J. Appl. Res. Ind. Eng. Vol. 4, No. 2 (2017) 148–157

Journal of Applied Research on Industrial Engineering

www.journal-aprie.com

Testing the Traditional CAPM and MCAPM on Tehran Stock Exchange

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PAPER INFO

Chronicle:
Received: 28 April 2017
Revised: 14 June 2017
Accepted: 07 July 2017
Available : 07 July 2017

Keywords :
Market Return.
Stock Return.
Pricing Model.

ABSTRACT

The purpose of this paper is to empirically test and evaluate the possibility of using the traditional Capital Asset Pricing Model (CAPM) and the Modified Capital Asset Pricing Model (MCAPM) on Tehran Stock Exchange. Traditional CAPM Sharpe-Linter as one of the ways in which investors can help explain the risk and return on investment offered by CAPM model to models of different MCAPM suggested by the Santosh Koirala [11].Therefore, to achieve the desired objective, the research models using monthly returns of firm 96 (2009 to 2015) and test based on index of cash and capital gain returns. The results indicate that the explanatory power MCAPM more about stock returns compared to traditional CAPM in the Tehran Stock Exchange.

1. Introduction

Failure to explain the relationship between risk and return and the lack of awareness in investors on the issue has provided misuse through price manipulation and the creation of price bubbles that causing the loss of much of investors and harm to the body of the capital market in the long run and subsequently it will weaken the role of funders. Capital asset pricing model to measure the systemic risk of each asset offers the expected return of the asset that is commensurate with its risk. With the development of these models can be achieved to optimally allocate resources and the optimal portfolio with a degree of risk-taking. On the other hand, it should further be noted given the significant role of capital markets in financing as well as the role of markets in creating social justice and benefit all segments of society from the profits to clarify the relationship between risk and return and help the investors in the formation of the optimal and expected portfolio and capital assets pricing while risk modeling and financial performance since Mean-variance theory of Markowitz was studied. In this regard, the theory of pricing using its basic and theoretical concepts has tried to determine why some of the assets have higher or lower returns than other assets. Thus in the past, companies and financial institutions, investors and financial researchers were considered greater return commensurate with the higher risk.

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DOI: 10.22105/jarie.2017.48259

The capital asset pricing model (CAPM) is one of the models of asset pricing that offered by William Sharp-Leitner. This model has been repeatedly tested and the last reform is applied on this model [19]. One of these models is the modified capital asset pricing model (MCAPM) that the present paper aims to examine and test the applicability of this model along with the traditional CAPM model in terms of the explanatory power for stock returns expected in Tehran Stock Exchange.

2. Capital Asset Pricing Model (CAPM)

CAPM model is based on the assumption that investors with the knowledge of the theory of portfolio and reduce unsystematic risk through diversification, exploiting it in order to create efficient portfolio and each one depending on the degree of risk aversion create different portfolios. CAPM model in response to how to measure risk of an asset and how the relationship between risk and expected return of investors, in addition to considering the assumptions of efficient market, consider the following three assumptions: First, there is a risk-free asset and investors can lend and borrow unlimited funds in risk-free rate and this rate is the same for all investors. Second, there are no tax, transaction costs, restrictions on borrowing selling and other market restrictions. The third is the quality of the entire fixed assets and all assets are tradable and divisible [15]. After considering the above assumptions, the model response to questions raised in this case that at first, the risk of each asset is determined based on the dependence of its efficiency to market efficiency secondly, the relationship between risk and expected return will be straightforward linear relationship. In other words, the traditional CAPM is a static model of portfolio allocation under uncertainty and risk aversion. In order to test the validity of CAPM, researchers always used the securities market line (SML). SML shows the relationship between risk and return. SML has always amenable to high slope. The more slope of the curve is steep, the more investors is risk averse. It should be noted that the traditional CAPM model a predicted single-factor model, while the anticipated returns (Late) is invisible. In general, the researchers focused on real returns and beta is usually obtained through the Security Characteristic Line (SCL) of stock excess returns associated with excess returns of the efficiently market index at time t. Historical SCL (former) can be written as follows [11]:

$$R_{it} - R_{ft} = \pi_i + b_i\left(R_{mt} - R_{ft}\right) + \varepsilon_{it}. \quad (1)$$

