Comparative Study of Capital Assets Pricing Models (CAPM) with Extrapolating Capital Assets Pricing Models (X-CAPM) in Tehran Exchange Market

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ABSTRACT

The main objective of this article is to present a comparative study of capital assets pricing models (CAPM) with extrapolating capital assets pricing models (X-CAPM) of companies admitted in Tehran Exchange Market which is accomplished for the first time by investigators of this research in Iran. Accordingly, the statistical population under study of this research includes all companies admitted in Tehran Exchange Market form 2006-2015. The present research method considering the current payment situation, is from descriptive- correlation type. In this research, both methods of gathering information including librarian and field methods are utilized. The required studies about research theoretical bases, research thematic literature, problem backgrounds and research subject have been made by librarian methods and for studying references, theses, and research about the subject internet bases have been used. Also the present research is included in survey researches, regarding its methods. In order to examine the hypotheses of this research, we used multivariate regression model. The findings of research shows the extrapolating capital assets pricing models (X-CAPM),companies admitted in Tehran Exchange Market, hasn't had high explanatory capability relative to other models, i.e. capital assets pricing models (CAPM), for instance reductive- undesirable capital assets pricing models (D-CAPM), adjustable capital assets pricing models (X-CAPM), interperiod capital assets pricing models, conditional capital assets pricing models (I-CAPM), revised capital assets pricing models (R-CAPM), consumption-based capital assets pricing models (R-CAPM), rewarding capital assets pricing models (RRM), behavioral capital assets pricing models (BAP).

Keywords:

Capital assets pricing standard models (CAPM), extrapolating capital assets pricing models (X-CAPM), Tehran Exchange Market.

1. Introduction

The recent theoretic activities relative to price behavior in stock market have totally tried to estimate some empirical rules. One of these services and attempts in regard to theoretic activities in this field include over-fluctuations in relation to Leroy Porter (1981), and Shiller (1981), the premium puzzle of stock owners rights of Mehra and Prescott (1985), the low relation between stock return and consumption growth mentioned by Hansen and Singleton (1982, 1983) and the most important of all, evidences in relation to estimation of stock market return utilizing the relation of sum of gain and price (Campbell and Shiller, 1988, Fama and French, 1988). Of course, both traditional and behavioral models have tried for estimation and finding some empirical rules according to empirical evidences (Braberis Greenwood and Shleifer (2015). So William Sharp (1960) has proposed capital assets pricing standard models (CAPM). Of course, since presenting capital assets pricing standard models (CAPM), discussions and criticisms and empirical studies have been made on measuring the accuracy of explanatory potential of this model in financial markets. So, nowadays we observe that capital assets pricing standard models (CAPM) have found significant popularity in financial science. Essentially, this model explains the relation between risk and return rate expected for an asset, if this asset has been utilized in a versatile stock portfolio and in relation to pricing securities, associated with risk. One of the methods contributing to capitalists in defining risk and investment return is using capital assets pricing standard model. This model was introduced in 1960 by William Sharp. In Sharp model which is called standard capital assets pricing standard model, the effect of systematic risk on investment portfolio is assessed by beta coefficient which is calculated by regressive analysis of portfolio return and basic portfolio return. Fundamentally investments are associated with risk because of the fluctuations made in their return. Till now financial economists have presented different patterns for measuring risk. Capital market theory derives a model for pricing risky capitals model by extrapolating the portfolio theory. The final output of this theory called capital assets pricing standard model provides the possibility of defining the return rate of risky assets. The main factor resulting in the extension of market theory is the meaning of riskless asset. These assets will have zero correlation with other riskless assets and its return rate will be riskless. Capital assets pricing models helps in calculating investment risk and expected stock return rate. The beginning point of this model is the rate of riskless return added to reward rate which the investors expect because admitting more risk. Beta coefficient is the systematic risk measurement unit related to every stock which in fact measures the sensitivity level of return changeability of each stock in relation to changeability of market return. It is worthwhile mentioning that after presenting capital assets pricing model many adjustments have been made to it, so with entering variables like financial risk factors, liquidity, undesirable, unexpected events, economic and operational the efficiency of this model developed. Because of these changes in financial markets news models according to capital assets pricing standard model (CAPM), including reductive- undesirable capital assets pricing model, adjustable capital assets pricing models (A-CAPM), interperiod capital assets pricing models, conditional capital assets pricing models, conditional assets pricing models (I-CAPM), revised capital assets pricing models (R-CAPM), consumption-based capital assets pricing models (R-CAPM), rewarding capital assets pricing models (RRM), behavioral capital assets pricing models (BAP) and in 2015, i.e. the year this article has been composed in order to identify and empirical examination of the model in Iran, extrapolating capital assets pricing models (X-CAPM) was presented by Nicholas Barberis, Robin Greenwood and Andre Shleifer (2015). Of course this practice is in fact derived from functional development (a practice or conclusion especially according to statistics) which is assumed in an unidentified situation considering the continuity of the current procedure and similar methods are practicable. Therefore, the main objective of this research is to present a comparative approach of comparing capital assets pricing models (CAPM) with extrapolating capital assets pricing model (X-CAPM) of companies admitted in Tehran Exchange Market form 2006- 2015.

2. Literature review

2.1 Capital assets pricing models (CAPM)

One of the methods contributing to investors in defining risk and investment return is using capital assets pricing model. As is mentioned in the introduction of this article, this model is introduced in 1960 by William Sharp and in this model which is called capital assets pricing models, the effect of systematic risk on investment portfolio is evaluated by beta coefficient calculated by portfolio return regressive analysis and base portfolio return. This model has been paid so much attention by investors and financial analysts and so many experts including Josung and Cheng (2008), and Rogros and Roberto (2009) have employed it in Shaghai and Sao Polo, respectively. Of course it was criticized later and many investigators developed it, some of which are: reductive, adjusted, interperiod, conditional, based on consumption, rewarding, behavioral and finally revised models (Fathi et al, 2012)

Capital assets pricing standard model (CAPM)

Essentially investments, because of fluctuations made in their return, have risks. Financial economists presented different patterns for measuring risk. Capital market theory derives a model for pricing risky assets by extending and extrapolating portfolio theory. The final output of this theory, called capital assets pricing model, makes it possible to determine the return rate of each risky asset (Reilly Frank K, Keith, C., 2006). Considering one of the main assumptions of capital assets pricing standard model (CAPM), based on linear relation between stock return of any activity and stock market return and possibility of lending and borrowing with riskless interest rate for asset expected return of asset (i), we will have :

$$E[R] = Rf + \beta_{im}.(E[Rm] - Rf) + e \qquad (1)$$

Where $R_m$is market portfolio, $R_f$is riskless asset return, $R_i$is expected return of asset (i), β_{im} is sensitivity coefficient, $E[R_m] - R_f$ is risk premium (R, Roodposhti and Amir Hosseini, 2010, pp: 49-68). Beta is the index of systematic risk and the above equation validates the result that systematic risk is the main factor in determining the expected return and non systematic risk doesn't play a role. Beta may be calculated by the following equation:

$$\beta_{im} = \frac{\mathrm{cov}\,(r_i, r_m)}{\mathrm{Var}\,(r_m)} \qquad (2)$$

Reductive – undesirable capital assets pricing model (D-CAPM)

