ASYMMETRIC RESPONSES OF CAPM - BETA TO THE BULL AND BEAR MARKETS ON THE BUCHAREST STOCK EXCHANGE

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ABSTRACT: *The CAPM - beta is one of the most used tools to estimate the systematic risks associated to stock. In the last decades different behaviours of beta were revealed for the circumstances of the bull and the bear markets. This paper analyses the CAPM – beta responses for bad and good news for ten representative stocks from the Bucharest Stock Exchange. We identify the bull, the bear and the tranquil markets using a univariate kernal density function and we calculate for each stage the single and the multifactor CAPM betas. We conclude that for most of the stocks CAPM betas are the largest in the bear conditions and they are the least in the bull markets conditions.*

KEY WORDS: *CAPM - betas, Bucharest Stock Exchange, Bull and Bear Markets, Systematic Risk, Kernal Estimation*

1. INTRODUCTION

Since the discovery, five decades ago, by the Markowitz (1959) of the portfolio optimization model, several attempts were made to evaluate the financial assets price taking into consideration their risks and returns. The works of Sharpe (1964), Lintner (1965) and Black (1972) lead to the development of the Capital Asset Price Model (CAPM), which arrived as one of the most important tools for the investment decision making.

The classical Capital Asset Price Model is based on the equation:

$$E\ (R_i) = R_f + [E\ (R_M) - R_f]\ \beta_{IM} \qquad (1)$$

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where:
$E(R_i)$ - the expected return of an asset i;
R_f - the risk free rate;
$E(R_M)$ - the expected return of the market;
β_{IM} - a coefficient, commonly known as beta, which reflects the sensitivity of the expected return of the asset to the difference between the expected return of the market and the risk free rate.

The beta coefficient associated to a financial asset is considered as an expression of its systematic risk. In practice beta of an asset is usually calculated by regressing the historical values of the asset returns and the market returns.

Several studies revealed the instability of CAPM beta conditions. Some of them indicate different behaviors of the financial assets returns in the presence of the good news, associated to a bull market and bad news, associated to a bear market.

The estimation of the asymmetric responses of CAPM beta to good and bad news is useful, especially when the bull market alternates frequently with the bear market. In Romania, where the financial markets could be still considered as emerging, the evaluation of assets in a CAPM framework with beta instability is not very used. In this paper we try to find if CAPM - beta for ten of the most liquid stocks from the Bucharest Stock Exchange (BSE) responded asymmetrically to good and bad news during the first semester of 2009.

The rest of this paper is organized as follows. In the second part we approach a literature review in the domain. The third part describes briefly the data and the methodology used in our investigation. The fourth part reports and analyzes the empirical results and the fifth part concludes.

2. LITERATURE REVIEW

The asymmetrical responses of CAPM - beta to the market conditions were approached in several studies. Levy (1974) proposed the calculation of distinct betas for bull and bear markets. Roll (1977) found the market conditions could significantly affect the values of the beta assets. The stability of betas over bull and bear markets was tested for the first time by Fabozzi and Frances (1977). They found no evidence to prove the betas sensitivity to the market conditions, but later studies doubt that conclusion. Braun et al (1995) proved the different behavior of betas in the good news and bad news circumstances. Cho and Engle (1999) found that news affected asymmetrically the betas. Ang and Chen (2003) analyzed CAPM for the US equity market from 1926 to 2001, concluding that betas are sensitive to the markets circumstances. One of the main tasks in analyzing the asymmetric responses to the good and the bad news consists in describing the bull and the bear markets. Fabozzi and Francis (1977) defined these market conditions in terms of positive or negative returns. Lunde and Timmermann (2000) studied the bull and the bear markets using functions of termination probabilities. Pagan and Sossounov (2000) analyzed the bull and the bear markets using data generating process in combination with various time series models. Granger and Silvapulle (2002) applied a bivariate kernal density function of a stock and market returns to separate, by quantile estimation, the markets conditions. Recently, Mahieu et al (2009) used a Bayesian approach to delimitate the bull from the bear markets.

