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Study of Effectiveness Models in Optimal Portfolio of Shares

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Abstract: One of the ways of controlling risk of investment, the formation of portfolio optimal shares. For the election portfolio optimal shares there are several different methods. In this study, Capital Assets Pricing Model (CAPM), Fama and French three factor model and Markowitz's models and their forecasting capabilities are thoroughly analyzed. Investors are aptly informed to make a conscious decision in extracting the best portfolio set. The study sample consisted of 100 companies listed in Tehran Stock Exchange, on a monthly basis (120 months) during 2000-2010 and was selected. This study is based on assumptions that each model is efficient enough to forecast the arrangement of optimum portfolios. The regression test of out hypotheses indicates that CAPM model and Fama and French model are competent enough to forecast the structure of portfolios but Markowitz's models estimations must be cautiously applied.

Key words: Markowitz's model · Optimum portfolio stock · CAPM · F and F

INTRODUCTION

Fama and French believe that in xamining the relationship between β and other variables, β has no special meaningful relationship with the average return of stock and two dominant and effective factors are the size and ratio of book value to market valve [1].

In this essay, three factor model introduced by Fama and French is analyzed. Because Value at Risk (VaR) gauges and predicts the risk on the basis of the last combination of the present assets in the portfolio and ignores the type of the risk and other determinative factors, tries to accumulate the risks of a financial asset to represent it as a number, considering a predetermined level of confidence [2] so the researches in gestation must entail all salient factors in addition to market risk. For example in 1999 Johnaton Lolen stated that applying a multi-factor model preferred over a single-factor model. Kayt Llam in a research concludes that the size of a company, the ratio of book value to markets value and the ratio of E/P as three influential factors are capable of explaining the variations in the average rate of return in Hong Kong stock exchange [3].

Markowitz was the first who proposed special criterion for developing portfolio model and the relationship between the risk and expected return. The general principle governing Markowitz theory is the principle of preference; according which, among all investments with any expected rate of return, preferred portfolio is one with the least risk. Capital market theory by extending and developing Markowitz's theory of portfolio has derived capital assets pricing Model (CAPM). In this model, from among all parameters affect the company, Just one factor (Market Risk) is used to depict the aggregate number of risks. This model, due to widespread criticisms, investors' change of behavior and thriving stock exchange has endured some changes. One of the developments accrued from these changes is Fama and French three factor model. Between 1980 to 1990, deviations of CAPM was revealed. [4] Researchers believe that these anomalies challenge CAPM's authenticity in explaining return considering systematic risk factor (β) [5].

In this essay we analyze the power of estimation of CAPM, F and F and Markowitz's models in determining the optimum portfolio to be helpful for investors, researchers, university students, stock brokers and all interested parties to have a lucrative investment.

Literature Review: CAPM model has evolved out of the Markowitz's works on portfolio selection model [6]. This model gauges the risk of Securities with its covariance with the stock market return and this covariance is used as the β of the market. In CAPM model expected return of each share is risk free rate of return plus multiplication of each share's β to market risk premium; in other words,

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expected premium on stock is the surplus of the expected rate of return commensurate with the β of the market [7] in which the expected rate of return of securities is a positive and linear function of the β of the securities [8].

CAPM model regression introduced by Black, Jensen and Sholes states:

$$E(R_{pt}) = R_{pf\,t} + b_{it}\left[R_{pmt} - R_{pft}\right] + e_{it}$$

Where $E(R_{pt})$ is expected return of portfolio I at time t; R_{pft} is risk free rate of return, b_{it} is the systematic risk of portfolio I; R_{pmt} is the return of market portfolio at time t, e_{it} is wrong calculations [9] and : $(R_{pmt}-R_{ft})$ is the difference between risk free return and market portfolio return (total market premium) [10]. Although some researchers believe that CAPM is the most versatile model for selecting a portfolio [11] but various types of risks including market risk, bankruptcy risk and liquidity risk can affect the final position of a company; but CAPM model Just uses market risk as an influential factor in describing the set of risks [12]. A revised model containing all influential factors can provide a guaranteed description and estimation of the situation. In other words, these appended factors can prognosticate the risks that a company many encounter [13].

