



Application of Data Mining Method in Anticipating of Relationship between Liquidity and Profitability in Capital Market

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Abstract

Two important subjects, liquidity, and profitability are under the special attention of scientists and financial managers of corporations. Liquidity as an effective factor in profitability has major importance that is interesting for corporations' financial managers. Therefore, this paper aims to apply the data mining technique in anticipating the relationship between liquidity and profitability in the capital market. This project is classified as library-type research work and based on data mining techniques (neural network, backup vector machine, and regression analysis). Here, the financial information of 147 corporations in the capital market from 2013 - 2018 was analyzed. The research method was inductive and posterior (using past information). This research is identified as descriptive–correlative. For analysis of data SPSS Modeler v. 18 and SPSS v. 23 programs were used. Research findings showed that neural networks and backup vector machines could predict the relationship between liquidity and profitability, but regression analysis could not anticipate it.

Keywords: liquidity, profitability, neural network, backup vector machine, decision tree

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1. Introduction

Profit is identified as the most important information in economic decisions. Profit as a guide of Dividend payment, a measurement of the effectiveness of management tools, and a prediction and evaluation of decisions facility has been under the attention of investors, managers, and financial analysts (Zhang, 2011). Accordingly, many scientists had efforts to detect effective factors on the profitability of corporations. Meanwhile, liquidity with major impacts on profitability is important to corporations' financial managers and could affect corporations' profitability (Ghaderi et al., 2013).

However, some scientists believe that liquidity has more importance, and if a firm is not profitable, it may be ill, but if it has not liquidity, it is in the dying process. On the other hand, if a corporation is non-profitable, it could be doing well, but it could not be alive (Darabi and Molaei, 2011).

The estimation of profitability and the assessment of the level and the profit trend are the best estimates of a company's average profits. The expectation of maintaining or repeating it with a degree of order in the next period is called profitability. Most of the profitability models are capitalized through an agent or coefficient that includes capital, risk, and expected future returns. Earnings per share are appropriate for assessing the power of profitability if calculated by emphasizing the continuous items of profit and loss. Analysts focus on identifying components of the flow of income and expenditure that are stable and predictable. For many years, the policy of dividing profits has been one of the main challenges of financial issues (Ghaderi et al., 2013). Investigating and analyzing the state of liquidity by managers and other users makes it possible to make efficient decisions. Financial information users usually use common ratios to determine the power of repayment of debts. They are less relevant to the relatively new cash cycle that is an effective factor in making decisions. The cash flow cycle as a dynamic and up-to-date liquidity indicator begins when paid for the raw material and continues until the goods' sale claims are received. While current and rapid ratios are a criterion for evaluating short-term obligations (Darwish, 2012), but in Iran though, the cash flow cycle ratio has been used in studies to examine the management of working capital and earnings management. Still, this ratio was not the main focus of liquidity ratios and performance evaluation and commitment (Hajiha and Feizabadi., 2013).

Liquidity demonstrates the company's ability to meet its short-term obligations. In other words, the company's liquidity is the relationship between cash flow amounts that will be available to the company in the short term and the cash that the company will need (Dahiyat, 2016). Liquidity management is one of the financial manager's main duties because if the liquidity ratios are not appropriate, the company may not pay its principal and interest of its debt on its exact time. According to the research background and theoretical foundations of research, the application of data mining techniques has not been studied in predicting the relationship between liquidity and profitability of the capital market in Iran. Therefore, the necessity of this research was highly felt. In this research, the data mining technique was used to predict the relationship between the capital market's liquidity and profitability.

Therefore, according to the stated issues, this research's main question is whether the application of data mining techniques is possible in predicting the relationship between liquidity and profitability of the capital market.

2. Theoretical Framework and Research Background

2.1. Theoretical framework

Cash flows for the company often accompany the company's profitability, so more profitable companies are less willing to hold and store cash. On the other hand, creditors tend to lend their money to more profitable companies to minimize their risk. Hence

companies with higher profitability have more access to external financing than companies with less profitability. Therefore, the need for cash holding in these companies is less due to increased financial flexibility and access to external sources (Lakshman et al., 2012). Therefore, from the point of view of balance, a company's profitability ratio with cash held in the company is negative.

Cash is the result of financing and investment activities. According to the hierarchy of finance, the domestic financial resources are the first option in the financing because they are low cost and the most accessible source of financing for the company, therefore, as soon as they can, companies will try to increase their domestic financial resources, and the more cash flow to the company cause that more companies will hold up more cash to boost their liquidity (Ezie, 2014). It is expected that the company's profitability ratio and the cash kept in the company will be positive. According to the free cash flow theory, the company's profitability will bring cash flows to the company. It allows the manager to add resources to his company by adding cash to the company; therefore, it is expected that a company's profitability ratio with cash held in the company would be positive.

