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Dual Beta Modeling of Karachi Stock Exchange

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Abstract
In the past three decades, the documentation of many features of returns in equity market has been noticed. But less attention has been paid to the feature attacks more commenting else, namely that there are extensive periods of time when equity prices rise and fall colloquially, these periods of time referred to as bull and bear markets respectively. The purpose of this research is to study the betas in the bull and bear market condition for a sample of stocks in the Karachi Stock Market (KSE), major stock market in Pakistan. The data consist of daily returns of two major sectors (Petroleum & Commercial banks) of KSE during the period of February 1997 to December 2007. The data pertains to the daily adjusted closing prices of 15 scripts that form a part of KSE index. This paper investigates whether betas of bull and bear market are statistically different from each other? KSE does not integrate any distribution so we use t-statistics. Analysis shows that beta is higher when the market is bearish than that when market is bullish for nine stocks while the reverse is true for other six stocks.
Keywords: Portfolio Beta, Portfolio Returns, KSE, Dual Beta

1. Introduction

Money and property are two of the few things people sacrifice their lives for. In the presence of risk, it is a challenging task to forecast the expected returned on investment for an ordinary investor. For this purpose, different models and techniques are used. A basic model called the capital asset pricing model (CAPM) developed by Markowitz (1959), which is a benchmark, for academics. Later, theorists like Sharpe (1964) and Black (1972) introduced multiple version of CAPM that risk measure beta for a specific stock is defined as being the covariance between stock return and market return per unit variance of market return. The basis of CAPM is that the return, received by an investor is in proportion with the level of risk. The past fifty years have borne witness to a proliferation of empirical studies, testing the validating CAPM and beta stability. Jones [1998] deduced, "Beta enables us to find out the fluctuations in price of a share, along with determining the relative movement of share portfolio to the market portfolio"

In 1974, levy proposed that beta may be variable with market condition. That is because orthodox CAPM does not estimate well when market's condition change. Fabozzi and Francis (1977) came up with three alternative definitions for bull and bear market conditions and calculate the approximate stability of beta over market conditions. They took help from a market conditions. A sample of about 700 stocks in Newyork Stock Exchange (NYSE) was taken and calculated whether the beta were significantly different in bull and bear conditions during 1966–1971. It concluded no significant difference exists between the three definitions. Beta for mutual fund has been studied by Fabozzi and Francis (1979) and concluded that it generally react different to bull and bear markets. It was pointed the fact that mutual fund managers do not grow or shrink beta during bull and bear conditions prevails, to earn different premium.

It has been discussed by Kim and Zumwalt (1979), Chen (1983) that the unsettled risk in the market model proves to be more suitable than the constant risk when the market condition are taken into account. Wiggins, J.B. (1992) discovered that high beta stocks in the past trend have higher systematic risk during rising market than during dropping market. There was no clear conclusion that was agreed upon by Chan and Lakonishok (1993) regarding whether to credit or discredit beta's role in explaining stock returns. In another conducted research that tested the claim that beta is no longer useful in explaining stock returns, Grundy and Malkiel (1996) replicated Fama and French's techniques and used a time frame similar to their study. Grundy and Malkiel (1996) concluded that, there is a clear relationship between beta and returns when there is a decline in a market, and for that reason beta is a useful tool in declining markets.

A consistent and significant relationship between the two, beta and returns, for the entire sample and for sub-periods was given by Sundaram and Mathur (1995). Another significant correlation is found by Harris and Spirey (1990) who claim to know the percentage decline in stock prices on the crash day and historical beta coefficients of the stocks. Chinebell et al. (1993) studied that for two out of three bulls and bears market definition, there is vast difference between upside and downside beta. Dufee (1995) discovered that the volatility of the market goes down when market is declining while Campbell et al.(2001) observed something entirely contrary. Bai and Perosn (2003), another group of theorist, found that there are asymmetric betas in majority

cases.

In this paper, we emphasize on the dual nature of betas of 15 different securities of only two major sectors i.e. Petroleum and Commercial banks, and test whether two betas are significantly different from each other or not. This study will cover, the duration of time between Feb 1997 to Dec 2007 approximately 10 years. We refrain from including 2008 because of global recession, in KSE-100 index was down to 3300 points from 9187 points to 5865 points in just 13 trading sessions only. Afterwards, the points jumped from 5707 points to 8345 points in just 19 trading sessions.