Where, bi is the fixed yields achieved in each period and the estimation of beta coefficient in SML. Then, the estimated beta used as an explanatory variable in the Cross-Sectional Equation. Generally, it is assumed that investors are risk-averse. This means that investor has no interest to venture and risky capital plans or in other words, a risk-averse investor is who in return for risk taking, waiting for higher yields. This relationship always represents a tilt-up slope that suggests that investors are more risk averse.

3. Modified capital asset pricing model (MCAPM)

Duality versions of dynamic and static CAPM have introduced the MCAPM model. This model [11] suggested that offers a new style and a combination that lies between dynamic and static versions. MCAPM proposes non-linear and time-dependent model aiming to provide a strong and simple model, while traditional CAPM and arbitrage pricing theory (APT) are static pricing models. The only difference is that CAPM is a single-factor model, while APT is a multi-factor model. However, a major constraint APT is that there is no consensus among researchers in multiple factors. CAPM model assumes a positive and negative linear relationship between the market returns and return on assets.

Nonlinear models in addition to the mean and variance of market return, is a combination of higher order moments effect. Nonlinear models can include time-varying and time stationary and single-time as well as multiple factors. Limitations of traditional CAPM model is that it is consider as a single factor linear version in asset pricing that does not consider the effect of multiple factors and is not a Time Varying Dynamic model. Relationship between risk and returns has been shown in a variety of asset pricing models in Fig 1 [11]:

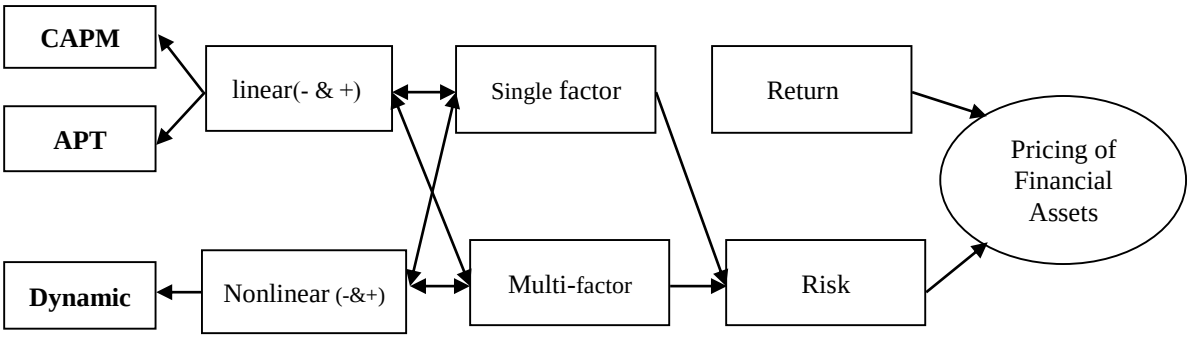

Fig 1. Relationship between risk and returns in a variety of asset pricing models

In addition, the other limitation of the MCAPM model is that it does not consider the multiple factors. However, some empirical important studies have been conducted in connection with stock prices and risk in financial management, which was used static version versus dynamic version of CAPM for the best return on financial assets that is presented in the table below.