2.2. International background

In their research, Bibi et al. (2017) investigated the relationship between liquidity and profitability (Karachi stock exchange case study) during the 2007-2011 years. This research indicates a significant relationship between the current ratio, total asset logarithm, and net sales logarithm with net operating profit ratio. There is a significant relationship between total asset logarithm and net sales logarithm with return on assets. Vintil and Nenu (2016) investigated the relationship between Romanian companies' liquidity and profitability in 2005-2014. The results of their research showed that liquidity has a negative and significant relationship with profitability. Majeed et al. (2013), in their research, evaluated the relationship between firm performance and cash cycle. He concluded an inverse relationship between the company's cash flow cycle and performance, including return on equity, return on assets, and equity (According to Bibi, 2017). Usama (2012) examined the relationship between liquidity and profitability in Pakistani food companies for 2006-2010. He concluded that working capital management has a significant positive effect on profitability and liquidity.

Dong and Su (2010) examined working capital management's effect on companies' profitability admitted to the Vietnam Stock Exchange from 2006 to 2008. This paper tried to examine the relationship between the cycle of cash and liquidity conversion on companies' profitability. The results showed that there is a significant negative relationship between the cash flow cycle and profitability. There is also a significant negative relationship between liquidity and profitability of these companies.

In their study, Shin and Soenen (2005) investigated the relationship between liquidity and profitability in American firms. This research was conducted on 58985 American companies between 1994 and 1997. These researchers used net business cycles as indicators of profitability and concluded a negative and significant relationship between the net business cycle and the profitability ratios. They eventually believed that the pure business cycle in companies was decreased; the profitability would be increased.

Kama (1989) explained the relationship between liquidity ratios and the company's profitability during 1970 and 1984. He concluded a positive and significant relationship between current and fast ratios with companies' profitability. The net business cycle and the cash flow cycle have a negative relationship with the companies' profitability.

Mohebi et al. (2016) investigated the relationship between liquidity risk and earnings management in banks admitted to the stock exchange from 2002 to 2008. They concluded a positive correlation between credit risk and bank profit management, indicating that the bank would increase its risk management by increasing its management.

Khamyabi and Rostamabadi. (2015) examined the effect of liquidity management on the companies' profitability approved in the Tehran Stock Exchange during the period from 2010 to 2013. The results of this research indicate that there is a positive and significant relationship between liquidity management and profitability criteria. Bahar Moghadam et al. (2015) investigated the relationship between liquidity and dividend indices of each share in companies listed on the Tehran Stock Exchange for 10 years from 2003 to 2012. This research indicates a significant relationship between the current ratio, generalized liquidity index, cash and cash withdrawal period, and dividend income of each share. Still, there is no significant relationship between the immediate ratio and dividend income of each share.

Ghayebi (2014) investigated the relationship between liquidity ratios and profitability of companies listed on the Tehran Stock Exchange. This research showed that the cash-flow cycle has a significant relation with the net profit margin ratio and has no significant relationship with equity ratios, return on assets, and debt ratios. There was no significant relationship between current and fast ratios with equity returns and net profit margin ratios.

Shah Wisie and Feizabadi (2013) investigated companies' profitability and the ability to meet their obligations using liquidity ratios. In general, the use of a sample of stockbroker companies between 1389 and 1392 suggests that the cash-flow cycle ratio to current and quick liquidity ratios is stronger for firms to measure profitability.

Jafari Samimi et al. (2012) predicted Iran's liquidity using an artificial neural network during the 1353-1383 years. This study's results have shown that liquidity prediction of the years 2005-2007 is more exact with the use of the neural network.

Asadi et al. (2008) examined the relationship between profitability and liquidity in companies and their impact on dividend income. The hypothesis test results indicated a strong relationship between profitability and dividend, a weak relationship between liquidity and dividend profit, and without the impact of industry on dividend yield.

2.3. Research Hypotheses

According to theoretical foundations and research background, the research hypothesis is as follows:

H1: The neural network is used to predict the relationship between liquidity and profitability of the capital market.

H2: A backup vector machine is used to predict the relationship between liquidity and the capital market's profitability.

H3: The decision tree is used to predict the relationship between liquidity and profitability of the capital market.

3. Research Methodology

This research is in the field of positive research and terms of its purpose. Given that historical information is used to examine the research hypotheses, it is included in the quasi-experimental research group. The method of this research is inductive and post-event (using past information) type. Also, this research is descriptive – correlative research.

3.1. Collecting data

To collect information on theoretical foundations and literature on research, library resources, articles, books, and thesis have been used. For collecting statistical information, audited financial statements and notes accompanying companies approved in the capital market are available on the official website of Tehran Stock Exchange and the Rahavard Novin software and site Codal website.

