Mean Reverting Phenomenon on Karachi Stock Market

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Abstract

The study examines the relationship between stock price and earnings-per-share for firms listed on the Karachi Stock Market (KSE) of Pakistan. The paper explores the phenomena of mean reversion which refers that the stock prices tend to move towards their average price over time. The stimulus for studying the phenomenon is the fact that less work has been conducted in emerging markets such as Pakistan. The data has been extracted from Karachi stock exchange and method used to find out relationship is random effect regression while using panel data. The results indicate that there is positive and significant relationship between the stock prices and earnings-per-share (EPS) which refers to the existence of mean reversion process. In addition, stock prices look to change with firm fundamentals, in the long-run and on average, but not essentially at the similar proportion and this relationship can help an investor to predict the stock prices with the help of earning per share.

Keywords: Mean Reversion, Earnings Per Share, Karachi Stock Market, Pakistan

Introduction

The behavior of stock price is one of the most widely investigated topics in the field of finance. Many researches have been conducted on stock prices and their relationship with other fundamentals for many years. Academics have expressed several philosophies and empirical justifications as to how and why a firm's fundamental affect the stock prices. Several of these researches have been carried out in developed stock markets including the US, the UK and many others (Hsu-Ling Chang et al., 2008). Different Proxies are used as a firm's fundamental values in earlier researches which consist of earnings, dividends, earnings-per-share (EPS), and net asset values (NAV); here in this research earning per share (EPS) is used to find the relationship between stock prices and firm's fundamentals.

Stock prices may follow random walk (Fama, 1965) but if the stock prices do not follow random walk then one possibility is that it follows mean reversion process (Hsu-Ling Chang et al., 2008). Mean reversion is a process in which the stock prices tend to move towards their average price over time. It is a force which pushes prices back to definite average level after ups and downs in it. So if there is mean reversion in stock prices in long run then with the movement of firm's fundamentals values one can predict the movements in stock price. Therefore, for investor point of view it may be beneficial to find out that stock price are mean reverting or not; if their exist relationship then it can be

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concluded that stock prices followed mean-reversion process and hence investor can predict the value of stock price from firm's fundamentals.

There are many reasons to explore relationship between stock prices and the EPS in Pakistan. The literature review shows that the relationship between stock price and firm fundamentals have been broadly investigated in stock markets of developed countries (Hsu-Ling Chang et al., 2008). However, there was less significant work carry out in emerging markets such as Pakistan. Hence, it was felt that investigating the relationship between stock price and firms fundamentals in firms listed on the KSE would make a significant contribution to literature.

In this research the main objective is to find the relationship between stock prices and earning per share. Furthermore, it investigates the presence of any information content in earning per share on the bases of which an investor can forecast the stock prices. In order to accomplish the objective, quantitative approach is adopted while using the regression (random effect) method. Data is taken on the basis of availability of data from the KSE website Pakistan.[i]

The structure of this study is organized as follow. First section is about introduction and importance of the study, it signifies the motivation and purpose of the study. Section two includes the literature review and section three explains the data and methodology of the study including types, sector and sample of the data and methods. Section four presents the empirical findings and results of all tests conducted in this research and section five concludes this research.

Literature Review

Literature Review of this study is whether stock prices follow mean reversion process or not and the response of EPS to stock prices. In mean reversion process both high and low prices of stocks are temporary and after some time, prices of the stocks will be likely to move to the average price over time.

In earlier studies, there is strong indication that stock prices in numerous stock markets followed the process of mean reversion. For example Hsu-Ling Chang et al. (2008) urged that stock markets of countries such as Spain, U.S, and Singapore followed mean reversion process. Furthermore, Hsu-Ling Chang et al. (2008) discussed the relationship between stock prices and EPS of quarterly data for 75 firms over a period from 1997 to 2006 firms listed on the stock exchange of Taiwan (TSEC). The authors found that stock prices were co-integrated with EPS in long run; which means that prices change with change in earning per share, but not at same proportion. And the single (individual) stock prices did not indicate co-integration to EPS. Moreover, they establish that there was inverse relationship between the growth rate and EPS i.e., firm having low level of growth rate, their EPS had greater influence in clarifying stock prices and vice versa.