Market risk factor Just analyses different components of a risk and is unable to describe and explain hard repercussions of each risk on the return [14]. Fama and French have provided incontrovertible evidence demonstrating the experimental deficiency of CAPM model. Applying sectional regression, they confirmed that size, the ratio of earnings to price (E/P), the ratio of ook value to market valve (BE/ME) and the β of the market bear momentous function in describing the return. They also approved the meaningful relationship between average rate of return and the β of each share [12]. The ratio of BE to ME demonstrates potential profitability of a company in future. When a company is expected to be profitable in near future, the book value can not disclose this potential boom due to on-going accounting operations but market value can be an appropriate basis. So, it is expected that the ratio of book value to the market value of the companies with relatively low ratio of BE/ME enjoy a brisk boom compared with book value of companies with relatively higher ratio of BE/ME. If investors concentrate on the probable opportunities of prosperity in future which reflects BE/ME, it can affect share price indices and can not be translated as absolute power of BE/ME in estimating the periodic return of shares. BE/EM ratio has meaningful relationship not only with prosperity possibilities but also with other factors like market deficiency or distinctive risk factors of the market. Distinctive risk factors of the market are highly dependent on future return of shares.

Market deficiency is free from such a dependency [15]. Another factor which is a component of Fama and French revised model is the size of the company. According to Financial surveys, Different factors should be considered to determine the size of a company, including assets value, Sales, market price per share, capital etc [10]. In this paper Market value is the basic criterion for determining the size of a company.

Because market risk premium, size of the company and BE/ME ratio are included in Fama and French model, it develops the capabilities of CAPM model due to adding the size of the company and BE/ME as distinctive risk factors of a company.

Three factors mentioned above, can explain nearly all of the returns resulted from risking [14]. Analytical model used for Fama and French model is analysed by the following multivariate regression:

$$\cdot E(R_{pt}) = R_{pf\,t} + b_{it}\left[R_{pmt} - R_{pft}\right] + S_{it}\cdot SMB + h_{it}\cdot HML + e_{it}$$

In which :$(R_{pmt}-R_{ft})$ is the difference between risk free return and Portfolio market return (market risk premium) [10], SMB is the average return of small companies minus large companies, HML is the average return of companies with high ratio of book value to market value minus average return of companies with low ratio of book value to market value and h_{it}, S_{it}, b_{it} are regression coefficients [16].

Risk management means evaluation and administration of richly varied number of risks in a financial portfolio of a company and related assets [17]. In 1998 Parson proposed that a comprehensive risk management strategy would be able to authorize the companies to:

- Avoid backbreaking loses incurred to due volatility in prices or change in energy consumption models,
- Decreasing the fluctuations in incomes of the company while maximizing the return,
- Applying supervisory measures to decrease the risk [17]

Value at risk (VaR) is one way of estimating risk exercised in risk management [18]; it is a concise evaluation of risk bearing an axiom which allows the users to keep their attention right to the natural conditions of the market in their daily activities [19].

VaR can be briefly defined as: quantitative portrayal of maximum possible loss with the level of certainty C for a period of time [20] and it demonstrates a loss incurred due to the increase of the market risk in a definite period of time at special level [21], using VaR, input data and parameters (goals, objectives and limitations) are determined as exact numbers or unique functions. So, it is assumed that decision makers can accurately determine unique input data and parameters [22]. Analyzing expected rate of return according to the assets and estimations of value at risk enormously help the company in optimum use of financial and physical resources [23].

