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EVALUATION OF RISKS AND RETURNS OF A COMPANY'S PORTFOLIO

Abstract

Expected return and standard deviation are a good measure of future return and risk estimation, not only for the investments in securities, but for the whole company's portfolio as well. This paper contributes to the understanding of the risks and returns of a company's portfolio, consisting of financial assets and projects.

Key words: *expected returns; portfolio; risks; standard deviation;*

JEL Classifications: G11, G12, G32

ПРОЦЕНА РИЗИКА И ПОВРАТАК НА ПОРТФОЛИО ПРЕДУЗЕЋА

Апстракт

Очекивани принос и стандардна девијација су добра мера будућих приноса и процене ризика, не само за улагања која се односе на хартије од вредности, већ и за портфолио целе компаније. Овај рад доприноси разумевању ризика и приноса портфолија компаније, која се састоји од финансијских средстава и пројеката.

Кључне речи: *очекивани принос; портфолио; ризици; стандардна девијација; пројекти.*

Introduction and theoretical background

As far back as 1952, Harry Markowitz introduced a portfolio theory, whereas investors had been interested in securities on an individual basis. The Markowitz theory defined an efficient portfolio as a portfolio with minimal risk for a given return, or, as the portfolio with the highest return for a given level of risk[2]. The expected utility of an individual's terminal wealth is a function of the mean and the variance of the portfolio return. The expected return of the portfolio is measured by the mean return. The risk, which corresponds to the uncertainty of obtaining the return, is measured by the variance[3] .

In the 70's, evaluating the performance of investment portfolios received a great deal of attention, mostly as a result of developments in the Sharpe's theory of capital-

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[2] Markowitz, H., 1952. Portfolio Selection, *Journal of Finance*, March, pp. 77–91.

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asset pricing[4], which have led to an improved understanding of the criteria necessary for evaluating investment performance. Also, this theory has influenced an increasing number of studies on this issue[5]. Measurement of portfolio performance is usually based on Sharpe ratio – "*the ratio of the excess expected return of an investment to its return volatility or standard deviation"*[6], by large a number of authors[7]. Sharpe (1964) improved the Markowitz's model on the possibility of simplifying the calculations in order to develop the practical use of the model.

The Sharpe ratio is now used in many areas of Finance and Economics. It is used for the purpose of evaluation of portfolio performance, to tests of market efficiency for risk management[8]. According to Levy (1972), the Sharpe ratio is closely related to the investment horizon under the assumption that portfolio return distribution is stable over time. Levy's assumption means that historical returns have predictive value regarding future performance. For many investors and mutual funds, this can make a highly

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[4] Sharpe, W. F., 1964. Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk, Journal of Finance, Vol. 19, pp. 425-442.

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important signal for purchase or sale. Later, Cvitanić, Lazrak and Wang[9] argue that the Sharpe ratio creates a tension between the short term performance and the long-term performance, called as the horizon problem[10]. This horizon problem arises mainly because the investment horizon of investors is different from that of fund managers.

Following these models, many authors have offered their models or so-called efficient portfolio models, which are usually based on Markowitz or Sharpe's theory, such as Optimal one-fund theorem, Merton and Jorion models, Cadsby ratio, Simplified methods by Elton and Gruber, etc. All these models are exclusively designed for measuring portfolio performance of mutual funds or finance companies, or even the interest of the investors in securities on an individual basis (Markowitz theory). However the question still lingers on how other companies measure the performance of their portfolio, with the observation that most companies do not deal only in securities or have a relatively small value of their assets as securities. This issue discusses the problem of majority of portfolios, which mostly include various projects. With regard to period when these theories were written, many financial instrument are designed, which influence on the selection of the portfolio and the ability to hedge. This is especially important for corporate risks and opportunities to manage these risks[11].

The primary purpose of this paper is to give expressions which will include the measurement of performance of the company's portfolio. The plan of the paper is as follows: First, the authors will express the returns within the period of investment, followed by measurements of the risks associated with the company's portfolio. The returns and risks are related to the securities held by the company and other various company projects. This will be closely followed with an illustration that explains the use of the expressions. The final section of the paper is a concluding statement and remarks on findings and learning statement.

