STUDY REGARDING THE ASSETS EVALUATION ON THE FINANCIAL MARKET THROUGH THE C.A.P.M. MODEL

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Abstract
Capital Asset Pricing Model (CAPM) was introduced through the works of William Sharpe (1964), John Lintner (1965) and Jan Mossin (1966) based on the research of Henry Markovitz. Due to the independent formulation of the model by these three american researchers, there are in the literature references to the Security Market Line (SML) model of financial assets evaluation. CAPM model, revolutionized the financial theory, highlighting the link between the rentability of the individual securities and the rentability of the financial market. The first fundamental hypothesis of the model is that investors are concerned about the expected rentability closely related to the risk associated with it. Consequently, under equilibrium conditions of the financial market, the CAPM model highlights a linear relationship between the expected rentability of the portfolio and the amount of risk assumed by investors.
Key words: CAPM model, rentability, risk, volatility
JEL classification:G12, G15.

1. Introduction

The capital asset pricing model (CAPM) of William Sharpe (1964) and John Lintner (1965) marks the birth of asset apricing model theory (resulting in a Nobel Prize for Sharpe in 1990).[i]

The C.A.P.M. model demonstrates that, at the efficient financial market equilibrium, the rentability of a financial instrument is determined by a macroeconomic factor, the market overall rentability, and by the β coefficient of the instrument. C.A.P.M. is a unifactorial model of equilibrium, it's value being a function that depends on the risk assumed by the investors and on the estimated rentability.

Applying this model, it can be established if a financial title is undervalued, overvalued or properly evaluated. If the theoretical price of the title is higher than the market price, than the title is undervalued and vice versa.

[i] *Eugene F. Fama, Kenneth R. French, "The Capital Asset Pricing Model: Theory and Evidence", Journal of Economic Perspectives-Volume 18, Number 3-Summer 2004.*

The attraction of the CAPM is that it offers powerful and intuitively pleasing predictions about how to measure risk and the relation between expected return and risk.[i]

2. Literature review

The CAPM model has been the subject to a large number of empirical studies since the papers of Lintner and Sharpe in 1960s. The most important studies are those of Fama and MacBeth (1973), Douglas (1968), Blume and Friend (1973), Miller and Scholes (1972) and Stambaugh (1982).

The fundamental assumption of the C.A.P.M. model is that the investors are concerned with the expected rentability closely related to the risk associated with it. There are also some traditional assumptions regarding the capital market perfection:

- the dividends and the capital gains are not taxed
- the buyers and the sellers are too many and they can not influence the market prices
- all the investors take investment decisions at the same moment
- the expectations regarding the title's performances are the same for all the investors
- it can be obtained for free any information needed for the titles's evaluation
- all the transaction costs and all the assets are perfectly divisible

The most important innovation of the C.A.P.M. model consists in defining the asset without risk. The asset without risk is the asset whose future rentabilities are uncertain.

Taking forward the arbitrage theory, William Sharpe develops the idea of combining an asset without risk with a portfolio of risky assets, but sufficiently diversified to obtain the lowest risk at an expected rentability (efficient portfolio or market portfolio).

This led him to a new frontier of efficiency, with a particular form: that of a line known as the Capital Market Line (CML).

The Capital Market Line equation is:

$$E_p = R_f + \frac{E_M - R_f}{\sigma_M} \times \sigma_p$$

The C.A.P.M. model equation is based on: the market interest rate without risk - Rf, the title's risk in relation to the market - σM (this is actually the CML's slope) and the risk premium - σp and measures the expected rentability of a portfolio of risky assets - Ep. William Sharpe defined the market portfolio as the portfolio which is composed of a title of each, the weighting being according to the ratio

[i] *Eugene F. Fama, Kenneth R. French, "The Capital Asset Pricing Model: Theory and Evidence", Journal of Economic Perspectives—Volume 18, Number 3—Summer 2004.*

