Managing a "N" Securities Portfolio

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Abstract

The financial market is characterized by circulating an impressive volume of data to be incorporated into financial decision in a very short time. Gathering and processing this data would be impossible without the level of performance the computer systems have nowadays. Excel management program used for this application, has the necessary functions for using any econometric model, data being processed in a current stream due to the possibility of the correlating the database with the subsequent stages up to the final stages.

For the application that will be described below, namely the management of a portfolio of eight security bonds, a financial analyst should carry more than 10^{15} computing operations. The demonstration focuses on the analysis of results and on summarizing the concepts used.

Key words: efficient border, capital market line, capital asset pricing model.
J.E.L. classification: F30, G01

1.Introduction

The object of analysis are the securities traded at BSE, taking into account a value that we considered to be significant both for the reasoning underlying the investment decision and for demonstrating the usefulness of portfolio management methods.

Selection of the securities included in the portfolio was based on the following considerations(Vlad C., 2015,113):

- Statistical data were analysed for the last two years, although the international practice recommends a five-year period of time. We considered that the transformations occurred on the Romanian capital market make insignificant the statistical data for longer periods of time.
- Financial investment companies that have not defined sectorial representation have been excluded.
- The minimum number of trading days each year = 200, to meet the liquidity requirement.
- Achieving the possible maximum of the sectorial diversification.
- Positive returns corresponding to a rational behaviour.

2.Markowitz efficient border.

Setting up the model started from the premise that the total elimination of specific risk through diversification is possible by studying the correlations between securities and not necessarily by the number of securities titles. This observation takes into account the fact that different industries evolve in the opposite way, the beneficial effects of a sector has adverse effects on other sector. If the correlations between securities are weak the diversification effect is big (Stancu I,2010,295).

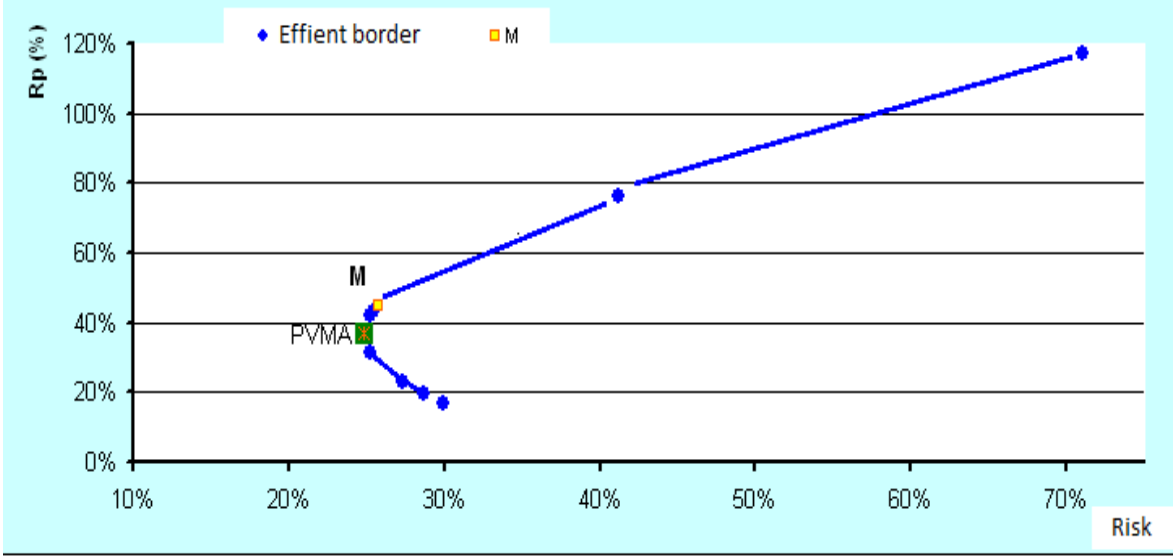
Starting from the idea of a direct relationship between the "assumed risk and the maximum return possible" Markowitz divided efficient and inefficient portfolios. Efficient portfolios are complying with the requirement of maximizing the value of the capital for the assumed level of risk.

Given that the selection of the portfolio is dominated by the attitude towards risk there has been drawn the segment on which to place all categories of investors:

✓ optimal portfolio (PVMA) corresponding to the lowest risk for a given return;

✓ the point where the marginal return is zero (M), over which, in an objective manner, cannot be obtained higher unit returns regardless of the assumed risk.

