Some Preliminary Evidence on Stock Price Bubbles in an Emerging Market

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This paper analyzes the presence of a speculative component during the extra ordinary upsurge in Karachi Stock Exchange. We implement cointegration tests, between 1997 and 2008, on price and dividends of various market and sectoral indices. The no bubble hypothesis could not be rejected for market level indices establishing the presence of a speculative factor. Among sectoral indices, banking sector depicted a speculative component, however, the price level of Oil and Gas sector did not diverge from the related dividends. These results remained robust with evidence of persistent volatility shocks for the sample period.
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1.Introduction

The fair value of a stock is a rational estimate of the expected market price based on investment utility and risk factors. The empirical literature on the subject has exhaustive evidence on determinants of fair value. Some of the notable variables discussed in previous researches include dividends, free cash flows, net income, operating

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profits etc. Although, all these variables can be used to calculate a theoretical fair value, dividends are assumed to reveal more information about a stock[3].

If markets depict rational expectations, the stock prices should correlate (to some extent) with the fair value. However, there are instances when the prevailing price level is artificially high to be justified by underlying fundamentals and available public information. Financial economists have attributed such phenomenon to the presence of a stock market bubble. *A speculative bubble is defined as series of events where markets experience high trade volumes with overvalued stock prices that could not be justified by any measure of stock valuation.*

The causes of such financial bubbles remained a challenge for the proponents of bubble theory. Many explanations have been offered for the existence of bubbles. Some believe that bubbles are a consequence of excess monetary liquidity coupled with *greed* and *irrational behavioural* of overly bullish investors. A relatively interesting rationale of *greater fool theory* for the presence of speculative bubbles has been used in behavioural finance. According to this proposition the bubble process is warranted by the behaviour of extra optimistic investors termed as *the fools*, who will buy fundamentally over valued stocks in anticipation of selling to other speculative participants (*the greater fools*) at a higher price. The bubble is expected to develop as long as *fools* can find *greater fools* to offload the overvalued stocks. The bubble will burst when the *greater fools* will become *greatest fools* paying the maximum price for a stock and could not find anyone offering a higher price to buy thus triggering panic sale. Regardless of the underlying cause, the impact of these bubbles has always been negative for markets in particular and economy in general. A speculative bubble driven by rumours and not supported by fundamentals will result in misallocation of resources into non optimal uses.

[3] For a comprehensive survey of dividends and their relevance to firm value please see Bhattacharya (1979), Miller and Rock (1985), John and Williams (1985), Allen and Michaely (1995).

Although the impact of a bubble is critical for both developed and emerging markets, the consequences for the later, with limited resources for recovery, are more devastating. The emerging economies have small size financial markets and thin trading with investment activity limited to few scrips that make them vulnerable to financial bubbles. Moreover, the lack of transparency coupled with informational inefficiency and speculative trading by few market makers increases the probability of financial bubbles.

Karachi Stock Exchange (KSE) is the largest stock market of Pakistan in terms of market capitalization and stock turnover. There are 653 listed companies with a market capitalization of approximately USD 46 billion[4]. KSE followed an overall bullish trend in the last five years[5]. Some analysts attribute this substantial growth to improvement in economic variables while several others relate the abnormal increase in stock prices to a speculative bubble. Since, every financial bubble is expected to be followed by a market crash, the recent panic in KSE resulting in a significant drop in price levels coupled with low volumes provide some support to the bubble hypothesis. The bubbles are crucial since they could possibly influence the investment behaviour of local as well as international investors. Similarly, another critical aspect of speculative bubbles is their impact on monetary policy. Chan et al (2003) argue that if markets are free from speculative bubbles, the monetary policy can simply rely on controlling market fundamentals otherwise a positive policy action would be required to account for bubble related expectations.

This paper will examine the relation between price level and dividends in KSE for last ten years to analyse the presence of a speculative component. The rest of the paper is organized as follows. Section II will summarize the empirical evidence on the subject. Section III will

[4] Source: KSE Website (As of July 31, 2008)
[5] KSE Index (Jan 2003) 2600 points increased by six times to over 15000 points (April 2008).

present data and methodology. The results will be discussed in Section IV while Section V will conclude.

2. Literature Review

The debate on existence of speculative bubbles has remained a challenge in financial research. There have been various propositions mixed empirical evidence for both developed and emerging markets. However, it must be noted that even if the *bubble* presence is controversial, the underlying statistics exactly reveal whether the price level exhibited a divergence from the related fundamentals. This section will summarize some of the empirical evidence on speculative bubbles.

Campbell and Shiller (1987) used cointegration analysis to study the present value model of stock prices. They analyzed the prices and dividends of S&P index from 1871 – 1986. The cointegration results revealed that the spread between stock prices and related dividends is significant and the deviation of stock prices from the present value model is constant. They concluded that absence of a price dividend relationship can be attributed to the presence of a speculative trend though the assumed discount factor under present value framework could have produces results against present value model.

