4. IS GROWTH RATE IMPLICIT IN IPO PRICES?

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Abstract

This study examines (a) the cash flow growth rate implicit by offer prices of IPOs in an emerging market using a reverse engineering DCF model and (b) the bias of implicit growth relative to the realized growth rate. We find that the estimated growth in cash flows is slightly higher than realized growth rate, which indicates that the median IPO firm is overvalued by 81% at the offering. It is observed that the estimation errors increase as a result of higher underpricing and diversified ownership. In addition, post-IPO returns are smaller for issues whose implicit growth rates are biased upward. We also find that IPOs underperform in long-run while employing a buy-and-hold investment strategy.

Keywords: initial public offerings, reverse engineering DCF model, valuation, growth rate

JEL Classification: G00, G30

I. Introduction

Going public is an important landmark in the life of the firm and a critical element in this process is how to determine the offer price so as to attract investors. An accurate estimate of the true offer price may limit overvaluation, which will benefit the company that issues their shares and enable them to leave less 'money on the table'. Over time, different valuation methods have been developed by researchers to value IPOs (e.g. dividend discount, discounted cash flow (DCF), earnings capitalization and residual income). Kojima (2007) argued that private information is used to identify the worth of new issues, but questions whether or not this information is beneficial. In another study, Barber and Odean (2008) predicted that the accessibility of public information creates a disparity between institutional and individual investors because institutional investors utilize resources to value firms whereas individuals do not have the capacity due to scarcity of funds (Field and Lowry, 2009).

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Two methods are typically employed for valuation: (a) direct valuation assesses firm fundamentals and (b) relative valuation evaluates the prices of comparable firms. According to Kaplan and Ruback (1995), the DCF model produces better results relative to comparable methods. Cassia et al. (2004) found that investment banks consider different methods to determine the offer prices while relative valuation (87% of IPOs) is commonly used followed by the DCF method (80% of IPOs). Purnanadam and Swaminathan (2004) reported that overvalued IPOs may earn excessive initial returns, but underperform in long-run, which implies that they use optimistic growth forecasts and focus less on the firm's profitability in determining offer prices by underwriters. When examining US IPOs, researchers have found that the median firm is overvalued by 50% relative to industry peers (Purnanadam and Swaminathan, 2004). Further, Deloof *et al*. (2009) suggested that discounted Firm Free Cash Flow (FFCF), a commonly used method, creates unbiased value estimates. Rossenboom (2012) proposed that different methods generate a positive bias relative to the equilibrium market value because underwriters deliberately discount the fair prices.

To examine the growth rate implied in offer prices, Cogliati, Paleari and Vismara (2011) developed a reverse engineering DCF model using 184 IPOs from 1995 to 2001 and found that the cash flow of IPO firms grew on average by 33.8% per year over a 5-year period. The estimation of the cash flow growth rate is higher than the realized (i.e. median estimated vs. realized: 21.5% vs. 1.8%). Additionally, estimates of the short-term implied growth rate have been shown to be inversely related to long-run IPO performance (Cogliati et al. 2011). Long-term IPO underperformance is caused by underpricing and book-to-market inflating estimation errors which occurred due to underpricing, leverage, book-to-market, size and age of the firm (Cogliati *et al*. 2011).

The objectives of the study are to: (a) investigate whether or not the growth implied in IPO prices are accurate and (b) identify the determinants of long-run IPO underperformance and estimation errors over 3- and 5-year periods using the Extreme Bounds Analysis (EBA) technique. This study adds the existing literature as it is the first attempt in the emerging markets to examine the growth rate embedded in offer prices.

II. Methodology

Earlier research argued that underwriters consider different methodologies for estimating new issues (Cogliati *et al*., 2011). The DCF or comparable multiples are traditionally used to price IPOs. The total cost of the capital is a blend of equity and debt measured by Weighted Average Cost of Capital (WACC), presuming that financial capital remained constant. Hence, capital cost does not change and the WACC is the same throughout the specified period.

According to the DCF model, the Enterprise Value in time period t (EV_t) is determined at the present value of expected FFCF ($E_t[FFCF_{t+i}]$) depending on the available information in time period t and then discounted it at business level risk. Deducting the outstanding debt in time period t (D_t) and afterwards obtains an expected equity value (E_t). Table 1 presents the description of the notation used in the reverse-engineered DCF model.

Table 1

Notation Used in the Reverse-engineered DCF Model

Notation	Explanation
EV_{IPO}	Enterprise value at IPO = $E_{IPO} + D_{IPO} - CI_{IPO}$
E_{IPO}	Equity value at IPO price = ρIPO . (NSHpre + NSHnew)
D_{IPO}	Outstanding debt prior to the IPO
CI_{IPO}	Cash inflow of subscribed shares at the IPO = ρIPO . NSHnew
$FFCF_{IPO}$	Firm Free Cash Flow before the IPO
WACC	Weighted Average Cost of Capital
NSH_{pre}	Number of existing shares before the IPO
NSH_{new}	Number of newly issued shares
g_1	First stage growth rate (extra growth)
g_2	Second stage growth rate (stable growth)
T	Duration of the first stage
ρ_{IPO}	Offer price = (EVIPO – DIPO) / NSHpre
υ_{IPO}	Fair price = (EV – DIPO)/NSHpre
$EE_{i,j}$	Estimation Error for firm j in year i
O.V.I.	Over-valuation index = (ρIPO – υIPO) / ρIPO

The important condition for terminating the ongoing concern is to determine the future cash flow values over an infinite period. Similar to other direct valuations, the DCF model segregates the future into two periods. According to Penman (2007), valuations are generally equal to indefinite forecasting periods. The going concerns are treated to operate for indefinite time period whereas practically it transacts over finite horizons. The objective of the different IPO valuation methods is to forecast over a finite horizon. During the first period, an individual forecast of cash flow is developed every year. The steady-state value of post-horizon assets is estimated through a continuous formula (i.e. the terminated value of the firm's cash flow is measured through the growth of a steady-state firm). Hence, it is supposed that the cash flows constantly increase at a rate (g_2) in future.

$$EV_t = \sum_{i=1}^{\infty} \frac{E_t[FFCF_{t+i}]}{(1+WACC)^i} = \sum_{i=1}^{T} \frac{E_t[FFCF_{t+i}]}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{E_t[FFCF_{t+i}]}{(1+WACC)^i} \quad (1)$$

Let

$$E_t[FFCF_{t+i}] = E_t[FFCF_{i+T}].(1+g_2)^{i-T} \qquad \forall\, i = T+1, \dots\dots\dots \infty$$

$$EV_t = \sum_{i=1}^{T} \frac{E_t[FFCF_{t+i}]}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{E_t[FFCF_{i+T}].(1+g_2)^{i-T}}{(1+WACC)^i} \quad (2)$$

