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Speculative Bubbles in Karachi Stock Exchange

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Preface

Centre for Research in Economics and Business (CREB) was established in 2007 to conduct policy-oriented research with a rigorous academic perspective on key development issues facing Pakistan. In addition the Centre (i) facilitates and coordinates research by the faculty at the Lahore School of Economics, (ii) hosts visiting international scholars undertaking research on Pakistan and (iii) administers the postgraduate programme leading to the M Phil and PhD Degree at the Lahore School.

An important goal of the Centre is to promote public debate on policy issues through conferences, seminars and publications. In this connection, the Centre organizes the Lahore School's Annual Conference on the Management of the Pakistan Economy. The proceedings of which are published in a special issue of the Lahore Journal of Economics.

The CREB Working Paper Series has been started to bring to a wider audience, the research being done at the Centre. It is hoped that these Papers will promote discussion on the subject and contribute to a better understanding of economic and business processes and development issues in Pakistan. Any comments and feedback on these Papers will be appreciated.

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Abstract

The fair price of a stock represents discounted claims on the future profitability of a firm. If markets are perfect, prevailing price level should exhibit a stable relationship with these claims. Dividends are a medium to share firm's profits with shareholders and consequently they form an integral input for most of the valuation models. Such valuation models warrant a long run relation between stock prices and dividends and a divergence of prices from related dividends is a possible indication of a speculative bubble. Karachi Stock Exchange has witnessed a tremendous growth during last decade. This paper analyzes the presence of a speculative component in the extra ordinary upsurge in the leading stock exchange of Pakistan. We implement cointegration tests, between 1997 and 2008, on price and dividends of various market level indices including KSE 100, FTSE Pakistan, DataStream Pakistan and sector indices of DataStream Bank, DataStream Oil and Gas, DataStream Telecom and DataStream Tobacco. Based on the results from unit root and cointegration, we could not reject a *no bubble* hypothesis for the sample period for the market level index. In 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.

JEL Classification: G01, G10, G12

Keywords: Karachi Stock Exchange, Speculative Bubbles, Cointegration, Unit Root, Dividend Yield.

Speculative Bubbles in Karachi Stock Exchange

1. Introduction

One of the cornerstones in theory of modern finance is the efficient market hypothesis (EMH). The term market efficiency has been interpreted differently by financial economists. Some refer market efficiency as a synonym to operating efficiency vis-à-vis focus on resources to facilitate market operations, while many advocate the notion of informational efficiency. An *informational efficient market* is one where stock prices, at any time, fully reflect available information thus making it impossible for an investor to consistently achieve abnormal profits[1] regardless of any investment strategy. Therefore, proponents of market efficiency believe that under a *fair game* setting, stock prices exhibit a random walk.

The pioneer work in stock market efficiency leads back to the findings of Working (1934) and Cowles and Jones (1937) who demonstrated that US stock prices and some other economic series fluctuate randomly. Similarly, Cowles (1944) could not find a single investment strategy that could have outperformed the market. More substantial evidence was provided by Fama (1965) replicating the *optimal procedure to find a drunk* of Pearson (1905)[2] to stock prices. Fama posits that price formation is a random process with independent and identically distributed price relatives[3] driven by available set of information. Therefore, in sufficiently active markets with large number of informed participants, stocks would be fairly priced. Consequently, the logical issue is to determine a fair price[4] given a particular state of information that eliminates the probability of consistent abnormal returns.

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[1] Abnormal profits or abnormal gains are realized returns in excess of equilibrium (theoretical) returns.

[2] Pearson (1905) hypothesized that a drunk left in the middle of a field is likely to move in a totally unpredictable and random fashion and is expected to end up closer to his initial position than to any other point.

[3] If $S_O, S_1, S_2, ..., S_N$ are successive prices for N periods, the corresponding price relatives (P_R) can be represented as $P_{R1} = S_1/S_O, P_{R2} = S_2/S_1, ..., P_{RN} = S_N/S_{N-1}$

[4] Fair Value and Intrinsic Value are alternate terms used for Fair Price in financial literature and investment research.