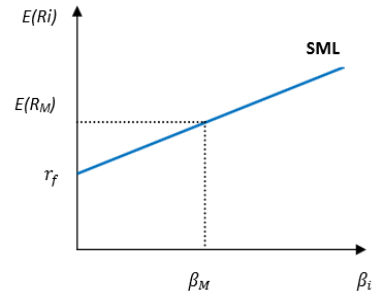
between the market value of each title and the overall value of the market. The C.A.P.M. model identifies the linear relationship between the expected rentability and the amount of systematic risk assumed by the investor to purchase the financial title.
That relationship is represented by the Security Market Line (SML):

$$Ei = R_f + (E_M - R_f)\beta_i$$

where: Ei = the expected rentability of the portfolio
Rf = the rentability of the financial instruments without risk
βi = the beta coefficient, the slope of the regression right
EM = the expected rentability of the market portfolio
EM – Rf = the market risk premium

The market risk premium depends on the level of aversion that the investors have toward the risk. At the financial market equilibrium, the risk premium of a financial asset is a linear function of the title's ("i") contribution in estimating the market risk. Therefore, the rentability of a risky financial title is equal to the rentability on a un-risky financial title (Rf), plus the market risk premium adjusted with the beta coefficient.
The relationship between the beta coefficient and the expected rentability of a financial title can be graphically represented by the SML right, the financial securities properly evaluated being on this right.

Figure nr.1. Security Market Line



The size of the systematic or unsystematic character of the title's risk is given by the intersection points distribution towards the regression right. More the individual points of intersection are closer to the regression right, more the systematic risk will have a higher weight and vice versa. The systematic, undiversified risk, depends on the most important macroeconomic indicators such as: the average rate of interest, the exchange rate, the Gross Domestic Product and the inflation.These indicators affect all the companies simultaneously, so the systematic risk can not be eliminated.
Therefore, more the beta coefficient is higher, more the systematic risk of the financial title will be higher. The coefficient can be positive, negative and can have

higher or lower values. Beta represents an elasticity coefficient of the variation of the title's individual rentability after the variation with one unit of the market overall rentability.

3. The research methodology

The research regarding the application of the C.A.P.M. model was based on the financial information of a company listed on the Bucharest Stock Exchange, at the first category.

The first part of the research is represented by the analysis regarding the shares rentability and risk. We considered as price analysis, the shares closing price (Pî) from the period 05.12.2013–30.05.2014. In order to calculate the rentability, it must be considered the value of the updated dividends (Da) granted by the issuing company.

During the financial years ended at 31 December 2012 and at 31 December 2013, the company didn't paid dividends to its shareholders, therefore to determine the weekly rentabilities of the company, we didn't calculated the sum between the weekly closing prices of the society and the updated dividends.

To observe the shares price reaction to the general index of Bucharest Stock Exchange (Bet Composite, BET-C) changes, the research continued with the determination of the beta coefficient, which highlights the amount of systematic risk of the securities. All the calculations were realised weekly. Regarding the shares volatility, we considered the closing prices, and the weekly values recorded by the BET-C index, resulting for the analyzed period a number of 26 weeks. We also determined the title's risk using statistical and mathematical models (the variance and the standard deviation) and the intensity of the correlation between the title and the market rentability, by calculating the correlation coefficient. In order to apply the C.A.P.M. model, it was considered the interest rate for the last issue of romanian governmental bonds, as the rate of rentability without risk.

Also, to obtain information concerning the future evolution of the company's shares, we conducted a technical analysis using the moving average method.

4. Discussions

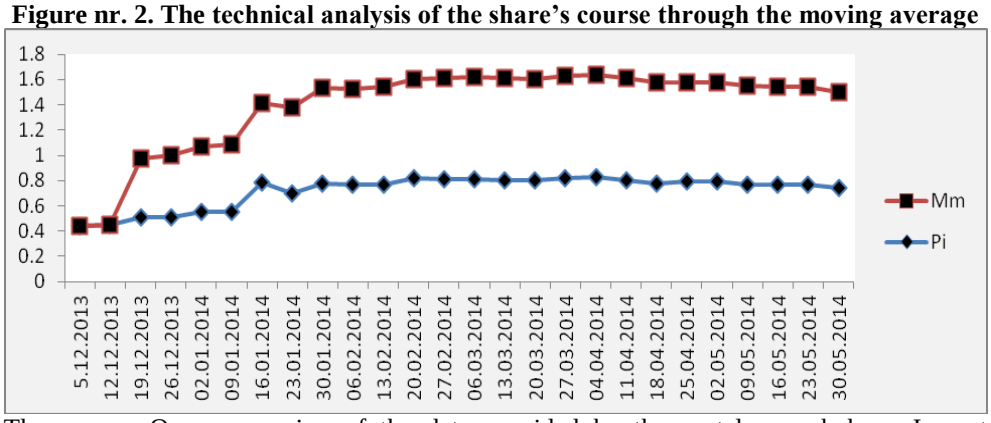
The analyzed company is Impact Developer & Contractor S.A. The main activity of the company is to provide construction services for residential and non-residential buildings, NACE code 4120. The company is listed on the Bucharest Stock Exchange since 1996, and has a subscribed capital of 197.866.574 lei. In 2006, its shares were promoted to the first category of the Bucharest Stock Exchange, becoming the most successful company in the construction sector. Its capital is divided into 197.866.574 common shares, with a nominal value of 1 leu per share.