3.2. Data analysis method

This research aims to use the data mining technique to predict the relationship between the capital market's liquidity and profitability. Data analysis is done in two parts: inferential statistics and descriptive statistics. In the descriptive statistics section, we use mean, mode, standard deviation, skewness, and kurtosis, and in part of inferential statistics, for prediction, we used neural network method, backup vector machine, decision tree, and regression, as well as SPSS MODLER v.18 and SPSS v.23 and MINITAB v.16 programs.

3.3. Research variables

The dependent variable is the ratio of net operating profit and returns on assets. Independent variables include net sales logarithms, return on equity, current ratio, cash flow, and total assets logarithms.

3.4. Research Model

The Bibi model (2017) has been used (Bibi, 2017).

Model 1:

$$NOI_{it} = \beta_0 + \beta_1 CR_{it} + \beta_2 CGS_{it} + \beta_3 LOGSALES_{it} + \beta_4 LOGTA_{it} + \beta_5 ROE_{it} + \varepsilon_{it}$$

NOI_{it} : Net operating profit ratio CR_{it} : Current ratio

CGS_{it} : Cash flow cycle $LOGTA_{it}$: Total asset logarithm

$LOGSALES_{it}$: Net sales logarithms ROE_{it} : Return on equity

ε_{it} : Error component

3.5. The Method of Measuring Variables

Net operating profit ratio (NOI_{it}): The net operating profit ratio is provided from model 2.

Model 2:

$$NOI = \beta_0 + \beta_1 CR_{it} + \beta_2 CGS_{it} + \beta_3 LOGSALES_{it} + \varepsilon_{it}$$

CR_{it} : Current ratio CGS_{it} : Cash flow cycle

$LOGSALES_{it}$: Net sales logarithms (Bibi, 2017)

Asset returns (ROA_{it}): This ratio calculates the return on the asset used and derives from the net profit ratio (after tax deduction) on total assets (Tehrani, 2010).

Current ratio (CR_{it}): This is the result of dividing current assets into current liabilities. This ratio represents the ability to repay current liabilities from the institution's current assets (Bibi, 2017).

The cash flow cycle (CGS_{it}) explains that the cash flow cycle is when cash is paid to purchase raw materials to be converted into inventory and until sales of products are assigned to accounts receivable. The cash flow cycle is a useful solution to assess liquidity, especially if the company has lesser financial resources (Smith and Begman, 1997). The cash flow cycle belongs to the days between receipt and payment of cash in relation to a separate operating unit. The cash flow cycle is calculated as equation 1 (Lyroutdi and John, 2000).

Equation 1:

$$CGS = ICP + RCP - PCP$$

ICP: Frequency of inventory turnover

RCP: The number of receivable accounts flows

PCP: Number of payable accounts

Total asset logarithm ($LOGTA_{it}$): The logarithm of the company's total assets in year t (Bibi, 2017).

Net sales logarithms ($LOGSALES_{it}$): The logarithm of net sales of the company i in year t (Bibi, 2017).

Return on equity (ROE_{it}): Return on equity (special value) shows the net profit generated against each equity share. Whatever this ratio is increased, shareholders' profitability will be increased too and provided by profit ratio (after tax) per equity.

3.6. Statistical Population and Sample Size

The statistical population of this research is the capital market during the period 2013 to 2018. In this study, the systematic deletion method was used to determine the statistical sample. Therefore, those statistical society companies that have the following conditions are selected as statistical samples, and the rest are excluded:

- Accepted in the capital market before the 2013 year;
- In terms of increasing comparability, their financial period ended in March and did not change its financial period during the years.

Due to the activity's specific nature, they should not be a part of the company's financial intermediation industry activity.

- Information about their financial statements should be available for the period of evaluation processes.

According to the Tehran Stock Exchange (TSE), 642 companies in the capital market were active in 40 different industries. Based on the above conditions and limitations, among these companies, 147 companies from 25 different industries have been selected as the statistical sample of the research.

4. Research Findings

4.1. Descriptive statistics

The summary of the status of the descriptive statistics of the variables of the model, according to Table 1 shows as follows:

Table 1. Descriptive statistics of research variables.

Return on equity	Total asset logarithm	Net sales logarithms	Cash flow cycle	Current ratio	Asset returns	The net operating profit ratio	
882	882	882	882	882	882	882	No.
4.584225	14.029533	13.729531	1.214779	1.540337	0.169896	16.484648	Mean
0.493313	13.878051	13.628854	0.841037	1.306834	0.134297	16.003934	Mode
19.8940906	1.4224011	1.3611102	2.6237265	1.0471967	0.3100959	3.1070316	Standard Deviation
7.177	0.697	0.542	15.085	5.085	21.875	9.751	Skewness
59.868	1.224	0.976	288.792	40.079	578.366	159.694	Kurtosis
0.0024	10.0312	9.421	0.066	0.2701	0.0004	10.4441	Min.
250.4092	19.1062	18.4405	58.3803	13.1506	8.448	75.0449	Max.

