

The Correlation in the Global Context of Financial Markets and the Evolution of Emerging Market of Romania Through the Bucharest Stock Exchange

C. Ciora, S. M. Munteanu, and V. Iordache

Abstract—The purpose of this article is verifying the existing relation between BET index (Bucharest Exchange Trading) and the main international stock index during 2005-2010, through correlation coefficients. Design/methodology to achieve the purpose we used econometric methods for calculating the evolution and variations of indexes. Finding –There is a strong link between the stock market in Romania and international markets, which can be quantified through stock market indexes. There is a high level of inter- correlation. Correlation matrix underpins our findings. Practical implications – Knowing the influences between the stock indexes can represent a starting point for investors, for following the international context and evolution which can lead to forecasting certain patterns for the evolution of BET index.

Index Terms— correlation, financial markets, stock index.

I. INTRODUCTION

Economic and financial environment in recent years has been characterized by high instability, leading to increased uncertainty among both investors at the stock market, and the economic and financial analysts. Uncertainty was manifested in particular by the differences between the analysts' forecasts and the reality in the financial sector.

One of the most important roles of the financial system and stock market in particular is that it brings face to face people with a surplus of funds, and those with financial needs. National and international trends and the stability of financial and economic environment influences the performance of companies listed on the stock market.

Stock markets are indicatives of real economies, showing progress in a given period. A comparison of stock indexes is necessary to assess the impact of economic growth and regression periods on the listed companies.

This paper aims to analyze the development of Romanian

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C. Ciora is teaching assistant at the Bucharest Academy of Economic Studies, Department of Economic and Financial Analysis, member of the Romanian Society of Economic and Financial Analysis and member of the International Economics Development and Research Center. (E-mail: costin.ciora@cig.ase.ro).

S. M. Munteanu is teaching assistant at the Bucharest Academy of Economic Studies in the field of efficiency and management (e-mail: sebastianmadalin@yahoo.com).

V. Iordache is a PhD candidate at the Bucharest Academy of Economic Studies in the field of Financial and Economic Analysis. (e-mail: vlad.iordache@yahoo.com).

capital market through BET. BET is the reference index of the Romanian capital market, and was launched on September 19, 1997 with a starting value of 1,000 points, the first index developed by BSE. BET covers the 10 companies which have the most liquid shares listed on BSE, regulated in categories I and II, except for investment companies traded on a regulated market of BSE, investment funds and other entities treated as such.

II. LITERATURE REVIEW

Over time, a number of studies have followed the comparative evolution of indexes for determining quantifiable influences. Correlations related to indexes were followed by authors such as [2] in terms of liquidity and correlations between stock prices changes.

Other authors such as in [11] have pursued the relationship and the correlation between options and capital market. Reference [15] shows the relationship between BET evolution and key macroeconomic variables in Romania: interest rate, inflation and unemployment. Links between stock indexes and exchange rates are brought to the fore as in [3], in a study realized between 1999 and 2007.

Correlations between the BET index and international stock market indexes are an important research topic, but also for practice, through studies and newspaper articles.

III. THE EMPIRICAL ANALYSIS OF ROMANIAN CAPITAL MARKET DEVELOPMENT

A. Developments in international financial markets during 2005-2010

The financial crisis of 2008-2009 profoundly affected the evolution of international capital markets. This resulted in decreases in the stock exchange rates in most listed companies. An investor seeks any information necessary for the development or minimization of its portfolio, market development being a crucial factor. Furthermore, investors follow the developments in international markets, and thus we can find correlations between various indexes.

For an overview, we followed up the following indices:

- BET - main index of the Bucharest Stock Exchange
- DJIA (Dow Jones Industrial Average) - also known as Dow Jones, Dow 30 or Dow is one of the most used indexes, known worldwide. The index was created by Charles Dow, Wall Street Journal editor and founder of Dow Jones & Company. This index follows the evolution of the 30 largest companies traded in the United States of America, and is calculated since

- 1896.
- S & P 500 - was created by Standard & Poor's, one of the most used global indexes together with DJIA, and includes the prices of 500 large companies traded in the United States of America.
- FTSE 100 - is the index of 100 most liquid companies, with the largest market capitalization on the London Stock Exchange, of 81% of the UK capital.
- DAX (Deutscher Aktien Index) - is the main German index of Frankfurt Stock Exchange including 30 large companies traded on that market.
- Nikkei 225 - is the index of the Tokyo Stock Exchange, including 225 Japanese companies, calculated since 1950.
- The performance of these indexes was monitored during 1 January 2005 - 31 December 2010. Fig.1 shows the indexes development.