The fair value of a stock is a rational estimate of the expected market price based on investment utility and risk factors. Although, EMH is somewhat controversial in financial community, academic researchers and practitioners have a general consensus about the existence of a fair value that is considered as a vital determinant of investment decisions by Fund managers and financial analysts. Since, investing in an asset assigns the claims on related future earnings to the investor, fair value of a stock should be a function of future prospects of a firm. 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 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[5].

The proponents of dividends, as an appropriate measure of valuation, have intuitively simple logic. They argue that dividends (stock and cash) are meant to share profits with the equity investors and therefore can be viewed as return to shareholders. If investors have rational expectations the fundamental value of stock should be related to the expected dividend stream. Williams (1938) provides the basis for this notion. He suggested that *"a stock is worth the present value of all the dividends ever to be paid upon it, no more, no less. Present earnings, outlook, financial condition, and capitalization should bear upon the price of a stock only as they assist buyers and sellers in estimating future dividends"*. Primarily, this is why dividends are assumed to be sticky and less volatile than earnings and therefore a dividend cut is interpreted as a negative signal by the stock market[6].

Assuming a dividend based valuation model, the expected stock price (P_t) is present (discounted) value of future dividends. Mathematically, this could be written as $P_t = \sum_{\tau=1}^{\infty} \frac{E(\tilde{d}_{t+\tau} | \Phi_t)}{(1+r)^{\tau}}$

where d_t is dividends at time t, Φ_t is set of available information and $(1+r)$ is the present value factor. If the information set Φ_t reveals perfect information about expected dividends, the realized dividends (ex post)

[5] 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).

[6] Lintner (1956), Charest (1978), Aharony and Swary (1980), Smith (1986)

at time *t* should equate expected dividends conditional on Φ_t. Thus, under rational expectations we will have $d_t = E(\tilde{d}_t | \Phi_t)$, consequently, the fair value (P_t^*) of the stock is represented as $P_t^* = \sum_{\tau=1}^{\infty} \frac{d_{t+\tau}}{(1+r)^{\tau}}$.

Therefore, given the information set Φ_t, in an informational efficient market with rational investors, the actual price (P_t) and fair value (P_t^*) should be in equilibrium with $P_t = E(P_t^* | \Phi_t)$. The relation, alternatively, could be expressed as $P_t = P_t^* + \varepsilon_t$, where ε_t is the error term with zero mean and constant variance. This holds that stock price (P_t) is sensitive to the intrinsic value (P_t^*) and any change in Φ_t will be result in an adjustment to fundamental value P_t^* and actual price P_t.

If markets depict rational expectations of investors, the stock prices should correlate (to some extent) with the fair value. However, there are instances when the prevailing price level is too high to be justified by underlying fundamentals and available public information. Financial economists have termed such phenomenon as the existence 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 behavioral* of overly bullish investors. A relatively interesting rationale of *greater fool theory* for the presence of speculative bubbles has been used in behavioral finance. According to this proposition the bubble process is warranted by the behavior 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 any participant offering a higher price to buy thus triggering panic sale. Similarly, herd behavior of investors to transact stocks in direction of market trend (bullish or bearish), is also attributed as possible reason for a financial bubble.

1.1 Research Rationale and Objectives

There are various explanations for the existence of bubbles in financial markets. However, the impact of these bubbles has always been negative for markets in particular and economy in general. A speculative bubble driven by rumors and not supported by fundamentals will result in misallocation of resources into non optimal uses. Moreover, when the *greater fools* become the *greatest fools* a crash follows causing economic turbulence and eroding substantial wealth.

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 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. Most of the emerging markets have significant foreign portfolio investment and with increasing global monetary integration, more investors from developed markets are likely to continue with international diversification by tapping opportunities in emerging markets. The substantial portfolio investment is expected in a market that is driven by fundamentals rather than speculative rumors. Therefore, for investment decisions it is crucial to identify whether the price level in a market is integrated with underlying fundamentals or it merely reflects an effort by *fools* hoping to get some *greater fools*.