4. Literature view

Buchner in a study [3] entitled adjusted return with Risk Private Equity using CAPM model and multi-factorial extensions concluded that in investments of venture capital, stock considerably better deal and their efficiency is like a small growth stocks. In addition, the results suggest that exposure to venture capital returns to transaction cash factor is negligible. Liu et al. [12] in a study titled transaction costs, liquidity risk and CCAPM concluded that cash-adjusted CAPM explains the greater part of the cross-sectional returns. Kim et al. [10] assess and compare the ability of different models of asset pricing in South Korea. In their research, they selected CCAPM, APT, CAPM models, three-factor and five-factor model of Fama and French and three-factor of [4] to investigate the relationship between risk and return on assets. The results of this study showed that the five and three-factor model of Fama and French, Chen et al three-factor model and the CAPM model has better performance than the other models, respectively. Da et al. [5] in their research examined the CAPM Model efficiency to estimate the cost of capital companies. Their results showed that despite some evidence that there is on the weaknesses of this model, use of the model to estimate the cost of capital and capital budgeting decisions has acceptable performance. Ray et al. [16] assess and compare the ability of model CAPM and its revised model. Assuming zero intercept in the revised model, they showed that CAPM model has better performance. Gregoriou and Ioannidis [8] by entering transaction costs variable in the CCAPM model tested it in the UK stock market. Using seasonal efficiency over the period 1980 to 2000 they concluded that although the model cannot explain stock returns, transaction costs variable is significant in all cases

and should be used in model. Pedro Ocampo [6] performed a research entitled "alternative methodology for testing the CAPM in the Philippine Stock Exchange" that its salient points include the following subjects: Researchers from the two classical and conditional approach tested CAPM model validity using monthly data of stock returns in Philippine market.

Table 1. Comparison of CAPM static version and dynamic version

	Model	Originators
STATIC	Markowitz mean Variance Theorem	Markowitz (1952)
	Sharpe-Linter CAPM	Sharp (1964) Lintner (1965) and Mossin (1966)
	Black Zero beta CAPM	Black(1972)
	CAPM with non markatable Human Capital	Mayers (1972)
	CAPM with Multiple Consumption Goods	Breeden (1979)
	International CAPM	Solnik (1974), Adler and Dumas (1983)
	Arbitrage pricing theory	Ross (1979)
	Fama French Three Factor Model	Fama and French (1993)
	Partial Variance Approach Model	Hogan and Warren (1974), Bawa and Linderberg (1977); Harlow and Roa
	Three moment CAPM	Rubinstein (1973), Kraus and Litzenberger(1979)
	Four moment CAPM	Fang and Lai (1997) and Dittmar (1999)
DYNAMIC	Inter-temporal CAPM	Merton(1973)
	Consumption CAPM	Breeden (1979)
	The Production Based CAPM	Lucas (1978), Brock (1979)
	Investment Based CAPM	Cochrane (1991)
	Conditional CAPM	Jagannathan and Wang(1996)
	Liquidity-based CAPM	Acharya and Pedersen(2005)

The results showed that in the conditional relationship, Pettengill, Sundaram and Mathur is better to explain the relationship between risk and return approach to Fama and Macbeth approach. Chen [4] makes a comparison between the CAPM and consumption-based capital asset pricing model (CCAPM) in Taiwan's stock market. In the CCAPM model, he assumed that the total consumption is equal to the total payable dividend and profit growth obeys from first-order auto-regression process. Comparing the two models in terms of compliance rate of return anticipated with real return, he came to the conclusion that in all cases, the explanatory power of traditional CAPM in the relationship between risk and return is more than the CCAPM model. Hejazi and Gholam Hosseini [9] investigated the use of CAPM in Tehran's Stock Exchange and came to the conclusion that the CAPM can explain the behavior of stock returns in the short-term periods and the relationship between risk and return in Tehran Stock Exchange confirmed the main claim of capital asset pricing model based on the linear function on the condition of weekly time data. Tehrani et al. [19] studied the traditional CAPM and CCAPM. Using the sensitivity of stock returns to changes in consumption per capita as a measure of systematic risk (Consumption beta) showed that unlike the theoretical framework, empirical performance of traditional capital asset pricing model is better than the capital asset pricing model on consumption. Mujtahidzade et al. [13] investigated the error of the CAPM and adjusted model for inflation conditions to predict stock returns. The results showed that the adjusted model has less margin of error in terms of return on assets estimation and the inflation factor in this model significantly increases its precision to the CAPM. Rahnama Roodposhti et al. [14] had been performed a comparative study on different capital asset pricing models, including traditional CAPM, DCAPM and the revised capital asset pricing model