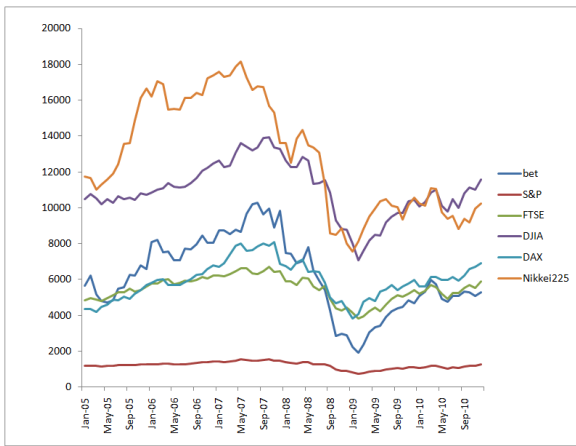


Fig. 1. Performance of stock index between 2005 and 2010

TABLE I: AVERAGE MONTHLY RETURNS FOR 2005-2010

	% BET	% S&P	% FTSE 100	% DJIA	% DAX	% N225
AVG T	0.50%	0.21%	0.37%	0.24%	0.81%	0.00%
AVG (1)	2.23%	0.74%	0.87%	0.81%	1.98%	1.24%
AVG (2)	-6.43%	-2.98%	-2.31%	-2.76%	-2.28%	-2.97%
AVG (3)	4.23%	2.30%	2.07%	2.11%	1.87%	0.86%

where:

AVG T = average monthly return over the period analyzed

AVG (1) = average monthly return over the period January 2005-August 2007

AVG (2) = average monthly return over the period September 2007 - March 2009

AVG (3) = average monthly return over the period April 2009 - December 2010

Average monthly return for the period under review was at similar values (between 0% and 0.81%), reflecting a similar trend in the same direction. BET had a average monthly return of 0.5%.

The period considered is especially important because is reflecting three significant stages:

- increasing evolution of indexes: January 2005 - August 2007 period (1);

- decreasing evolution of indexes: September 2007 - March 2009 period (2);
- increasing evolution of indexes between April 2009 and December 2010(3).

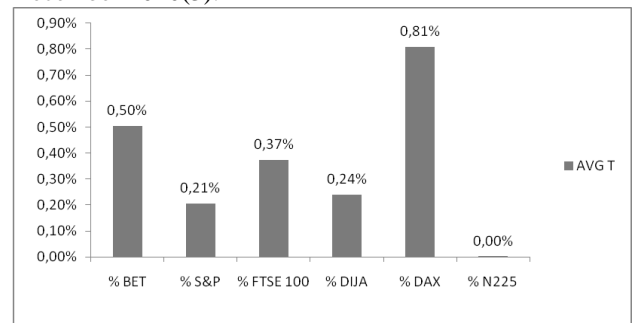


Fig. 2. Monthly average returns of analyzed indexes

On this regard, starting from monthly return, we calculated the total average of the period for each index, and also average return for each period presented above.

The analysis of indexes on periods is needed to see how financial markets have evolved in a time of rising and falling.

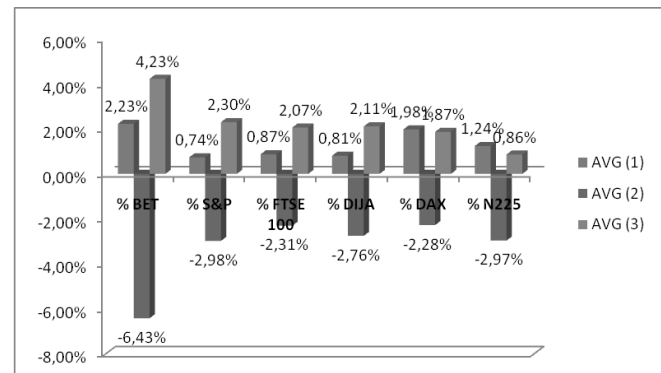


Fig. 3. Average monthly return for the three stages of analysis

Figure 3 presents comparative evolution of the average monthly return for the three periods of analysis. It is noted that BET had a higher development, compared with other presented indexes. Both increases and decreases were amplified in the evolution of BET.