The model is classified as a two-stage because the growth rates of the cash flows before and after the event may be different. The extra growth (g_1) is supposed to grow annually at a constant rate. EV_t is combination of five elements: (i) $FFCF_t$, (ii) T = length of first stage growth, (iii) g_1 = first stage growth, (iv) g_2 = second stage growth, and (v) *WACC*. Referring equation 2:

$$E_t[FFCF_{t+i}] = FFCF_t.(1+g_1)^i \qquad \forall\, i = 1,\ldots\ldots T$$

$$EV_t = \sum_{i=1}^{T} \frac{FFCF_t.(1+g_1)^i}{(1+WACC)^i} + \sum_{i=T+1}^{\infty} \frac{FFCF_t.(1+g_1)^T.(1+g_2)^{i-T}}{(1+WACC)^i} \tag{3}$$

$$EV_t = FFCF_t \left[\sum_{i=1}^{T} \left(\frac{1+g_1}{1+WACC}\right)^i + \left(\frac{1+g_1}{1+WACC}\right)^T \sum_{i=1}^{\infty} \left(\frac{1+g_2}{1+WACC}\right)^i\right] \tag{4}$$

Using DCF model to price the IPO ($t = IPO$), the actual *FFCF* at IPO ($FFCF_t \equiv FFCF_{IPO}$) is used to find cash flows after the IPO. To apply the DCF model, g_1 and g_2 are applied to cash flows before the IPO's issuance to calculate the *FFCFs*. Considering the assumptions, EV_{IPO}[3] is estimated by adding the DCF expectations expressed as a function of the cash flows at the IPO. Referring Eq. (4), $t = IPO$

$$EV_{IPO} = FFCF_{IPO} \left[\sum_{i=1}^{T} \left(\frac{1+g_1}{1+WACC}\right)^i + \left(\frac{1+g_1}{1+WACC}\right)^T \sum_{i=1}^{\infty} \left(\frac{1+g_2}{1+WACC}\right)^i\right] \tag{5}$$

II.1 Reverse-engineering the DCF Model

Following the methodology of Cogliati *et al*. (2011), this study estimates the expected growth rate implied in offer price using a reverse-engineering DCF model. This method is like, to some extent, measuring the interest rate on a bond considering the estimated future coupon payments and market values as well. While estimating the growth rate, a number of firm-specific factors are accounted for. Cogliati *et al*. followed a similar methodology for prior accounting studies; for example, Ohlson (1995) and Feltham and Ohlson (1995) emphasized that the inverse residual income valuation method generates estimates of the proposed return on a stock investment. We assuming that the market may expect that newly issued equities have higher growth rates as most of the IPO firms are young but have less accounting information when compared against more seasoned equities. Cogliati et al. emphasized analyzing the short-term growth rate until the firm reaches a more steady state of growth. Empirical studies, such as Cassia et al. (2004) pointed out that estimating cash flow growth in the short-run is complex.

In line with the model as developed by Cogliati et al. (2011), the growth expectation is illustrated as follows:

$$\rho_{IPO} = \frac{FFCF_{IPO}}{WACC.NSH_{pre}} \left[\frac{(1+g_1)[(1+WACC)^T - 1 + (1+g_2).(1+g_1)^{T-1}]}{(1+WACC)^T}\right] - \frac{D_{IPO}}{NSH_{pre}} \tag{6}$$

where: ρ_{IPO} = offer price, NSH_{pre} = number of existing shares prior to the IPO, D_{IPO} = outstanding debt, $FFCF_{IPO}$ = firm free cash flow before IPO[4], WACC = weighted average cost of capital[5], g_1 = an undefined estimator of first stage growth where T is presumed

[3] $EV_{IPO} = E_{IPO} + D_{IPO} - CI_{IPO}$ *where* $CI_{IPO} = \rho_{IPO} . NSH_{new}$ *and* $\rho_{IPO} = (EV_{IPO} - D_{IPO}) / NSH_{pre}$

[4] *FFCF is calculated as: Cash flow from operating activities + Interest (1 – tax rate) – Capital expenditures.*

[5] $WACC = \frac{E_{IPO}}{D_{IPO}+E_{IPO}}.K_E + \frac{D_{IPO}}{D_{IPO}+E_{IPO}}.K_D$ where: E_{IPO} = market values of equity, D_{IPO} = outstanding debt, K_E = cost of equity capital through CAPM: $K_E = r_f + \beta_E(r_m - r_f)$ where r_f = risk-free rate, r_m

5 years for all firms, g_2 = a stable constant growth after the end of first stage[6]. These parameters are estimated from the IPO prospectuses and financial statements. The research questions implied in this analysis is as follows: (a) Is the growth rate implicit in IPO prices, (b) Is the Compound Annual Growth Rate (CAGR) positive over a five-year period but not in first year, and (c) Are the values of the expected cash flows determined for every firm *j* in year 1 based on information available after IPO. Ex-ante expectations are compared by actual ex-post value using Estimation Errors $(EE_{i,j})$.

$$E_{IPO}\left[FFCF_{i,j}\right] \ = \ FFCF_{IPO,j}.(1+\ g_1)^i$$

$$EE_{i,j} = \frac{FFCF_{IPO,j}.(1+g_1)^i - FFCF_{i,j}}{FFCF_{IPO,j}.(1+g_1)^i} \tag{7}$$

Extending the analysis, the researchers contrasted offer prices (P_{IPO}) to fair value estimates. Cogliati *et al*. (2011) argued that the fair value at the IPO (v_{IPO}) depends upon actual ex-post realizations of cash flows over a 5-year period rather than pre-IPO cash flows. This indicates that the actual ex-post realization of cash flows is determined by underwriters' at the IPO may have been perfectly fair depending on the information relating to growth prospects of the firm at that time. Hence, Over Valuation Index (OVI)[7] is expressed in the following equation:

$$Over\ Valuation\ Index \ = \ \frac{P_{IPO} - v_{IPO}}{P_{IPO}} \tag{8}$$

(*)To estimate the growth rate as well as Compound Annual Growth Rate (CAGR) over five years, two hypothesis are tested: (a) growth rate implicit in IPO prices, and (b) CAGR is positive over five years but negative in first year.

II.2 Long-term IPO Performance

When the estimated growth in cash flow is higher than its actual realization; it is important to determine whether such bias in implied growth may indicate an opportunity to earn profit for investors, for instance, investigate the underperformers' ex-ante. This section examines whether estimation errors and implied growth are correlated with post-IPO returns. Following the Loughran and Ritter (1995), BHAR is used to examine the aftermarket performance of IPOs computed for firm *i* at time period *T* as:

$$BHAR = \frac{1}{n}\sum_{i=1}^{n} \left[\prod_{t=1}^{T}\left(1+R_{i,t}\right) - \prod_{t=1}^{T}\left(1+R_{m,t}\right)\right] \tag{9}$$

where: $R_{i,t}$ = return of stock *i* at time *t*, $R_{m,t}$ = return on KSE-100 index and *n* = number of IPOs. Aftermarket performance is measured over 3- and 5-year period excluding first

= market return, β_E = firm's levered beta and K_D = cost of debt.$(1\text{-}t_c)$, where: t_c = corporate income tax rate.

