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TESTING THE MARKET MODEL – A CASE STUDY OF FONDUL PROPRIETATEA (FP)

Sorin Claudiu RADU

Faculty of Finance, Banking and Accounting Bucharest, "Dimitrie Cantemir" Christian University, E-mail: radusorin_ucdc@yahoo.com

Abstract *The financial theory related to the bond portfolio analysis was coined by Harry Markowitz, an authentic 'pioneer of the modern bond theory', and his well- thought interpretation of the bond selection model may be found in his research papers "Portfolio Selection" (Markowitz M. Harry, 1952) and "Portfolio Selection: Efficient Diversification of Investments" (Markowitz M. Harry 1960). This paper is proposed to test the market model in the Romanian stock market, case of Property Fund.*

Key words:
Portfolio of securities financial, the market model, regression function, Property Fund
JEL Codes:
G11, G14, G17

1. Introduction

The works written by Markowitz, the winner of the Nobel Prize for Economy in 1990, have as starting points risk and return on a diversified portfolio of securities financial and highlight that the management of the financial instrument portfolio must not focus on revenues generated by investment opportunities and their profitability, but on the relation established between profitability and risk.

As for Markowitz's financial model, in the same way as for the case of the other financial models, the expected revenue or profitability shall be considered to be equal to the average yields recorded (or the average yields for the various scenarios of production), and the risk is the variance or, as the case may be, the standard deviation of these outputs from the average. Markowitz, "*Portfolio Selection*", said that the yield and the risk of any investment are two concepts directly proportional, which means that the higher investment risk is, the larger the yield expected by rational investor gets, willing to expose to the risk only in exchange for an appropriate remuneration of the placement.

Markowitz also considers that any asset may be very risky if this is taken separately as a non-diversified investment, but if it is included in a portfolio together with another asset that is negatively correlated, may diminish the risk of that particular portfolio.

The most important conclusion of the model is that an investor can reduce the volatility of its portfolio (its risk respectively) and can (at the same time) increase its yield, as Markowitz's model aims at maximizing the expected yield, and, in this context, it's important to study the selection of the estate bond portfolio in order to set up the optimal proportion of the portfolio bonds.

Although the theory of optimal portfolio selection, elaborated by Markovitz led to adopting some changes of this model to comply better with the requirements regarding a better selection and administration of the investment portfolios.

2. The market model

Along this line of thought, the relation existing between the yield achieved by an estate value and market yield, was formalized by William Sharpe through „ *the market model*", on the basis of the following principle: managing the financial bond portfolios is the concern of the financial investors to anticipate the growth trends or the decrease ones of the general index of the capital market, considering the fact that each estate value is linked to the market trends.

The model of the market, "in its simplest form, stands for the linear relation that may exist between the profitability rates recorded during a period of time on an action or on a portfolio of financial instruments and the rates of the yield achieved in the same period by the index of stock market" (Anghelache, G., Dardac, N., Stancu I., 1992).

According to the model, the total variability of the yield of a financial instrument is determined by:

- The influence of the stock market, which always results in a risk, also known as risk without distinction or the risk of the market. This risk is linked to the main variability of the macroeconomic indicators: gross domestic product (GDP), inflation rate, average interest rates, the exchange rate, etc. Macroeconomic

indicators variability induces a more or less obvious influence on the yield of instruments, and this influences size is determined by the dependence size of the company's activities that sets up the national economic environment conditions;

- the influence of the features specific to each instrument, which determines the specific or differentiated risk.

According to the market model, the equation of the line which statistically adjusts at best the variation points is:

$$R_i = \alpha_i + \beta_i \cdot R_M + \varepsilon_i \quad (1)$$

Where:

α_i - parameter of the function is equal to R_i then when R_M is 0;

β_i - coefficient of regression, volatility;

R_M - market yield measured through the general index of the stock exchange;

ε_i - parameter specific to title through which the individual risk is measured.

The most important parameter of the regression function is coefficient β, which expresses the marginal yield of the bond „i" referring to the general yield variability on the stock exchange market, so the systematic risk quantity of the bonds. The coefficient estimates for each title in part have a certain approximation, bigger or less.