The correlation degree of the Bucharest Stock Exchange with external capital markets is analyzed further by determining the correlation coefficients. This indicator measures the strength of linear relationship between the two analyzed indexes. The correlation coefficient is a dimensionless measurement, which makes possible for the variables values to be expressed in any unit.

The correlation coefficient (r_{yx}) can range between -1 and +1, the sign indicating the type of link: inverse or direct. The correlation coefficient is calculated using the formula:

$$r_{yx} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{n \sigma_x \sigma_y} \quad (1)$$

where:

r_{yx} = correlation coefficient

x = average variable x

y = average variable y

n = number of pairs observations

σ = Standard deviation of variable x or y

Determining the extent to which the BET index responds to changes of analyzed indexes, and hence the change sensitivity of BSE main index at indexes variations is made using the elasticity coefficient. Basically, the coefficient of elasticity is a ratio between the relative change of a variable and the relative change of another variable. The coefficient of elasticity was introduced by A. Marshall in 1890 and is used in the theoretical study of consumer demand.

In our case we will calculate the elasticity coefficients of the evolutions, the ratio of BET's annual return and annual return on stock market index for comparison, according to the formula:

$$Ce = \frac{\Delta BET}{\Delta Ind} : \frac{BET_0}{Ind_0} = \frac{\Delta\% BET}{\Delta\% Ind} \quad (2)$$

where:

Ce = elasticity coefficient between BET and benchmark index

ΔBET = BET absolute change in a year of analysis

ΔInd = absolute change of benchmark index in a year of analysis

BET_0 = closing value of BET index in the first trading day of an year

Ind_0 = closing value of benchmark index in the first trading day of an year

$\Delta\% BET$ = percentage change of BET index in one year of analysis

$\Delta\% Ind$ = percentage change of benchmark index in a year of analysis

B. Comparative evolution of BET and S & P500 index

First we followed up the comparative evolution on BET and S & P500 indexes through monthly returns. From Figure 4. we can observe the increased monthly developments of BET indexes.

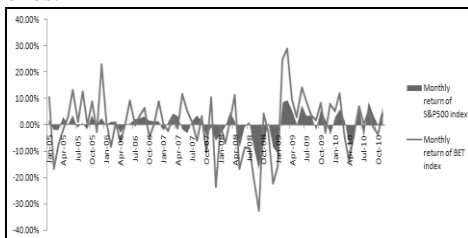


Fig. 4. Comparison between monthly returns of BET and S&P500

From Figure 4, BET high volatility is apparent for the period 2005-2010. In figure 5 we presented the annual returns of two indexes, from which we calculated the elasticity coefficients in Figure 6. If in 2005, BET's annual return was 16.7% in the same year the S & P500 annual return was 5.7%, resulting in a coefficient of elasticity of 2.94. Thus a 1% change in the S & P500 index over a period of one year, reflected in an increased BET with an average of 2.94%. This year the correlation coefficient was 0.7611, indicating an average predictability of the evolution of the Bucharest Stock Exchange. In 2006, the elasticity coefficient value was 1.63 (on a 1% change in S & P500 index, BET has changed 1.63%), while the correlation coefficient value was 0.6482. In 2007, as shown in Figure 5, BET has been much progress over the development of S & P500. Such a change of 3.5% S & P500

index, BET has grown by 22.1%, resulting in a coefficient of elasticity of 6.25. The correlation coefficient for this year was 0.4601 indicating a low correlation between the two indices.

