Atta ur Rahman[1], Sana Ejaz[2], Muhammad Akbar[3]

STABILITY OF BETA OVER DIFFERENT MARKET PHASES: AN EMPIRICAL STUDY OF PAKISTANI EQUITY MARKET

The study examines the stationarity of individual as well as portfolio beta over bullish and bearish market phases at the stock market of Pakistan using monthly market and company returns of 100 listed companies at Karachi stock exchange for the period of 6 years (January 2004 to December 2009). For individual beta stationarity, 2 methods of regression with and without dummy variables, and Chow test are applied. Paired t-test and Spearman rank order correlation test are used to test the stationarity of portfolio beta. The results in general suggest that both individual as well as portfolio betas remains stationary and do not change with the changing bullish and bearish market trends at Pakistani stock market.

Keywords: *beta, systematic risk, bullish, bearish, Chow test.*

Атта ур Рахман, Сана Ейяз, Мухаммад Акбар

СТАБІЛЬНІСТЬ БЕТА-ВЕЛИЧИН НА РІЗНИХ РИНКОВИХ СТАДІЯХ: ЕМПІРИЧНЕ ДОСЛІДЖЕННЯ ФОНДОВОГО РИНКУ ПАКИСТАНУ

У статті вивчено стаціонарність бета-величин окремих акцій і портфелів на ринкових стадіях підвищення і зниження цін на прикладі фондового ринку Пакистану. Використано щомісячні дані по ринку і доходах 100 компаній, що котируються на фондовій біржі Карачі, за 6 років (січень 2004 — грудень 2009). Для визначення індивідуальної стаціонарності застосовано два методи регресії і тест Чоу, для портфельної стаціонарності — парний Т-тест і кореляційний метод Спермана. Результати підтвердили стаціонарність бета-величин окремих акцій і портфелів на ринкових стадіях підвищення і зниження цін на фондовому ринку Пакистану.

Ключові слова: *бета-величини, систематичний ризик, підвищення і зниження цін, тест Чоу.*

Форм. 8, Табл. 7.

Атта ур Рахман, Сана Эйяз, Мухаммад Акбар

СТАБИЛЬНОСТЬ БЕТА-ВЕЛИЧИН НА РАЗНЫХ РЫНОЧНЫХ СТАДИЯХ: ЭМПИРИЧЕСКОЕ ИССЛЕДОВАНИЕ ФОНДОВОГО РЫНКА ПАКИСТАНА

В статье изучена стационарность бета-величин отдельных акций и портфелей на рыночных стадиях повышения и понижения цен на примере фондового рынка Пакистана. Использованы ежемесячные данные по рынку и доходам 100 компаний, котирующихся на фондовой бирже Карачи, за 6 лет (январь 2004 — декабрь 2009). Для определения индивидуальной стационарности применены два метода регрессии и тест Чоу, для портфельной стационарности — парный Т-тест и корреляционный метод Спермана. Результаты подтвердили стационарность бета-величин отдельных акций и портфелей на рыночных стадиях повышения и понижения цен на фондовом рынке Пакистана.

Ключевые слова: *бета-величины, систематический риск, повышение и понижение цен, тест Чоу.*

[1] Assistant Professor, Institute of Management Sciences, Hayatabad, Peshawar, Pakistan.
[2] Graduate Scholar, Institute of Management Sciences, Hayatabad, Peshawar, Pakistan.
[3] Assistant Professor, Department of Management Sciences, Bahria University, Pakistan.

1. Introduction. Investors face two kinds of risks while investing their money; systematic or non-diversifiable risk and unsystematic or diversifiable risk (Sharpe, 1963). Systematic risk arises because of external factors like changes in inflation, condition of economy and interest rate whereas unsystematic occurs because of business risk or financial risk specific to a firm. As investors do not have control of these external factors, therefore, they cannot diversify the risk created by these factors. Systematic risk is measured through market beta. According to Ray (2010), beta shows the relationship between the stock return and market return, and provides information on the uncertainty of stock returns in relation to market.

The value of stock beta plays a vital role in decision-making and is used both by investors and researchers. Investors use this value in selecting stocks for their portfolio. It is also used in estimating the cost of capital and required rate of return on investment, for performance evaluation and risk estimation. Academicians use this value for testing the efficiency of market and also for testing the models of asset pricing. It is crucial for both investors and academicians to know how efficiently beta can be estimated. Efficiency of beta is related to its stationarity, i.e., if beta is stationary over different time periods then this means that it is efficient enough to be used in decision-making. Beta is said to be non-stationary if it changes from period to period. In contrast, stationarity of beta means the absence of fluctuations. Beta can fluctuate because of different reasons, i.e. change in market trends, change in company policy (leverage or investment policy) etc.