According to Table 1, the analysis of the central indices, the dispersion of the research variables is as follows:

- 1) The operating profit ratio includes 16.485, the median of 16.004, standard deviation

- 3.107, skewness and kurtosis, 9.751 and 159.694, respectively.
- 2) The return on assets has a mean of 0.169896, a median of 0.134297, a standard deviation of 0.3100959, and skewness and kurtosis of this variable of 21.875 and 578.366, respectively.
 - 3) The current ratio has a mean of 1.540337, a median of 1.306834, a standard deviation of 1.0471967, and skewness and kurtosis of this variable is 5.085 and 40.079, respectively.
 - 4) The cash-flow cycle has a mean of 1.214779, a median of 0.841037, a standard deviation of 2.6237265, and skewness and kurtosis of this variable is 15.085 and 288.79, respectively.
 - 5) The net sales logarithm has a mean of 13.729531, a median of 13.628854, a standard deviation of 1.3611102, skewness and kurtosis of this variable of 0.542 and 0.976, respectively.
 - 6) The total logarithm of the asset has an average of 14.029533, a mean of 137.878051, a standard deviation of 1.4224011, and skewness and kurtosis of this variable of 0.697 and 1.224, respectively.
 - 7) Equity returns have a mean of 4.584225, a median of 0.493313, a standard deviation of 19.8940906, skewness and kurtosis of this variable being 7.177 and 59.868, respectively.

Investigating the degree of skewness and kurtosis of variables showed that these variables do not normally have a normal distribution.

4.2. Kolmogorov-Smirnov test

The output results of the Kolmogorov-Smirnov test in SPSS 23 for these variables are described in Table 2:

Table 2. Kolmogorov-Smirnov test.

The significance level	The net operating profit ratio	Indicator
0.000	0.179	Statistics

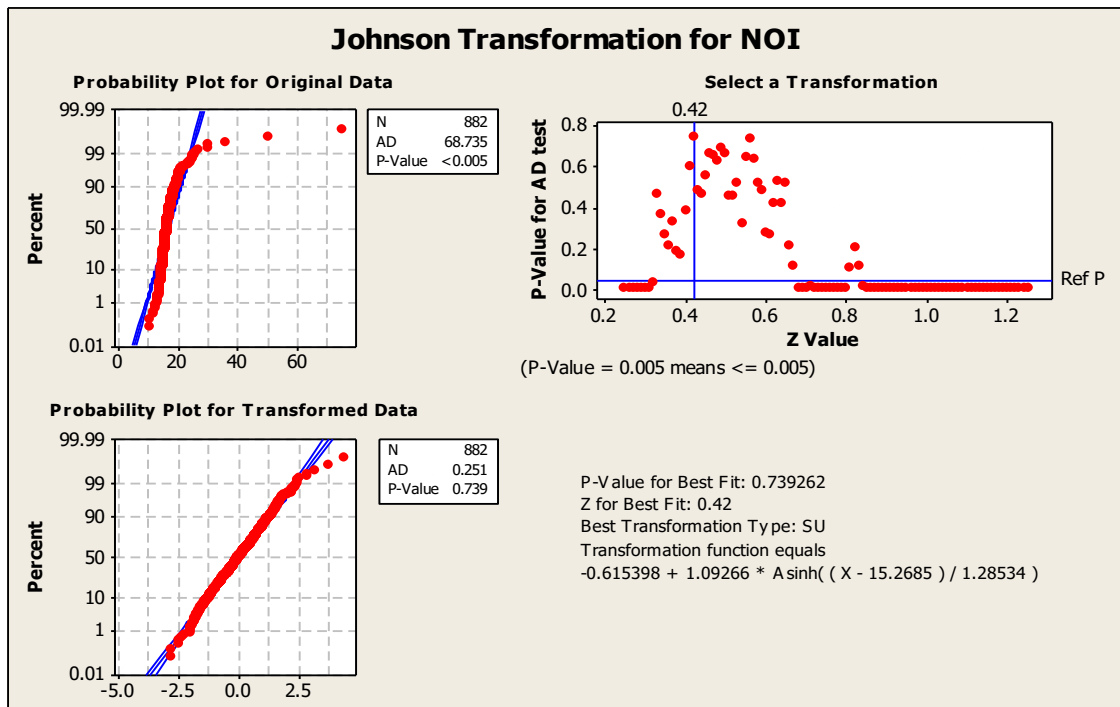


Chart 1. Johnson Conversion Net Operating Profit Ratio.

Considering that the significance level obtained for the ratio of net operating profit is equal to 0.0000, this value is less than 0.05, this variable's distribution is not normal. Therefore, the Johnson transformation method has been used for normalization.