2. Research Methodology

The study has focuses upon the calculation of two betas of fifteen companies depend on market conditions and test the statistical significance whether these two betas of same stock are different from each other or not? The CAPM model claim that the average return for any asset is the function of the average market return;

$$R_i = \alpha + \beta.R_m + \varepsilon_i \quad (1)$$

Where R_i is return of i^{th} security, R_m is market return and α is the intercept representing average abnormal return. The gradient, β represents the systematic risk or beta of the i^{th} security. ε_i is normally distributed error term with the mean zero.

Classical static beta model may not be reliable because risk measure beta is constant, which is an unrealistic assumption. The constant beta model has been criticized for several reasons, i.e. the investigating influence of constant beta model, has been establish too low, as it depend on a single beta for decision and uses market returns for calculation of returns. Beta has different values depending on market conditions, estimating the return by using asymmetric beta is more reliable as compare to static beta model. (Figure 3 shows the difference between constant and dual beta models).

3. Dual Beta Model

The dual beta model is represented by the equation,

$$R_i = \alpha_1 + \alpha_2.D + \beta_1.R_m + \beta_2.R_m.D + \varepsilon_i \quad (2)$$

Where α_2 is the difference between bull and bear is market alpha $(\alpha_{bull} - \alpha_{bear})$ and β_2 is the difference between bull and bear market betas $(\beta_{bull} - \beta_{bear})$. Also α_1 and β_1 are the estimators.

So this equation (2) can be expressed as ;

$$R_i = \alpha_{bull} + (\alpha_{bull} - \alpha_{bear}).D + \beta_{bear}.R_m + (\beta_{bull} - \beta_{bear}).R_m.D + \varepsilon_i \quad (3)$$

Where R_i and R_m is same as mention above, and D is a Dummy variable whose value is one when $R_m > 0$ otherwise zero.

The dual beta model gives the possibility to investigate β_2 which represents $(\beta_{bull} - \beta_{bear})$ is statistically different from zero. This means that we are able to investigate if average abnormal returns and systematic risk differ between bear and bull market conditions. We are interested in this research, whether beta is stable between the market states; in the context of this Dual-Beta CAPM framework a additional tests can be performed to test for the equality of the up-market and down-market betas

$$H_o : \beta_{bull} = \beta_{bear} \quad (4)$$

Therefore we will test β_2 by a standard t-test, if H_0 is rejected at a reasonable confidence level, the security has a statistically significant bull and bear beta. The t-statistics for testing these hypotheses can be expressed as follows

$$t = \frac{\beta_2}{SE_{\beta_2}} \quad (5)$$

where SE_{β_2} is the standard deviation of errors.

4. Data and Sample

Karachi Stock Exchange (KSE) is considered as a main financial market of Pakistan. An econometric analysis is to be performed in the study which is based on the data of fifteen firms listed on KSE market for the period of 131 months, which has not been covered in any other study. These 15 firms were nominated out of the total of 66 firms. In the selecting of the firms there was a criteria consisting of following points:

1) Companied that have continuous listing on exchange for the whole period of analysis
2) Data covers two most important sectors, and

3) Companies' possess high average turnover while the analysis being conducted.

Stock and share prices for this study have been adapted from Bloomberg. The observations are branched into two sub groups, keeping in mind whether market return is negative (market goes down) or positive (market rises).

5. Discussion of Results

The data used in this study is the daily adjusted price relatives of the 15 securities of Karachi Stock Exchange's, giving 2845 observations. A continuously compound percentage returns series for each industry and the market index was calculated as the difference of the of the prices relative to initial price. The empirical finding of this research are expressed in form of graphs, which shown below. Figure A shows the index level of KSE. The price level are somehow stationary before 2002 but after that it is totally non-stationary. It also show that there is a dramatic increasing trend after 2002 as Pakistan is the one of the front line supporters of war against terrorism so western aid attracts investors to invest in security market .

