

Identifying the Factors Affecting the Cost of Capital and Determining an Appropriate Model for Calculating the Cost of Capital

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ABSTRACT

This paper investigates the relationship between the selected independent variables (size of company, debt ratio, level of disclosure, and type of industry) and dependent variable (cost of capital). For this purpose, the quantitative required information and data have been extracted from the financial statements of companies listed in Tehran Stock Exchange, and the statistical population of about 90 eligible companies has been chosen using a classification sampling method. For data analysis, first the cost of capital was calculated through five models introduced in the research and then the significance test was done for determining the differences in results of models. Then the calculations were performed using the excel software, and the statistical softwares sas.spss-10 were used for the statistical analysis. The results of research indicate that the accounting evaluation model is considered as the most appropriate model for calculating the capital cost, and type of industry and the size of company are selected as the factors affecting the cost of capital.

KEYWORDS: Cost of capital; capital; level of disclosure; size of company; debt ratio; type of industry.

INTRODUCTION

Decision-making and selecting the optimal solutions for funds investment and the cost of capital are the major issues in the financial literature in order to increase the total value of economic unit. In this regard, the financing issue is centre stage in general, and the cost of capital in particular; and this study intends to investigate this two topics.

Financing in the economic units is done by different ways and using the multiple sources. Several factors are involved in selecting the best financing options and the most important ones are the financing costs or expenses which are named as the cost of capital in the financial literature.

Investors including the shareholders and long-term loans and financial facilities suppliers as invest their capital or money accept implicitly the risk of not receiving it. Risk taking has a direct relationship with the cost of capital level. While investors transfer the resources under their control, admit the price of possible risks and demand a fee for their expected profit, so the total of these two forms the expected return for the investor. Therefore, the cost of capital is the minimum rate of return which economic unit must be achieved in order to meet the investors' expected return.

Issue Statement

Cost of capital is one of the concepts which have always been considered by the financial experts and is the main factor in creating gap between the accounting profit and the economic profit. Capital cost is important in two aspects; first, all securities assessment models are based on the cost of capital. None of the assessment models – from the simplest model to the most complex one- is based just on the cost of capital; therefore, without the cost of capital model, we cannot be optimistic about the securities assessment models. Second, funds investing by the company and determining the investment priorities and the optimal capital structure would not be feasible without determining the cost of capital rate, so that in evaluating techniques which are based on the time value of money, having the rate of capital cost is a denial necessity.

The validity of cost of capital models is measured via three methods in the financial literature. In the first method for validating the model is the correlation intensity of cost of capital which is calculated by the systematic risk (beta) index. The second method for model validation is when the calculated value is close to the price of stock market; and the third method for the model validation is the effectiveness test for the cost of capital by the factors which are known as the factors that affect the investment cost in the financial literature. Each model, which is more affected by these factors, is more reliable. The size of company, level of disclosure, type of industry, and the debt ratio are the factors which affect the cost of capital in the financial researches, and these factors have different degrees in terms of controllability, so that some factors are controllable for the economic unit and the others are uncontrollable. This research aims to study the controllable factors. Two methods have been proposed technically for changing the price of securities in the financial literature. First, changing the price of stock market by manipulating or changing the profits; and second, changing the price by

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the changes in the expected rate of return; the second method is the subject for the cost of capital which is considered in this study.

Research Background

There have been conducted relatively large numbers of researches about the cost of capital and this will make the literature of subject richer.

Weston (1959) also achieved an acceptable correlation between the financial leverage and the cost of capital by interacting two variables of size and growth, and concluded that there is an inverse relationship between the financial leverage and the cost of capital.

In this regard, Barges (1963) studied the relationship between the cost of capital and the financial leverage in three industries including the railroad, cement and large chain stores. He concluded in his research that the average cost of capital first is decreased by increasing the financial leverage and then it will be increased.