West (1987) developed a framework for speculative bubbles and investigated S&P Composite Price Index from 1871 - 1980 and Dow Jones data from 1928 - 1978 for presence of bubbles. Assuming a constant expected rate of return, he proposed a three step process for the bubble hypothesis. In the first stage, he examined the simple present value relation (arbitrage equation) of price and expected dividends and estimated a discount rate. The second step comprised of forecasting dividends by an ARMA equation in which future dividends is a function of past dividends. The third step comprised of regression of *ex post* stock prices on lagged dividends. He compared the estimates of forecasted variables from the first two equations to

the estimates of third equation. West (1987) reported that sample data revealed substantial differences between the ex post and forecasted estimated. He concluded that these differences indicate the presence of speculative bubbles in S&P and Dow Jones stocks[6].

Diba and Grossman (1988a, 1988b) used the rationale of cointegration to test for the price level bubbles. They demonstrated that if stock prices are solely a function of expected dividends, then dividends and prices will be stationary in means when there are no speculative bubbles. Furthermore, they argue that even if dividends and prices are non-stationary, presence of a cointegration relationship will exhibit a no bubble situation. They analyzed dividend and price series for the S&P 500 and reported that dividend and price series for the index had difference stationarity thus confirming the absence of a speculative behavior. Their cointegration analysis supported the stationarity results and cointegrated dividends and prices confirmed the absence of a speculative bubble.

Ahmed and Rosser (1995) were the first to examine the speculative trend in Karachi Stock Exchange. They employed daily stock market and exchange rate data between 1987 and 1993. Using VAR technique and lagged first difference of the log of exchange rate and stock index, they estimated the fundamental price level. The residuals were then used in a regime switching model and related Wald test showed that trends in the residual depict speculative behavior. The residuals also depicted a non linear behavior that remained even after correcting for ARCH effects. They concluded that during their sample period KSE depicted complex dynamics coupled with significant trends that might be attributed to the presence of speculative bubbles.

Chan et al (1998) analyzed stock markets of Hong Kong, Japan, Korea, Malaysia, Thailand and Taiwan for presence of speculative bubbles. The monthly and weekly returns were observed from 1975 to

[6] West (1987) noted that the rejection of no bubble hypothesis could be in part a consequence of upward biased estimates from regression on stock prices and dividends.

1994 for bubble specific characteristics including autocorrelation, skewness, kurtosis and leptokurtosis. Since autocorrelation, skewness and kurtosis could be a consequence of change in fundamental value, they further examined the returns for two bubble specific tests. The first series of tests were duration dependent while in the second category, they examined return behavior prior to the stock market crashes. The duration dependent and conditional skewness results showed that none of the six markets had bubble characteristics. The returns in Hong Kong, Malaysia and Thailand depicted explosive behavior prior to crash; however, the markets on average took much longer to reach their lowest levels. They concluded that the six markets in general did not exhibit significant bubble characteristic and pre crash increasing returns are marginal evidence to support bubble hypothesis.

Ahmed et al. (1999) replicated Ahmed and Rosser (1995) study on ten Pacific Rim stock markets between 1986 and 1996 for the existence of speculative bubbles. They applied a vector autoregression (VAR) model to estimate the fundamental stock prices and the residuals from the VAR model were analyzed using a regime switching model to identify speculative trends. The empirical findings rejected the no bubble hypothesis for all ten countries indicating the possible presence of speculative bubbles. Moreover, they reported the presence of significant non linearity beyond ARCH effects in residuals from all countries. They concluded that the stock prices in the Pacific Rim demonstrated a non linear speculative behaviour with the caveat that misspecified fundamental value could have biased the results.

Blancard and Raymond (2004) investigated the validity of dividend discount and model and speculative bubble hypothesis on French, German, Japanese, UK and US stock markets from 1973 to 2002. They employed cointegration tests corrected for Skewness and excess kurtosis. The results demonstrated significant growth in stock prices vis-à-vis dividends and earnings from 1990 to 2000. The cointegration

tests proved the deviation of stock prices from the dividends for the sample period for all countries. Similar results were reported even after the inclusion of earnings along with dividends. They concluded that the divergence in stock prices could symbolize the presence of a bubble and similar results for all countries in the sample could be a consequence of strong interdependence of these markets.

Herrera and Perry (2003) examined the presence of stock market bubble in five Latin American countries. They used dividend price cointegration tests on the sample period of 1980 to 2001 that was marked with significant overvaluation of stock prices. The results revealed that in Latin American region, 22 instances confirmed the presence of bubbles in stock markets and most of these bubbles were followed by crashes. They identified 24 to 41 crashed of which 14 were related to the stock market bubbles. They concluded that the bubbles and crashes had similar average duration with bubbles remaining for eight months while crashes lasted for approximately ten months.

Cunado et al (2005) used NASDAQ data to test for the presence of rational stock bubbles between 1994 and 2003. They analyzed the order of integration of NASDAQ stock prices and dividends along with the price dividend differential using a fractional integration approach with various sample frequencies. The results showed mixed evidence about speculative trend in NASDAQ stocks. The monthly data revealed no cointegration suggesting the presence of a bubble. However, daily and weekly data showed some level of integration between price and dividends rejecting the no bubble hypothesis. They argued that the difference in results by changing the frequency from monthly to weekly or daily could be attributed to two factors. Firstly, with relatively longer time period (a month vis-à-vis week or day) the persistent behaviour in the observation is likely to disappear. Secondly, the use of low frequency data can bias the results to reveal slow convergence. They concluded that as the price adjustment to new

information including dividends is swift, the results of no bubble from high frequency data (daily or weekly) are more appropriate.