3. DATA AND METHODOLOGY

In our investigation we use data from a reference index of BSE called BET. This index is calculated based on the ten most liquid companies listed on BSE and it would be considered as an expression of an efficient market portfolio. We use also, as data, the prices of the ten stocks aggregated in the BET index. Our sample includes daily values from 20th of January to 20th of July provided by BSE. From the stock prices we obtain daily returns computed as:

$$R_t = 100 \text{ x } [\ln (P_t) - \ln (P_{t-1})] \tag{2}$$

where:
R_t - the return at time t;
P_t - the price at time t;
P_{t-1} - the price at time t-1.

As a term of comparison we calculated first the betas of all ten stocks, ignoring the asymmetric responses to the bull and bear markets. We use the following equation:

$$R_t = \alpha + \beta \, Rm_t + u_t \tag{3}$$

where:
Rm_t - the market return at time t;
u_t - an error term, $u_t \sim N(0, \sigma^2)$.

We identify tranquil, bull and bear markets using, as Granger and Silvapulle (2002) suggested, a univariate kernal density function.

We apply the normal reference rule proposed by Silverman (1986) to obtain kernal density estimation. Then we employ a technique developed by Hyndman (1996) to compute an adequate Higher Density Regions (HDR). We split the BET index returns into three intervals: the central part, associated to tranquil market conditions which represent middle 100 (1 – p) % HDR; the left tail, representing the bear market conditions; the right tail, associated to the bull market conditions.

We make the distinction between the three intervals using two quantiles: Q_p - the p per cent quantile and Q_{1-p} - the (1 – p) per cent quantile.

Based on the two quantiles we define three dummy variables:

- a dummy variable corresponding to the bear market, defined by:

$$D_1 = 1 \text{ if } Rm_t < Q_p \text{ or } 0 \text{ otherwise} \tag{4}$$

- a dummy variable corresponding to the tranquil market, defined by:

$$D_2 = 1 \text{ if } Q_p \leq Rm_t < Q_{1-p} \text{ or } 0 \text{ otherwise} \tag{5}$$

- a dummy variable corresponding to the bull market, defined by:

$$D_3 = 1 \text{ if } Rm_t > Q_{1-p} \text{ or } 0 \text{ otherwise} \tag{6}$$

The three dummy variables are included in a model assigned to capture asymmetric responds of betas to the bull and bear markets:

$$Rt = \alpha + \beta_1 D_1 Rm_t + \beta_2 D_2 Rmt + \beta_3 D_3 Rm_t + u_t \quad (7)$$

where:
β_1 are betas corresponding to the bear market conditions;
β_2 are betas corresponding to the tranquil market conditions;
β_3 are betas corresponding to the bull market conditions.

The parameters of the equation (7) are estimated using the OLS method.

4. EMPIRICAL RESULTS

We compute the daily returns of BET and the ten stocks. The BET returns are in the range of -8.98 to 6.58, while the ten stocks returns are in the range of -16.3 to 14.0. BET and the most of the ten stocks daily returns exhibit significant standard deviation, skewness and excess kurtosis (the descriptive statistics are presented in table 1).

Table 1. Descriptive Statistics of BET and the Ten Stocks Returns

Stock	Min.	Max.	Mean	Std. Dev.	Skewness	Ex. Kurtosis
Bet	-8.9825	6.5783	0.23228	2.8660	-0.37760	0.28211
Azomures	-15.942	13.976	0.36688	5.2028	0.44088	1.3935
S.S.I.F. Broker	-16.251	13.959	0.50241	6.9422	-0.070411	0.63501
Impact Developer	-16.164	13.858	0.61096	5.6346	-0.26858	1.4184
Biofarm S.A.	-13.353	13.641	0.68542	4.6036	0.22743	1.4325
Transelectrica	-10.536	10.798	0.082726	2.9381	-0.064962	2.2466
S.N.T.G.N. Transgaz	-8.0421	10.037	0.25422	2.5910	0.35337	3.5068
Rompetrol Rafinare	-10.763	13.976	0.42529	4.0481	0.13053	0.74702
Banca Transilvania	-11.152	13.235	0.037821	4.4750	0.24509	0.88883
BRD - GSG	-14.183	13.976	0.066181	4.2853	-0.50437	1.5725
Petrom	-8.7647	10.622	0.23161	3.5629	0.22579	0.26261

We calculate, using the OLS method, the single factor CAPM - betas (β) for the ten stocks. They are in the range of 0.60 to 1.02 (the values of single factor CAPM - betas for the ten stocks are reported in the Table 2).

