Economia Aplicada, v. 21, n. 3, 2017, pp. 549-579

SHORT AND INTERMEDIATE-TERM PRICE PERFORMANCE OF UNSEASONED ISSUES

Muhammad Zubair Mumtaz [*]
Zachary Alexander Smith [†]

Resumo

Avaliamos o desempenho de preços no curto e médio prazo de ofertas públicas iniciais no período de 1995 a 2014. Encontramos que as novas emissões, em média, são subavaliadas no dia de listagem e obtêm retornos anormais significativos até os quinze dias de negociação. No caso do desempenho a médio prazo, os investidores obtêm retornos positivos anormais para, no máximo, dois meses de negociação. Utilizamos análise de limites extremos, regressão lasso e regressão passo a passo para selecionar os fatores determinantes do desempenho a curto e médio prazo. Cada método econométrico possui suas próprias especificações e características para identificar os melhores parâmetros.

Palavras-chave: Ofertas públicas; *Performance* de preço; Curto prazo; Médio prazo; Análise de limites extremos.

Abstract

The researchers examined the short-term and intermediate-term price performance of unseasoned issues during the period lasting from 1995 to 2014. We find that new issues, on average, are underpriced on listing day and obtain significant abnormal returns up to fifteen trading days. In case of intermediate-term performance, investors yield positive abnormal returns for the first two months of trading but not thereafter. We employ Extreme Bounds Analysis, Lasso Regression, and Stepwise Regression to select the determinant factors of short-term and intermediate-term performance and find that each econometric method has its own build-in specifications and characteristics to identify the best parameters.

Keywords: Unseasoned issues; Price performance; Short-term; Intermediate-term; Extreme Bounds Analysis.

JEL classification: G11, G14

DOI: http://dx.doi.org/10.11606/1413-8050/ea140809

[*] National University of Sciences and Technology, School of Social Sciences & Humanities, Pakistan. Email: zubair@s3h.nust.edu.pk
[†] Saint Leo University, Donald R. Tapia School of Business, United States. Email: zacharyasmith@gmail.com

Recebido em 25 de setembro de 2016 . Aceito em 04 de novembro de 2016.

1 Introduction

Over the past four decades, the underpricing of unseasoned issues has been a pervasive phenomenon for which prior research documented that new issues generally tend to be underpriced (Logue 1973, Ibboston 1975). Underpricing is the percentage premium that an investor receives at the initial market trade. Researchers attempted to shed light on determination of abnormal returns in different countries as well as across time periods. Ibboston (1975) found that, on average, new issues earned significant abnormal return on initial trading day. However, the magnitude of the underpricing varies from country to country. Banerjee et al. (2011) argued that underpricing is not a country specific issue but is a general phenomenon. Loughran et al. (2013) observed higher underpricing in developing markets when compared to developed markets. They postulated that higher underpricing is attributed to the volatility of developing countries markets entailing higher risk. Moshirian et al. (2010) documented that initial underpricing in Asian countries is comparatively higher than other markets.

In Pakistan, Sohail & Nasr (2007) examined 50 unseasoned issues during the 2000–2006 period and documented the existence of initial underpricing of 35.66%. Sohail & Rehman (2010) further measured short-run underpricing of 73 IPOs over 20-trading days starting from listing during the 2000–2009 period and found evidence of underpricing that ranged from 37% to 42%. Kayani & Amjad (2011) reported initial underpricing of 39.86% using 59 IPOs from 2000 to 2010. Additionally, Afza et al. (2013) using 55 IPOs found the existence of initial underpricing of 28.03% during the period of 2000–2011. Recently, in another study carried out by Mumtaz & Ahmed (2014) using 75 IPOs, the researchers found the existence of initial underpricing of 30.30% during the 2000 to 2011 time period. All these studies have examined underpricing in the Pakistani market using the following time periods: (a) at listing day and (b) over the 30-trading day period starting from listing comprising the periodicity from 2000 to 2011. This study adds to the existing literature by measuring the short-term and intermediate-term pricing performance of 121 IPOs listed on the Karachi Stock Exchange from 1995 to 2014. Short-term performance is measured from listing to 15-trading days and intermediate-term performance is examined from one to six months of trading. In prior studies, researchers selected control variables at random and identified whether they were significant or not but in the case of IPO studies there was no specific methodology applied to classify explanatory variables based on their sensitivity and robustness. To examine the robust determinants of short-term and intermediate-term performance of unseasoned issues, a comprehensive analysis has been carried out using the EBA technique. This method identifies the true and robust variables that affect the performance of unseasoned issues. The purpose of this study is to identify the best descriptive model of performance of unseasoned issues by including the EBA technique. This method enhances the study by employing a sensitivity analysis to illustrate that the parameter estimates are stable, which reduces the uncertainty in selecting the final model (Leamer 1983), and provides an enhanced platform to identify and evaluate whether the variables are 'true' predictors of unseasoned issues.

In line with previous researches, this study reports the strong evidence of short-term underpricing in Pakistani market. Unseasoned issues are underpriced on average by 14.23% on listing day. The results of short-term price

performance predict that investors earn significant positive abnormal return over 15-trading days. However, intermediate-term performance suggests that investors obtain positive returns after 2 months but thereafter no evidence of abnormal returns is found over 6 months. The robust predictors of short-term performance are investigated through the EBA technique on the first and fifteen trading days and results thereof suggest oversubscription being foremost factor followed by aftermarket risk level. Other robust variables include rate of return on assets, offer price and market return. The determinants of intermediate-term performance are examined over third and six month of trading and found that oversubscription, rate of return on assets and underwriters prestige are the robust predictors. We also compare our results with other econometric techniques (e.g. lasso regression and stepwise regression). The results suggest that every technique has its own methodological framework to identify and select variables, however, the EBA is preferable over the others based on its sensitivity analysis thereby reducing the ambiguity in selecting explanatory variables.

2 Literature Review

Researchers provided evidence that unseasoned issues earn abnormal excess returns on listing day (Agathee et al. 2012, Aggarwal et al. 1993), illustrating that the closing market price is more than the offer price. The magnitude of underpricing in developing markets is higher as compared to the developed markets (Loughran et al. 2013, Banerjee et al. 2011). There are a few studies that have examined the short-term performance of unseasoned issues up to one-month. Ljungqvist et al. (2006) argued that the post-issue prices in developing markets may take more time to reach its equilibrium. We extend the existing literature by examining the short- and intermediate-term price performance of new issues up to the 6th month of trading to detect abnormal returns.

Several theoretical explanations have been formulated to describe short,-term performance. First, the winner's curse hypothesis is one of the most prominent models developed by Rock (1986). It assumes that asymmetric information caused underpricing. Rock categorized investors into two forms: (a) informed and (b) uninformed. To determine the value of the firm as well as offer price, informed investors sought information through an evaluation of costs while uninformed investors do not have access to obtain readily available information. Informed investors participate only in those issues that tend to be underpriced leading to an impression that the new stocks may be, oversubscribed. The problem of information asymmetry suggests that uninformed investors may invest in overpriced issues which lead them to obtain negative returns (Ritter & Welch 2002). This position is known as winner's curse. Second, the signaling hypothesis explains that this mechanism used by firms (Welch 1989) caused underpricing whereby prominent companies deliberately underprice their issues to provide indication to the market and "leaving a good taste in investors' mouths" (Ibboston 1975). Subsequently, these firms issue seasoned offerings at higher prices. Third, the ex-ante uncertainty hypothesis is related to information asymmetry emphasizing the investing risk faced by the prospective investors. In presence of the ex-ante uncertainty, the offering price will be too low thereby increasing the level of over-

subscription. Unseasoned issues are intentionally underpriced to reduce the possibility that the issue will fail. Moreover, underpricing is correlated positively with the ex-ante uncertainty. Fourth, the ownership dispersion hypothesis posits that issuers deliberately underprice securities to generate more demand so a large number of small shareholders may be attracted (Ritter 1998). This dispersed ownership may increase the liquidity of the firm. Prior studies documented a negative relationship between promoters' holdings and underpricing. Fifth, the monitoring hypothesis describes that firms have the benefit to underprice IPOs leading to a decrease in the costs of monitoring by large institutional investors and new shareholders as well. As a result, conflicting interests arise because the benefits of both the managers and the shareholders are misaligned. Brennan & Franks (1997) argued that underpricing is a way to dispersed ownership by managers. However, managers use it as a tool to determine the level of underpricing. Sixth, the hypothesis of law avoidance presents that companies underprice their issues to minimize the possibility of lawsuits from the investors that may arise because of any error or omission in the issuance of the prospectus. Banerjee et al. (2011) found a direct association between the accessibility of legal recourse and underpricing.

Empirically, it has been found that unseasoned issues outperform in short-run. In an early study, Reilly & Hatfield (1969) documented initial underpricing of 11% in the US market from 1963–1965. During the decade of the 1980s, underpricing was just 7% while it was almost double (15%) from 1990–2000. Liu & Ritter (2010) reported the underpricing of 12% during the 2001–2008 period. However, the level of underpricing was more than 65% during the bubble period (i.e. 1999–2000) illustrating that abnormal excess returns vary with the time period. In the U.K. market, Khurshed & Mudambi (2002) argued that the degree of underpricing depends on the benchmarks used. Belghitar & Dixon (2012) examined 335 UK IPOs and found initial underpricing of 12.07%. Additionally, they documented that IPOs backed by venture capital firms are less underpriced than non-venture capitalist IPOs.

Prior research has argued that the underpricing in the emerging markets is greater than underpricing in the developed markets due to the higher uncertainty associated with new issues. Borges (2007) examined 41 Portuguese unseasoned issues and found initial underpricing of 11.12%. To analyze different IPO methods, Kucukkocaoglu (2008) concluded that underpricing is higher when the fixed offer and book building mechanisms are used. In an analysis of 34 Tunisian IPOs from 1992–2008, Zouari et al. (2009) found underpricing of 16.1%, 16.8% and 17.8% on the 1, 2 and 3-trading day respectively. They determined that oversubscription, capital retention, underwriters' reputation, and offer price are significant factors of underpricing. Underpricing of 47 Gulf firms was found to be 290% during the 2001–2006 period (Omran et al. 2010). Moshirian et al. (2010) comprehensively analyzed the initial excess returns during the 1991 to 2004 period in six Asian-Pacific countries and found: (a) 202.63% in China, (b) 70.30% in Korea, (c) 61.81% in Malaysia, (d) 21.43% in Hong Kong, (e) 34.04% in Japan and (f) 33.10% in Singapore. In the Hong Kong market, Yan et al. (2010) reported initial underpricing of 16.8% during the 1993–2003 period.

