

Investigating the nonlinear relationship between financial ratios and capital structure in companies listed on Tehran Stock Exchange

Asghar Karimi Khorami^{a,*}, Mohammadreza Farahmand^b

^aDepartment of Accounting, Abarkouh Branch, Islamic Azad University, Abarkouh, Iran

^bDepartment of Computer, Abarkouh Branch, Islamic Azad University, Abarkouh, Iran

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Abstract

The aim of this study was to investigate the nonlinear relationship between financial ratios and capital structure in companies listed on the Tehran Stock Exchange over a period of six years, from 2014 to 2020. The samples of the present study include 134 eligible companies listed on the stock exchange. Tehran and the research method is descriptive-correlational. Data and theoretical foundations of the research have been collected through library studies. Nonlinear regression was not used for data analysis using Ives and Stata econometric software. The results of this study show that a significant non-linear relationship was observed between the financial relations of the capital structure, so it can be justified by referring to the process of political spending, which is one of the components of accounting theories. Also, other research results are based on the non-linear relationship between the variable components of financial ratios and capital structure.

Keywords: financial ratio, capital structure, asset turnover, inventory turnover
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1 Introduction

The capital structure and its impact on the financial and non-financial activities of the business entity has been considered by many researchers since long. So that researchers consider the extent and degree of using the financial ratios as one of the most important tasks of financial managers. Companies need capital for living, growing and developing. Part of this capital is provided through accumulated profit within the company which is the result of the company's profitability and it is not distributed among shareholders. The rest of the capital can be created through borrowing from capital financial markets[9].

Decisions regarding the capital structure of the company have two aspects: first, the amount of capital which it needs and second, the combination of sources of financing. It is assumed that the enterprise is aware of the amount of capital which it needs. In such a case, the question is that What resources should the business entity use to increase capital?[7] The literature about the determinants of a corporate's capital structure has evolved and grown steadily

*Corresponding author

Email address: karimi4946@gmail.com (Asghar Karimi Khorami)

since Myers' initiative. One of the most controversial topics in the corporate financial literature is the theory of corporate capital structure and corporate financing composition [10].

The question is still how companies decide on their financial composition. Companies that generate high-risk debt, negatively affect the current market value of the company's assets. Real options through the company's non-optimal investment strategies such as borrowing are also negatively correlated with market value [11]. Companies can also use debt only in the case of internal financing. Nowadays, determining the appropriate financing method according to the competitive market conditions is necessary for increasing the profitability and for surviving the companies. Business entity also need capital to enter the business and continue their activities in it (Ngok et al., 2021). Decision-making and judgment about the most appropriate combination of company capital structure with the aim of background of the shareholders' wealth is one of the most important issues in the field of financial management.

Accordingly, knowing the capital charge has always played a key role in company's decisions. [19] Achieving the right cost rate in determining the optimal composition of company's capital structure and especially in obtaining the best results of operations in the form of profitability, increasing the stock prices and increasing the intellectual capital of companies has a particular importance. Capital structure means how the company is financed that affects the value of the company. In other words, the relationship between the components of the capital structure which is a mixture of bonds and stocks for financing, has a significant impact on the performance of companies.

Decisions related to capital structure will play an effective role in the efficiency and validity of companies with financial institutions. As a result, understanding the theory of capital structure can allow managers to achieve the desired capital structure in order to maximize shareholder wealth. Using the information in financial statements to make decisions without analyzing them is not helpful and may even mislead users [20]. However, by examining and analyzing them, valuable and useful information can be obtained. So the analysis of financial statements has a significant importance. This information will be the basis for decisions for future activities if it is properly and accurately analyzed and expected to be repeated in the future [18]. In general, there are various types of financing sources which are divided into internal financial sources and external financial sources. The company's past profitability requires capital from internal sources, which is provided from the accumulation of past profits and it is a good source for financing the company. It means that instead of distributing profits among shareholders, the profit is used in the company's operational activities to earn more returns [16]. Today, according to this point that the companies are in competition in attracting shareholders' capital and also because of the attractiveness of profitability for individuals, examining the relationship between capital structure and financial ratios is still very attractive. Companies have to compete for surviving. So managers are faced with many factors to decide about the optimal capital structure in order to provide profitability for the company by performing their tasks. There should be an incentive in the business entity for the optimal use of the limited source of financing. This optimal use shows itself in the form of increasing profitability [3]. Therefore, the study of financing by leverage methods has special importance.