(RCAPM) and adjusted capital asset pricing model (ACAPM). In their study, they concluded that RCAPM method compared with other forms of capital asset pricing has higher explanatory power to forecasting risk and return followed by ACAPM, CAPM and DCAPM in Tehran Stock Exchange, respectively. Tavangar et al. [18] examined the CAPM and the traditional DCAPM pricing model power to explain the relationship between risk and return. The results of this study showed that generally, DCAPM model has more explanatory power on the expected returns on the Tehran Stock Exchange than CAPM model. The result can be seen in both short-term and long-term periods. Talaneh and Ghasemi [17] compared the CAPM and APT in Tehran's Stock Exchange. Their results confirm the CAPM model and lack of evidence regarding the approval of arbitrage pricing theory. Badri and Hashemlu [1] in a study entitled the CAPM explanatory power compared to DCAPM came to the conclusion that expected returns calculated with downside Beta criteria than expected returns calculated with Beta standard better explained the real returns. However, strong evidence on the superiority of significant downside criteria was not found over the desirable criteria. There was also not found the evidence on the superiority of portfolio returns with high upside Beta than portfolios with downside low Beta. Foroghnejad et al. [7] in a study entitled the relationship between risk and return: Compare the traditional CAPM model and C-CAPM model concluded that traditional CAPM model to explain the relationship between risk and return on equity has better performance compared to the C-CAPM model. Bagherzadeh and Salem [2] studied the inter-temporal relationship between risks and return using dynamic conditional correlation and beta temporal variations and concluded that it shows relative risk aversion coefficient in the capital asset pricing inter-temporal model between 0.013 and 0.28 (average 0.20). That according to meaningless intercept in most equations, it can be said that there is inter-temporal Capital Asset Pricing Model in the Tehran Stock Exchange. Also, the assets that are highly correlated with the volatility of market conditions have lower expected return in the next period. In other words, the risk of market volatility has negative impact on the expected return on these assets. Assets that have high correlation with the currency price growth; in addition to market risk gain will acquire positive risk reward. Thus, in the course of the transaction, they will gain greater expectations efficiency.

5. Theorem MCAPM

If y as multiple dependent functions is offer as follows:

(x, g) f = y, x and g are as explanatory variables.

Or

$$y = f(x) + f(g) + f(x).f(g). \tag{2}$$

Orthogonal impact of x and y on the last term of the (1) $f(x).f(g)$, as zero is negligible. Thus, equation (2) can be written as follows:

$$y = f(x) + f(g)\,. \tag{3}$$
$$y = \left(\frac{\partial y}{\partial x}\right) \times x + \left(\frac{\partial y}{\partial g}\right) \times g.$$

And

$$y = \left(\frac{\partial y}{\partial x}\right) \times \bar{x} + \left(\frac{\partial y}{\partial g}\right) \times \bar{g}.$$

Where

$$\left(\frac{\partial y}{\partial x}\right) = \left(\frac{\partial f(x)}{\partial x}\right).$$

And

$$\left(\frac{\partial y}{\partial g}\right) = \left(\frac{\partial f(g)}{\partial g}\right).$$

Replacing y by return on assets and x by the return on the market and g as the same Co-movement (CM), MCAPM model is defined:

$$R_j = \alpha + \beta_j R_m + \delta_j CM_j + \varepsilon\,. \tag{4}$$

Equation 4 can be described in the form of excess returns and with the limitations α =0, that given these constraints, equation (4) can be transform in to the following equation:

$$R_j - R_f = \beta_j (R_m - R_f) + \delta_j CM_j + \varepsilon\,. \tag{5}$$

In particular case, given to the model (4), When βj =1 and δ_i= 0, in this case, Rm=Rj, ie, the stock returns is equal to market return. Also, when δ_i=0, Eq. (4) can be transform in to the following equation:

$$R_j = \alpha + \beta_j R_m + \varepsilon. \tag{6}$$

And, (5) is as the following:

$$R_j - R_f = \beta_j (R_m - R_f) + \varepsilon\,. \tag{7}$$

This represented the traditional CAPM.