After applying the Johnson transformations, the results of the Kolmogorov-Smirnov test are as follows:

Table 3. Kolmogorov-Smirnov test after normalization process.

Significance level	The net operating profit ratio	Indicator
0.21	0.013	Statistics

If the level of significance is greater than 0.05, then our dependent variable is normal, and this is the case with this variable, and our dependent variable is normalized.

4.3. Correlation between research variables

Table 4. Correlation Coefficient.

The net operating profit ratio			
Interpretation (the type of relationship)	Significance level	Correlation coefficient	
Straight and significant	0.000	0.422	Current ratio
Straight and significant	0.000	389	Cash flow cycle
Straight and significant	0.000	0.642	Net sales logarithms
Straight and significant	0.000	0.732	Total asset logarithm
Straight and significant	0.000	0.293	Return on equity

5. Estimation of Research Hypotheses

5.1. Estimation of the first hypothesis

Hypothesis 1: The neural network is used to predict the relationship between liquidity and profitability of the capital market; H_0 and H_1 of this hypothesis are as follows:

H_0 : Neural network is used to predict the relationship between liquidity and profitability of the capital market.

H_1 : Neural network is not used to predict the relationship between liquidity and profitability of capital markets.

Assign the number of sample members

In this study, according to Table 5, 71.43% of data is equivalent to 630 data as a training sample, and 28.57% of the data is equivalent to 252 data as a test sample.

Table 5. Assignment of sample members.

Percentage	Number		
71.43	630	Training	Sample
28.57	252	Testing	
100	882	Total	



Chart 2. Assigning the number of sample members

Summary of Neural Network Model

In order to predict the use of an artificial neural network model with the following specifications, which is also mentioned in Table 6:

- 1) Input layer with 5 units
- 2) The number of units in the middle layer (2 units)
- 3) Output layer with one unit
- 4) Hyperbolic Tangent: activity function used in the middle layer
- 5) Decision criterion for learning: mean absolute error
- 6) Decision criteria for choosing the best network structure: mean absolute error
- 7) Selection of the most effective variables in prediction: Intrusion Factor Strategy

Table 6. Summary of Neural Network Model

Current ratio	1	Independent and control variables	Input layer
Cash flow cycle	2		
Net sales logarithms	3		
Total asset logarithm	4		
Return on equity	5		
5	Number of input layers		Middle layer
2	The number of units in the middle layer		
Hyperbolic Tangent	Used function		Output layer
1	1	The dependent variable	
1	Number of middle layers		
Linear	Used function		
Average absolute error	Error function		

Neural Network Structure and Topology (Neural Network Architecture)

The neural network structure and the topology (neural network architecture) in Fig. 3 indicate that the neural network architecture has 1 dependent variable, 2 intermediate variables, and 5 independent variables.

Selection of the Best Network Structure to Predict

The absolute error obtained from this model's fit is 0.305 in the training sample, and the error value obtained in the testing test is 0.034. Since the error rate obtained in the Testing sample is less than the training sample, therefore fitting the model is acceptable.

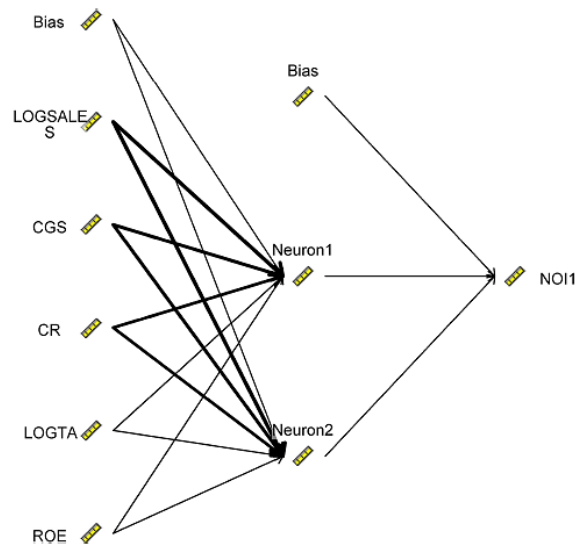


Chart 3. Neural Network Architecture.

Table 7. Selecting the best network structure for prediction.

	Minimum error	Maximum error	Average error	Average absolute error
Training	-0.266	1.453	0	0.035
Testing	-0.191	0.328	-0.003	0.034

Neural Network Estimation Accuracy

According to Table 8, the linear correlation in the training sample is 0.997. The testing sample is 0.999, which indicates accuracy in estimating both training and testing samples. The accuracy of the estimation is also 99.7%.

Table 8. Neural Network Estimation Accuracy.