The use of financial ratios as a criterion for evaluating companies has a long history. In recent years, there has been a significant growth in the application of these ratios. Financial ratios are the most common way to summarize financial statement data. The reasons for examining data in the form of ratios are as follows [2]:

1. Controlling the effect of size among companies during the time.
2. Meeting the fundamental assumptions of statistical tools such as regression analysis.
3. Using the observed empirical routine and order between a financial ratio and estimating or predicting a variable of interest (for example, the risk of financial disability to pay debts, the probability of bankruptcy).
4. A careful examination of a theory in which the variable of interest theory is a financial ratio.

One of the problems in using financial ratios for evaluating the financial condition of companies is that each set of financial ratios evaluates a specific dimension, so that a set of these ratios measures the liquidity capacity of the organization. One group evaluates the profitability of the organization and the other part determines the growth ability of the company. In order to solve this problem of the analysis of financial ratios, the capital structure must be considered [1].

So far, much research has been done about the relationship between financial ratios and capital structure. [12] state that capital structure and asset turnover have a significant effect on financial ratios. While this variable has no effect on financial ratios. [5] also reported in their research that the capital structure and financial performance of companies are interdependent and can influence each other.

The most important difference between the present study and the other researches is that this research investigate the non linear relationship between financial ratios and the capital structure variable and intends to consider the financial ratio variable according to the three variables such as inventory turnover, fixed assets turnover and the

total assets turnover and examine the relationship between these three variables and the variable of capital structure. Therefore, the main purpose of this study is to investigate the effect of non linear relationships between financial ratios and capital structure and also it examines that which of the financial ratios variables has a non linear relationship with the capital structure of the company listed on the Tehran Stock Exchange. On the other hand, the results of this study can suggest new perspectives for selecting other researches in the field of accounting and capital market.

Research Hypotheses

There is a non-linear relationship between inventory turnover ratio and capital structure.

There is a non-linear relationship between fixed asset turnover ratio and capital structure.

There is a non-linear relationship between the ratio of total assets turnover and the capital structure.

research methodology

This research is operatiol in terms of purpose and it is descriptive-correlational in terms of method. The statistical population includes all active companies on Tehran Stock Exchange and the statistical sample includes companies that have the following conditions:

1. Companies that were listed on the stock exchange before 2013 and will be listed on the stock exchange until the end of 2019.
2. Investment companies, insurance companies, banks and financial intermediaries and financing institutions should not be included, because the pattern of accruals and their cash flows are different from other companies.
3. Companies whose fiscal year ends in March (for having more comparability).
4. Companies that do not have a change in fiscal year during the period under review (2014-2020).
5. The companies whose data are necessary to conduct this research should be available.

Considering the above conditions, the number of samples of this research that use the systematic elimination method is 134 companies for the period under review (2014-2020).

Research model and variable measurement method

The model used to measure the first hypothesis of the research is as follows:

$$CS_{i,t} = \alpha_0 + \beta_1 ITR_{i,t} + \beta_2 ITR2_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 ACCR_{i,t} + \beta_6 PPE_{i,t} + \beta_7 Current_{i,t} + e_{i,t}.$$

The model used to measure the second hypothesis of the research is as follows:

$$CS_{i,t} = \alpha_0 + \beta_1 FATR_{i,t} + \beta_2 FATR2_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 ACCR_{i,t} + \beta_6 PPE_{i,t} + \beta_7 Current_{i,t} + e_{i,t}.$$

The model used to measure the third hypothesis of the research is as follows:

$$CS_{i,t} = \alpha_0 + \beta_1 TATR_{i,t} + \beta_2 TATR2_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 LIQ_{i,t} + \beta_5 ACCR_{i,t} + \beta_6 PPE_{i,t} + \beta_7 Current_{i,t} + e_{i,t}.$$

Here, t and i represent the year and company. The dependent variable is the capital structure, while the independent variables are linear and quadratic functions of the financial ratios, respectively. All variables used in the models are described below.

