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Estimating the capital asset pricing model based on Tobin's minimum rate of return

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Abstract

This study aims to present a capital asset pricing model based on Tobin's minimum rate of return in the Iranian stock market. In research conducted in Iran, the bank deposit interest rate has been used as the risk-free interest rate to estimate the capital asset pricing model. Because this rate is determined arbitrarily in Iran, it is not an appropriate estimate of the macroeconomic, social, and political realities of society, and it is not considered a complete index for determining returns in the stock market. Therefore, in this study, Tobin's minimum rate of return has been used instead of the bank deposit interest rate to express the economic, social, and political reality of society. In this regard, information on 32 companies listed on the Tehran Stock Exchange, which were selected through multi-stage sampling, has been collected from 2006 to 2010, and with the panel data model, the monthly returns of the sample companies have been calculated and used as the basis for the tests. The results of the tests showed that the capital asset pricing model based on Tobin's minimum rate of return, compared to the CAPM method in different cases, has a more appropriate explanation of the stock return rate and the estimation of systematic risk in the Iranian stock market.

Keywords: Tobin's minimum rate of return, Tobin's model, panel data, critical interest rate, capital asset pricing model
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1 Introduction

An important issue for investors in the financial market is the rate of return on financial assets and the risk of their purchase. One of these risks that investors pay attention to is Systematic Risk, which is caused by macroeconomic variables. These variables affect the stocks of all companies, but the degree of their impact on different stocks is different [15]. Systematic risk can affect the value and return of their financial assets and affect investors' decisions. Systematic risk is market risk, which is measured in the CAPM capital asset pricing model through a coefficient. Beta is a measure of the systematic risk of a security that cannot be reduced or eliminated as part of the overall risk through diversification. The beta coefficient is the change in the return of the share versus the change in the market return [20].

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Beta can take different values. A specific share whose beta is greater than one shows great sensitivity to market changes (is riskier). If the market return increases, the return of the asset in question will be higher than the market, and if it decreases, the return of the asset will decrease more rapidly. Such a security is called an aggressive security. A beta equal to one is a state in which the stock acts exactly like the market, and such a stock with a beta equal to one is called a neutral or insensitive security. A beta less than one is a state in which the stock shows less sensitivity to market changes, and such a security is called a defensive security [16].

The basis of the CAPM is based on the assumption that investors diversify to find efficient portfolios, according to modern portfolio theory, and to reduce risk, and each chooses one of the efficient portfolios according to their degree of risk aversion. First, it is assumed that investors can make their choices based on the expected return and variance of returns among different portfolios, and that all investors agree on the investment horizon and the distribution of asset returns, and that there are no barriers in the capital market. Accordingly, first, the risk of each individual asset is determined by the degree to which its return depends on the return of the market portfolio, and second, the relationship between risk and expected return will be a simple and direct linear relationship [1].

The real risk-free rate of return is the interest rate for which there is no uncertainty about future flows. In a non-inflationary economy, the investor knows with certainty when and what cash flows he will receive and is the applicant for the real risk-free rate [16].