6. Hypothesis and Model

In this section, we have the following hypothesis:

1. There is a significant relationship in the traditional CAPM model between market returns and stock returns in Tehran Stock Exchange.
2. There is a significant relationship in the MCAPM model between basic variables and stock returns in Tehran Stock Exchange.
3. MCAPM models has greater explanatory power compared to traditional CAPM model to explain stock returns in Tehran Stock Exchange.

This article employed paired regression comparisons using the following regression:

$$R_j = \alpha + \beta_j R_m + \varepsilon_j. \tag{8}$$

And

$$R_j = \alpha + \beta_j R_m + \gamma_j CM_{j,m} + \varepsilon_j. \tag{9}$$

Where, $E(\varepsilon_j) = \sigma_j^2$ is heteroscedastic.

The model of Eq. 8 was employed to examine the relationship between stock market and stock returns with the traditional CAPM model and the model of Eq. 9 employed for testing the relationship between stock returns and market returns through the model MCAPM. Therefore, the trend of testing MCAPM in this study is as follows: At first, the explanatory variable that is market returns in the paper is defined.

Then the Co-movement variables (CM) where a point-to-point change is the explanatory variable per unit change in the explanatory variable (the original equation fitted regression determination coefficient) and eventually the main explanatory variable regression with variable CM were defined. The interpretation of the results is that CM Significant beta represents the ultimate dynamic effect and non-linear effect of an explanatory variable and insignificant beta is represents balancing risk and linear and static return so that shows the traditional CAPM. Finally, beta with CM =1 and beta Rm= 1 is as a proposed to traditional storage market portfolio.

7. Methodology

The method used in this study is to test the hypothesis based on deductive-inductive reasoning that arise from theoretical and empirical analysis of the contents. Accordingly, the present study is a kind of correlation research. Its main purpose is to determine the existence and extent of the relationship between the studied variables. Library method is used for collecting data in this study. The examined observations is extracted from the public archive of financial statements of Stock Exchange and CDs provided by the public relations agencies and Tadbirpardaz database and RahAvard Novin softwar as well as the data of the Central Bank of Iran's economic fluctuations. The population is considered all companies listed on the Tehran Stock Exchange during the period 2009 to 2015. While in Tehran, as well as the stock of other developing countries, stock liquidity was low and limited trading done on stock, so for this reason, it is difficult to gather detailed information about all shares. Due to these limitations, out of total listed companies in Tehran Stock Exchange, 96 Companies have been selected for the period 2009 to 2015. The criterion for selecting these companies is the average number of days traded on stock per year. For this purpose, mean Statistics of the average number of days estimated transaction is equal to 125 days that according to this criterion, only 96 were qualified company of various industries.

8. Results and Analysis

8.1 The Testing of traditional CAPM

In this study, the following regression model was used to test the hypotheses:

$$R_j = \alpha_0 + \beta_1 R_m + \varepsilon_{it} \quad . \tag{9}$$

After regression assumptions testing and ensuring them, the results of the regression equation fitted is provided in the Table 1. The statistic F (2.75) also indicated that the regression model is significant

As the Table 1 is specified, there is a significant relationship between market returns and stock returns according to the traditional CAPM model in companies listed on Tehran Stock Exchange. Thus, the first hypothesis is confirmed. In addition, the coefficient of determination and adjusted determination coefficient of the model are 47.9 and 30.5 percent. Thus, we can conclude that in the regression equation, only about 47.9 percent of the changes in stock returns of the studied companies are explained by the independent variable market returns. In this table, positive numbers (negative) in the coefficient value column represents the direct effect (reverse) of each of the variables on stock returns.