Independence variable

Financial ratios (FR): In this study, financial ratios are considered as an independent variable.

Financial ratios: The financial ratios used in this study include inventory turnover, fixed assets turnover and total assets turnover (Homayouni Rad et al. 2011).

Inventory turnover ratio: The way of calculating this variable is as follows:

$$ITR_{i,t} = COSG_{i,t} / AI_{i,t}.$$

$ITR_{i,t}$ = Company's inventory turnover ratio (i) at the end of year (t)

$AI_{i,t}$ =The average of company’s inventory (i) during the year (t)
 $COSG_{i,t}$ =Cost of inventory sold by company (i) at the end of year (t)

Fixed asset turnover ratio: The way of calculating this variable is as follows:

$$FATR_{i,t} = S_{i,t}/AFA_{i,t}.$$

$FATR_{i,t}$ = Company’s fixed assets turnover ratio (i) at the end of the year (t)
 $AFA_{i,t}$ = The average of company’s fixed assets (property, plant and equipment) (i) at the end of year (t)
 $S_{i,t}$ = Company’s sales amount (i) at the end of year (t)

Total assets turnover ratio:The way of calculating this variable is as follows:

$$TATR_{i,t} = S_{i,t}/ATA_{i,t}.$$

$TATR_{i,t}$ = Company’s total assets turnover ratio (i) at the end of the year (t)
 $ATA_{i,t}$ = The average of company’s total assets (i) during the year (t)

Dependence variable

Capital structure(CS): It is the total debt to the total assets of each company in each year.

Control variables:

The size of the company (size): Company size is calculated as the natural logarithm of the market value of the company’s equity.It is expected that the larger companies do more investment due to the lower information asymmetry and more access to external financing sources(Esteen 2003).

Financial leverage: (LEV) Company financial leverage is the ratio of company’s total debt to total assets. It is expected that the companies’ investment will reduce by increasing company’s debt ratio and imposing more restrictions by creditors(Trinogruhu Verinova, 2011).

Cash flow (LIQ): cash is the total assets of each company in each year. Profit accruals (ACCR): It is the profit after tax deduction that is minus net cash divided by total assets of each Company in each year.

Current ratio: It is the total current liabilities ratio to total current assets of each company in each year

Tangible fixed assets (PPE): It is the ratio of property, plant and equipment to the total assets of each company in each year.

Table 1: Descriptive statistics of research variables

Variable name	Number	Average	Standard deviation	The least	the most
Inventory turnover ratio	1045	58/3	14/3	00/0	22/24
Fixed turnover ratio	1045	55/4	71/3	00/0	31/33
Turnover ratio of total assets	1045	79/0	51/0	00/0	01/4
Capital Structure	1045	45/2	67/0	012/0	31/3
size of the company	1045	64/7	36/4	41/5	78/8
Financial Leverage	1045	23/1	69/0	11/0	28/2
Profit accruals	1045	009/0-	135/0	714/0-	711/0
Tangible fixed assets	1045	449/0	182/0	018/0	896/0
Current ratio	1045	75/1	03/1	45/0	71/6
Cash flow	1045	078/0	052/0	035/0	402/0