Methodology

Monroe and Trieschmann[12] are researched portfolio performance of property-liability insurance companies. In their study, the rate of return measure used for all portfolios is the ratio of all realized and unrealized investment income to the market value of the investment at the beginning of the year. According to these authors (1972, p. 3) the annual rate of return for each insurance company portfolio is defined as:

$$R_{it} = \frac{I_{it} + RG_{it} + UG_{it}}{V_{i(t-1)} + NI_{it} / 2}$$

[9] Cvitanić, J., Lazrak, A., Wang, T., 2008. Implications of the Sharpe ratio as a performance measure in multi-period settings, *Journal of Economic Dynamics and Control,* Vol. 32, pp. 1622-1649.

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Where:

- R_{it} = annual rate of return for i^{th} firm during year t,
- IT_{it} = investment income (dividends and/or bond interest) ,
- RG_{it} = realized gains on the sale of securities,
- UG_{it} = unrealized gains on securities,
- $V_{i(t-1)}$ = end-of-year market value, and
- NI_{it} = net investment (purchases-sales).

Monroe and Trieschmann (1972) defined investment company portfolio rates of retum from reported per share data adjusted for all stock splits and dividends, as:

$$IR_{it} = \frac{V_{it} + I_{it} + CG_{it}}{V_{i(t-1)}} - 1$$

Where:

- IR_{it} = annual retum for i investment company in year t,
- V_{it} = end-of-year market value per share,
- I_{it} = income distributions, and
- CG_{it} = capital gain's distributions.

In Schlarhaum study[13], the measurement of investment performance was based on the following way: Portfolio performance is examined from the point of view of an insurance company shareholder. Schlarhaum is evaluated the performance of the companies' common stock portfolios by comparing the returns earned by these portfolios with those that could have been achieved by investing in randomly selected portfolios of common stocks. Risk is taken into account by keeping constant either the variability of annual rates of return or the coefficient of nondiversifiable risk (the beta coefficient in the market model). He argued (1974) that the variability measure is more appropriate for an insurance-company shareholder with no other investments in securities, while the beta coefficient is more appropriate for an insurance-company shareholder who holds a diversified portfolio of his own.

In performance evaluation, many authors uses Sharpe ratio, which is widely adopted and used to compare the performance with other funds and market indices[14]. According to Sharpe's formula, using historical holding period returns (i.e., monthly, quarterly and semi-annual returns) for fund *p*, each investment horizon can be calculated as:

$$SR_p(\lambda_j) = \frac{\bar{R}_p(\lambda_j) - \bar{R}_f(\lambda_j)}{\sqrt{\sigma^2(\lambda_j)}}$$

This formula is adopted from Kim and Park (2011), where $\bar{R}_p(\lambda_j)$ and $\bar{R}_f(\lambda_j)$ are the mean values of mutual fund returns and the risk-free rate at investment horizon λ_j. In this specification, $SR_p(\lambda_j)$ indicates the Sharpe ratio of mutual fund returns, which can be varying depending on the investment horizons. Given formula clearly shows the possibility of calculating returns, returns of mutual funds or banks.

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[13] Schlarhau, G., 1974. The investment perfomance of the common stocks portfolios of property-liability insurance companies, *Journal of financial and quantitative analysis*.

[14] Kim, S., Park, H., 2011. Examining the effect of investment horizon on the mutual fund performance measures. Annual Paris Conference on "Money, Economy and Management". Paris, France.

