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THE BETA COEFFICIENT AS A VOLATILITY INDICATOR IN THE PORTFOLIO MANAGEMENT THEORY

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Abstract: *In this paper, the volatility of a certain share is described, and the beta coefficient is introduced as a significant measurement of the market volatility. The beta coefficient is presented graphically and mathematically, and an easier formula is derived to make smoother and time-saving the process of making financial strategies. Further, the standard deviations, the rates of return and the coefficients of correlation are calculated from the data for the period 01.10.2021 – 30.09.2022. After that, the beta coefficients are calculated, and a comparison is made both Bulgarian companies – Alterco JSC and Speedy JSC.*

Keywords: *Beta Coefficient, Volatility, Benchmark, Asset's Return, Rate of Return, Profitability, Portfolio Management Theory, Risk.*

INTRODUCTION

Every trader of financial instruments desires to accomplish as higher profit as they can at minimum risk. The investors with longer experience on the stock markets have their own methodology and they can more easily choose the 'right' assets for them and the right strategy of buying and selling. Some of them are using technical analysis, others are observing the economic indicators of the market, and others are using known theories and models like Markowitz's model, CAPM, and Portfolio Management Theory [8].

In the Portfolio Management Theory and the financial markets, the most used term is *'volatility'*. Even though a lot of traders know the meaning, some of them do not realise the full meaning and usage of it, therefore investors cannot take the full advantage and the maximum profit from their portfolios.

EXPOSITION

Volatility in the financial markets

One of the basic characteristics of the financial markets is the volatility. It measures the price variation of a financial asset for a given period of time and shows the risk related to the changes in the assets' price.

Every investor and trader should be familiar with the volatility of the financial instrument so that he can trade with minimum risk. The most essential perks of the volatility are [7]:

- To define the risk of the deal that the investor is going to open.
- To define the deal's profit that will be opened.
- To be able to define the risk portfolio and the potential profit of the complete portfolio.
- Financial assets can be compared through the volatility, so that can be chosen the better asset (can be different according to the investor's goal).
- Gives information about the future financial state of the market – improving, stability or decreasing.

The volatility of one financial asset can be found through technical indicators and other measures, while the volatility of a complete risk portfolio can be found through the changes of the return. The market volatility can be measured and presented in proportional or absolute values. The relation between the volatility and the return can be defined as:

- High volatility – means that there are bigger changes in the price, which indicates

higher risk and potential higher return.
- Low volatility – is a sign of smaller changes in the price, which indicates lower risk for the investor and lower return.

In accordance with the observed financial market and what kind of information the investor is looking for, there are couple of indicators for measuring the market volatility:

- Volatility index (VIX) – main index that is used for defining the volatility in the United States (for German Stock Market – VDAX, for French - VCAC). It is daily calculated by Chicago Board Options Exchange (CBOE) through averaging the volatility of the call and put options on the S&P 500 stock index.
- Sharpe's Ratio – it helps the investors to know the return in comparison with the risk that will bring one investment.
- Indicators for volatility – used to find the volatility of different financial markets, e.g., Forex, shares, indexes, etc. Some of the most popular indicators are the standard deviation and the Average True Range (ATR).
- Beta Coefficient – a volatility measurement of a given asset which compares the asset with the benchmark.

Beta Coefficient

The beta coefficient β shows the relation between the asset's return or the portfolio's return to the return of the market portfolio. This indicator is widespread among the well-developed financial markets, for example in the American or German markets.

Let present the relation between the returns of the market and a given asset graphically. On Figure 1, is shown the characteristic line of the relation between the returns of the stock and the market. It can be seen that the steeper the slope of the line, the higher systematic risk and the more volatile the share's performance [6].

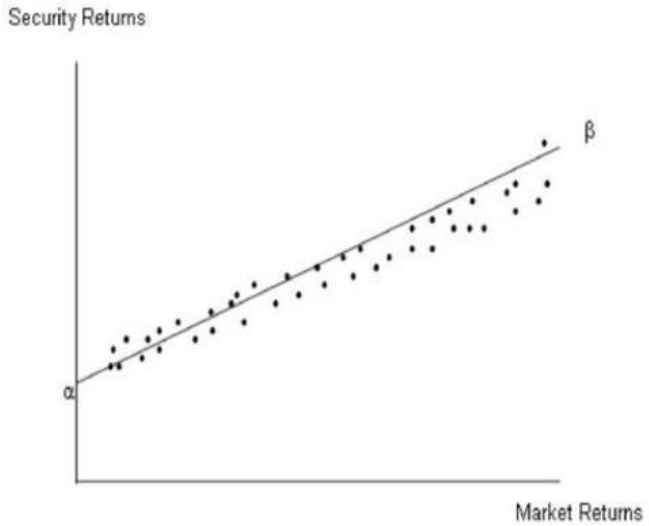

Fig. 1. Relation between the stock's return and the market returns (see [6])

The beta is a measure of volatility, or systematic(market) risk. It shows how much risk on investment will bring to the given portfolio, as well as how much the price of a particular share will rise/decrease compared to how much prices will rise/decrease in the market. There is no specific time frame for which beta should be calculated. According to the financial analysts, it must be at least one year, so that the prediction can be closer to the reality.

The Capital Asset Pricing Model very accurately represents the relation between the risk of an assets and its expected return [1]. This model uses the beta coefficient as measurement of the risk and takes important role in the model. Most of the time the beta is not given and it should

be calculated, that is why the covariance of the market return with the stock return and the variance if the market return should be defined.

$$\beta_i = \frac{cov(r_i, r_m)}{var(r_m)}, \quad (1)$$

Where

- r_i – the rate of return of a given assets

- r_m – the rate of return of the market.