[6] *Estimated using historical growth of real GDP in Pakistan – a nominal long-term growth rate for all firms assumed as constant equals 4%.*

[7] $P_{IPO} = \frac{EV_{IPO} - D_{IPO}}{NSH_{pre}}$ $\quad v_{IPO} = \frac{EV_{IPO}^{\text{actual FFCF}} - D_{IPO}}{NSH_{pre}}$

21-trading days after IPO issuance to avoid potential bias from the price stabilization period. It is, therefore, hypothesized that mean BHAR is equal to zero.

II.3 Extreme Bounds Analysis

Prior research identified various explanatory variables that affect long-run IPO performance. To examine the sensitivity and robustness of explanatory variables of long-run IPO performance and estimation errors, the EBA technique (Leamer, 1983) is used. The model identifies variables that 'truly' influence the dependent variable and minimizes the chances of model uncertainty upon choosing control variables. The model is described as:

$$BHAR_i = \alpha_0 + \sum_{j=1}^{n} \delta_i X_{ji} + \beta Q_i + \sum_{j=1}^{m} \gamma_i Z_{ji} + \varepsilon_i \quad (10)$$

where: X is a fixed variable, Q is the variable of interest and Z is a potentially important variable. This method identifies the robust variables that maintain the same sign as well as significant in the exercise of exhaustive regressions otherwise it is a fragile variable.

The possible determinants of post-IPO performance are presented in the following equation:

$$BHAR_i = \alpha_o + \beta_1 g_1 + \beta_2 Momentum_i + \beta_3 EE_i + \beta_4 Leverage_i + \beta_5 Underpricing_i + \beta_6 Dilution_i + \beta_7 Participation_i + \beta_8 Age_i + \beta_9 B_2 M_i \; \beta_{10} Size_i + \epsilon_i \quad (11)$$

Where:

g_1	–	The short-term growth rate (g_1) implicit in offer prices obtained from the reverse engineering DCF model;
Momentum	–	Market momentum measured as KSE-100 index return over 6-month prior to listing;
$EE_{i,j}$	–	Estimation Error ($EE_{i,j}$) is calculated as:

$$EE_{i,j} = \frac{FFCF_{IPO,j} \cdot (1+g_1)^i - FFCF_{i,j}}{FFCF_{IPO,j} \cdot (1+g_1)^i}$$

Leverage	–	Book value of debt / book value of equity prior to IPO;
Underpricing	–	First day market adjusted stock return;
Dilution	–	A ratio between new shares and pre-IPO shares;
Participation	–	A ratio between disposal of existing shares and number of pre-IPO shares;
Age	–	Natural log of one plus the firm's age – IPO year minus establishment year;
B2M	+	Book to market (B2M) = book value of equity plus capital inflow at IPO / market value; and
Size	–	Logarithm of pre-IPO sales (PKRm).

It is hypothesize that the EE will be inversely affecting the BHAR if investors employ cash flow expectations that are implicit in IPO valuations. If the estimation of underwriters becomes inaccurate, then IPO prices adjust accordingly. To find the determinants using BHAR, ten explanatory variables are used. Of these, two are *X*-variables selected as fixed for use in each regression while *Q* and *Z* variables are selected from the rest of the eight variables. The robustness of the *Q*-variable is examined from eight variables giving in total 560 regressions.

II.4 Determinants of Estimation Errors

After the growth rate is estimated can investors' ex-ante identify the extent of bias? To examine the determinants of the estimated errors scaled based upon the difference between the actual and estimated cash flows, the possible explanatory variables are written in the following form:

$$EE = \alpha_o + \beta_1 P/E_i + \beta_2 Participation_i + \beta_3 B_2M_i + \beta_4 Momentum_i + \beta_5 Age_i + \beta_6 Dilution_i + \beta_7 Leverage_i + \beta_8 Underpricing_i + \beta_9 Size_i + \epsilon_i \quad (12)$$

All the variables are explained above except P/E (i.e. the ratio of market price and earnings per share). The sensitivity and robustness of the explanatory variables are examined through the EBA technique.

The sample consists of 92 fixed priced IPOs issued on the KSE during the period ranging from January 1995 to December 2008. It excludes financial firms, which covers banks, insurance, leasing, modaraba, mutual funds, etc. Privatized IPOs are also excluded due to the reason that political objectives may distort the sample. The following filters are used as: (1) The pre-IPO *FFCF* was positive (losing 8 IPOs), and (2) Availability of cash flows for 5 years after the IPO (losing 10 IPOs). The final sample covers 35 IPOs for which inverse the DCF model is used.

The current study examines the growth implicit in offer prices covering the period lasting from 1995 to 2008. By using different filters (e.g. eliminate negative FFCF before IPOs and ignore IPOs due to non-availability of financial statements); the sample of this study covers 35 IPOs.

III. Empirical Findings

III.1 Implied Growth Rates and Estimation Errors

This section investigates the rate at which IPO firms are expected to grow? The reverse engineering DCF model (equation 6) is used to assess the growth embedded in IPO prices. Table 2 reports the results of short-term implied growth rates and forecast errors. It is found that on average for IPO firms the expected growth rate for the first 5 years as a public company is 25.5% (14.1% in median). From the view point of underwriters' optimistic tendencies, it is argued that such growth rates implied by IPO prices are higher than their actual realization. Cogliati *et al*. (2011) applied the reverse engineering DCF model using 184 IPOs and reported that IPO firms grew on average by 33.8% per year after 5 years (21.5% is the median).

The median Compound Annual Growth Rate (*$CAGR_1$*) of FFCF was -141.2% illustrating that most of the sample firms in the first year after listing incurred a negative cash flow. The negative *CAGR* reflects a signal of intense investment behavior or market timing motivation to go public; for instance, the window dressing and signal jamming hypotheses. As the time goes on, the IPO firms recover cash flows; therefore, the median *CAGR* is positive at 11.5% over the 5 year period (*$CAGR_5$*). It is observed that the actual growth rate is slightly lower than expected (g_1 = 14.1% representing the median value implied by the offer price). In addition, the actual cash flows of 46% of firms are more than expected. Cogliati *et al.* (2011) reported the median *$CAGR_5$* was 1.8% representing that 36% of firms have actual cash flows that are more than expected.

Table 2

Implied Growth Rates and Forecast Errors

	Average	25th	Median	75th	Aggregate	Std Dev
g_1	25.5	-6.1	14.1	43.8		48.3
$CAGR_1$	n.s.	-517.3	-141.2	114.6	-421.3	805.2
$CAGR_3$	-50.1	-42.7	-10.2	54.3	-5.2	212.7
$CAGR_5$	-20.4	-18.3	11.5	37.4	15.4	114.9
EE_3	29.2	-61.4	52.0	89.5	51.5	211.1
EE_5	20.7	-112.3	18.8	94.6	19.9	263.8
O.V.I.	68.6	27.6	80.6	93.8		69.4

This presents the results of 35 non-financial IPOs listed KSE from 1995–2008 where g_1 = short-term implied growth rate, CAGR = actual post-IPO cash flows, EE = estimation error and O.V.I. = overvaluation indices. The result of $CAGR_1$ is not reported due to negative $FFCF_1$ after IPO. The aggregate CAGR is obtained by adding the cash flows of event firms. Aggregate estimation errors are determined by difference between sum of estimated and actual cash flows scaled with sum of estimated cash flows. All values are in percentages.