Adjasi et al. (2011) studied 80 Nigerian issues reporting initial underpricing of 43.10% during 1990–2006 period. They determined that offer size, a firm's size and auditing firms significantly impact underpricing. However, the size of the firm is positively associated with underpricing. Initial under-

Table 1: Underpricing of unseasoned issues in developing countries

Study	Period	Sample Size	Country	Underpricing (%)	Possible causes of IPOs underpricing identified by various studies
Islam (2014)	2003-2013	105	Bangladesh	250.38	Oversubscription, offer size, market capitalization, underwriters' prestige and ownership retention.
Mumtaz & Ahmed (2014)	2000-2011	75	Pakistan	30.30	Aftermarket risk, oversubscription, offer price and financial leverage.
Song et al. (2014)	2006-2011	948	China	66.00	Offer size, age of firm, and earnings per share.
Afza et al. (2013)	2000-2011	55	Pakistan	28.03	Corporate governance and CEO duality.
Chuanrommanee & Boonchuaymetta (2013)	2001-2011	153	Thailand	18.03	Offer size, IPO allocation to institutional investors and length of lockup period.
Darmadi & Gunawan (2013)	2003-2011	101	Indonesia	22.20	Board size, Board independence and institutional ownership.
Avelino (2013)	2004-2011	129	Brazil	4.79	Market returns and assets of the firm.
Sahoo (2012)	2002-2008	72	India	39.93	Post issue promoters holding, P/E ratio, IPO activity, and book value.
Abubakar & Uzaki (2012)	2000-2011	476	Malaysia	35.87	Offer size, issue price and firm's age.
Jewartowski & Lininska (2012)	1998-2008	186	Poland	13.95	Size of firm, ROE and volatility of market return.
Agathee et al. (2012)	1989-2005	44	Mauritius	13.14	Aftermarket risk level of IPOs, age of firm, Z-score and earnings per share.
Alagidede & Heerden (2012)	2006-2010	138	South Africa	108.30	-
Kayani & Amjad (2011)	2000-2010	59	Pakistan	39.87	Oversubscription, ex-ante uncertainty, offer size and market capitalization.
Adjasi et al. (2011)	1990-2006	80	Nigeria	43.10	Offer price, quality of audit firms, and offer size.
Sohail & Rehman (2010)	2000-2009	73	Pakistan	42.10	-
Chong et al. (2010)	1993-2003	92	Hong Kong	16.80	Market conditions, offer price, historical growth of firm, and price to book ratio.

Table 1: Underpricing of unseasoned issues in developing countries (continued)

Study	Period	Sample Size	Country	Underpricing (%)	Possible causes of IPOs underpricing identified by various studies
Samarakoon (2010)	1987-2008	105	Sri Lanka	33.50	Offer size, underwriter's prestige, hot market dummy, market sentiment, and privatization issues.
Islam et al. (2010)	1995-2005	117	Bangladesh	156.16	Offer size, and firm's size.
Chorruk & Worthington (2010)	1997-2008	136	Thailand	17.60	-
Pande & Vaidyanathan (2009)	2002-2004	55	India	22.62	Oversubscription and listing delay.
Zouari et al. (2009)	1992-2008	34	Tunis	16.10	Oversubscription, capital retention, underwriters, and offer price.
Kucukkocaoglu (2008)	1993-2005	217	Turkey	11.73	Percentage of shares offered, offer size, net profit, and age of firm.
Lin & Hsu (2008)	1999-2004	171	Hong Kong	6.09	Oversubscription, and trading and services dummy.
		103	Taiwan	2.57	Oversubscription, and trading volume.
Deng & Dorfleitner (2008)	2002-2004	237	China	89.61	P/E ratio, offer size, cost of offerings, and net asset per share.
Hassan & Quayes (2008)	1991-1997	90	Bangladesh	108.00	Long-term debt/total assets, foreign ownership, insider share and offer size.
Sohail & Nasr (2007)	2000-2005	50	Pakistan	35.66	Market capitalization, ex-ante uncertainty, size of firm, percentage of shares offered.
Borges (2007)	1988-2004	41	Portugal	11.12	Private ownership, secondary offering and book building.
Ghosh (2005)	1993-2001	1,842	India	91.06	Size of firm, seasoned offerings and hot/cold IPOs.
Kiymaz (2000)	1990-1996	138	Turkey	13.60	Firm's size, market return and self-IPOs.

pricing of 476 Malaysian IPOs is reported by 35.87% (Abubakar & Uzaki 2012) and found that offer size and age of the firm influenced underpricing. Jewartowski & Lininska (2012) concluded that there was evidence of significant abnormal returns of 13.95% for186 Polish IPOs from 1998 to 2008. Agathee et al. (2012) argued that the level of underpricing is more significant in small cap companies when compared to large cap companies. Furthermore, they found that financially healthy firms caused lower underpricing. They reported that the underpricing of 44 Mauritius IPOs was 13.14% from 1989 to 2005. This underpricing was affected due to the financial strength, risk and prestige of auditors. Alagidede & Heerden (2012) examined 138 South African IPOs from 2006 to 2010 and documented abnormal excess returns of 108.3%, 102.4%, 195.8%, 201.2% and 197.8% on the 1, 5, 10, 15 and 20-trading day, respectively.

Banerjee et al. (2011) analyzed 8,700 IPOs in 36 countries between the period lasting from 2000 to 2006 and provided evidence of initial underpricing in all the countries illustrating that it is a general phenomenon. Average underpricing is less than 10% in a few European countries and more than 20% in some Asian and North American countries. Banerjee et al. (2011) reported the evidence of average abnormal returns in 11 Asian countries: (a) 57.14% in China, (b) 22.21% in Hong Kong, (c) 31.18% in Malaysia, (d) 45.50% in Philippines, (e) 54.57% in Korea, (f) 19.15% in Thailand, (g) 45.14% in Japan, (h) 52.25% in Indonesia, (i) 25.01% in India, (j) 17.25% in Taiwan and (k) 12.94% in Singapore. They found that information asymmetry and agency cost hypotheses are influencing factors in determining underpricing. In addition, they argued that underpricing can be reduced through an effective contract enforcement mechanism. Loughran et al. (2013) measured the initial underpricing of 50 countries including 11 Asian countries which were: (a) 137.4% in China, (b) 15.4% in Hong Kong, (c) 62.6% in Malaysia, (d) 21.2% in Philippines, (e) 61.6% in Korea, (f) 36.6% in Thailand, (g) 40.2% in Japan, (h) 25.7% in Indonesia, (i) 88.5% in India, (j) 37.2% in Taiwan and (k) 26.1% in Singapore. Underpricing of unseasoned issues and their causes in developing countries is summarized at Table 1.

3 Unseasoned issues in Pakistan

In the Pakistani market, the floatation of unseasoned issues is a not new proposition for firms that desire to raise capital. To this end, the first unseasoned equity issuance was the Karachi Electric Supply Corporation, which did not issue a prospectus but was listed on the Karachi Stock Exchange on April 2, 1949. M/s Hussain Industries, a company limited in shares, took the initiative to become the first to issue its prospectus in 1953 inviting subscription from the general public. From 1953 to 1990, the pace of IPO issuance remained sluggish.

Table 2 exhibits the characteristics of newly issued securities in Pakistan during the period lasting from 1991 to 2014. The table shows that the pace of unseasoned deals was elevated from 1991 to 1996 but it showed a decreasing trend after 1997. The Corporate Law Authority (CLA) was set up in 1986 as a regulatory body solely responsible for regulating the issuance of unseasoned shares. But it was not that efficient as most of the companies presented themselves as underwriters' to float their shares to the general public. Over

time, the CLA was abolished and in order to promote better regulatory management, the Securities and Exchange Commission of Pakistan (SECP) was formulated in 1997 so as to make the IPO process more rigorous and competitive.

On average, 18 IPOs were issued per year with capital of Rs.11.20 billion raised over the sample period. Between 1991 and 1999, 37 IPOs floated on average with gross proceeds of Rs. 9.36 billion whereas during the period lasting from 2000 to 2014, on average 6 IPOs were issued with a capital raised amounting to Rs.12.32 billion. During the years, 2004, 2005 and 2007, the number of unseasoned deals was small but attracted a huge amount of money from the general public. After the formulation of SECP, the number of deals substantially decreased due to the fact that only those firms having the ability to sustain and perform in future were allowed to issue their shares to the general public. The average proceeds per unseasoned issue over the sample period is reported at Rs. 232.73 million.

Table 2: Position of unseasoned issues in Pakistan, 1991 – 2014

Year	Number of IPOs	Aggregate proceeds (Rs. Mn.)	%	Average proceeds/IPO (Rs. Mn.)
1991	61	5,297.00	5.32	86.84
1992	86	5,609.18	5.63	65.22
1993	38	2,521.09	2.53	66.34
1994	73	5,668.85	5.69	77.66
1995	41	8,375.78	8.41	204.29
1996	30	3,136.50	3.15	104.55
1997	4	662.50	0.67	165.63
1998	1	99.60	0.10	99.60
1999	-	-	-	-
2000	3	542.00	0.54	180.67
2001	4	895.00	0.90	223.75
2002	4	877.54	0.88	219.39
2003	4	2,654.85	2.67	663.71
2004	9	17,610.40	17.68	1,956.71
2005	14	10,741.80	10.78	767.27
2006	3	1,126.50	1.13	375.50
2007	11	14,300.55	14.36	1,300.05
2008	9	7,067.22	7.09	785.25
2009	5	1,648.60	1.66	329.72
2010	7	4,693.00	4.71	670.43
2011	6	2,716.88	2.73	452.81
2012	5	575.00	0.57	115.00
2013	2	835.65	0.84	417.83
2014	8	1,954.86	1.96	244.36
Total	428	99,610.35	100.00	232.73

The table shows the year-wise position of unseasoned issuance activity during the period from 1991 to 2014. Aggregate proceeds, their percentage participation, and average proceeds per IPO are also reported.