Stationary beta also means stationary systematic risk. Stationarity of beta is an important issue as it has many applications in evaluating the effects of accounting information on stock prices (Meyers, 1973). In order to evaluate the performance of portfolio managers and to test the validity of capital asset pricing model, a stationary beta is required (Brenner & Smidt, 1977). Stationary historic beta is preferred for estimating future beta (Irala, 2007).

Generally, it becomes very difficult to have stationary beta because of different market phases. In this connection, separate beta for each market phase is considered to obtain reliable estimates. Keeping in view the importance of efficiency and stationarity of beta, this study was conducted to know whether betas of securities and portfolios at Pakistani market are stationary or non-stationary over different market phases, i.e., bullish and bearish. It also aimed at determining whether size of a portfolio affect the stationarity of beta or not.

2. Literature Review. Different studies have been conducted to examine the stationarity of beta over market phases in different countries but yielded mixed results. Robert (1971) used weekly returns of 500 companies listed at New York Stock Exchange utilizing the data of 10 years, 1960 to 1970. The results revealed that beta is extremely stable for large portfolios and less stable for small portfolios. It was further concluded that past beta is stable enough to be used for estimating future beta in portfolios that have more than 25 stocks and estimation period is greater than 26 weeks.

O'Malley and Gooding (1977) carried out a study to examine the stationarity of portfolio betas over bullish and bearish market trends using 200 largest US industrial stocks during 1966-1974. It was found that the betas of well diversified portfolios are

non-stationary which is attributed to changing market trends. Fabozzi and Francis (1977) investigated the stationarity of alpha and beta over market phases using the sample of 700 stocks listed at NYSE by taking 2 different time periods, Jan 1950 to Dec 1964 and October 1966 to May 1970. In both periods, they found that alpha and beta are stationary over different phases of market. Kim and Zumwalt (1979) also investigated whether securities respond differently in up and down markets or not. They took the sample of 322 securities for the period February 1962 to December 1976 and developed two-beta model having up and down market betas. According to their results most securities had the same betas at both up and down markets.

Selection of return interval is a very crucial decision to take. Most researchers use monthly returns as according to them beta will be more biased if estimated using daily returns (Wood and McInish,1986; Bartholdy and Peare, 2001). Hawawini (1983) investigated the effect of return interval on beta by using returns of different intervals (monthly, three-weekly, biweekly, weekly and daily) in calculation of beta and came up with different values of betas for every return interval. Estrada (2000) came up with the same results by using daily, monthly and quarterly returns in calculating beta for 14 European stock exchanges. Xiao (2007) carried out a study on Chinese stock market to know the characteristics of beta by taking 28 companies listed at Shanghai stock exchange for the period January 2000 to February 2007. Using regression equation with dummy variables it was observed that beta is different at bull and bear markets. The findings of the study suggested that return interval used is related to the value of beta. According to him, daily beta and weekly beta are similar, whereas daily beta and monthly beta are significantly different.

Woodword and Anderson (2003) conducted a study to know whether bull and bear betas differ or not. They used the monthly price data of 24 Australian stocks for the time period from December 1979 to December 2001. They found that in all the industries beta was different at bull and bear markets. Das (2007) examined the stationarity of beta over different market phases using the data on 39 stocks listed at NSE Nifty for the period of February 1999 to September 2007. Stability was tested by using regression analysis technique while taking time as independent variable in one case while in another case different market phases are considered as dummy variables. The sampled period was divided into 3 subperiods comprising of one bearish and 2 bullish subperiods. According to the results 85% of stocks got stable beta under regression using time as an independent variable and 65% stocks had stable beta under regression using dummy variables.

3. Methodology.

3.1 Selection of Companies. In the present study, the monthly prices of 100 stocks listed at Karachi stock exchange (KSE) as well as monthly index value of KSE 100 index for the time period of Jan. 2004 to Dec. 2009 were used. The sample was composed of the companies from different sectors of Pakistan like industrial metals & mining, beverages, food producers, pharma and biotech, travel & leisure, personal goods, forestry & paper, construction & materials, automobile & parts, textile, chemicals, oil & gas and refinery. Only those companies were included in the sample whose share prices for the entire sample period were available.