There have been conducted useful researches about the level of disclosure and the cost of capital and they can be divided into two groups. First group contains the researches which have led to this conclusion that the increased disclosure reduces the cost of capital. Studies conducted by Demsetz (1968) and Galia (1983) are classified in this group. The second group contains the studies which prove these claims that the cost of capital has a direct relationship with the disclosure; it means that the increased disclosure will lead to higher cost of capital.

Klein and Bawa (1976) and also Barry and Brawn (1986) have conducted studies which are classified in this group.

According to a research conducted by Botosan (1990) there is a relationship between the voluntary disclosure and the shareholders' cost of capital. He achieved to two results in his studies. The first result is that the voluntary disclosure reduces the shareholders' cost of capital; second, there is an inverse relationship between the disclosure and the cost of capital in the companies which a few financial analysts work on their stock, but in companies which numerous financial analysts work on their stock, there is a significant relationship between the disclosure and cost of capital.

Long and Lundholm (1993) in their study found that there is a direct relationship between the disclosure and size of company; it means that the larger a company is, the more its level of disclosure is increased. Partha Sengupta (1998) studied the relationship between the quality of corporate disclosure and their debt cost and concluded that the more the quality of disclosure is, the less their debt costs will be.

Research Hypotheses

This research studies the relationship between the selected independent variables (size of company, debt ratio, level of disclosure, and type of industry) and the dependent variable (cost of capital) and reviews the relationship between the size of company, debt ratio, level of disclosure, and type of industry and the cost of capital.

Research Objectives

Research objectives are summarized as follows:

- 1 – Determining the reliable model(s) for calculating the cost of capital.
- 2 – Identifying the factors affecting the cost of capital.
- 3 - Determining a basis for selecting the optimal capital structure.

METHODOLOGY

B) Research Method:

This experimental study is classified in the field of financial and accounting positive theories. The empirical and quantitative evidence will be collected and analyzed by the Cross Sectional Correlation and the theorization will be done through the inductive method.

B) Information and Data Collection methods:

Quantitative data and information, needed for this study, are extracted from the financial statements of companies listed in the Tehran Stock Exchange, and they are available by different ways. Moreover, data related to the theoretical bases of research are collected and analyzed by the library method.

C) Statistical population, sampling method, and sample size:

Statistical population in this study contains the companies listed in Tehran Stock Exchange. From all eligible companies, 86 companies were selected as the samples using the stratified sampling.

- 1- In order to eliminate the effects of seasonal fluctuations, the financial period should be ended in Esfand.
- 2- They should have provided the preliminary data needed for this study for stock exchange in a 6-year period (1383 to 1388).
- 3- Their activity should be productive in terms of increased comparability of selected samples. The investing companies will not be selected as the samples due to the difference in the nature of their activities.

4 - Company should not have been governmental or non-affiliated to the governmental public institutions. In the other words, management of company should be a private.

D) Methods of data analysis

For data analysis, first the cost of capital is calculated through five models presented in this study, and then the significance test of differences in the results of models is done. If there is no significant difference between the results of these models, one of the models are used as the index model, but if the difference between the models was significant, the index model should be selected according to the logic in the financial literature and the research process should be continued based on it.

Cost of capital calculated in the multivariate regression model is considered as the dependent variable; and the effects of independent variables including "the level of disclosure, size of company, debt ratio, and type of industry", which are rating, numeric, and nominal, on the dependent variable will be put to the test.

Calculations were performed using the EXCEL software and the statistical softwares SAS, SPSS-10 were used for the statistical analysis.

Definitions of concepts and specific words of project

Capital: Capital is the equity plus the long term debts with interest.

Cost of Capital: Cost of capital is the minimum rate of return through which the value of companies will remain constant, and it is calculated through the capital suppliers' expected rate of return.

Optimal capital structure: Optimal capital structure is a combination of financial resources by which the average combination of corporate cost of capital will be reduced to the least level.

Disclosure: In this study, disclosure means providing the annual financial audited information of companies for the Stock Exchange.

Size: In this study, size means the natural logarithm of average selling price, market price of equity and book value of total assets.

Debt ratio: the ratio of debt is the ratio of debts to the equity.