In research conducted in Iran, the bank deposit interest rate has been used as the risk-free interest rate to estimate the capital asset pricing model. Because this rate is determined arbitrarily in Iran, it is not a suitable estimate of the macroeconomic, social, and political realities of society, and it is not considered a complete index for determining returns in the stock market. Therefore, it seems that we need a more accurate rate of return to calculate CAPM, which is discussed in this research. The most important research conducted in this field is as follows: Fama & French [6] conducted an international test of the five-factor asset pricing model, which includes the factors of size, value, profitability, and investment. Based on their results, the average stock returns for North America, Europe, and Asia Pacific have a positive relationship with the book-to-market ratio and profitability, and a negative relationship with investment. In this study, two factors of profitability and investment have been added to the three-factor model. It should be noted that the results of the 2015 study by these researchers also indicated that the role of the value factor in explaining average returns is reduced by adding profitability and investment. Chaudhary [12] examined the three-factor Fama and French models and the capital asset pricing model in the United States and India. The results of his study showed that although capital asset pricing can explain returns in the United States and India, the three-factor Fama and French model provided a more appropriate estimate of returns for these markets, and the estimated model can also be used in both developed and developing markets. Qi Lin [13] in his study entitled “Controversial pricing and the five-factor Fama and French capital asset pricing model in the Chinese stock market” examined the new Fama and French model in the Shanghai and Shenzhen markets. The findings of Lin’s study are consistent with the findings of the study by Guo et al. and confirm the better performance of the five-factor model compared to the three-factor model in the Chinese stock market. Jegadeesh et al. [8], in their study titled “Empirical Test of the Asset Pricing Model with Individual Assets”, investigated the error of variables in estimating the risk premium by using individual stocks versus bonds as the instrumental variables for testing the assets. The results indicate consistent estimates for the risk premium, such that the market risk premium under the adjusted pricing model and the Fama and French one-factor model was negligible. Daniel Andrei et al. [2] provide a new explanation for the failure of the capital asset pricing model despite its widespread practical use, arguing that in a rational-expectations economy where information is dispersed, the variation in expected returns over time and across investors maintains a deep information gap between investors and CAPM empiricalists. They then provide a new interpretation of why betting against beta works and conclude that empiricalists recover a stronger CAPM on macroeconomic announcement days. Melissa et al. [10] conducted a study on CAPM as the most popular model in the family of capital asset pricing models; their main goal was to show why, empirically, the CAPM model is still the most popular model for pricing capital assets. They were able to test individual CAPM models and conclude that the individual models in the CAPM family have complex and variable relationships with each other that complement each other theoretically and empirically. ZARIFFARD et al. [1] conducted an empirical test on the capital asset pricing model, which they believe that although CAPM can establish a linear and positive relationship between systematic risk and asset returns, systematic risk alone cannot predict stock returns and in the real world other factors such as company size, company leverage, P/E ratio play a role in return fluctuations. Mojtahedzadeh et al. [11] compared the capital asset pricing model and the adjusted model under inflationary conditions. For the period 2003 to 2007 and monthly data of 72 listed companies, the adjusted model has a lower error coefficient in terms of asset return estimation, and the presence of the inflation factor in this model significantly increases its accuracy compared to the capital asset pricing model. Talaneh et al. [19] compared the capital asset pricing model with the arbitrage model in an empirical test and believe that, contrary to evidence that multiple economic factors are effective in determining the share return in APT, the APT theory cannot be confirmed in the global Iranian market and consider the CAPM model to be of relative superiority. Mohammadzadeh et al. [3] studied the relationship between macroeconomic markets and the financial market using conditional capital asset pricing models and concluded that: the model coefficients are significant and in the conditional C-CAPM model (a representative of macroeconomic risks) along with the rate of change of per capita consumption and the P/E ratio play an important role in predicting excess returns of industrial stocks. Fallahpour et al. [5] compare the time-varying beta-based contingent asset pricing model with the standard asset pricing model. In this study, the pairwise comparison test and Diebold-Mariano test were used, and the results using the mean absolute error and mean square error criteria showed that the contingent asset pricing model performed better than the standard model based on both the diagonal Baba-Engel-Kraft-Kroner (BEKK) model and the full-order (BEKK) model.

The main concern of the research is whether using the Tobin minimum rate of return variable in the Tobin return expectations model instead of the safe rate of return Rf will yield better results in estimating the systematic risk coefficient in the CAPM capital asset pricing model. In this research, the comparative expectations method is used to extract the expected rate of return. Then, the CAPM regression model is specified, and the monthly returns of the sample companies are calculated and used as the basis for the tests using the panel data technique. The data are for the top 32 companies in the country on the Tehran Stock Exchange and for the period of 2006 to 2010. The innovation of the research is also in the two cases. 1- The adaptive expectations method has been used in the Keynesian and monetarist schools to predict the expected rate of return and calculate the critical interest rate, which is unprecedented. 2- The use of the Tobin minimum rate of return TMRR (critical interest rate) instead of the guaranteed rate of return Rf (bank interest rate) in estimating the traditional CAPM model, which has shown better results in estimating the amount of systematic risk (higher coefficient of determination and lower variance of the coefficient).