Total	Testing	Training	
0.997	0.999	0.997	Linear correlation (estimation accuracy)

Ordering the effect of variables on prediction

In this study, based on the Bibi et al. (2017) model, a prediction of the ratio of net operating profit to the independent variable of the current ratio, cash flow cycle, net sales logarithm, total asset logarithm, and equity returns using the neural network method has been used. The ordering of the importance of independent variables in the neural network structure model is shown in Table 9 and Figure 4.

Table 9. How to enter variables into the neural network model

Priority	Level of importance	Independent and controllable variables
1	0.3786	Net sales logarithms
2	0.3182	Cash flow cycle
3	0.2701	Current ratio
4	0.0189	Total asset logarithm
5	0.0142	Return on equity

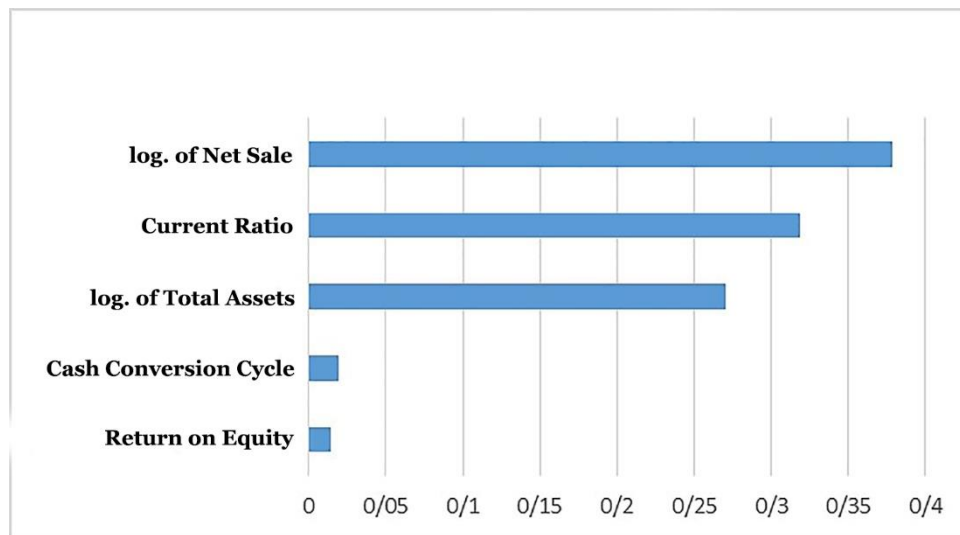


Chart 4. How to enter variables into the neural network model

5.2. Estimation of the Second Hypothesis of the Research

Second hypothesis: A backup vector machine is used to predict the relationship between liquidity and profitability of the capital market; H_0 and H_1 of this hypothesis are as follows:

H_0 : The backup vector machine is used to predict the relationship between liquidity and profitability of the capital market.

H_1 : The backup machine is not used to predict the relationship between liquidity and profitability of the capital market.

Assign the Number of Sample Members

In this study, according to Table 10, 71.43% of the data is equivalent to 630 data as training sample (learning), and 28.55% of the data is equivalent to 252 data as the test sample.

Table 10. Assignment of sample members.

Percentage	Number		
71.43	630	Training	Sample
28.57	252	Testing	
100	882	Total	

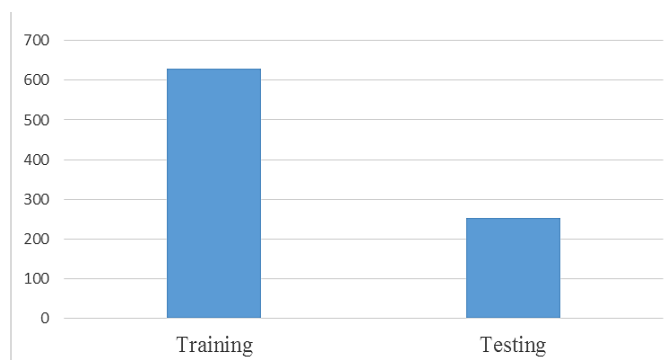


Chart 5. Assignment of sample members.

Summary of Vector Backup Model

In order to predict the use of a backup vector machine with the following specifications, which is also mentioned in Table 11.

- 1) Input layer with 5 units
- 2) Output layer with one unit
- 3) The algorithm: LSVM
- 4) Decision criterion for learning: mean absolute error
- 5) Decision criteria for choosing the best network structure: mean absolute error
- 6) Selection of the most effective variables in prediction: Intrusion Factor Strategy

Table 11. Summary of vector support model.

Current ratio	1	Independent and control variables	Input layer
Cash flow cycle	2		
Net sales logarithms			
Total asset logarithm	4		
Return on equity	5		
5		Number of input layers	
The net operating profit ratio	1	Dependent variable	Output layer
LSVM		Algorithm	
Linear		Function used	
Average absolute error		Error function	

Select the Best Network Structure to Predict

The mean absolute error obtained from this model's fit is 0.262 in the training sample, and the error value obtained in the testing sample is 0.24. Since the error rate obtained in the Testing sample is less than the training sample, therefore fitting the model is acceptable.