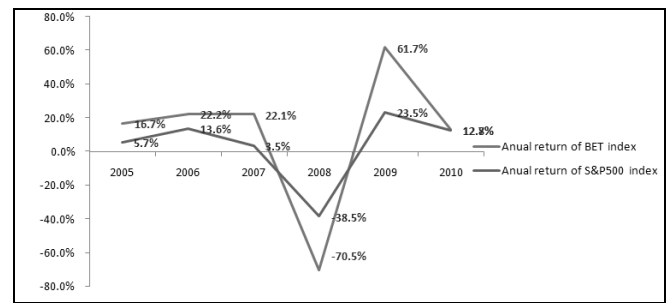


Fig. 5. Comparison between annual returns of BET and S&P500

The correlation coefficient in 2008 was 0.9518 indicating a high correlation, evidence of a level of the coefficient of elasticity, calculated on the basis of annual returns, of 1.83. At a 1% increase of the S & P500 index BET index rose by 1.83%. The year 2008 brought significant decreases in both considered markets; the Bucharest stock market volatility is high. 2010 has brought a different pattern of BET, having approximately the same evolution with the S & P500 index.

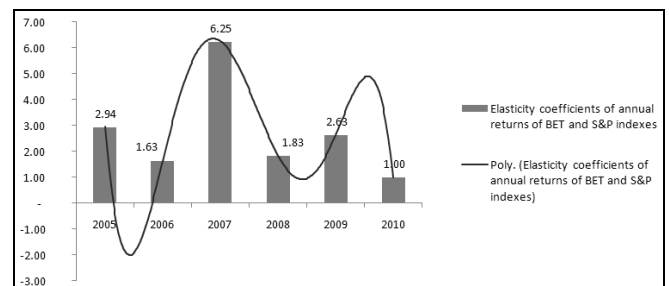


Fig. 6. Elasticity coefficients of BET's annual returns and S & P500 index

C. Comparative evolution of the BET and FTSE index

Next, we compared the BET and FTSE index through absolute values, monthly returns and annual returns as well. London Stock Exchange is one of the most important trading markets and FTSE index expresses the evolution of the most liquid 100 listed companies. The importance of this stock exchange is a starting point for investors to analyze the Bucharest stock market, who use, in my view information concerning the trend on FTSE index.

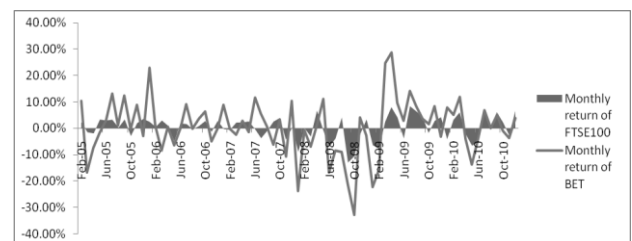


Fig. 7. Comparison between monthly returns of the FTSE index and BET

In 2005, annual returns of the two indexes have similar values (16.7% BET index, the FTSE index 15.8%), with a coefficient of elasticity of 1.06 (on a 1% change in the FTSE index, BET index has changed to 1.06%). In this year the

correlation coefficient was 0.71 indicating an average correlation between the two financial markets. In 2006, BET change was higher than the FTSE index, with an elasticity coefficient of 2.07. This year the correlation coefficient between the two indices was 0.63.

A different situation is found for the first two years in 2007, when the two indexes had a correlation coefficient of 0.38 indicating a decoupling between the evolution of the two indexes. This year, the coefficient of elasticity was 5.81. Thus a 1% change in the FTSE index, changed BET index with 5.81%.

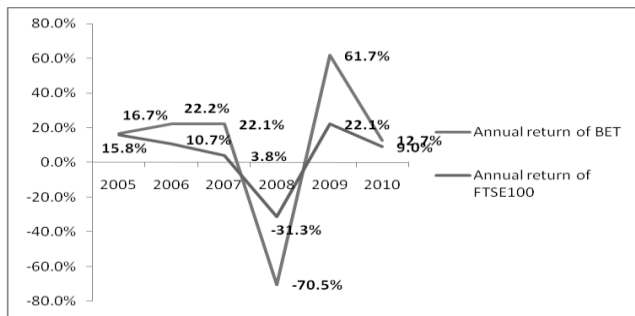


Fig. 8. Comparison between annual returns of the FTSE index and BET

Evolution of the two indexes in 2008 and 2009 aimed restoring the degree of correlation (with correlation coefficients of 0.97 in 2008 and 0.95 in 2009). At the annual returns we find a similar pattern. Thus, a 1% change of the FTSE index, BET index has changed in 2008 to 2.25% and 2.79% in 2009. In 2010, the coefficient of elasticity was 1.42, close to the evolution of the two indexes.