There are three stock exchanges in Pakistan with Karachi Stock Exchange (KSE) being the biggest stock market in terms of market capitalization and stock turnover. There are 653 listed companies[7] with a market capitalization of approximately USD 46 billion[8]. The second largest stock market is Lahore Stock Exchange (LSE) with approximately 519 listings and market capitalization of USD 9 billion[9]. The third stock market is Islamabad Stock Exchange (ISE) with 248 listed companies and a market capitalization of approximately USD 5 billion[10]. Table 1 presents inter market correlations among the three stock exchanges in

[7] Market reforms and active monitoring by regulatory authorities resulted in delisting and mergers of many firms during 2001 – 2008.
[8] Source: KSE Website (As of July 31, 2008)
[9] Source: LSE Website
[10] Source: ISE Website

Pakistan. The higher correlations with other two markets in terms of market index, turnover and trading value clearly depicts KSE as benchmark stock exchange and trading patterns in KSE are expected to drive the investment process in LSE and ISE.

Table 1: Correlation Matrix (July 2007 - June 2008)

	Index		Turnover		Trading Value	
	LSE	**ISE**	**LSE**	**ISE**	**LSE**	**ISE**
KSE	53.60%	84.59%	72.05%	60.38%	70.41%	63.57%

The performance of KSE can also be gauged by the recommendation of "*Business Week*" that has listed KSE consecutively for four years among the best performing stock markets of the world. Table 2 presents an overview of the Karachi Stock Exchange since its inception.

Table 2: Decade Wise Performance of KSE

Year	No of Listed Companies	Listed Capital (PKR in Million)	Market Cap (PKR in Million)
1950	15	117	-
1960	81	1007	1871
1970	291	3864	5658
1980	314	7630	9767
1990	487	28056	61750
2000	762	236458	382730

Source: KSE Website

The stock markets in Pakistan have witnessed an upsurge in the last five years[11]. Some analysts attribute this substantial growth to improvement in economic variables. If the price levels are justified by the underlying fundamentals, we can safely assume a fair game in KSE. However, several analysts 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.

[11] KSE Index level in Jan 2003 was 2600 points that increased by six times to over 15000 points by April 2008.

The purpose of this research is to examine the anatomy of price behavior in KSE using various time spans. The bubbles are crucial since they could possibly influence the investment behavior of local as well as international participants. 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. Therefore, in an emerging market, like Pakistan, studying price patterns and observing the extent of their relationship with market fundamentals provides valuable insight for policy making and investment decisions. The outcome of the research could help us identify that whether during different time intervals our markets were trading at justified price levels or they were merely driven by *fools'* instincts.

However, it must be admitted that our acceptance or rejection of bubble hypothesis will be based on cointegration of dividend and market price level and the presence or absence of a speculative bubble will be vis-à-vis dividend based valuation methods. The rest of the paper is organized as follows. Section II will review the theoretical and empirical aspects of the subject. Section III will discuss data and methodology employed for the research. The results will be discussed in Section IV while Section V will conclude.

2. Literature Review

The existence of a financial bubble remained a puzzle for practitioners and academicians. The bubble favoring arguments suggest that a bubble will exist when the stock price is at variance to the fair value[12]. Few deny economic bubbles by questioning the validity of an intrinsic value given the qualitative aspects of valuations. They argue that it is difficult to observe the true intrinsic value and therefore, presence of a bubble cannot be established. The controversy of financial bubbles is further aggravated by the fact that bubbles can be identified ex post after a sudden drop in price level termed as a *crash* or *bubble burst*. Some of the famous bubbles include historic panics of *Tulip Mania (1634 – 1638), Mississippi bubble (1719 – 1720), South Sea bubble (1720), Bull*

[12] King, R. et al (1993)

Markets of US in Twenties (1924 – 1929) and recent crashes from *Asian Financial Crisis (1997)* and *Dot Com Bubble (1995 – 2001)*.

The discussion so far suggests that bubbles are mostly a consequence of irrational speculative behavior of market participants. However, some empirical evidences suggest that bubbles are rational and contagious and could appear without speculation and uncertainty. The bubbles have remained robust in experimental markets with no uncertainty and symmetric information. Smith et al. (1988) used an experimental asset market to examine the phenomenon of bubbles and crashes. The hypothetical investors were given similar dividends from a known probability distribution. The results revealed that even with rational knowledge of future dividends the price bubbles, relative to intrinsic value based on future dividends, emerged that were followed by crashes. They further observed that with repeated experiments the investors became experienced that reduced the number of crashes but the probability of a bubble was not completely eliminated[13].

