A COMPARISION BETWEEN R-CAPM AND FAMA AND FRENCH'S MODELS IN PREDICTING TEHRAN STOCK EXCHANGE

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Abstract

In this paper we examine Revised Capital Asset pricing Model (R-CAPM) and Fame and French 's model in Tehran Stock Exchange to find best model according to condition of Iran. We examine two models in three perspectives as follows:

- Expected return equals actual return with lag +1.
- Expected return equals simple average of past returns
- Expected return equals geometric average of past returns

We consider expected return in each perspective as dependent variable and betas obtained from two models as independent variable. Both models have been implemented to test hypothesis from three mentioned perspectives include Pearson correlation test, regression analysis. After examination, we understand R-CAPM has more explanatory power than in predicting expected return with first perspective.

Keywords: R-CAPM's Model – Fama and French's Model – Systematic Risk – Unsystematic Risk – Expected Return

JEL classification: G12

1. Introduction

A lot of scientists do research about Capital Asset Pricing Model and trying to find the best model according to the conditions of their country. Some scientist expand capital asset pricing to find the best model, like Estrada (that suggested D-CAPM) and Acharya and Pedersen (that suggested A-CAPM). One of the most researches in the world about asset pricing model is done by Fama and French that they suggested a model and this model is very famous and in a lot of country is tested. Rahnamay Roodposhti suggests another model that we called it R-CAPM (Revised CAPM). In this model consider both systematic and unsystematic risk and economic disturbance. We

consider Fama and French model and RCAPM for finding the best model in Tehran stock exchange.

2. Literature and Theoretical Framework of Fama and French' s Model

Early evidence in the 1970s largely supports the Sharpe-Lintner-Black capital asset-pricing model (CAPM) and the efficient market hypothesis (Fama, 1991). The seminal work of Fama and French (1992), however, identified market value (size) and the ratio of book to market equity (B/M) as the two major determinants of the cross-sectional expected returns, and sentenced the "death" of beta. The publication of this work initiates the war on the life and death of beta, as well as the competition between the rational school and the behavioral school (Fama and French (1998) and Davis, Fama and French (2000)).Cross-sectional regularities such as size and B/M have been perceived as asset-pricing anomalies that are inconsistent with the mainstream theories. Anomalies may stem from (1) chance results or data mining, (2) market frictions (transaction cost), (3) outliers or extreme observations, (4) incorrect model specification, (5) improper measures of risks, or (6) market inefficiency (see Knez and Ready (1997), Fama and French (1998), Hawainini and Keim (2000), and Schwert (2002)). Fama and French (1993) view size and B/M as variables capturing certain distressed factors that are not included in the CAPM, and propose a three-factor model *a la* Merton's intertemporal asset-pricing model or Ross's arbitrage pricing theory (APT).

We analyze a model which also contains, as explanatory variables, size, and book to market equity ratio which Fama and French (1992) studied. The size and book to market equity ratio are both well-accepted idiosyncratic explanatory variables for return [Chan et al. (1991) and Fama and French (1992)]. In addition, we do comparison between fama and french' model.

*C*APM assumes that an asset's return is a linear function of the risk of the asset as compared to the market. CAPM says the efficiency of the market portfolio leads to two implications: expected returns are a positive linear function of market betas and market betas suffice to describe the cross-section of expected returns (Qing Caoa, Karyl B. Leggioa, Marc J. Schniederjansb (2004). However, an alternative 3-factor model, proposed by Fama and French Fama, E.F. and K.R. French (1992), Fama, E.F. and K.R. French (1993) demonstrates firm size and the book to market ratio, together with a market factor, is an alternative model to capture the cross-sectional variation in average stock price returns. .(Qing Caoa, Karyl B. Leggioa, Marc J. Schniederjansb(2004).In the multivariate linear model, the dependent variable is assumed to be a linear function of one or more independent variables plus an error introduced to account for all other factors:

$$Y_i = a_1 x_1 + ... + a_k x_k + u_i \quad (1)$$

In the multivariate model in Eq. (1), Y_i is the dependent variable, $x_1,...,x_k$ are the independent or explanatory variables, and u_i is the disturbance or error term. The goal of multivariate analysis is to obtain estimates of the unknown parameters $a_1,...,a_k$ which indicate how a change in one of the independent variables aspects the values taken by the dependent variable.

The multivariate linear model in this study is described as follows:

$$Y = a_1 x_1 + a_2 x_2 + a_3 x_3 + u \quad (2)$$

Where Y is the stock price returns, x_1 is β, x_2 is the market capitalization, x_3 is the book-to-market value B/M, u is the disturbance or error term. (Qing Caoa, Karyl B. Leggioa, Marc J. Schniederjansb (2004).
In this paper we follow Eq. (2) for estimating return.

3. Literature and Theoretical Framework of R-CAPM

Hamada (1969, 1972) demonstrated systematic risk can be decomposed into operating risk and financial risk and enter accounting variables into risk measuring discussion. Hawawini and Viallet (1999) illustrated financial risk as the relation between earning after taxes and earning before interest and taxes, and operational risk as the relation between EBIT and sales.