Like the international experiences, Pakistani market also shows evidence of underpricing. A few studies have examined the price performance of unseasoned issues in Pakistan. To begin with, Sohail & Nasr (2007) examined 50 IPOs listed on KSE from 2000 to 2005 and documented an average initial return of 35.66%. They found that oversubscription, market capitalization, offer size, and risk are the significant determinants that caused IPO underpricing. Rizwan & Khan (2007) analyzed 35 IPOs during the 2000 to 2006 time

frame and reported initial underpricing of 36.48%. Sohail & Rehman (2009) further reported an average underpricing of 35.52% for financial firms and 36.80% for non-financial firms. Sohail & Rehman (2010) analyzed the short-term performance of 73 IPOs over a 20-trading day period and found IPO underpricing during this period. Kayani & Amjad (2011) examined 59 IPOs and reported on average an initial underpricing of 39.87% during the 2000 to 2010 period. Afza et al. (2013) reported initial underpricing of 28.03% after analyzing 55 IPOs from 2000 to 2011. In a recent study, Mumtaz & Ahmed (2014) conducted short-run performance over 30-trading day using 75 unseasoned issues during the period from 2000 to 2011. They found that IPO are underpriced by 30.30% on listing day and investors earned significant abnormal return over 30-trading day. Moreover, they reported that risk, oversubscription, offer price and financial leverage are the main determinants of IPO underpricing.

4 Empirical Methodology

4.1 Measuring Short- and Intermediate-term Performance of Unseasoned Issues

To estimate the performance of unseasoned issues, different methods have been used. We follow the similar methodology used in prior researches (Aggarwal et al. 1993, Mok & Hui 1998, Sohail & Nasr 2007, Agathee et al. 2012). Almost all the empirical studies examined underpricing on the initial trading day while a few concentrated on performance over a longer time horizon[1]. Ljungqvist et al. (2006) argued that it is, appropriate to measure the short-term performance in a longer-window as emerging markets may take more time to adjust the post-issue prices towards their longer-term equilibrium. Kooli & Suret (2004) argued that initial underpricing is desirable when the difference between subscription and listing date persists. From the perspective of the Pakistani market where persistence of time gap is long as compared to developed markets, it is more suitable to investigate short-term as well as intermediate-term pricing performance. Short-term price performance is, therefore, estimated through market adjusted abnormal returns (MAAR) stock i at dth trading day as:

$$MAAR_{i,d} = 100 \times \frac{(1 + R_{i,d})}{1 + R_{m,d}} - 1 \tag{1}$$

where $MAAR_{i,d}$ is the abnormal excess return for stock i at the close of dth trading day (d = 1,2,3,...,15). $R_{i,d}$ is raw return for stock i at the dth trading day[2] and $R_{m,d}$ is market return of the corresponding day to the offering by stock i[3]. Average $MAAR_(i,d)$ of the sample IPOs at the dth trading day is measured as: $\overline{MAAR_t} = \frac{1}{n}\sum_{i=1}^{n} MAR_{i,d}$. For testing the null hypothesis that

[1] Short run performance examined up to one month (Khurshed & Mudambi 2002, Sohail & Rehman 2010, Alagidede & Heerden 2012, Perera & Kulendran 2012, Mumtaz & Ahmed 2014)

[2] $R_{i,d}$ = the raw return for stock i at the end of the dth trading day. It is computed as: $R_{i,d} = (\frac{P_{i,d}}{P_{i,0}} - 1)$ where $P_{i,d}$ = price of stock i at the end of dth trading day and $P_{i,0}$ = offer price of stock i.

[3] $R_{m,d}$ = the market return (benchmark index i.e., KSE-100). It is calculated as: $R_{m,d} = (\frac{I_{m,d}}{I_{m,0}} - 1)$ where $I_{m,d}$= value of market index at the end of the dth trading day and $I_{m,0}$ = value of market index on the offering date of stock i.

mean market adjusted abnormal return is equal to zero, test statistic is computed as: $t = \frac{\overline{MAAR_d}}{s/\sqrt{n}}$, where s is the standard deviation of $MAAR_{i,d}$ for a n number of firms. Following hypothesis is developed to test the mean $MAAR$ on the first to fifteen trading days is equal to zero:

Hypothesis 1:

$$H_0 : \overline{MAAR_t} = 0$$

$$H_1 : \overline{MAAR_t} \neq 0$$

Subsequently, intermediate-term price performance is examined over 6-month of trading starting from the first month, it is hypothesized as:

Hypothesis 2:

$$H_0 : \overline{MAAR_t} = 0$$

$$H_1 : \overline{MAAR_t} \neq 0$$

4.2 Extreme Bounds Analysis for Testing the Factors that Cause Short- and Intermediate-term Price Performance

A regression model is based on examining how various explanatory variables affect the dependent variable. However, the influence of explanatory variables over the dependent variable varies, that's why developing a model remained an issue. In empirical modeling, model uncertainty is an important problem (Temple 2000). Thus, a preferred model is used followed by result of diagnostic tests. Temple argued that "several different models may all seem reasonable given data, but lead to very different conclusions about the parameter of interests". To examine the determinants of short- and intermediate-term pricing performance of unseasoned issues, a theoretical framework for the researchers formulating a proper regression model is desired. Various regression models have been developed so far by researchers but if the question is to examine the robustness of variables of interest a specific method should be used. The extreme bounds analysis (EBA) methodology is used to evaluate the robustness of the independent variables in determining the performance of IPOs.

Initially, Cooley & LeRoy (1981) argued that the economic theory does not elaborate as to which variables are to be kept constant by applying statistical tests. To investigate the determinant variables that influenced the dependent variable, EBA was developed by Leamer (1983, 1985) and implemented practically by Levine & Renelt (1992). The EBA technique is useful process to evaluate and provide the sensitivity of expected outcomes to specification changes. Further, EBA reduces the model uncertainty because the extreme values of coefficient on the variable of interest minimizes the chances of uncertainty. The explanatory variable is classified as 'robust' if expected outcomes remain significant and do not alter its sign when set of explanatory variables is changed. To determine the influencing factors, Moosa & Cardak (2006) defined the following regression:

$$Y_i = \alpha_0 + \sum_{j=1}^{n} \alpha_j X_{ji} + \epsilon_i \tag{2}$$

where Y_i is the dependent variable of firm i, X_{ji} is the j^{th} explanatory variable of firm i; and ϵ_i is error term. Prior studies proposed various regressions

that elucidate the combination of explanatory variables. The purpose of applying this technique is to select true predictors of the dependent variable. For instance, x_1 may be significant when x_2 and x_3 are included in the regression and not when x_4 is included. Generally, it is an issue for selecting of which set of all variables $x_{j's}$ do we select? Earlier studies have shown that after extensive data mining and research, appropriate regressions can be found that support a preconceived idea. To investigate the explanatory variables, EBA technique is used to a linear regression. The model can be specified as:

$$Y_i = \alpha_0 + \sum_{j=1}^{n} \delta_i X_{ji} + \beta Q_i + \sum_{j=1}^{m} \gamma_i Z_{ji} + \epsilon_i \tag{3}$$

where X is an important explanatory variable(s) as indicated by previous studies, called the free or fixed, Q is the variable of interest of which robustness is tested; and Z is the potentially important determinant. This technique estimates the coefficient of variable of interest Q of which robustness is tested. To examine the sensitivity of an explanatory variable, thousands of regressions are run to find the values of the respective coefficient. Fixed variable(s) X is used in every regression, the variable of interest Q and the set of Z variables are selected from a predetermined pool. This technique is based on estimated coefficient values for the variable of interest, Q. Owing to more Z variables, the number of regression increases. For instance, Sala-i Martin (1997) ran almost two million regressions. Initially, Sala-i Martin (1996) ran nearly four million regressions to examine the robustness of explanatory variables under EBA method.

In face of criticism, it creates the problem of multicollinearity inflating standard errors. Generally, it happens because of weak data problem. To overcome, Levine & Renelt (1992) proposed three conditions: (a) in each regression, only three explanatory variables are used, (b) small group of variables comprised three Z variables, and (c) the selection of Z variables as variable of interest. In addition, this approach is too stringent. If a coefficient alters its sign in a single out of many thousand regressions, it is treated as "fragile". In empirical testing, EBA is the robust predictor of explanatory variables which emphasizes that it is superior from relative to conventional cross-sectional analysis. It is a procedure that gives a sensitivity analysis and generates robust results. In conventional reporting, Leamer & Leonard (1983) opposed the empirical results arguing that "the reported findings are extensively regarded to overemphasize the accuracy of estimate and possibly to distort them as well" (p. 306).

To summarize, EBA is an effective tool which reduces the ambiguity by selecting the explanatory variables. After rigorous regressions, it selects only those variables that are true predictors of dependent variable.

4.3 Comparison of the EBA Technique with Other Econometric Methods

The objective of using the EBA technique in this study is to identify variables that are robust and 'truly' influence the performance of short- and intermediate-term unseasoned issues. To examine the sensitivity and robustness of the EBA, we compare the results obtained by other econometric methods. Statistically, lasso (least absolute shrinkage and selection operator) is a regression

analysis which emphasizes the selection of variables to enhance the regression's prediction accuracy. Lasso regression, an innovative variable selection technique, was proposed by Tibshirani (1996). Because the selection of parameters is crucial in a regression under which a large collection of possible covariates selects a parsimonious set for the well-organized prediction of a response variable. This technique reduces the residual sum of squares with the requirement that the sum of the absolute value of the coefficients be less than some constant. Lasso tends to assign zero weight to the most irrelevant features and therefore, it is a promising technique for feature selection. This method not only improves the prediction accuracy in the wake of multicolinearity, but also emphasizes various properties like interpretability and numerical stability. The lasso estimate is defined as:

$$\begin{aligned} \hat{\beta}^{lasso} = argmin_{\beta} \sum_{i=1}^{n} (y_i - \beta_0 - \sum_{j=1}^{p} x_{ij}\beta_j)^2 \\ subject\ to\ \sum_{j=1}^{p} |\beta_j| \leq t \end{aligned} \tag{4}$$

If $t > \sum_{j=1}^{p} |\hat{\beta}_j^0|$, then the lasso algorithm obtains the same result as the OLS estimate. However, if $0 < t < \sum_{j=1}^{p} |\hat{\beta}_j^0|$ then the problem is equivalent to:

$$\hat{\beta}^{lasso} = argmin_{\beta} (\sum_{j=1}^{n} (y_i - \beta_0 - \sum_{j=1}^{p} x_{ij}\beta_j)^2 + \lambda \sum_{j=1}^{p} |\beta_j|) \tag{5}$$

$\lambda = 0$ which shows a one-to-one relationship between λ and lasso parameter t. The Lasso tends to produce some coefficients that are exactly zero. Comparing the OLS whose predicted coefficients $\hat{\beta}^0$ is an unbiased estimator of $\hat{\beta}$ showing a small bias to reduce the variance of the predicted value and improve the overall prediction accuracy.