3.2 Market Phases. Literature suggests different techniques and threshold values for identifying market phases. However, in the present study, in order to divide market into different phases, the techniques of Kim and Zumwalt (1979) and Woodward and Anderson (2003) were merged to form a single method. To check the stationarity of beta over different market phases, the market was divided into different phases on the bases of monthly returns by following the trend base scheme. Returns were first smoothed out through 12 months moving averages and then threshold value was calculated with which market returns were compared. The threshold value used was the mean return and when the market returns were less than the mean of 12 months moving average of returns of KSE 100 index then the phase was declared as bearish, otherwise — bullish. In this way 4 different phases were identified along with their time period and duration (Table 1).

3.3 Individual securities Beta. Closing price of each month was recorded from January 2004 to December 2009 and monthly returns were calculated from prices through following formula:

$$R_{k,t} = \ln(P_1 / P_0), \quad (1)$$

where $R_{k,t}$ is the return of k^{th} stock in month, t; P_1 is the price of k^{th} stock in month t and P_0 is the price of k^{th} stock in month t-1. Monthly market returns were computed by the formula:

$$M_{r,t} = \ln(K_1 / K_0), \quad (2)$$

where $M_{r,t}$ is the market return at month t, K_1 is the KSE 100 index at month t and K_0 is the KSE 100 index at month t-1. After calculating the stock and market returns, beta for each stock, for each phase and entire sample period was calculated through the following regression equation:

$$R_{k,t} = \beta_0 + \beta_1 M_{r,t} + \mu_t, \quad (3)$$

where $R_{k,t}$ is the return of k^{th} stock at month t, β_0 is the intercept term, β_1 is the beta of stock and μ_t is the error term.

In order to test the stationarity of beta dummy variables were added to the regression equation (1) to represent the absence or presence of a market phase. As there were 4 market phases, so to avoid the dummy trap 3 dummy variables were added and the fourth phase was taken as the base period (Gujrati, 2004). In order to include the effect of 4 phases, equation (1) was extended as:

$$R_{k,t} = \beta_0 + \beta_1 M_{r,t} + \beta_2 D_1 + \beta_3 D_2 + \beta_4 D_3 + \mu_t, \quad (4)$$

where: $D_1 = 1$ for market phase 1 and $D_1 = 0$ otherwise, $D_2 = 1$ for market phase 2 and $D_2 = 0$ otherwise, $D_3 = 1$ for market phase 3 and $D_3 = 0$ otherwise. In order to check the stationarity of beta the significance of β_2, β_3 and β_4 was checked through Student t-test. Even if 1 of 3 (β_2, β_3 and β_4) proves to be significant, this means that stock beta changes with time and insignificant β_i's will show the stationarity of beta over market phases (Ray, 2010).

Chow test was used to check the stationarity of betas as well as the structural or parameter stability of the regression model which is the second method in the pres-

ent study. Structural change reflects that the values of the parameters of the model keep on changing from period to period and do not remain constant throughout the sample period. Since the sample was divided into 4 phases which gave out 5 regression models, one regression model was employed for the entire sample period and 4 regression models, each for each subperiod, was used. These regression models are reproduced as:

$$R_{k,t} = \lambda_0 + \lambda_1 M_{r,t} + \mu_t \quad (5)$$

$$R_{k,t} = \gamma_0 + \gamma_1 M_{r,t} + \mu_t \quad (6)$$

Equation (5) is for the entire sample period and equation (6) is for each subperiod. There were 72 observations (n = 72) for the entire sample period and the number of observations for subperiod (1, 2, 3, 4) where n1 = 36, n2 = 5, n3 = 12, n4 =19 respectively. The possible structural changes or differences over the sample period can be because of the changes in any of the coefficients (intercept or slope) or both coefficients. These structural changes were examined by conducting Chow test.

3.4 Portfolio Beta Stationarity

To form portfolios, first of all the historical betas of the initial phase were arranged in the ascending order. 3 portfolios having 5 stocks each were formed by selecting every fourth stock. After that, 3 portfolios with 10 stocks each by selecting every second stock were formed. At the end 3 portfolios of 20 stocks were formed by selecting first 20 stocks, then next 20 stocks and so on. All these portfolios were formed by excluding the stocks with negative beta (Gooding and O'Malley, 1977). In this way 9 portfolios of different sizes were formed using 100 stocks excluding the stocks with negative betas.

In order to check the stationarity of portfolio beta over different market phases two tests were applied, namely paired t-test and Spearman rank correlation test (Gooding and O'Malley, 1977). The paired t-test was applied to check whether the beta for a given portfolio in one phase differ or not from the beta of the same portfolio in the next phase. In this test the following hypothesis was tested:

$$H_0 : \beta_{bl} - \beta_{br} = 0$$
$$H_a : \beta_{bl} - \beta_{br} \neq 0$$

where β_{bl} is the population portfolio beta in bullish market and β_{br} is the population portfolio beta in bearish market.