To highlight the relevance of coefficient β, the observations on the yield of bond „i" and the market itself, are done considering minimum the last five years, for which it is expected to get a sustainable β (with a constant value in the future). Determining the coefficient β is done using the method of the small square method.

$$\beta_i = \frac{\text{cov}_{im}}{\sigma_m^2} \quad (2)$$

According to the formula, the coefficient „β" of the volatility title „i", this is equal to "co-variation" (σ_{im}) of the rates of "i" bond yield with those of the stock exchange market, according to the dispersion of the general index of the bond market.

$$\text{cov}_{im} = \frac{1}{n}\sum_{t=1}^{n}\left[Rt_i - \overline{R}_i\right]\left[Rt_m - \overline{R}_m\right] \quad (3)$$

As mentioned above, the risk of an investment stands for the possibility of yield anomaly compared to the expected average as a result of modifying the economic-financial phenomena, which determines it. Considering their frequency and their more or less symmetrical distribution on the one hand and the average, on the other hand, the risk effects can be anticipated.

Taking into account this hypothesis of normality, the frequently used instruments for measuring risk are dispersion σ^2 and the root mean square anomaly σ.

The dispersion of „i" bond is calculated by the means of formula: $\sigma_i^2 = \frac{1}{n}\sum_{t=1}^{n}\left[Rt_i - \overline{R}\right]^2$ and represents the average of the effective square anomaly yield compared to the average yield, calculated either on the basis of some values recorded in the past, or on the basis of a certain probability distribution. The average square anomaly (volatility) as a measure of estate value risk $\sigma_i = \sqrt{\sigma_i^2}$, is the square root of dispersion.

To estimate correctly the risk of the market, it is necessary to test the intensity of the correlation that leads to determining coefficient β. The statistic measure of this intensity is given by two indicators, such as: coefficient of correlation (ρ) that expresses the degree of determining the yield of „i" bond by the yield of the stock exchange market „m" and its square, the coefficient of determination (R Square, R^2), respectively.

$$\rho_{im} = \frac{\text{cov}_{im}}{\sigma_i \times \sigma_m} \quad (4)$$

As resulting from the statements above, as statistic size, the coefficient of correlation is determined by reporting co-variation to the standard anomalies of „i" and „m" yields. The correlation indicates the intensity of the link existing between the variables by measuring the degree of spreading the data recorded around the regression line.

The positive values of the coefficient reveals a dependency directly proportional between „i" and „m" values. The maximum value equal to 1 stands for a strictly positive correlation, respectively the whole variation of „i" bond, is determined by the variation of „ m" market yield, similarly. In this case, the risk that appears is the market risk, without any specific risk. For null values, the coefficient highlights a lack of correlation between „i" and „m" yields, respectively, an independency of their determination. For „i" bond, the only risk that is manifested is the specific risk, the market risk being equal to zero. The negative values of the coefficient reveal a dependency indirectly proportional between „i" and „m" yields. The maximum value equal to -l stands for a correlation strictly negative, which eliminates the specific risk. The difference towards the strictly positive correlation consists of the fact that the variation of „m" yield determines the same variation, but conversely to „i" yield.

The coefficient of determining R^2 is a complement of the correlation coefficient. It expresses the proportion in which the variability of „i" bond yield is explained (determined) through the market model (linear):

$$R^2 = \rho^2 = \beta^2 \frac{\sigma_m^2}{\sigma_i^2}.$$

Estimating the separated yield, R_i, starts with „β" already calculated and constant for the following period. Practically, these coefficients are changeable in time. To estimate „β" is calculated anterior as a bench measure unit determined considering the anterior variability, both of R_i, and of R_M.

As $\frac{1}{n}\sum_{t=1}^{n}\left(R_{it} - \bar{R}_i\right)\times\left(R_{Mt} - \bar{R}_M\right)$ represents co-variation (σ_{iM}) of the yield rates of „i" bond with the ones of the stock-exchange, and $\frac{1}{n}\sum_{t=1}^{n}\left(R_{Mt} - \bar{R}_M\right)$ represents the dispersion (σ_M^2) of the general index of the market, simplified β_i, can be written as follows:

$$\beta_i = \frac{\sigma_{iM}}{\sigma^2_M} \qquad (5)$$

To measure the current correlation between the securities yield and stock market profitability, it is used another indicator called the correlation coefficient "r", calculated as the ratio between the co-variation of "i" bond profitability rates with the ones of the stock market, as well as the product between the standard deviation of the bond and that of the market profitability:

$$\rho = \frac{\sigma_{iM}}{\sigma_i \times \sigma_M} \quad \text{sau} \quad \rho = \beta_i \times \frac{\sigma_M}{\sigma_i} \qquad (6)$$

3. Testing the market model- a case study of FP-Property Fund

For testing the market model there were used the closure rates of BET-C index and Property Fund shares, a company listed on the Bucharest Stock Exchange to category I as from January 25 2011, each Wednesday of the week, considering the period from 03.01.2013 to 17.12.2013.