One of the assumptions in explaining reductive-undesirable capital assets pricing model (D-CAPM), is the conditions of symmetric market. But studies show that in cases market conditions are asymmetric, meaning that factors while influencing risk premium influence the expected asset return rate, too, and destroy risk compromise and return (Sadeghi Sharif-2003). So, the limiting assumptions of capital asset pricing theory made the authorities of management and economy to develop this theory and approach the real conditions of the market. So, many criticisms are made to capital assets pricing standard model (CAPM), which itself is the most important factor of inventing negative risk conception and finally reductive – undesirable capital assets pricing model (D-CAPM). Negative risk conception was initiated in 1950s by Roy and finally in 2002 a research named Estrada proposed a model named reductive capital assets pricing model which may develop a suitable estimation from expected return in asymmetric market conditions. According to this model, risk is calculated according to a pseudo-variance. Therefore, we may divide pseudo-covariance to market pseudo-variance return and obtain reductive (negative) beta, asset (i) (β^D) in the following way (Estrada J., 2003):

$$\beta^D{}_i = \frac{\Sigma_{im}}{\Sigma_{im}^2} = \frac{E\{\min[(R_i - \mu_i)0] \times \min[(R_m - \mu_m)0]\}}{E\left\{\min[(R_m - \mu_m)0]^2\right\}} \quad (3)$$

Adjustable capital assets pricing model (A-CAPM)

When buying stocks various are paid attention to, one of most important of them is convertibility to cash flow which is called stock liquidity. It means that investors are going to sell their stock in the least time period and easily, if required. So, one of the elements affecting the expected return of even one share, is its liquidity power (Amihud, Y, and Wood R., 1990). Adjusting capital assets pricing model (A-CAPM) provides a pattern according to which we may examine how liquidity risk influences assets price, i.e. the model not considered in other capital assets pricing models (R, Roodposhti and Amir Hosseini, 2010). Amihud and Madleson addressed the liquidity concept in an article called "Assets pricing and supply and demand gap" (Amihud, Y, and Mandleson, H, 1986).

Following the research made, Pastor and Stambaugh in an article named “Liquidity risk and stock expected return” called liquidity an expanded and confusing concept which explains the ability of dealing lots of assets rapidly and with minimum expense, without any change in the price (Pastor, L. Stambaugh R.F. 2003). Amihud , in his research in 2003, calls illiquidity measure (ILLIQ). This measure is daily proportion of stock return absolute value on its trade dollar volume averaged in time period. He explained that stock expected extra return, besides risk premium indicates compensation for being influenced by expected illiquidity; so, additive function form illiquidity is expected by the market. In Amihud model (2003), stock expected illiquidity is defined as the following (R, Roodposhti and Amir Hosseini, 2010):

$$\mathrm{ILLIQ}_t^i = \frac{1}{\mathrm{Days}_t^i}\sum_{d=1}^{\mathrm{Days}_t^i}\frac{|R_{id}^i|}{V_{id}^i} \qquad (4)$$

Where: V_{id}^i, R_{id}^i are respectively equal to return and volume in Rials (million), on day (d), month (t); $Days_t^i$ indicates the days the stock (i) is traded in month (t) (Amihud, Y, 2002). Acahria and Peterson (2005) believe that if we don’t use illiquidity measure, we will face two main problems; at first, in this measure the effect of a mega variable like price general level (inflation) is not considered. For example, if the trade volume of a stock in the beginning of 2002 is equal to 1 billion Rials and at the end of 2006, it is equal to 5 billion rials, it doesn’t mean that its illiquidity has been lowered five times, but this increase may be the result of increasing general level of prices. While illiquidity measure (ILLIQ) is a measure to compute sale exchanges, it cannot consider all trade exchanges directly and for solving all these problems, a normalized measure of illiquidity is defined as C_t^i (R, Roodposhti and Amir Hosseini, 2010).

$$C_t^i = \min(0.25 + 0.30 ILLIQ_t^i P_{t-1}^M, 30.00) \quad (5)$$

In which we have, P_{t-1}^M is equal to the proportion of liquid index of market portfolio in the first period (t-1), modifier P_{t-1}^M solves the first problem and the liquidity measure to appear. 0.25 and 0.30 are coefficients resulting from share exchange expenses and also the difference between share trade price and the average gap of the announced supply and demand, is resulted and reported by Chalmers and Kadlec in 1998. For this the illiquidity normalized measure, a maximum equivalent to 3 percent has been considered to prevent form the illogical limit variables resulting from low trade level and not so much days passed from share trade days in a month (Achraya Viral V, Pedersen L. H. 2003). Achraya & Pederson model in 2005 considers simple and economic generations in which a new generation of economic brokers in any period is born. Illiquidity exchange (C_t^i) in this model is simply considered equivalent to the sale price of each share of securities (i). So economic brokers may buy it (P_i^i) price (P_i^i) but should sell it to ($P_i^i - C_t^i$) price. In this model there is no borrowing sale. Achraya and Pederson (2005) explain the expected return of asset (i) in the following form (R, Roodposhti and Amir Hosseini, 2010):

$$E(r_{t+1}^i - C_{t+1}^i) = r^f + \lambda_t \frac{\mathrm{Cov}_t\ (r_{t+1}^i - C_{t+1,}^i r_{t+1}^m - C_{t+1}^m)}{\mathrm{var}_t(r_{t+1}^m - C_{t+1}^m)} \qquad (6)$$

Accordingly, Achraya and Pederson (2005) explain their model in a way in which ($\lambda = E(r_{t+1}^m - C_{t+1}^m - r^f$) is equivalent to premium risk (Achraya Viral V, Pedersen L. H. 2003). So $\beta^A$is measured in this model from the following formula to calculate systematic risk (R, Roodposhti and Amir Hosseini, 2010):

$$\beta^A = \frac{\mathrm{Cov}_t\ (r_{t+1}^i - C_{t+1,}^i r_{t+1}^m - C_{t+1}^m)}{\mathrm{var}_t(r_{t+1}^m - C_{t+1}^m)} \qquad (7)$$

Inter-period capital assets pricing model

Following capital assets pricing model (CAPM), the substitute model introduced by Robert Morton (1973) was a linear functional model with variables of capital and situation which predicts the changes in return distribution and future return. Investors utilize this model to solve long-time consumption decisions while confronting indetermination. The main difference between Inter-period capital assets pricing model and standard model are situational variables; in fact investors confront with it to challenge market fluctuations. Morton (1973) believes that investors act in order to cover risk based on current and future situations. So variables including inflation, employment opportunities and coming stock market return are considered. This model may have lots of utilizations and Javern et al. (2003) have used this model to evaluate optimal portfolio selectivity and measure chronometry in investment portfolio. Results show that capital fund which behave during portfolio formation in a planned and categorized way, for instance in investment portfolio provide a class called asset assignment have positive market chronometry ability and may obtain the most of the existing opportunities with their timely diagnosis (Fathi et al. 2012, pp.27-46). The recent research explains significant results in regard to this model and the relation of risk changes and return in New York stock market considering Dow Jones average industrial index is studied by Baii & Angel (2009). Paolo Mayo (2008) evaluates three factors of cash flows future perspective, stock owners' rights future perspective, and securities future perspective by employing this model. The results of this research shows that this model provides a better prediction model compared to investment portfolio future conditions compared to Fama & French three-factor model (1993). Also, this model has the capability of measuring the extraordinary flows beyond the stock premium unlike Fama & French model (Fathi et al. 2012, pp.27-46).

Conditional Capital Asset Pricing Model (I-CAPM)

Essentially, the main difference between this model and Sharp standard model is the variables which investors consider them important in some of their financial exchanges to prevent from bankruptcy, including probable changes and challenges in investment return. This model explains that all investors don't have similar expectations and the main reason is the changes of market conditions (Hans & Richard, 1978). Conditional Capital Asset Pricing Model is presented as the general model of non-conditional capital asset pricing model in order to assume that investors have similar conditional expectations about asset returns. In this case, we may not utilize the standard model for estimation. Accordingly, in this model beta coefficient is obtained from the following equation:

$$\beta = \frac{Var\ (r_M)}{Cov\ (r_i, r_M)} \qquad (8)$$

The assumptions of this model include:

1) Investors have always required to obtain more return compared to the risk level they accept in investment.
2) Investors may change the stocks of companies that don't necessitate versatility according to the expectations (while they may not require that).
3) Capital asset pricing model is not erroneous (Fathi et al. 2011, pp.27-46).