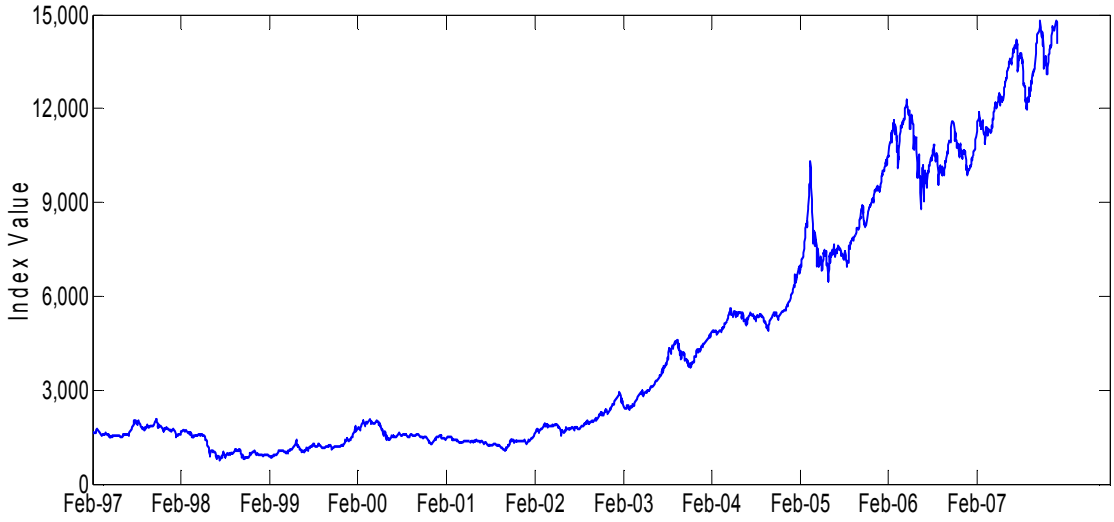

Figure AThe market index of KSE for 131 months

The returns of the market, showed in figure B are stationary. Figure B also show that KSE is generally a high volatile market. Market went into depression and in the process of early 1997. From the period of August 1997 to April 2000 is the peak period of returns and was go along with by a high level of risk as well. From 2001 it shows that market is smooth till 2007.

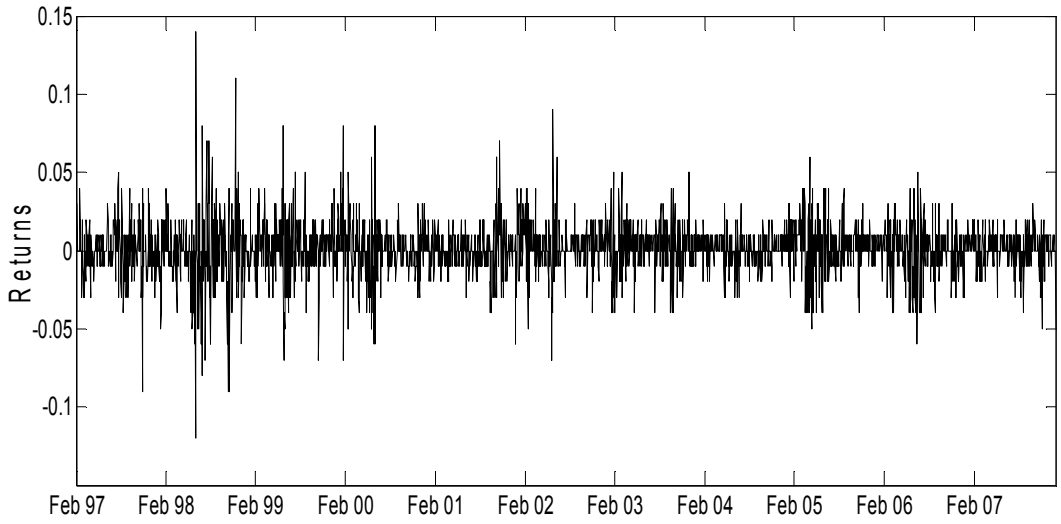

Figure BReturns of KSE-100 index

Some descriptive statistics for the returns data for each of the 15 securities and the KSE market index are in Table A. In keeping with other studies of financial time series all 16 return series (15 securities + KSE itself) are

leptokurtotic and exhibit positive skewness except KSE which has negative skewness.

Over these securities The Bank of Punjab Limited (BOP) and Muslim Commercial Bank Limited (MCB) offered the highest and the Pakistan State Oil Co. Ltd. (PSO) the lowest mean return over this period. The standard deviation was highest for the NIB Bank Limited and lowest for Bank AL-Habib Limited, Sonari Bank Limited and SHEL Pakistan. The constant risk market model beta estimate was highest for the BOP and lowest for the HMB.

6. Conclusion

In this paper the relationship of average abnormal returns and systematic risk differ between bear and bull market conditions is empirically tested. The sample of fifteen listed companies on Karachi stock Exchange was taken. Dual Beta model was used to find out the relationship of average abnormal returns and systematic risk. We found that nine out of fifteen stocks has significantly different betas. Results provided are somewhat mixed, indicating a rise in the beta in some cases and a fall in other cases. In petroleum sector; all securities shows the significance difference between bullish and bearish beta while in banking sector, three out of eight securities reject the hypothesis.