Koustas and Serletis (2005) studied S&P 500 series using a fractional integration process from 1871 – 2000. They argue that fractional integrated processes differ from stationary and unit root as they are persistent and mean reverting. The results from logged dividends, logged prices and a differential of logged dividend and prices revealed that dividend yield for S&P series is mean reverting thus establishing a unit root. They concluded that mean reverting dividend yield with presence of unit root indicates absence of rational bubbles in stock prices for their sample period.

Jirasakuldech et al. (2008) examined Thai equity markets from 1975 – 2006 using a cointegration approach to observe the deviation in stock prices from their fundamentals due to speculative bubbles. The results for the data reported no cointegration between dividends and stock prices indicating a departure of equity prices from dividends. As a robustness test they included earnings as another fundamental variable but the results remained unchanged. Moreover, to avoid possible biases in data due to highly volatile period of Asian crisis, they subdivided the sample period into pre and post crisis. The sub period results showed presence of bubble in pre crisis period, however, post crisis period (1998 – 2006) indicated a persistent relationship between prices and underlying fundamentals. The duration dependent tests revealed similar results, with evidence of negative duration dependence in runs of positive returns, for the full and sub sample period indicating the likelihood of bubble. They concluded that a speculative bubble caused the prices to deviate from their fundamental values in pre crisis period; however, the prices remained cointegrated with dividends in the recent period showing no evidence of bubbles in post crisis period.

3. Research Methodology. The stock markets in Pakistan remained stagnant with range bound stock prices, market indices and trading volumes till early 2003. The later half of 2003 witnessed an upsurge that has continued till March 2008. The five year bull rally has witnessed some turbulent periods with market panics that resulted in losses for many investors. However, the post March 2008 period has witnessed a collapse with low trading activity and non existent liquidity that forced the regulators and market participants to freeze the market index (KSE 100) at certain level.

The freezing of market index was a unique effort to overcome a crisis situation. However, it could not improve the situation and market experienced a steep decline once the cap was lifted. The puzzling question in this context is to identify the possible factors that have contributed for the ups and downs in stock market. One relevant factor could be the presence of a speculative bubble in KSE. Table 1 represents the progression in KSE 100 index over the years.

Table 1

Year wise Performance of KSE 100 Index

Year	KSE 100 Index
1997	1753.82
1998	945.24
1999	1408.91
2000	1507.59
2001	1273.06
2002	2701.41
2003	4471.60
2004	6218.40
2005	9556.61
2006	10040.50
2007	14077.16
2008	5865.10

Source: Data Stream (As of Dec 31)

The data on KSE 100 is electronically available from July 1997 and our sample period constitutes of almost ten years from July 1997 to August 2008. It is possible that in a relatively large period, the presence of small speculative bubbles is mitigated; therefore, we will examine two sub periods. The sub sample periods will include 1997 to 2003 that was marked with moderate level market activity and 2003 to 2008 that has witnessed a rapid increase in price level, volumes and volatility.

3.1 Model Specification

The theoretical framework to test for price level speculative bubbles was suggested by Campbell et al (1997). To develop the *no bubble hypothesis*, they assumed a rate of return *R* on a stock that is given by the respective sum of capital gain and dividend yield. Mathematically, this can be written as

$$R_{t+1} = \frac{P_{t+1} - P_t}{P_t} + \frac{d_t}{P_t}$$

Further assuming a constant return R and taking condition expectation $E_t(.)$ on both sides we get the following price dividend relationship

$$P_t = \frac{E_t(P_{t+1} + d_{t+1})}{(1+R)}$$

Considering T time periods and using forward iteration we get

$$P_t = \sum_{t=1}^{T} \frac{E_t(d_{t+i})}{(1+R)^i} + \frac{E_t(P_{t+T})}{(1+R)^T}$$

If there are no price bubbles, the expected price at T is a finite value and the transversality condition holds. The condition for non bubbles can be expressed as

$$\lim_{T \to +\infty} \frac{E_t(P_{t+T})}{(1+R)^T} = 0$$

and the fundamental stock price (with above condition) can be rewritten as

$$P_t = \sum_{i=1}^{+\infty} \frac{E_t(d_{t+i})}{(1+R)^i}$$

which alternatively can be expressed as

$$P_t - \frac{d_t}{R} = \frac{1}{R}\sum_{i=1}^{+\infty} \frac{E_t(\Delta d_{t+i+1})}{(1+R)^i} \quad (1)$$

Equation (1) means that even if stock prices and dividends are difference stationary [I(1)] then under the transversality condition the two series should be cointegrated. Taking a Taylor series approximation of equation (1) Campbell et al. (1997, pp. 261 – 262) derive the following relationship for empirical analysis.