4.1. The technical analysis of the course of the company's shares

This type of analysis provides information regarding the future evolution of the share's course. The technical analysis is based on the following assumptions: all

factors that influence the share's course are contained in its levels, the history repeats and the participants at the market generally have an irrational behavior.
The data used in this analysis are those related to the course of the company's share, considered to be the most important element in the technical analysis. The course evolution in a long time forms a trend. It is considered that the history repeats on the financial markets because the participants have a relatively constant behavior. Moving averages are one of the oldest and most popular instruments used in technical analysis, highlighting the upward or downward trend of the share's course and signaling the moment for purchase or for sale.
The buying signal is given when, for the first time, the price of the title is higher than the moving average, and the signal of sale when, for the first time, the price of the title is lower than the moving average.
We consider that the analyzed period to determine the moving average (05.12.2013-30.05.2014 – about 200 days) is long enough for highlighting a trend (figure nr. 2).

Figure nr. 2. The technical analysis of the share's course through the moving average



The source: Own processing of the data provided by the portal www.bvb.ro- Impact Developer & Contractor S.A. company

We notice that, after the first six weeks of the analyzed period, the course of the share (Mm) begins to have a relatively linear trend, fluctuating around the same values. However, through the whole period, the closing prices of the share (Pi) are below the moving average curves. This reflects the decreasing trend of the shares course and a signal for investors to sell them.

4.2. The financial assets evaluation through the Capital Asset Pricing Model (C.A.P.M.)

In order to apply the C.A.P.M. model, we determined the company's rentability and risk, based on the weekly closing prices of the analyzed period and on the weekly values of the Bet Composite (BET-C) index – table nr.1.

