MODELS OF PORTOFOLIO MANAGEMENT. MARKOWITZ MODEL VS CAPM MODEL

IONEL EDUARD IONESCU
"SPIRU HARET" UNIVERSITY OF BUCHAREST, FACULTY OF FINANCE AND BANKING
13 ION GHICA STREET, BUCHAREST, ROMANIA
eionescu.fb@spiruharet.ro

Abstract
The portfolio represents a combination of financial actives, owned by an individual or a group of investors, with the purpose to reduce the risk through diversity.
The return of a movable asset represents the payoff obtained following the investment of a capital. Any investor is tempted to invest, according to the information to which he is privy. However, such an investment can be dangerous; the price of financial actives drops or rises spectacularly at any given moment. Is the investment truly worth it? Could the potential growth cover the forecasted costs? This article attempts to discuss the way in which an investor should efficiently allocate investments on the capital market, through the thousands of opportunities.

***Key words**: financial actives, risk, portfolio management, systematic risk*

JEL classification*: *G1, G11

1. Return of portofolio management.

The portfolio represents a combination of financial actives, owned by an individual or a group of investors, with the purpose to reduce the risk through diversity.

Strictly speaking, the term of "portfolio" is used only for the combinations of financial actives; therefore a movables portfolio may be defined as the sum total of non-banking financial actives that an investor owns and is materialized in financial assets, which are tradable on stock markets: shares and bonds, but also financial derivates - futures contracts or options contracts.

Portfolio management represents the building of groups of actives, in a way which would allow their market evolution to ensure the fulfillment of return objectives as defined by the investor, while also respecting risk restrictions, as determined by the allocation of actives; therefore, the management of financial assets portfolios seeks to maximize the risk - return relation.

Return is sometimes defined as a gain obtained as a result of holding a certain movable value for a certain period of time, respectively one may speak of a return calculated in absolute terms; thus, for example when talking about a share, we refer to a return expressed in dividends obtained by shareholders but also by stock rising, and in the case of a bond, the return is given by the annuities registered as well as the difference between the buying and selling prices.

Return rates obtained following the actual indicators, in order to be usable in a relevant study, must take into account the influence of factors of disturbance, such as the inflationary environment. Therefore, these nominal values of return must be transformed into real values, in order to be measurable and comparable. Therefore, the real return is obtained using Fisher's equation:

$$(1 + R_{nominal}) = (1 + R_{real}) \times (1 + R_{inflation})$$

where:

- $R_{nominal}$ = return, in nominal terms;
- R_{real} = return, in real terms;

- R inflation = inflation rate.

Return rates depends of degree of rik of investition**.** The Investopedia Dictionary defines risk as the possibility that the actual investment not reach expected return.

The risk of a movable asset may be defined as:

- the measurable possibility of loss or gain;
- the sacrifice of a certain and immediate advantage or the absence of an immediate consumption in exchange for possible future advantages;
- the uncertainty regarding the value of a financial good which will be registered at a future date.

The risk describing a certain asset has two components:

- systematic risk - is a measure of the way in which movable values covariate the market and cannot be eliminated by diversifying the portfolio;
- non-systematic risk - is specific to each movable value and is reduces through portfolio diversification.

The dictionary defines risk as the possibility of facing danger, of confronting an adversity or suffering some sort of damage; possible danger. The complete dictionary of market economy defines risk as a probable and unsure event or process which may cause a loss in an economic activity, operation or endeavor. To point out the close connection between the two notions, we may recall the return - risk criteria, which assumes the selection of the investment which has the maximum medium return estimation - max E (R), considering a given risk σ (R), and the selection of a return defined by the minimum risk σ (R) min, for a certain level of the estimated medium return - E (R). This criteria represents an essential principle which is at the basis of the process of developing a portfolio.