$$Ln(d_t) - Ln(P_t) = -\frac{\kappa}{1-\rho} + \sum_{i=0}^{+\infty} \rho^i E_t[-\Delta Ln(d_{t+1+i}) + Ln(R_{t+1+i})] \quad (2)$$

with $\rho = 1/\langle 1 + \exp[Ln(d_t) - Ln(P_t)]\rangle$ and $\kappa = -Ln(\rho) - Ln(1/\rho - 1)(1-\rho)$

If the stock prices [Ln(P)] and dividends [Ln(d)] follow a [I(1)] process then [Ln(d)-Ln(P)] will be stationary [I(0)] if and only if the ex post rate of return R is also generated by a stationary process [I(0)] and *Ln(P)* series will be cointegrated with *Ln(d)* and a no bubble situation can be established. However, Campbell et al. (1997) suggested that the assumption of a constant rate of return is too stringent and in practice returns are generated from a process that is difficult to be differentiated from an [I(1)] process. Assuming a non stationary return variable Ln(R), they proposed the following transformation.

$$Ln(d_t) - Ln(P_t) - \frac{Ln(R_t)}{1-\rho} = -\frac{\kappa}{1-\rho} + \sum_{i=0}^{+\infty} \rho^i E_t[-\Delta Ln(d_{t+1+i})] + \frac{1}{1-\rho}\sum_{i=0}^{+\infty} \rho^i E_t[\Delta Ln(R_{t+1+i})] \quad (3)$$

The equation (3) implies that if the returns are non stationary, the price level speculative bubbles will be absent if dividend yield [*Ln(d) – Ln(P)*] is cointegrated with Ln(R). This relationship will hold even if the returns are non stationary at a higher process than [I(1)].

The rationale behind equation (2) and (3) is simple. Campbell et al (1997) noted that since these equations are derived from an identity using transversality conditions and expected values. To maintain a stationary *Ln(d) – Ln(P)* ratio in case of an increase in price level, either dividends should increase or future returns should decline. If price level is increased and the dividends or future returns do not change accordingly, this will indicate that prices are following a bubble path and are not supported by the fundamentals. This explanation will warrant two levels of tests. In the first instance, we will test for unit roots in *Ln(d) – Ln(P)* ratio and returns. If dividends are difference stationary [I(1)] then returns and *Ln(d) – Ln(P)* must have unit roots and no bubble hypothesis will be rejected. Secondly, we will examine the cointegration between returns and dividend yield and absence of a stable relationship will reject the no bubble hypothesis.

3.2 Estimation of Variables

The benchmark index for Karachi Stock Exchange is KSE100 that was introduced with a base value of 1000 points. The index includes 100 companies from every sector selected on basis of market capitalization representing approximately 80% of total listed market capitalization. The KSE 100 index is considered as a relevant indicator and its performance is frequently quoted to support the level of economic development. To test for speculative bubble in KSE under the framework of Campbell et al (1997), we will use daily price level, returns and dividends on KSE 100. The logarithmic returns on KSE 100 will be estimated as

$$R_{(KSE100)t} = Ln\left[\frac{KSE(100)_t}{KSE(100)_{t-1}}\right] \quad (3)$$

where $KSE(100)_t$ and $KSE(100)_{t-1}$ represent closing index value on day t and t – 1 respectively. Similarly dividends and price (closing index) on day t would be represented by $Ln[d_{(KSE100)t}]$ and $Ln[Index_{(KSE100)t}]$ and the differential could be written as $Ln[d_{(KSE100)t}] - Ln[Index_{(KSE100)t}]$.

In order to provide substantial evidence on the bubble phenomenon, our analysis will include some independent indices and related dividends streams. These include FTSE Pakistan Stock Price Index *[FTSE(PI)]* and dividends *[d(FTSE)]*. FTSE provides indices of emerging markets including Pakistan that are extensively used by foreign investors for portfolio allocation decisions. Other widely used international indices covering KSE stocks are DataStream indices (DS) including market level DS(Market) and sectoral indices of DS(Oil and gas), DS(Banks), DS(Tobacco) and DS(Telecom). The various index variables used for unit root and cointegration tests will take the form

$$R_{Xt} = Ln\left[\frac{Index(X)_t}{Index(X)_{t-1}}\right] \quad (4)$$

and $Ln[d_{(X)t}] - Ln[Index_{(X)t}]$

with *X* taking values of FTSE[7], DataStream market[8] and DataStream sector indices[9] respectively. The choice of sector index is based on the average trading activity (based on turnover) for the sample period. We included top three active sectors along with the least traded sector. Table 2 presents average trading activity for the various sectors of KSE.

[7] *[FTSE(PI)]* and *[d(FTSE)]*.
[8] *DS(M)*
[9] *DS(OG)* for Oil and gas, *DS(B)* for Banks, *DS(T)* for Tobacco and *DS(Tel)* telecom sector.