Table 12. Selecting the best network structure for prediction

	Min. error	Max. error	Ave. error	Average absolute error
Training	-9.722	1.424	-0.013	0.262
Testing	-1.544	0.857	0.02	0.24

The Precision of the Vector Backup Machine

According to Table 13, the linear correlation in the training sample is 0.872, and in the testing sample, it is 0.955. This is an indication of accuracy in estimating both training and testing. The accuracy of the estimation is also 0.892.

Table 13. Estimation accuracy of vector support machine.

Total	Testing	Training	
0.892	0.955	0.872	Linear correlation (estimation accuracy)

Arrays the Effect of Variables on Prediction

In this paper, based on the Bibi et al. (2017) model, we used the support of a backup machine to predict the ratio of operating profit from the independent variable of the current ratio, cash turning cycle, net sales logarithms, total logarithms, and return on equity. The order of the importance of independent variables in the model of the structure of the backup vector machine is shown in Table 14 and the following diagram.

Table 14. How to enter variables into backup vector machine model

priority	Level of importance	Independent and control variables
1	0.42	Net sales logarithms
2	0.24	Current Ratio
3	0.19	Total asset logarithm
4	0.15	Cash flow cycle
5	0	Return on equity

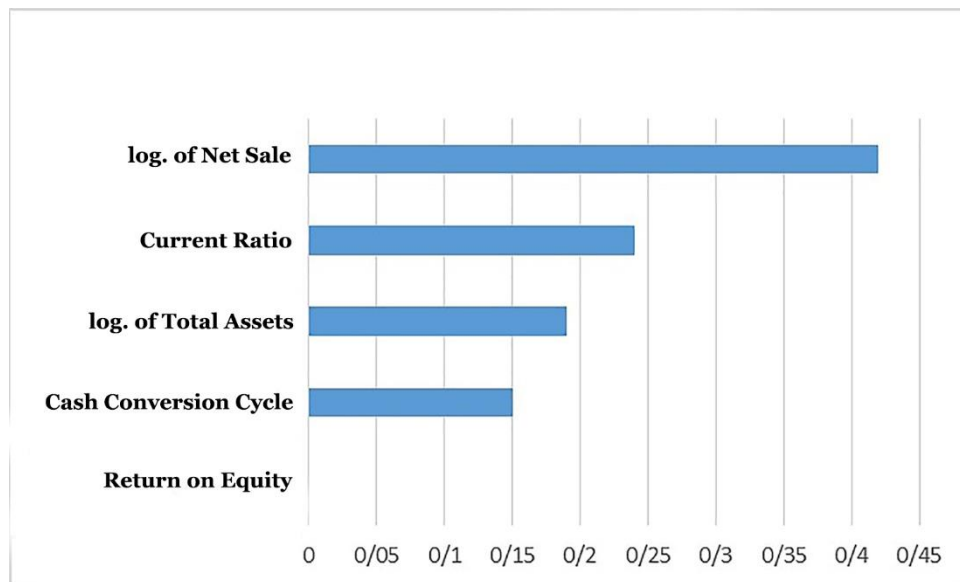


Chart 6. How to enter variables into a backup vector machine model

5.3. Estimation of the Third Hypothesis of Research

Hypothesis 3: The regression method is used to predict the relationship between liquidity and profitability of the capital market; H_0 and H_1 of this hypothesis are as follows:

H_0 : The regression method is used to predict the relationship between liquidity and profitability of the capital market.

H_1 : The regression method does not apply to predict the relationship between liquidity and profitability of capital markets.

Model Summary

Table 15 summarizes the regression of the third hypothesis:

Table 15. Model summary.

Correlation coefficient	Coefficient of determination	The adjusted coefficient of determination	Error standard deviation	Independent variable	Dependent variable
0.928	0.861	0.860	0.369292	1. Return on equity 2. Current ratio 3. The net sales logarithm 4- Cash Conversion Cycle 5. Total property logarithm	The net operating profit ratio

In this hypothesis, the correlation coefficient is equal to (0.928). This indicates a correlation among the return variables of equity, current ratio, net sales logarithms, cash flow cycle, and total asset logarithm with the net operating profit ratio. In this hypothesis, the variable of return on equity, current ratio, net sales logic, cash flow cycle, total asset logarithm can account for 86% of the net operating profit ratio.

ANOVA Test

The results of this test are summarized in Table 15.

Table 15. ANOVA test

Sig.	F	Average squares	df	Sum of squares	
0.000	1086.64	148.193	5	740.963	Regression
		0.136	876	119.466	Residual
			881	860.429	Total

According to Table 15, the significance level calculated for the statistics is equal to 0.0000 and indicates that the regression is significant at the 95% level.