Tabel nr. 1. The risk and the volatility of the share of the analyzed company

IMP									
Data (05.12.2013 – 30.05.2014)	**Bet-C**	**Rp (%)**	**Pî**	**Rs (%)**	**Rs-Rsm (A)**	**Rp-Rpm (B)**	**B^2**	**A^2**	**A*B**
05.12	3310		0.4420						
12.12	3264	-1.39	0.4510	2.04	-0.42	-1.43	2.04	0.18	0.60
19.12	3303	1.19	0.5075	12.53	10.07	1.15	1.32	101.4	11.58
26.12	3338	1.06	0.5100	0.49	-1.97	1.02	1.04	3.88	-2.01
02.01	3348	0.3	0.5490	7.65	5.19	0.26	0.07	26.94	1.35
09.01	3404	1.67	0.5510	0.36	-2.1	1.63	2.66	4.41	-3.42
16.01	3400	-0.12	0.7870	42.83	40.37	-0.16	0.03	1630	-6.46
23.01	3390	-0.29	0.7015	-10.86	-13.32	-0.33	0.11	177.4	4.4
30.01	3326	-1.89	0.7800	11.19	8.73	-1.93	3.72	76.21	-16.85
06.02	3292	-1.02	0.7720	-1.03	-3.49	-1.06	1.12	12.18	3.7
13.02	3268	-0.73	0.7670	-0.65	-3.11	-0.77	0.59	9.67	2.39
20.02	3265	-0.09	0.8200	6.91	4.45	-0.13	0.02	19.80	-0.58
27.02	3237	-0.86	0.8100	-1.22	-3.68	-0.9	0.81	13.54	3.31
06.03	3249	0.37	0.8100	0	-2.46	0.33	0.11	6.05	-0.81
13.03	3164	-2.62	0.8015	-1.05	-3.51	-2.66	7.08	12.32	9.34
20.03	3191	0.85	0.8020	0.06	-2.4	0.81	0.66	5.76	-1.94
27.03	3209	0.56	0.8200	2.24	-0.22	0.52	0.27	0.05	-0.11
04.04	3261	1.62	0.8240	0.49	-1.97	1.58	2.5	3.88	-3.11
11.04	3248	-0.40	0.8000	-2.91	-5.37	-0.44	0.19	28.84	2.36
18.04	3291	1.32	0.7800	-2.5	-4.96	1.28	1.64	24.60	-6.35
25.04	3270	-0.64	0.7900	1.28	-1.18	-0.68	0.46	1.39	0.80
02.05	3268	-0.06	0.7900	0	-2.46	-0.1	0.01	6.05	0.25
09.05	3326	1.77	0.7700	-2.53	-4.99	1.73	2.99	24.90	-8.63
16.05	3249	-2.32	0.7700	0	-2.46	-2.36	5.57	6.05	5.81
23.05	3239	-0.31	0.7700	0	-2.46	-0.35	0.12	6.05	0.86
30.05	3337	3.03	0.7400	-3.90	-6.36	2.99	8.94	40.45	-19.02
		1		**61.42**			**44.07**	**2241.77**	**-22.55**
		Rpm= 0,04		**Rsm = 2.46**			**σ^2_p= 1.76**	**σ^2_s= 89.67**	**σ_s*_p= -0.9**

The source: Own processing of the data provided by the portal www.bvb.ro- Impact Developer & Contractor S.A. company

The indicators calculated in the table nr.1 have the following meanings:

- Rp = the market rentability, according to the evolution of the BET-C index;
- Rpm = the average rentability of the market;
- Rs = the share's rentability, determined according to the closing price evolution;
- Rsm = the average rentability of the share;
- σ^2_p = the market rentability dispersion;
- σ_s*_p = the covariance between the title's rentability and the market rentability;
- σ_p = the standard deviation of the market, the overall risk of the market;
- σs = the standard deviation of the share;
- $ß_p$ = the volatility coefficient of the market;
- $ß_S$ = the volatility of the share;

- ρs*p = the correlation coefficient between the title's rentability and the market rentability

The volatility and the risk of the market

- The average rentability of the market: Rpm = 0,04%
- The market rentability dispersion: $\sigma^2_p = \sum(Rp-Rpm)^2/25 = 44,07/25 = 1.76$
- The standard deviation of the market (the overall risk): $\sigma_p = \sqrt{\sigma_p^2} = \sqrt{1.76} = 1,33$

We can conclude that, in the future, the market rentability can record weekly, values between 0.04% ± 1.33%

The beta coefficient of the market is 1.

$$ß_p = \sigma_{p*p}/\sigma_p^2 = (1/\sigma_p^2*n) * \sum (Rpi-Rpm)^2 = \sigma^2_p/\sigma^2_p = 1$$

The volatility and the risk of the company's share

-The average rentability of the share: $Rsm = \sum Rs/25 = 61/25 = 2.46$

-The rentability's dispersion: $\sigma^2_s = \sum(Rs-Rsm)^2/25 = 2242/25 = 89.67$

-The standard deviation (the overall risk): $\sigma_s = \sqrt{\sigma^2_s} = \sqrt{89.67} = 9.47$, it results that the share's rentability can have in the future, weekly values between 2.46±9.47%

- The covariance between the title's rentability and the market rentability:

$$\sigma_s*_p = \sum (Rs-Rsm)*(Rp-Rpm)/25 = (-22.55)/25 = -0.9\%$$

- The share's volatility ($ß_S$):

$$ß_S = \sigma_s*_p/\sigma^2_p = (1/\sigma_p^2*n)*\sum(Rs-Rsm)*(Rp-Rpm)$$

$$ß_S = (-0.9)/1.76 = -0.51$$

Generally, ß coefficient values are positive, the titles with ß<0, being very rare. This value of the volatility indicates an evolution of the title contrary to that of the market. As a result, when the market increases, the share decreases, and vice versa.