Chart no.1. Markowitz efficient border



Source:(Vlad C., 2015,115)

A remark should be made regarding the location of the higher limit of the efficient border in comparison with the highest individual return. Higher profitability requirement restricts the possibilities of portfolio diversification leading to increased risk by adding a portion of the specific component. Therefore, the upper limit of effective border is below the maximum individual return. Plotting efficient border is determined by full investment of available capital and by the portfolio credit position ($\mathbf{x_i \geq 0}$)(Stancu I,2010,297)..

Analysis of the chart no. 1 data presents the following situation:

Four portfolios (SNP, TVL, OIL, AMO) are placed under PMVA, fact which is confirmed both by the achieved returns and by the return-risk ratio. PMVA and the M market portfolio have almost equal risks (25% and 26%) but they have different profitability. This means that it makes sense to consider the risk-adverse market portfolio as optimal. For the same risk the M portfolio provides a unitary return of 1.73 which is superior to that of PMVA of 1.48.

In terms of structure, among the portfolios located on the efficient border two (PTR and BRD) are illegitimate meaning that they calls for the elimination of some securities and investing in others. Investments with negative weight are those with the lowest returns, which logically cannot contribute to achieving high returns as required by the two portfolios.

The risk is proportional to the returns achieved for the portfolios located on the efficient border. Note that the efficient portfolio with the highest return, BRD, ensures the lowest consistent return (1.64). The explanation is that it has the highest risk due to the reduced diversification opportunities, only four security bonds. OLT and BRD portfolios realize very close returns and risks, being the only legitimate portfolios, thus having the maximum of diversification.

Structurally, the lowest weight is given to BRD security bond which is the most cost effective but also the most risky. Noteworthy is the fact that OLT and ATB portfolio risk values being close of the ones of PVMA, makes them attractive to risk averse investors.

3.Capital market line (CML).

Its starting point is the efficient border pattern. Correlations taken into account are no longer the ones between the securities, but between them and the market as a unifying factor. Security-market relationship is bivalent: the market triggers a certain risk for the security, which in turn has a particular contribution to the overall risk.

In addition, in the equation is also introduced the risk-free asset as a reference for the effectiveness of the portfolios.

Thus the created portfolio can be assimilated to a portfolio composed of two securities, one without risk but with a lower return and a risky one that provides a return proportional with the risk exposure.

The optimum weight (x) results from the following equations (Lumbi S., 1994,312) :

$$X_{Arisc} = \frac{R_i - R_M}{R_f - R_M}$$

$$X_{Rf} = 1 - X_{Arisc}$$

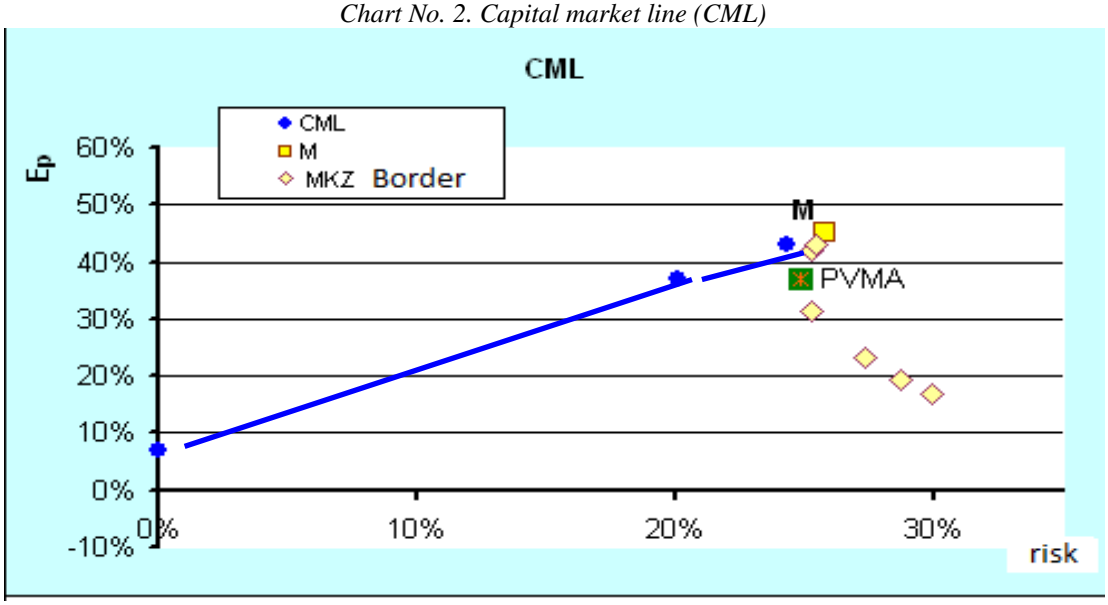
Where: R_i - Return of the risky security;

R_f - Return of the risk-free assets;

R_M - Return on market portfolio.

