (-1.54)	Constant	0.0573 (0.82)
X variables		X variables	
LT	-0.1001 (-3.22)***	MAAR	-0.0096 (-1.32)
INDUSTRY	0.0194 (2.09)**	Time	-0.0274 (-3.17)***
Q variables		Q variables	
LDel	0.0093 (0.73)	ROA	-0.1161 (-3.16)***
FinLev	0.0267 (1.33)	Risk	0.0009 (3.08)***
FSize	0.0186 (1.06)	PIPH	0.0250 (0.93)
Risk	0.0002 (0.67)	LT	-0.0471 (-1.84)*
Z variables		Z variables	
MAAR	-0.0022 (-0.45)	FinLev	0.0064 (0.39)
Time	-0.0079 (-0.76)	FSize	-0.0006 (-0.18)
PIPH	0.0344 (1.06)	INDUSTRY	-0.0027 (-0.36)
MktRet	0.4059 (0.21)	MktRet	0.1725 (0.11)
OSize	0.0032 (0.52)	OSize	-0.0057 (-1.14)
Sub	0.0008 (0.54)	Sub	-0.0003 (-0.28)
EPS	-0.0015 (-0.34)	EPS	0.0016 (0.44)
ROA	-0.0415 (-0.93)	LDel	0.0138 (1.31)
Age	0.0088 (1.51)	Age	0.0106 (2.22)**
MktVol	-0.0067 (-0.01)	MktVol	0.0786 (0.11)
Adj. R^2	0.0902	Adj. R^2	0.3535
F-value	1.43	F-value	2.91***

Note: The dependent variables are the three-year equal-weighted BHAR (regression I) and CAR (regression II) based on the size-matched firm benchmark.
The independent variables include *LT* (long-term investment ratio), *INDUSTRY* (dummy variable = 1 for firms in the financial sector and 0 otherwise), *LDel* (listing delay), *FinLev* (financial leverage), *FSize* (size of the firm), *Risk* (aftermarket risk level of the IPO), MAAR (on the first trading day), *Time* (dummy variable = 1 for firms issued an IPO in a high-activity period and 0 otherwise), ROA, PIPH, *MktRet* (market return measured through KSE-100 index over three months prior to the IPO date), *OSize* (offer size of issue), *Sub* (oversubscription ratio), EPS, *Age* (firm age), and *MktVol* (volatility of market returns).
The t-values are shown in parentheses. ***, ** and * = significant at the 1, 5 and 10% level, respectively.
Source: Authors' calculations.

Regression I found in Table 10 provides empirical evidence of an insignificant relationship between the MAARs and the IPO activity periods (*Time*) with the BHARs. In regression II, all the variables are insignificant except for the age of the firm variable. Regressions I and II include other Z variables, such as market returns, offer size, oversubscription, EPS, ROA, and market volatility. We observe that offer size, EPS, ROA, age and market volatility are seen to have no significant effect on IPO performance.

In comparing the results of the regressions with and without the Z variables, we conclude that economic theory does not produce a complete specification of which variables researchers should hold constant when performing statistical tests. EBA, as the more useful approach, explains that a sensitivity analysis provides more authentic results in terms of the significance of the explanatory variables.

6.7.4. Results of Sensitivity Analysis

We test the sensitivity of the X and Q variables to examine whether they are robust or fragile. In each regression, three of 13 Z variables are chosen as regressors. For each regression, a total of 286 forms are tested. The purpose of this is to identify which variables are significant at the 10 percent level. Table 11 gives the results of the sensitivity test under the EBA method. The results show that, in regression I, the long-term investment ratio, industry effects, and financial leverage are the robust variables in determining IPO underperformance. Regression II shows that the initial MAAR variable, IPO activity period, ROA, PIPH and aftermarket risk level are the robust predictors that influence longer-term underperformance.

Table 11: Summary of EBA tests

Variable	Sign	Regression I	Regression II
X variables			
Long-term investment ratio	–	Robust	NA
Industry effects	+	Robust	NA
MAAR	–	NA	Robust
Time	–	NA	Robust
Q variables			
Listing delay	+	Fragile	NA
Financial leverage	+	Robust	NA
Firm size	–	Fragile	NA
Aftermarket risk level of IPO	+	Fragile	Robust
ROA (total assets)	–	NA	Robust
Long-term investment ratio	–	NA	Fragile
PIPH	+	NA	Robust

Note: We test the robustness of the variables based on a significance level of 10%. Significant variables are termed "robust" while the others are classified as "fragile." NA = not applicable in the regression.
Source: Authors' calculations.