Table 2 presents a median Estimation Error of 52.0% 3 years after the IPO (*EE_3*) and 18.8% after 5 years (*EE_5*). This finding supports the strong evidence of over-optimism in the DCF model employed by the underwriters. Cogliati *et al.* (2011) reported the median EE_3 of 99.6% after 3 years and EE_5 of 61.0% after 5 years. The aggregate values of estimation errors are almost the same (51.5% after 3 years) whereas they are 19.9% after 5 years. This indicates that investing in IPOs is not an appropriate investment strategy. In aggregate, it may be a losing strategy but if investors were able to cherry-pick different issues they would be able to obtain economically and statistically significant abnormal performance. Thus, the benefit of correctly selecting the best IPO firms ex-ante is substantial.

The results of Over-valuation Index (O.V.I.) are shown in Table 2. The median firm is overvalued by 80.6% at its offering as compared to the ex-post fair value. This overvaluation indicates that the ex-post realized cash flows is rightly skewed. Short-term implied growth rates, on the whole, are slightly higher reflecting higher values in the average estimation errors and overvaluation index. The observed differences (i.e. 14.1% vs. 11.5%) are small and confirm the goodness of the assumptions as well as robustness of the model.

Table 3 exhibits the results estimating by listing year, industry and operating FFCF. From results, it is clearly observed that underwriters' growth expectation (g_1) is higher in most of cases relative to actual ex-post realization (CAGR of free cash flows). It is calculated by both the estimation errors (at 3 and 5 years) and overvaluation index. It can be seen that short-term implied growth rate is higher during 2002–2008 due to expanding business opportunities in Pakistani Market. Industrial sectors expected to have the highest growth as compared to the lowest growth in technological sector. Lastly, sample was divided into three $FFCF_{IPO}$ segments to examine the sensitivity of these indices to firm size. It is reported that firms with lower FFCFs before IPO are characterized by higher expectations (g_1). Very low initial cash flows ($FFCF_{IPO}$ < PKR 15m) entail very high growth potential to justify a high IPO valuation. The expectations might be correct from the perspective of fast growing nature of small firms of which median CAGR is 9.41% as compared to median CAGR of 11.46% for the largest firms.

Table 3

Estimating by Listing Year, Industry and Operating FFCF

	IPOs	g_1	CAGR	EE_3	EE_5	OVI
Panel A: IPOs by year						
1995–2001	16	16.44 (9.85)	6.25 (18.74)	16.85 (33.42)	-54.12 (-68.25)	58.61 (66.53)
2002–2008	19	33.12 (14.93)	-42.87 (6.69)	39.64 (59.53)	83.76 (81.32)	76.97 (85.34)
Panel B: IPOs by industry						
Industrials	19	38.04 (16.58)	-29.84 (14.44)	24.24 (52.03)	33.16 (38.30)	65.20 (61.50)
Oil and Gas	6	14.52 (4.62)	35.67 (32.82)	-77.37 (5.91)	-156.82 (-117.35)	66.92 (73.30)
Technology & Communications	5	2.57 (20.06)	12.11 (14.65)	284.50 (186.90)	-11.15 (9.46)	33.10 (81.69)
Others	5	13.89 (6.17)	-84.41 (-25.49)	-79.18 (-168.31)	218.43 (97.88)	118.86 (98.94)
Panel C: IPOs by size (FFCFIPO)						
< PKR 15m	8	46.08 (48.21)	-12.02 (9.41)	102.36 (37.08)	140.53 (68.84)	44.39 (70.90)
PKR 15 – 100m	14	30.21 (8.04)	-7.39 (12.59)	-1.37 (67.90)	-72.27 (-72.56)	63.31 (73.30)
> PKR 100m	13	7.75 (10.16)	-39.60 (11.46)	17.17 (40.10)	47.15 (18.80)	89.13 (82.44)

The table summarizes short-term implied growth rates on the basis of offer price using reverse engineering DCF model. Sample is segregated by listing year, industry, and operating free cash flow prior to IPO. It reports mean and median values (in brackets). All values are percentages.

Table 4 examines the perceived differences in the underwriter's estimate of the IPO firm's implied growth rate and the Market's estimate in the implied growth rate by applying the reverse DCF engineering model (equation 6) to estimate the implied growth rates at the offer price and at the close of trading on the first day of trade. The researchers make this distinction because many studies have provided evidence of economically and statistically significant short-run abnormally positive performance events experienced in the first day of trading across many developed and emerging stock markets (e.g. Banerjee, S., Dai, L. & Shrestha, K., 2011 and Sohail, M. & Nasr, M., 2007). Panel A (Table 4) shows that the average offer price is lower than the average price at the close of the first day of public trading and the estimation results posit that average implied growth rate based upon the price of the IPO at the close of the first day of trading is 38.6% and at the offer the implied growth rate is 25.5%. Panel B represents the median $CAGR_5$ is 11.5%; however it seems to take some time for the new issues to achieve this growth rate given the results presented for the Cumulative Annual Growth Rates estimated over the one and three year periods. The results of estimation errors is higher if growth is calculated on the first trading day than offering (Panel C) and O.V.I is almost same in both the cases (Panel D). Based upon this evidence it seems as though the underwriters have more reasonable estimates of the unseasoned IPOs implied growth rates as compared against the markets initial reaction.

Table 4

Estimation of Results by Offer Price and First Day Closing Market Price

	Average	25th	Median	75th	Aggregate	SD
Panel A: Estimations (short-term implied growth rate)						
g_1 Offer	25.5	-6.1	14.1	43.8		48.32
g_1 1st day	38.6	-4.3	25.9	54.3		67.44
Panel B: Realizations (actual CAGR of FFCF)						
$CAGR_1$	n.s.	-517.3	-141.0	114.6	-421.3	805.23
$CAGR_3$	-50.1	-42.7	-10.2	54.3	-5.2	212.66
$CAGR_5$	-20.4	-18.3	11.5	37.4	15.4	114.90
Panel C: Estimation errors						
EE_3 Offer	29.2	-61.4	52.0	89.5	55.2	211.07
EE_3 1st day	64.8	-32.8	69.0	97.4	66.7	172.15
EE_5 Offer	20.7	-112.3	18.8	94.6	31.6	263.75
EE_5 1st day	22.0	-78.3	37.2	97.6	58.4	231.69
Panel D: Over-valuation indices						
O.V.I. Offer	68.6	27.6	80.6	93.8		69.43
O.V.I. Ist day	73.5	44.0	84.6	92.5		54.44

The table presents short-term implied growth rates (Panel A), the actual post-IPO cash flows (Panel B), estimation errors (Panel C) and over-valuation indices (Panel D) using the reverse engineering DCF model. "Offer" refers the actual offer price and "1st day" shows the first day closing market price. The values of aggregate CAGR are determined by adding the cash flows of IPO firms. Aggregate estimation errors are obtained by sum of estimated cash flows minus sum of actual cash flows divided by sum of estimated cash flows. All values are percentages.