Despite of a continuous debate on the causes of financial bubbles, a general consensus exists about the definition of a bubble. As discussed earlier, a bubble is formed when asset prices deviate from the fundamental fair value. Therefore, the tests for bubbles are mainly an observation of the deviation of prices from their equilibrium level. The following section presents an overview of most commonly used tests for speculative bubbles.

2.1 Tests for Speculative Bubbles

There are various statistical techniques that have been proposed to test for possible speculative bubbles. These techniques could be classified into three main categories discussed below.

a) Tests for Bubble Premiums

The expected stock return for an investor comprised of a risk free rate, a risk premium and a stochastic error term. The notion of bubble premium suggests that a bubble premium is the excess return over and above equilibrium return that investors would require in presence of a speculative bubble. The premium follows a bubble path depicting a

[13] For more on rational and contagious stock bubbles please see Lei et al. (2001) and Topol (1991).

geometric growth and is vulnerable to explosive nature of the speculative bubble. The proponents of bubble premium propose that presence of successive positive and increasing excess returns indicates the presence of a bubble premium from a speculative bubble process. Two notable studies using bubble premium approach are Hardouvelis (1988) and Rappoport and White (1993).

Hardouvelis (1988) examined the possibility of bubble premium in NYSE, London and Tokyo stock exchange from 1977 to 1987. In the first instance a model was used to predict the actual excess returns. The model incorporated variables for market and corporate risk. Moreover, the market level dividends and debt policy were considered. Lastly, a time factor was used to observe the impact of time varying risk factors. The parameter stability test indicated a breakpoint in the post 1985 data while the model's prediction power was adequate for the 1977 to 1985 period. Hardouvellis (1988) suggested that the breakpoint indicates a bubble possibility from 1985 to 1987. Assuming pre 1985 period as bubble free, the bubble premium was estimated as the difference between the excess returns of post 1985 and pre 1985 period. The estimated bubble premium was positive and increasing for the 18 month period prior to October 1987 crash. He concluded that presence of a bubble premium established the presence of a speculative bubble that could have contributed towards the crash of 1987.

Rappoport and White (1993) used an indirect method to observe a bubble premium by deploying the interest rates of brokers' loans before the crash of 1929. They compared the interest rate on broker loans and interbank interest rates and observed that premium on broker loan, vis-à-vis interbank market, demonstrated a sizeable increase from 1928 to 1929. They concluded that an increasing premium was a clear indication that brokers perceived an increased market risk due to the presence of a speculative bubble.

The tests for bubble premiums have been criticized on the simplified underlying assumptions. The critics comment that the presence of bubble premium could be a consequence of misspecification or some exogenous factors. The assumption of bubble free period (1977 to 1985) by Hardouvellis (1988) to estimate a bubble premium was dubious with no empirical support. Similarly, the calculation of premium by subtracting the excess returns of post 1985 period from pre 1985 period assumes constant slope parameters of the model, for the two periods,

which was not empirically established. Liu et al (1995) investigated the claim of Rappoport and White (1993) and reported that a similar interest premium was present in 1919 - 1920. Therefore, if Rappoport and White (1993) were correct, a bubble could have exploded in post 1920 period but there was no crash. They concluded that increase in interest rates in that era was a consequence of tight monetary policy by the Federal Reserve and rejected the possibility of speculative bubble based on bubble premium.

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 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.

b) Tests for Excess Volatility

The second category of bubble detection involves examination of excess volatility of stock market prices. The tests for excess volatility compare the variance of actual and fundamental prices. The fundamental prices are estimated by ex post analysis based on dividends and other variables that investors perceive as important components of valuation. Since, this method employs a fundamental price the discount rate becomes a critical factor. The excess volatility approach assumes that the presence of a speculative bubble will result in a higher volatility for observed stock price vis-à-vis a fundamental price.

Shiller (1981) applied the concept of excess volatility by comparing the variance of actual and fundamental prices of S&P from 1971 to 1979. The fundamental prices were computed from real dividends assuming a

constant discount rate and terminal value with perfect information. The variance bound tests were applied with the hypothesis that in absence of a speculative bubble, the variance of actual prices will be lower than the variance of fundamental prices. The results rejected the no bubble hypothesis and revealed that variance of actual prices was significantly higher indicating the presence of a bubble.