Spearman rank correlation test was applied to know whether the portfolio beta in one phase was correlated to the portfolio beta in the next phase or not. In this case, the following null and alternative hypotheses were considered:

$$H_0 = \rho_{B_{bl}\beta_{br}} \leq 0$$
$$H_a = \rho_{B_{bl}\beta_{br}} > 0$$

where ρ is the Spearman rank correlation coefficient between 9 portfolio betas in a bear market and the corresponding 9 portfolio betas in a bull market.

4. Results and Discussion.

4.1 Individual Securities Beta. Descriptive statistics of individual stock betas for 4 different phases and the entire sample period are displayed in Table 2. It shows that the mean beta for the overall sample period was 0.55 with the standard deviation of 0.41, whereas the maximum and minimum betas were 1.36 and -0.44 respectively.

Increasing trend was observed in mean beta from phase-I to phase-III with 0.59 in phase-I and 0.76 in phase-III, whereas mean beta again decreased to 0.45 in phase-IV. It further reveals that standard deviation is fluctuating throughout 4 phases, i.e., increased from 0.4 to 1.12 in phase-II, decreased to 0.5 in phase-III and again increased to 0.61 in phase-IV. Similarly, the standard deviation of beta was the highest in phase 2 indicating that beta values are mostly fluctuated in this phase. Maximum beta of all 4 phases and the overall sample period was 2.91 which corresponds to Dandot Cement company in phase-II. It shows that Dandot Cement was the most volatile stock of phase-II as compared to other stocks.

In the first stage, individual stocks' betas were calculated over the 4 market phases. Table 3 provides the individual stock betas over 4 phases of 31 stocks (the remaining 69 stocks' betas over the 4 phases are available upon request). The results reveal that 20 stocks had beta of more than 1 in phase-I, increased to 36 in phase-II, decreased to 33 in phase-III and further reduced to 22 in phase-IV. In case of the overall sample period only 17 stocks had betas of more than one. Generally, beta shows the volatility of stock and the results revealed that volatility increased from phase-I to phase-III. Of the total 100 companies, 35 had betas less than one in all 4 phases as well as in the overall sample period showing that these 35 stocks were less volatile as compared to the whole market. 18 companies showed negative betas in recent phase (from June 2008 to Dec 2009) and 7 of them also had negative betas in phase one and only one (Quality Steel) of the stocks had negative beta in all 4 phases and the overall sample period. Furthermore, from phase-I to phase-II 57 companies had increasing and 34 companies had decreasing betas. Also from phase-II to phase-III 42 companies showed increasing and 48 had decreasing betas, whereas from phase-III to phase-IV 32 companies had increasing and 65 had decreasing betas. These results suggest that systematic risk keeps on changing throughout the 4 selected phases.

In case of the overall sample period, 67 out of 100 companies had significant betas and from phase-I to phase-IV the number of significant beta ranges from 16 to 61. It reveals the fluctuation of beta over different market phases, i.e., bullish and bearish. Also the test under null hypothesis was significant ($P < 0.05$) for 67 out of 100 cases (for the overall sample period) and 61 out of 100 cases in phase-III (Table 3). Based on the results obtained, it is concluded that beta was non-stationary over market phases and was affected by bullish or bearish market trends.

In order to check the stationarity of beta of individual securities regression model (Equation 2) with dummy variables was used. The results for 31 stocks are summarized in Table 4 (the results for 69 stocks are available upon request. The results reveal that out of 100 companies, 60 had insignificant ($P > 0.05$) β_2, β_3 and β_4, whereas 40 companies had significant ($P < 0.05$) β_2, β_3 or β_4. Out of the 40 companies, 21 companies had significant β_2, 9 had significant β_3 and 15 had significant β_4. 3 companies had both significant β_2 and β_3, 6 companies had both significant β_2 and β_4 and only one company had significant β_2, β_3 and β_4. In order to clarify the regression results with dummy approach for stationarity of individual beta, Chow test was applied and the results for 31 stocks are displayed in Table 5 (the results of Chow test for 69 stocks are available upon request). The results of Chow tests suggest that out of 100 compa-

nies, only 11 had significant ($P < 0.05$) F-ratio. Based on the results, it is concluded that individual stock beta was stationary over the bullish and bearish market phases.