Revised Capital Asset Pricing Model (R-CAPM)

Our economic managers have applied the only efficient risk on their decisions as systematic according to models like Capital Asset Pricing Model (CAPM), Reductive-Undesirable Capital Asset Pricing Model (D-CAPM), and also Adjustable Capital Assets Pricing Models (A-CAPM) and used the rule to justify their performance; they announce the factors outside the company and beyond their decision making as the criteria of inefficiency or not realizing their objectives which is somehow not real in regard to our business conditions. One of the limitations of the traditional models and adjusted models based on it is that in these models we just consider the historical data to compute the expected return rate and systematic risk and non-systematic risk is not considered at all. So, we'd better search for a model in which systematic and non-systematic risks and also historical and forthcoming data (prediction) are regarded as integrated (R, Roodposhti and Amir Hosseini, 2010). Therefore, the expected return rate predicted in this way will be more accurate and adaptable to the realities of our society.

The implications and achievements related to revised capital asset pricing model (R-CAPM) include (R. Roodposhti,Nikomaram H.,2009): 1. Developing a capital asset pricing model and achieving a comprehensive pricing model; 2. Integrating pricing models with leverages and presenting a developed pricing model; 3. Considering the systematic and non-systematic risks as integrated; 4. Considering historical data and predicted data as integrated; and 5. It is more adaptable to the realities of our society. The present innovation has had practical and objective adaptation to the realities of market and the effect of all kinds of risks on decision making of the active participants of capital market. It also develops two theoretical discussions, pricing model and leverages integrated in a model and presents the pricing model. So, beta coefficient located in revised capital asset pricing model (R-CAPM), is calculated from the following equation (R, Roodposhti and Amir Hosseini, 2009):

$$\beta^{R} = (DEL)(DFL)(DOL)\beta^{O}{}_{j} \qquad (9)$$

Where:

$\beta^{O}{}_{j}$ is the inherent risk of company (j), DOL coefficient is the operational leverage degree, DFL coefficient is financial leverage degree and DEL coefficient is economic leverage degree. So, the economic leverage degree includes the percentage of accomplished changes in company sale divided to the percentage of changes obtained from external economic disruption (Z_t) which is calculated from the following formula (R, Roodposhti and Amir Hosseini, 2010):

$$DEL = \frac{\%\Delta Q}{\%\Delta Z} \qquad (10)$$

$\beta^{O}{}_{j}$ is the inherent risk of company (j), or internal risk after excluding operational and financial risks and is used to determine the economic leverage degree beta and is calculated in the following way (R, Roodposhti and Amir Hosseini, 2010):

$$\beta^{O}{}_{j} = \frac{\mathrm{Cov}_t\left[\left(\frac{\pi_{j,t-1}}{Z_{j,t-1}}\right)\left(\frac{\tilde{Z}_{j,t}}{E_{j,t-1}}\right),\tilde{R}_{mt}\right]}{\delta_{mt}{}^{2}} \qquad (11)$$

Where: $\pi_{j,t-1}$ is the coefficient of dividend after subtracting the tax of the end of the period; ($Z_{j,t-1}$) the coefficient of economic disruptions of the period; ($E_{j,t-1}$) the period market value (the pure expected return from company market share);($\tilde{Z}_{j,t}$) the economic disruption of the forthcoming period (predicted); ($\tilde{R}_{mt}$) the market return of the subsequent period and ($\delta_{mt}{}^{2}$) is the variance of subsequent period market index. Finally, in calculating the expected return in the revised capital asset pricing model(R-CAPM), the main point is(R, Roodposhti and Amir Hosseini, Z., 2010):

$$R_i = R_f + \beta^{R}\left(R_m - R_f\right) \qquad (12)$$

It worth mentioning that the ability to explain the revised capital asset pricing model(R-CAPM) has been tested in the industry of automobile and manufacturing parts just with assuming one macroeconomic variable (interest rate) influencing the calculation of beta sensitivity coefficient (Griffin F., Dugan T. 2003). Using this model, we may achieve a developed model called revised and adjusted capital asset pricing model with the risk of liquidity and compare and test it with the adjusted capital asset pricing model (R, Roodposhti and Amir Hosseini, Z. , 2010). We may also estimate different betas according to each of the models under study and employ them in experimenting models explanatory power (R, Roodposhti and Amir Hosseini, Z. , 2010). So, we have considered the total risk in this model (systematic and non-systematic risk). In the studies made by Rahnama(2009) and Amir Ebrahimi, Rahnama and Khosravi (2010) in Tehran stock exchange market, it was shown that the explanatory power of this model compared to other standard capital asset pricing models, the reductive capital asset pricing model and adjusted capital asset pricing model has better efficiency in predicting the return and forthcoming investment portfolio risk. In the most recent analysis made in this relation the efficiency of this model Roodposhti and Amir Hosseini (2010) the efficiency of this model has been compared to the three-factor model of Fama & French (1993) and demonstrated the better efficiency of this model (Fathi et.al, 2012. pp:27-46).

Consumption-based Capital Assets Pricing Model (C-CAPM)

In consumption-based capital assets pricing model, the risky assets cause unreliability in consumption. The main question here is that does the investor consider the expenses related to his investment appropriate to the unreliability in market (for example, change in income and asset value)? This unreliability stems from the difference found in decisions taken for investment in risky assets. In standard models for capital assets pricing, premium risk in the portfolio is a measure for evaluating risk expense. This is while beta coefficient measures risk level. The market risk level is measured by changes in risk premium in relation to consumption growth. Therefore, in this model, we describe how much of the changes in stock market return relates to consumption growth. Consumption-based capital assets pricing model is based only on the assumed bases and is seldom used in practice. There is no doubt that C-CAPM is not used in real world as much as the capital assets pricing model. The main reason is that consumption-based capital assets pricing model is not evaluated practically and empirically. Since in consumption-based capital assets pricing model, we measure between investment return and its required consumption, this model provides a better performance compared to the standard model. According to a scientific view, the consumption-based capital assets pricing model is used more than capital assets pricing model. This model which is introduced as consumption-based capital assets pricing model, is a developed from capital assets pricing model used only for measuring the asset returns of one financial period. Also, that consumption-based capital assets pricing model creates a basis to understand the relation between asset, consumption, and risk avoidance of capitalists. The simplest form of consumption-based capital assets pricing model (C-CAPM) shows the linear relation between risky assets and market risk premium and therefore its formula would be (Fathi et al, 2012, pp: 27-46):

$$\bar{r}_a = r_f + \beta_c(\bar{r}_m - r_f) \qquad (13)$$

In the above equation, we have: r_f: riskless return rate; $\bar{r}_a$: the expected return rate of assets; $\bar{r}_m$: the expected return rate of market; $\bar{r}_m - r_f$: market risk premium and β_c: assets consumption-based beta. Return and risk premium is defined by investors' consumption growth and their risk avoidance like capital assets pricing standard model. In this model the relation between risky asset and systematic risk is evaluated. Systematic risk is calculated by consumption-based beta and is explained in the following way (Fathi et al, 2012, pp: 27-46):

$$\beta_c = \frac{Cov(\bar{r}_a, consumption\ growth)}{Cov(\bar{r}_m, consumption\ growth)} \qquad (14)$$

Rewarding Capital Assets Pricing Models (RRM)