Research Limitations

Limitations which exist in conducting this study and should be considered in interpreting the results of research and its generalization are as follows:

1 - Lack of efficiency in the capital market of Iran is as a confounding factor which can affect the results of research and it is impossible to be controlled by the researcher. This subject is one of the problems in implementing the studies which are based on the capital market such as the current study.

2 - Access to the external scientific sources and supplying the necessary information about the companies listed in the Stock Exchange has been the most important limitation which researcher has been encountered.

3 - Due to the lack of national accounting standards until 1378, the quality of used financial information and the effects of differences in the accounting methods on measuring and reporting the financial events may affect the results.

4 - The paucity of companies existing in the Stock Exchange is another possible limitation of this study which affects the possibility of generalizing the results.

5 - The financial statements have been used as reported by companies. Since the auditing report of most companies has been conditional and there has not been any modification for this case due to the lack of access to the information, the possible effects of these modifications on the results of prediction are unclear. The annual modifications (Errors modifications of past courses) are the most significant cases in the financial statement of companies.

6 - Access to the information of companies has been led to the numerous problems and required spending the long time. Tehran Stock Exchange has no comprehensive database, and the corporate financial reports are recorded incoherently and irregularly. Dena Sahm and Sahra databases also do not have the information about some years and companies, and transferring the data from the corporate financial statements to these banks has been resulted with errors. However, controls have been done in order to ensure partly the accuracy of information.

Calculating the Cost of Capital

Cost of Capital includes the cost of components which form the capital and the sum of corporate capital structure. The major components of capital structure are the debt with interest, preferred stocks, retained earnings and common stocks. Since the owners of each of the sources have their own expected rate of return, they also have a different cost and their cost of capital also vary with each other due to the different nature of each of these sources.

In order to determine the corporate cost of capital, first the cost of each of the components of capital should be independently calculated and obtained based on their ratio in the total average capital structure of corporate capital cost.

Different models have been introduced in the financial literature and used in the financial markets in order to calculate the cost of common stock. Each of these models have the effectiveness needed for estimating the cost of capital in one or more specific market in a period of time; and their efficiency is reduced and replaced with each other over time. These models are:

1. Average Realized Returns Model
2. Adjusted Average Realized Returns Model
3. Capital Assets Pricing Model
4. Accounting Base Assessment Model
5. Tobin's q Model
6. Dividend Growth Model

1 - Average Realized Returns Model: According to this model the investors' expectation of their investments in the common stock is equal to the same return which they have obtained in the past period(s).

2 - Adjusted Average Realized Returns Model: this model is the Realized Returns Model which is adjusted for the dividend growth and profits. According to this model, the common stockholders' expected return is affected by two other variables including the growth rate of future profits and the percentage of dividend interest.

3 - Capital Assets Pricing Model: *CAPM* Model indicates that the expected return of common stock (or cost of capital) is equal to the risk-free rate of stock return plus a risk that shareholders demand because of assuming a certain level of risk.

4 - Accounting Base Assessment Model: This model is known the *EBO* in which the share price is defined as a function of book value and current value of future unexpected earnings; and the discount rate used in this model is the cost of capital.

5 - Tobin's q Model: This model is based on this fact that there is a direct relationship between the corporate cost of capital and the rate of *q*. According to this model, each company will have the tendency to new investment only when the market value exceeds a new capital unit per spent cost in order to financing it.

6 - Dividend Growth Model: Important issue in this model is measuring the growth rate of dividends according to the investors' belief; and all efforts should be according to this fact that the expected growth rate is estimated accurately. When this rate is calculated accurately, the cost of common stock will easily be calculated, and it is expected that the past process of earnings per share, which is useful in predicting the expected future growth, can be used as the growth variable.

Model Assumptions

Assumptions were divided into two parts in this study. The first part is an assumption which is related to the differences in calculated cost of capital in various models. Sometimes in a company or an industry, different models of calculating the cost of capital lead to the fairly similar values, but in many cases the final result of these models provide different results. Therefore, the relationship between the results of these models in the specific economic, political, and social conditions of Iran, and the significant difference between their results are studied. Therefore, the hypothesis which has been the object of desire for this purpose is as follows.