Another econometric technique is a stepwise regression, which is commonly used for identifying the explanatory variables (Clawson 1974, McIntyre et al. 1983). Using the statistical tool, it identifies a subset of independent variables to be included in the model. Stepwise regression minimizes the number of explanatory variables to achieve a parsimonious model but maximize the explanatory power. Soroush et al. (2012) argued that stepwise regression predicts the best explanatory variables affecting input variable. In this regression, variables are added and this process is continued until either all variables have been selected or no further improvement is being observed.

5 Data and Explanation of Variables

This study employs 121 unseasoned issues listed on Karachi Stock Exchange during the period from 1995 to 2014 period. The data for the study on unseasoned IPO shares was obtained from the prospectus for issuance of new shares from the SECP and both opening and closing prices of shares as well as KSE-100 Index was gathered from the KSE database. We determine the robust predictors that influence the short-term and intermediate-term. Following explanatory variables have identified that may affect pricing performance of unseasoned issues:

$$\begin{aligned} MAAR_i = {} & \alpha_0 + \beta_1 Sub_i + \beta_2 Risk_i \\ & + \beta_3 ROA_i + \beta_4 OPrice_i + \beta_5 UW_i \\ & + \beta_6 PSO_i + \beta_7 LDel_i + \beta_8 FinLev_i \\ & + \beta_9 Mkt\_vol_i + \beta_{10} Age_i + \beta_{11} FSize_i \\ & + \beta_{12} EPS_i + \beta_{13} Mkt\_ret_i + \beta_{14} Hot_i + \epsilon_i \end{aligned} \tag{6}$$

Table 3 presents the description of explanatory variables used in this study. Earlier studies documented different control variables that influence the level of underpricing, however, it is crucial to choose only those factors that truly cause short- and intermediate-term pricing performance. This study employs EBA technique to examine the determinant factors that cause performance of unseasoned issues. Therefore, fourteen explanatory variables are considered, out of which two X-variables are selected as fixed to be used in every regression while from rest of twelve variables, Q and Z variables are selected. In empirical testing, the X variable(s) are important determinants with regard to theoretical and empirical evidences identified by earlier studies. Out of twelve, the robustness of the variable of interest Q is examined. However, three Z-variables are chosen from the rest of eleven variables, leading to 1,980 regressions (165 regressions for each variable of interest) and in total 7,920 regressions.

Table 4 presents the characteristics of 121 IPOs issued on KSE from 1995 to 2014. On average, unseasoned issues are subscribed by 2.63 times and the median value is slightly more than one times indicating nominal oversubscription in Pakistani market. The mean value of *Risk* is 1.52 whereas median value is 0.97 illustrating the small variability in post-issue pricing. *ROA*, on average, is 2.67% describing the negligible returns earned by firms prior to going public. Median *ROA* is just 0.02% along with a standard deviation of 5.49%. Highest and lowest *OPrice* are PKR 235 and PKR 10 respectively. *OPrice* is PKR 20.04 on average and a median value is PKR 10. This implies that matured firms offer high prices because of their sound financial credentials while small and young firms offer low prices with an objective to achieve the desired results. OSize is PKR 464.23 million on average whereas median size of new issues is PKR 160 million. Average *PSO* is 28.21% showing the proportion of shares offered to general public. Median *PSO* is 25% with standard deviation of 18.93%.

Listing delay is 58.59 days on average and median value is 47 days. This reflects that firms take a long time from the offering and listing which creates uncertainty and affect abnormal returns. On average, financial leverage is 17.35% while median value is 6.28% representing firms' borrowed small proportion of funds. On an average, *Mkt_vol* is 1.30% explaining small fluctuations in market return. Average age of firm is 8.71 years. In sample, eleven firms having life of more than 25 years, excluding these, average age of the firm reduces to 5.02 years closing to median age of 4 years. The mean value of FSize is PKR 16,264 million. The lowest and highest firm size include PKR zero million and PKR 562,916 million respectively. Large variations of firm size depicts that diversified IPOs are included in the sample. Every share of IPO firm earns on average EPS of PKR 0.73 indicating the minimal income earned by firms prior to listing. Maximum and minimum EPS is PKR 5.79

Table 3: Description of explanatory variables used in the study

Variable	Description	Sign	Empirical evidence
Sub	Oversubscription ratio obtained from shares demanded by shares offered.	+	Mumtaz & Ahmed (2014), Lin & Hsu (2008)
Risk	Aftermarket risk level of the IPO. Calculated as standard deviation of post-issue pricing of first 30 trading days.	+	Agathee et al. (2012), Kayani & Amjad (2011), Mumtaz & Ahmed (2014)
ROA	Rate of return on assets. Estimated as net income by total assets.	−	Tian (2012), Sahoo (2012)
OPrice	Offer price is a log of issue price.	−	Chong et al. (2010), Adjasi et al. (2011)
UW	A dummy variable classifying high prestige underwriters for 1 and 0 otherwise.	−	Johnson & Miller (1988), Chang et al. (2008), Zouari et al. (2009), Islam (2014)
PSO	Proportion of shares offered to the general public.	−	Sohail & Nasr (2007), Kucukkocaoglu (2008)
LDel	Listing delay measured by logarithm of number of days differentiating between offering and listing day.	+	Ljungqvist & Wilhelm (2002), Loughran & J. (2004), Pande & Vaidyanathan (2009)
FinLev	Financial leverage of firm prior to IPO. It is derived as long-term debt divided by total assets.	+	Loughran & Ritter (1995), Hassan & Quayes (2008), Mumtaz & Ahmed (2014)
Mkt_vol	Standard deviation of market return over 45 days prior to IPO.	+	Jewartowski & Lininska (2012)
Age	Age of event firm prior to IPO. It is scaled as the difference between year of establishment and going public.	−	Abubakar & Uzaki (2012), Song et al. (2014), Kucukkocaoglu (2008)
FSize	Firm size measuring by natural logarithm of total assets.	−	Avelino (2013), Kiymaz (2000), Islam et al. (2010)
EPS	Earnings per share is obtained by net income to number of shares outstanding.	+	Agathee et al. (2012), Song et al. (2014)
Mkt_ret	Market return estimated on KSE-100 index over 45 days before listing; and	+	Kiymaz (2000), Samarakoon (2010)
Hot	A dummy variable if IPO is issued in hot activity period which is categorized as 1 and 0 otherwise.	−	Samarakoon (2010), Chong et al. (2010), Ghosh (2005)

Table 4: Descriptive statistics of variables

Variables	Mean	Median	Max. Value	Min. Value	Std. Dev.
Sub	2.630	1.090	28.510	0.01	4.680
Risk	1.520	0.970	16.570	0.00	1.920
ROA	2.670	0.020	26.730	12.54	5.490
OPrice	20.160	10.000	235.000	10.00	26.100
PSO	28.210	25.000	100.000	2.50	18.930
LDel	58.590	47.000	211.000	9.00	30.840
FinLev	17.350	6.280	78.000	0.00	21.480
Mkt_vol	1.300	1.200	3.050	0.63	0.530
Age	8.710	4.000	66.000	0.00	11.630
FSize	16,264	850,000	562,915	0.00	66,246
EPS	0.730	0.000	5.790	0.00	1.230
Mkt_ret	2.180	4.720	32.700	−28.24	11.410

It presents descriptive statistics of 121 IPOs issued on KSE from 1995 to 2014. The variables include oversubscription (Sub), aftermarket risk level of IPO (Risk), rate of return on assets (ROA), offer price (OPrice), proportion of shares offered (PSO), listing delay (LDel), financial leverage (FinLev), market volatility (mkt_vol) firm's age (Age), size of the firm (FSize), earnings per share (EPS) and market return (mkt_ret). Underwriter prestige (UW) and hot period activity (Hot) are considered as dummy variables.

and PKR zero respectively. Market return is 2.18% on average indicating a low return obtained by benchmark index.

6 Results

6.1 Short-term Price Performance of Unseasoned Issues

Short-term price performance of unseasoned issues is measured to examine whether or not an investor that participates in an offering at the offer price and sells it on the listing day or at any other day up to the 15th trading day, earned a significant abnormal returns? The purpose of measuring short- term performance over the 15-trading days, starting from the listing, is that post-issue prices may take more time to reach their equilibrium in emerging markets (Ljungqvist et al. 2006). Table 5 (Panel A) reports the short-term pricing performance of 121 IPOs listed on KSE during the period lasting from January 1995 to December 2014.

On listing day, the results show that average raw return is 14.20%, market return is 0.41% and market adjusted abnormal returns is 14.23% on listing day. This indicates that, on average, IPOs are significantly undervalued on the listing day showing evidence of the underpricing in Pakistani market. The degree of underpricing is the highest on the 4-trading day; however, it declines if investors hold on to IPOs up to the 15th trading day. This illustrates that an investor who purchased the unseasoned issues on the offering day and sold it on 4th trading day they earn the highest abnormal excess returns when compared against any other day up to 15th trading day. The significance of the returns assures that investors earn positive abnormal returns in Pakistani IPO market from the listing to the 15th trading day. The standard deviation of the underpricing shows marginal variation in abnormal returns from the listing day to the 15th trading day. The initial underpricing in the Pakistani IPO market is smaller when compared to other developing economies. This

result is consistent with prior studies (Guo et al. 2006, Zouari et al. 2009, Yan et al. 2010, Agathee et al. 2012, Jewartowski & Lininska 2012, Aijo et al. 2014). Further, the magnitude of underpricing in Pakistan is lower relative to other South Asian countries, for instance, Sri Lanka, 33.50% (Samarakoon 2010), India, 46.55% (Sahoo & Rajib 2010) and Bangladesh, 108% (Hassan & Quayes 2008).