Table 1: researches conducted about the subject of the essay

Subject	Year	Researcher	Findings
Rosenberg and lanstein Direct relationship between the ratio of BE/ME to share return [27]	1985	Rosenberg and Lanstein	The ratio of BE/ME to share return Definite
evidence about the average of returns in using portfolios with the similar weight compared with the portfolios organized on the basis of weight value [4]	1992	Fama and French	Three factor model test
Positive relation between BE/ME and average return and negative relation between the size of a company and average return [25]	1995	*Maroney Neal*	The ratio of BE/ME to market value In performance assessment of investment portfolios, Fama and French model is
more productive than CAPM model [28]	1997	*Kothari* and *warner*	About comparing Fama and French three factor model and CAPM model
Fragile relationship between β and forecasted return and power of explaining the forecasted return by BE/ME [29]	1998	*Chui and wei*	The relation
between β, the size of thecompany and the ratio of BE/ME to orecasted return of each share Extent of application three factor and CAPM models [30]	2001	Graham and Harvey	Extent of application three factor and CAPM models
Calculation of capital expense of 45 companies using CAPM model [31]	2004	Brounen and Jong and Koedigk	Extent of application of three factor and CAPM models
11 portfolios out of 25 portfolios have Rs more than 90, 12 portfolios with R between 70 and 90 and 2 portfolios with R less than 70 [32]	2003	*Naudis, Hans*	CAPM model, Fama and French model
Application of one of the models according to the attributes of industry under study and better performance of CAPM model over Fama and French model [33]	2004	Qi	CAPM model and Fama and French three factor
model Demonstrating the suitable performance of Fama and French three factor model in analyzing portfolio data applying time series test and favorable performance of CAPM model on the basis of data obtained from periodic tests [3]	2005	Lam	Comparing Fama and French model with CAPM model
Inappropriateness of both models in forecasting specific value and better explanation of return deviations by Fama and French model comparing with CAPMmodel [10]	2005	*Bartoldy and perare*	Expected return in CAPM and F and F models
The ratio of profit to price, debt to owners' equity and book valve to market valve effectively affect share return [14]	2006	*Womack and Zhang*	Influential factors on Share return Superiority of variance
average method over minimax, random programming and accumulation convergence methods [34]	1999	Puelz	Comparing methodologies used to optimize portfolios
For some investors unlikely to bear high risks, a portfolio with high variance means lower value at risk [35]	2001	*Gordon and Alexander Baptista*	Comparing of var average and variance average for Portfolio selection
Comparing the forecasted VaR and the real return and with significance level of %95 is generally acceptable. China has a highly fluctuating stock exchange *[36]*	2004	*Fan.and Himig. and alan and Shapiro*	Estimation of VaR using parametric variance-covariance in China stock exchange
Inventing SVaR for minimizing the VaR; in order to have an approximate estimation, historical VaR and filtering local fluctuations are adopted [37]	2005	Gaivoroski and pfiug	Minimizing VaR
In analyzing VaR, whether interior or exterior to sample,FIGARCH model demonstrates better performance [38]	2007	Wu and Shieh	Using ARCH1and FIGARCH to calculate VaR
Capability of the model to select the optimum portfolio in a logical perion of time provide that there are limited number of assets [39]	2007	Benati and Rizzi	A model based on Complex integer inear rogramming to select the optimum
portfolio More accurate forecasting of VaR by semi-Parametric GARCH [40]	2008	*Costello and Asem and Gardner*	Generalized Auto Regressive Conditional Hete roskedastic Comparing ARMA models with historical simulation and Semi-Parametric GARCH

Methods of calculating value at risk is divided in to parametric and non-parametric methods. Parametric method comprises variance-covariance, Average-variance and some other analytical methods. Non-parametric methods include historical simulation and Monte-Carlo simulation [24]. Variance-Co-variance and historical methods are the most widely used methods applied to predict VaR. Variance. Co-Variance method is introduced by Risck Matrix [6]. This method, in order to calculate VaR, estimates the capital which is in fact a Simple mobile Average (SMA) The outstanding hypothesis is that share return (Portfolio) is distributed normally demonstrating [25]. In this method we assume the incurred loss is determined on the basis of loss standard deviation, so VaR equals:

$$VaR = M.Z_{\alpha}.\sigma\sqrt{T}$$

VaR is value at risk, M is the market valve, a is error level and T is the time Period within hich the research is conducted.

Historical simulation is another approach applied to gauge VaR which substantially simplifies the process of VaR calculation, because no longer the hypothesis of normal probability distribution of asset return is required. This model use the ceteris paribus assumption that the financial return will not undergo noticeable changes [25]. In Monte-carlo method, normal distribution of assets is not necessary. Instead of using diachronic information, probable changes in future are estimated using computer-based wide-scale simulations and random processes [26]. As Gyot and lorent (2004), Chang and others (2005) Pojarliev and Polasek (2000) Hendriks (1996) and Pagan and Schwartz demonstrated Parametric methods are more authentic than non-Parametric methods in describing the attributes of financial data and in their estimations of cases out of the original sample.