Similarly, Kim et al. (2006) used annual data for firms listed on the Stock Exchange of Korea over the time period of 20 years (1981 to 2000). Due to non-stationary data they

used panel cointegration techniques. The results showed that relationship of cointegration is present between the stock prices and EPS; but for the separate stock prices, the tests did not notice any cointegration.[ii] They determined that stock prices are "mean reverting" in long-run.

Sing et al. (2002) studied mean reversion process based on property stocks price to their fundamental values of Singapore. The authors studied the phenomenon for period of 10 years from 1989 to 1999. While using earning per share (EPS), net assets value (NAV) and dividend per share (DPS) as proxies for corporate fundamentals. The researchers no significant relationships between stock prices and firm's fundamental values. Out of fifteen stocks, only six shows significant relationship and remaining nine show no cointregration.[iii] Sing et al. (2002) further argued that if mean reversion process is present in stock prices then for stock selection process more attention should be given by the institutional investor for performance of stock in term of EPS and other firm fundamentals.

Ansotegui and Esteban (2002) empirically confirmed the presence of a long run association between the stock prices of Spanish market and its fundamentals values. They used the financial approach and checked the relationship for forecasting.[iv] The study tests the presence of long run relationship by testing the presence of cointegration in the VAR. The existences of cointegration concluded that these variables change together overtime. After that, short run interactions between the variables are contingent over impulse response function.

Chiang et al. (1995) used dividends and earnings as proxies for the fundamental values and tested the model empirically which is well-matched with Campbell and Shiller (1988) model in the earnings case and Fama and French (1988) framework in dividend case. Their findings were also similar with other researcher and suggested that the stock prices followed means reversion process.

Besides other factors, future profit is also the important feature of the firm which has impact on the stock prices. It is considered that earning information contain maximum information content for all accounting information and as it is due to presence of important discussion regarding the relationship between stock prices and accounting earnings.

For example, Hsu-Ling Chang et al. (2008) measured the response of stock prices to earning per share established on earnings response coefficient (ERC). They considered it an extent of timeliness of accounting earnings. ERC is relationship between a firm's equity returns and unexpected earnings declarations.

Ball and Brown (1968) quantified the disparity of annual stock price by using security Abnormal Performance Index (API). The purposes were to measure effectiveness of current accounting income numbers by observing their information content and suitability. The authors assumed that for a specific firm the absence of valuable

information over a period, and then the rate of return over that period would reveal only the presence of market-wide information which concerns to all firms.

Beaver et al. (1980) studied the relationship of information content of stock prices with change in earnings. They documented that there was significant correlation between the variations of stock prices and earnings. The relationship provides an explanation between earning changes and price changes which is earlier witnessed by Ball and Brown (1968) and Beaver et al. (1979).

Freeman (1987) explored the association in the middle of the accounting earnings and stock earnings on both and small companies. The study concluded two findings. Firstly, the security prices of large firms expect accounting earnings before than the small firms. Secondly, the aggregate abnormal returns of small firms for a specified level of 'unexpected' earnings go beyond from large firms.

Beaver et al. (1997) stated that both stock prices and earnings are equally affected by information and they related with each other. In order to find the relationship of stock prices with earnings they used simultaneous equations and found that the relationship existed

Kormendi and Lipe (1987) explored the relationship with the evidence that there was information content in earnings and examined the effect of unexpected earnings on stock returns which was associated with the present value of revisions in expected future earnings. The researcher urged that the extent of relationship was positive related with reversion in future earnings. This positive relation inferred that time series property of annual earnings were different through firms so therefore there would be no random walk for each firm.