In financial theory, economic agents are considered to be characterized by aversion to risk, regardless of the level of their wealth. In these conditions, the criteria of maximizing the medium estimated utility - E(u(w)) will be equivalent to the risk-return criteria. In order to prove this, we start from the following premises:

$$w = w_0 (1+R),\ R = \frac{\Delta w}{w_0} \rightarrow E(w) = w_0 \times E(R)$$

$$E(R),\ \sigma^2_R - \text{given and } E^{n-1}(R) = 0 \text{ and } E(R^n) = 0 \text{ for } n \geq 3$$

where:

- w = the final wealth of the investor;
- w_0 = the initial wealth of the investor;
- $R = \frac{\Delta w}{w_0}$ – the return of the investment.

E(R) is not zero, however, any exponent of E(R) larger than 1 is a number which could be approximated to zero. At the same time, the mathematical expectancy of R at any exponent is considered low enough to be neglected. Under these conditions, the distribution of R is considered only through the indicators of average and dispersion, the other ones, orders larger than 3, may be approximated to zero E((R-R average).

2. The Markowitz model - the revolutionary theory of portfolio management

Nobel Prize in economics in 1990 laureate, Harry Markowitz develops a model - the Markowitz model - which uses as a starting point the risk and return of a diversified asset portfolio. Markowitz is considered by numerous specialists as the founder of the modern science, the creator of a revolutionary model in the field of portfolio theory, starting from the two concepts: risk and return on the one hand, and portfolio diversity on the other.

Portfolio management theory outlines the resulting risk of an investment in a combination of individual actives. The main point of departure of this theory is the premise that investors are characterized by aversion to risk; which means that a higher risk portfolio will not be taken into account if it isn't accompanied by the possibility of equivalently high payoff. Starting from this theory, many researchers have developed models of analysis for investor behavior, with regards to portfolio selection.

According to the Markowitz model, portfolio selection has two phases[1]:

- the first phase infers the study and analysis of value assets available on the capital market, analysis which helps to build a foundation for a prediction of the future performance of those assets;
- the second phase is based on the predictions of the future performance of the value assets, on the basis of which one establishes a portfolio of assets which will give off maximum returns.

The Markowitz model is exemplified through the following mathematical relation:

$$E(R_p) = \sum_{i=1}^{n} x_i E(R_i)$$

$$\sigma^2_p = \sum_{i=1}^{n} \sum_{j=1}^{n} x_i x_j \sigma_{ij}$$

$$\sum_{i=1}^{n} x_i = 1$$

where:

- x_i = the weighting factor of asset i within the portfolio;
- $E(R_i)$ = the predicted return of asset i;
- $E(R_p)$ = the anticipated return for portfolio p;
- σ^2_p = the risk of portfolio p expressed as a variance (dispersion);
- σ_{ij} = the covariance between the returns of assets i and j;
- $\sigma^2_i = \sigma_{ii}$ = the risk of active i expressed as a variance (dispersion);
- n = the number of assets in the portfolio.

Quantifying the existing ties between the assets is done by covariance. Generalizing covariance for any two assets within the portfolio "i" and "j" may be defined thus:

$$\sigma_{ij} = E\{[R_i - E(R_i)]\ [R_j - E(R_j)]\}$$

Variance is an accepted measure of risk. Among other measures used to characterized risk, we have:

- standard deviation or mean deviation: $\sigma = \sqrt{V}$
- the variation coefficient: $C_{variation} = \sigma / E$

Markowitz' model allows the determination of the absolute minimum variance; which, in turn, will determine the efficient combination of assets capable of offering the lowest level of risk; therefore, the model of selection for the optimum portfolio responds to the requirements which satisfy the risk-return criteria, following the maximization of return and minimization of risk.

Before getting practically close to his model, Markowitz introduced a key-concept, the efficient frontier. The principle characteristic of the efficient frontier is that regardless of the behavior of the portfolio's manager, these portfolios are designed in such a way that all combinations of investment return are situated within this efficiency frontier, regardless of the degree of risk taken into account.