However, the variance bound methodology is subject to limitations. Marsh and Merton (1986) studied the process of dividend valuation and reported that the fundamental price computed through dividend discount model under inappropriate assumption of terminal value could lead to biased conclusions about bubble presence. They argued that this limitation is likely to bias the results more seriously when dividends are generated from a non stationary process. Lastly, they criticized the use of constant discount rate as a constant discount factor unrealistically assumes that investors risk preferences remained constant throughout the valuation periods. They concluded that under these limitations the volatility tests are biased towards rejecting the no bubble hypothesis.

Kleidon (1986) addressed the issue of excess volatility and demonstrated that excess volatility is not solely caused by the presence of a bubble. He argued that it could be investors' irrationality or more generally a model misspecification that could result in reporting excess variance for actual prices. He pointed that the fundamental prices estimated from ex post dividend data are questionable as investors' ex ante forecasts are made under uncertainty while ex post forecast for variance bound tests uses realized and observed data.

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[14] 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

[14] Autoregressive Moving Average

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[15].

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 Hamilton (1989) 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[16] 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.

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 methodology of Hamilton (1989) 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 behavior with the caveat that misspecified fundamental value could have biased the results.

c) Tests for Non Stationarity and Cointegration

A more acceptable technique for detecting speculative bubble is to observe the non stationarity and cointegration of price level and dividends. Similar, to excess volatility tests, the rational lies in dividends, however, these tests do not require the estimation of a fundamental value using some terminal value and discount rate. These

[15] 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.
[16] Autoregressive Conditional Heteroscedasticity

tests for stock price level bubbles assume that no bubble situation will prevail if the dividends and price levels are cointegrated.

Campbell and Shiller (1987) used cointegration model to analyze the present value model of stock prices. They analyzed the prices and dividends of S&P[17] 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.

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.

A comprehensive framework to test for price level speculative bubbles was suggested by Campbell et al. (1997). To develop their *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 conditional expectation $E_t(.)$ on both sides we get the following price dividend relationship

[17] Standard and Poor's

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

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

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

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

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

The above equation 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 above equation Campbell et al. (1997, pp. 261 – 262) derive the following relationship for empirical analysis.

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

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.

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

The above equation implies that if the returns are non stationary, the price level speculative bubbles will be absent if *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 stock level approach could be replicated for the whole stock market by using price level, dividends and returns of market indices.

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 crashes 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.

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.

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 behavior 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.

The cointegration based tests are also subject to limitations of model misspecification but they have performed better to identify the presence of a long term relation between stock prices and fundamental variables. Moreover, these tests are sensitive to thinly traded small markets[18] and have demonstrated better results in markets with small capitalization and low trading activity.

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 continued till March 2008. The five year bull rally 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 nonexistent 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 phenomenon to overcome a crisis situation. However, it could not improve the situation and market experience 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 3 clearly depicts the progression in KSE 100 index over the years.

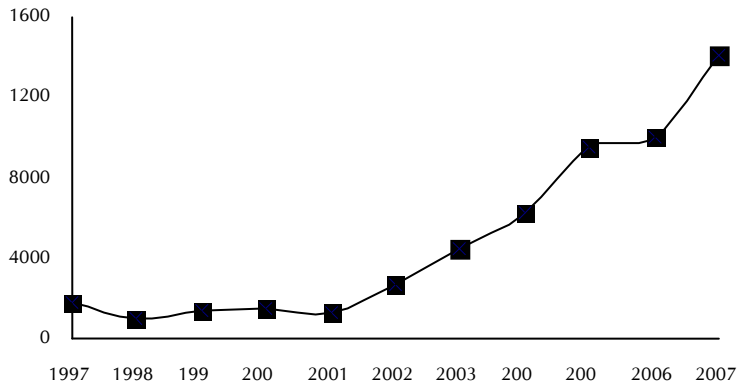
[18] Craine (1993), Donaldson and Kamstra (1996)

Table 3: Year wise KSE 100 Index Performance

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)

Figure 1: KSE 100 Index



The research period to examine the cointegration of dividends and stock prices will be from January 1997 to August 2008. It is possible that in a relatively large period, the presence of small speculative bubbles is mitigated; therefore, we will distribute time period into two sub periods. This would include sub sample period of 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. The secondary data from KSE, FTSE and DataStream indices will be used for

this study. The daily closing index values and dividend values will be extracted from Thomson Financial database.