Table 2

Average Trading Activity of KSE (1997 - 2008)

Sector	Contribution in Total Turnover
Financial Sector	34.09%
Oil and Gas	19.30%
Telecom	12.57%
Textile	11.67%
Others	22.06%
Tobacco	0.01%
Total	100%

3.3 Types and Sources of Data

The daily closing index and dividend values were extracted from Thomson Financial database. In order to observe the impact of increasing market activity from 2003 onwards and mitigate the impact of increased volatility, we will analyze two sub periods of 1997 – 2003 and 2003 – 2008. The sub sample period of 2003 – 2008 would provide robust evidence that whether hype in Pakistan financial scene from 2003 onwards was supported by the underlying dividend stream.

4. Empirical Results and Analysis

4.1 Descriptive Statistics

Table 3 represents descriptive statistics for daily returns on KSE 100, FTSE and Data Stream Indices for the full sample period of 1997 – 2008 while Table 4 and Table 5 illustrate similar data for the sub periods of 1997 – 2003 and 2004 – 2008 respectively. The high intraday volatility is evident from sizeable spread between the maximum and minimum returns and standard deviation for the study period. KSE 100 is the largest index with maximum number of stocks compared to other indices used in this research. The mean return for KSE 100 has been around 0.06% with a standard deviation of 1.8%.

In the sectoral indices a notable volatility could be observed with a maximum of 3.17% for Tobacco sector and a minimum of 2.19% for Oil and Gas. The volatility in Tobacco sector for the full sample period is apparent with a maximum intra day return of 33% and a minimum of -26%. The thin trading phenomenon for KSE is evident from the median return of zero percent for the four sectoral indices.

Table 3

Descriptive Statistics of Daily Index Returns (1997 - 2008)

Index	Mean	Median	Maximum	Minimum	Standard Deviation
KSE 100	0.06%	0.16%	12.76%	-13.21%	1.80%
FTSE Pakistan	0.02%	0.00%	18.72%	-17.93%	2.17%
DS Pakistan	0.03%	0.03%	14.26%	-14.72%	1.91%
DS Banks	0.08%	0.00%	15.35%	-12.74%	2.25%
DS Oil and Gas	0.04%	0.00%	13.61%	-21.38%	2.19%
DS Telecom	0.00%	0.00%	25.45%	-19.10%	2.67%
DS Tobacco	0.05%	0.00%	33.65%	-26.06%	3.17%

The sub sample statistics reveal interesting information about the trading patterns in KSE. The initial period of 1997 to 2003 is subject to a highly volatile market and this is obvious from the standard deviation and maximum and minimum returns for the period. The period witnessed low level of trading activity with moderate investment level and therefore non synchronous trading phenomenon is likely to be more severe for the initial period.

Table 4
Descriptive Statistics of Daily Index Returns (1997 - 2003)

Index	Mean	Median	Maximum	Minimum	Standard Deviation
KSE 100	0.07%	0.13%	12.76%	-13.21%	1.97%
FTSE Pakistan	0.01%	0.00%	18.72%	-17.93%	2.44%
DS Pakistan	0.02%	0.00%	14.26%	-14.72%	2.11%
DS Banks	0.05%	0.00%	15.35%	-12.74%	2.44%
DS Oil and Gas	0.05%	0.00%	13.61%	-21.38%	2.34%
DS Telecom	0.00%	0.00%	25.45%	-19.10%	2.67%
DS Tobacco	0.01%	0.00%	33.65%	-26.06%	3.88%

The period from 2004 to 2008 is marked with extraordinary growth and high trading frequency. The investment levels were high vis-à-vis 1997 – 2003. This is the period that is more suspected to have a speculative bubble and some market crashes were observed.

Table 5
Descriptive Statistics of Daily Index Returns (2004 - 2008)

Index	Mean	Median	Maximum	Minimum	Standard Deviation
KSE 100	0.06%	0.19%	8.25%	-6.04%	1.55%
FTSE Pakistan	0.04%	0.06%	9.13%	-7.24%	1.72%
DS Pakistan	0.04%	0.09%	8.53%	-6.65%	1.58%
DS Banks	0.11%	0.07%	8.92%	-8.47%	1.95%
DS Oil and Gas	0.03%	0.00%	9.38%	-6.30%	1.96%
DS Telecom	-0.01%	0.00%	9.53%	-11.59%	2.26%
DS Tobacco	0.11%	0.00%	7.18%	-5.33%	1.74%

The volatility as measured by the standard deviation of daily returns is on a lower side vis-à-vis 1997 – 2003, but it must be noted that during

this later period circuit breakers in KSE were functional. Moreover, frequent trading in a market always results in reporting low volatility for intraday data and an increase in trading activity is eminent from the high intraday average returns for the market and sectoral indices compared to previous period. The banking sector has a maximum average return of 0.11% along with the tobacco sector while the observed mean returns for Telecom sector were -0.01%.