In order to identify the bear, the tranquil and the bull market conditions we computed 90% HDR of the univariate kernel density function and we established the three dummy variables: D_1, D_2 and D_3. Then we calculated, using the multiple factor CAPM equation, the betas for bear (β_1), tranquil (β_2) and bull market (β_3) conditions (their values are presented in table 2).

For six of the ten stocks the bear market betas exceeded the values of the tranquil market betas or the bull market betas. For three stocks the maxim beta occurred for tranquil market conditions while for the one stock the maxim beta occurred for bull market.

Table 2. CAPM -betas for the ten stocks

Stock	Single factor CAPM-betas (β)	Bear market CAPM-betas (β_1)	Tranquil market CAPM-betas (β_2)	Bull market CAPM-betas (β_3)
Azomures	0.86927	1.2176	1.0355	0.4258
S.S.I.F. Broker	1.259	1.5167	1.7343	0.80261
Impact Developer	1.438	1.5221	1.0176	1.4218
Biofarm S.A.	1.1058	1.3573	0.51258	0.92507
Transelectrica	0.73640	0.87470	0.75159	0.57698
S.N.T.G.N. Transgaz	0.59987	0.57443	0.81508	0.5864
Rompetrol Rafinare	1.0273	1.1585	0.56194	0.96326
Banca Transilvania	0.92461	0.81433	0.88669	1.0595
BRD - GSG	1.2880	1.5523	0.87016	1.064
Petrom	0.97269	0.76063	1.1823	1.1783

The mean of single factor CAPM-betas (β) is less than the mean of the bear market CAPM-betas (β_1) but larger than the mean of tranquil market CAPM-betas (β_2) and the mean of the bull market CAPM-betas (β_3). For all four types of betas the standard deviations are significant (the descriptive statistics are presented in table 3).

Table 3. Descriptive Statistics of CAPM - betas

Betas	Min.	Max.	Mean	Std. Dev.
Single factor CAPM-betas (β)	0.599875	1.43840	1.02217	0.258731
Bear market CAPM-betas (β_1)	0.574438	1.55234	1.13489	0.357704
Tranquil market CAPM-betas (β_2)	0.512588	1.73432	0.936794	0.347875
Bull market CAPM-betas (β_3)	0.425860	1.42189	0.900479	0.306237

5. CONCLUSIONS

In this paper we studied the CAPM - betas of ten stocks considered as representative for the Bucharest Stock Exchange. We used daily returns stocks from the first semester of 2009 to calculate single and multifactor CAPM - betas. We identified by a univariate kernal function three stages of the markets: bearish, tranquil and bullish. It resulted that for most of the ten stocks CAPM - betas are largest in bear market conditions and the least in the bull market conditions. The mean of the bear market CAPM - betas is 1.135 in comparison with 0.937 for the tranquil CAPM - betas, 0.900 for the bull CAPM - betas and 1.022 for single factor CAPM - betas. This situation reflects asymmetrical responses of CAPM - beta to the bad and good news on the markets. It could be explained by the optimistic perceptions of the investors on the *bull* market and rather pessimistic perceptions of the investors on the *bear* market.

From this point of view the BSE situation is similar to the one from the developed stock markets. However, in the interpretation of the results we have to take into account the impact of the present global financial crisis which affected the systematic risks of stocks. In the future the research of the CAPM - beta in the bear and bull market conditions should be extended to a larger sample of stocks traded to BSE and to a bigger period of time.

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