7. Conclusion and Policy Implications

This study investigates the short-run and longer-term performance of unseasoned issues using 57 event firms listed on the KSE during the period lasting from 2000–10. We find that, at least initially, companies seem to underprice their IPOs – on average by 32.0 percent – which we attribute to the uncertainty attached to the sample IPOs. The degree of underpricing between financial and nonfinancial firms is initially almost the same. A comparison of the magnitude of the underpricing of Pakistani IPOs in comparison to international markets indicates that Pakistani issuers of unseasoned equity shares seem to leave too much money on the table (Loughran & Ritter, 2002).

To gauge the level of long-run abnormal performance, this study documents how IPOs underperform against their respective benchmarks over a three-year period following the issuance of unseasoned equity shares. The results are highly sensitive to the methodology used to identify abnormal performance. Interestingly, IPOs underperform significantly over the three years, but the pattern of underperformance is not always the

same. The results of the calendar time analysis suggest that IPOs underperform significantly in the long run.

To identify the robust predictors of long-run performance, this study uses the EBA technique and reports the following: (i) long-term investment ratio has a negative effect on aftermarket performance, (ii) financial firms seem to produce better returns when compared against nonfinancial firms over the long run, which is contrary to empirical evidence, (iii) firms that use more leverage seem to generate better performance when compared against firms that use less leverage, (iv) there is a negative relationship between the short-term MAAR and longer-term performance, (v) IPOs issued during high-activity periods seem to generate lower returns in long-run studies of IPO performance, (vi) as the aftermarket risk of the new issues increases, the long-run performance increases, (vii) when the promoters hold a higher proportion of the shares, this adds value to the firms which eventually increases the IPO performance, and (viii) firms that initially have a higher return on assets produce lower returns over the long-run. These results are consistent with both the fads and window-of-opportunity hypotheses, which imply that the enthusiasm surrounding IPO stocks decreases over time and that prices are eventually corrected, which affects the longer-term performance.

In summary, IPOs outperformed over the short run and underperformed over longer-term time horizons. However, the results of longer-term performance may vary, depending on the choice of model used to gauge abnormal performance. It is, therefore, argued that the level of performance is improved by controlling for the timing of the new issue, the level of initial underpricing, the long-term investment, financial leverage, aftermarket risk level, return on assets, post-issue promoters' holding, and IPO activity period. It is important to improve IPO performance through the determination of the true offer price, which may help to reduce the deterioration in IPOs' aftermarket performance. It is, thus, appropriate for the underwriters to use the book-building mechanism to determine the appropriate offer price – this may reduce the chances of longer-term underperformance.

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Appendix

Description and computation of explanatory variables used to measure longer-term performance

Explanatory variables	Expected sign	Calculation
LT = long-term investment ratio	–	Long-term investments divided by total assets.
INDUSTRY = industry effects	–	Sample IPOs are segregated into two categories: financial and nonfinancial. The dummy variable = 1 if firms are in the financial sector and 0 otherwise.
LDel = listing delay	+	Natural logarithm of the number of days separating the closing of subscription and the first day of trading.
FinLev = financial leverage	+	Financial risk of the firm. Calculated as the book value of long-term debt to total assets.
FSize = size of the firm	–	Natural logarithm of the firm's total assets prior to IPO.
Risk = aftermarket risk level of the IPO	+	Standard deviation of the post-issue pricing of the first 245 trading days.
MAAR = short-run underpricing	–	Market-adjusted abnormal returns on the first day of trading earned by IPO investors.
Time = IPO activity period	–	Dummy variable = 1 for firms that are listed during the hot period and 0 otherwise. A hot period is one in which at least five IPOs took place in a year.
PIPH = post-issue promoters' holding	+	Number of shares owned and retained by the promoters and the promoter group, divided by total number of issued shares.
MktRet = market return	+	Measured through KSE-100 value-weighted index over three months prior to IPO.
OSize = issue proceeds	–	The number of shares issued multiplied by offer price: the amount a firm wants to issue through IPO.
Sub = oversubscription ratio	+	The number of shares demanded by the number of shares offered.
EPS = earnings per share	–	Total income divided by outstanding shares prior to IPO.
ROA = return on assets	–	Net income by total assets.
Age = age of the firm prior to IPO	–	Scaled as the difference between year of establishment and going public.
MktVol	+	Standard deviation of market return over three months prior to IPO.