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Prediction of Economic Value Added status of Tehran Stock Exchanges by using Genetic Algorithm

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Abstract

The main purpose of this article is to present a model to predict the status of economic value added of Tehran Stock Exchanges by using Genetic Algorithms.

Investors' concern of the return of principle as well as profit of their investment has led us to forecast status of economic value added as a basis to evaluate companies' performance. Predicting the status of economic value added is one of the ways that can be used to exploit investment opportunities and also to avoid waste of resources. Firstly, necessary warnings can alert companies toward their future performance, moreover investors can recognize good and unfavorable investment opportunities.

In this research, independent variables are defined as: Equity premium Reserve, R & D Reserve, Precautionary Reserve, Legal Reserve, Special Reserve, Capital expenditures, Interest Bearing Liabilities, Finance Costs, Capital, Sum of Equity, Long Term Receivables, Nopat, Return of Capital, Investing, Accumulated Profit and Loss, Earning after interest and tax, Receivable Financing Facility and Economic Value Added is as a Dependent variable. The studied population is the accepted companies in Tehran Stock Exchange for the period of 1385 to 1391.

At first, by using average test among the variables, those variables that have a significant difference in the two groups of firms with positive EVA and negative EVA are specified. To do so, independent sample T Test from SPSS software is used.

Then, using the techniques of Genetic Algorithms, Which is one of the best evolutionary algorithms, variables with greatest ability to distinguish between positive EVA and negative EVA are specified then the predictive model is derived.

Derived model from the algorithm enabled us to classify the companies with negative economic value added into the correct categories of negative and positive economic value added, one year prior to the occurrence of negative EVA, with an accuracy of 83%.

Keywords: Prediction, Economic value added, Genetic algorithm

Introduction

In today's world one of corporate goals is creating value for shareholders, thus corporate executives are looking for strategies to increasing their wealth and value. There are different methods to evaluate these strategies. Logical concerns of investors about return of principal and interest of their investments caused in this study we look to predict the situation of economic value added as a basis for evaluating company performance.

Performance evaluation criteria can be divided into accounting and Economics categories with regard to accounting concepts and economic concepts. In accounting criteria, corporate performance is evaluated according to accounting data, while in the economic criteria, corporate performance is evaluated according acquisition power of existing assets and potential investors with regard to the rate of return and the rate of cost of capital.

Each one of traditional criteria of performance assessment has a number of disadvantages that if used as the basis for measurement, performance measurement and determining of the value of company will not be in accordance with the existing reality[7]. Economic value added is the only criterion which calculates the value of the company in real terms and is the fundamental indicator to measure the performance and determining of the value of the company [4].

As mentioned one of the ways that with using it can be paid to the proper utilization of investment opportunities and also prevention of waste of resources and assessment of performance, is prediction of the situation of economic value added. In this way, first by offering the necessary warnings, could be informed companies about their performance in the future because they enable to take appropriate actions according to these warnings, and second, investors enable to recognize favorable investment opportunities from undesirable opportunities and enable them to invest their resources in the right opportunity and places.

So the main subject of this study is providing a predictive model which predict negative economic value added before its occurrence. In this study, prediction model which will be presented using a genetic algorithm, is tools of financial variables analysis and also tools which used to develop this prediction model are financial variables which derived from the financial statements. Also the suitability of these variables will be discussed for modeling.

Evolutionary algorithms have advantages compared with other methods that enable its for widely used. For example, these algorithms don't need to full defining problem and can work just with having some information about defining the problem. Also have not restrictions about fitness function and it's not necessary that this function be differentiable, for example.

In addition to these, because evolutionary algorithms have population of organisms and work on different parts of the population in parallel, they have less likely to be at the local optimum. This capability of evolutionary algorithms allow that the optimization and forecasting carried out in parallel on several sections of the population.

In this study, genetic algorithms is used as one of the best evolutionary algorithms to predict the economic value added.

The aim of this study is build a model to predict the situation of economic value added with using of genetic algorithms which be consistent with the country's economic system, be established based on the variables affecting Iran and have optimal performance and satisfactory in forecasting economic value added. The algorithm inputs include: accumulated profit and

losses, legal reserve, Intrest Bearing Liabilities, Sum of Equity at the end of the fiscal year, CAPITAL, the rate of cost of capital (C), financial costs, Profit(Cost) After Tax, NOPAT and Rate of return on capital (r).