On the basis of our empirical analysis we can conclude that there is a statistically significant relationship between risk return and asymmetric beta. Our results are consistent with the previous studies conducted to assess the risk return beta relationship. Future research might be conducted by segregating other sectorial representations in the KSE-100 index.

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Table 1 Summary Statistics of Daily Stock Returns of Companies included in the sample

Name of Company	Symbol	Mean	Variance	Kurtosis	Skewness
Askari Bank Ltd.	AKBL	0.13%	0.09%	78.57	2.69
Attock Refinery Ltd.	ATRL	0.14%	0.06%	30.46	0.77
Bank AL-Habib Limited	BAHL	0.17%	0.14%	10.77	0.13
Bank Of Punjab Limited.	BOP	0.10%	0.09%	12.07	0.78
Faysal Bank Limited	FABL	0.15%	0.07%	26.55	0.73
Habib Metropolitan Bank Limited	HMB	0.17%	0.09%	5.48	0.05
Mari Gas Company Limited	MARI	0.14%	0.15%	6.04	0.68
MCB Bank Limited	MCB	0.12%	0.06%	21.75	0.34
National Refinery Ltd.	NRL	0.12%	0.07%	30.12	1.16
NIB Bank Limited	NIB	0.12%	0.08%	38.08	2.18
Pakistan Oilfields Ltd.	POL	0.15%	0.11%	98.46	4.78
Pakistan Refinery Ltd.	PRL	0.15%	0.08%	23.29	2.03
Pakistan State Oil Co. Ltd.	PSO	0.11%	0.10%	11.30	0.39
Shell Pakistan Limited	SHEL	0.06%	0.08%	30.17	0.21
Sonari Bank Limited	SNBL	0.08%	0.06%	13.29	0.08
Karachi Stock Exchange	KSE 100	0.09%	0.03%	5.77	-0.18

Table 2 Estimators in constant beta model mentioned in Eq. (1)