4.2 Empirical Results

Table 6

Unit Root Tests

Augmented Dicky Fuller Statistics (ADF)			
Price (P)			
Index	1997 – 2008	2004 – 2008	1997 - 2003
KSE 100	-0.63698	-1.66614	2.11433
FTSE Pakistan	-0.79080	-1.55741	-0.99082
DS Pakistan	-0.81972	-1.74388	-0.20010
DS Banks	-0.69369	-1.39542	1.97132
DS Oil and Gas	-1.10167	-1.99148	0.27362
DS Telecom	-1.68531	-1.87597	-1.96427
DS Tobacco	-0.30659	-1.43650	-1.78706
Dividend (d)			
Index	1997 – 2008	2004 – 2008	1997 - 2003
KSE 100	0.39236	-0.77348	1.47976
FTSE Pakistan	-0.53792	-0.87939	-0.27023
DS Pakistan	-1.09205	-1.57318	-0.48697
DS Banks	0.67311	-0.22927	0.20105
DS Oil and Gas	-0.52416	-1.22263	0.63141

DS Telecom	-2.65471	-2.16042	-0.58881
DS Tobacco	-1.56845	-1.52659	-1.19425
LN (P)			
Index	1997 – 2008	2004 – 2008	1997 - 2003
KSE 100	-0.31316	-2.03542	0.49822
FTSE Pakistan	-0.72793	-1.63696	-1.37025
DS Pakistan	-0.61447	-1.94199	-0.85293
DS Banks	-0.02714	-2.13054	0.15463
DS Oil and Gas	-0.76824	-1.75347	-0.43554
DS Telecom	-1.65373	-1.66247	-2.14894
DS Tobacco	-0.44673	-2.25927	-1.69706

The procedure for testing of price level speculative bubbles is a two step process. In the first stage, we will use Augmented Dicky Fuller (ADF) statistics to estimate the stationarity in prices, dividends, logged prices, logged dividends, returns and logged dividend yield ratio. This will enable us to establish appropriate variables that will be used in the second step for the contigeration tests using residuals ADF statistics from cointegrating regression. The estimated ADF statistics for unit root tests are reported in Table 6.

Table reports ADF Statistics for Unit Roots. Figure in Italics indicate significance at 5%

Table 6

Unit Root Tests

Augmented Dicky Fuller Statistics (ADF)

LN (d)

Index	**1997 – 2008**	**2004 – 2008**	**1997 - 2003**
KSE 100	-0.42967	-0.79151	0.45059
FTSE Pakistan	-2.08373	-1.09183	-1.52490
DS Pakistan	-1.53125	-1.51046	-1.33181
DS Banks	-0.64050	-0.36047	-0.72785
DS Oil and Gas	-1.46891	-1.90617	-0.34840
DS Telecom	-1.80434	-0.64187	-2.14751
DS Tobacco	-1.71269	-1.92013	-1.56002

LN (R)

Index	**1997 – 2008**	**2004 - 2008**	**1997 - 2003**
KSE 100	*-34.2054*	*-22.7463*	*-25.6549*
FTSE Pakistan	*-36.6057*	*-24.2581*	*-27.6532*
DS Pakistan	*-35.9342*	*-23.3204*	*-27.3588*
DS Banks	*-35.9865*	*-22.0817*	*-28.2057*
DS Oil and Gas	*-35.0029*	*-22.9730*	*-26.4717*
DS Telecom	*-37.5385*	*-24.1101*	*-28.6869*
DS Tobacco	*-40.1737*	*-22.1080*	*-31.4345*

LN (d) - LN(P)

Index	1997 – 2008	2004 - 2008	1997 - 2003
KSE 100	-1.92824	-2.01287	-1.87065
FTSE Pakistan	*-3.11407*	-1.73221	-2.60854
DS Pakistan	-2.77476	-2.68827	-2.42986
DS Banks	-1.51284	-1.88915	-2.33606
DS Oil and Gas	*-3.40000*	-2.73589	-2.10022
DS Telecom	*-3.30402*	-2.12067	-2.65196
DS Tobacco	-1.19244	-1.67172	-1.09763

Table reports ADF Statistics for Unit Roots. Figure in Italics indicate significance at 5%

The insignificant ADF statistics could not reject the hypothesis of a unit root for all indices and establishes non stationarity for prices in level and logarithms. Similarly, dividends in level and logarithms are non stationary. These results hold for full sample as well as both sub sample periods. The ex post returns depict strong stationarity for all indices at 5% (even at 1%) from 1997 to 2008 (and for sub periods). For the period between 1997 and 2008, the dividend yield ratio demonstrated stationarity for FTSE Pakistan and two sector indices DS Oil and Gas and DS Telecom. However, we could not reject the unit root hypothesis in two sub periods for these indices. The dividend yield ratio for all other indices and for all periods remained non stationary. Given these results, a couple of preliminary observations about the cointegrating relationship can be established. The non stationarity of dividend yield ratio will possibly result in a no cointegrating relationship between logged prices and logged dividends

except for the indices that depicted some level of stationarity in dividend yield ratio. Similarly, the cointegration between returns and dividend yield ratio will be difficult to establish for indices with stationary returns but non stationary dividend ratio. Lastly, as the returns are generated from a stationary process [I(0)], the relevant cointegration relation will be between prices and dividend in level as well as logged values. However, to improve the power of results, we will also report the cointegrating relation between dividend yield and returns.