2 Theoretical and theoretical foundations

2.1 Capital asset pricing model (CAPM)

The CAPM capital asset pricing model determines the relationship between the expected return on a company's stock and its systematic risk (stock market risk). In fact, it shows that the more risk an investor takes, the higher the expected return. This model is stated as follows.

$$E(R_j) = R_f + \text{Risk Premium (Risk reward)} \tag{2.1}$$

$$E(R_j):\ \text{Expected rate of return on the company's stock}:\ j$$

$$E(R_j) = R_f + \beta_i\left[E(R_m) - R_f\right]$$

$$\text{Reliable rate of return}:\ R_f$$

$$E(R_m):\ \text{Expected rate of return on the stock market (portfolio)}$$

$$\beta = COV(j, M) \div VAR(M) \tag{2.2}$$

$$\text{(Risk-free return − Market return)} \div \text{(Risk-free return − Asset return)} = \beta.$$

In the CAPM model, the expected rate of return on company j's stock depends on the amount of systematic risk of company j's stock relative to the systematic risk of the market portfolio (the coefficient) and the reward for accepting systematic risk (the excess of market return) [1]. The real risk-free rate of return is the interest rate at which there is no uncertainty about future flows. In a non-inflationary economy, an investor knows with certainty when and what cash flows he will receive and is demanding the real risk-free rate [16]. As the number of diversified stocks increases, the total risk decreases. By diversifying, unsystematic risk is reduced, and systematic risk does not change. The portfolio risk does not decrease at a constant rate. Rather, when new stocks are added to the portfolio, the total risk decreases more rapidly. Gradually, the risk decreases and no longer decreases with diversification [14]. The degree to which risk is minimized depends on the correlation between the assets being combined. In other words, by combining two assets with a perfect correlation ($p = -1$), the total risk of the portfolio can be eliminated. Combining two assets with a perfect positive correlation ($p = +1$) does not help reduce risk. In the case of perfect positive correlation, no matter how many securities are added to the portfolio, the portfolio risk will still be the weighted average of all the securities that make up the portfolio, and there will be no reduction in the level of risk. When the correlation between two securities is zero ($p = 0$), there will be no relationship between the returns of the two securities, and knowing the return of one of the securities will not help in predicting the return of the second security [18].

2.2 The regressive expectation model of Tobin

One of the innovations of the research is that instead of the safe rate of return, the CAPM model uses Tobin's Minimum Rate of Return, which is derived from Tobin's Regressive Expectation Model. An individual who holds fixed-income securities has two expected sources of income. One is the annual interest paid to him and the other is the potential capital gain (the increase or decrease in the market price of the security during its holding period).

The interest income of a bond, y, is usually determined as a percentage of the nominal value of the bond. The market interest rate of a bond is the ratio of the interest income, y, to the bond price, pb. Therefore, the market interest rate of a bond is obtained from the following equation.

$$r = y/pb.$$

And since the interest income y is a fixed amount determined as a percentage of the bond's face value, the market price of the bond is obtained from the following equation:

$$pb = y/r.$$

The expected percentage return on capital, g, is the percentage increase in the bond price from the purchase price pb to the expected selling price pb_e. This definition gives the expression for the percentage return on capital:

$$g = (pb_e - pb)/pb. \tag{2.3}$$

Using the above equations and with the bond interest income y held constant, the expected bond price pb_e is related to its expected interest rate:

$$r^e = y/pb.$$

Therefore, capital gains can be written in terms of expected and current rates as follows:

$$g = \frac{\frac{y}{r^e} - \frac{y}{r}}{\frac{y}{r}}, \quad r = \frac{y}{pb}, \quad r^e = y/pb \Rightarrow pbe = \frac{y}{r^e}, \quad g = \frac{\frac{y}{r^e} - \frac{y}{r}}{\frac{y}{r}} = g = \frac{\frac{1}{r^e} - \frac{1}{r}}{\frac{1}{r}} = \frac{r}{r^e} - 1$$

$$e(\text{earnings}) = r + g = r + \frac{r}{r^e} - 1 \qquad \text{Total bond yield curve.} \tag{2.4}$$