Graham Bornholt (2006) believes that investors require a better methodology to estimate the expected return of stocks. In this relation he presents the rewarding beta model to substitute for Capital Assets Pricing Model. Its assumptions are matched with Arbitrage pricing theory (APT). He divides stock return to two parts: 1) expected stock return and 2) expected stock return. So, Rewarding Capital Assets Pricing Model is explained in the following way (Fathi et al, 2012, pp: 27-46):

$$E(r_i) = R_F + \beta_i[E(R_M) - R_F] + \beta r_i[R_m - E(R_m)] \qquad (15)$$

In this model, rewarding beta is j share and calculated in the following way (Fathi et al, 2012, pp: 27-46):

$$\beta r = \frac{E(r_i) - R_f}{E(r_m) - R_f} \qquad (16)$$

Therefore to calculate rewarding beta, we should just divide the monthly average risk premium of the share in the last period to market monthly risk premium in the mentioned period and use the calculated rewarding beta to estimate stock return for the forthcoming period. In the rewarding beta model, the term used in $[E(R_m) - R_F]$is market risk premium for t period which constitutes the expected stock return and the last market return is used as market expected return. The term used in $[E(R_m) - R_F]$is the difference between market real return in t-period and market expected return and constitutes the unexpected stock return. Beta coefficient is the same beta of Capital Assets Pricing Model, i.e. the covariance between stock return and market return. Then Bornholt (2006) arranged the stocks available in New York exchange market for the period (1963-2003) according to Fama& French methodology, which means formulation 25 classified portfolio on the basis of company size and the ratio of book value to market value and showed that rewarding beta model functions better than Capital Assets Pricing Model in predicting stock expected return (Rogers& Securato, 2007). Bornholt research was repeated in New York exchange market (2006) and during (1967-2006) in Sao Polo stock market in Brazil. Their methodology was exactly the same as Bornholt and their results approved the priority of rewarding beta model function over Capital Assets Pricing Model, too (Fathi et al, 2012, pp: 27-46).

Behavioral Capital Assets Pricing Model (BAP)

One of the main issues that nowadays have a determining role in the exchanges is how people behave in their transactions. This review is discussed as the basis of behavioral financial theory. Hishleifer (2001) explains that in behavioral financial literature, pricing paradigm of behavioral asset is developing and paying more attention to this type of financial literature in the future shows that we should witness replacing of Capital Assets Pricing Model with this theory. Behavioral investing portfolio theory defines the behavior of investors in selecting investment units and may also be considered as a basis for determining suitable performance. Especially in this theory investors constitute their securities portfolio as a pyramid in several layers; so the lower layers are designed for protecting investments from unfavorable conditions and higher layers are designed potentially for favorable conditions. While some investors fill the highest layers of their investment portfolio with a few diverse investments, others complete it randomly and unplanned. This causes that investors look for an optimal solution to protect their capital against loss. It is in this condition that the behavioral theory of Capital Assets Pricing Model is discussed (Fathi et al, 2012). Of the main characteristics of behavioral investing portfolio is to review the investors view about investing portfolios not as a whole but as discrete parts in investment assigning pyramid. When different parts with special purposes considered for them join each other, if the behavioral policy about risk admitting is different among parts, some of them may have been designed to protect the investment against bankruptcy. In the simple model of investment portfolio behavioral theory, investors divide their capital in two parts: one part to protect their investment against unfavorable situation and the other to acquire gain in favorable situation. In the detailed description of this theory investors divide their capital according to the objectives and goals of some of investors to various parts (Fathi et al, 2012).

Extrapolating capital assets pricing models (X-CAPM)

As we have mentioned in the introduction of the present article, after developing standard capital assets pricing models (CAPM) by William Sharp in 1960, many discussions and criticisms and empirical studies were made on the accuracy of responsiveness of this model in financial markets, so we witness today that capital assets pricing models (CAPM) has got considerable fame in financial sciences. After that as a result of revolutions in financial markets new models have been developed according to standard capital assets pricing models (CAPM), including reductive-undesirable capital assets pricing models (D-CAPM), adjustable capital assets pricing models (A-CAPM), interperiod capital assets pricing models, conditional capital assets pricing models (I-CAPM), revised capital assets pricing model (R-CAPM), consumption-based capital assets pricing models (R-CAPM), rewarding capital assets pricing models (RRM), behavioral capital assets pricing models (BAP). And finally now extrapolating capital assets pricing models (X-CAPM) has been developed by Nicholas Barberis, Robin Greenwood and Andre Shleifer (2015). Of course this method is in fact derived from the term expanding function (a method and conclusion according to statistics) which is practicable in an unknown situation on the assumption of continuity of the current trend.

Nicholas Barberis, Robin Greenwood and Andre Shleifer (2015) in their article named as X-CAPM: extrapolating capital assets pricing models expressed their view that the evidences of their review demonstrates that most of investors constitute their beliefs about the future of stock market return by extrapolating the past return. These beliefs are not easy to be consolidated with the existing modes in the whole stock market. It is worthwhile mentioning that their research is focused on Consumption-based Capital Assets Pricing Model (C-CAPM) which is not so much significant in reviewing and experimentation of this model in financial markets. Accordingly, in extrapolating capital assets pricing models (X-CAPM), some investors formulate their beliefs about the future of stock market return by extrapolating the past return, while others hold on to their rational and intellectual beliefs. So, their findings showed that the sequential model of most characteristics including price and real return have introduced till now but the most important of them is developed according to the evidences of study on investor expectations, extrapolating capital assets pricing models (X-CAPM).

In this section, we suggest a heterogeneous consumption factor according to a model in which some investors predict past extrapolation of stock price changes in price variations. Constructing such a model considering the significant current challenges are the reasons of heterogeneity and also the reason of price change is endogenous quantity and the beginning of extrapolation. Contrarily constructing a model on the basis of essential exogenous extrapolation is somehow simple (Barberis, Greenwood and Shleifer, 2015).

Barberis, Greenwood and Shleifer (2015), in order to prevent conversion of model to a complicated one and prevention from interpreting it, consider some simple assumptions about dividend trend (including a random step in the levels), about the priorities of the investor (desirability) and riskless rate (a constant exogenous coefficient). So, we expect, according to their model and approach, that the model evidences be more complicated for writing formulas. We consider a constant interest rate (r) and risky asset which we think about as total stock market and have a per capita constant capital offer (Q) (although the discourse of constant interest rate assumption is discussed in the end of 2nd section). Risky assets are a claim about the continuous dividend division developed in a unit level of time and explained as the arithmetic Brownian motion. The equation (17) describes it:

$$dD_t = g_D dt + \sigma_D d\omega_t \qquad (17)$$

Where (g) and (σ) are expected value and standard deviation from dividend changes respectively and (ω) is a one-dimensional vineries standard. Two factors (g) and (σ) are constant in our model. We also define stock market in t time by(P_t).

So, according to the above model, we assume that there are two kinds of traders with eternal life in economy: extrapolators and intellectual traders the job of both is to maximize consumption expected gain during lifetime. The only difference is that the first trader follows correct beliefs about the expected return from risky assets while the other trader doesn't do this. Modeling related to extrapolations show that evidences of review by analysis has been the motivation of Vissing-Jorgensen (2004), Amromin and Sharpe (2008), Bacchetta, Mertens, and Wincoop (2009), Greenwood and Shleifer (2013).