Previous Research: In the following table a brief description of researches associated with the current essay is provided.

Hypotheses of Research: Considering the necessities and objectives of the research following hypotheses are constructed:

- Capital Asset Pricing Model (CAPM) is competent enough to select the optimum portfolio.
- Fama and French three factor Model is competent enough to select the optimum portfolio
- Markowitz's models is competent enough to select the optimum portfolio

Method of Research and Hypothesis Testing: This research is practical considering its goals and descriptive-correllational research.

In this research each portfolio contains twenty shares of the companies accepted in stock market. The companies included should not be limited to a specific industry and in the selected set of portfolios there should be no repetitive portfolio [41].

In order to screen the hypotheses of the research each portfolio is individually investigated. At last, the first hypothesis is examined fifteen times and each portfolio whose quantile equals %95, is separately analyzed. The second hypothesis is also examined fifteen times. For the final conclusion, if half of the portfolios satisfy the conditions provided in the hypotheses, hypotheses will be confirmed.

Society and the Statistical Sample: Statistical population of the research contains all the companies accepted in Iran's stock exchange, in a monthly fashion (120 months) from 2000 to 2010 satisfying the following conditions:

- Before the financial year of 2001 are accepted in Tehran stock exchange and not taken out of the quotation boards until the end of financial year 2010.
- Their financial year ends in Esfand.
- These companies are not investment or mediating companies.
- The book value of the companies is not negative

Considering the above mentioned conditions, from among 488 companies accepted in Tehran stock exchange, Just 100 companies fulfilled all the above-mentioned conditions. All of the necessary data are applied monthly.

Analysis of Hypothesis: In order to screen the hypotheses of the research and examine the regression model, regression test of basic suppositions of the research is performed and the findings are represented in tables.

First Hypothesis: Capital Asset Pricing Model (CAPM) is competent enough to select the optimum portfolio. The outputs of screening the first hypothesis are represented in the following table.

Portfolio no	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R Square	0.138	0.122	0.074	0.282	0.148	0.122	0.073	0.027	0.585	0.216	0.073	0.212	0.2	0.159	0.428
Significance level of thewhole model	0.000	0.014	0.007	0.000	0.000	0.014	0.048	0.114	0.000	0.000	0.053	0.000	0.000	0.005	0.000
Significance level of the co-efficient R_m-R_f	0.000	0.014	0.007	0.000	0.000	0.014	0.048	0.114	0.000	0.000	0.053	0.000	0.000	0.005	0.000

level of the co-efficient R_m-R_f

In the first step, to investigate the normality of the dependent variable we use Kolomugorof-Simonov test to show that in all portfolios, the dependent variable is normal. In the next step, In order to investigate the autocorrelation we have used Watson test indicating the vacancy of autocorrelation between Variables. As the outputs demonstrate, we can conclude that the whole model is significant except for the portfolios 8 and 11. Significance level of the variable Rm-Rf in the thirteen portfolios specifies the profound impact of this variable in the wholesome significance of the model.

Second Hypothesis: Fama and French three factor Model is competent enough to select the optimum portfolio. The outputs of analyzing the second hypothesis are represented in the following table.

Portfolio No		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R Square		0.251	0.227	0.083	0.286	0.328	0.377	0.195	0.200	0.415	0.217	0.237	0.243	0.249	0.127	0.441
Significance level of the whole model		0.000	0.000	0.045	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.006	0.000
Significance level																
of the co-efficient	Rm-Rf	0.000	0.000	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
	SMB	0.961	0.498	0.973	0.637	0.815	0	0.595	0.909	0.88	0.664	0.034	0.054	0.86	0.37	0.142
	HML	0.333	0.041	0.427	0.489	0.405	0.01	0.461	0.621	0.284	0.899	0.751	0.575	0.02	0.458	0.677