Now, given that bonds have a certain expected return e and money has a zero return, we can expect that holders of liquid wealth will hold all their liquid wealth in bonds if they expect e to be greater than zero, and they will hold all their assets in money if they expect a total return less than zero. In the regressive expectations model, it is assumed that each individual has an expected interest rate (r to the power of e) r e that corresponds to a conventional medium and long-term rate. That is, the investor estimates the medium and long-term interest rate within the framework of his expectations. If the real interest rate is higher than this expected long-term rate, he expects it to decrease, and if the real rate is lower than it, he expects it to increase. Therefore, his expectations are regressive. The expected interest rate of the asset holder r e, together with the observed and market interest rate r, determines the percentage return of the investor e. Given the expected interest rate, we can find the critical (sensitive) level of the market interest rate r, r_c, that yields a net return of zero for bonds (i.e., the value of r that makes e equal to zero). When the observed r is greater than r_c, the investor holds all of his liquid assets in bonds, and when the observed r is less than rc, the investor holds all of his assets in money. To find the critical (sensitive) interest rate, we set the total return given in the formula above to zero.

$$r + \frac{r}{r^e} - 1 = 0 \quad \Rightarrow \quad r = \frac{r^e}{1 + r^e} = r_c.$$

Here, r_c is the market interest rate r that makes e equal to zero, and in fact, the minimum rate that attracts investors to invest is the one where the return on investment is zero and the investor expects an increase in return [4]. In other words, r_c is the investor's TMRR.

$$TMRR = \frac{r^e}{1 + r^e}.$$

This rate can vary among different investors depending on their expectations of the bond interest rate, resulting in the following two situations:

$$r_c < r^e \quad \Rightarrow TMRR < r^e \quad \Rightarrow \quad \text{Investment is made} \tag{2.5}$$

In this study, it is expected that calculating CAPM with Tobin's minimum rate of return will improve the model results.

$$R_j = R_f + \beta(R_m - R_f)$$

$$R_j = TMRR_j + \beta(R_m - TMRR_j) \tag{2.6}$$

$$\beta = COV(j, M) \div VAR(M) \tag{2.7}$$

(**Tobin's minimum rate of return**−**market return**)÷(**Tobin's minimum rate of return**−**asset return**) = $\boldsymbol{\beta}$

2.3 Panel data regression

The panel data model is a combination of a cross-sectional and time series model in which information from several units (company, province, country, sector) is examined in different time periods. To learn more about panel data regression, we consider the following:

$$Y_{it} = XK_{it}\beta_i + \alpha_i Z + u_{it} \tag{2.8}$$

$$Y_{it} = \alpha_i + \beta_i XK_{it} + u\_it \tag{2.9}$$

where α is the width of the origin, β is the vector of coefficients or parameters, X includes k explanatory variables, Z is the unobservable behavioural characteristics of the sections, and u is the model disturbance that follows the classical assumptions of linear regression. To estimate the regression equation using panel data, the following steps are performed [17].

2.3.1 Estimating panel data regression as a fixed effect model

Estimating panel data regression as a fixed effects model assumes that the sections (companies) have different behavioural characteristics, such as management style, general principles, management philosophy, and environmental and economic conditions. In this case, the panel model is written as Equation (2.9). Equation (2.9) shows that the width of the origins of the sections is different.

But if the sections (companies) do not have different behavioural characteristics, the panel data regression is estimated as a pooled regression. The pooled regression model is written as equation (2.10), so the width from the origin in it will be constant and the same for all sections [9].

$$Y_{it} = \alpha + \beta_i XK_{it} + u_{it}. \tag{2.10}$$

To distinguish between the estimation of a fixed effect (panel) regression model with different widths from the same origin and the estimation of a pooled data model with the same width, the Limer F test is used. In the Limer F test, the null hypothesis of equality of width from the origin of the sections and the alternative hypothesis of inequality of widths from the origin of the sections are rejected, and the F statistic is used. If its value is large enough, it falls in the critical region and the null hypothesis is rejected, and the alternative hypothesis is accepted. To reject the null hypothesis, the probability of the F statistic must be less than 5%. If the null hypothesis is rejected, it will be a panel model. That is, the sections differ in terms of unobservable behavioural characteristics.