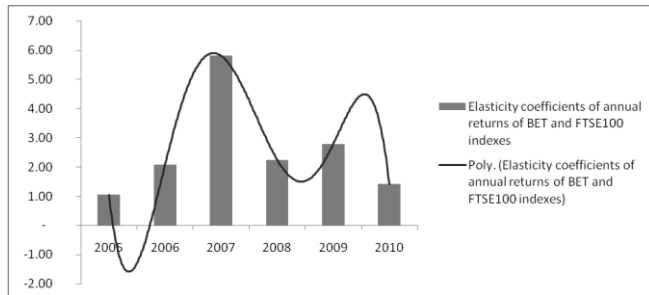


Fig. 9. Comparison between annual returns of the FTSE index and BET

D. Comparative evolution of the BET and DJIA

Comparing the BET monthly returns and monthly returns of the Dow Jones Industrial Average index, we continue to analyze the correlation with the Bucharest Stock Exchange with the most important external capital markets. Figure 10. High volatility of BET is apparent, compared with DJIA index.

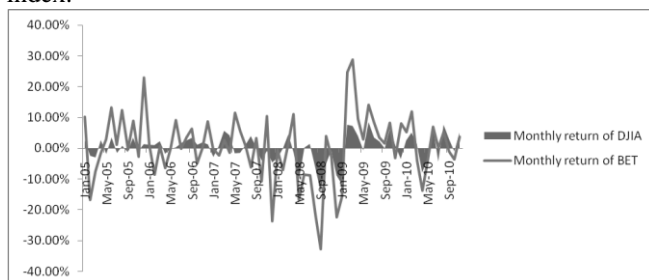


Fig. 10. Comparison between monthly returns of the FTSE index and BET

Annual developments of the two indices continue the

elements mentioned above. Thus, in 2005 at a 1% change in DJIA index, BET has changed to 7.68% at a correlation coefficient of 0.79. In Figure 11. you can find the plot of the two indexes. The year 2006 brings an approach of the evolution of the two indexes (coefficient of elasticity 1.36) but a low correlation level of 0.57.

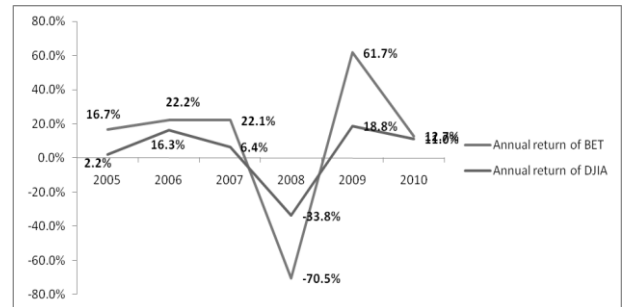


Fig. 11. Comparison between annual returns of the DJIA index and BET

In 2007, BET has grown by 22.1% compared with the 6.4% annual evolution of the DJIA index. The last two years of analysis show a high correlation (correlation coefficient of 0.95 in 2008 and 0.97 in 2009), the coefficients of elasticity of 2.08 in 2008 and 3.28 in 2009. Figure 12 the elasticity coefficient trend of annual returns of BET index and DJIA. Last year analysis shows an elasticity coefficient of 1.16.