III.2 Estimation Results: Pre-tech and Post-tech Bubble Periods

To determine whether a 'bubble' in the series or a 'bubble bursting' in the sample would have an impact on the expected growth rates and the results presented in this study, the researchers focused this section of the analysis on the pre-tech and post- tech bubble periods. The present study defines the pre-tech bubble period as the period that lasted from January 1995 to March 2000. Ofek, E. and Richardson, M. (2003) and Griffin, J., Harris, J., Shu, T., and Topaloglu, S. (2011) use different starting periods to describe the start of the tech-bubble period (i.e. January 1998 and January 1997 periods, respectively). In this analysis, the researchers included the 1995 and 1996 periods as a component of the 'pre-tech bubble' period to increase the sample size and because there does not seem to be an agreed upon starting point to the 'technology bubble period'. Next, the researchers used the 'peak' of the S&P 500 Index in March 2000 as the point at which the 'bubble burst', which coincides with the transition point used in the Ofek, E. and Richardson, M. (2003) and Griffin, J., Harris, J., Shu, T., and Topaloglu, S. (2011) papers. Many studies focus only on the impact of the bursting of this 'tech bubble' on the U.S. financial markets, but it is obvious, after a brief review of the performance of major global stock market indices, that the bursting of this bubble had very negative and broad performance implications across major global financial markets, which would presumably affect the performance of emerging market economies and stock markets.

This section examines the estimation results including pre- and post-bubble periods. The sample is divided into two parts: (i) the pre-bubble period (January 1995 to March 2000) and (ii) the post-bubble period (March 2000 to September 2002). The results of pre-bubble period (Table 5) indicate that the average short-term implied growth rate (g_1) was 16%, this estimate is significant at the 10% level, and the median growth rate was 10% (Table 5). The average CAGR of five year period leading up to the bursting of the Tech Bubble was 23% and the median value was 24%. These results indicate that the actual growth was more than expected. The median IPO firm was overvalued by 67% as compared against the ex-post fair value. In short, the short-term implied growth rates are slightly lower; moreover, the observed differences are small and confirm the goodness and the robustness of the reverse engineering DCF model. The results of post-bubble period show that the average growth is 20% which is marginally higher than median growth of 18%. The median IPO firm is overvalued by 135%. Interestingly, the expected growth is more than actual growth rate. These results confirm the tendency related to high growth expectation to IPO firms (the average expected short-term growth is 20%), which are not sustained afterwards (the average 5-year CAGR is -106%). The median Estimation Errors of 28.6% 3 years after the IPO and 171.2% after 5 years. This evidence provides the basis of over-optimism deployed by underwriters.

In summary, the results posit that before the dot-com bubble period, on average, IPO firms obtained lower expected growth than actual and the post dot-com bubble period shows a reversal of this trend wherein the actual growth is lower than expected.

Table 5

Estimating Results of Pre- and Post-bubble Periods

	IPOs	g_1	CAGR	EE_3	EE_5	OVI
Jan.1995 to March 2000	14	15.7* (9.8)	22.9 (24.3)	25.4 (56.9)	-66.1 (-68.3)	55.1 (66.5)
March 2000 to Sept. 2002	4	20.1 (18.4)	-108.1 (-106.1)	11.8 (28.6)	100.3 (171.2)	115.6 (135.0)

*The sample is divided into two periods: (i) pre-tech bubble and (ii) post-tech bubble. g_1 = short-term implied growth rate, CARG = compound annual growth rate over 5 years, EE = estimation errors, and OVI = over valuation index. Median values are shown in parenthesis. All values are in percentages. The significance of g_1 is estimated by t-statistics. * indicates significance at 10% level.*

III.3 Misevaluation of IPO Prices between Emerging and Developed Markets

There are different approaches used by the researchers to value IPOs (Kim & Ritter, 1999 and Berkman, Bradbury & Ferguson, 2000). It is important to note that the underwriters' intentionally underpriced IPOs which results in misevaluation of IPOs. However, the concept of misevaluation is more prevalent in the emerging markets as compared against studies on developed markets. This section compares the results of this study conducted on an emerging market with the results of a study on developed markets; i.e. France, Germany and Italy (Cogliati, Paleari and Vismara, 2011). The researchers question whether and how similar the misevaluation of IPO prices are in regards to the growth expectations that are embedded in IPO prices. This section will provide a further evidence of the over-optimism in the growth estimates embedded in the DCF model assumptions used by the underwriters.

Comparing the results of both the studies (Table 6), the researchers find that the short-term implied growth rate is implicit in IPO prices. Cogliati *et al*. found that the market attached a high growth expectation to IPO firms; therefore, the cash flow of an average IPO firm is expected to grow by about one-third each year for 5 years whereas this study finds that IPO firm is expected to grow by one-fourth annually for 5 years in an emerging market. Interestingly, the actual growth rate (CAGR) is higher in the emerging markets when compared against the developed markets. This illustrates that the emerging market IPOs generated higher growth in their firm's free cash flow during the period of 5 years following the issuance of unseasoned equity shares when compared against the developed market IPOs. The empirical findings of both the studies corroborate evidence of IPO overvaluation (Purnanandam and Swaminathan, 2004). Cogliati *et al*. found that the median IPO firm is overvalued at its offering by 74% relative to the ex-post fair value. This study finds that the median IPO firm is overvalued by 81%. In addition, it seems that while estimating short-term implied growth rate, the median estimation error over the 3-year period are higher but median estimation errors over the 5-year period reduces. More or less both the studies have similar findings.

We conclude that short-term implied growth is implicit in the IPOs prices of emerging and developed markets; however, the magnitude of growth varies depending upon the market in which growth is determined.

Table 6

Comparing Results Between Emerginga Developed Markets

	IPOs	g_1	CAGR	EE_3	EE_5	OVI
Cogliati, Paleari and Vismara (2011)	184	33.8 (21.5)	-55.5 (1.8)	145.8 (99.6)	85.5 (61.0)	119.7 (73.8)
Current Study	35	25.5 (14.1)	-20.4 (11.5)	29.2 (52.0)	20.7 (18.8)	68.6 (80.6)

This table compares the results of developed and emerging markets. g_1 = short-term implied growth rate, CARG = compound annual growth rate over 5 years, EE = estimation errors, and OVI = over valuation index. Median values are shown in parenthesis. All values are in percentages.