2.3.2 Estimating panel data regression as a random effect model

Estimating panel data regression as a random effects model is based on the fact that there is a relationship between the independent variables of the model and the random component [7]. To distinguish between the estimation of a panel regression model from a fixed effect model or a random effect model, the Hausman Test is used. In the Hausman test, the null hypothesis is that there is a relationship between the independent variables of the model and the random component, and the alternative hypothesis is that there is no relationship between the independent variables of the model and the random component. It uses the chi-square statistic. If its value is large enough, it falls in the critical region, and the null hypothesis is rejected and the alternative hypothesis is accepted. To reject the null hypothesis, the probability of the chi-square statistic must be less than 5 percent. If the null hypothesis is rejected, the panel model will be a fixed-effect model. That is, the independent variables of the model and the random component have no relationship.

3 Methodology

The present research is an applied study. In this research, library and archive methods have been used to develop theoretical foundations and concepts. Our research population was all companies listed on the Tehran Stock Exchange, of which 435 companies were listed on the Tehran Stock Exchange by the end of 2006. Since this research uses the beta of stocks of companies listed on the Tehran Stock Exchange and also the market rate of return, the sample size in this research is the top 50 companies that have improved their financial performance according to the announcement of the Tehran Stock Exchange Organization. The identification of these top companies is often based on the criteria of stock liquidity, the company's impact on the market, and the superiority of financial ratios. Accordingly, the identification of more active companies in the Tehran Stock Exchange is based on a combination of the liquidity of the shares and the amount of shares traded in the trading floor (number and value of shares traded), the frequency of shares traded in the trading floor (number of trading days and number of times traded), and the measure of the company's impact on the market (average number of shares issued and average current value of the company's shares during the review period). However, in this period, only 32 companies were able to maintain their superior value during the mentioned time period, of which 4 companies were eliminated at different stages due to missing data, and finally, our statistical sample is the top 28 listed companies.

The beta of listed companies and the real rate of return of companies and market returns in the years in question were collected using the official website of the Tehran Stock Exchange Organization and also using the Rahavard Novin and Tadbir Pardaz software.

Descriptive statistics of the three variables of corporate rate of return, stock market rate of return and Tobin's minimum rate of return used in the estimation of the CAPM model are as follows in Table 1.

Table 1: Descriptive statistics of the three variables of corporate rate of return, stock market rate of return and Tobin's minimum rate of return

Index	r_j	r_m	tm_{rr}
Mean	0.218234	0.038938	0.132324
Median	0.049872	0.037091	0.046418
Maximum	55.3424	0.109798	2.62385
Minimum	1.690459	0.067165	2.893700
Standard Deviation	3.325517	0.048172	0.632084
Skewness	16.35165	0.692727	0.650666
Skewness	271.5732	3.06371	7.493759
Jark-Barre statistic	854012 0.00000	22.4413 0.000013	255.3522 0.00000
Probability	3085.478	0.64742	111.4687
Sum of Squares	28	28	28
Standard Deviation	280	280	280

Source: Research Results

3.1 Research hypotheses

3.1.1 First hypothesis: Using the tobin minimum rate of return TMRR or the critical interest rate

Instead of the guaranteed rate of return Rf (bank interest rate) in estimating the traditional CAPM model shows better results in estimating the amount of systematic risk.

3.2 Model estimation

3.2.1 Specification of the CAPM model by panel data method

The regression model of the CAPM model is specified as a panel in the following way

$$R_{jt} - R_{ft} = \alpha_i + \beta[R_{mt} - R_{ft}] + U_{it} \tag{3.1}$$

R_{jt}: Company j stock rate of return over time
R_{ft}: Secured rate of return (bank interest rate) over time

R_{mt}: Stock market price index (portfolio) return over time
$R_{jt} - R_{ft}$: Stock savings over time
$R_{mt} - R_{ft}$: Risk reward over time
U_{it}: Random factors over time

3-2-1-1. Stationarity test of CAPM model variables

Before running the model, the stationarity or stochasticity of the model variables must be checked so that the regression estimation results are not spurious. The stationarity or stochasticity of the model variables was performed using the Levin method and the results showed that the variables are stable.

Table 2: Stationarity or stochasticity of the CAPM model variables using the Levin, Lin and Cho method

Variable	Levin, Lin & Chu Test Statistic (at level, without intercept)		Result
	Value	Probability	
R_j	-11.1699	0.0000	Stationary
R_m	0.0000	-10.5197	Stationary
R_f	0.0010	-3.08306	Stationary

Source: Research Results

2-1-2-3. Limer F-statistic

Limer F-statistic showed that the data are panel. Therefore, the 28 companies studied have different behavioral characteristics.