Before presenting the results related to the fitness of model and the final estimation of the research model for ensuring the classical regression assumptions, the Harris test was used to test the significance of variables and check the existence of a single root in the panel data. The results of the research show that all variables are meaningful. In order to check the normality of the disturbance component, the Jarque-Bera test was used. The results of the Jarque-bera test indicate that the residual of all research models are normal.The study of variance heterogeneity shows that the significance level of the adjusted Wald test is less than 5% and it indicates the existence of variance heterogeneity in the disruptive sentences which is solved in the final estimation of the models (by weighting method to data through the generalized squares command). The results indicate that the first and second hypotheses have no

serial autocorrelation in the models, but the rest of the hypotheses have serial autocorrelation in the models which this problem has been solved through the automatic correlation command in Stata software. The results of the Chow test indicate the acceptance of the panel data pattern. If the panel data structure is selected, the Hausman test must also be performed to detect fixed or random effects. The results of Hausman test indicate the acceptance of the fixed effects pattern. The results of the mentioned tests are not presented due to brevity.

The results of testing first model:

According to the obtained results, the square of the inventory turnover ratio has a negative coefficient and a significance level is less than 5%. Therefore, the first hypothesis is accepted and it can be said that there is a non-linear relationship between inventory turnover ratio and capital structure. It means that if the ratio of inventory turnover is higher than a certain limit, the capital structure of the company also decreases and vice versa. The adjusted coefficient of determination is equal to 69%. It shows that the independent and control variables of the model are able to explain 69% of the changes in the dependent variable. The Wald statistic is equal to 229.21 and its significance level is less than 5%, so it can be said that the fitted model has sufficient validity.

Table 2: Final estimation of the first regression model

Variable name	Coefficients	Standard deviation coefficient	Statistic-z	Significance level	Inflation variance factor	Tolerance	Result
Inventory turnover ratio	186/0	075/0	96/1	014/0	32/4	234/0	Lack of alignment
The second power is the inventory turnover ratio	211/0-	062/0	52/3-	00/0	36/3	254/0	Lack of alignment
Capital Structure	441/0	036/0	22/2	016/0	36/3	125/0	Lack of alignment
size of the company	256/0	023/0	45/1	044/0	25/2	321/0	Lack of alignment
Financial Leverage	241/0	041/0	75/0	036/0	59/2	301/0	Lack of alignment
Profit accruals	130/0	0012/0	88/7	017/0	12/2	125/0	Lack of alignment
Tangible fixed assets	23/0-	033/0	20/4-	021/0	12/1	369/0	Lack of alignment
Current ratio	102/0	041/0	97/1	00/0	21/1	391/0	Lack of alignment
Cash flow	069/0	014/0	69/6	001/0	58/1	456/0	Lack of alignment
y-intercept	391/0	098/0	29/3	00/0			
Adjusted coefficient of determination	69 %			Parent statistics and its significance		21/229	(000/0)

The results of testing second model:

According to the obtained results, the square of company size has a positive coefficient and its significance level is less than 5%. Therefore, the second hypothesis is accepted and it can be said that there is a non-linear relationship between company size and profitability. It means that if the size of the company is higher than a certain limit, the company's profitability will increase and vice versa. The adjusted coefficient of determination is equal to 50.51% which shows that the independent and control variables of the model are able to explain 50.751% of the changes of the dependent variable. The Wald statistic is equal to 281.63 and its significance level is less than 5%, so it can be said that the fitted model has sufficient validity.

The results of testing third model:

According to the obtained results, the square of the capital structure has a negative coefficient and its significance level is less than 5%. Therefore, the third hypothesis is accepted and it can be said that there is a non linear relationship between capital structure and profit distribution. This means that if the capital structure is higher than a certain limit, the company's profit distribution will be reduced and vice versa. The adjusted coefficient of determination is equal to 68.90% which shows that the independent and control variables of the model are able to explain 68.90% of