These types of investors formulate their beliefs about changing the future price of stock market by extrapolating the recent changes of market price. In order to establish this subject, we measure the defined feelings in the following way:

$$S_t = \beta \int_{-\infty}^{t} \overline{e^{\beta(t-s)}}\, dP_{s-dt'} \qquad (18)$$

Where: (s) is a variable used for integral; S_t is the simple weighting average of recent price changes in stock market in which reducing weights are mostly based on the past. S_t variable includes even the change of most recent prices $(dP_t - d_t \equiv P_t - P_{t-dt})$. β plays a significant role in our model. If high, feeling are at first defined by recent changes in price; and if weak, even price changes in the last times plays a significant role in the current feelings. In section 3, we use the obtained data from field research and referendum to estimate parameterβ. We assume that we expect from the extrapolations that price change in unit of time is in the stock market value which is shown by this formula:

$$g_{P,t}^{e} \equiv \frac{\mathbb{E}_t^e[dP_t]}{dt} = \lambda_0 + \lambda_1 S_t \qquad (19)$$

Where the index is written above, a summary of extrapolators' concept and in the other form, it is currently our only condition in imposing constant parameters λ_0 and $\lambda_1$in the model, where $\lambda_1 > 0$. Considering all of them together, equations 2, 3 consider the nature of research results in the studies made by Greenwood and Shleifer (2013); which explains after the good return of stock market, extrapolators expect that stock market continues its good trend and if the stock market is weak, they expect to have a weak performance in the following. While we have constant parameters which are not recognizable now and placed as λ_0 and $\lambda_1$in the model, are the inherent values $\lambda_1 = 0$ and$\lambda_1 = 1$, and they are really the values we will use later. We may not have a strong position on the main source of extrapolator expectations in equation (19). By the way, there is a possible source introducing the substitution or has an near belief in it under the law of small numbers (Barberis, Shleifer, and Vishny 1998; Rabin 2002). For example, under the law of small numbers, people think that even in similar small samples resembling our statistical population the samples are taken from them and if witness recent good return in stock market, they think the stock market has an average high return and will follow it in the future. The second type of investor, logical trader, has accurate beliefs in evaluating the future trend of stock price. By proper interaction with adjusting price processes (balancing price trend), logical investors open a full account on endogenous extrapolators in relation to all price movements all times in the future. Generally, there is one change of both kinds of logical traders and extrapolators in economy: Logical traders and extrapolators will take time to use risky asset as their data in making commercial decisions and will have constant absolute risk aversion (CARA) or absolute risk aversion (γ) and time discounting factor (δ).In zero time, in order to maximize each extrapolator we will have:

$$\mathbb{E}_D^e\left[-\int_0^\infty \frac{e^{-\delta t-\gamma C_t^e}}{\gamma}dt\right] \quad (21)$$

We also should consider the subject related to budget limitation, so:

$$dW_t^e \equiv W_{t+dr}^e - W_t^e = (W_t^e - C_t^e dt - N_t^e Pt)(1 + r\,dt) + N_t^e D_t dt + N_t^e P_t dt - W_t^e = rW_t^e dt - C_t^e dt - rN_t^e P_t dt + N_t^e dP_t + N_t^e D_t dt \quad (22)$$

Similarly, in zero time, to maximize each logical trader, we will have:

$$\mathbb{E}_D^r\left[-\int_0^\infty \frac{e^{-\delta t-\gamma C_t^r}}{\gamma}dt\right] \quad (23)$$

Where, N_t^e is the number of per capita stock in order to invest in risky asset in t time and the index written above r is a summary of logical trader concept. Logical traders have a proper estimation of price process (P_t) and so their expectations matches with something beyond econometric principles. We assume that logical traders constitute a fraction (μ) and for an extrapolator ($1-\mu$) chosen from total investing population .The conditions of market settlement should be considered all times of holding assets include:

$$\mu N_t^r + (1-\mu)N_t^e = Q \quad (24)$$

Where Q is the per capita number of investor stock for investing in risky asset in t time, while we assume that both kinds of logical traders and extrapolators are continuously observing D_t and P_t. Additionally, we all know the values of μ andQ and that trades of the first type know and understand how the other traders form their beliefs about the future. Barberis, Greeenwood and Shleifer (2015) have used a dynamic random programming and developed Morton method (1971) and achieved the following premise:

Premise 1: (model solution): in the heterogeneous factor of the above model, to describe adjusting price from risky asset:

$$P_t = A + BS_t + \frac{D_t}{r} \quad (25)$$

Table 1: Types of Capital Assets Pricing Model (CAPM)

No	Model name	Developer	Year
1	Capital Assets Pricing Model (CAPM)	William Sharp	1960
2	Reductive-Undesirable Capital Assets Pricing Model(D-CAPM)	Hajun& Varoon	1974
3	Adjustable Capital Assets Pricing Model (AX-CAPM)	Amihood& Mendleson (1989), Pasteur & Stambaff (2003)	1989 - 2003
4	Interperiod Capital Assets Pricing Model	Robert Morton	1973
5	Conditional Capital Assets Pricing Model (I-CAPM)	Hans & Richard	1978
6	Revised Capital Assets Pricing Model (R-CAPM)	R, Roodposhti and Amir Hosseini, Z.	2009
7	Consumption-based Capital Assets Pricing Model (R-CAPM)	Douglas& Robert Lucas	1982
8	Rewarding Capital Assets Pricing Model (RRM),	Graham Bornholt (2006) & Rojers & Secorato (2007)	2006, 2007
9	Behavioral Capital Assets Pricing Model (BAP)	Jackvert &Hishleifer	2001, 2002
10	Extrapolating Capital Assets Pricing Model (X-CAPM)	Nicholas Barberis, Robin Greenwood and Andre Shleifer	2015

Source: research findings

Table 2: Models developed according to Capital Assets Pricing Model (CAPM)

Model name	Developers and researchers	Variables used	Comments
Capital Assets Pricing Model	William Sharp (1969)	Beta, riskless return rate, risk & market return	This model is based on market symmetrical assumptions and information in the market
Reductive-Undesirable Capital Assets Pricing Model	Hajun& Varoon (1974)	Semi-variance measure and beta in undesirable explained according to Semi-variance	When distribution of returns lower or higher than symmetry, this model may be used.
Conditional Capital Assets Pricing Model	Hans & Richard	Beta is established according to dividing market variance to stock return covariance and market return	Not all investors have similar expectations and the main reason is change in market conditions
Consumption-based Capital Assets Pricing Model	Douglas& Robert Lucas (1982)	Beta is defined based on the consumption growth of investors and consumption growth in the market	Higher values of beta points to higher return in risky assets
Adjustable Capital Assets Pricing Model	Amihood& Mendleson (1989), Pasteur & Stambaff (2003)	Defining liquidity risk in obtaining investment beta	liquidity risk of securities and market liquidity risk
Behavioral Capital Assets Pricing Model (BAP)	Jackvert (2002) &Hishleifer (2001)	Defining investors' behavior in selecting investment units	In this theory, investors constitute their securities portfolio like a pyramid
Rewarding Capital Assets Pricing Model (RRM),	Graham Bornholt (2006) & Rojers & Secorato (2007)	Stock return is divided to two parts of expected and unexpected return	Risk premium average of monthly stock in the last period is divided to risk premium average in the mentioned period
Revised Capital Assets Pricing Model (R-CAPM)	R, Roodposhti and Amir Hosseini, Z.	Compiling the beta of the revised models of capital assets related to the assumptions of operational, financial and economic leverages	Considers the concepts of operational, financial and economic risk

Source: research findings

2.2. Research background

R, Roodposhti and Amir Hosseini addressed the Revised Capital Assets Pricing Model (R-CAPM) and their research results showed that Revised Capital Assets Pricing Model (R-CAPM) has more ability in interpreting capital assets in regard to market conditions, the existing situation in economic units and finally investment portfolio. Fathi et al. in 2012 reviewed Capital Assets Pricing Model in their research by attitude toward the new economic models based on it. They explained that after developing Capital Assets Pricing Model many adjustments have been made on it, so that entering variables like financial risk factors, illiquidity, undesirable, unexpected event, economic and operational, the efficiency of the model developed. As a result of these transformations, new models were proposed according to Standard Capital Assets Pricing Model including Revised Capital Assets Pricing Model which is proposed in 2009 by Iranian researchers R, Roodposhti and Amir Hosseini and has more ability in interpreting capital assets in regard to market conditions, the existing situation in economic units and finally investment portfolio. In their research they introduced each model and reviewed them to show the importance of using them for financial managers, economic analysts and investors.