Table 5: Price performance of unseasoned issues

Trading	Raw Return (%)	Market Return (%)	MAAR (%)	Std. Dev.	t-Statistics	p-Value
Panel A: Short-term price performance						
1-day	14.20	0.41	14.23***	32.14	4.87	0.00
2-day	14.75	0.25	14.89***	33.02	4.96	0.00
3-day	14.75	0.23	14.83***	33.17	4.92	0.00
4-day	15.32	0.40	15.16***	35.00	4.77	0.00
5-day	14.40	0.41	14.19***	34.62	4.51	0.00
6-day	14.11	0.38	14.06***	34.32	4.51	0.00
7-day	13.64	0.31	13.60***	34.10	4.39	0.00
8-day	13.63	0.17	13.70***	34.08	4.42	0.00
9-day	13.69	0.29	13.73***	34.71	4.35	0.00
10-day	13.06	0.29	13.21***	34.80	4.17	0.00
11-day	12.81	0.39	12.83***	34.17	4.13	0.00
12-day	12.89	0.52	12.66***	33.92	4.11	0.00
13-day	12.50	0.59	12.11***	34.71	3.84	0.00
14-day	12.41	0.70	11.74***	34.96	3.69	0.00
15-day	12.29	0.80	11.41***	34.93	3.59	0.00
Panel B: Intermediate-term price performance						
1-month	10.57	1.18	9.47***	33.72	3.09	0.00
2-month	8.53	2.66	6.15*	35.25	1.92	0.06
3-month	6.22	2.54	4.77	35.17	1.49	0.14
4-month	5.74	2.88	4.41	38.37	1.26	0.21
5-month	5.72	4.06	3.33	36.92	0.99	0.32
6-month	4.19	4.60	0.96	39.05	0.27	0.79

The table depicts the price performance of 121 unseasoned issues from 1995-2014. MAAR is computed as: $(\frac{1+R_{i,d}}{1+R_{m,d}} - 1) \times 100$ where $R_{i,d}$ denotes raw return and $R_{m,d}$ represents market returns. $R_{i,d} = (\frac{P_{i,d}}{P_{i,0}} - 1)$ and $R_{m,d} = (\frac{I_{m,d}}{I_{m,0}} - 1)$. In short-term performance, d denotes number of trading day, *i.e.*, 1, 2,. . . . . ,15 and in intermediate-term performance d represents trading month, *i.e.*, 1,2,. . . ,6. *** and * show statistical significance at 1 and 10% level.

Out of 121, 40% of the new issues are overpriced illustrating that their list prices are below than offer prices. When overvalued issues are extracted, underpricing, on average, jumped to 31.45% on listing day relatively higher than international evidences (Chahine 2008, Kooli & Suret 2002). The short-term price performance of undervalued IPOs over 15-trading days indicates that the underpricing ranged between 32% and 28% reflecting that Pakistani issuers leave too much money on the table.

6.2 Intermediate-term Price Performance of Unseasoned Issues

The purpose of measuring the intermediate-term price performance is to analyze how new issues perform from the first-month to the six-month of trading, if investors participate on the offering date. It also illustrates how long an in-

vestor earns positive abnormal returns. Table 5 (Panel B) exhibits the results of intermediate-term pricing performance of 121 unseasoned issues from the first- to six-month. At the close of trading after one-month of seasoning the average raw return is 10.57%, market return is 1.18% and market adjusted abnormal return is 9.47%. These returns are highly significant illustrating that investors get positive abnormal returns if they participate in the offering. At the end of the second month, the abnormal returns deteriorated to 6.15% and their significance declined to the 10% level. An analysis of performance from the third to the sixth month of trading indicated that the average market adjusted returns decrease from 4.77% to 0.96%. Importantly, these returns are insignificant which indicates that if investors hold the new issues to their sixth month anniversary it seems as to the abnormal performance trends to zero. The standard deviation of underpricing increases over the 6-month period, which indicates that the risk associated with new issues increases as they season.

It can be inferred from the results that investors obtain significantly positive abnormal returns over the period lasting from the issuance to the 15th day of trading, which illustrates that there is strong evidence of underpricing in Pakistan. However, the significance of the abnormal returns deteriorated as the researchers evaluated the intermediate-term performance. This reflects that investors earned significant excess returns in the first two months of trading but thereafter there is no evidence of positive abnormal returns.

6.3 Determinants of Short-term and Intermediate-term Price Performance of Unseasoned Issues

To investigate the determinants of short- and intermediate-term pricing performance of unseasoned issues, the EBA technique is used to evaluate the sensitivity of the control variables. The determinants of short-term performance are examined on the first and fifteen trading day and the intermediate-term performance on the third and six month of trading.

Some preliminary results

Using EBA technique, the significance of the preliminary factors was tested to determine which factors affected short-term and intermediate-term price performance. Preliminary regressions include the oversubscription (Sub) and the aftermarket risk level of the IPO ($Risk$). The results of preliminary regressions using 121 unseasoned issues can be specified as:

$$MAAR_{1-day} = \underset{(0.51)}{1.7763} + \underset{(4.19)^{***}}{2.5575}Sub + \underset{(2.71)^{***}}{3.7528}Risk \quad Adj.R^2 = 0.2100 \qquad (7)$$

$$MAAR_{15-day} = \underset{(-0.84)}{-3.1332} + \underset{(4.31)^{***}}{2.6379}Sub + \underset{(3.37)^{***}}{4.9849}Risk \quad Adj.R^2 = 0.2268 \qquad (8)$$

$$MAAR_{3-month} = \underset{(-1.35)}{-5.4133} + \underset{(3.88)^{***}}{2.5348}Sub + \underset{(1.45)}{2.3003}Risk \quad Adj.R^2 = 0.1325 \qquad (9)$$

$$MAAR_{6-month} = \underset{(-1.81)^{*}}{-8.3668} + \underset{(2.93)^{***}}{4.8733}Sub + \underset{(1.75)^{*}}{3.2143}Risk \quad Adj.R^2 = 0.1037 \qquad (10)$$

The t-values are shown in parentheses. *** and * show significance at 1 and 10% level respectively. In determining the short-run pricing performance, both preliminary factors (i.e. oversubscription and aftermarket risk level of new issues) are highly significant variables that influencing the market adjusted abnormal returns. By analyzing the determinants of intermediate-term pricing performance, oversubscription is a highly significant factor but aftermarket risk level is only significant on the sixth month of trading. This implies that the risk factor is not an important variable to use to find the market adjusted abnormal return on the third month of trading. The coefficients attach to both variables are positively correlated with the market adjusted abnormal returns. The Oversubscription variable indicates that the shares demanded outpace the offered shares; thus, investors are interested in participating in the unseasoned issuance of shares that have a low offer price, which seems to translate into higher abnormal returns. The Aftermarket risk of the new issues posits that the higher the fluctuation in post-issue prices lead to greater uncertainty associated with the respective unseasoned issues and these issues consequently face higher abnormal returns. In short, the oversubscription variable is found to be the most important factor over all of the event windows that influence both the short-term and intermediate-term price performance of unseasoned issues.

Results of Basic Model Without Z-variables

To examine the determinants of short-term and intermediate-term pricing performance, four regressions were estimated excluding the Z-variables. X-variables (i.e. oversubscription and aftermarket risk level of unseasoned issues) are fixed used in all regressions. To test the sensitivity of Q-variables, thousands of regressions are run to find whether a particular variable maintains the same sign ensuring that a variable passes the sensitivity test. The rate of return on total assets (ROA) is the only variable used in all regressions, offer price is used in the first two regressions, percentage of shares offered (PSO) in regression I, II and IV, market return (Mkt_return) in regression I, II and III, age of the firm (Age) in regression I, underwriter's prestige (UW) in regression I and III, listing delay ($Ldel$) in regression III, financial leverage ($FinLev$) in regression II and volatility of market return (Mkt_vol) in regression IV are used as the Q-variable.

Table 6 presents the result of regression I to IV. From the X-variables, oversubscription is significant in all regressions but aftermarket risk is only significant in regression I and II. This indicates that oversubscription is a key factor in determining the short-term and intermediate-term performance. The coefficient of oversubscription is positive which illustrates that new issues are oversubscribed when offer price is lower leading to higher underpricing (Ljungqvist et al. 2006). The positive effect of aftermarket risk of IPOs describes the uncertainty of post-issue pricing. This implies that as risk is increased the likelihood of underpricing increases (Sohail & Nasr 2007, Sahoo & Rajib 2010).

Among the Q-variables, the ROA is positive and significantly affects the abnormal returns in regressions I, II and IV – contrary to an earlier finding. This implies that firms that have higher ROA prior to unseasoned issue subsequently desire a higher level of underpricing (Tian 2012). The coefficient of offer price is negative and significantly influences the dependent variable

regressions I and II. This implies that a low offer price may result in oversubscription, which thereby inflates underpricing (Zouari et al. 2009, Adjasi et al. 2011). The percentage of shares offered is negatively related to the dependent variable, but is insignificant in regressions I and II. This illustrates that the offering of a high proportion of outstanding leads to large proceeds obtained by issuing firm, which results in lower underpricing (Sohail & Nasr 2007). Market return is another important variable in determining the price performance. The market return variable is positive and significant in regression II. This implies that firms issue in shares in high activity period will be getting higher abnormal returns. Abnormal returns negatively affect underwriters' prestige in regression III, which indicates that the high prestige underwriters have the capability to obtain true offer price; therefore, the abnormal return was lower (Johnson & Miller 1988, Chang et al. 2008). The volatility of the market returns was significant in regression IV, which shows that the higher market returns increased the magnitude of abnormal returns. Listing delay and the age of the firm are insignificant from the Q-variables. The positive relation associated with the listing delay illustrates the uncertainty associated with a delay in offering and the listing day (Ljungqvist & Wilhelm 2002, Loughran & J. 2004). The Age of the firm variable indicates that there is a negative but insignificant effect in regression I. This implies that large firms properly evaluate the value of new issues, which results in lower underpricing (Kenourgios et al. 2007). In regression IV, market volatility (Mkt_vol) is influenced positively by MAAR indicating that higher fluctuations in market returns thereby result in higher abnormal returns (Jewartowski & Lininska 2012). This implies that Mkt_vol is a significant variable in determining intermediate-term price performance, that is, over sixth month of trading.

Result of Basic Model with All Z-variables

Table 7 reports the results when all the Z-variables are included. The results show that no Z-variable is significant in all the regressions. The coefficient of firm size is positively correlated in regressions III and IV, which illustrates that underpricing increases due to the large size of the assets, which is contrary to earlier findings. The size of the firm is seen to have no effect in all regressions. The coefficient of financial leverage positively influences the dependent variable in regressions I, III and IV. The positive sign postulates that the higher financial leverage indicates larger ex-ante uncertainty which subsequently increases the underpricing (Loughran & Ritter 1995). The EPS variable is negatively associated with underpricing in all cases except in regression II which indicates that as firms earn higher levels of income their market adjusted abnormal returns are lower. The negative effect of "Hot" implies that when firms went public during a period that was associated with hot market activity the underpricing experienced by new issues was less severe. In a hot period, firms may obtain higher offer price which leaves a smaller difference between offering and listing price.