What happens to everyday investment? Is this formula should be used by other companies that do not invest only in securities that have a different portfolio, which consists in part of a larger of material asset. The answer to this question is given below. The investor's holding period is the interval of time between successive portfolio actions. In our expression it is assumed on lengthening investment horizon. Assumptions are as follows:

1. First, company's portfolio can be very complex, in terms of duration, associated risks and mix, as they range from long to short-term, medium to high risks and a mix of stocks, bonds, cash-equivalents etc. It is easier to express complex company's portfolio in a long term interval. Bearing this assumption in mind, the time interval in our expression will be shown as time T-1 (beginning) and T (ending). For the purpose of simplicity of expression, multiple time intervals will not be considered.
2. Numerous authors consider that the investors are better off holding risky assets in the long-run investment climate. This point was confirmed through research and analysis by the following authors: Lloyd and Haney 1980, McEnally 1985, Butler and Domian 1991, Bodie 1995, Levy and Spector 1996, Hansson and Persson 2000, Strong and Taylor 2001, Jan and Wu 2008[15]. However, there is a group of authors who argued that increasing the proportion of investing risky asset over long-run investment horizon is illusory[16]. Bearing in mind the assumption 1 and referring to the researches of majority authors with the view that investors are better off to hold risky assets in the long-run investment horizon, our expression is based on long-run investment horizon.
3. We defined portfolio as a set of various kinds of assets belonging to any institution or individual, which hold these assets in order to achieve returns and therefore are willing to take a risk. Company's portfolio consists of projects and financial assets. We consider projects as all company investments in order to achieve the expected results (returns) and those they

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[15] Lloyd, W. P., Haney, L. R., 1980. Time Diversification: Surest Route to Lower Risk, Journal of Portfolio Management, Vol. 6, pp. 5-9.
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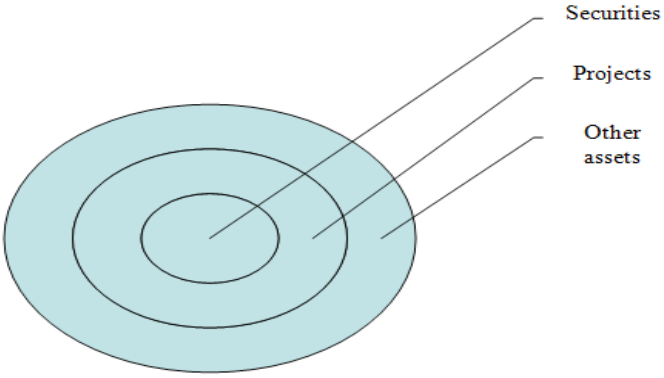
are not securities. Due to the simplicity of the model, the financial assets in the company's portfolio are not diversified into different forms of assets.

Picture 1.Different forms of assets in long-run investment horizon



Source: Authors

Holding period return is the rate of return over a period of investment. Marking the ending price and beginning price of securities as $P_{t(s)}$ and $P_{t-1(s)}$ respectively, and project ending price and project beginning price as $P_{t(p)}$ and $P_{t-1(p)}$, formula can be expressed as:

Holding period return of company = Holding period return of securities + Holding period return of projects

$$HPR_c = HPR_s + HPR_p \quad (a)$$

HPR_s = dividend yield (interest yield)* + capital yield = [dividend (interest) + (ending price - beginning price)] / beginning price

$$HPR_s = [\text{dividend (interest)} + (P_{t(s)} - P_{t-1(s)})] / P_{t-1(s)}$$

* If a company holds shares, the expression involves the calculation of dividends. Where the company holds bonds, the expression involves the calculation of interest. In both cases, the calculation is the same. Consequently , for the sake of clarity and transparency, only dividends will be calculated.

HPR_p = [project ending price - project beginning price] / project beginning price

$$HPR_p = [P_{t(p)} - P_{t-1(p)}] / P_{t-1(p)}$$

Holding period returns on project is essentially similar to the definition of Return on Investment (ROI), where instead of total benefits and total costs we use project ending price and project beginning price. Use of this terminology ensures simplicity of expression.