3. Methodology

Generally the present methodology is based on arithmetic financial methods and models and utilizing the frameworks of Capital Assets Pricing Model (CAPM) i.e. according to Capital Assets Pricing Model (CAPM), including Reductive-Undesirable Capital Assets Pricing Model(D-CAPM), Adjustable Capital Assets Pricing Model (A-CAPM), Interperiod Capital Assets Pricing Model, Conditional Capital Assets Pricing Model (I-CAPM), Revised Capital Assets Pricing Model (R-CAPM), Consumption-based Capital Assets Pricing Model (R-CAPM), Rewarding Capital Assets Pricing Model (RRM), Behavioral Capital Assets Pricing Model (BAP), Extrapolating Capital Assets Pricing Model (X-CAPM) by Nicholas Barberis, Robin Greenwood and Andre Shleifer (2015), to which the second part mentions in details. So, the present research is descriptive- correlation type because it has used both data gathering including library and field methods. Reviewing the research theoretic bases, thematic literature, problem history and research subject were made by librarian methods, theses and research related to the subject and using internet databases. Also the research is from survey type considering its method. In order to test the hypotheses, we have used multivariate regression and besides to analyze data we have used Excel software, SPSS and econometric software Eviews.

4. Results

In this research in order to analyze the information we have se descriptive inferential statistical method. At first the extracted information from financial statements is regulated and then descriptive statistics like average, mean, profile (mode) and deviations of each is calculated and the columnar graph related to frequency percentage has been plotted. In order to accept or reject each hypothesis of the research we used inferential statistic method and hypothesis test including Pearson correlation coefficient, regression and Kolmogorov-Smirnov test to investigate normality test and is explained further in detail. Analyzing information is made by statistical tables Excel, SPSS and econometric (Eviews) software.

4.1. Kolmogorov - Smirnov test for measuring data normality

After data gathering, we should consider the distribution nature of research quantitative data form normality point of view. Data situation test from this aspect is prerequisite to use parametric and non-parametric tests. In this research, with this prerequisite, we use Kolmogorov-Smirnov test to identify the normality of research data to recognize the normality situation of research data distribution and find that in order to test these hypothesis should we use parametric or non-parametric tests.

H_0: data is normal (data has been brought from normal population)

H_1: data is not normal (data hasn't been brought from normal population)

Table 3: Results of the normality of research variables

Variable	Observation no	Test level (Z)	Level of significance	Variable status	normality assumption status
X-CAPM	12360	1.782587	.0003	abnormal	(H_0)assumption is not approved
CAPM	12360	1.782587	.0001	abnormal	(H_0)assumption is not approved
A-CAPM	12360	7.927847	.0001	abnormal	(H_0)assumption is not approved
I-CAPM	12360	4.73183	.0011	abnormal	(H_0)assumption is not approved
R-CAPM	12360	12.27443	.0001	abnormal	(H_0)assumption is not approved
C-CAPM	12360	2.994385	.0001	abnormal	(H_0)assumption is not approved
RRM	12360	11.30768	.0001	abnormal	(H_0)assumption is not approved

Source: research findings

Generally, the results of this test showed that test level is all variables is significant in error level of more than 0.05; i.e. data distribution in the variables is not normal. A presumption of linear regression is that the dependent variable data distribution should be normal or near normal. Since according to table 5, the same variables don't follow normal distribution, so, we haven't used data logarithm to perform regression. Since the results show that in regard to test statistical value (sig), in all variables as shown in table 5, and considering the comparison with critical value in error level 5%, we observe that data doesn't have normal distribution.

Research first hypothesis: The expected risk calculated from extrapolating capital asset pricing (X-CAPM), compared with the risk calculated from CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, RRM has positive significance and has higher explanatory power.

The first method for inferential statistical testing of research first hypothesis: In general, in this section, we deliver the statistical results relating to research first hypothesis using the absolute value of difference between estimated and real values of calculated risk (calculated beta or β) and methods relating to capital assets pricing standard model (CAPM), reductive- undesirable capital assets pricing model, adjustable capital assets pricing models (A-CAPM), interperiod capital assets pricing models, conditional capital assets pricing models, conditional assets pricing models (I-CAPM), revised capital assets pricing models (R-CAPM), consumption-based capital assets pricing models (R-CAPM), rewarding capital assets pricing models (RRM), and also extrapolating capital assets pricing models (X-CAPM) presented by Nicholas Barberis, Robin Greenwood and Andre Shleifer (2015). The statistical value of root mean square error (RMSE) and mean absolute error (MAE) are calculated and the results are presented in table (4).

Table 4: statistical values of root mean square error and mean absolute error for expected risk

No.	Test statistics	Methods for calculating asset expected risk						
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		X-CAPM	CAPM	A-CAPM	I-CAPM	R-CAPM	C-CAPM	RRM
1	mean absolute error	0.3891943	0.0828272	0.0046069	0.0016751	0.0307545	1.0656271	0.0828272
2	root mean square error	0.0156561	0.0033313	0.0001855	6.7416730	0.0012366	0.0428663	0.0033524
3	Level of significance (P-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	The most suitable model for predicting risk	6	3	1	7	2	5	4

Source: researcher calculations

Explanation and interpretation of the results of table (4): we may explain that considering the values of root mean square error (RMSE) and mean absolute error (MAE), the lower values of each of these measures are more desirable and explains the accordance of model data with financial market reality, and so according to both statistics, the most suitable model for predicting risk among CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, and extrapolating capital asset pricing model (X-CAPM), respectively include: 1. A-CAPM model; 2. R-CAPM model; 3. CAPM model; 4. RRM model; 5. C-CAPM model; 6. X-CAPM model; 7. I-CAPM model.

The second method for inferential statistical testing of research first hypothesis: in order to compare the absolute value of the difference between real and predicted observations for each of the seven methods, we have used repetitive measures comparison test. So, considering that there are large data in the research, we use Freidman non-parametric test to compare the mean ranking of different models. But before presenting the results, we explain the zero hypothesis and zero research hypothesis.

Zero hypothesis (H_0): Deviation of estimated values from risk real values from X-CAPM, CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, RRM, doesn't have positive significant difference while X-CAPM doesn't have higher explanatory power.

Research hypothesis (H_0): Deviation of estimated values from risk real values from X-CAPM, CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, RRM, has a positive significant difference while X-CAPM has higher explanatory power.

Explanation and interpretation of the results of table (2): Generally the results of Freidman test in table 5 are calculated according to Chai-square statistics (793.421) and shows error level (p. value=0.000). There is at least one significant difference between the mean absolute value of ranks of deviations of estimated and real observations in seven methods of risk estimation and the least mean rank of deviations in estimated and real observations is appropriated to methods: 1) I-CAPM; 2)CAPM; 3) RRM; 4) C-CAPM; 5) X-CAPM; 6)A-CAPM; 7)R-CAPM. Of course considering that Freidman variance analysis is a general test, we use Wilcoxon complementary test. The result of test in shown in table (6).

Table (5): the results of Freidman ranking test to compare deviations of expected risk calculation methods

No	Test statistics	Methods for calculating asset expected risk						
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		X-CAPM	CAPM	A-CAPM	I-CAPM	R-CAPM	C-CAPM	RRM
1	Mean rank	4.26591	3.9897	4.27614	2.27106	5.78088	4.201461	4.02597
2	Level of significance (P-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	The most suitable model for predicting risk	3	4	7	1	6	2	5
	Model statistical values	Chi-square= 793.421 asymp.sig=0.000						

Source: researcher calculations

Table 6. Mean deviation rank of methods used for calculating expected risk

		N	Mean Rank	Sum of ranks
CAPM- X-CAPM	Negative ranks Positive ranks Ties Total	326 282 0 12360	314.3771 326.1176	105630.9 93868.8
A-CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6155 6205 0 12360	386.9922 252.769	119966.2 79533.51
I- CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6137 6223 0 12360	379.034 144.2812	67580.49 131919.3
R-CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6166 6194 0 12360	344.802 312.6039	92096.7 107403
C-CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6131 6229 0 12360	297.0838 348.7133	105630.9 93868.8
RRM X-CAPM	Negative ranks Positive ranks Ties Total	6086 6274 0 12360	314.3771 333.1515	11695.4 81794.78

Source: researcher calculations.