Research History

Economic Value Added which is a measurement criteria of financial performance and is a tool to calculate the amount of value created for shareholders and also is a tool for decision making in investing in a company, is a criterion which also was considered cost of capital used in the company to evaluate company performance. Economic Value Added is excess return that is created in result of perform an investment. On the other hand, Bacidore et al (1997) noted that Economic Value Added can be used the basis for calculation of management bonuses as a financial performance measurement tool, becuase on the one hand, EVA is highly related to the change in shareholder wealth and on the other hand does not have a negative impact on stock prices of companies. Also , EVA helps to creat communication between accounting data of a company and its stock market performance. Also, in addition to evaluating the performance of managers, EVA can be used as a tool for financial analysis and decisions making about investments in different projects (Farsio et al., 2000).

Foreign studies that have been done on the Economic Value Added

In the late 1980s, Stern Stewart Company used widespread advertising to introduce EVA. Until now, more than 300 companies, including large and international corporations like Coca-Cola and Siemens used this system in action and used this criteria as internal and external evaluation criteria, instead of profits or operating cash flow. "Stern Stewart" Institute which is research-advisory firm, works In the field of "Financial Management System, EVA".

In 1994, Stewart in his research showed that EVA is the best criteria for wealth among other criteria that are its contemporaries, in Fortune Journal some titles were published for EVA like "Real Solution for Value Creation" (1993), "A new way to find customers" (1996) and company annual classification that named "1000 Performance" that its data is extracted from Stern Stewart Institute (1993 to 1997). Also, based on research conducted in April 1995 is predicted that EVA will be alternative to EPS in the future for operation reporting in financial market. In 2009, a study by Hamid Reza Abbasi was done thate named as "Predicting bankruptcy of companies accepted in Tehran Stock Exchange with using of neural networks and genetic algorithms". The results showed that artificial intelligence models have high potential in predicting bankruptcy of financial companies and also, due to the necessity and importance of accuracy at the highest level was detected that genetic algorithms have done better performance than neural networks and have greater accuracy.

In 2003, a study by Alireza Kavousi was done that named as "The relationship between the proportion and EVA in firms that accepted in the Tehran Stock Exchange".

The results showed that there is a significant correlation between Tobin's Q ratio and EVA and EVA can be considered a appropriate replacement for Tobin's Q ratio.

In 2003, a study by Nasser Izadinia was done that named as "Evaluation of business units with using of EVA models and free cash flows and determining the price gap and shareholder value". The results showed that in Iran capital market, there is a significant relationship between stock

prices, the market value corporate, market value added and value creation factors such as EVA and free cash flow.

In 2011, a study by Mahmoud Firouzian et al was done that named as "Application of genetic algorithm in predicting bankruptcy and its comparison with Altman Z score in Companies that accepted in the Tehran Stock Exchange". On average in a year and two years before the base year Genetic algorithms model respectively have 90 and 91.5 percent accuracy, and Altman Z score has an accuracy of 83.32 and 83.32 percent. According to the results, the genetic algorithm is more accurate in predicting bankruptcy, as a result, is more suitable tool to predict. In 2011, a study by Hamideh Nazarian was done that named as "Using artificial intelligence methods in prediction of total price index of Tehran Stock Exchange". The result showed that Genetic Algorithm makes improvement in the model which has been obtained by neural network model.

In 2011, a study by Qodratollah Emamverdi et al was done that named as "Forecasting return index of Tehran Stock Exchange: Application of Neural Network Based on Genetic Algorithm". The results of this study showed that artificial neural network Model based on GMDH algorithm have a remarkable performance in the return series of Tehran Stock Exchange (in the sample period) and is able to provide accurate predictions than ARIMA model.