4.2 Portfolio Beta.

To check the stationarity of portfolio beta paired t-test and Spearman rank correlation tests were performed (Tables 6 and 7). Table 6 depicts that in case of both consecutive and non-consecutive market phases, 48% of portfolio betas were significantly ($P < 0.05$) different over the market phases suggesting that beta is non-stationary and changes with the changing market trends. In addition, the test under the null hypothesis of non-significant portfolio beta was rejected in 48%. The results revealed that portfolio with 5 stocks had significantly different beta in 4 out of 18 pairs of phases. The number increased to 9 out of 18 in case of 10 stocks and further increased to 13 out of 18 pairs of phases in case of 20 stocks. These results indicate that as the size of portfolio increased, the stationarity of beta decreased which lead to the conclusions that the size of portfolio had affected the stationarity of portfolio beta. Furthermore, it reveals that low risk portfolio beta in case of 5 stocks per portfolio was significantly ($P < 0.05$) different in 2 out of 6 pairs of phases and in case of high risk portfolio the number reduced to 0 out of 6. In case of 10 stocks per portfolio, the low risk portfolio had significantly different beta in 4 out of 6 pairs and the number reduced to 1 out of 6 in case of high risk portfolio. Similarly, in case of 20 stocks per portfolio, the low risk portfolio had significantly different beta in 5 out of 6 pairs of phases and the number reduced to 2 out of 6 for high risk portfolio. On the basis of these findings it may be concluded that portfolios with high risk stocks had somewhat stationary betas as compared to the portfolios with low risk stocks.

Results of Spearman's rank correlation test for testing the stationarity of beta are given in Table 7. It shows that the null hypothesis is significant in 1 out of 6 cases, only 1 pair of 6 pairs of phases had correlation statistically greater than zero and the remaining 5 pairs of phases had correlation less than or equal to zero which means that portfolio beta was non-stationary and was changing with changing market phases.

Comparing the results of both tests (paired t-test and Spearman's rank correlation) for stationarity of portfolio beta, it is evident they are in contradiction. Because, t-test shows stationarity and correlation test shows non-stationarity of portfolio beta. Results of correlation test can be misleading as it compares the portfolio beta over different time periods and make use of ranks of beta. So, if ranks order does not change or betas move in the same direction then the results will be misleading. Therefore, in such case the results of paired t-test are considered more reliable as compared to Spearman's rank correlation test which suggests that portfolio beta is stationary in different market phases.

5. Conclusion. The results of the data analysis reveal that in case of the entire sample period most companies had statistically significant beta. Subsequently the stability of individual stock betas was checked using two methods: regression equation with dummy variables and Chow test. The results of the regression with dummy variables reveal that beta is stationary over market phases in 60 out of 100 cases and non-stationary in 40 cases. According to the results of Chow test the beta was non-stationary in 11 out of 100 cases and stationary in 89 out of 100 cases. The results further reveal that 60 out of 100 stocks had stationary betas according to both methods. From

this it was concluded that beta of individual stocks was stationary over market phases at Pakistani equity market, i.e., KSE. These results are consistent with the results of Das (2007), Fabozzi and Francis (1977) and Kim and Zumwalt (1979).

In addition to individual stock betas the study also examines the stationarity of portfolio betas through paired t-test and Spearman rank correlation test. The results reveal that beta was significantly stationary over bullish and bearish market trends for all sizes of portfolios, i.e., 5, 10 and 20 and as the size of portfolio increased the stationarity of beta decreased which showed that the stationarity was affected by the size of portfolio. The results are consistent with the results of Robert (1971). The results of the paired t-test further revealed that portfolios with high risk stocks had somewhat stationary betas as compared to the portfolios with low risk stocks.

Table 1. **Phases based on mean returns**

Phase Name	Time period	Duration	Trend
Bull1	Jan 2004 to Dec. 2006	36 months	Bullish
Bear1	Jan 2007 to May 2007	5 months	Bearish
Bull2	June 2007 to May 2008	12 months	Bullish
Bear2	June 2008 to Dec 2009	19 months	Bearish

Table 2. **Descriptive statistics of stock betas**

	Minimum	Maximum	Mean	S.D
Overall	-$0.44	$1.36	$0.55	$0.41
Phase-I	-$0.30	$1.47	$0.60	$0.41
Phase-II	-$3.19	$2.91	$0.46	$1.12
Phase-III	-$0.91	$2.38	$0.76	$0.53
Phase-IV	-$0.80	$1.91	$0.45	$0.61