As shown by the above formulas, the market line has two key indicators: risk-free asset (R_f) and point **M** representing the market portfolio determined by the Markowitz efficient border. Point M divides the creditor portfolios located within the range[R_f - M] from the debtor ones located above point M. Accepting debtor portfolios removes the restriction imposed by Markowitz efficient border, allows full of capital investment, and help increase the volume of investments by borrowing at the interest rate of the risk-free asset. In fact such loans are not possible, but there can be introduced corrections of the portfolio return (E_p) namely the difference between the effective interest rate of the loan (Rd) and the one of the risk-free asset: $E_p - (Rd - R_f)$

Chart No. 2. Capital market line (CML)



Source:(Vlad C., 2015,117)

Identification of the debtor portfolios can be done according to the following criteria:

- Risky assets with negative weight;
- The risk of the **i** portfolio larger than the one of portfolio larger than **M** ($\sigma_i > \sigma_M$) portfolio.

The position of the portfolios on the market line is dominant compared to those on the efficient border except point M, the common point, as they should be considered only for the market risk, the specific risk being eliminated through diversification. Using the same portfolio of securities, to demonstrate the structure of the capital market line have been selected three portfolios on Markowitz efficient border

As a risk-free asset (R_f) due to a weak issue of government securities in Romania have been analysed bonds issued on the domestic market by the European Investment Bank with an interest

rate of 7%, ranked in "0" risk class (AAA). 7% interest rate is close to the average interest rate on deposits used in the banking sector. It is shown that two portfolios (PMVA and ATB) are creditor portfolios, but containing a small percentage of risk-free assets (22% and 5%).

Reaching the other two return objectives (BRD and PTR) is possible only through loans from risk-free interest rate (7%). In real, these portfolios will bring the following returns considering a 12% interest on loans:

$$E_{BRD} = E_{Rf} - (Rd - Rf) = 117 - (12 - 7) = 112\%$$

$$E_{PTR} = E_{Rf} - (Rd - Rf) = 76 - (12 - 7) = 71\%$$

The introduction of the risk-free asset has produced structural changes compared with the efficient border, and in the BRD case it indicates the same insufficiency of the diversification opportunities. The substantive changes determined by the risk-free asset target the risk and unitary return.

Table no.1. Comparison between the unitary risks and returns (CML / SML)

Running no	Indicators	PMVA	$\mathbf{E_{BRD}}$	$\mathbf{E_{PTR}}$	$\mathbf{E_{ATB}}$
1.	σ_{CML}	20	74	47	24
2.	σEfficient border	25	71	41	25
3.	Dif. (1-2)	- 5	+ 3	+ 6	- 1
4.	E_p / σ_{CML}	1,85	1,58	1,61	1,79
5.	$E_p / \sigma_{Fr.efic.}$	1,48	1,64	1,85	1,72
6.	Dif. (4-5)	+ 0,37	- 0,06	- 0,24	+ 0,07

Source:(Vlad C., 2015,118)

Corresponding to the risk changes there occur unit return changes in the same direction. The portfolios with the highest returns (BRD and PTR) have recorded an increase of the risk, as the appropriate diversification cannot be achieved.

4. Capital Asset Pricing Model

The model brings together in a unitary manner the achievements of the financial of science in the 60s. The essence is to establish a linear relationship, a line of the financial securities (SML), between the expected return of a quite diversified portfolio and market risk[3].

$$\mathbf{E_i = Rf + \beta(E_M - Rf)}$$ where:

$\mathbf{E_p}$ - The hope of portfolio return;

$\mathbf{R_f}$ - Risk-free asset interest rate

$\boldsymbol{\beta}$ - Volatility coefficient of the securities relative to the capital market