The result of analyzing hypothesis test is that risk estimation with I-CAPM model has the least deviation from real observations. These methods don't have significant difference with each other and ore significantly better than other methods and ranked first. In the second rank, model CAPM is located whose estimation deviation from real observations compared with real observations is significantly large and is better compared with the methods of 3rd, 4th,5th, 6th and seventh levels. In the third level, we have model RRM which is better compared with 4th, 5th, 6th and seventh levels and has more deviation in regard to higher ranks. In the fourth level, model C-CAPM is located which is better compared with 5th, 6th and seventh levels and has more deviation in regard to higher ranks. In the fifth level, model X-CAPM is located which is better compared with 6th and seventh levels and has more deviation in regard to higher ranks. In the sixth level, model A-CAPM is located which is better compared with seventh level and has more deviation in regard to higher ranks. In the seventh level, we have model R-CAPM which highest deviation in regard to other ranks.

Table 7. Mean deviation rank of methods used for calculating expected risk

Test statistics						
	CAPM X-CAPM	**A-CAPM X-CAPM**	**I- CAPM X-CAPM**	**R-CAPM X-CAPM**	**C-CAPM X-CAPM**	**RRM X-CAPM**
Z Asymp. Sig (2-Tailed	-1.299337a .0001	-4.4658315 a 0000	-17.3180137 a .0000	-7.1064526a .000	-1.6901612b .0011	-1.299337b .0000
a. Based on positive ranks b. Based on negative ranks c. Wilcoxon signed ranks test						

Source: researcher calculations.

Research second hypothesis: The expected return calculated from extrapolating capital asset pricing (X-CAPM), compared with the risk calculated from CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, RRM has positive significance difference and has higher explanatory power.

The first method for inferential statistical testing of research second hypothesis: In general, in this section, we deliver the statistical results relating to research first hypothesis using the absolute value of difference between estimated and real values of calculated risk (calculated beta or β) and methods relating to capital assets pricing standard model (CAPM), reductive- undesirable capital assets pricing model, adjustable capital assets pricing models (A-CAPM), interperiod capital assets pricing models, conditional capital assets pricing models, conditional assets pricing models (I-CAPM), revised capital assets pricing models (R-CAPM), consumption-based capital assets pricing models (R-CAPM), rewarding capital assets pricing models (RRM), and also extrapolating capital assets pricing models (X-CAPM) presented by Nicholas Barberis, Robin Greenwood and Andre Shleifer (2015). The statistical value of root mean square error (RMSE) and mean absolute error (MAE) are calculated and the results are presented in table (8).

Explanation and interpretation of the results of table 8): we may explain that considering the values of root mean square error (RMSE) and mean absolute error (MAE), the lower values of each of these measures are more desirable and explains the accordance of model data with financial market reality, and so according to both statistics, the most suitable model for predicting risk among CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, and extrapolating capital asset pricing model (X-CAPM), respectively include: 1. A-CAPM model; 2. C-CAPM model; 3. CAPM model; 4. I-RRM model; 5. R-CAPM model; 6. RRM model; 7. X-CAPM model.

The second method for inferential statistical testing of research first hypothesis: in order to compare the absolute value of the difference between real and predicted observations for each of the seven methods, we have used repetitive measures comparison test. So, considering that there are large data in the research, we use Freidman non-parametric test to compare the mean ranking of different models. But before presenting the results, we explain the zero hypothesis and zero research hypothesis.

Zero hypothesis (H_0): Deviation of estimated values from risk real values from X-CAPM, CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, RRM, doesn’t have positive significant difference while X-CAPM doesn’t have higher explanatory power.

Research hypothesis (H_0): Deviation of estimated values from risk real values from X-CAPM, CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, RRM, has positive significant difference while X-CAPM has higher explanatory power.

Table 8: statistical values of root mean square error and mean absolute error for expected return

No.	Test statistics	Methods for calculating asset expected risk						
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		X-CAPM	CAPM	A-CAPM	I-CAPM	R-CAPM	C-CAPM	RRM
1	mean absolute error	0.027309	0.05087	0.002461	0.096928	0.007349	0.146829	0.036977
2	root mean square error	0.001099	0.002079	9.896398	0.003899	0.000296	0.005916	0.001511
3	Level of significance (P-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	The most suitable model for predicting risk	7	3	1	4	5	2	6

Source: researcher calculations

Table (9): the results of Freidman ranking test to compare deviations of expected return calculation method

No	Test statistics	Methods for calculating asset expected risk						
		Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)
		X-CAPM	CAPM	A-CAPM	I-CAPM	R-CAPM	C-CAPM	RRM
1	Mean rank	6.597193	2.470904	7.132759	3.103845	5.659954	2.288325	6.82846
2	Level of significance (P-value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	The most suitable model for predicting risk	7	2	1	4	5	3	6
	Model statistical values	Chi-square= 793.421 asymp.sig=0.000						

Source: researcher calculations

Explanation and interpretation of the results of table (2): Generally the results of Freidman test in table 5 are calculated according to Chai-square statistics (2426.708) and shows error level (p. value=0.000). There is at least one significant difference between the mean absolute value of ranks of deviations of estimated and real observations in seven methods of return estimation and the least mean rank of deviations in estimated and real observations is appropriated to methods: 1) a-CAPM; 2)CAPM; 3) C-CAPM; 4) I-CAPM; 5) RCAPM; 6)RRM; 7)X-CAPM. Of course considering that Freidman variance analysis is a general test, we use Wilcoxon complementary test. The result of test in shown in table (10).

The result of analyzing hypothesis test is that risk estimation with A-CAPM model has the least deviation from real observations. These methods don't have significant difference with each other and ore significantly better than other methods and ranked first. In the second rank, model C-CAPM is located whose estimation deviation from real observations compared with real observations is significantly large and is better compared with the methods of 3rd, 4th,5th, 6th and seventh levels. In the third level, we have model CAPM which is better compared with 4th, 5th, 6th and seventh levels and has more deviation in regard to higher ranks. In the fourth level, model I-CAPM is located which is better compared with 5th, 6th and seventh levels and has more deviation in regard to higher ranks. In the fifth level, model R-CAPM is located which is better compared with 6th and seventh levels and has more deviation in regard to higher ranks. In the sixth level, model RRM is located which is better compared with seventh level and has more deviation in regard to higher ranks. In the seventh level, we have model X-CAPM which highest deviation in regard to other ranks.

Table 10. Mean deviation rank of methods used for calculating expected return

Ranks				
		N	Mean Rank	Sum of ranks
CAPM- X-CAPM	Negative ranks Positive ranks Ties Total	6168 6192 0 12360	324.3379 165.0957	180009.8483 7421.097261
A-CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6175 6185 0 12360	340.1606 299.1326	104769.9351 94729.8111
I- CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6177 6183 0 12360	339.9833 131.9213	192771.7367 6728.009541
R-CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6178 6182 0 12360	352.2492 259.4411	148648.8024 50850.94382
C-CAPM X-CAPM	Negative ranks Positive ranks Ties Total	6188 6172 0 12360	338.3979 110.8315	193224.4079 4987.206824
RRM X-CAPM	Negative ranks Positive ranks Ties Total	6169 6191 0 12360	288.6666 334.4657	81405.21272 106025.7329

Source: researcher calculations

Table 11. Mean deviation rank of methods used for calculating expected return

Test statistics						
	CAPM X-CAPM	**A-CAPM X-CAPM**	**I- CAPM X-CAPM**	**R-CAPM X-CAPM**	**C-CAPM X-CAPM**	**RRM X-CAPM**
Z Asymp. Sig (2-Tailed	-23.7657a .000	-1.32005a .000	-24.4473a .000	-12.8511a .000	-24.8563a .000	-3.38989b .005
a. Based on positive ranks b. Based on negative ranks c. Wilcoxon signed ranks test						

Source: researcher calculations.