The previous literature showed the existence of mean reversion process documented mostly in developed countries. The current study tries to replicate the study in emerging market of Pakistan.

Methodology

This study proposes the model for analysis of relationship between stock prices and earnings per share (EPS). If with change in EPS, the stock prices change then it is suggested that there is mean-reversion process in stock prices; then ultimately it can be concluded that stock prices react to inherent assets value of a firm.

Hypothesis

Based on the above literature review and theoretical consideration, the hypothesis of study is stated as:

Ho: Earning Per share has no significant influence on the stock prices of the KSE firms.
H1: Earning Per share has a significant influence on the stock prices of the KSE firms.

In order to answer the hypothesis the model is constructed as below.

The Model

The model used for this research is random model effect. It is a type of categorized linear model.[v] It undertakes that the data set contains a hierarchy of unlike populations whose variances relate to that hierarchy. In econometrics, the model used in the analysis of hierarchical or panel data, it is used when one undertakes no fixed effects (i.e., no individual effects). As random effects model (REM) is a special case of the fixed effect model; however, the random effects model is extra proficient than the fixed effects model.[vi] Random effects undertake that the error term is not interrelated to the predicator and it permits for time invariant variables in order to play a part as independent variables. Random effect permits to generalize the interpretations beyond the sample used in the model. Now the model for stock prices and earning per share (EPS) is as follows:

$$S_{i,t} = \alpha_i + \beta_i EPS_{i,t} + e_{i,t}$$

Here, S_t stands for stock prices for firm i at time t. $EPS_{i,t}$ is the earnings-per-share for firm i at time t. while EPS is the earnings per share. While $e_{i,t}$, $\varepsilon_{i,t}$ and $u_{i,t}$ are normal distributed error-terms with expected mean of zero, constant variance and no autocorrelation.

Sample

The sample in this research is firms listed on the KSE. The selection of final data is based on the accessibility of stock prices in the KSE. Out of all listed firms[vii], on the KSE, there were 110 such firms whose data is available for the period from 2003 to 2012. From the sample of 110 firms, 40 companies have negative EPS; thus, the sample is reduced to 70 companies, having stock price data and earning per share over the whole 10 years (2003-12). Data for both the variables are taken annually and then the returns of them are calculated for further analysis. The returns are calculated using the following formula.

$$R=LN (St / S_{t-1})$$

Whereas R stands for return of the stocks and LN stands for Log. While S_t Stands for stock price at time t and S_{t-1} stands for stock price at previous time.

In order to test the hypothesis that relationship exists between stock prices and earning per share, regression analysis is used. The data used is panel data which has both time effects and group effects. Both fixed effect as well as random effect regression can be used, but here the data fits for random effects, so random effect analysis is used in the study.

After normality of data, the study can run regression analysis. First, the outliers are checked in the data, there found some outlier and which are been removed. Some tests are also conducted to check the problems of hetroscadicity and multicollinearity and after that fixed and random effect regression is employed. In order to find that which

regression analysis is better for the data, the study employed another test which is known as Hausman Test which tells about the best fitted regression for data among fixed effect and random effect.

The Panel data offers a number of major benefits, comparative to conventional single cross-sectional or time-series data sets. In order to improve power of the test, panel data combines time series and cross section data which it offers a countless enhancement to the power of tests and panel data also accurately inference the parameters. It usually contains more degrees of freedom and more sample variability than cross-sectional data; hence improving the efficiency of econometric estimates (Hsiao et al., 1995). Researchers use panel methods to advance the power of tests.

Numerous outdated approaches might be adopted to increase power of tests. For instance, one may include more observations or may increase the time periods of the data (Hsu-Ling Chang et al., 2008). However, it is difficult to increase both of them because of availability of data. Furthermore, there might be problem of structural break[viii], if data has been included for a longer period of time. Alternative choice is to divide the data set into months or quarters, it increases their regularity. But, earning per share and net profit data of the stocks are usually stated not more than twice a year.