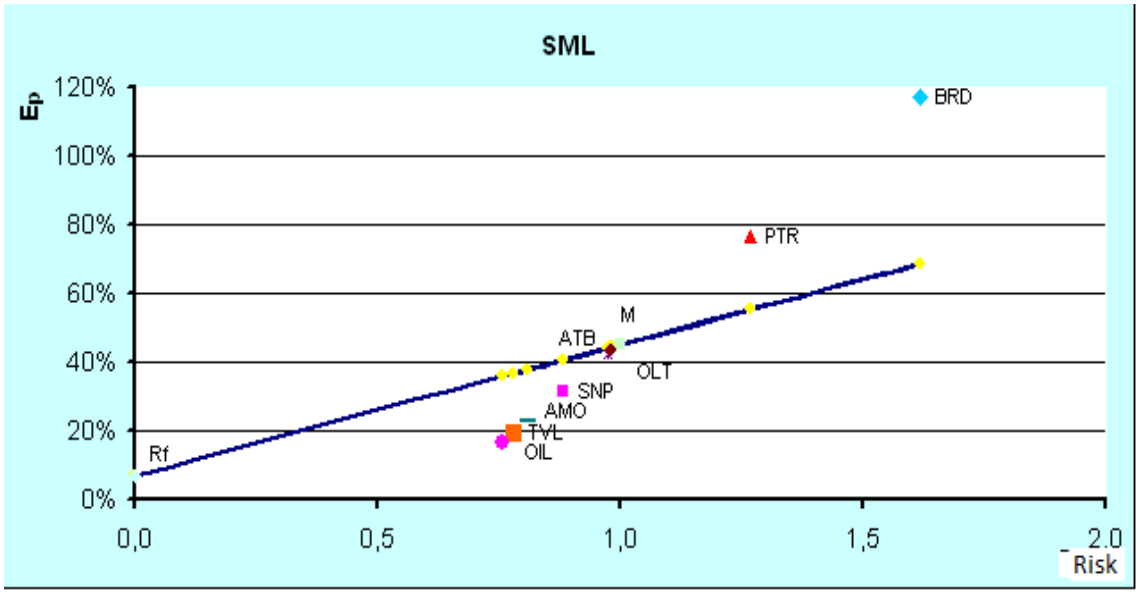
$\mathbf{E_M}$ - Market return

The difference between the market return and risk-free asset ($\mathbf{E_M - Rf}$) is the reward of the investor for the systematically taken risk, after having first made an appropriate selection of the securities in his portfolio to assure the elimination of their specific risk. Financial securities line set up pursuant to the rule of the return of securities indicated by CAPM, is the reference for the way in which the investor should act. Pursuant to "Jensen's equality" the prices of the securities tend to standardize with the market and therefore the securities situated above SML are sold, being overvalued and those located under the line are bought because they are undervalued. Pursuant to the arbitration conducted between the two categories of securities the maximum return of the portfolio can be achieved.

The application created for the portfolio selected by BSE reveals a large area where securities are located. ATB, OLT securities and the portfolio M are located on SML. BRD and PTR securities

are overvalued, and the other are located in the in the area of undervaluation. Arbitration is generally limited as overvalued securities represent only 24% of the portfolio.

Chart No. 3. Securities line



Source:(Vlad C., 2015,119)

The return of the securities calculated using the CAPM model is used as an update rate for calculating the VAN. Among the analysed securities only those with the highest returns (BRD and PTR) had a positive net actuarial value. The same indication results by comparing the market $\mathbf{E_{CAPM}}$ with the internal rate of return (IRR), the latter being higher for the two aforementioned securities. The comparison between the two returns, namely of the market and of the investment project, is very important because it reveals the security-market interdependence(Halpern P. et al, 1998,496).

In other words, the individual is compared with the real possible remuneration of the market. The rate $\mathbf{E_{CAPM}}$ can be used both for pass / fail decision and for substantiating the market action: sale / purchase of securities according to their position on the capital market line.

5.CAPM has zero β.

This version is designed to supplement the practical shortcomings for identifying a risk-free asset as the reporting basis for calculating the risk premium[2].

$$\mathbf{E_i = E_z + \beta(E_M - E_z)}$$

The portfolio, consisting of hypothetical risky assets, must provide a maximum diversification, including for the disposal systematic risk. Studies conducted on various combinations of portfolios of BSE securities emphasize the fact it is tough to identify a risk-free portfolio. For values of β above 0,02 the return of the portfolio is negative and is therefore not logical to take it into account. The portfolio chosen for exemplification has β = 0.07 and E_z = - 0.289%.

The cause is the fact that not in many cases an appropriate structure for the total elimination of market risk can be achieved. Basically, the portfolio return with β_0 must be situated between a macroeconomic benchmark (inflation, bank interest, etc.) and PMVA.

The accuracy of the models applied has been tested by introducing securities with negative returns in the portfolio. It results from the analysis of efficient portfolios that such securities are insignificant or it is recommended to sell them (negative weights).

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