5. Discussion and Conclusion

At the beginning of present article, we pointed out that the main objective of this research is to present a comparative study approach toward capital assets pricing models (CAPM) with extrapolating capital assets pricing models (X-CAPM) of companies admitted in Tehran Exchange Market from 2006-2015. According to descriptive- correlation method, we have described the current condition. In this research, both methods of gathering information including librarian and field methods are utilized. The required studies about research theoretical bases, research thematic literature, problem backgrounds and research subject have been made by librarian methods and for studying references, theses, and research about the subject and internet bases have been used. The results of the research show that extrapolating capital assets pricing models (X-CAPM), companies admitted in Tehran Exchange Market, hasn't had high explanatory capability relative to other models, i.e. capital assets pricing models (CAPM), for instance reductive- undesirable capital assets pricing models (D-CAPM), adjustable capital assets pricing models (X-CAPM), interperiod capital assets pricing models, conditional capital assets pricing models (I-CAPM), revised capital assets pricing models (R-CAPM), consumption-based capital assets pricing models (R-CAPM), rewarding capital assets pricing models (RRM), behavioral capital assets pricing models

(BAP). Because according to the explanation and interpretation of table 4, to explain and estimate asset risk level or stocks of the companies admitted in Tehran Exchange Market, we may explain that considering the values of root mean square error (RMSE) and mean absolute error (MAE), the lower values of each of these measures are more desirable and explains the accordance of model data with financial market reality, and so according to both statistics, the most suitable model for predicting risk among CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, and extrapolating capital asset pricing model (X-CAPM), respectively include: 1. A-CAPM model; 2. R-CAPM model; 3. CAPM model; 4. RRM model; 5. C-CAPM model; 6. X-CAPM model; 7. I-CAPM model. Also according to the explanation and interpretation of table 4, to explain and estimate asset risk level or stocks of the companies admitted in Tehran Exchange Market, we may explain that considering the values of root mean square error (RMSE) and mean absolute error (MAE), the lower values of each of these measures are more desirable and explains the accordance of model data with financial market reality, and so according to both statistics, the most suitable model for predicting risk among CAPM, A-CAPM, I-CAPM, R-CAPM, C-CAPM, and extrapolating capital asset pricing model (X-CAPM), respectively include: 1. A-CAPM model; 2. C-CAPM model; 3. CAPM model; 4. I-RRM model; 5. R-CAPM model; 6. RRM model; 7. X-CAPM model. Also, the results of the research show that extrapolating capital assets pricing models (X-CAPM), companies admitted in Tehran Exchange Market, hasn’t had high explanatory capability relative to other models, i.e. capital assets pricing models (CAPM), for instance reductive- undesirable capital assets pricing models (D-CAPM), adjustable capital assets pricing models (X-CAPM), interperiod capital assets pricing models, conditional capital assets pricing models (I-CAPM), revised capital assets pricing models (R-CAPM), consumption-based capital assets pricing models (R-CAPM), rewarding capital assets pricing models (RRM), behavioral capital assets pricing models (BAP). Of course, this is attributed to the architecture of X-CAPM model which is firstly based on consumption and far from expectations because of the high fluctuations of consumption in real and financial sections and as proposed, the essence of performing such models in lack of fluctuations in market. Secondly, there may be some criticisms and failures in X-CAPM model in the future which will result in elimination of some parameters of the model or substitution it; they may enhance the results obtained in the future.

References

1) Acharya Viral V, Pedersen L.H. (2003). Asset pricing with liquidity risk, work paper, New York University; 2003
2) Acharya Viral V, Pedersen L.H. Asset pricing with liquidity risk, Journal of Financial Economics; 2005; 77: 375-41.
3) Amilhud Y.(2002). Illiquidity and stock returns: cross-section and time series effects d; Journal of Financial Economics 2002; 5:31-56.
4) Amilhud Y; Mendelson, H. (1986). Asset pricing and the bid-ask spread; Journal of Financial Economics 1986; 17:223-249.
5) Amilhud Y; Mendelson, H. Wood, R (1990). Liquidity and the 1978 Stock Market crash, Journal of portfolio management Spring 1990: 65-69.
6) AmirHosseini, Z. (2010). Explanation the power of economic leverage degree to test the sensitivity coefficient and measuring company performance (case study: Iran Khodro Diesel Company) Doctorate thesis, Islamic Azad University, Science and Research Branch.
7) Bornholt, Graham (2006), Extending the CAPM: the Reward Beta Approach: Accounting& Finance. Vol.7; Issue 1, pp:69-83, DOI: 10/1111/j.1467-629X.2007.00202
8) Campbell, John and John Cochrane. (1999). By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior; Journal of political economy, 107, 210-251.
9) Campbell, John and Robert Shiller. (1988). The dividend ration and expectations of future dividends and discount factors; review of financial stiduies,1, 195-228.
10) Estrada, j. (2003). Mean- semi variance behavior: Downside risk and capital asset pricing, International review of economics and finance, 2003
11) Fama, Eugene and Kenneth French,(1988). Dividend yields and expected stock returns; Journal of financial economics 22, 3-25.

12) Fathi Zadollah; AmirHosseini Zahra;Ahmadini, Hamed (2012). Reviewing capital asset pricing models with the attitude toward modern economic models based on it: economic journal, bi-monthly Reviewing economic issues and policies, no. 7& 8 Oct- Nov. 2012; pp: 27-46
13) Griffin,F. Dugan,T. (2003).Systematic risk and revenue volatility, the Journal of financial and research 2003; XXVI (2); 179-189
14) Hansen Lars and Kenneth Singleton.(1982). Generalized instrumental variables estimation of nonlinear rational expectations models; Econometrical 50, 1269-1286.
15) Hansen Lars and Kenneth Singleton; 1983; Stochastic consumption, risk aversion, and the temporal behavior of asset returns; Journal of political economy 91, 249-265.
16) Le Roy, Stephen and Richard Porter, (1981). The present value relation: Tests based on implied Variance bounds; Econometrica, 49, 555-574.
17) Nicholas Barberis, Andre Shleifer& Robert Vishnet. (1998). A Model of Investor Sentiments. ; Journal of Financial Economics49, 307-343.
18) Nicholas Barberis, Robin Greenwood, Lawrence Jin, and Andre Shleifer (2015). X-CAPM: An extrapolative capital asset pricing model. Journal of Financial Economics 115 (2015), pp: 1-24; journal homepage
19) Nicholas Barberis, Robin Greenwood, Lawrence Jin, and Andre Shleifer (2015). X-CAPM: An extrapolative capital asset pricing model. Journal of Financial Economics 115 (2015), pp: 1-24
20) Pastor L. Stambaugh R.F. (2003). Liquidity risk and expected stock returns, Journal of political economy 2003: 111:642-685.
21) Rahnamye Roodposhti , F. and Amir Hosseini, Z. (2010). Estimation of the explanatory power of RA-CAPM in comparison with A-CAPM to explain risk and return, Global finance conference, 2009
22) Rahnamye Roodposhti , F. and Amir Hosseini, Z. (2010). Explanation of capital asset pricing: comparative study of models: the magazine of studying accounting and auditing; series 17; no. 62. pp:49-68.
23) Rahnamye Roodposhti , F. Nikoomaram H. and Amirhosseini, Z (2009). Managing firm's systematic risk through sales variability minimization, Global economy and finance journal 2009; 2(1): pp:63-74
24) Reilly, Frank, K, Keith C (2006).Investment analysis and portfolio management 2000; 6 ed, the Dryden press
25) Shiller, Robert. (1981). Do stock prices move too much to be justified by subsequent changes in dividends? American economic review, 71, 421-436