To validate the market model, respectively to highlight the dependency degree between the market yield (BET-C index) and the yield of FP shares, we analysed the statistic data by the means of Regression analysis instrument, Microsoft Office - Excel, which executes the analysis of linear regression by using 'small square' method, thus determining the parameters 'α' and 'β', of the regression function and representing graphically the regression function.

Further on, we analysed the variance (ANOVA - Analyses of variance), on the basis of which we achieved the data analysis. As the results given by the econometric analysis soft -EViews (Econometric Views), contain, besides the results got after a variance analysis and a number of supplementary tests, we considered it to be necessary to present the results got after using this soft.

To aim this objective, we have studied and calculated the statistical features of BET-C and FP yields and the grid of the FP correlation coefficients compared to the general index of the market. Thus, the synthesis of the numerical results in the case of action is presented in the table no. 1.

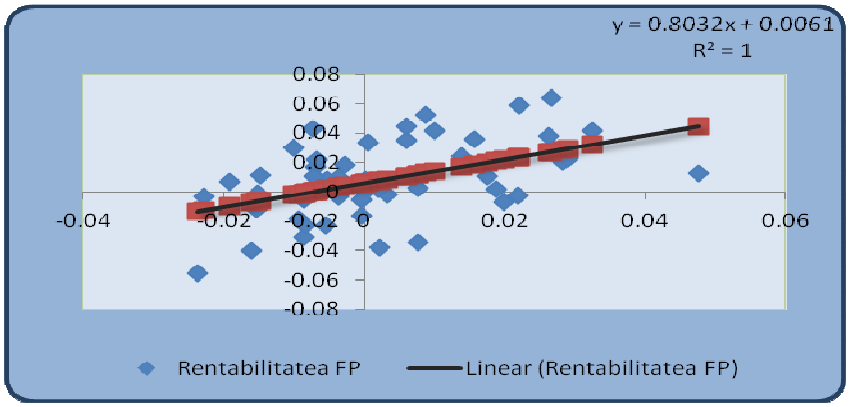
Table 1. Synthesis of the numerical results for FP – BET-C

Average yield in %		**Variation (dispersion) Average anolamy of yield** in %		**Co-variation** in %
R_{BET-C} = 0,27%	R_{FP} = 0,83%	σ^2_{BET-C} = 0,02	σ^2_{FP} = 0,07	$\text{cov}_{FP-BET-C}$ = 0,02
Volatility (average square anomaly) in %		**Coefficient of correlation**		
σ_{BET-C} = 1,57	σ_{FP} = 2,63	$\rho_{FP-BET-C}$ = 0,479944		

Source: My own analysis of the processed data (Microsoft Excel)

Further on, I have represented graphically the market model for the FP shares.

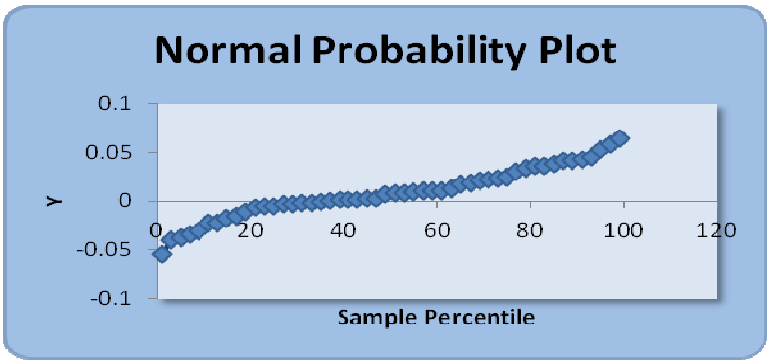
Graphic 1. Representation of the market model for FP - BET-C



Source: processing the data by using EViews 4.0.

The graphic representation of the regression line points to a high volatility which means a variation of the market yield of ±1%, FP yield is modified by 80%. Thus, we can remark that FP displays a high sensitivity to the general evolution of the market. In graphic no. 2, I pinpoint the analysis of the quality of the chosen analysis model.