III.4 Sensitivity Analysis of the Reverse-engineering DCF Model

A sensitivity analysis is conducted with several assumptions on these parameters so as to check the robustness and obtained similar results. When the reverse engineering DCF model is applied, short-term implied growth rate (g_1) has the strongest impact on the estimates that involved long-term growth rate (g_2) and T. g_1 refers to the short term growth rate during the first 5 years while g_2 is the long-term growth rate for years 6 onwards. Table 7 reports that long-term growth rates (g_2) as well as T are higher; it results to decrease in short-term growth estimates (g_1). However, the change in g_2 and T, the main results are not affected in the analysis.

Table 7

Implied Growth Rates and Forecast Errors

g_2	T = 5	T = 6	T = 7
3	25.91 (14.42)	23.92 (12.55)	22.69 (11.24)
4	25.49 (14.11)	23.60 (12.48)	22.38 (11.00)
5	25.13 (13.80)	23.24 (12.02)	22.08 (10.77)

Table shows the results of average and median (in brackets) short term implied growth using the reverse engineering DCF model (Eq. 6) with different values of g_2 and T. where g_2 = 3%, 4% and 5% and T = 5, 6 and 7 years.

III.3 Long-term IPO Performance and Determinants

The long-term IPO performance is examined over a 3- and 5-year using buy-and-hold market adjusted abnormal returns (BHARs). The results reveal that IPOs underperform over a 3- and 5-year period by 29.5% (*t*-statistic = -2.06) and 69.7% (*t*-statistic = -3.46) respectively whereby IPO stocks are not better off than an investment in the benchmark index. It reflects that investors who participate at the offer price and keep IPOs up to the 3- or 5-year anniversary obtain negative abnormal returns. The previous finding confirms that investments in Pakistani IPOs over a longer-term investment horizon are not beneficial for investors. To circumvent the potential bias from the price adjustment period, the first 21 trading days are excluded. As a result, IPOs underperform by 22.8% (*t*-statistic = -1.65) and 61.7% (*t*-statistic = -3.93) over 3- and 5-year respectively thereby registering a decrease in abnormal returns by 7%.

The determinants of long-run underperformance are investigated using Extreme Bounds Analysis[8]. The preliminary regressions include the *X*-variables of BHAR[9] i.e., short term implied growth rate (g_1) and market momentum (Momentum) estimated by the Newey-West procedure (Newey and West, 1987). In both the equations, *X*-variables significantly influence the long-run underperformance. Without *Z*-variables, the two regressions are tested to examine the robust predictors of long-run underperformance over 3- and 5-year periods. EE (estimation errors), Underpricing, Participation (the ratio of exiting shares to pre-IPO shares), Age (firm's age) and Size (sales of firm) are considered as the *Q*-variables.

Table 8

Estimation Results of Benchmark Models without *Z*-variables

	Descriptive statistics	(I) BHAR year IPO + 3	(II) BHAR year IPO + 5
Constant		0.4966 (1.90)*	-0.2552 (-1.14)
***X*-variables**			
g_1	25.5% (14.1%)	-0.7988 (-2.47)**	-1.1804 (-2.22)**
Momentum	4.00% (4.74%)	1.2989 (3.23)***	1.8484 (3.10)***
***Q*-variables**			
EE_3	29.2% (52.0%)	0.0359 (0.66)	–
EE_5	20.7% (18.8%)	–	-0.0210 (-0.37)
Underpricing	32.7% (3.7%)	0.0881 (0.52)	0.2532 (1.51)
Participation	4.2% (0.0%)	2.0485 (1.23)	0.8802 (0.60)
Age	7.60 (5.00)	-0.3960 (-2.74)**	
Size	864.67 (65.76)		-0.0712 (-1.98)*
Adj. R^2		0.2770	0.2301
F-value		7.13***	4.89***

The table presents the results of benchmark model without Z-variables covering 35 IPOs from 1995 to 2008 period. Two cross-sectional OLS regressions include: $BHAR_{3y} = \alpha_0 + \beta_1 g_1 + \beta_2 Momentum_i + \beta_3 EE_3 + \beta_4 Underpricing_i + \beta_5 Participation_i + \beta_6 Age_i + \square_i$ *and* $BHAR_{5y} = \alpha_0 + \beta_1 g_1 + \beta_2 Momentum_i + \beta_3 EE_5 + \beta_4 Underpricing_i + \beta_5 Participation_i + \beta_6 Size_i + \square_i$, *where dependent variable is 3- and 5-year buy-and-hold market adjusted abnormal returns and independent*

[8] *Under the EBA technique, ten explanatory variables are considered. Of these, two X-variables are fixed and the robustness of eight variables is tested using three Z variables giving 560 regressions in total.*

[9] *Buy-and-hold abnormal return (BHAR) is measured over 3- and 5-year excluding the first 21 trading day.*

*variables include: g_1 = short-term implied growth rate, Momentum = market momentum, EE = estimation errors, Underpricing = stock return on the first day of trading, Participation = the ratio of exiting shares to pre-IPO shares, Age = age of the firm at the IPO and Size = pre-IPO sales. The t-statistics are based on Newey-West HAC standard errors. ***, ** and * represent significance level at the 1, 5 and 10%, respectively.*

Table 8 reports the results of the estimation results in regression I and II. The results report that the *X*-variables significantly affected the post-IPO returns over the 3- and 5-year periods in both the regressions. The coefficient of the short-term implied growth rate (g_1) is significant and negatively affects long-run underperformance. This illustrates that long-run IPOs underperform less because there is higher growth implicit in offer price (Cogliati *et al.*, 2010).

Table 9

Estimation Results of Benchmark Models with all *Z*-variables

	(III) BHAR year IPO + 3	(IV) BHAR year IPO + 5
Constant	0.6915 (1.85)*	-0.2712 (-0.39)
***X*-variables**		
g_1	-0.8061 (-2.26)**	-1.1708 (-2.12)**
Momentum	1.2832 (2.37)**	1.8823 (2.43)**
***Q*-variables**		
EE_3	0.0456 (1.30)	–
EE_5	–	-0.0218 (-0.32)
Underpricing	0.0694 (0.50)	0.1398 (1.35)
Participation	1.8759 (0.63)	0.0526 (0.02)
Age	-0.3163 (-1.074)	–
Size	–	-0.0696 (-1.03)
***Z*-variables**		
Age	–	0.0478 (0.11)
Size	-0.0148 (-0.37)	–
B2M	-0.3878 (-2.38)**	0.0917 (0.29)
FinLev	-0.0518 (-0.28)	-0.1046 (-0.47)
Dilution	0.3065 (0.93)	-0.2866 (-0.55)
Adj. R^2	0.2380	0.1159
F-value	9.90***	2.60**

*The table presents the estimation results of benchmark model with all Z-variables covering 35 IPOs issued from the 1995 to 2008 period. Two cross-sectional OLS regressions include all the variables reported above. The dependent variable is the 3 and 5-year buy-and-hold market adjusted abnormal returns in regression III and IV. The independent variables include: g_1 = short-term implied growth rate, Momentum = market momentum, EE = estimation errors, Underpricing = stock return on the first day of trading, Participation = the ratio of exiting shares to pre-IPO shares, Age = age of the firm at the IPO, Age = age of the firm at the IPO, Size = pre-IPO sales, B2M = book to market ratio, FinLev = financial leverage prior to IPO, and Dilution = the ratio between newly issued shares and number of pre-IPO shares. The t-statistics are based on Newey-West HAC standard errors. ***, ** and * represent significance level at the 1, 5 and 10%, respectively.*

Market momentum is positively correlated with underperformance which indicates that the KSE-100 Index obtained higher returns relative to IPO firms.