Conceptual Model

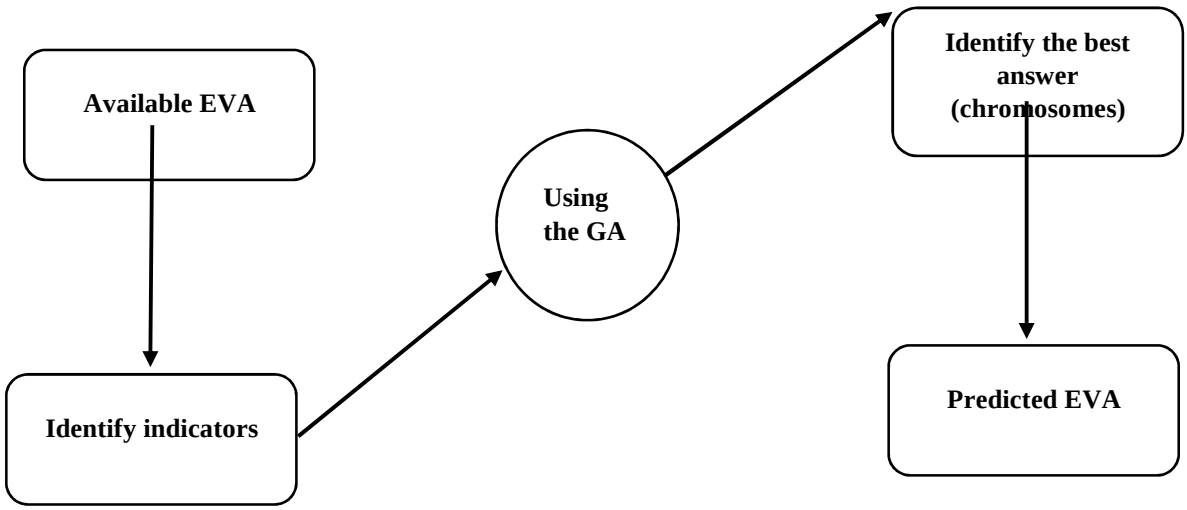


Figure 1: Conceptual Model of Research

Theoretical Foundations of Research

Economic Value Added (EVA)

EVA is a measurement Criterion of performance that calculate correctly ways which lead to increase or loss of company value. This metric represents the profit remaining after deducting the cost of capital.

Economic Value Added as an evaluation criterion, considers the opportunity cost of shareholders and the time value of money and fix distortions that is caused by using of accounting principles.

EVA is a Criterion that deduct opportunity cost of all business resources in the company from net operating profit. In other words, positive EVA represents optimum resource allocation to shareholders and conversely, a negative EVA represents a waste of resources and loss of wealth of shareholders.

EVA concept proponents claim that this index is the best evaluation criterion of performance. Because as an evaluation criterion, considers the opportunity cost of shareholders and the time value of money and fix distortions that is caused by using of accounting principles.

If EVA was greater than zero, the company succeeded and created wealth for its shareholders.

If EVA was equal to zero the company just achieved returns equal the cost of capital so the added value is zero.

If EVA was less than zero, it means that shareholder wealth was wasted in this situation generally stock was sold in these firms.

Application of EVA

Applications of economic: knowing the economic capabilities of firms such as the productivity of resources and production factors.

Application of management: knowing the capabilities and human resource functions such as the production employees for performance evaluation.

Application of accounting: logical and useful financial analysis of financial condition and performance of economic institutions in compared with accounting profit.

The method of EVA calculation

Following equation is used for EVA calculation:

Equation 1) $EVA= (r-c) * Capital$

In Equation EVA is economic value added

r: rate of overall efficiency of capital

c:rate of cost of capital.

The method of calculating of rate of overall efficiency of capital (r)

This formula is calculated using the following formula based on the financial approach:

Equation 2) $r = NOPAT / CAPITAL$

In equation NOPAT is equal with:

NOPAT = Accounting profit after deduction of taxes + Interest costs - Tax savings in interest costs + Doubtful Receivables Cost + Cost of Reduction of inventory value + Cost of Reduction of investments value + Deferred Costs + Cost of End of service benefits

Tax savings in interest costs = Interest costs * Effective tax rate

Capital is calculated like following ways:

Capital = Rights of shareholders + Intrest Bearing Liabilities + Save of Reduction of inventory value + Save of Reduction of investments value + Cost of Doubtful Receivables + Save of End of service benefits + Save of deferred costs

Intrest Bearing Liabilities = Received facilities From banks + sales collected in advance + Bonds payable

Sales collected in advance of products in the above formula, is Intrest Bearing Liabilities for companies that sell their products with annual contribution profit. Costs are equal with capital except interest costs and mentioned save in the NOPAT and Capital formula.

Since cost of End of service benefits in Iran for companies that have save of End of service benefits and is cost of non-cash component, this costs and its saves are equal with capital.