Graph 2. Independent variable diagram vs. residuals for FP - BET-C



Source: processing the data by the means of EViews 4.0

Further on, using Excel/Data Analysis, I have achieved the following results:

Table 2. Regression of the adjusted week yields (dependant variable - FP) towards the coefficient of asymmetry (independent variable - BET-C) in 2013

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.479944
R Square	0.230346
Adjusted R Square	0.214312
Standard Error	0.023291
Observations	50

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.007793	0.007793	14.36571	0.00042
Residual	48	0.026038	0.000542		
Total	49	0.033831			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.006083	0.003344	1.81902	0.075149	-0.00064	0.012806
Market yield (BET C)	0.803168	0.211906	3.790212	0.00042	0.377103	1.229233

Source: processing the data by using the function of Regression of Microsoft Office Excel

From the table of variation analysis ANOVA (table no. 2), we can draw the following conclusions:

- The correlation coefficient (ρ), expressing the degree of determination of the FP share yield by the market yield, has the value of 0.4799 which indicates a low dependency of FP share compared to the market yield. In other words, 47.99% of FP share yield is determined by the direct dependency considering the market (its volatility), the rest of 52.01% of the yield being determined by the influence of other unrecorded factors, usually the internal factors of the company;

- Coefficient of regression (β) is positive (the yield of BET-C yield) and reaches 0.80. Even if the positive sign of the regression coefficient pinpoint the direct connection between the market yield and FP share yield, however, a small variability of FP yield is remarked, and determined by the variation of the market yield, more exactly the increase by a unit of the market yield index of FP shares , which is about 0,80 units increase;

- parameter α of the regression function, which signifies that the value of the FP bond yield then when the general yield of the market is null, has, in our case, for $R_m = 0$, a positive value, of 0,0060;

- from the point of view of the determination coefficient, the value of R^2 (R Square) reveals a low proportion (23.03%) of explaining the variation of FP yield through the variation of BET-C yield.

As for the series of X data (the yield of BET-C index), Y (the yield of FP shares), regression achieved by EViews, the following data are given:

Table 3. The features of the regression model- FP case study

Dependent Variable: R FP				
Method: Least Squares				
Included observations: 440				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
R BET C	0.803168	0.211906	3.790212	0.0004
FP	0.006083	0.003344	1.819020	0.0751
R-squared	0.230346	Mean dependent var		0.008271
Adjusted R-squared	0.214312	S.D. dependent var		0.026276
S.E. of regression	0.023291	Akaike info criterion		-4.642341
Sum squared resid	0.026038	Schwarz criterion		-4.565860
Log likelihood	118.0585	F-statistic		14.36571
Durbin-Watson stat	2.424834	Prob(F-statistic)		0.000420

As for the data got as a result of the regression got with the help of EViews 4.0. package, I have reached the following conclusions:

- as for FP, for the free term of the model (Intercept), we have *P-value* = 0.23, which determine us to state that if the hypothesis according to which the intercept is equal to zero, then the error is only 23,03%. In this case, we reject this statement and accept that the real hypothesis according to which the intercept is different from zero. Thus, we draw the conclusion that the slope of the line is different statistically from zero;

- the absolute value of t-statistic is higher than 2 (3.790212, in our case) indicates the value of β which is not zero, but not significantly. If β is significantly different from 0, the factor X (the yield of BET-C index, of the market) does not explain the evolution of FP yield;

- considering the analysed data, as F = 14.36571, which is a very small value, and significance F = 0.000420, so a very small value, the conclusion is that we cannot accept that the chosen model adjusts properly to the sample data. As a result, using F test, we cannot accept that the regression model is good.

4. Conclusions

In accordance with the above rules, for the purpose of the estimation of parameters of actions mentioned, using the software EViews and analysing the

information box about the model sustainability, I noticed that the values of the multiple determination coefficient (R Square)" and of the coefficient of adjusted determination „$\overline{R}^2$"" are small, which means that through regression it is explained a small percentage of total variance of dependant variables. I have also noticed that the standard error of the model, is high, and the sum of error squares is very high.

Considering the above statements and analysing through the graphic method of the market model, I drew the conclusion that the variation of the model may raise different issues, and as for FP shares, it does not seem to be constant.

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