Coefficient of Regression Effect

The regression effect table provides us with the necessary information to predict the dependent variable. The results of this test are summarized in Table 16.

Table 16. Coefficient of regression effect.

Significance level	T	Standardized coefficient of regression	Non-standardized coefficients		Variables
			Standardized Error	β	
0.000	-60.116		0.151	-9.082	Constant factor
0.000	36.250	0.473	0.012	0.447	Current ratio
0.000	17.722	0.274	0.006	0.103	Cash flow cycle
0.000	8.542	0.310	0.026	0.225	Net sales logarithms
0.000	14.574	0.533	0.025	0.370	Total asset logarithm
0.000	-8.099	-0.118	0.001	-0.006	Return on equity

In this research, the significance level of all variables is less than 5% less. Therefore, there is a significant relationship between the return on equity ratio, current ratio, net sales logarithm, cash flow cycle, total asset logarithm, and net operating profit ratio. The standardized regression coefficient also shows the effect of variables on the dependent variable. In this hypothesis, the standardized regression coefficient shows the effect of the independent variable on the dependent variable, for example:

- 1) For the current ratio variable, the standardized regression coefficient is equal to 0.473, which indicates the effect of the current ratio variable on the net operating profit ratio. It means that, by increasing one unit of the current ratio, the ratio of net operating profit increases to 0.473 units. Therefore, there is a significant and direct relationship between the current ratio with the net operating profit ratio.
- 2) For the cash flow cycle variable, the standardized regression coefficient is equal to 0.274, which indicates the effect of the variable of the cash flow cycle on the net operating profit ratio. It means that, by increasing one unit of the cash flow cycle, the net operating profit ratio increases to 0.274 units. Therefore, there is a significant and direct relationship between the cash flow cycles with the net operating profit ratio.
- 3) For the net sales logarithm, the standardized regression coefficient is equal to 0.310, which indicates the effect of the net sales logarithm variable on the net operating

profit ratio. It means that, by increasing a unit of the logarithm of net sales, the ratio of net operating profit increases by 0.310 units. Therefore, there is a significant and direct relationship between the net logarithms with the net operating profit ratio.

- 4) For the variable logarithm of the total assets, the standardized regression coefficient is equal to 0.533, which indicates the effect of the total logarithmic variables on the net operating profit ratio. It means that, by increasing one unit of the total asset logarithm, the ratio of net operating profit to 0.533 units increases. Therefore, there is a significant and direct relationship between the total asset logarithms and the net operating profit ratio.

For the equity return variable, the standardized regression coefficient equals -0.118, which indicates the effect of the return on equity ratio on the net operating profit ratio. With the increase of one unit of return on equity, the net operating profit ratio is reduced to 0.118 points. Therefore, there is a significant and inverse relationship between return on equity and net operating profit ratio.

6. Conclusion and Discussion

This research aims to use the data mining technique to predict the relationship between liquidity and the capital market's profitability. This research's theoretical basics are based on the library method and statistical data of financial statements of 147 companies extracted in this research in the capital market from 2013 to 2018 years. The data mining technique was used for data analysis, and SPSS MODLER 18 and SPSS 23 software were used to analyze the research results. The results of the research hypotheses are as follows:

Table 17. Summary of the results of research hypotheses.

Impact	Accept or Reject	Description of Hypothesis	Hypothesis number
√	Accept	The neural network is used to predict the relationship between liquidity and profitability of the capital market.	1
Interpretation: Since the testing sample's error rate is less than the training sample, then fitting the model is acceptable.			
Impact	Accept or Reject	Description of Hypothesis	Hypothesis number
√	Accept	A backup machine vector is used to predict the relationship between liquidity and the capital market's profitability.	2
Interpretation: Since the testing sample's error rate is less than the training sample, then fitting the model is acceptable.			
Impact	Accept or Reject	Description of Hypothesis	Hypothesis number
√	Accept	The regression method is used to predict the relationship between liquidity and profitability of the capital market.	3
Interpretation: Since the significance level of all variables is less than 5%, there is a significant relationship between the return on equity ratio, current ratio, net sales logarithm, cash changeover cycle, the total logarithm of the asset with the ratio of net operating profit.			

The research hypotheses contradict Bibi et al.'s (2017) research, Dahiyat et al. (2016). In their research, Bibi et al. (2017) investigated the relationship between liquidity and profitability (Karachi stock exchange case study). The results of this study indicate that there is a significant relationship between total asset logarithm and net sales logarithm

with asset returns. Dahiyat et al. (2016) also investigated the relationship between liquidity and the ability to pay off debt on profitability and concluded that liquidity was significantly negatively correlated with profitability. The difference in this research results with the published research results is the lack of transparency of information in the Iranian capital market.

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