Regression I illustrates that only the Age variable is inversely and significantly correlated with long-run underperformance. This shows that mature firms perform better than younger firms and obtain higher returns which subsequently improve their financial performance thereby resulting in lower underperformance (Brau *et al.*, 2012). Other *Q*-variables included EE_3, underpricing and participation which are insignificant in determining 3-year underperformance. EE_3 and long-run underperformance have a positive relation but an insignificant effect. This demonstrates that higher estimation errors will inflate short-term growth expectations thereby resulting in higher underperformance – contrary to an earlier finding (e.g., Cogliati *et al.*, 2011). The underpricing variable has a positive relationship to abnormal performance, which is contrary to the prior result. This may be interpreted through the information asymmetry hypothesis and we could conclude that market is not correcting the mispricing which in turn leads to further underperformance.

The coefficient attached to the Participation variable is positively associated with underperformance, which helps to illustrate the dilution effect of promoters' holding. As the shareholder base is increased, the diversified shareholding effect makes it more difficult for firms to manage the business activities and deteriorates financial performance. This finding presents evidence that corroborates previous findings in support of the agency cost hypothesis.

Regression II illustrates that only the Size variable is the only Q-variable that significantly affects 5-year underperformance of IPOs. It is argued that firms that have generated higher sales, reflecting more demand as well as prospective growth, may have lower underperformance. EE_5 negatively influence underperformance but this underperformance is insignificant. This relationship illustrates the negative reaction of the market towards the disclosure of lower than expected cash flows, which illustrates that investors are constantly evaluating the accuracy of the pre-IPO estimates. As a result, investors are revising their expectations accordingly. Moreover, Underpricing and Participation have an insignificant effect.

Table 9 presents the results of the basic model with all *Z*-variables included. Among the Z-variables, only the book to market ratio (B2M) has a significantly negative influencing on the dependent variables over a3-year time horizon in regression III – contrary to earlier findings (i.e., Bonardo *et al.*, 2011). The negative relation posits that when the book- relative to market-value of equity is higher showing the good financial position resulting lower underperformance. The coefficient attached to the Size and Leverage variables negatively influenced the dependent variable. Large size of sales indicates high demand of the products or services which ultimately lowers the underperformance. High financial leverage indicates that the availability of financing is better and utilization of this financing in an effective manner may reduce the underperformance. Dilution positively affects the underperformance demonstrating that the high ratio of issuance of shares to the general public leads to agency problems, which affects financial performance.

In regression IV, no variable is significant from the *Z*-variables. There is a positive relationship between the firm's age and underperformance, which reflects that more mature firms may take more risk while investing in new projects with the perspective to generate higher returns. Due to riskiness of the projects, the stock returns may become volatile increasing the underperformance. B2M shows a positive relation indicating that the increase in net worth of firm without taking on future projects may not increase the market price of shares, which inflates underperformance.

Table 10

Estimation Results of Benchmark Models without and with all Z-variables

	Without *Z*-variables		With all *Z*-variables	
	EE_3	EE_5	EE_3	EE_5
	I	II	III	IV
***X*-variables**				
P/E	-0.0597 (-2.21)**	-0.1382 (-1.19)	-0.0308 (-1.16)	-0.1199 (-0.98)
Participation	7.4426 (3.69)***	0.7383 (0.20)	7.8381 (3.06)***	-0.427 (-0.07)
***Q*-variables**				
B2M	-0.3431 (-0.91)		-0.2053 (-0.61)	
Momentum	-1.8449 (-1.92)*	-1.8238 (-1.48)	-1.2274 (-1.03)	-1.4120 (-1.31)
Age	-0.2235 (-0.94)	0.5898 (2.02)*	0.1294 (0.29)	0.8926 (1.25)
Dilution		1.6859 (1.74)*		1.6288 (1.39)
Leverage		-0.524 (-2.29)**		-0.7527 (-1.53)
***Z*-variables**				
B2M				-0.0995 (-0.42)
Dilution			-0.9727 (-1.44)	
FinLev			0.3110 (0.80)	
Underpricing			-0.0353 (-0.10)	0.0996 (0.16)
Size			-0.1743 (-1.17)	-0.0870 (-0.83)
Constant	0.7190 (1.22)	-1.1502 (-2.98)***	0.6049 (0.93)	-1.2554 (-172)
Adj. R^2	0.1575	0.0562	0.1486	-0.0863
F-value	4.10***	3.88**	5.38***	2.32*

*The table presents the estimation results of benchmark model without Z-variable (Regression I and II) and with all Z-variables (Regression III and IV) covering 35 IPOs issued from 1995 to 2008 period. The dependent variable is 3- and 5-year estimation errors. The independent variables include: P/E = price/ earnings ratio, Participation = the ratio of exiting shares to pre-IPO shares, B2M = book to market ratio, Momentum = market momentum, Age = age of the firm, Dilution = the ratio between newly issued shared and number of pre-IPO shares, Leverage = financial leverage prior to IPO, Underpricing = stock return on the first day of trading and Size = pre-IPO sales. The t-statistics are based on Newey-West HAC standard errors. ***, ** and * represent significance level at the 1%, 5% and 10%, respectively.*

The negative sign on dilution reflects diversified ownership involve in effective management of resources thereby reducing underperformance.

The sensitivity of the *X*- and *Q*-variables is examined to test whether these variables are robust or fragile? The purpose is to select those significant at 10% level. The results indicate that robust predictors of long-run IPO underperformance include: (a) short-term implied growth rate (g_1), (b) market momentum, (c) age of the firm, and (d) size of the firm.