Let us present the beta in a mathematical way, which will show why it is more preferred by investors [2].

Alternatively, equation (1) can be rewritten as:

$$\beta_i = \frac{cor(i, m).\sigma_i\sigma_m}{var(r_m)}$$

The theoretical value for beta can be defines as follows:

$$\beta_i = \frac{\rho(r_i, r_m).\sigma_i.\sigma_m}{\sigma^2{}_m}$$

$$\beta_i = \frac{\rho_{i,m}.\sigma_i}{\sigma_m}. \quad (2)$$

Once, the standard deviation and the covariance (correlation coefficients) are found, the calculation of beta is extremely easy using equation (2).

The parameter beta can be negative, positive and zero. When $\beta < 0$, the returns are moving oppositely.

When the parameter is positive and higher that 1 ($\beta > 1$), then the yield of the given stock and the benchmark alter similarly, but the volatility of the given stock is greater than the one of the benchmark. And while beta is nearly equal to 1, the volatility is similar and the profits from the asset and the benchmark are changing identically.

The stock's returns and the profit from the benchmark can move (increase or decrease) in the same direction only when beta is between 0 and 1. However, when beta is equal to 1 then the volatility is the same for both, and when beta is between 0 and 1, the given stock is more financially stable than the market that is more volatile [4], [5].

Data Description

The observed investment portfolio includes shares of two Bulgarian companies in the following branches – technology and courier services. The companies that are building the portfolio are the technology holding Alterco JSC and the courier company Speedy JSC. For the purposes of the study, a daily data for the period 01.10.2021 – 30.09.2022 for Alterco JSC and Speedy JSC is taken from the Bulgarian Stock Exchange [3].

Allterco JSC - Sofia Allterco Robotics is a company with many years of experience in the field of telecommunications and smart technologies. It is found in 2010 in Sofia, Bulgaria as an innovative company with a focus on technology development and trade with IoT devices. The most famous articles on the market are the smartwatches for kids - MyKi, and the technology for every household – Shelly. On 1 December 2016 the company's shares were listed on the Bulgarian Stock Exchange (BSE).

Speedy JSC was found in 1998 and it is proved as a leading courier company in Bulgaria. Since then, Speedy has developed its partnership with DPD (Europe's largest ground delivery

network), which contributes to successful deliveries worldwide. In November 2012, Speedy went public on BSE, becoming the first company in this industry to go public.

Comparison between Alterco JSC and Speedy JSC

Using the daily closing prices of the instruments Alterco (A4L), Speedy (SPDY) and the Bulgarian Stock Exchange (BGBX40), a comparison between the assets of Alterco and Speedy will be made. The Beta coefficient will show which company is more suitable for the different types of investors.

After collecting the required data, the standard deviation (or $\sqrt{Var}$) can be calculated and the results are shown in Table 1.

Table 1. Standard Deviation

Company	Standard Deviation
BGBX40	3.8661
A4L	2.4707
SPDY	4.2190

The obtained results for the monthly return of each of the assets, as well as the monthly return of their index BGBX40 for the given period can be seen in Table 2.

Table 2. Monthly rate of returns of the assets of Alterco (A4L), Speedy (SPDY) and BGBX40

Year	2021			2022								
Month	**10**	**11**	**12**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**
BGBX40	**-0.83%**	**0.83%**	**4.62%**	**-1.83%**	**-4.34%**	**8.91%**	**-3.07%**	**-0.83%**	**-0.99%**	**-3.33%**	**2.11%**	**-4.51%**
EAC	-0.35%	29.88%	-0.41%	-31.34%	-4.83%	7.52%	5.99%	-8.97%	3.27%	-6.47%	5.07%	-18.22%
SPDY	5.70%	8.70%	-12.96%	-1.21%	0.50%	-3.04%	-4.35%	-28.27%	4.34%	0.88%	7.07%	5.84%

Based on the obtained results for the corresponding rate of returns, the correlation coefficient can be calculated for each company. The correlation matrix is presented in Table 3.

Table 3. Correlation Matrix

	BGBX40	A4L	SPDY
BGBX40	1.000000000	0.408062174	-0.157236769
A4L	0.408062174	1.000000000	0.243240254
SPDY	-0.157236769	0.243240254	1.000000000

Once, the standard deviation and the correlation coefficients are calculated, the beta coefficient can also be found using (2).

Alterco JSC (A4L):

$$\beta_{A4L} = \frac{0.40806\ .\ 2{,}4707}{3{,}8661} = \frac{1.008193842}{3.8661} = 0.260778$$

Speedy JSC (SPDY):

$$\beta_{SPDY} = \frac{-0.15724\ .\ 4{,}2190}{3{,}8661} = \frac{-0.66339556}{3.8661} = -0.171593$$

CONCLUSIONS

The present work examines the beta coefficient as a crucial indicator of the volatility. With the obtained results some conclusions can be made:

1) The beta coefficient of the technology holding Alterco JSC is a positive value – 0.2608, while for the courier company Speedy JSC is negative – -0.1716.
2) The beta coefficient of Alterco is positive value between 0 and 1, this means that Alterco's assets are moving in sync with the market BGBX40.
3) Alterco's assets have smaller volatility than its benchmark.
4) The beta coefficient of Speedy is a negative value, therefore the assets and the market will move in opposite ways. (E.g., If the market shows an increase in the profit, the assets' profit will decrease).
5) As its beta is negative, and it is more volatile, Speedy stocks have higher risk and would reach potential higher return.
6) For investors with higher risk aversion, more suitable investment is Speedy.
7) If the investors do not have big experience in trading, or they are just more careful and do not like the risk, then Alterco is the better option to invest.

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