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FEATURES OF FORMATION OF AN INVESTMENT PORTFOLIO MARKOVITSA ON THE EXAMPLE OF AUTOMOTIVE COMPANIES

In 1952 Harry Markowitz formed the Markowitz efficient frontier (MEF). The collection of all efficient portfolios is called the Markowitz efficient set of portfolios, or the MEF [1]. Specifically it is the portfolio which subjugates the efficient fragments of the risk return spectrum. Furthermore MEF is the collation of portfolios that fulfil the requirement that other portfolios do not exist having a higher expected return however with the same standard deviation of return. There are two main concepts in Modern Portfolio Theory, which are [2]:

- any investor's goal is to maximize Return for any level of Risk;

- risk can be reduced by creating a diversified portfolio of unrelated assets

Other names for this approach are Passive Investment Approach because you build the right risk to return portfolio for broad asset with a substantial value and then you behave passive and wait as it grows.

According to Markowitz, any investor should base their choice solely on the expected return and standard deviation when choosing a portfolio. Thus,

after evaluating various combinations of portfolios, he must choose the "best" based on the ratio of expected returns and the standard deviation of these portfolios. At the same time, the ratio of return to portfolio risk remains normal: the higher the return, the higher the risk. An effective portfolio is a portfolio that provides: the maximum expected return for a certain level of risk, or the minimum risk level for a certain expected return. To find the optimal portfolio, it is necessary to determine the acceptable set of risk-return ratios for the investor, which is achieved by constructing the minimum dispersion border of the portfolios, i.e. the boundaries on which portfolios have minimal risk for a given profitability [3]. To complete this work, 22 closing prices of shares of 2 companies were downloaded from the Bloomberg financial platform. In our case, these companies are Tesla and Ford Motors (Tab.1).

Table 1. Comparing of price and return of Tesla and Ford Motor stock

Date	Price of Tesla stock	Return of Tesla stock	Price of Ford Motor stock	Return of Ford Motor stock
04/09/2019	220.68		9.2	
05/09/2019	229.58	4.0330%	9.34	1.5217%
06/09/2019	227.45	-0.9278%	9.34	0.0000%
09/09/2019	231.79	1.9081%	9.54	2.1413%
10/09/2019	235.54	1.6178%	9.42	-1.2579%
11/09/2019	247.1	4.9079%	9.42	0.0000%
12/09/2019	245.87	-0.4978%	9.41	-0.1062%
13/09/2019	245.2	-0.2725%	9.45	0.4251%
16/09/2019	242.81	-0.9747%	9.3	-1.5873%
17/09/2019	244.79	0.8155%	9.28	-0.2151%
18/09/2019	243.49	-0.5311%	9.25	-0.3233%
19/09/2019	246.6	1.2773%	9.1	-1.6216%
20/09/2019	240.62	-2.4250%	9.17	0.7692%
23/09/2019	241.23	0.2535%	9.16	-0.1091%
24/09/2019	223.21	-7.4700%	9.11	-0.5459%
25/09/2019	228.7	2.4596%	9.2	0.9879%
26/09/2019	242.56	6.0603%	9.14	-0.6522%
27/09/2019	242.13	-0.1773%	9.08	-0.6565%
30/09/2019	240.87	-0.5204%	9.16	0.8811%
01/10/2019	244.69	1.5859%	8.9	-2.8384%
02/10/2019	243.13	-0.6375%	8.61	-3.2584%
03/10/2019	233.03	-4.1542%	8.71	1.1614%

According to the above data we can observe the variability in the return in both companies, but Tesla has a higher stock price. Based on the work of Dutt and Humphery-Jenner, return is the difference or change in an asset or investment over a period of time. Basically, this can be represented in terms of changes in price or interest [4].

The next step is to calculate the average return and variance of each company in the portfolio. Vaiance is an indicator that is used to estimate the variation in the values of a random variable relative to its mathematical expectation. In portfolio theory, return variance is a measure of the risk associated with investing in a particular asset or portfolio of assets [1].

The higher the variance is, the higher the spread in the return of an asset or portfolio of assets relative to its expected return, the higher the level of risk. On the contrary, low values of this indicator indicate a low level of risk associated with the implementation of investments [4]. Based on the results in the table above, it can be concluded that Tesla has the lowest.

The next step is to compute the variance-covariance matrix and correlation for each company in the portfolio. The dispersion covariance matrix shows the covariance between the paired elements of a specific random case. There is a variance on the diagonal of the matrix, which is responsible for the covariance of each element with itself. Correlation is described as statistics that measures the ratio of two securities to each other [3].