Table 3: Final estimation of the second regression model

Variable name	Coefficients	Standard deviation coefficient	Statistic-z	Significance level	Inflation variance factor	Tolerance	Result
Inventory turnover ratio	231/0	066/0	26/2	00/0	71/5	326/0	Lack of alignment
The second power is the inventory turnover ratio	312/0-	065/0	69/4-	032/0	41/4	306/0	Lack of alignment
Capital Structure	325/0	051/0	36/2	024/0	78/3	098/0	Lack of alignment
size of the company	291/0	032/0	77/1	014/0	27/2	201/0	Lack of alignment
Financial Leverage	261/0	036/0	23/1	026/0	03/2	169/0	Lack of alignment
Profit accruals	149/0	011/0	63/6	027/0	26/2	098/0	Lack of alignment
Tangible fixed assets	311/0-	041/0	45/4-	035/0	15/2	113/0	Lack of alignment
Current ratio	210/0	052/0	11/1	049/0	02/1	203/0	Lack of alignment
Cash flow	077/0	030/0	61/5	005/0	90/1	296/0	Lack of alignment
y-intercept	201/0	168/0	02/4	00/0			
Adjusted coefficient of determination		51/50 %		Parent statistics and its significance		63/281	(000/0)

the changes of the dependent variable. The Wald statistic is equal to 301.30 and its significance level is less than 5%, so it can be said that the fitted model has sufficient validity.

Discussion and conclusion

The purpose of this study is to investigate the non-linear relationship between financial ratios and capital structure in companies listed on Tehran Stock Exchange. Investing is a vital and necessary thing for continuous development and progress in line with the goals of each country. The best capital and resources for investing are absorption of funds and liquidity and directing these savings to the production cycle. Due to the competitiveness of markets, the optimal structure of resources helps developing the companies. The results show that the capital structure has been caused the increase of the inventory rate of the company to some extent. In other words, the relationship between the inventory rate of goods and the capital structure of the company is initially positive and upward. It can be said that inventory turnover affects net income through net sales. This means that inventory turnover will be high and therefore the company profits will increase. Therefore, it can be concluded that the company will be able to sell existing products so that it can make a profit regardless of the company that sells the products by credit or cash transactions. But this relationship changes and will be negative. So it indicates a non-linear relationship between the inventory rate of goods and the capital structure of the company. Also, the non-linear relationship between the capital structure and the company's inventory rate is like an inverse U. The results of the present study are consistent with [4] research, [14], [6] and [15]. The result of the second hypothesis of the research shows that there is a non-linear relationship between the ratio of fixed assets turnover and capital structure. It means that if the ratio of fixed assets turnover is higher than a certain limit, the capital structure of the company will increase and vice versa. In other words, it can be concluded that the ratio of fixed assets turnover has been caused the reduction of the capital structure of the company and the existing relationship has been negative, but it eventually has had an upward trend. Therefore, the results indicate that the relationship between the ratio of fixed assets turnover and capital structure is non-linear and it can be said that the relationship between the ratio of fixed assets turnover and capital structures is like U form. The results of the present research is in line with [5], [17] and [9].

In a challenging economy where international organizations are looking for new ways to grow and improve financial performance and reduce risk, assets turnover is an important resource for improving financial performance. With these characteristics, working capital management is an essential requirement of the organization's ability to adapt to a challenging economy. Fixed asset turnover seeks to make a sensitive balance between maintenance of liquidity

Table 4: Final estimation of the third regression model

Variable name	Coefficients	Standard deviation coefficient	Statistic-z	Significance level	Inflation variance factor	Tolerance	Result
Inventory turnover ratio	321/0	059/0	75/3	00/0	41/5	411/0	Lack of alignment
The second power is the inventory turnover ratio	302/0-	071/0	52/4-	012/0	65/3	365/0	Lack of alignment
Capital Structure	217/0	041/0	65/3	014/0	09/4	141/0	Lack of alignment
size of the company	119/0	029/0	24/2	021/0	36/3	278/0	Lack of alignment
Financial Leverage	152/0	040/0	69/1	039/0	98/1	236/0	Lack of alignment
Profit accruals	096/0	019/0	59/5	047/0	69/1	111/0	Lack of alignment
Tangible fixed assets	214/0-	049/0	58/5-	041/0	25/2	210/0	Lack of alignment
Current ratio	136/0	061/0	45/2	022/0	21/2	329/0	Lack of alignment
Cash flow	102/0	039/0	59/4	016/0	36/2	324/0	Lack of alignment
y-intercept		109/0	298/0	32/3	00/0		
Adjusted coefficient of determination		90/68 %		Parent statistics and its significance		30/301	(000/0)