3-1-2-3. Hausman statistic

Hausman statistic showed that the panel model is not a random effect model because the probability of the chi-square statistic is less than 5%. Therefore, the model is estimated with fixed effects.

3.2.2 Estimating the CAPM panel regression model in the fixed effects model

$$\begin{aligned} R_{jt} - R_{ft} &= 0.07 + 1.67 \\ &\text{Variance}(0.029)\ (0.548) \\ &\text{T-student}(2.77)\quad (3.29) \end{aligned} \tag{3.2}$$

$$R^2 = 0.25 \qquad D - W = 2.10$$

$$R_{jt} - TMRR_{jt}] = \alpha_i + [R_{mt} - TMRR_{jt}] + U_{it} \tag{3.3}$$

The results of the CAPM model estimation from the fixed effects model show that:

1. As expected, the sign of the coefficient is positive and significant, indicating that with increasing risk, the savings in stocks increase.
2. The coefficient of determination shows that 25% of the risk of the companies' stocks is related to systematic risk.
3. The Durbin-Watson statistic shows that there is no serial autocorrelation, which indicates the correct specification of the model.
4. Since the coefficient is greater than one, it indicates that the companies' stocks are aggressive and risky.
5. The coefficient variance is equal to 0.548.

3.3 Estimating the CAPM regression model from the panel data technique using the minimum Tobin rate of return TMRR in the Iranian stock market

3.3.1 Specification of the CAPM regression model using the minimum Tobin rate of return TMRR

The CAPM regression model is specified using the minimum Tobin expected rate of return as follows.

R_{jt}: Rate of return of stock of company j over time

$TMRR_{jt}$: TMRRjt Tobin's minimum expected rate of return over time

R_{mt}: Rate of return of stock market price index (portfolio) over time

$R_{jt} - TMRR_{jt}$: Stock savings over time

$R_{mt} - TMRR_{jt}$: Risk reward over time

U_{it}: Random factors over time

1-1-3-3. Stationarity test of CAPM model variables using Tobin's minimum rate of return TMRR

Stationarity or stationarity of the Tobin's minimum rate of return TMRR variable was performed using the Levin, Lin and Cho method, and the results showed that it is stable.

Table 3: Stationarity or stationarity of the Tobin's minimum rate of return TMRR variable using the Levin, Lin and Cho method

Variable	Levin, Lin & Chu Test Statistic (at level, without intercept)		Result
	Value	Probability	
TMRR	0.0000	- 6.707	Stationary

Source: Research Results

2-1-3-3. Limer F-statistic

Limer F-statistic showed that the data are panel, so the 28 companies studied have different behavioural characteristics.

3-1-3-3. Hausman statistic

Hausman statistic showed that the panel model is a random effect model because the probability of the Chi statistic is twice 0.22 and is more than 5%. Therefore, the model is estimated with random effects.

3.3.2 Estimation of the CAPM panel regression model using the Tobin minimum rate of return in the Iranian stock market in the random effects model

$$\begin{array}{rllll} R_{jt} - TMRR_{jt} = & \multicolumn{4}{l}{0.09 + 0.98[R_{mt} - TMRR_{jt}]} \\ \text{Variance} & (0.045) & (0.011) & & \\ \text{T-student} & (1.99) & (88) & D = W = 1.91 & R^2 = 0.96 \end{array} \tag{3.4}$$

The results of the CAPM regression model estimation using Tobin's minimum rate of return show that, as expected, the sign of the coefficient is positive and significant, indicating that with increasing risk, the savings in stocks increase.

The coefficient of determination shows that 96 percent of the risk of companies' stocks is related to systematic risk. This result was as expected because the rate of return of companies' stocks, which is used to calculate the critical rate of return, is affected by macroeconomic variables such as interest rates, inflation, business cycles and non-economic factors. Therefore, the coefficient of systematic risk obtained using it should have more explanatory power.