The intensity of the correlation between the share's rentability and the market rentability is given by the correlation coefficient (ρs*p) that is equal with the ratio between the title's covariance with the market and the standard deviations of the share's rentability and those of the Bet-C index.

$$\rho s*p = \sigma_s*_p/(\sigma_s*\sigma_p) = (-0.9)/(9.47*1.33) = (-0.9)/12.6 = (-0.0714)*100 = -7\%$$

The correlation coefficient (-7%) highlights a negative conection and a low intensity between the share's rentability and the market rentability.

Knowing that $\sigma^2(R_i) = ß_i^2\,\sigma^2(Rp) + \sigma^2(\varepsilon_i)$

or (The total risk)² = (The systematic risk)² + (The specific risk)², it results that the **specific diversifiable risk**:

$$\sigma^2(\varepsilon_s) = \sigma^2_s*(1-\rho^2 s*p) = 89.67*(1 - 0.0051) = 89.67*0.9949 = 89.21$$

$$\text{So, } \sigma(\varepsilon_s) = \sqrt{89.21} = 9.44\%$$

Considering the obtained volatility of -0.51 (<0) we can assume that in the future, a increase in the market rentability with a percentage point would cause a decrease in the share's rentability with less than a percentage point. Instead, if there would be a

decrease in the market rentability, it would be preferable to increase the title's weight in the portfolio because the rentability would increase, even if with less than a percentage point.

$$Ei = R_f + \left(E_M - R_f\right)\beta_i$$

Ei = 3,5 + (1– 3,5)*(-0.51)= 4.8%

Ei (CAPM) > EM => the share is overvalued.

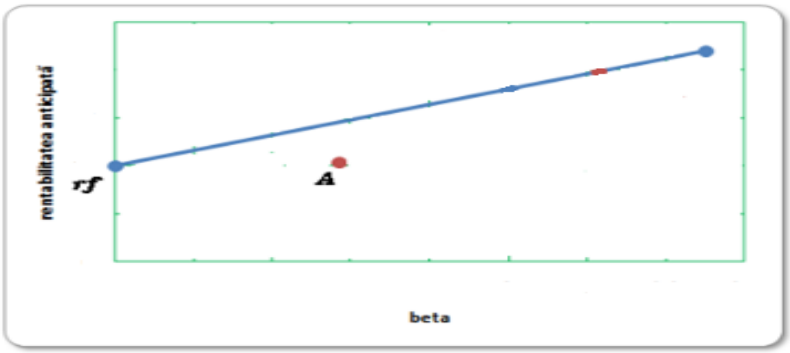
4.3. The financial assets evaluation through the Security Market Line (SML)

The graphical representation of the relationship between the beta coefficient calculated through the C.A.P.M. model and the expected rentability of a financial title is called the Security Market Line, and the properly evaluated assets are situated on it.

Beta coefficient will be zero in the case of an un-risky financial title, because the covariance between the rentability of the un-risky financial title and any other risky title is zero.

The financial titles evolution of the analyzed company is presented in the figure nr.3.

Figure nr. 3. The society's shares evaluation through SML



The shares situated below the SML right are overvalued. Therefore, the company's share, noted with A, will be sold, and its price will decrease until it will be on the SML right and it will be properly evaluated.

All the three types of analysis, lead to the conclusion that the shares value presents a downward tendency, so it is recommended to sell them.

5. Results

Applying the C.A.P.M. model for the financial assets evaluation on the period 05.12.2013–30.05.2014, we reached to the conclusion that the company's shares are overvalued. Also, considering the obtained volatility of -0.51 (<0), it can be said that in the future, a change in the market rentability with a percentage point would cause a change in the share's rentability with less than a percentage point and in the opposite direction. If there would be a decrease in the market rentability,

it would be preferable to increase the title's weight in the portfolio because the rentability would increase, even if with less than a percentage point.

Despite the criticisms of the C.A.P.M. model, especially those related to the beta's coefficient variability in time, and to the possibility to be only approximated, this model remains the most commonly used both for portfolio selection and for the company's evaluation.

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