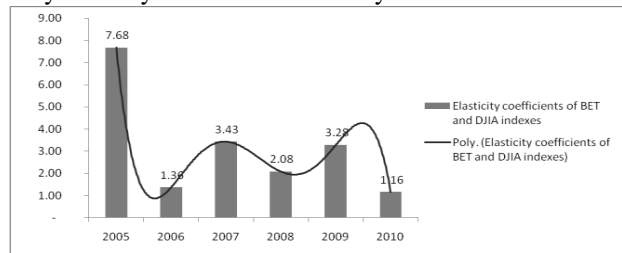


Fig. 12. Elasticity coefficients annual returns of DJIA index and BET

E. Comparative evolution of BET and DAX

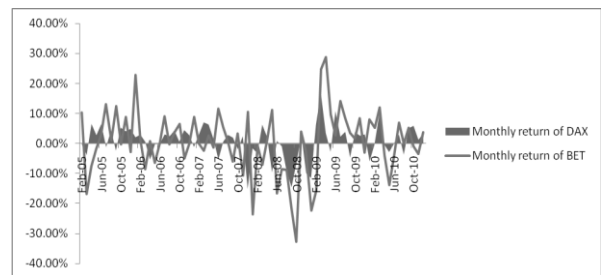


Fig. 13. Comparison between the monthly returns of the BET and DAX index

Besides the analysis of the indices from the US capital market, we have analyzed and compared the evolution of the BET index against the one of the German DAX index.

The annual return of DAX index outclassed the annual return of the BET index in 2005; the elasticity factor (annual BET return/ annual DAX flow) had a value of 0.55% (at a change of 1% of the DAX index, the BET index changed with 0.55% 0.55%). For this year, the correlation factor was of 0.61. A close value was calculated also for 2006 (of 0.65), but with a different evolution of the annual returns against 2005. In the analyzed year, the modulus of elasticity had the value of 1.13, indicating similar annual returns.

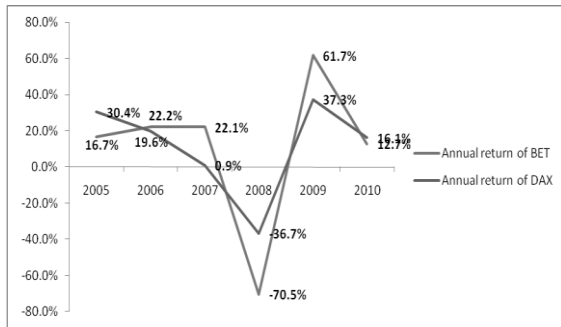


Fig. 14. Comparison between the annual returns of the BET and DAX index

In 2007, the DAX index changed with 0.9%, in comparison with the evolution of 22.1% of the BET index. The level of correlation of the two indices was very low in value of 0.35. For this year, is observed a decoupling of the evolution of the two indices both at flow level and correlation factors level.

In figure 14 we can observe the stressed decrease in 2008 of the annual return for the two indices, similar with the evolutions previously presented of the S&P500, FTSE and DJIA indices. In this year, the coefficient of elasticity, presented as an evolution in the period 2005-2009 in figure 15, had a value of 1.92. In return, in 2009, we have calculated a coefficient of elasticity of 1.65. The correlation factors were of 0.91 in 2008 and 0.93 in 2009. In 2010, the coefficient of elasticity had a value of 0.79, the subunit value representing the low evolution of the BET index against DAX.

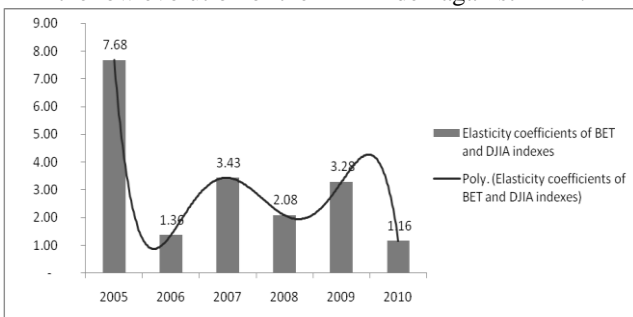


Fig. 15. Elasticity coefficients of the BET and DAX index

F. Comparative evolution of the BET index

The development of the Asian markets was obvious in the last years, as a consequence of the economic development and exchanges with these states. The performances of the companies listed on the Asian stock markets have determined the recognition of the Nikkei225 index as international index of reference for investors. This reflects best the stock evolution of the Asian companies.