3.1 Model Specification

As discussed earlier, Campbell et al. (1997) derived a framework for the speculative bubble hypothesis. They suggested that if returns follow a I(0) process then price dividend relationship could be modeled as

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

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

Thus, if returns are stationary, then *Ln(d)-Ln(P)* will be stationary [I(0)] and no bubble situation will prevail if Ln(d) and Ln(P) are cointegrated following I(1) process. If returns are not stationary with I(1) or higher order, then above equation could be modified as follows.

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

The no bubble hypothesis will prevail, if *Ln(d) – Ln(P)* is cointegrated with *Ln(R)*. The rationale behind above equations is simple. Campbell et al (1997) noted that since these equations are derived from an identity using transversality conditions and expected values, then 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 *Ln(d) – Ln(P)* and absence of a stable relationship will reject the no bubble hypothesis.

3.2 Estimation of Variables

As already mentioned, the market level dividend based speculative bubble hypothesis can be examined by testing the unit root and

cointegration relationship between market index and related dividends. The benchmark index for Karachi Stock Exchange is KSE 100 that was introduced in November 1999 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

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

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[19] 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. Another widely used international index series covering KSE stocks are DataStream indices (DS) including market level DS(Market) and sectoral indices of DS(Oil and gas)[20], DS(Banks)[21], DS(Tobacco) and DS(Telecom)[22]. The various index variables used for unit root and cointegration tests will take the form

$$R_{Xt} = Ln\left[\frac{Index(X)_t}{Index(X)_{t-1}}\right] \text{ and } Ln[d_{(X)t}] - Ln[Index_{(X)t}]$$

[19] Financial Times Stock Exchange
[20] Includes refineries, oil and gas exploration and marketing companies
[21] Commercial banks, investment banks, leasing companies, insurance, modarabas, brokerage firms and mutual funds.
[22] Sector comprises of technology and communication firms.

with *X* taking values of FTSE[23], DataStream market[24] and DataStream sector indices[25] 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. The following table presents average trading activity for the various sectors of KSE.

Table 4: 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%**

4. Empirical Results and Analysis

4.1 Descriptive Statistics

Table 5 represents descriptive statistics for daily returns on KSE 100, FTSE and Data Stream Indices for the full sample period of 1997 – 2008 while Table 6 and Table 7 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.

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

Table 5: 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 6: 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 7: 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%. Figure 2 present the graphical trend of KSE 100 Index and related dividend for the sample and sub sample period while Figure 3 plots other indices used in this study. The KSE 100 index depicts a modest growth till 2004 with similar trend for the underlying dividends. However, the later half is clearly marked with extraordinary increase in price levels while dividends continued to increase moderately. Similar trend can be observed in FTSE Pakistan and DS Pakistan index. Among sector indices, abnormal growth can be observed in financial stocks in post 2005 period. However, a possible mean reversion can be seen in 2008 indicating the possibility of a speculative factor in financial sector stocks. The remaining three sector indices were subject to constant growth in price level with Oil and Gas index demonstrating slight turbulence in post 2005 period.

Figure 2: KSE 100 Index and Dividends (1997 – 2008)