Indeed, work that relates accounting numbers to market measures of systematic equity risk was largely undertaken in the 1970s and early 1980s (Ryan, 1997). Research in this field can be usefully divided between theoretical and empirical studies. The empirical work has, largely, been unguided by a theoretical model (Foster, 1986). This has resulted in regressions of market measures of market beta on various accounting measures of risk (Beaver, Kettler and Scholes, 1970; Pettit and Westerfield, 1972; Breen and Lerner, 1973; Rosenberg and McKibben, 1973; Thompson, 1974; Lev, 1974; Lev and Kunitzky, 1974; Bildersee, 1975; Beaver and Manegold, 1975) or the use of accounting number analogues to market derived measures of risk (Hill and Stone, 1980).

Lev (1974) separated operating leverage from the other two variables and found it to be individually significant and reported that operating leverage has a positive effect on systematic risk. Financial leverage also has a positive effect on systematic risk (Myers, 1977) and explains about 25 percent of systematic risk (Hamada, 1972). Gahlon and Gentry (1982) developed a model for calculating beta that included the degree of operating leverage (DOL) and the degree of financial leverage (DFL) as explicit variables. Specifically, the study examined how operating and financial decisions will affect systematic risk and value. They identified the DOL and DFL as real-asset risk measures. Furthermore, they analytically demonstrated that beta is a function of the degrees of operating and financial leverage, the coefficient of variation of the revenues, and the correlation coefficient between the cash flows to the owners and the aggregate dollar return to all capital assets.
Huffman (1989) found that systematic risk is positively related to DFL but negatively related to DOL. Mensah (1992) pointed out that the operating, financing and strategic decisions of a firm are related to its systematic risk.

Li and Henderson (1991) examined the relation between combined leverage and common stock risk, and report that high growth firms have high operating and financial leverages at the same time. Mandelker and Rhee (1984) explicitly incorporate measures of the degree of operating and financial risk into their theoretical model. Griffin and Dugan (2003) considered multiple dimensions of systematic risk defined by Hawawini and Viallet and empirically represented the economic risk construct through the use of the term, degree of economic leverage (DEL). They define DEL as a

percentage change in firm's sales resulting from a unit percentage change attributable to an exogenous disturbance, so

$$DEL = \frac{\%\Delta Q}{\%\Delta Z} = \frac{\left(\tilde{Q}_{jt} / Q_{jt-1}\right) - 1}{\left(\tilde{Z}_{jt} / Z_{jt-1}\right) - 1} \quad (3)$$

Z_{jt} = exogenous disturbance in period t.

They developed Mandelker and Rhee's model by using DEL and offered their risk measure as:

$$\beta_j = (DEL)(DFL)(DOL)\beta^o{}_j \quad (4)$$

Where

$$\beta_j^o = \frac{COV\left[\left(\frac{\pi_{j,t-1}}{Z_{j,t-1}}\right)\left(\frac{\tilde{Z}_{j,t}}{E_{j,t-1}}\right), \tilde{R}_{m,t}\right]}{\delta_{m,t}^2} \quad (5)$$

The first term within the covariance is the constant that represent that represents the last period's earnings after taxes ($\pi_{j,t-1}$) that already reflect the economic disturbance ($Z_{j,t-1}$) that may have occurred in that period. The second term within the covariance includes an expectation that a firm's equity market value ($E_{j,t-1}$) already reflects anticipated future economic disturbance ($\tilde{Z}_{j,t}$). It is the covariance of the product of these two terms with the market return that represents the intrinsic business risk faced by the firm.

In this paper, we utilize systematic and unsystematic risk through combining leverage and the traditional CAPM as well as historical and estimated data completely and Rahnamay RoodPoshti (2009) will call it Revised Capital Asset Pricing Model (R-CAPM). Then we compared this model with Fama and French model

According to R-CAPM supposition the equation is used for linear calculation of securities market:

$$R_i = R_f + \beta^R (R_m - R_f) \quad (6)$$

Where: $\beta^R = (DEL)(DFL)(DOL)\beta^o{}_j$

4. Methodology

We have considered only one hypothesis which is "The R-CAPM in comparison with Fama and French Model has a more explanatory power of expected return" to see which model have a relative excellence in explain expected return with three perspectives which is posed in regard to expected return. They are (i) expected return of equity equals its real return with one positive lag (+1); (ii) expected return of equity equals simple average of its past real returns; (iii) expected return of equity equals geometric average of its past real returns

To investigate this hypothesis with considering aforementioned perspectives, we implement two models which include Pearson correlation test, regression analysis to test explanatory power of two models.

4.1 Pearson Correlation Test

To run Pearson correlation test at first stage we have calculated expected return through three perspectives and in other hand calculated adjusted betas of Fama and French's model and Revised-Beta (β^R) to calculate expected return with considering two first perspectives we have used simple and geometric average of eight past returns of each stock from 2003 to 2008 respectively and for third perspective we consider real return of each stock in 2009 (t+1) as expected return. Finally we estimated correlation coefficient between each beta and each three expected return which has been obtained from a different perspective. So for any perspective table 1 shows Pearson correlation coefficients and their significance level.