The method of rate of cost of capital

Weighted Average Cost Of Capital (WACC) is used for calculation of rate of cost of capital. Applying this method requires the identification of financial resources of companies and then cost of each of these resources should be calculated. Based on the balance sheet of companies that is test, these companies have used the following sources:

1. Intrest Bearing Liabilities

2. New ordinary shares

3. Other components of Rights of shareholders

In this case, rate of cost of capital is calculated with Weighted Average as follows:

Equation 3) $WACC = [Wd * Kd (1- t)] + (Wc * Kc) + (Ws * Ks)$

Wi = The weight of each of the sources of all resources, T = Effective tax rate, K = rate of cost of capital of each of the sources

Genetic Algorithm

A genetic algorithm is a problem-solving technique that has been established based on Darwin's theory of natural selection in natural evolution garlic. In the seventies a scientist from the University of Michigan that named John Holland introduced the idea of using genetic algorithms in engineering optimizations. In fact, the basic framework of genetic algorithm was developed by John Holland. The basic idea of this algorithm is transmission of hereditary characteristics by genes.

Methods of genetic algorithm is that first, the initial population of chromosomes are formed. Each chromosome is made up of several genes and could be an answer to the problem. The

initial population are generated randomly and are named as parents. Each problem has a fitness function or assessment that evaluate the degree of suitability of each chromosome. In other words, every chromosome has a fitness, which ultimately determines the probability of its survival. A series of actions of integration and mutation is carried out on chromosome and a new population that is named children, is obtained. Then chromosomal analysis of child will be discussed and the best answer is selected from between parents and children as the new generation and the above actions are repeated. This cycle continues until a solution is found with desired accuracy or number of predetermined repetitions will occur.

Coding and presentation techniques

The first step in designing a genetic algorithm is providing a plan for replies encoding. Surely, finding the appropriate coding method is part of art of using of genetic algorithms.

Selection methods: One of the steps of genetic algorithm is the selection of population of next generation. Choose action specifies that which of chromosomes are involved in next generations in reproduction. There are several methods to choose. In most selection methods, chromosomes are selected with a possibility of proportional selection with its fitness value. In fact, selection criteria, is the fitness function. Methods that are listed below, are the most common methods of choice.

Operators: Usually integration and mutation operators are used in a simple genetic algorithm, in the following, this operators are discussed.

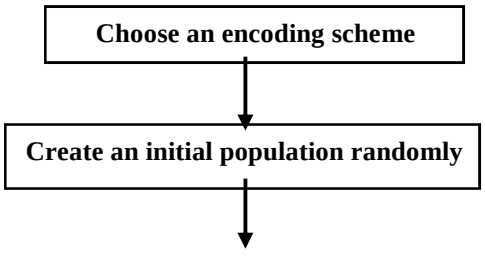
Integration Operator: The purpose of integration operator is space exploration of parameter and as much as possible is keep the information contained in chromosomes. Integration operator is a combination operator that includes three action. First, a pair of chromosomes are selected randomly. In the next step, in each chromosome one place is chosen randomly for integration, and finally contents of two chromosomes are exchanged from integration of sites that are selected.

Mutation Operator: After the merger of chromosomes, it is the turn of the mutation. Mutation Operator is done with binary coding that a bit of a chromosome is selected randomly, if this bit is zero it is changed to one and Vice versa.

Mutation operator is usually considered as a secondary operator and in order to keep the information that is being lost. This operator is useful to prevent of fast convergence and help to search algorithm for escape from being trapped in local optimum points. Also this operator is used for maintaining different modes and distinguishing chromosome in a population.

In summary, mutations function causes to movement in the search space.