Table 3. **Individual stock beta for each phase and overall data**

Company	Overall		Phase 1		Phase 2		Phase 3		Phase 4	
	β	P-v	β	P-v	β	P-v	β	P-v	β	P-v
Abbott	0.59	0.00	0.51	0.13	0.86	0.15	0.81	0.01	0.58	0.01
Al ghazi	0.45	0.00	0.29	0.12	0.40	0.70	0.56	0.05	0.50	0.11
Atlas	-0.01	0.96	0.21	0.57	0.27	0.61	0.52	0.22	-0.29	0.48
Attock Cem	0.69	0.00	0.11	0.79	0.57	0.34	1.12	0.00	0.84	0.01
Attock Ref	1.29	0.00	0.78	0.02	1.34	0.52	1.34	0.03	1.60	0.00
Bannu	0.31	0.22	0.79	0.02	1.05	0.47	0.72	0.24	-0.16	0.78
Bata	0.20	0.56	0.41	0.66	-3.19	0.03	0.67	0.21	0.12	0.62
Bestway	0.27	0.13	0.38	0.26	0.61	0.40	1.16	0.02	-0.10	0.73
Cherat Cem	0.75	0.00	0.78	0.03	0.43	0.61	0.76	0.00	0.68	0.00
D.g khan	1.35	0.00	1.06	0.00	0.53	0.30	1.58	0.00	1.45	0.00
Engro	0.95	0.00	0.40	0.19	0.83	0.05	0.97	0.00	1.26	0.00
Fauji Cem	0.91	0.00	1.13	0.00	0.75	0.47	0.90	0.00	0.78	0.00
FFBQ	0.89	0.00	0.69	0.01	0.84	0.01	0.79	0.01	1.04	0.00
Fauji Fert	0.64	0.00	0.25	0.19	0.86	0.04	0.52	0.00	0.90	0.00
Gadoon	0.31	0.06	0.66	0.02	0.86	0.42	0.68	0.03	-0.05	0.88
Ghani glass	0.46	0.00	0.28	0.22	0.28	0.66	-0.51	0.14	0.82	0.00
Honda atlas	1.35	0.00	1.27	0.00	-0.01	0.99	2.38	0.02	1.19	0.00
I.C.I	1.12	0.00	0.88	0.00	0.92	0.00	1.09	0.01	1.35	0.00

The End of *Table 3*

Table 4. **Result of regression with dummy variables**

Company	Overall		Phase 1		Phase 2		Phase 3		Phase 4	
	β	P-v	β	P-v	β	P-v	β	P-v	β	P-v
Ibrahim Fib	0.43	0.00	0.18	0.12	0.53	0.70	1.46	0.00	0.29	0.27
Indus motor	0.77	0.00	0.45	0.18	0.64	0.50	1.29	0.00	0.81	0.08
K.E.S.C	1.10	0.00	1.18	0.00	0.61	0.19	0.49	0.02	1.28	0.00
Lakson Tob	0.06	0.77	0.08	0.87	2.76	0.35	0.71	0.04	-0.30	0.36
Lucky Cem	1.24	0.00	0.87	0.06	0.86	0.51	1.39	0.00	1.40	0.00
Maple	1.12	0.00	1.20	0.00	-0.85	0.45	1.22	0.00	1.08	0.00
Mari	1.11	0.00	0.95	0.01	0.41	0.74	1.32	0.05	1.19	0.00
Millat	0.31	0.03	0.00	0.99	0.95	0.21	0.23	0.13	0.48	0.11
National Ref	0.99	0.00	0.54	0.08	1.50	0.23	0.64	0.16	1.30	0.00
Nestle	0.38	0.46	0.49	0.72	0.52	0.76	0.38	0.18	0.28	0.26
Nishat	1.15	0.00	1.15	0.01	1.54	0.02	1.07	0.00	1.18	0.00
O.G.D.C	1.13	0.00	1.17	0.00	0.80	0.01	0.66	0.00	1.35	0.00
P.S.O	0.74	0.00	0.76	0.00	0.69	0.28	0.88	0.00	0.72	0.07