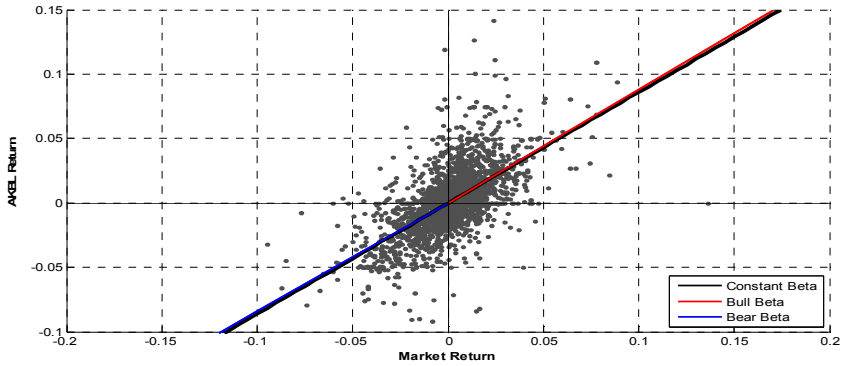
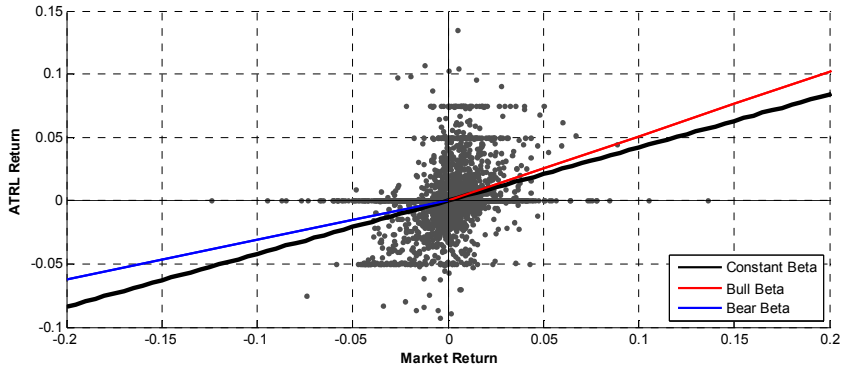
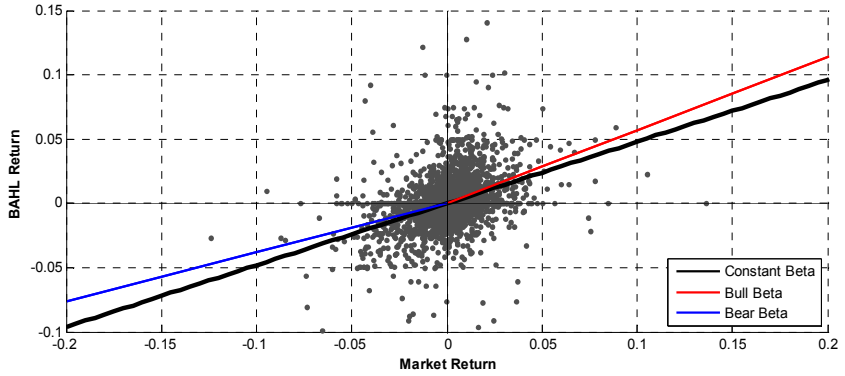
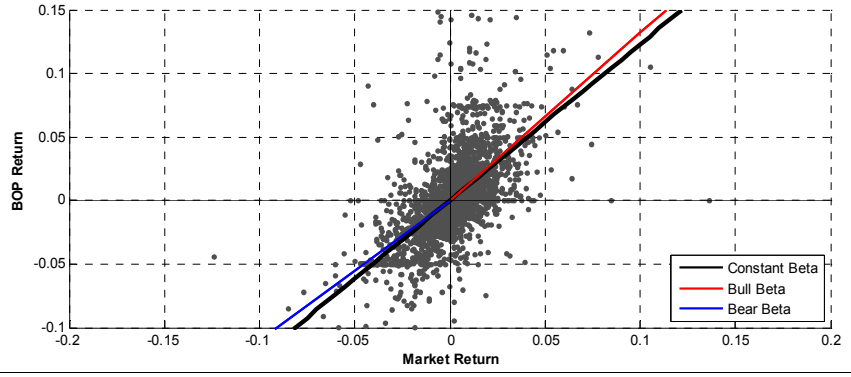
Stocks	AKBL	ATRL	BAHL	BOP	FABL	HMB	MARI	MCB	NIB	NRL	POL	PRL	PSO	SHEL	SNBL
α	0.00 (0.96)	0.00 (1.64)	0.00 (2.13)	0.00 (1.10)	0.00 (0.51)	0.00 (2.41)	0.00 (1.50)	0.00 (1.52)	0.00 (1.10)	0.00 (1.49)	0.00 (1.93)	0.00 (1.13)	0.00 (-0.81)	0.00 (0.36)	0.00 (1.92)
β	0.86 (30.13)	0.42 (15.55)	0.48 (19.02)	1.23 (37.16)	0.86 (29.65)	0.34 (12.13)	0.53 (18.45)	1.16 (47.10)	0.73 (18.44)	0.65 (18.78)	0.63 (22.47)	0.54 (16.27)	1.07 (45.79)	0.72 (29.73)	0.44 (17.52)