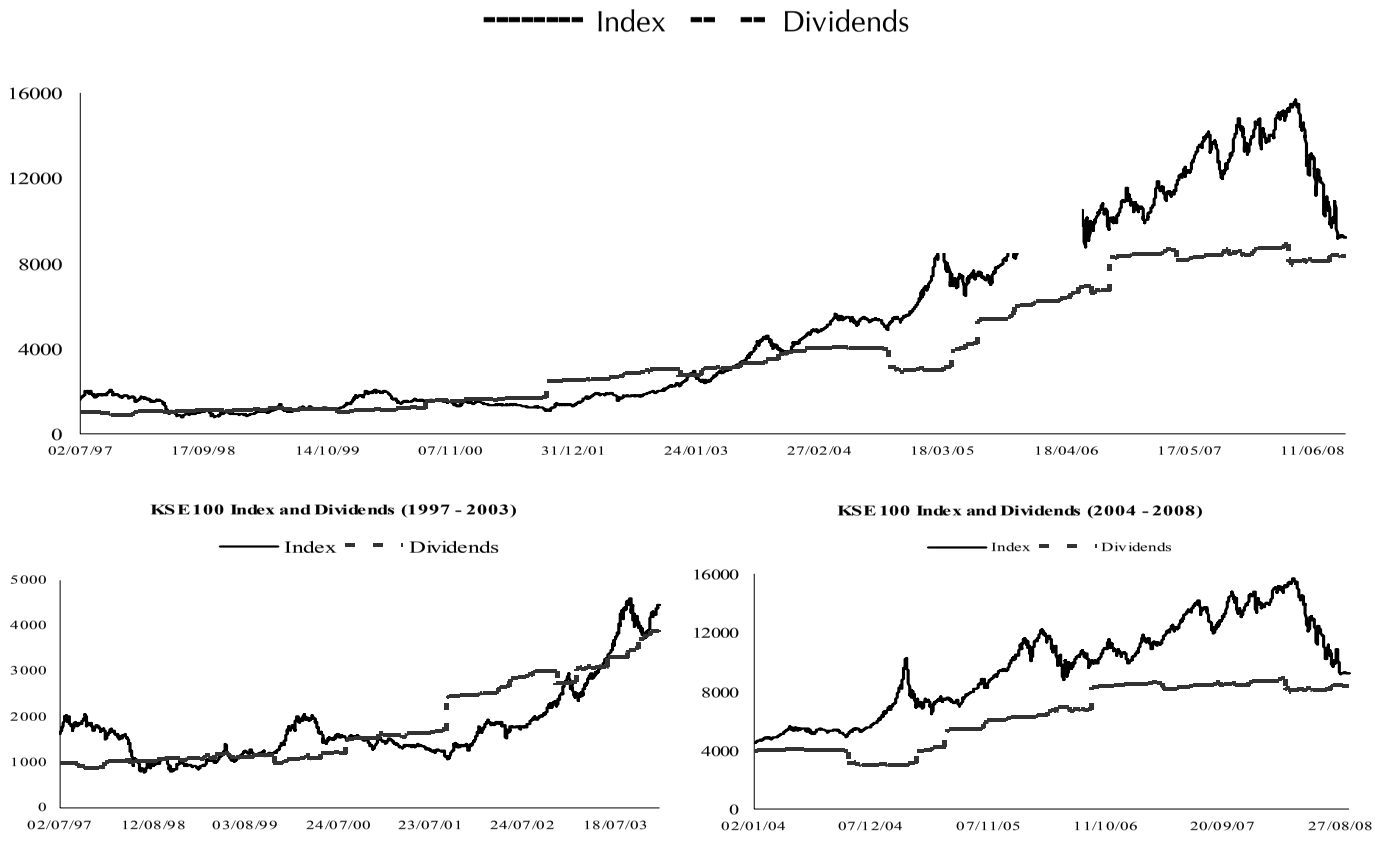
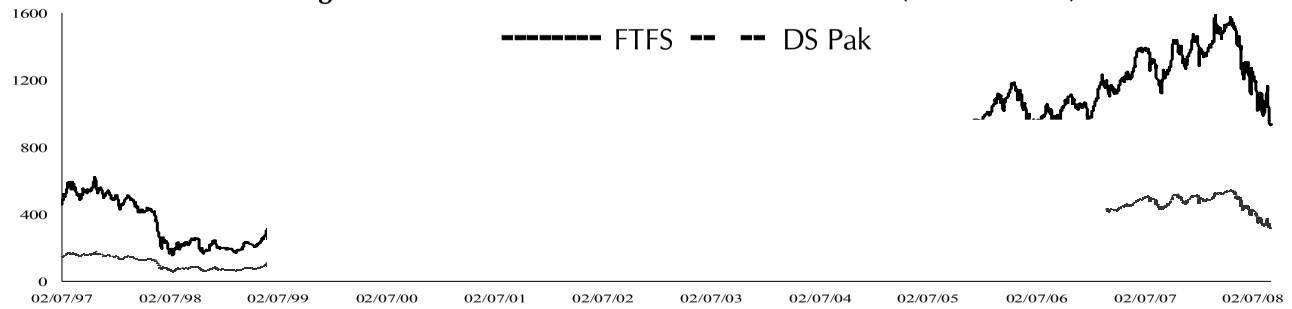
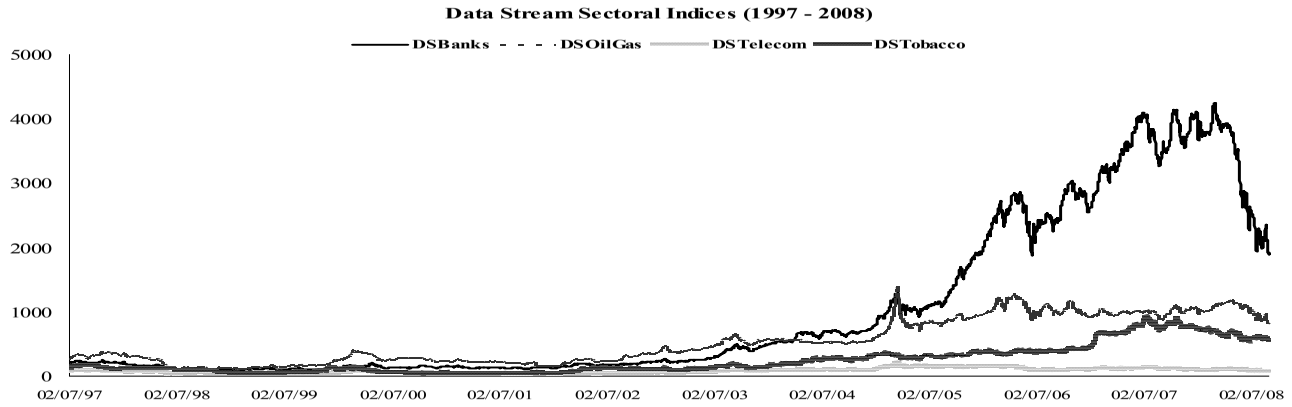