[1] Markowitz, Harry, *Portfolio Selection*, The Journal of Finance, vol.VII, No.1, martie 1952, p.77-91

In the case of the Markowitz model, this process of selecting the optimum portfolio is comprised principally of the present period of asset evaluation and the formulation of scenarios tied to the evolution of risk and return, scenarios formulated on the behavior of financial actives which constitute portfolio in the previous periods.

Through his model, Markowitz realizes the fact that the first condition which must be respected is the desire of the investors to maximize the return of the assets in their possession. However, the investor has to take into account the possibility that what will be returned following the investment may be less or much less than the initial investment, therefore, one of the basic concepts on which the portfolio is based is the concept of risk, defined by professor Markowitz using another basic concept, that of return dispersion.

The value of the Markowitz model is in the fact that it is not limited to a theoretical description but also refers to practical aspects, based on certain key-premises, which Markowitz considers as fundamental for the understanding of the way in which the risk-return mechanism functions.

Markowitz' model doesn't take into account the existence of different macroeconomic factors and their influence on the values of risk and return. Although it grouped assets randomly, two by two, this model is not able to anticipate the future evolutions of the assets, evolutions which were heavily influenced by the macroeconomic conjecture as well as different individual factors, specific to each asset in the portfolio. Practically, within this mode, the values registered in the past, regarding the two elements - risk, return - are assumed to maintain the same law of distribution and probability in the future.

Although it presents a series of advantages tied to the simple application, the objectivity at the moment of analysis, most of the times, the application of this model of portfolio management is not always on the same page as financial reality, especially if different significant obstacles appear on the capital market, for example the phenomenon of the current crisis, which manifests itself in all fields. Thus, those values of return registered in the past are no longer relevant to constructing a logical and as close to reality a prediction for the future.

3. CAPM Model

Having as a starting point Markowitz' model, W. Sharpe establishes the basis of a new model of portfolio management, called the diagonal model of portfolio selection. As opposed to Markowitz, it was a model which focused on the simple calculus mechanism; it was a model which could be created without using all of the relations between the assets.

The Sharpe model formed the basis of developing the CAPM (Capital Asset Pricing Model). For the first time, the CAPM model is presented by Sharpe in 1964. The CAPM is a new model, with a series of hypotheses meant to lead to capital market perfection.

The main hypotheses on which the CAPM model is founded are [2]:

- on the market, there is the possibility of investing in assets devoid of risk;
- investors are rational and characterized by aversion to risk;
- any information necessary for the correct evaluation of stocks and shares can be obtained free by all investors;
- the period of investment is the same for all investors.

[2] Victor Dragotă, *Gestiunea portofoliului de valori mobiliare,* Editura Economică Bucureşti 2003, p.89-90

The CAPM model introduces for the first time in the calculations the risk-free active, it is the active which is not plagued by the uncertainty of whether or not "to invest". With the introduction of the risk-free active in the portfolio, a few new elements are also introduced:

- risk-free interest rate (R_f)
- the risk bounty, comprised of two components:
  a) systematic risk $(E_m - R_f) / \sigma_M$
  b) specific risk (ε_i)

Security Market Line (SML) expresses the necessary return of the investment as a sum between the rate at zero-degree and a risk adjustment factor which the investors ask for as a compensation for assuming the risk. This factor of risk adjustment of a given share is obtained by multiplying the risk bounty of the market with the risk of individual investment measured by beta. The SML equation is the following[3]:

$$k_i = k_{RF} + \beta_i (k_M - k_{RF})$$

where:

- k_i = the necessary rate of return for share i;
- k_{RF} = the rate of return of a risk-free asset.
- k_{RF} is, in general, measured by the rate of return of governmental bonds. Depending on the use of calculated cost or the respective share, a long or short term asset is selected;
- β_i = the beta coefficient of share i.
- k_M = the necessary rate of return of a portfolio formed by all assets, the market portfolio. k_M is, also, the necessary rate of return of an average share;
- $RP_M = (k_M - k_{RF})$ = the market risk bounty. This is the additional return, over the rate of the risk-free instruments, which an investor asks for as compensation for assuming a medium risk.