Table 2. Linear Regression model for the traditional CAPM

Variable	Coefficient value	T-statistic	p-value
C	0.5638402	14.50547	0.000
R_m	-0.889139	-13.66122	0.000
R-squared	47.9%	F- statistic	2.75
Adj R-squared	30.5%	*P-Value*	0.000
		Durbin-Watson statistic	2.49

8.2 The Testing of MCAPM

In this study, the following regression model was used to test the second model:

$$R_j = \alpha_0 + \beta_1 R_m + \beta_2 CM + \varepsilon_{it} \quad (10)$$

After regression assumptions testing and ensuring them, the results of the regression equation fitted is provided in the Table 2. The statistic F (9.21) also indicated that the regression model is significant. As the lower part of the Table 2 has been determined, the coefficient of determination and adjusted coefficient of determination of the model are 85% and 78.5 percent. Thus, we can conclude that in the regression equation, only about 85 percent of the stock returns of the companies are explained by the independent variables.

Table 2. Linear Regression model for the MCAPM

Variable	Coefficient value	T-statistic	p-value
C	0.5548381	1.84E+16	0.000
R_m	-0.81072	-1.60E+16	0.000
CM	1.00000	2.20E+16	0.000
R-squared	85%	F- statistic	9.21
Adj R-quared	78.5%	*P-Value*	0.000
		Durbin-Watson statistic	2.48

According to the results the above table can conclude that in MCAPM model, there is a significant relationship between market returns and stock returns of companies listed on Tehran Stock Exchange. Hence the second hypothesis is confirmed. It also compares the information in the Table 1 and Table 2 it follows that despite the Co-movement variable (CM), MCAPM model compared to the CAPM model has high explanatory power in explaining stock returns. Thus, the third hypothesis is confirmed.

9. Conclusions

According to the results of hypotheses testing, considering Co-movement variable (CM) in predicting risk and stock returns is very important. Method for predicting risk and stock returns that have been used so far by investors was regardless this variable. Therefore, this study aimed to investigate the

changes in stock returns associated with market returns and mainly analyze the relationship between market returns and stock returns on capital asset new pricing model, which was called MCAPM models. The findings suggest that traditional CAPM has no greater explanatory power than the MCAPM to explain stock returns of companies. This is because of adding co-movement variable that the explanatory power of the dependent variable and the adjusted R2 also significantly improved and this shows the superiority of the MCAPM over CAPM. Thus, it can be argued that MCAPM model is from non-trivial capital asset pricing models. Since the Tehran stock exchange is toddlers and young and the investment culture in exchange and expertise knowledge is weak among people in the country and that investors make decisions based on efficiency, that is the investors, investment managers, capital market analysts and other used it to predict stock returns to select the best stock from MCAPM models, because in Iran's exchange, the traditional CAPM model through systematic risk alone cannot justify changes in stock returns, therefore, other versions of the model, including MCAPM model clearly showed that despite the Co-movement variables, efficiency changes through systematic risk is explained with greater explanatory power. Comparing the results of this research with other research suggests that like the research of Rahnama Roodposhti et al. [14] and Tavangar et al. [18], CAPM model has no more power to explain the expected returns in Tehran Stock Exchange compared to R-CAPM and DCAPM models, while according to [4], traditional CAPM model has more power in explaining the expected returns relative to the CCAPM pricing model.

10. Future works

We propose the future researches as follows:

- The Comparative test of MCAPM model with other pricing models, including CCAPM, DCAPM, ICAPM, R-CAPM, ACAPM and APT to explain the expected return of stock.
- To explain and evaluate the model using weekly data for the period of seven years.
- To implement this model with larger samples with separation of various industries.

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