Given expression (a) can be represented as (b):

$$HPR_c = HPR_s + HPR_p = [\text{dividend (interest)} + (P_{t(s)} - P_{t-1(s)})] / P_{t-1(s)} + [P_{t(p)} - P_{t-1(p)}] / P_{t-1(p)} \quad (b)$$

This formula allows the exact arithmetic return on a portfolio to be obtained easily, as a linear combination of the returns on the assets that make up the portfolio. By introducing probability (p) for each HPR, we could calculate the Expected return - $E(HPR_c)$. Expected return can be expressed as the average HPR of all investments in company's portfolio. The term can be expressed as:

$$E(HPR_c) = E(HPR_s) + E(HPR_p) = \sum_{s=1}^{s} p_s r_s + \sum_{s=1}^{s} p_p r_p \quad (c)$$

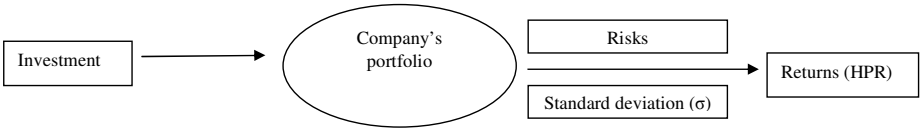
Considering that we have probabilities to realize a HPRs and expected return, it is now easy to determine the squares of deviations from the expected value and calculate the variance (d) and standard deviation (e).

$$\sigma^2 = \sum_{s=1}^{s} p_s [r_s - E(HPR_s)]^2 + \sum_{s=1}^{s} p_p [r_p - E(HPR_p)]^2 \quad (d)$$

$$\sigma = \sqrt{\sigma^2} \quad (e)$$

The uncertainty surrounding the investments depends largely on unforeseen factors. The risk of possible surprises expresses the variance, i.e. the standard deviation is the square root of the variance. All deviations are squared, otherwise the negative deviation reverse the positive deviations, which would result in the expected deviations from the average value is zero. Nonlinear transformation (squaring) increases the importance of large deviations, and reduces the significance of small deviations. Also, the risk is expressed in the same way as the expected return; standard deviation is used as the square root of the variance.

Picture 2. Risks and returns of a company's portfolio



Source: Authors

Illustration

In our example we will assume that company ABC operates over a longer period of time, passing through a phase of cyclical expansion, normal growth and recession. Beginning price is 30 dollars for the financial asset and 2.000.0000 for project. For each cyclic phase we assume the probabilities, ending prices and dividends for the financial asset. According to this data, we could calculate the returns and risks that the company generates. The data is presented in the table below.

Table 1. Illustration of portfolio of the company ABC

		Portfolio of ABC company					
		Financial assets				Projects	
	Probabilities (p_s)	Dividends	Ending prices $P_{t(s)}$	Returns (r_s)	Probabilities (p_p)	Ending prices $P_{t(p)}$	Returns (r_p)
Recession	0,25	4	17	-30%	0,25	2.200.000	10%
Normal growth	0,35	5	31	20%	0,35	2.600.000	30%
Expansion	0,25	7	33,5	35%	0,25	2.800.000	40%

Sources: Authors

$E(HPR_c) = E(HPR_s) + E(HPR_p) = [0,25(-10\%)+0,35(20\%)+0,25(35\%)] + [0,25(10\%)+0,35(30\%)+0,25(40\%)] = 8,25\% + 23\% = 31,25\%$

$\sigma^2 = \sigma^2_s + \sigma^2_p = [0,25(-30-8,25)^2+0,35(20-8,25)^2+(0,25(35-8,25)^2] + [0,25(10-23)^2+0,35(30-23)^2+(0,25(40-23)^2] = 592,978 + 131,65 = 724,628$

$\sigma = \sqrt{\sigma^2} = 26,919$

Concluding remarks

With a simple illustration we have demonstrated that it is possible to calculate expected returns and risks of portfolio of the company, which consist of both - financial asset and project. Standard deviation is calculated as the square root of the variance of the total of the portfolio, rather than as the sum of standard deviation of portfolio that relates to financial asset and portfolio that relates to the project. Therefore, the standard deviation of the total portfolio of company ABC is less than the standard deviation which calculates the sum of standard deviations of each one. The reason lies in the nature of the portfolio - when the portfolio is more diversified then the risk is lower.

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