Empirical Findings

This section discusses the empirical results of the all the tests for the Panel data for 70 firms listed on the KSE over the period from 2003 to 2012. The analysis consists of total 699 observations. For analysis of panel data both fixed and random effects of regression is used; in this research thesis, random effect (REM) is more appropriate. Furthermore, this section also discusses the descriptive statistic of the variables. The results for the test of hetroscadicity and multicollinearity are also explained in this section.

Test of Hetroscadicity

Table 1 displays the outcomes of Breusch-Pagan / Cook-Weisberg test, which is used for checking the linear form of heteroscedasticity, the null hypothesis is that of constant variance, while alternative hypothesis is heteroscedastic variance, means that the error variances rise (or decline) as the forecasted values of Y rise, e.g. the larger the predicted value of Y, the larger the error variance. If null hypothesis is accepted then there is homoscedastic variance and vice versa. Here in this situation the P-Value is 0.6227 which is greater than 0.005, its means that null hypothesis is accepted and it suggests that the problem of heteroscedasticity do not exist and the variance is constant.

Table 1 Breusch-Pagan/ Cook-Weisberg test's Result for Heteroscedasticity

Breusch-Pagan/ Cook-Weisberg Test	
Chi2(1)	0.24
Prob > chi2	**0.6227**

Notes: 1. Ho: Constant Variance and Hi: Heteroscedastic Variance

Table 2 Correlation Matrix

Variables	Stock Price	EPS
Stock Price	1.0000	
EPS	0.4378	1.0000

Table 2 indicates that correlation between stock price and EPS it confirms that Stock price is positively correlated to earning per share by 0.4378.which infers that both the variables moves together positively with a magnitude of 0.43.

Table 3 Hausman Test for Model Selection

Hausman Test	
chi2(1)	1.05
Prob > chi2	0.3044s

Table 3 shows the result of Hausman test, it is used to distinguish between fixed effects and random effects model in analysis of panel data. The null hypothesis is that the random effects model is preferred model while the alternative hypothesis is to opt for the fixed effects. It mainly tests whether the unique errors (ui) are correlated with the regressors, the null hypothesis is they are not. If null hypothesis is accepted then random effect is to be used otherwise fixed effect. Here in this situation, the value of Prob Chi 2 is 0.3044 which is greater than 0.005, its means that to accept the null hypothesis and it suggests that random effect model is fit for regression analysis.

Table 4 Estimation Results with Random Effects

Variable	
Earnings per share	0.19344*** (0.01548)
No. Of Observations	660
R^2	18.64%
Adjusted R^2	19%
*** shows significance at 1%.	

After hausman test, it is cleared that random effect model is best for this research analysis and hence the results are discussed as follows. The coefficient of EPS is 0.1934; it infers that 1 unit rise in EPS will cause 0.1934 unit increase in stock price and vice versa. As the results indicate that there is significant relation between stock price and earning per share at 1% level; it infers that stock price are mean reverting and these stock prices can be predicted from firm's fundamentals. The R^2 tells us about the significance of overall model. Here, value of R^2 is 0.1864 which refer that the total effect of the independent variable (i.e., EPS) on dependent variable (stock price) is 18.64% whereas the remains of the effect is recognized as error term. With this analysis, it is also inferred that the independent variable (i.e., EPS) has positive and significant effect on the dependent

variable (i.e., stock price), with increases in EPS of firms their stock prices will also increases.

The research study generally marks numeral offerings to the literature in field of finance, and particularly about the Pakistani market. First, the outcomes of the regression analysis tell that earning per share and stock prices are significantly positive correlated. The second outcome of present research study indicates that present study has similar results with previous researches which had conducted in developed markets such as the UK, the US and etc. (Hsu-Ling Chang et al., 2008). The findings of this research consequently support the concept that methods and models which are used in developed markets are also suitable in environment of emerging stock market such as Pakistan. This present findings support the view that researches in developed countries have to be duplicated in emerging countries which have unique financial and institutional contexts. Third and last, the researches expose that most of Pakistani stock holders are risk-takers and they take their judgments on the basis of rumors and word of mouth, they did not do any sophisticated financial or technical analysis (Tijjani, 2008). Thus, managers essentially educate such investors about the implications of matters such as share prices and their relationship with other firm's fundamentals.