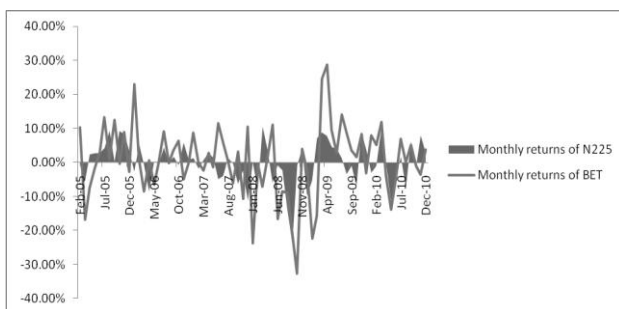


Fig. 16. Comparison between the monthly returns of the BET and Nikkei225 index between 2005 and 2009

In the last part of our analysis we have compared the BET

index and Nikkei 225 index. In 2005, the annual flow of the Nikkei 225 index was 41.8%, with a level of the correlation factor of 0.8. The year of 2006 presents a low level of the correlation factor of 0.41, on the background of a significant difference between the annual returns (at an increase of 1% of the Nikkei 225 index, the BET index increased with 5,05%).

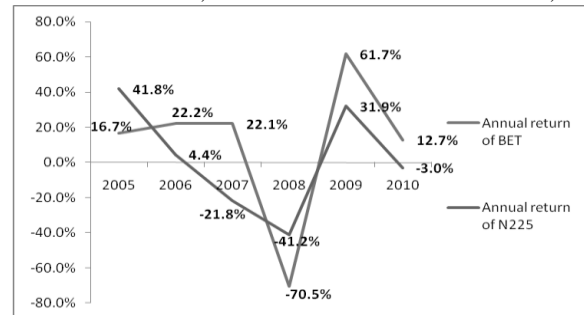


Fig. 17. Comparison between the annual returns of the BET and Nikkei225

The year of 2007 presents a total decoupling of the two indices, these not being modified in opposite way (the Nikkei 225 index dropped with 21.8% while the BET index increased with 22,1%). The last two years of analysis presents correlation factors of 0.89 in 2008 and 0.79 in 2009. The elasticity factors were at similar values (1.71 in 2008 and 1.93 in 2009). In 2010, the BET index increased with 12.7% while the NIKKEI 225 index dropped by 3%.

Figure 18 presents the trend of the elasticity factors of the annual returns for the BET and Nikkei 225 index.

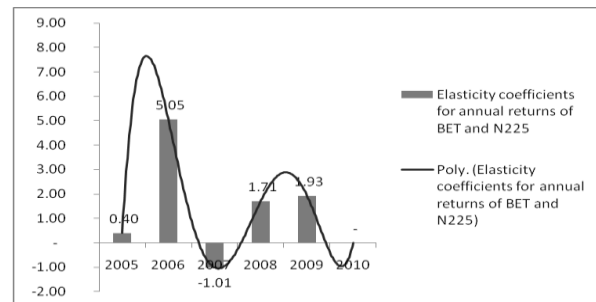


Fig. 18. Elasticity coefficients for BET and Nikkei225

IV. CONCLUSIONS

The Bucharest Stock Market presents a high level of volatility, situation observable from the comparative analysis with international stock indices presented previously. The complexity of the financial market does not leave room for generalizations or categorical statements. The financial world is in continuous change leading to unpredictable evolutions that exceed the mathematical calculations.

Bucharest Stock Market presented in the past two years of analysis a high level of correlation with external markets. The evolution of BET index, determined by the evolution of the companies, may offer us important information about the financial context of our analysis. As such, for a detailed analysis of the performance of the analyzed companies which are listed at the Bucharest Stock Market, will be followed also the stock market evolutions, and the line with other indicators for measurement of the performance or value request.

The impact and evolution of the financial markets can give us information needed for developing the analysis at

companies' level. The evolution of the financial markets affects the investment decisions, together with other factors at macroeconomic, financial or other level. These influences determined the ratio between the request and offer from the shares of a company, leading to changes in the same way of the instruments for measurement of the performance

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C. Ciora is teaching assistant at the Bucharest Academy of Economic Studies, Department of Economic and Financial Analysis, member of the Romanian Society of Economic and Financial Analysis and member of the International Economics Development and Research Center. (E-mail: costin.ciora@cig.ase.ro).

S. M. Munteanu is teaching assistant at the Bucharest Academy of Economic Studies in the field of efficiency and management (e-mail: sebastianmadalin@yahoo.com).

V. Iordache is a PhD candidate at the Bucharest Academy of Economic Studies in the field of Financial and Economic Analysis. (e-mail: vlad.jordache@yahoo.com).