for supporting daily operations and maximizing short-term investment opportunities. Based on the results of testing the research hypotheses, it is suggested to managers that the factors affect the working capital of the organization (including current assets turnover, debt collection period, debt repayment period, cash conversion period) must be identified well, because it can be useful in the financial flexibility and the competitiveness of the organization and this will increase the profitability and optimal liquidity of the organization. Managers can reduce the current assets to Make the company as competitive as possible and this will be achieved through the proper management of accounts receivable cash, inventories and the desirable management of collections.

With the increase of fixed assets and the lack of turnover, the company's profitability decreases. The use or management of fixed assets of company keeps the sales in good condition because the company can effectively manage its assets. Efficient and current assets help in profitability and this can improve the capital structure. On the other hand, if the asset turnover rate decreases and the companies investment in profit affairs will decrease and the volume of debts will accumulate. This will shake the optimal capital structure and can cause the capital structure becomes weak that this will be associated with low profitability.

The result of the third hypothesis of the research shows that there is a non linear relationship between the ratio of total assets and capital structure. It means that if the ratio of total assets is higher than a certain limit, the capital structure of the company will increase and vice versa. In other words, it can be concluded that the ratio of total assets has been caused the reduction of the capital structure of the company and the existing relationship has been negative, but it eventually has had an upward trend. Therefore, the results indicate that the relationship between the total turnover ratio of total assets and the capital structure is non linear and it can be said that the relationship between the total turnover ratio of assets and capital structure is like U form. The results of the present study are in line with the researches of [13] and [8].

The increase in total asset turnover indicates that the company's asset management will be in good condition for production and sales. Because of this, the company can manage its assets effectively. The highest total asset turnover indicates the effectiveness of using the company's assets, using the optimal assets which can help in profitability. If the total turnover of assets increases, sales volume can be increased by the same amount of assets. So it can help the optimal capital structure. The expansion of the capital structure and its inefficiency reduces the company's liquidity and reduces the distribution of profits between shareholders, but by determining the desired capital structure, the company will not be financially constrained and can distribute more profits among shareholders.

In general, the research findings show that the higher turnover ratio of total assets causes the higher profitability of the company and profit payment and vice versa. In other words, with respect to the non linear relationship, the higher turnover ratio of total assets causes the more successful trading of the company and more competition with competitors. Therefore, it will have more share of the sales market in the large (main) markets and this will make higher sales (higher profitability). In other word, based on the non linear relationship between the capital structure and the ratio of total assets, if the asset turnover is higher, the capital structure will be more optimal. According to all research, this research also has the following limitations:

- Lack of control over some effective factors on the research results including the impact of variables such as economic factors, political conditions, company's life, laws and regulations that are out of reach of the researcher may affect the study of relationships.
- Because the prepared information of the financial statements on the basis of historical cost has been used to calculate the research variables, so if the mentioned information is adjusted for inflation, a different conclusion may be obtained from the current results.
- Restrictions on access to companies' financial information cause that the companies listed on Tehran Stock Exchange are used for conducting research, so it is suggested that non-listed companies could be examined in the future research of other companies.

Also, suggestions for future research can be provided. The discussion of linear regression has been seen among the researches less than usual. Due to the difference in the obtained results in the field of linear and non linear regression, researchers are interested in the subject of this research based on the following suggestions. So they do more expensive researches.

1- Investigating the linear and non-linear relationship between the rate of adjustment of capital structure and financial ratios and dividend policy and comparing the results of linear and non-linear relationships with each other.

2- Considering the subject area of the present study, it is suggested that a study with the mentioned title could be done in banks and financial institutions of investment companies, financial intermediaries, holding companies and leasing companies. Then its form and results could be compared with the results of manufacturing companies. Because the capital structure of such companies (omitted in the present study) is different and it may not be generalizable to other manufacturing companies.

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