H0: There is no significant relationship between the calculated rates of capital costs in different models.

H1: There is a significant relationship between the rates of capital costs in different models.

Studied Variables

Identification and definition of variables and calculating their accurate and precise influence have determining effects on the results of research, so they must be carefully defined and measured, although the variables of this research depend on other variables which calculating and reporting them are out of researcher's control.

Capital cost, as the dependent variable, has a special position in this research and is the main axis. If this parameter is not carefully calculated, the accuracy in calculating the independent variables will have no results. In this study, the cost of equity capital is calculated and put to the test using the five models.

Size of company is one of the independent variables used in this study. In order to determine the size of company, the weighted average of book value of assets, market value of net assets and net sales price are used for each of these components equally.

Statistical Population

Statistical Population is a set of elements which have one or more common features, and the element means a person or object about who/which the measurement is done. Since the companies listed in Tehran Stock Exchange have common features, information about them is accessible, and their information is relatively accurate, they have been considered in this study. Common features in these companies are: They are Public Joint Stock; they have a good accounting system, their shares have the names, they were profitable in last two periods, their profitability is foreseeable in the future, and they have passed at least two years of operation.

According to these common features, companies listed in Tehran Stock Exchange have been considered as the statistical population.

Statistical Sample

Scientific research aims to discover common principles which are true in all cases, but to study all elements of society for this purpose, if not impossible, at least is not economically feasible, so the sampling is used.

Sample is a smaller group of society which is selected for observation and analysis; and if this sample is selected carefully and scientifically, its results can be generalized to the whole community.

Statistical methods

The multi-variable regression model is used in order to test the research hypotheses. In this model, the cost of capital is considered as the dependent variable, and the size of company, debt ratio, level of disclosure, and type of industry are considered as the independent variables.

In general, the "multiple linear regression model" was as follows: first, the method for estimating the parameters in it, the total significance test of model, the total significance test of coefficients, confidence intervals for regression coefficients, and other major parameters in the "multiple regression" are explained, and then the "multiple regression model" is introduced in line with this study in particular.

Model introduction

If the response variable (y) is related to the k independent (predictive) variable, the regression model, which is known as the "multiple regression model", is defined as follows:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik} + \varepsilon_i \quad i = 1, 2, \dots, n \quad (1)$$

In which Y_i is the *th response, and $x_{i1}, x_{i2}, \dots, x_{ik}$ are the values of independent variables which are assumed to be fixed and clear.

$\beta_0, \beta_1, \dots, \beta_k$ are the parameters of model, and the ε_i s are the components of error of model which is assumed to be distributed independently, normal, with mean zero, and constantly.

Estimating the parameters of model (regression coefficients)

In order to estimate the parameters of multiple Regression model introduced above, we use the method of least squares. In this regard, we assume that the components of error model of ε_i s is not correlated, with mean zero ($E(\varepsilon_i) = 0$) and has constant variance $var(\varepsilon_i = \sigma^2)$.

We rewrite Model (1) as follows:

$$Y_i = \beta_0 + \sum_{j=1}^k \beta_j x_{ij} + \varepsilon_i; i = 1, 2, \dots, n \quad (2)$$

Because the minimization in the method of least squares is done based on the total square of errors, the function of least square is defined as follows:

$$S(\beta_0, \beta_1, \dots, \beta_k) = \sum_{i=1}^n \varepsilon_i^2 = \sum_{i=1}^n \left(y_i - \beta_0 - \sum_{j=1}^k \beta_j x_{ij} \right)^2 \quad (3)$$

The function S should be minimized according to the parameters $\beta_0, \beta_1, \dots, \beta_k$. The estimators of least squares must be true in the following conditions about the parameters of model ($\beta_0, \beta_1, \dots, \beta_k$):

$$\frac{\partial S}{\partial \beta_0} \Big|_{\beta_1, \beta_2, \dots, \beta_k} = -2 \sum_{i=1}^n \left(y_i - \beta_0 - \sum_{j=1}^k \beta_j x_{ij} \right) = 0 \quad (4)$$