The End of *Table 4*

Company	Constant		MR		MR*D1		MR*D2		MR*D3	
	β 0	P-v	β 1	P-v	β 2	P-v	β 3	P-v	β 4	P-v
Abbott	-0.01	0.57	0.58	0.00	-0.08	0.81	0.03	0.97	0.22	0.63
Al ghazi	0.00	0.87	0.49	0.00	-0.22	0.49	0.25	0.73	0.07	0.87
Atlas	0.00	0.92	-0.27	0.34	0.47	0.34	0.60	0.59	0.76	0.23
Attock Cem	-0.01	0.75	0.84	0.00	-0.71	0.11	0.53	0.59	0.30	0.59
Attock Ref	0.00	0.94	1.61	0.00	-0.91	0.04	-0.24	0.80	-0.31	0.58
Bannu	-0.03	0.92	-0.13	0.71	0.95	0.11	1.54	0.25	0.83	0.28
Bata	0.03	0.44	0.12	0.81	0.12	0.89	-0.54	0.78	0.51	0.64
Bestway	-0.02	0.20	-0.08	0.73	0.52	0.20	0.76	0.40	1.25	0.02
Cherat Cem	-0.03	0.07	0.69	0.00	0.13	0.73	0.43	0.60	0.08	0.86
D.g khan	-0.02	0.13	1.45	0.00	-0.41	0.20	0.05	0.94	0.13	0.74
Engro	0.00	0.93	1.26	0.00	-0.90	0.00	-0.31	0.67	-0.32	0.44
Fauji Cem	-0.03	0.04	0.78	0.00	0.36	0.24	0.33	0.63	0.14	0.71
FFBQ	-0.01	0.52	1.04	0.00	-0.38	0.19	-0.03	0.96	-0.25	0.50
Fauji Fert	0.00	0.88	0.89	0.00	-0.67	0.02	-0.27	0.66	-0.38	0.28
Gadoon	-0.02	0.16	-0.03	0.88	0.73	0.06	0.94	0.27	0.71	0.15
Ghani glass	-0.01	0.63	0.84	0.00	-0.57	0.04	-0.60	0.34	-1.39	0.00
Honda atlas	-0.02	0.19	1.19	0.00	0.07	0.88	-0.74	0.46	1.20	0.04
I.C.I	0.00	0.90	1.33	0.00	-0.53	0.06	-0.35	0.60	-0.25	0.50
Ibrahim Fib	0.00	0.86	0.29	0.08	-0.12	0.67	0.35	0.58	1.16	0.00
Indus motor	-0.01	0.81	0.80	0.00	-0.37	0.44	0.33	0.76	0.49	0.43
K.E.S.C	-0.02	0.12	1.26	0.00	-0.10	0.77	-0.65	0.40	-0.76	0.09
Lakson Tob	-0.01	0.51	-0.30	0.35	0.45	0.42	2.69	0.03	1.04	0.15
Lucky Cem	-0.01	0.65	1.40	0.00	-0.58	0.17	0.33	0.73	-0.02	0.97
Maple	-0.03	0.09	1.09	0.00	0.13	0.77	-0.55	0.58	0.13	0.82
Mari	-0.01	0.74	1.20	0.00	-0.32	0.51	-0.24	0.82	0.07	0.90
Millat	0.00	0.79	0.46	0.02	-0.48	0.15	0.41	0.58	-0.22	0.61

Table 5. **Results of Chow test**

Company	Constant		MR		MR*D1		MR*D2		MR*D3	
	β 0	P-v	β 1	P-v	β 2	P-v	β 3	P-v	β 4	P-v
National Ref	-0.01	0.44	1.30	0.00	-0.77	0.03	0.08	0.92	-0.66	0.14
Nestle	-0.01	0.92	0.27	0.70	0.19	0.87	0.87	0.75	0.11	0.94
Nishat	-0.02	0.35	1.17	0.00	-0.07	0.87	0.52	0.59	-0.11	0.85
O.G.D.C	-0.01	0.50	1.33	0.00	-0.24	0.50	-0.74	0.35	-0.68	0.13
P.S.O	-0.01	0.60	0.73	0.00	-0.01	0.98	0.18	0.83	0.13	0.78