III.4 Determinants of Estimation Errors

Table 10 exhibits the results of the basic model without *Z*-variables (I and II). *X*-variables included P/E and Participation. *Q*-variables included B2M, Momentum and Age in equation I and Momentum, Age, Dilution and Leverage in equation II. The results of regression I indicated that both *X*-variables significantly influenced the EE_3. Participation is positively associated with estimation errors, which indicates that as the participation in IPOs become more diversified agency problems may occur thereby resulting higher estimation errors (Cogliati *et al*., 2011). P/E and EE_3 are negatively associated illustrating that a higher P/E reflects a higher market price, which results in lower estimation errors. Momentum is only significant at 10% level, which illustrates that high market momentum prior to IPO leads to an increase in estimation errors --- contrary to earlier findings, which is described by higher the market momentum, higher underpricing and lower the estimation errors. B2M and Age variables are insignificant variables. Regression II posits that both *X*-variables are insignificant while Age, Dilution and Leverage are significant factors to determine the estimation errors over the 5-year period. Age is positively correlated and leverage is negatively associated with EE_5. Both of these findings provide contrary evidence to earlier results (Cogliati *et al*., 2011). It reflects that mature firms may incur high estimation errors as they intentionally underprice their shares leading to inflated estimation errors. Dilution positively affects EE_5, which suggests that higher dilution may cause agency conflicts between management and shareholders and this may inflate estimation errors. When all *Z*-variables are included, Table 7.5 reports the estimation results (Regression III and IV). In regression III, Participation is the only significant variable from the *X*-variables while no variable is significant from the *Z*-variable over 3 year period; moreover, no *Q*- or *Z*-variable is significant from regression IV.

The sensitivity results posit that P/E, Participation and Momentum are the robust determinants in regression I while Age, Dilution and Leverage are the robust variables in regression II which influences estimation errors. Other variables are treated as fragile variables.

IV. Conclusions

To determine the value of the IPOs, a variety of models have been developed. Of these, the most popular is the Discounted Cash Flow model. In this study, the reverse engineering DCF model (Cogliati *et al*., 2011) has been used to estimate the growth expectations implicit by offer price. Generally, high growth rates are compensated by excessive valuation because investors are seemingly overoptimistic in their evaluations (Loughran and Ritter, 1995). The distribution of realized future cash flows are rightly skewed depending on the estimation made by investors either to overestimate high profits (right tail) or underestimate low profits (left tail). As a result, the valuation of almost all IPOs becomes too high.

Covering a sample of IPOs with positive FFCF traded on the Pakistan market from 1995-2008, it is estimated that the growth rate in cash flows to be realized through offer price relative to bias of implied growth. To have persistence future growth, typical pricing is done by IPO firms so as to get the extreme expectations achieved. The researchers found that the cash flow of the average IPO firms is expected to grow by one-fourth annually over a 5 year period, which illustrates that the actual CAGR of cash flows are lower than expected. The 'Fair value' is estimated by actual ex-post cash flows and this project finds that the median IPO firm is overvalued by 80%. This overvaluation is higher than the earlier studies [e.g. Purnanadam and Swaminathan (2004) and Cogliati *et al*. (2011)] which concluded that the median estimates are overvalued by 50% and 74%, respectively.

The results of BHARs reveal that IPOs underperform over the 3- and 5-year periods. To determine the influential predictors of long-run underperformance, Extreme Bound Analysis is used and the researchers found that the short-term implied growth rate, market momentum, firm's age and size of sales are significant determinates of underperformance. The robust determinants of estimation errors are P/E, participation, market momentum, leverage, age and dilution in this analysis. In addition, overvalued IPOs yield lower long-run returns as compared to undervalued IPOs (Purnanadam and Swaminathan, 2004). Primarily, the initial overestimation and desperation thereafter may cause post-IPO underperformance. These results provide further support in regard to the divergence of opinion hypothesis (Miller, 1977) and the window of opportunity hypothesis (Loughran and Ritter, 1995).

References

Barber, B. and Odean, T., 2008. All that glitters: the effect of attention on the buying behavior of individual and institutional investors. *Review of Financial Studies,* 21, pp. 785–818.

Banerjee, S. Dai, L. and Shrestha, K., 2011. Cross-country IPOs: What explains differences in underpricing? *Journal of Corporate Finance*, 17(5), pp. 1289-1305.

Berkman, H. Bradbury, M.E. and Ferguson, J. 2000. The accuracy of price-earnings and discounted cash flow methods of IPO equity valuation. *Journal of International Financial Management and Accounting,* 11, pp. 71-83

Bonardo, D. Paleari, S. and Vismara, S., 2011. Valuing university-based firms: the effects of academic affiliation on IPO performance. *Entrepreneurship Theory and Practice,* 35(4), pp. 755-776.

Cassia L. Palcari, S. and Vismara, S., 2004. The valuation of firms listing on the nuovo mereato: the peer comparables approach. *Advances in Financial Economics,* 10, pp. 113-129.

Cogliati, M.G. Paleari, S. and Vismara, S., 2011. IPO pricing: growth rates implied in offer prices. *Annals of Finance,* 7(1), pp. 53-82.

Deloof, M. De Maeseneire, W. and Inghelbrecht, K., 2009. How do investment banks value IPOs? *Journal of Business Finance and Accounting,* 36(1&2), pp. 130-160.

Feltham G.A. Ohlson, J.A., 1995. Valuation and clean surplus accounting for operating and financial activities. *Contemporary Accounting Research,* 11, pp. 689-731

Field, L.C. and Lowry, M., 2009. Institutional versus individual investment in IPOs: the importance of firm fundamentals, *Journal of Financial and Quantitative Analysis,* 44, pp. 489-516.

Griffin, J.M. Harris, J. H., Shu, T.S. and Topaloglu, S., 2011. Who drove and burst the Tech Bubble? *Journal of Finance, 66(4)*, pp. 1251-1290.

Kaplan, S.N. and Ruback, R.S., 1995. The valuation of cash flow forecasts: an empirical analysis. *Journal of Finance,* 50 (4), pp. 1059-1093.

Kim, M. and Ritter, J.R., 1999. Valuing IPOs. *Journal of Financial Economics,* 53, pp. 409-437

Kojima, N., 2007. IPO share allocation and conflicts of interest. *Annals of Finance,* 3, pp. 369-387.

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

Loughran, T. and Ritter, J.R., 1995. The new issue puzzle. *Journal of Finance, 50*, pp. 23-51.

Lyon, J.D. Barber, B.M. and Tsai, C.-L., 1999. Improved Methods for Tests of Long-Run Abnormal Stock Returns. *Journal of Finance*, 54(1), 165–201.

Ofek, E. and Richardson, M., 2003. DotCom Mania: The rise and fall of Internet Stock Prices. *The Journal of Finance, 58(3),* pp. 1113-1137.

Ohlson, J.A., 1995. Earnings book values and dividends in equity valuations. *Contemporary Accounting Research*,11, pp. 661-687.

Penman, S.H., 2007. *Financial Statement Analysis and Security Valuation*. 3rd Edition. New York: McGraw-Hill.

Purnanandam, A.K. and Swaminathan, B., 2004. Are IPOs really underpriced? *Review of Financial Studies,* 17(3), pp. 811-848.

Roosenboom, P.G.J., 2007. How do underwriters value IPO? An empirical analysis of the French IPO market. *Contemporary Accounting Research* 24, pp. 1217-1243

Sohail, M.K. and Nasr, M., 2007. Performance of initial public offerings in Pakistan, *International Review of Business Research Papers*, 3(2), pp. 420-441.