And
$$\frac{\partial S}{\partial \beta_j} \Big|_{\beta_1, \beta_2, \dots, \beta_k} = -2 \sum_{i=1}^n \left(y_i - \beta_0 - \sum_{j=1}^k \beta_j x_{ij} \right) x_{ij} = 0 \quad (5)$$

The reinvented and expanded relations 4 and 5, which are known as the normal equations, are as follows and they calculate the estimation for each of the coefficients:

$$\begin{aligned}
 n\hat{\beta}_0 + \hat{\beta}_1 \sum x_{i1} + \hat{\beta}_2 \sum x_{i2} + \dots + \hat{\beta}_k \sum x_{ik} &= \sum y_i \\
 \hat{\beta}_0 \sum x_{i1} + \hat{\beta}_1 \sum x_{i2}^2 + \hat{\beta}_2 \sum x_{i1}x_{i2} + \dots + \hat{\beta}_k \sum x_{i1}x_{ik} &= \sum x_{i1}y_i \\
 &\vdots \\
 &\vdots \\
 &\vdots \\
 \hat{\beta}_0 \sum x_{ik} + \hat{\beta}_1 \sum x_{ik}x_{i1} + \hat{\beta}_2 \sum x_{ik}x_{i2} + \dots + \hat{\beta}_k \sum x_{ik}^2 &= \sum x_{ik}y_i \tag{6}
 \end{aligned}$$

By calculating the above equations, each of the regression coefficients will be calculated and estimated.
 Note: It is usually preferred in the multiple regression that the equations to be displayed in the matrix notation. On this basis, the equation (2) can be expressed in the matrix notation as follows:

$$\underline{Y} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}_{(n \times 1)} \quad \text{and} \quad \underline{X} = \begin{bmatrix} 1 & x_{11} & x_{12} & \cdot & \cdot & \cdot & x_{1k} \\ 1 & x_{21} & x_{22} & \cdot & \cdot & \cdot & x_{2k} \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\ 1 & x_{n1} & x_{n2} & \cdot & \cdot & \cdot & x_{nk} \end{bmatrix}_{(n \times k)} \quad \text{and}$$

$$\underline{\beta} = \begin{bmatrix} \beta_0 \\ \beta_1 \\ \cdot \\ \cdot \\ \cdot \\ \beta_k \end{bmatrix}_{(k \times 1)} \quad \text{And} \quad \underline{\varepsilon} = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \cdot \\ \cdot \\ \cdot \\ \varepsilon_k \end{bmatrix}$$

In the matrix notation, when we estimate $\hat{\beta}$ in a way that the least square function is minimized as follows, the coefficients are estimated as follows:

$$S(\underline{\beta}) = \sum_i \varepsilon_i^2 = \underline{\varepsilon}' \underline{\varepsilon} = (\underline{Y} - \underline{X}\underline{\beta})'(\underline{Y} - \underline{X}\underline{\beta}) = \underline{Y}'\underline{Y} - 2\underline{\beta}'\underline{X}'\underline{Y} + \underline{\beta}'\underline{X}'\underline{X}\underline{\beta} \tag{7}$$

The matrix least squares of regression coefficients ** are estimated in the matrix notation as follows:
 (Normal equations in the matrix notation):

$$\frac{\partial S}{\partial \underline{\beta}} \Big|_{\hat{\beta}} = -2\underline{X}'\underline{Y} + 2\underline{X}'\underline{X}\hat{\beta} = 0 \equiv \underline{X}'\underline{X}\hat{\beta} = \underline{X}'\underline{Y} \tag{8}$$

This estimate is provided even if $(\underline{X}'\underline{X})^{-1}$ exists, and it is possible just when the independent variables are linearly independent, it means that none of the columns of matrix \underline{X} is a linear combination of others. The multivariate regression function regression is estimated in the matrix notation as follows by calculating the regression coefficients using the above method: $\hat{\underline{Y}} = \underline{X}'\hat{\underline{\beta}}$