Variance-covariance matrix		
	Tesla	**Ford Motor**
Tesla	0.0872%	0.0011%
Ford Motor	0.0011%	0.0188%
Correlation		
Tesla	0.0000%	2.8464%
Ford Motor	2.8464%	0.0000%

Thus, with an increase in the number of portfolio assets, covariance becomes more and more important, otherwise everything does not change. Covariance members show how the combined movement of the return on individual assets affects the variance of the entire portfolio. For example, consider two stocks: one has a tendency to high returns (relative to its expected return), and the other has a low return (relative to its expected returns). The return on one stock tends to offset the return on the other, reducing the variability or variance of the return on the portfolio [5].

Then we select two companies from the tables above with the highest correlation coefficient. Using different weights for the two companies, we create an N combination, with N> 8. We calculate the expected return and standard deviations of each combination. Companies with lowest correlation are Tesla and Ford Motor (Tab.2).
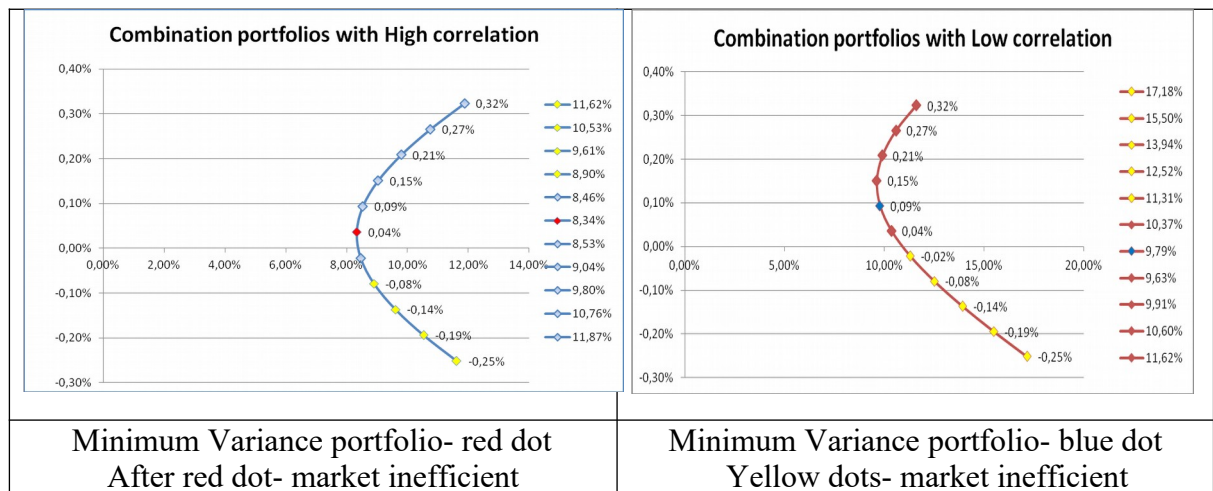
Table 2. Two-stock portfolio Tesla x Ford

Combinations	Weight Company A	Weight company B	Return (%)	STDEV(%)
1	1	0	-0.25%	17.18%
2	0.9	0.1	-0.19%	15.50%
3	0.8	0.2	-0.14%	13.94%
4	0.7	0.3	-0.08%	12.52%
5	0.6	0.4	-0.02%	11.31%
6	0.5	0.5	0.04%	10.37%
7	0.4	0.6	0.09%	9.79%
8	0.3	0.7	0.15%	9.63%
9	0.2	0.8	0.21%	9.91%
10	0.1	0.9	0.27%	10.60%
11	0	1	0.32%	11.62%

The concept of Efficient Frontier was also introduced by Markowitz and is easier to understand than it sounds. It is a graphical representation of all the possible mixtures of risky assets for an optimal level of Return given any level of Risk, as measured by standard deviation.

The meaning of the optimal portfolio model is very simple and at the same time useful: knowing your expected rate of return, you can calculate a fair percentage of risk. And vice versa: knowing the risk that you are willing to bear,

you can calculate a fair rate of return for this risk. According to Dutt and Humphery-Jenner the common advantage of portfolio is diversification [4]. Diversification allows to investor to hold as much as he wants stocks from different companies in different industries what easily reduce a large portion of the risk. Mostly remaining risk is considered as systematic risk which refers to the volatility of the certain market.

Minimum Variance portfolio- red dot After red dot- market inefficient	Minimum Variance portfolio- blue dot Yellow dots- market inefficient

Summing up the results of the research and based on modern portfolio theory, in our opinion, it is reasonable for investors to choose an optimal portfolio with positive returns from MEF Ford.

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