Table 7

Tests for Speculative Bubbles

Augmented Dicky Fuller Statistics (ADF) on Residuals			
Cointegration between P and d			
Index	**1997 - 2008**	**2004 - 2008**	**1997 - 2003**
KSE 100	-2.47066	-2.08998	-0.85946
FTSE Pakistan	-2.09476	-1.45995	-1.46880
DS Pakistan	*-3.22924*	-2.34680	-1.35213
DS Banks	-1.03115	-0.68682	-1.52077
DS Oil and Gas	*-3.76461*	*-3.16048*	-1.88171
DS Telecom	*-3.77756*	*-3.33286*	-1.71056
DS Tobacco	-1.84657	-1.94224	-2.33773
Cointegration between LN(P) and LN(d)			
Index	**1997 - 2008**	**2004 - 2008**	**1997 - 2003**
KSE 100	-2.13023	-2.33825	-1.32561
FTSE Pakistan	-2.45007	-1.76894	-1.52652
DS Pakistan	*-2.89922*	-2.66972	-1.25190

DS Banks	-2.31890	-1.52998	-1.24621
DS Oil and Gas	*-3.21228*	*-3.42685*	-1.75965
DS Telecom	-2.74900	*-3.20709*	-1.83857
DS Tobacco	-1.04145	-1.65923	-2.17202

Cointegration between LN(d) - LN(P) and R

Index	**1997 - 2008**	**2004 - 2008**	**1997 - 2003**
KSE 100	-1.96220	-1.98904	-1.87034
FTSE Pakistan	*-3.11323*	-1.79923	-2.61040
DS Pakistan	-2.82037	-2.69022	-2.46330
DS Banks	-1.55186	-1.93266	-2.33582
DS Oil and Gas	*-3.37557*	-2.74494	-2.03132
DS Telecom	*-3.31385*	-2.11186	-2.65927
DS Tobacco	-1.18396	-1.67237	-1.12481

Table reports ADF Statistics on residuals from Cointegrating regressions. Figure in Italics indicate significance at 5%

The results of cointegration tests are summarized in table 7. Based on the ADF statistics on residuals from cointegrating regressions, we could not establish a stable relationship between price and dividends in level as well as their lagged values on KSE 100 index. Similarly, the non stationarity of residuals could not be rejected for the dividend yield ratio and ex post index returns. These results demonstrate that the price level for KSE 100 deviated from their dividends between 1998 and 2008. Moreover, no stable relationship between price and dividends was present in either of the two sub periods. As KSE 100 is the most representative index of Karachi Stock Exchange vis-à-vis other indices used in this study, we could infer that a speculative

bubble was present and price level of the index could not be justified by the related dividends.

On the contrary, the results for DS Pakistan showed price dividend relationship both for level and logged values for the sample period. Although these results suggest a no bubble situation but the presence of unit root in sub periods overcast the validity of result. Similarly, the absence of a relationship between dividend yield and returns questions the robustness of a no bubble situation. FTSE Pakistan depicts cointegration between dividend yield and return which is not surprising considering the already observed stationarity in dividend yield ratio and returns for this index.

The sector indices disclose some interesting results. There was no relation between price and dividend of financial sector stocks. Moreover, we could not establish a contigeration relationship between dividend yield and returns. Similar results prevailed in the sub periods. The Oil and Gas index showed a cointegration relation between price level and dividends and divided yield and returns. Comparable results are reported for Telecom index that are cointegrated in level of price and dividends and dividend yield and returns. Surprisingly, for telecom index the logged price and logged dividends remained cointegrated in the turbulent period of 2004 – 2008. In Tobacco sector, the price levels were not justified by their dividend stream.

The cointegration results suggest that during the study period, Karachi Stock Exchange was subject to a speculative bubble that artificially inflated the prices to an extent that could be justified from the dividends. The financial stocks constitutes 34% of the trading activity therefore it is likely that much of the speculative factor came from the financial sector stocks where the prices showed a complete departure from a dividend base fair value. The price level of Oil and Gas and Telecom stocks mostly remained in line with their dividend base while index level of Tobacco sector remained discontinued from relevant dividends.

These results are substantial evidence of speculative bubbles in Karachi Stock Exchange for our sample period. In presence of speculative components, financial markets are subject to volatility with persistent shocks. The aggressive investors, who get high returns during bull rally with no downside, are likely to continue with their aggressive behaviour. This aggression normally results in portfolio holdings that become more volatile when market volatility reverts to normal levels and are likely to fuel panic in declining markets. Since these volatility shocks are common in speculative markets, we will analyze their persistence as robustness check for our results.

The analysis for volatility dynamics is based on framework of Engle (1982) who proposed the notion of volatility clustering in financial returns. If there is volatility clustering, large (small) changes in returns are likely to be followed by subsequent large (small) changes, producing shocks that could substantially change the variance of stock markets. As mentioned earlier such shocks are present in markets with speculative components and can be modeled as a GARCH process. A GARCH (1, 1) model can be specified with mean and variance equations as under.

$$R_t = c + \varepsilon_t$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \quad (5)$$

Where R_t represent index returns and σ_t^2 is the conditional variance of these returns dependent on a constant term ω, innovation in volatility from the previous period ε_{t-1}^2 (ARCH term) and last period variance σ_{t-1}^2 (GARCH term). The significance of coefficients (α, β) will establish the presence of volatility shocks and if α + β is close to one, this will indicate the persistence of such shocks. Table 8 reports the results for variance specific equation for returns on all indices for the sample period (1997 – 2008).