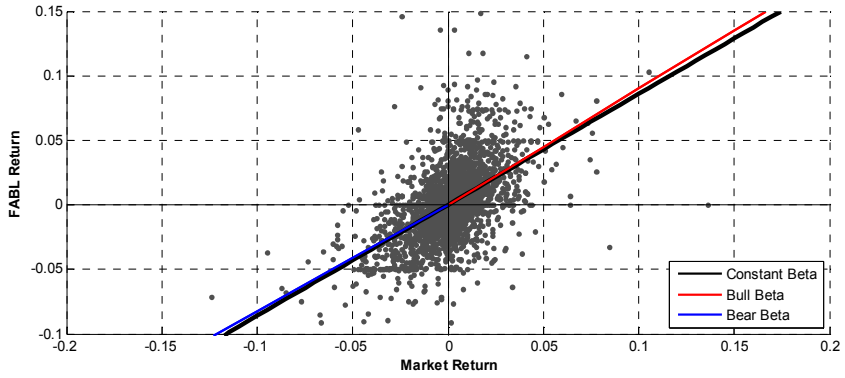
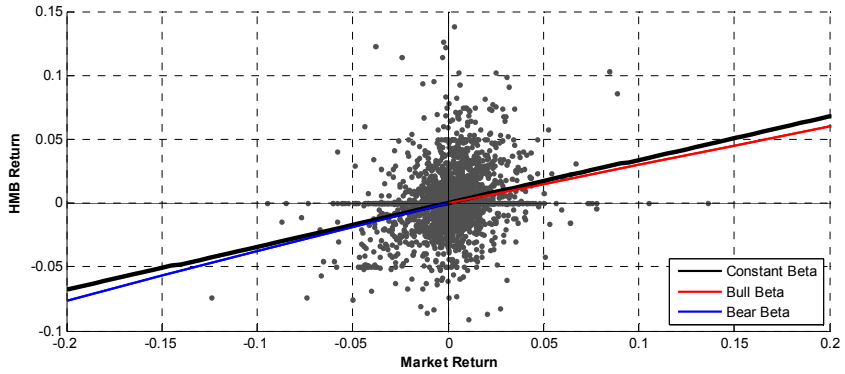
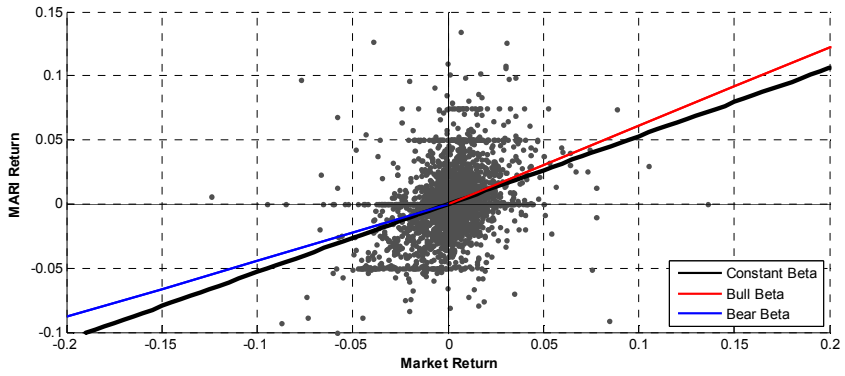
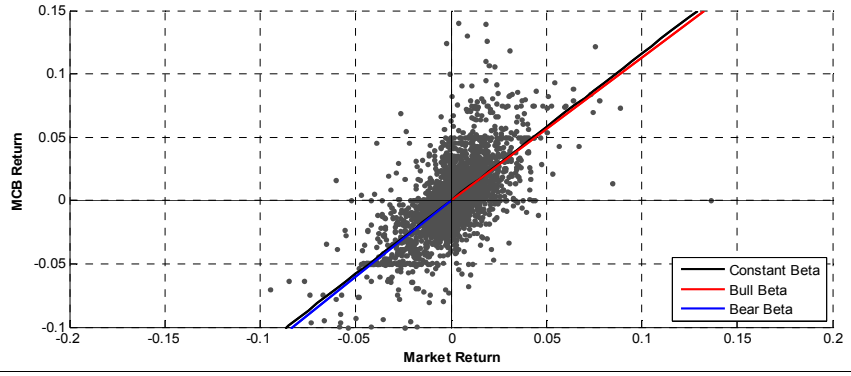
Table 34 Estimators of betas in dual beta model mentioned in Eq. (3)