The results presented in Table 6 and 7 suggest that performing statistical test grounded in economic theory does not provide a complete set of variables as to which are to be held constant. The EBA technique, however, is considered as an important tool to use to measure the sensitivity of the variables to different iterations of the test and it appropriately identifies the robust explanatory variables.

Table 6: Estimation results of benchmark models without *Z*-variables

Regression	Short-term		Intermediate-term	
	I	II	III	IV
Constant	0.5977 (3.54)***	0.4796 (3.08)***	−0.2433 (−1.06)	−0.0997 (−0.90)
X-variables				
Sub	0.0244 (4.32)***	0.0255 (2.27)**	0.1688 (4.64)***	0.1595 (4.32)***
Risk	0.0607 (3.43)***	0.0763 (2.56)**	0.0071 (0.39)	0.0263 (1.45)
Q-variables				
ROA	1.3406 (2.50)**	1.6435 (2.64)***	0.7094 (0.99)	1.3123 (1.89)*
OPrice	−0.1826 (−2.85)**	−0.2033 (−2.96)***	–	–
PSO	−0.1992 (−1.40)	−0.1222 (−0.98)	–	−0.1878 (−1.35)
Mkt_return	0.3706 (1.55)	0.4039 (1.76)*	0.3198 (1.21)	–
Age	−0.0399 (−1.43)	–	–	–
UW	−0.0727 (−1.37)	–	−0.1104 (−2.19)**	–
LDel	–	–	0.0778 (1.31)	–
FinLev	–	0.1307 (1.30)	–	–
Mkt_vol	–	–	–	11.3083 (2.47)**
Adj. R^2	0.3009	0.3305	0.1686	0.1409
F-value	7.4600***	4.8700***	3.1900***	3.4300***

The table presents the results of regressions estimated using stata on the first and 15th trading day (short-term performance – Regression I & II) and 3- and 6-month trading (intermediate-term performance – Regression III & IV). Dependent variable is market adjusted abnormal returns whereas independent variables include: Sub = oversubscription ratio, Risk = aftermarket risk level of the unseasoned issues, ROA = rate of return on total assets, OPrice = offer price, PSO = percentage of shares offered, Mkt_return = market return, Age = age of the firm prior to new issues, UW = underwriters' prestige, Ldel = listing delay, FinLev = financial leverage and Mkt_vol = volatility of market return. The t-statistics are based on Newey-West HAC standard errors. ***, ** and * represent significance level at the 1, 5 and 10% respectively.

Comparison of the EBA Technique with Other Econometric Methods

This section compares the results of the EBA technique with other econometric methods, that is, lasso regression and stepwise regression. The lasso approach minimizes the residual sum of squares and improves the prediction accuracy by selecting those variables that have lower standard errors thereby resulting in higher *t*-values. Like lasso, stepwise regression is also used to select appropriate explanatory variables affecting dependent variable. In this method, variables are inserted stepwise in a regression and variables are only included into the model if they improve the model's predictive power; therefore, it enables the researcher to identify the true explanatory parameters. When researchers employ stepwise regression, they ensure that variables selected in a model have the significance of 20%. Table 8 exhibits the comparison of the EBA technique with other econometric methods to identify the explanatory variables for the performance of unseasoned issues.

Comparing the parameter and model estimates obtained using lasso and stepwise regressions to the EBA technique, the researchers find some variations over one method to the other. First, we analyze the results of short-term

Table 7: Estimation results of benchmark models with all *Z*-variables

Regression	Short-term		Intermediate-term	
	I	II	III	IV
Constant	0.3741 (1.10)	0.2604 (0.80)	−0.3072 (−0.73)	−0.3889 (−0.85)
X-variables				
Sub	0.0245 (2.99)***	0.2600 (2.53)**	0.1839 (4.40)***	0.1560 (3.64)***
Risk	0.0603 (3.58)***	0.0763 (2.51)**	0.0169 (0.81)	0.0253 (1.12)
Q-variables				
ROA	1.3790 (2.35)**	1.5749 (2.27)***	0.8191 (0.86)	1.4250 (1.61)*
OPrice	−0.1722 (2.81)**	−0.1981 (−2.59)***	–	–
PSO	−0.2273 (−1.33)	−0.0472 (−0.27)	–	−0.0284 (−0.14)
Mkt_return	0.3935 (1.85)*	0.4417 (1.69)*	0.2541 (0.79)	–
Age	−0.8800 (−0.0390)	–	–	–
UW	−1.4600 (−0.0703)	–	−1.6200 (−0.0917)	–
LDel	–	–	0.0935 (1.38)	–
FinLev	–	0.1729 (1.36)	–	–
Mkt_vol	–	–	–	8.9652 (1.55)

The table presents the results of regressions estimated using stata on the first and 15th trading day (short-term performance – Regression I & II) and 3- and 6-month trading (intermediate-term performance – Regression III & IV). Dependent variable is market adjusted abnormal returns whereas independent variables include: Sub = oversubscription ratio, Risk = aftermarket risk level of the unseasoned issues, ROA = rate of return on total assets, OPrice = offer price, PSO = percentage of shares offered, Mkt_return = market return, Age = age of the firm prior to new issues, UW = underwriters' prestige, Ldel = listing delay, FinLev = financial leverage and Mkt_vol = volatility of market return, EPS = earnings per share, Hot = a dummy variable describing that unseasoned issues if issued in hot period treated as 1 otherwise 0, and FSize = size of the firm's assets. The t-statistics are based on Newey-West HAC standard errors. ***, ** and * represent significance level at the 1, 5 and 10% respectively.

Table 7: Estimation results of benchmark models with all *Z*-variables (continuação)

Regression	Short-term		Intermediate-term	
	I	II	III	IV
Z-variables				
EPS	−0.0073	0.0151	−0.0038	−0.0155
	(−0.21)	(0.38)	−0.09	(−0.41)
Hot	−0.0020	−0.0469	0.0042	−0.0149
	(−0.03)	(−0.78)	(0.07)	(−0.21)
FSize	−0.0001	−0.0015	0.0017	0.0008
	(−0.01)	(−0.21)	(0.21)	(0.11)
Mkt_vol	2.2043	5.0622	5.9878	–
	(0.48)	(0.89)	(0.93)	
FinLev	0.0745	–	0.0759	0.0840
	(0.67)		(0.41)	(0.50)
LDel	0.0418	0.0483	–	0.0705
	(0.72)	(1.04)		(0.88)
UW	–	−0.0274	–	−0.0724
		(−0.50)		(−1.03)
Age	–	−0.0306	0.0049	0.0358
		(−0.64)	(0.10)	(0.58)
Mkt_return	–	–	–	−0.0396
				(−0.12)
PSO	–	–	−0.0296	–
			(−0.20)	
OPrice	–	–	−0.0538	−0.0366
			(−0.65)	(−0.39)
Adj. R^2	0.2687	0.3012	0.1230	0.0864
F-value	5.0200***	5.3700***	4.9600***	3.9300***

The table presents the results of regressions estimated using stata on the first and 15th trading day (short-term performance – Regression I & II) and 3- and 6-month trading (intermediate-term performance – Regression III & IV). Dependent variable is market adjusted abnormal returns whereas independent variables include: Sub = oversubscription ratio, Risk = aftermarket risk level of the unseasoned issues, ROA = rate of return on total assets, OPrice = offer price, PSO = percentage of shares offered, Mkt_return = market return, Age = age of the firm prior to new issues, UW = underwriters' prestige, Ldel = listing delay, FinLev = financial leverage and Mkt_vol = volatility of market return, EPS = earnings per share, Hot = a dummy variable describing that unseasoned issues if issued in hot period treated as 1 otherwise 0, and FSize = size of the firm's assets. The t-statistics are based on Newey-West HAC standard errors. ***, ** and * represent significance level at the 1, 5 and 10% respectively.

Table 8: Comparison of estimation techniques

	Lasso regression		Stepwise regression		EBA	
Panel A: Determinants of short-term performance of unseasoned issues						
Constant	0.6674 (4.07)***	0.4623 (2.99)***	0.5977 (3.54)***	0.4761 (3.10)***	0.5977 (3.54)***	0.4796 (3.08)***
Sub	0.0265 (4.81)***	0.0257 (4.37)**	0.0244 (4.32)***	0.0251 (4.29)***	0.0244 (4.32)***	0.0255 (2.27)***
Risk	0.0678 (3.94)***	0.0779 (4.24)***	0.0607 (3.43)***	0.0764 (4.17)***	0.0607 (3.43)***	0.0763 (2.56)**
ROA	1.4152 (2.63)**	1.6392 (2.92)***	1.3406 (2.50)**	1.6677 (2.97)***	1.3406 (2.50)**	1.6435 (2.64)***
OPrice	−0.2146 (−3.51)***	−0.2232 (−3.53)***	−0.1826 (−2.85)**	−0.2197 (−3.48)***	−0.1826 (−2.85)**	−0.2033 (−2.96)***
PSO	−0.2301 (1.62)	–	−0.1992 (−1.40)	–	−0.1992 (−1.40)	−0.1222 (−0.98)
Mkt_return	–	0.3695 (1.50)	0.3706 (1.55)	0.4109 (1.69)*	0.3706 (1.55)	0.4039 (1.76)*
Age	−0.0355 (−1.27)	–	−0.0399 (1.43)	–	−0.0399 (1.43)	–
UW	−0.0549 (−1.05)	–	−0.0727 (−1.37)	–	−0.0727 (−1.37)	–
FinLev	–	0.1220 (0.98)	–	–	–	0.1307 (1.30)
Adj. R^2	0.2922	0.3308	0.3009	0.3310	0.3009	0.3305
F-value	8.0800***	10.8900***	7.4600***	12.8800***	7.4600***	4.8700***
Panel B: Determinants of intermediate-term performance of unseasoned issues						
Constant	−0.0305 (−0.60)	−0.2024 (−2.05)	−0.0205 (−0.44)	−0.1096 (−2.36)**	−0.2433 (−1.06)	−0.0997 (−0.90)***
Sub	0.0236 (3.53)**	0.0138 (1.86)*	0.0243 (3.70)***	0.0133 (1.80)*	0.1688 (4.64)***	0.1595 (4.32)***
Risk	0.0087 (0.52)	0.0281 (1.47)	–	0.0264 (1.39)	0.0071 (0.39)	0.0263 (1.45)
ROA	1.1130 (1.96)*	1.6095 (2.46)**	1.2101 (2.26)**	1.6357 (2.50)*	0.7094 (0.99)	1.3123 (1.89)*
PSO	–	–	–	–	–	−0.1878 (−1.35)
Mkt_return	0.4035 (1.49)	–	0.4197 (1.50)	–	0.3198 (1.21)	–
UW	−0.0802 (−1.31)	–	−0.0835 (−1.38)	–	−0.1104 (−2.19)**	–
LDel	–	–	–	–	0.0778 (1.31)	–
Mkt_vol	–	6.8846 (1.06)	–	–	–	11.3083 (2.47)**
Adj. R^2	0.1595	0.0974	0.1648	0.0963	0.1686	0.1409
F-value	5.5500***	4.2400***	6.9200***	5.2600***	3.1900***	3.4300***