CAPM model (Capital Asset Pricing Model) is used primarily for calculations on invested capital assessment, namely its cost.

CAPM model makes a distinction between the notion of risk unsystematic (firm specific risk) and systematic risk (risk determined by the entire evolution of the market overall). Any economic activity is subject to a certain degree of risk. A certain risk is characteristic for any investment. An investment will perform well or poorly according to expectations of each investor, related to the obtained profit. Unsystematic risk refers at specific risk of each security that makes up the portfolio. This risk can be reduced respectively removed by a portfolio diversification. Systematic risk focus on macroeconomic indicators, the whole economic situation in which the investor acts. CAPM model measures the systematic risk. For a better determination of this risk the CAPM model is using factor beta. This factor is a measure of a security risk compared with the general market risk; like an interpretation at the mean market change, that this factor beta is proportional to the speed of change in asset prices.

Beta factor measurement of systematic risk is influenced, in turn, by other components, including:

- elasticity of cash flow;
- the level of fixed costs
- indebtedness

CAPM model is nothing but a simplification of Markowitz's model, that to find a variety of portfolios optimally efficient one.

---

[3] Eduard Ionescu, *Gestiunea portofoliului* , Editura Fundaţiei România de Mâine, Bucureşti 2009,p. 100-101

Although it is based on a very strict set of assumptions, the model has become fundamental to financial theory. According to the CAPM model, on market can invest in total risk-free securities;

The CAPM model affirms that the stock market is in equilibrium; all assets are properly valued in the market. The value of each asset depends on the expected return and on the risk level of each asset. Practical, the CAPM model demonstrates that there are not abnormal returns on Capital Market.

REFERENCES

1 Badea, L, *Gestiunea portofoliului de titluri primare*, Editura Economica, Bucureşti 2003

2 Brezeanu, P, *Gestiunea financiara a portofoliului*, Editura Economica, Bucureşti, .(2002)

3 Dragota, V.*Piete si sisteme financiare*, Editura Academiei de Studii Economice, Bucureşti (2008**)**

4 Ionescu Eduard , *Gestiunea portofoliului,* Editura România de Mâine, Bucureşti 2009

5 Ionescu, E., *Piete de capital si titluri de valoare*, Editura Fundatiei Romania de Maine, Bucuresti (2003),

6 Markowitz, H., *Portofolio Selection*, The Journal of Finance, vol. VII, No. 1, (1952),

7 Stancu, I., *Piete financiare si gestiunea portofoliului*, Editura Economica, Bucuresti (2002),

8 Eduard Ionescu, *Value At Risk – Strengths and weaknesses of its main approaches on the contemporary financial market*, Metalurgia International, pp.213-216, vol. XV, special issue no 5/2010, ISSN 1582-2214, publicaţie cotată CNCSIS categoria A, Thomson ISI acientific Master Journal List, indexată în bazele de dated EBSCO, EP Products, SCOPUS, Science Citation Index Expanded (Sci Search), Journal Citation Reports/Science Edition

9 Eduard Ionescu, Sebastian Chirimbu, *The Markowitz Model – Challenges and efficiency on the 21st century financial markets*, Metalurgia International, pp.167-170, vol. XV, special issue no 5/2010, ISSN 1582-2214, publicaţie cotată CNCSIS categoria A, Thomson ISI acientific Master Journal List, indexată în bazele de dated EBSCO, EP Products, SCOPUS, Science Citation Index Expanded (Sci Search), Journal Citation Reports/Science Edition

10 Eduard Ionescu , Oprea Constantin Cristian - *The management of the risk and return of movable assets,* International Conference – XIth edition *Risk in contemporary economy*- Dunarea de Jos, University of Galati, Faculty of Economics and Buisness Administration, 26-27 noiembrie 2010, vol I. ISSN 2067-0532