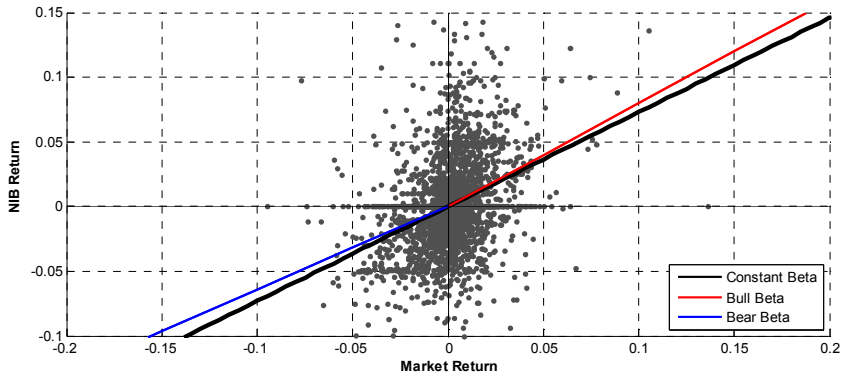
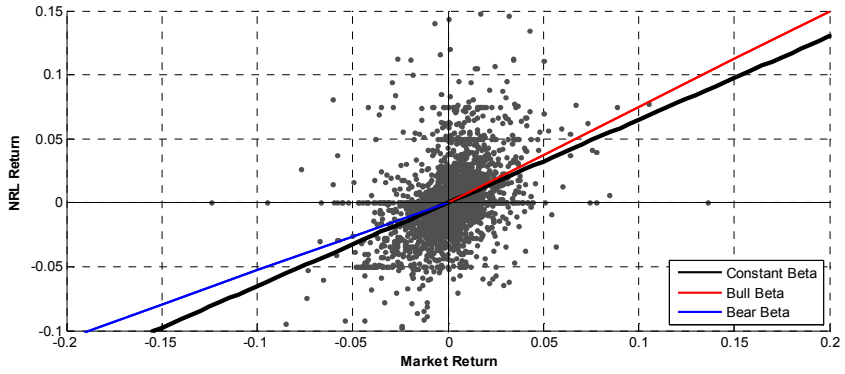
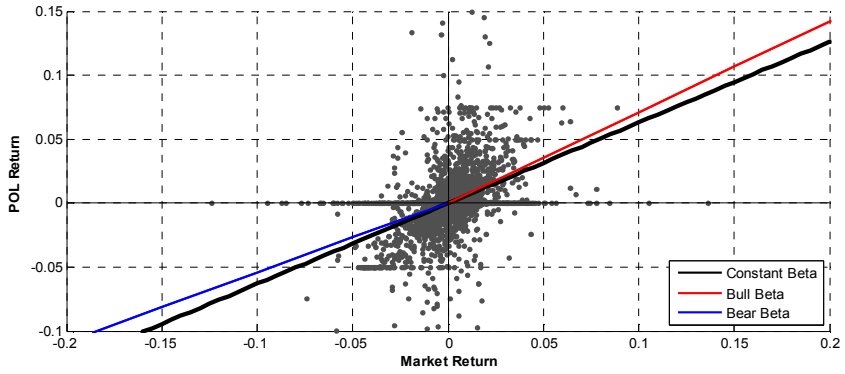
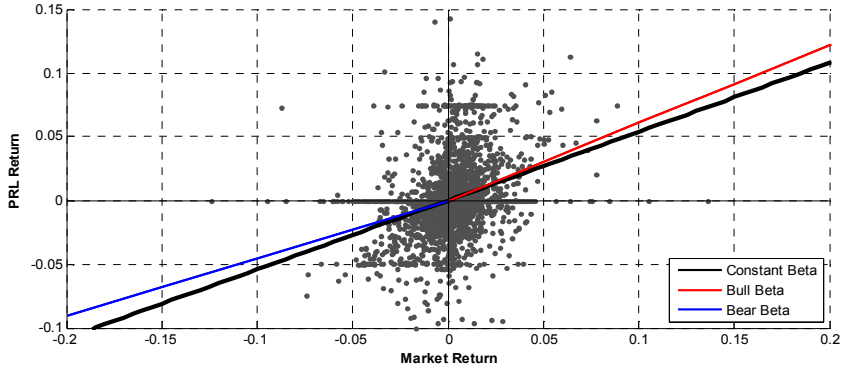
Stocks	AKBL	ATRL	BAHL	BOP	FABL	HMB	MARI	MCB	NIB	NRL	POL	PRL	PSO	SHEL	SNBL
α_1	0.00 (0.74)	0.00 (-0.10)	0.00 (0.30)	0.00 (-0.68)	0.00 (0.13)	0.00 (0.67)	0.00 (0.80)	0.00 (1.66)	0.00 (-0.29)	0.00 (0.06)	0.00 (0.78)	0.00 (-1.55)	0.00 (-1.57)	0.00 (0.14)	0.00 (-0.50)
α_2	0.00 (-0.27)	0.00 (1.03)	0.00 (0.88)	0.00 (1.37)	0.00 (0.09	0.00 (1.09	0.00 (-0.13)	0.00 (-0.83)	0.00 (1.01)	0.00 (0.76)	0.00 (0.19	0.00 (2.58	0.00 (0.86)	0.00 -0.17	0.00 (1.94)
β_1	0.84 (19.94)	0.31 (7.81)	0.38 (10.13)	1.10 (22.67)	0.82 (18.98	0.38 (9.19	0.44 (10.45)	1.20 (32.91)	0.64 (10.98)	0.53 (10.37)	0.54 (13.01	0.45 (9.13)	0.93 (27.07)	0.64 17.99	0.40 (10.76)
β_2	0.04 (0.67)	0.20 (3.64)	0.19 (3.71)	0.22 (3.34)	0.09 (1.50	-0.08 (-1.44	0.16 (2.83)	-0.06 (-1.28)	0.16 (1.96)	0.22 (3.16)	0.17 (3.02)	0.16 (2.34)	0.26 (5.51)	0.15 (3.00)	0.07 (1.33)
β_{bull}	0.88	0.51	0.57	1.32	0.90	0.30	0.61	1.13	0.80	0.75	0.71	0.61	1.19	0.79	0.47
β_{bear}	0.84	0.31	0.38	1.10	0.82	0.38	0.44	1.20	0.64	0.53	0.54	0.45	0.93	0.64	0.40
99%	0	1	1	1	0	0	1	0	0	1	1	1	1	1	0