In the first step, to investigate the normality of the dependent variable we use Kolomugorof-Simonov test to show that in all portfolios, the dependent variable is normal. In the next step, In order to investigate the autocorrelation we have used Watson test indicating the vacancy of autocorrelation between Variables. As the outputs indicate, in all of the portfolios, the whole model is significant and the significance level of the variable R_m-R_f demonstrates fundamental effects of this variable in the significance of the model. Significance level of the variable SMB in all of the portfolios except portfolios 6 and 10 and the significance level of the variable HML in all of the portfolios except portfolios 2, 6, 12 and 13 obviously manifest the feeble effect of these variables in the significance of the whole model.

Third Hypothesis: Markowitz's models is effectively liable to select the optimum portfolio.

The outputs of analyzing the third hypothesis are demonstrated in the following table.

Portfolio No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R Square	0.022	0.005	0.034	0.024	0.155	0.011	0.012	0.037	0.042	0.03	0.002	0.002	0.081	0.038	0.002
Significance level of the whole model	0.148	0.478	0.07	0.128	0.132	0.305	0.909	0.06	0.045	0.093	0.636	0.674	0.005	0.058	0.665
Significance level of the co-efficient	0.148	0.478	0.07	0.128	0.132	0.305	0.909	0.06	0.045	0.093	0.636	0.674	0.005	0.058	0.665

In order to investigate the normality of the dependent variable, we used Kolomugorof-Simonov test and in all of the portfolios the dependent variable is normal. In order to explore the autocorrelation, we used Watson's test. As the results indicate, in portfolios 2, 3, 7, 10, 12 and 14 the vacancy of autocorrelation between variables is observed and in the remaining variables, the autocorrelation is confirmed. As you see, in the portfolios 9, 13 and 14 the model is significant and in other portfolios it is non-significant. In portfolios 9, 13 and 14, significance level of the variables reveals the constructive impact of this variable to have a significant model.

CONCLUSION

First Hypothesis: According to the data obtained, because our proposed model is significant except in portfolios 8 and 11, we can conclude that the hypothesis of the research is approved and the portfolios are ordered on the basis of higher determination co-efficient and there is a linear relationship between R_m-R_f and the portfolio return. So CAPM model is truly proficient in selecting the optimum portfolio. According to Fama and French, calculated R^2 in this model is about %85 which is just able to elucidate %85 of return fluctuations. So, you may ask yourself how we can

clarify the remaining fluctuations [12]. Basu [42] discerned that when the ordinary shares are arranged according to E/P ration, the ability to predict the return comparing CAPM model is substantially increased. Banner (1981) has documented the effects of size. As he concludes, the shares of small companies yield more return in compare with the predictions of CAPM model.

The shares of the small companies enjoy greater β s and more average return as compared with the shares of larger companies.

Second Hypothesis: According to the data obtained, because our proposed model is significant in all of the portfolios, we can conclude that the hypothesis of the research is ratified and the portfolios are arranged on the basis of higher determination co-efficients. The linear relationship between Rm-Rf and the return of the portfolio in compare with other independent variables investigated is more obvious. So, Fama and French three factor model is truly proficient in selecting the optimum portfolio. Hung Chao applied Fama and French model in analyzing non-financial companies. As the results disclose, there is a negative relation between the size and share return and a positive one between the ratio of book value to market value and share return and there is also a simple linear relationship between β and return. [16]. Basu (1997) Banz (1981). Behaldari (1988) and Rosenberg and Statman have respectively scrutinized the effects of the ratios profit to price, debt to owners' equity and book value to market valve on share return and concluded that these factors significantly affect the return [14].

Third Hypothesis: Considering the data obtained, Just 3 portfolios are significant out of 15 portfolios, so we can conclude that this hypothesis is rejected and Markowitz's models is not suitable to select the optimum portfolio. Chang and others (2005) Pojarliev and Polasek (2000) [43] Handriks (1996) [13] applied parametric models to estimate the Markowitz's models. They showed the appropriate performance of parametric methods in distributing the attributes of financial data. They also demonstrated the advantageous performance of parametric methods in out-of-sample evaluations over non-parametric methods.

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