Company	RSS1	RSS2	RSS3	RSS4	RSSU	RSSRS	F-Stat	H_0
Abbott	0.59	0.01	0.06	0.23	0.89	0.90	0.31	not rejected
Al ghazi	0.18	0.03	0.05	0.46	0.73	0.74	0.61	not rejected
Atlas	0.71	0.01	0.13	0.87	1.71	1.79	1.61	not rejected
Attock Cem	0.86	0.01	0.06	0.47	1.41	1.52	2.71	not rejected
Attock Ref	0.61	0.12	0.23	0.35	1.30	1.45	3.81	not rejected
Bannu	0.54	0.06	0.28	1.68	2.55	2.73	2.30	not rejected
Bata	4.59	0.02	0.21	0.31	5.13	5.39	1.75	not rejected
Bestway	0.60	0.01	0.16	0.41	1.18	1.31	3.73	not rejected
Cherat Cem	0.66	0.02	0.05	0.21	0.94	0.96	0.91	not rejected
D.g khan	0.44	0.01	0.05	0.22	0.71	0.76	2.20	not rejected
Engro	0.48	0.00	0.02	0.23	0.72	0.82	4.61	rejected
Fauji Cem	0.40	0.03	0.04	0.18	0.64	0.66	1.17	not rejected
FFBQ	0.35	0.00	0.06	0.20	0.60	0.62	1.13	not rejected
Fauji Fert	0.18	0.00	0.01	0.34	0.53	0.59	3.37	not rejected
Gadoon	0.40	0.03	0.06	0.54	1.03	1.13	3.02	not rejected
Ghani glass	0.26	0.01	0.08	0.18	0.54	0.71	11.03	rejected
Honda atlas	0.64	0.02	0.59	0.18	1.44	1.56	2.93	not rejected
I.C.I	0.33	0.00	0.10	0.10	0.53	0.58	3.41	not rejected
Ibrahim Fib	0.07	0.05	0.12	0.33	0.57	0.67	6.49	rejected
Indus motor	0.59	0.02	0.08	1.01	1.70	1.76	1.08	not rejected
K.E.S.C	0.59	0.00	0.02	0.25	0.86	0.92	2.17	not rejected
Lakson Tob	1.36	0.21	0.07	0.55	2.19	2.42	3.54	not rejected
Lucky Cem	1.08	0.04	0.04	0.12	1.29	1.35	1.72	not rejected
Maple	0.90	0.03	0.03	0.42	1.39	1.45	1.47	not rejected
Mari	0.69	0.04	0.30	0.58	1.62	1.68	1.33	not rejected
Millat	0.31	0.01	0.02	0.41	0.75	0.80	2.27	not rejected
National Ref	0.49	0.03	0.15	0.18	0.86	0.94	3.21	not rejected
Nestle	9.94	0.08	0.06	0.30	10.37	10.40	0.09	not rejected
Nishat	1.03	0.00	0.07	0.24	1.35	1.36	0.35	not rejected
O.G.D.C	0.80	0.00	0.02	0.05	0.87	0.93	2.31	not rejected
P.S.O	0.12	0.01	0.03	0.74	0.91	0.92	0.52	not rejected

Table 6. **Portfolio beta stability using Student's t distribution**

Table 7. **Portfolio Beta Stability Using Spearman Rank Correlation Test**

No of Securities per portfolio	Consecutive market Phases			Non-consecutive market Phases		
	Bull 1 with Bear1	Bull 2 with Bear2	Bear 1 with Bull2	Bull 1 with Bull2	Bear 2 with Bear2	Bull 1 with Bear2
5.00	-2.44	5.69*	-0.62	-10.35**	1.95	-1.41
5.00	1.89	-1.78	-4*	-2.06	-3.76*	-2.21
5.00	1.03	-1.71	0.54	1.89	-0.59	2.24
10.00	-5.77**	2.7*	0.23	-18.24*	1.42	-11.68**
10.00	-4.54**	3.13*	0.87	-6.62**	3.99**	-1.51
10.00	-1.61	-0.51	2.29*	2.20	2.06	1.73
20.00	-14.83**	8.08**	-1.58	-32.18**	3.44**	-20.56**
20.00	-12.51**	14.14**	4.19**	-14.66**	12.84**	3.09**
20.00	1.42	-4.12**	1.39	4.17**	-1.22	-0.38

*Note:**Significant at 5% and ** Significant at 1%.

References:

No of portfolio	Consecutive market phases			Non-consecutive market phases		
	Bull 1 with Bear1	Bull 2 with Bear2	Bear 1 with Bull2	Bull 1 with Bull2	Bear 1 with Bear2	Bull 1 with Bear2
9	0.52	0.47	0.25	0.50	0.10	0.75*

Note:*Significant at the 5% level.

1. *Sharpe, W.* (1963). A Simplified Model for Portfolio Analysis, Management Science, 9 (2).

2. *Bartholdy, J., Peare, P.* (2001). The Relative Efficiency of Beta Estimates, http://ssrn.com/abstract=263745.

4. *Brener, M., Smidt, S.* (1977). A Simple Model of Non-Stationarity of Systematic Risk, Journal of Finance, 32(4).

5. *Das, S.* (2007). Testing the Stability of Beta over Market Phases: An Empirical Study in the Indian Context, http://ssrn.com/abstract=1031389.

6. *Estrada, J.* (2000). The Cost of Equity in Emerging Markets: A Downside Risk Approach, Emerging Markets Quarterly, 4.

7. *Fabozzi, F., Francis, J.* (1977). Tests for Alphas and Betas over Bull and Bear Market Conditions, Journal of Finance, 32(4).

8. *Gooding, A., O'Malley, T.* (1977). Market phase and the Stationarity of Beta, Journal of Financial and Quantitative Analysis, Vol. 12, No.5.

9. *Gujrati, D.* (2004). Basic Econometrics. (4th ed.). New Delhi: McGraw-Hill.

Стаття надійшла до редакції 07.09.2012.