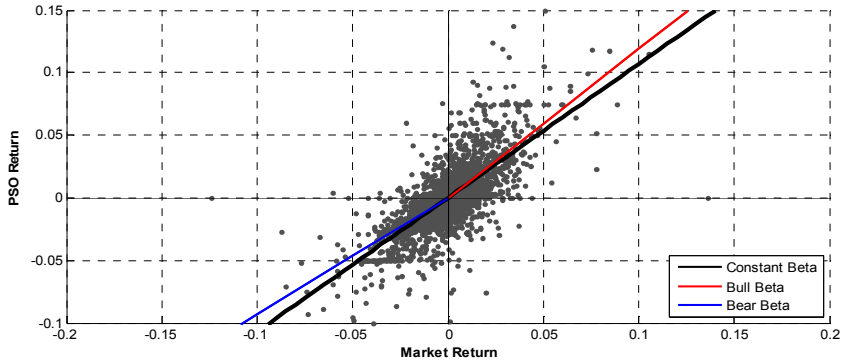
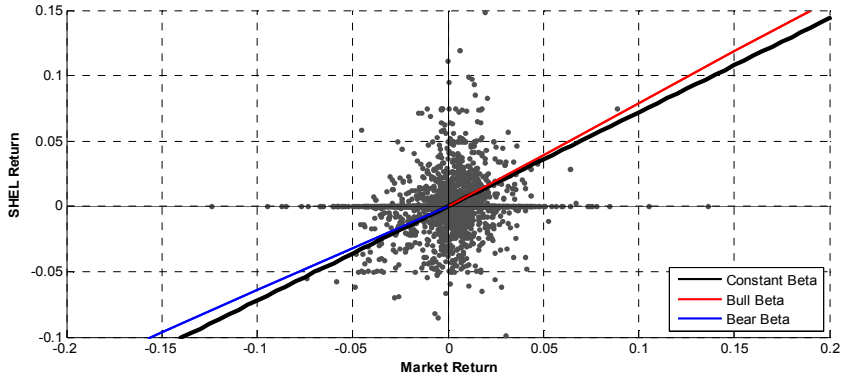
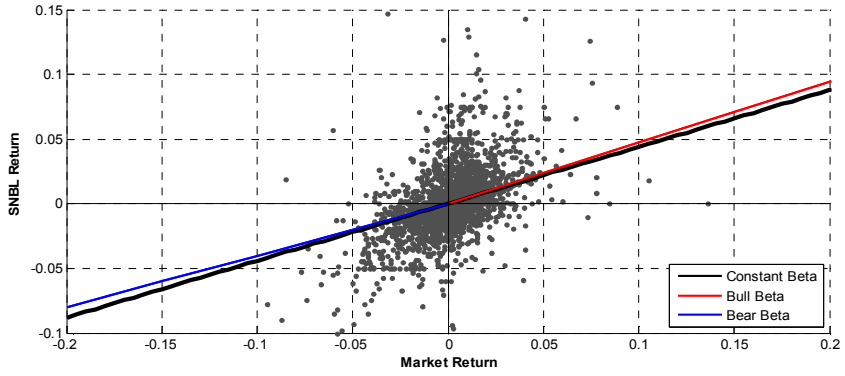
Note: Where "0" represent there is no significance difference between bull and bear betas
"1" shows that there is a difference in bull and bear betas

Figure 3: Graphs show the comparative analysis of constant beta and dual betas models for 15 selective securities listed in KSE

1	AKBL	
2	ARTL	
3	BAHL	
4	BOP	

5	**FABL**	
6	**HMB**	
7	**MARI**	
8	**MCB**	

9	**NIB**	
10	**NRL**	
11	**POL**	
12	**PRL**	

13	**PSO**	
14	**SHEL**	
15	**SNBL**	

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