Table 8

Tests for Volatility Shocks
Estimates of Variance Equation GARCH (1,1)

Index	A	β	α + β	Standard Error		Z Statistics	
				α	β	α	β
KSE 100	0.1770	0.7890	0.9660	0.0100	0.0070	17.5070	103.5630
FTSE	0.1539	0.8300	0.9839	0.0079	0.0063	19.4394	132.6660
DS Pakistan	0.1399	0.8377	0.9776	0.0076	0.0067	18.3638	125.8498
DS Banks	0.1351	0.8102	0.9454	0.0091	0.0097	14.9046	83.7783
DS Oil and Gas	0.1584	0.8223	0.9807	0.0085	0.0075	18.6926	110.3055
DS Telecom	0.0806	0.9057	0.9862	0.0038	0.0039	21.2302	234.5511
DS Tobacco	0.0076	0.9917	0.9994	0.0002	0.0001	47.4909	7056.955

The coefficients for various indices are highly significant depicting the presence of volatility clustering in Karachi Stock Exchange. Moreover, the estimated values for α + β for these indices is very close to one indicating the strong persistence of volatility shocks. These findings on persistent volatility shocks complement our earlier results and suggest the possibility of a speculative component in KSE that could have contributed towards the presence of significant ARCH effects during the sample period.

5. Conclusion

Financial academicians have long argued that stock price movements could involve speculative bubbles as speculation is often ascertained to be the prime reason for overpriced markets, financial panics and market crashes. The presence and detection of such bubbles is inherently an empirical issue that has remained a challenge for financial community atleast for two reasons. Firstly, all such bubbles could only be detected ex post and cannot be predicted with ex ante

estimations. Secondly, all empirical techniques for bubble hypothesis rely on a fair value (or fair price level) that, itself, is a controversial issue in empirical finance. This paper is an effort to explore the possibility of price level speculative bubbles in Karachi Stock Exchange that has experienced tremendous growth in last decade (notably the later half) both in prices and volumes.

The analysis was based on examining the long term stable relationship between price level and dividends of KSE using a unit root and cointegrating approach. We have used price series and dividends of KSE 100 index as the representative index of the market. In order to analyse a broader version, we further incorporated DataStream Pakistan and FTSE Pakistan Index. Lastly, DataStream sector indices of Financial Sector, Oil and Gas, Telecom and Tobacco were included to examine if the price movements in these sectors were justified by the underlying dividends. The sample period of 1997 to 2008 was divided into two sub periods of 1997 to 2003 and 2004 to 2008. The results from Augmented Dicky Fuller statistics revealed that prices and dividends emanated from a non stationary process while returns exhibited stationarity.

The stationarity in return series validate the use of cointegration between price and dividend (level and Logs) as appropriate variables. However, to increase the significance of results we also examined the relationship between dividend yield ratio and returns. Based on ADF statistics on cointegrating regression residuals, we could not reject no bubble hypothesis for Karachi Stock Exchange. The sector analysis reveal that financial stocks could have contributed towards the speculative activity in the market while prices in Oil and Gas sector did not deviated from their dividends. Lastly, the variance specific GARCH test indicates the presence of persistent volatility shocks that could be the consequence of a speculative component in KSE.

These results have implications for investors and policy makers. The presence of bubble could benefit investors by making abnormal

profits as long as they are *greater fools*. However, the probability of becoming a *greatest fool* is always high since financial panics and crashes are inevitable in presence of speculative bubbles. This has been experienced in almost all markets that were subject to speculation including Karachi Stock Exchange. The losses to *greatest fools* are always substantial that result in significant erosion of wealth. The identification of speculative bubble can act as an overvaluation signal for investors who can rationally revisit their risk return preferences offloading overvalued stocks. The rational selling of such overvalued stocks will ultimately correct the price towards its fair value.

Moreover, the presence of a speculative bubble indicates imperfections in financial markets. Such asset price bubbles and resulting crashes could weaken the balance sheets of the firms. The overvalued assets from a speculative bubble have more severe balance sheet implications for financial sector. Most of the assets (mainly stocks and marketable securities that contribute approximately 25% towards total assets) are marked to market and a post bubble steep correction in prices could deflate the asset base eroding the risk absorption capacity and triggering instability in financial sector. Therefore, in such cases policy makers should intervene to remove market imperfections through market reforms and efficient controls.

At the end a couple of points need to be emphasized. The results reported here reject a no bubble hypothesis for Karachi stock exchange based on selected indices and price dividend cointegrating relationship. These results should not be confused with the presence of excess volatility in KSE during the sample period. Furthermore, our tests assumed a widely accepted dividend based valuation. However, if such valuation model is not appropriate for KSE, our results can be discarded in favor of a better predictor of stock prices. Lastly, we could not reject a no bubble hypothesis providing evidence in favor of speculative bubbles, but reader need to be cautioned that such

evidences are dependent on the statistical tests and can be assumed credible as long as a type I error is not committed.

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