The table presents the comparison of estimation results of different techniques. Panel A exhibits short-term performance (first and fifteenth trading day) and Panel B shows intermediate-term performance (third and sixth trading month) of unseasoned issues. Dependent variable is market adjusted abnormal returns whereas independent variables include: Sub = oversubscription ratio, Risk = aftermarket risk level of the unseasoned issues, ROA = rate of return on total assets, OPrice = offer price, PSO = percentage of shares offered, Mkt_return = market return, Age = age of the firm prior to new issues, UW = underwriters' prestige, FinLev = financial leverage, Ldel = listing delay, and Mkt_vol = volatility of market return. ***, ** and * represent significance level at the 1, 5 and 10% respectively.

performance of unseasoned issues over the first and fifteenth trading day. Interestingly, both stepwise regression and EBA technique show similar results regarding the determinants on the first trading day illustrating that their specification for selecting an appropriate model is the same. Oversubscription, aftermarket risk level, rate of return on assets and offer price are the significant factors identified by all econometric techniques. Over the first trading day, percentage of shares offered (PSO) is identified by all methods, but insignificant. The EBA technique classifies PSO as an important parameter after passing sensitivity tests, however, it may not affect the performance of unseasoned issues over the fifteen days of trading after the issuance of unseasoned equity shares. Market return is selected as a determinant by all approaches over fifteenth trading day but the lasso regression did not find that its influence was significant. When we include market return in the lasso regression, it results in a decrease of the residual sum of squares but it is not included in the final model. The Age of the firm and underwriters' prestige (UW) variables were insignificant, but included in all methods over the first trading day. Financial leverage (FinLev) was recognized as an insignificant contributing variable by the lasso regression and EBA in determining short-term performance over fifteenth day of trading.

Regarding intermediate-term performance, the oversubscription variable is the only statistically significant variable across all econometric techniques and all time horizons. The Aftermarket risk level of unseasoned issues is identified by the lasso and EBA in both regressions while stepwise regression rejects this variable over three-months of trading. Due to exclusion of the aftermarket risk variable, the adjusted r-squared of stepwise regression showed improvement in the model as compared to other techniques. ROA is found to be an important determinant in all regressions but when the EBA technique is employed, ROA becomes insignificant in the analysis of three-month performance. PSO and listing delay were identified by the EBA technique to have no significant impact over the three and six-month period of trading, respectively. Market return also causes performance over three-months of trading but had an insignificant effect in all models. UW prestige is another variable that was selected by all of the econometric techniques over three- months of trading but when we applied the EBA technique the variable became significant. This implies that the UW variable is a more important variable under the EBA method which emphasizes that using more information provides better results in this case. Market volatility is selected by the lasso regression and EBA method but the results show that the variable is significant in case of EBA illustrating that the sensitivity and robustness is determined which illustrates that it is an important variable.

Summarizing the results shown in Table 8, the researchers employ all three methods in order to compare the techniques to identify which variables explain the performance of unseasoned issues. By analyzing the results, it appears that every method has its own specification to classify the explanatory variables that affect dependent variable. Likewise, these methods have some limitations; therefore, their results vary from method to method. In most instances the findings obtained from all the methods are similar. From a methodological standpoint, the Lasso regression limits the results by selecting variables based on a small residual sum of square and the stepwise regression approach identifies variables based on a certain level of significance. The objective of this study is to identify the best descriptive model of short-term and

intermediate-term performance of unseasoned issues and because the EBA method employs sensitivity analysis to ensure the stability of the parameters, thereby reducing the uncertainty in selecting the choice of method (Leamer & Leonard 1983), and considering an option to assess and identify whether the variables are 'true' predictors, the researchers prefer this approach. In addition to those advantages, the EBA technique adds rigidity to the process of searching for and identifying the explanatory variables that affect the dependent variable.

Results of Sensitivity Analysis

Sensitivity analysis tests whether *X*- and *Q*-variables are robust or fragile. Out of fourteen variables, three *Z*-variables are selected in each regression – 165 forms, in total, are tested. Under the EBA approach, only the variables that show significance at 10% are selected. Table 9 presents the results of the sensitivity test of the EBA method. The results indicate that (a) oversubscription, (b) aftermarket risk, (c) *ROA*, (d) offer price and (e) market return are the robust variables in determining short-term performance. Moreover, (a) oversubscription (b) *ROA* and (c) underwriters' prestige are variables that robustly affect intermediate-term performance while the remaining variables are fragile in this analysis.

Table 9: Summary of EBA tests

	Sign	Short-term		Intermediate-term	
		I	II	III	IV
		Robust/Fragile			
X-variable					
Oversubscription	+	Robust	Robust	Robust	Robust
Aftermarket risk level	+	Robust	Robust	Fragile	Fragile
Q-variable					
Return on total assets	+	Robust	Robust	Fragile	Robust
Offer price	-	Robust	Robust	N/A	N/A
Percentage of shares offered	-	Fragile	Fragile	N/A	Fragile
Market return	+	Fragile	Robust	Fragile	N/A
Age of the firm	-	Fragile	N/A	N/A	N/A
Underwriters' prestige	-	Fragile	N/A	Robust	N/A
Listing delay	+	N/A	N/A	Fragile	N/A
Financial leverage	-	N/A	Fragile	N/A	N/A
Market volatility	+	N/A	N/A	N/A	Robust

N/A = not applicable

7 Concluding Remarks

This study examines the short-term and intermediate-term pricing performance of 121 unseasoned issues listed on KSE from 1995 to 2014. This paper finds that unseasoned issues, on average, exhibited abnormal excess returns of 14.23% on the listing day. Abnormal returns deteriorate with an increase in the number of trading days due to the fact that post-issue prices are adjusted

accordingly. The short-term pricing performance predicts that investors earn positive excess returns over the period of 15-trading days. In intermediate-term price performance, investors earn positive abnormal returns over the period of two months following the issuance of shares, but not thereafter. Hence, the data illustrates that Pakistani unseasoned issues outperform over the 2 month period of trading following issuance. This study employs EBA technique to find the determinants of short-term performance on the first and fifteenth trading day and found that the robust predictors include: (a) oversubscription illustrates that the number of shares demanded are greater than the shares offered due to the fact that offer prices are too low, which leads to increase in underpricing, (b) an increase in the aftermarket risk level of the unseasoned issues indicates that the issue may experience higher levels of uncertainty, which results in higher underpricing (c) the rate of return on total assets is higher, which indicates that investors obtain positive abnormal returns, (d) a higher offer price decreases the magnitude of underpricing, and (e) as the market return increases prior to the new issue there seems to be a relationship between this and higher levels of underpricing. The determinants of intermediate-term price performance over the third and sixth month period of trading suggest the robust predictors of underpricing consists of (a) oversubscription (b) rate of return on total assets and (c) higher underwriters' prestige, which illustrates that they may use all the resources to determine the true offer price resulting in lower underpricing. While comparing the results of EBA techniques with other econometric methods, we find that every methodology has its built-in specification to find the factors that influence the dependent variable. The EBA is considered the more appropriate model, because hundreds of regressions are run to identify the sensitivity and robustness of the control variables. Hence, this method increases the chances of selecting the 'true' predictor variables for the dependent variable. Given the relative advantages of the EBA technique over the other techniques evaluated in this research project, we think that future research focused on evaluating the short- and long-term performance of new issues in other emerging markets should also include the EBA approach to improve the perceived robustness and accuracy of the variable selection process and identify the true determinates of IPO performance.

Bibliography

Abubakar, N. & Uzaki, K. (2012), A test of ipos underpricing performance in malaysian stock exchange, *in* 'Paper presented at the Third Asian Business and Management Conference, Osaka, Japan'.

Adjasi, C. K. D., Osei, K. A. & Fiawoyife, E. U. (2011), 'Explaining underpricing of ipos in frontier markets: evidence from the nigeria stock exchange', *Research in International Business and Finance* **25**, 255–265.

Afza, T., Yousaf, H. & Alam, A. (2013), 'Information asymmetry, corporate governance and ipo underpricing', *Science International (Lahore)* **25**(4), 989–997.

Agathee, U. S., Sannassee, R. V. & Brooks, C. (2012), 'The underpricing of ipos on the stock exchange of mauritius', *Research in International Business and Finance* **26**(2), 281–303.

Aggarwal, R., Leal, R. & Hernandex, L. (1993), 'The aftermarket performance of initial public offerings in latin america', *Financial Management (Spring)* pp. 42–53.

Aijo, J., Vahamaa, S. & Hal, T. (2014), 'Value versus growth in ipos: new evidence from finland', *Research in International Business and Finance* **31**, 17–31.

Alagidede, P. & Heerden, G. V. (2012), 'Short run underpricing of initial public offerings (ipos) in the johannesburg stock exchange', *Review of Development Finance* **2**, 130–138.

Avelino, R. G. R. (2013), 'The underpricing of brazilian ipos and the adjustment of public and private information', *Rio de Janeiro* **67**(1), 3–23.

Banerjee, S., Dai, L. & Shrestha, K. (2011), 'Cross-country ipos: what explain differences in underpricing?', *Journal of Corporate Finance* **17**(5).

Belghitar, Y. & Dixon, R. (2012), 'Do venture capitalists reduce underpricing and underperformance of ipos?', *Applied Financial Economics* **22**, 33–44.

Borges, M. (2007), 'Underpricing of ipos: The case of portugal', *International Advances in Economic Research* **13**, 65–80.

Brennan, M. J. & Franks, J. (1997), 'Underpricing, ownership and control in initial public offerings of equity securities in the u.k', *Journal of Financial Economics* **45**, 391–413.

Chahine, S. (2008), 'Underpricing versus gross spread: New evidence on the effect of sold shares at the time of ipos', *Journal of Multinational Financial Management* **18**, 180–196.

Chang, X., Gygx, A. F., Elaine, O. & Zhang, H. F. (2008), 'Audit quality, auditor compensation and ipo underpricing', *Journal of Accounting & Finance* **48**(3), 391–416.