Conclusion

The research focuses primarily to determine whether a relationship exists between stock prices and EPS in Pakistani stock market, and secondly, to investigate that either stock prices are mean reverting or not, and is there any "Information Content"[ix] present in Pakistani market.

The findings of REM propose that stock prices have positive and significant relationship with EPS. On the basis of which it is concluded that that stock prices changes with EPS, but not essentially at the similar proportion. In addition, it establishes confirmation that EPS influence stock prices, and the presence of "Information Content" in the listed companies on the KSE. With this relationship it can be concluded that stock prices are mean reverting and thus it could offer stockholders and investors a technique to forecast the deviation for stock prices in planning for long-run investment. This findings show that investors can earn profit on utilizing the information contents of earning per share in Pakistan. Thus policies which may offer cost-effective opportunities would be applied in other markets if stock prices changes with firm fundamentals. Moreover, the results of the study also show consistency with the findings of developed market such as the UK, the UK etc., therefore it is urged that models used in developed market should be replicated in emerging market with different fundaments such as Pakistan.

One limitation of the study is that the method used for analysis is regression based method, but there has been evidence that in researches carried out in developed countries have some problem in regression stated by Newbold and Granger (1974). But here data is stationary so co-intregration can be applied.

Although accepting the limitations of the research, this study signifies the most important studies concerning relationship of stock price with earning per share. Furthermore, it is

amongst the first research studies to investigate the effect of firm fundamentals on stock prices in an emerging economy, i.e. Pakistan. Consequently, this research thesis would act as a base for future research in this area.

The method employed in this thesis is random effect regression based analysis, while literature reveals that in developed countries some researcher carried out research with cointregration method. So in future there is a need to accomplish this research with the help of cointregration methods. In this research, Earning per share is taken as proxy for firm fundamental for investigation the relationship between firm fundaments and stock price. But in future research it needs to take other proxy such as dividends, net asset values, and price to earnings ratio for testing the above stated relationship.

Future research can accomplish further generalizability by having a greater sample for the analysis. This will not only signify the results but will also generalize the effect over the market. Furthermore, this type of research must be carried out in further developing markets in the world, particularly the South Asian countries. The research in other emerging countries will also improve the understanding and will strengthen the evidence of relationship.

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Notes

[i] It is believed that variances across entities have some impact on the dependent variable that's why random effects model is used for analysis. An advantage of random effects is that it also includes time invariant variables. Usually, the random effects model is used as it estimates variables which are constant within unit.

[ii] The researcher concluded that stock prices change with change in firm fundamentals, but as not essentially on similar ratio

[iii] These results were also consistent with Campbell and shiller (1988) and chiang et al. (1995).

[iv] The authors used (vector autoregressive) VAR for analysis which consist of the stock market price index , interest rates, industrial production and inflation.

[v] In statistics, random effect model is also famous as variance components model.

[vi] The logic behind random effects model is that, not like the fixed effects model, the discrepancy across entities is presumed to be random and not correlated with the independent variables incorporated in the model. "…the crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not" (Green, 2008, p.183)

[vii] There were 660 listed firms on Karachi stock exchange in 2013.

[viii] A structural break appears when we see an unexpected shift in a (macroeconomic) time series. This can lead to huge forecasting errors and unreliability of the model in general. This issue was popularized by David Hendry.

[ix] The increase or decrease in the price of a stock as a result of new relevant information. An instance of this effect occurs when a stock rises in price after a positive earnings report is released and vice versa.