TABEL1: Pearson correlation coefficient between expected returns and betas with their significance level

		BetaR-CAPM	Beta	ln(me)	ln(be/me)	Y1	Y2	Y3
BetaR-CAPM	Pearson Correlation	1	.063	.201	-.065	-.361**	.130	.155
	Sig. (2-tailed)		.604	.095	.597	.002	.283	.200
Beta	Pearson Correlation	.063	1	.633**	-.105	-.145	.266*	.066
	Sig. (2-tailed)	.604		.000	.390	.230	.026	.587
ln(me)	Pearson Correlation	.201	.633**	1	-.510**	-.249*	.181	.138
	Sig. (2-tailed)	.095	.000		.000	.038	.133	.254
ln(be/me)	Pearson Correlation	-.065	-.105	-.510**	1	.201	.079	.060
	Sig. (2-tailed)	.597	.390	.000		.098	.519	.624

Note: numbers in parentheses under correlation coefficient show significance level. Likewise the symbols (*) and (**) indicate statistical significance at the 5% and 1% level.

As table 1 show first expected return (*Y1*) has a significant and positive relationship with revised beta (β^R). So Pearson correlation test approve the hypothesis if we consider first perspective in regard to expected return. In other word if we suppose expected return equals expected return of equity equals its real return with one positive lag (+1), R-CAPM has excellence rather than Fama and French's model to explain expected return.

Investigating correlation coefficient related to second perspective shows that there is no relationship between second expected return (*Y2*) with revised beta. There is no relationship between fama and French's betas and second perspective of return.

Investigating correlation coefficient between third expected return (*Y3*) with betas shows result so that third expected return has no relation with revised beta (β^R) where as not with fama and French's beta.

4.2 Regression Analysis

For regression analysis first using five-year data of each stock calculated betas, Fama and French's beta and β^R for each of them and then for each model we regressed net expected return ($E(R_j)$) of 70 stocks on betas obtained from that model. In other words, in this examine we have not estimate beta using regression because in contrary with traditional CAPM, these two aforesaid betas are not so simple that be obtained from simple regression.
According to equation (1) and (2) our regression models are as follows:

$$\left[E(R_j)\right] = a_0 + a_1 b_1 + a_2 b_2 + a_3 b_3 + \varepsilon_j \quad (7)$$

And

$$\left[E(R_j - c_j)\right] = a_0 + a_1 \beta_j^R + \upsilon_j \quad (8)$$

$E(R_{j\,j})$ Denotes expected return. Constant term in each regression model can be interpreted as risk free rate. To run regression for each three perspective, we must put related expected return instead of *E (R_j)*. In addition, it is obvious to get right term of regression model .Note, it is not necessary to check Heteroskedasticity, autocorrelation and etc. for regression since our examination is cross sectional and our data are undated. Table 2 shows result of two regression model with considering first perspective.

Table2: Regression analysis of hypothesis with considering first perspective

Model	*R*	*R Square*	*Adjusted R Square*	*F*	*Sig.*
R-CAPM	*.361*	*.130*	*.117*	*10.174*	*.002*
F&F	*.266*	*.071*	*.028*	*1.655*	*.185*

The R-squared shows how much fluctuate of dependent variable have been caught by independent variables. All reported values in table 2 demonstrate that based on first perspective our hypothesis is accepted. It means if we consider expected return of equity equals its real return with one positive lag (+1), performance of R-CAPM is outstanding rather than Fama and French in explain expected return.

At the next stage and for examining hypothesis from view of second perspective we place simple averages as expected return instead of R_j. Then run two regression models.

Table3: Regression analysis of hypothesis with considering second perspective

Model	*R*	*R Square*	*Adjusted R Square*	*F*	*Sig.*
R-CAPM	*.130*	*.017*	*.002*	*1.170*	*.283*
F&F	*.301*	*.090*	*.048*	*2.151*	*.102*

We find if we consider expected return of equity equals simple average of its past real returns as expected return, R-CAPM and Fama and French model is not meanful. To examine hypothesis from view of third perspective we consider expected return of equity equals geometric average of its past real returns

Table4: Regression analysis of hypothesis with considering third perspective

Model	*R*	*R Square*	*Adjusted R Square*	*F*	*Sig.*
R-CAPM	*.155*	*.024*	*.010*	*1.672*	*.200*
F&F	*.215*	*.046*	*.002*	*1.051*	*.376*

If we consider expected return of equity equals geometric average of its past real returns, R-CAPM and Fama and French model is not meanful.

5. Conclusion

In this paper we examine R-CAPM with Fama and French model in three perspective view (i) expected return of equity equals its real return with one positive lag (+1); (ii) expected return of equity equals simple average of its past real returns; (iii) expected return of equity equals geometric average of its past real returns, and we find that R-CAPM has more power than Fama and French model in explanatory in risk and return with first perspective in Tehran stock exchange. About second and third perspective we do not get clear result. Considering to systematic economic disturbance and unsystematic risk are one of the most factor and especially in developing country and we hope that follow researches continue this way to get the best result.

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