Chong, T. T.-L., Yuan, S. & Yan, I. K.-M. (2010), 'An examination of the underpricing of h-share ipos in hong kong', *Review of Pacific Basin Financial Markets and Policies* **13**(4), 559–582.

Chorruk, J. & Worthington, A. (2010), 'New evidence on the pricing and performance of initial public offerings in thailand, 1997-2008', *Emerging Markets Review* **11**, 285–299.

Chuanrommanee, W. & Boonchuaymetta, E. (2013), 'Management of the ipo performance in thailand', *Journal of Multinational Financial Management* **23**, 272–284.

Clawson, C. J. (1974), 'Fitting branch locations, performance standards and marketing strategies to local conditions', *Journal of Marketing* **38**, 8–14.

Cooley, T. F. & LeRoy, S. F. (1981), 'Identification and estimation of money demand', *American Economic Review* **71**, 825–844.

Darmadi, S. & Gunawan, R. (2013), 'Underpricing, board structure, and ownership: An empirical examination of indonesian ipo firms', *Managerial Finance* **39**(2), 181–200.

Deng, H. & Dorfleitner, G. (2008), 'Underpricing in chinese ipos – some recent evidence', *Applied Financial Economics* **18**, 9–22.

Ghosh, S. (2005), 'Underpricing of ipos: The indian experience', *Emerging Markets Finance and Trade* **41**(6), 45–57.

Guo, R., Baruch, L. & Charles, S. (2006), 'Explaining the short- and long-term ipo anomalies in the us by r&d', *Journal of Business Finance and Accounting* **33**, 550–579.

Hassan, T. & Quayes, S. (2008), 'Underpricing of initial public offerings in bangladesh', *Applied Financial Economic Letters* **4**, 5–8.

Ibboston, R. G. (1975), 'Price performance of common stock new issues', *Journal of Financial Economics* **2**, 235–272.

Islam, A., Ali, R. & Ahmad, Z. (2010), 'An empirical investigation of the underpricing of initial public offerings in the chittagong stock exchange', *International Journal of Economics and Finance* **2**(4), 36–46.

Islam, R. (2014), 'An empirical investigation of short-run ipo underpricing: Evidence from dhaka stock exchange', *IOSR Journal of Economics and Finance* **4**(4), 1–11.

Jewartowski, T. & Lininska, J. (2012), 'Short- and long-term performance of polish ipos', *Emerging Markets Finance & Trade* **48**(2), 59–75.

Johnson, J. & Miller, R. (1988), 'Investment banker prestige and the underpricing of initial public offerings', *Financial Management* **17**(2), 19–29.

Kayani, S. & Amjad, S. (2011), 'Investor interest, underpricing and trading volume in pakistan secondary market', *Business and Economic Journal* **39**, 1–15.

Kenourgios, D., Papathanasiou, S. & Melas, E. R. (2007), 'Initial performance of greek ipos, underwriter's reputation and oversubscription', *Managerial Finance* **33**(5), 332–343.

Khurshed, A. & Mudambi, R. (2002), 'The short-run price performance of investment trust ipos on the uk main market', *Applied Financial Economics* **12**, 697–706.

Kiymaz, H. (2000), 'The initial and aftermarket performance of ipos in an emerging market: Evidence from istanbul stock exchange', *Journal of Multinational Financial Management* **10**, 213–227.

Kooli, M. & Suret, J. (2004), 'The aftermarket performance of canadian ipos', *Journal of Multinational Financial Management* **14**, 47–66.

Kooli, M. & Suret, J. M. (2002), The underpricing of initial public offerings: Further canadian evidence., *in* 'CIRANO Working Paper', number 2001-50.

Kucukkocaoglu, G. (2008), 'Underpricing in turkey: a comparison of the ipo methods', *International Research Journal of Finance and Economics* **13**.

Leamer, E. E. (1983), 'Let's take the con out of econometrics.', *American Economic Review* **73**, 31–43.

Leamer, E. E. (1985), 'Sensitivity analyses would help', *American Economic Review* **75**(3), 308–313.

Leamer, E. E. & Leonard, H. (1983), 'Reporting the fragility of regression estimates', *Review of Economics and Statistics* **65**, 307–317.

Levine, R. & Renelt, D. (1992), 'A sensitivity analysis of cross-country growth regressions', *American Economic Review* **82**(4), 942–963.

Lin, C.-T. & Hsu, S.-M. (2008), 'Determinants of the initial ipo performance: Evidence from hong kong and taiwan', *Applied Financial Economics* **18**, 955–963.

Liu, X. & Ritter, J. R. (2010), 'Local underwriter oligopolies and ipo underpricing', *Journal of Financial Economics* **102**(3), 579–601.

Ljungqvist, A., Nanda, V. K. & Singh, R. (2006), 'Hot markets, investor sentiment and ipo pricing', *Journal of Business* **79**, 1667–1702.

Ljungqvist, A. & Wilhelm, W. J. (2002), 'Ipo allocations: discriminatory or discretionary?', *Journal of Financial Economics* **65**, 167–201.

Logue, D. (1973), 'On the pricing of unseasoned equity issues, 1965-69', *Journal of Financial and Quantitative Analysis* **8**(1), 91–103.

Loughran, T. & J., R. (2004), 'Why has ipo underpricing changed over time?', *Financial Management* **33**(3), 5–37.

Loughran, T. & Ritter, J. (1995), 'The new issues puzzle', *The Journal of Finance* **50**(1), 23–51.

Loughran, T., Ritter, J. R. & Rydqvist, K. (2013), 'Initial public offerings: international insights.'. http://bear.warrington.ufl.edu/ritter/int.pdf.
URL: *http://bear.warrington.ufl.edu/ritter/int.pdf*

McIntyre, S. H., Montgomery, D. B., Srinivasan, V. & Weitz, B. A. (1983), 'Evaluating the statistical significance of models developed by stepwise regression', *Journal of Marketing Research* **20**, 1–11.

Mok, H. M. K. & Hui, Y. V. (1998), 'Underpricing and aftermarket performance of ipos in shanghai, china', *Pacific-Basin Finance Journal* **6**(5), 453–474.

Moosa, I. A. & Cardak, B. A. (2006), 'The determinants of foreign direct investment: an extreme bounds analysis', *Journal of Multinational Financial Management* **16**, 199–211.

Moshirian, F., Ng, D. & Wu, E. (2010), 'Model specification and ipo performance: New insights from asia', *Research in International Business and Finance* **24**, 62–74.

Mumtaz, M. Z. & Ahmed, A. (2014), 'Determinants of underpricing of initial public offerings', *Journal of Business & Economics* **6**(1), 47–80.

Omran, M., Delgado, F. & Al-Hassan, A. (2010), 'The underpricing of ipos in gulf cooperation council countries', *Research in International Business and Finance* **24**, 344–360.

Pande, A. & Vaidyanathan, R. (2009), 'Determinants of ipo underpricing in the national stock exchange of india', *The Icfai Journal of Applied Finance* **15**(1), 14–30.

Perera, W. & Kulendran, N. (2012), New evidence of short-run underpricing in australian ipos, *in* 'Paper presented in Financial Markets and Corporate Governance Conference'.

Reilly, F. K. & Hatfield, K. (1969), 'Investor experience with new stock issues', *Financial Analysts Journal* pp. 73–80.

Ritter, J. R. (1998), *Initial public offerings*, John Wiley & Sons., New York.

Ritter, J. R. & Welch, I. (2002), 'A review of ipo activity, pricing, and allocations', *Journal of Finance* **57**(4).

Rizwan, M. & Khan, S.-A. (2007), 'Long term performance of public vs. private sector initial public offerings in pakistan', *The Pakistan Development Review* **4**(46), 421–433.

Rock, K. (1986), 'Why new issues are underpriced', *Journal of Financial Economics* **15**, 187–212.

Sahoo, S. (2012), 'Syndicate size, structure and performance: an empirical investigation for indian ipos', *IUP Journal of Applied Finance* **18**(3), 67–83.

Sahoo, S. & Rajib, P. (2010), 'Aftermarket pricing performance of initial public offerings (ipos): Indian 2002-2006', *The Vikalpa: Indian Institute of Management Ahmedabad (IIMA)* **35**(4), 25–41.

Sala-i Martin, X. (1996), 'I just ran four million regressions', *NBER Working Paper* (No. 6252).

Sala-i Martin, X. (1997), 'I just ran two million regressions', *American for Economic Review* **87**, 178–183.

Samarakoon, L. P. (2010), 'The short-run underpricing of ipos in the sri lankan stock market', *Journal of Multinational Financial Management* **20**, 197–213.

Sohail, M. K. & Nasr, M. (2007), 'Performance of initial public offerings in pakistan', *International Review of Business Research Papers* **3**(2), 420–441.

Sohail, M. K. & Rehman, A. (2009), 'Determinants of underpricing of ipos regarding financial and non-financial firms in pakistan', *European Journal of Economic, Finance and Administrative Sciences* **15**, 62–73.

Sohail, M. K. & Rehman, A. (2010), 'Examining the short-run ipos performance in stat of economy: normal, boom and recession', *International Research Journal of Finance and Economics* **35**, 173–186.

Song, S., Tan, J. & Yi, Y. (2014), 'Ipo initial returns in china: underpricing or overvaluation?', *China Journal of Accounting Research* **7**, 31–49.

Soroush, A., Bahreininejad, A. & van den Berg, J. (2012), 'A hybrid customer prediction system based on multiple forward stepwise logistic regression mode', *Intelligent Data Analysis* **16**(2), 265–278.

Temple, J. (2000), 'Growth regressions and what the textbooks don't tell you', *Bulletin of Economic Research* **52**(3), 181–205.

Tian, Y. (2012), An examination factors influencing underpricing of ipos on the london stock exchange, Master's thesis, Saint Mary's University, London.

Tibshirani, R. (1996), 'Regression shrinkage and selection via the lasso', *Journal of the Royal Statistical Society* **Series B 58**(1), 267–288.

Welch, I. (1989), 'Seasoned offerings, imitation costs, and the underpricing of new issues', *Journal of Accounting and Economics* **8**, 159–172.

Yan, I. K.-M., Chong, T. T.-L. & Yuan, S. (2010), 'An examination of the underpricing of h-share ipos in hong kong', *Review of Pacific Basin Financial Markets and Policies* **13**(4), 559–582.

Zouari, S., Boudriga, A. & Boulila, N. (2009), 'What determines ipo underpricing? evidence from a frontier market', *Working paper* (18069).