Figure 3: FTFS and Data Stream Pakistan Index (1997 – 2008)





4.2 Empirical Results

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 [*LN(d) – LN(P)*]. This will enable us to establish appropriate variables that will be used in the second step for the cointegration tests using residuals ADF statistics from cointegrating regression. The estimated ADF statistics for unit root tests are reported in Table 8.

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.

The unit root results for our indices of Karachi Stock Exchange in sample and sub periods have practical implications beyond the presence of speculative bubbles. Most of the asset pricing and valuation models use the framework of Ordinary Least Squares (OLS) for estimation of expected returns or fair value. An important input to almost all of these models is the use of return on stock market indices as a proxy of market

return. If the returns are non stationary with a unit root, the use of OLS can produce invalid estimates. The variance and mean of such time series are not independent of time factor and coefficients from regressions could be "spurious" with high R^2 and significant t values depicting no economic rationale[26]. The returns on all our indices between 1997 and 2008 (and for sub periods) were stationary at 1% and are free from biases resulting from unit root. Therefore, the returns on all these indices could be used under OLS framework for asset pricing and valuation purposes. However, the price level and dividends on these indices are subject to unit root and need to be corrected before used as input for empirical or applied analysis.

[26] Granger and Newbold (1974)

Table 8 (a): 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

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

Table 8 (b): 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 results of cointegration tests are summarized in table 9. 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 value 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 price level 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.

Table 9: 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%

These results are substantial evidence of speculative bubbles in Karachi Stock Exchange during 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 behavior. 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 ARCH/GARCH[27] 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.

$$R_t = c + \varepsilon_t$$
$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$$

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 10 reports the results for variance specific equation for returns on all indices for the sample period (1997 – 2008).

[27] GARCH (Generalised Autoregressive Conditional Heteroscedasticity) is a restricted infinite order ARCH model

Table 10: Tests for Volatility Shocks

Estimates of Variance Equation GARCH (1,1)

Index	α	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 $\alpha + \beta$ 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 improve the significance of results 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 deviate 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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