Overall significance test of model

Using this test, it is evaluated that whether there is a linear relationship between y and the independent variables in the model or not. In the other words, the following assumptions are tested:

$$\begin{cases} H_0 = \beta_1 = \beta_2 = \dots = \beta_k = 0 \\ H_1 = \beta_j \neq 0 \end{cases} \quad \cdot \text{ At least for one } j$$

By rejecting the hypothesis zero in this test, it will become obvious that the response variable has at least a significant linear relationship with one of the independent variables. For this test, the statistic F is used as follows:

In a regression model, the square of total variation available in the observation of SSY can be separated into two components, the first part indicates the portion of regression model in explaining this variability (SSR), and the second part cannot be expressed by the regression line and is related to the remaining data (errors) of model (SSE)

Each of the squares, which are mentioned above, is defined as follows:

$$1) \quad SSY = \sum y_i^2 - \frac{(\sum y_i)^2}{n} = \underline{Y}' \underline{Y} - \frac{(\sum y_i)^2}{n}$$

$$2) \quad SSR = \underline{\hat{\beta}}' \underline{X}' \underline{Y} - \frac{(\sum y_i)^2}{n}$$

$$3) \quad SSE = \underline{Y}' \underline{Y} - \underline{\hat{\beta}}' \underline{X}' \underline{Y}$$

Because to the F statistic is defined as a ratio in the chi-square statistic which is divided into the degrees of freedom, the chi-square statistics obtained from the sum of square errors and the sum of regression squares are as follows:

The ratio of SSR to k (Number of parameters) is distributed as χ^2 with k degree of freedom: $\frac{SSR}{K} \sim \chi^2(k)$

The ratio of SSE to n-k-1 (degree of freedom related to the SSE) is distributed as χ^2 with n-k-1 degrees of

freedom: $\frac{SSE}{n-k-1} \sim \chi^2(n-k-1)$

Thus, the test statistic is defined as follows:

$$F = \frac{\frac{SSR}{K}}{\frac{SSE}{n-k-1}} = \frac{MSR}{MSE} \sim F(k, n-k-1) \tag{9}$$

In fact, the significance test of regression model in the analysis of variance process is performed according to the following table:

| Total square of Changes | Total square of components in the model | Degrees of freedom | Mean square of components in the model | F |
|-------------------------|---|--------------------|--|-------------------|
| Regression | SSR | K | MSR | $\frac{MSR}{MSE}$ |
| Remained data (errors) | SSE | n-k-1 | MSE | |
| Total | SSY | n-1 | | $\frac{MSR}{MSE}$ |

Whenever the value of statistic in the test, which is calculated based on the data, is greater than its critical value which is extracted from its table, the hypothesis zero, tested by it, will be rejected.

When the hypothesis zero is rejected in this test, the adequacy of our model is confirmed; in the other words, there is a relationship between the dependent variable and at least one of the independent variables. Therefore, in order to investigate that which one of variables is related to the dependent variable, the regression coefficients testing should be done.

Conclusion

Decision making and choosing the optimal strategies about the fund investing and the capital structure are the main topics in the financial literature for increasing the overall value of economic unit. In this regard, the subject of financing is considered in general, and the cost of capital is considered in particular. Moreover, this research investigates these two issues deeply. For this purpose, the required information and data are extracted from the financial statements of companies listed in Tehran Stock Exchange and the statistical population of about 90 eligible companies is chosen using a classification sampling method. In order to analyze the data, first the cost of capital is calculated by the five models introduced in the study, and then the difference in the calculated cost of capital in the various models have been tested and their significance have been proven. Then, the validity of each of the models is tested and the models are rated based on the validity rate. After determining the validity of these

models, the factors affecting the cost of capital in each of the models are put to the test. Finally, the evaluating accounting model has been introduced as the most reliable model for calculating the cost of capital, and the type of industry and size of company have been identified as factors affecting the cost of capital.

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