The Durbin-Watson statistic shows that there is no serial autocorrelation. This indicates the correct specification of the model because the coefficient is almost equal to one, indicating that companies' stocks are indifferent in this case, unlike the traditional CAPM, which was aggressive and risky.

3.4 The comparison of the results of estimating

The CAPM model using the traditional method of using the bank interest rate and the minimum rate of return method in the Tobin return expectations model is summarized in Table 4.

The comparison of the results indicates that the estimation of the CAPM model based on the minimum rate of return absorption in the Tobin return expectations model has better results in three aspects compared to the CAPM model that uses the bank interest rate as the usual rate of return.

Table 4: Results of estimating the CAPM model using the traditional method and the proposed method of the minimum rate of return absorption in the Tobin return expectations model

CAPM regression model using Tobin's minimum rate of return RF				CAPM regression model using Tobin's minimum rate of return TMRR			
	Coefficient	Variance	t		Coefficient	Variance	t
α	0.07	0.029	2.77	α	0.09	0.045	1.99
$R_{mt} - RF_{jt}$	1.68	0.548	3.29	$R_{mt} - TMRR_{jt}$	0.98	0.011	88
R^2	0.25			R^2			0.96
$D - W$	2.10			$D - W$			1.91

Source: Research Results

1. It underestimates the amount of systematic risk (coefficient) in the Iranian stock market. The β coefficient in the CAPM regression model using the minimum rate of return absorption in the Tobin return expectations model is 0.98, and in the CAPM regression model using the bank interest rate is 1.68. This shows less of the impact of market risk on the variable of corporate savings. In other words, it does not introduce stocks as aggressive.

2. The coefficient of determination is higher. The coefficient of determination in the CAPM regression model using the minimum rate of return absorption in the Tobin return expectations model is 0.96, and in the CAPM regression model using the bank interest rate is 0.25. This shows the explanatory power of the minimum rate of return absorption variable in the Tobin return expectations model on the corporate stock savings variable.

3. Underestimates the variance of the coefficient. The variance of the coefficient in the CAPM regression model using the minimum rate of return absorption in the Tobin return expectations model is 0.011, and in the CAPM regression model using the bank interest rate is 0.548. This increases the validity of the t-statistic and the significance of the β coefficient and makes it more reliable.

4 Conclusion

Investing in securities is a decision directly related to the investor's risk-taking and risk-aversion. Risk-averse individuals are not willing to accept risk in any model and tend to receive a profit that is probably higher than the usual bank profit while maintaining their capital principal, while risk-taking individuals tend to earn more profit by accepting more risk.

In studies conducted so far, various capital asset pricing models have been determined, and different betas (risk-determining factors) have been calculated in each model. The problem with these studies is that because the interest rate in Iran is determined ordinarily and is fixed, firstly, it increases the variance of the regression coefficient and reduces the credibility of the t-statistic and the significance of the coefficient, and secondly, this variable is not affected by the macro-economic, social, and political realities of society, so it is not considered a complete and real indicator for determining a reliable rate of return in the stock market. To solve this problem, in this study, instead of the bank interest rate, the minimum rate of return absorption in the Tobin return expectations model or the return rate (which is part of the research innovations compared to previous studies) was used, which is extracted using the expected stock return rate in the adaptive expectations method.

Comparison of the results showed that the proposed research model has better results in the following three areas.

A. It underestimates the systematic risk coefficient (β) in the Iranian stock market. This shows less of the impact of market risk on the variable of corporate savings. In other words, it does not introduce stocks as aggressive.

B. The coefficient of determination is higher. This shows the explanatory power of the minimum rate of return absorption variable in the Tobin return expectations model on the variable of corporate savings.

C. It underestimates the variance of the β coefficient. This increases the validity of the t-statistic and the significance of the β coefficient and makes it more reliable.

Therefore, the main hypothesis of the study, that using the minimum rate of return variable in the Tobin return expectations model instead of the bank safe rate of return Rf in estimating the systematic risk coefficient in the CAPM model, cannot be rejected. Also, the results of the present study are consistent with those of the study by Melissa et al., which was mentioned, and are in conflict with those of the study by Andri et al. because Andri et al. believe that the capital asset pricing model has lost its efficiency in practice, while the capital asset pricing model based on the rate of return presented in this study indicates the efficiency of the CAPM in practice.

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