Stages of Genetic Algorithm



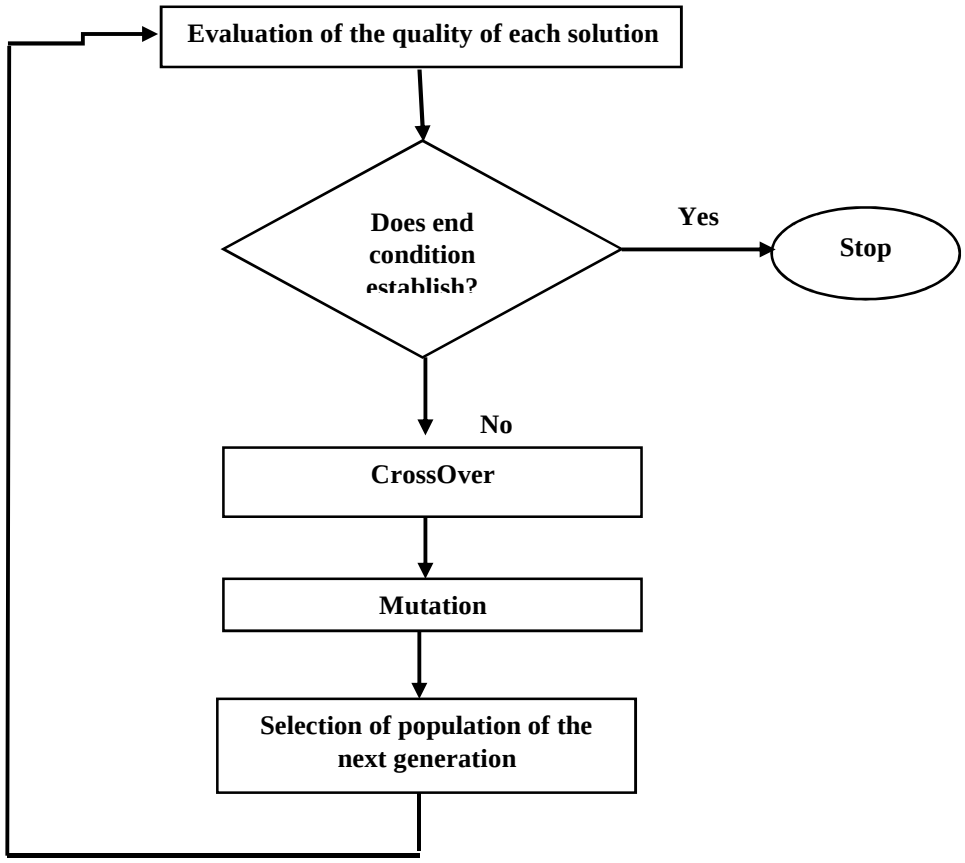


Figure 2: Flowchart of Genetic Algorithm

Research Hypothesis

Hypothesis 1: "Stock Reserve" can be used in modeling of forecast of EVA

Hypothesis 2: "R & D Reserve" can be used in modeling of forecast of EVA

Hypothesis 3: "Precautionary Reserve" can be used in modeling of forecast of EVA

Hypothesis 4: "Legal Reserve" can be used in modeling of forecast of EVA

Hypothesis 5: "Special Reserve" can be used in modeling of forecast of EVA

Hypothesis 6: "C" can be used in modeling of forecast of EVA

Hypothesis 7: "Intrest Bearing Liabilities" can be used in modeling of forecast of EVA

Hypothesis 8: "Finance Costs" can be used in modeling of forecast of EVA

Hypothesis 9: "Capital" can be used in modeling of forecast of EVA

Hypothesis 10: " Sum of Equity at the end of the fiscal year " can be used in modeling of forecast of EVA

Hypothesis 11: "Long Term Receivables" can be used in modeling of forecast of EVA

Hypothesis 12: "NOPAT" can be used in modeling of forecast of EVA

Hypothesis 13: "r" can be used in modeling of forecast of EVA

Hypothesis 14: "Investing" can be used in modeling of forecast of EVA

Hypothesis 15: "Other Items of Equity" can be used in modeling of forecast of EVA

Hypothesis 16: "Accumulated Profit and Loss" can be used in modeling of forecast of EVA

Hypothesis 17: "Profit(Cost) After Tax" can be used in modeling of forecast of EVA

Hypothesis 18: "Receivable Financing Facility" can be used in modeling of forecast of EVA

Hypothesis 19: Genetic algorithm has the appropriate power to predict the EVA of companies

Period of the study was selected between 2006 to 2012. This research is applied research and data were collected through a survey method that is based on analysis of data which is collected from statistical society.

There is 18 variables to predict the genetic algorithm, Related and more effective variables should be detected to import in the genetic algorithm through Independent Sample T-test and then are imported in GA.

Implementation of Average test and selection of variables

First, with run of average test among variables, variables that have a significant difference between the two groups of companies with positive EVA and negative EVA, are specified and are entered in the genetic algorithm, then using genetic algorithms techniques, variables with greatest ability to distinguish between positive EVA and negative EVA are specified then the predictive model is derived.

Independent Sample T-test was selected to do this. The significance level of 5% was selected to test of hypotheses. SPSS 20.0 was used to perform this test. In all tests of hypothesis, H0 that is the statistical hypothesis, represents equality of average of each variable between two groups. If the collected data related to a variable, rejects H0, then this variable can be used in forecasts of EVA.

So H0 and H1 hypothesis could be wrote as follows:

H0: Average of X variable is equal between the two groups of positive and negative EVA.

H1: Average of X variable is significantly different in two groups with positive and negative EVA.

H0 rejection and H1 acceptance is means that intended variable has a high ability to distinguish companies with positive EVA and EVA negative. In the other words, research hypothesis acceptance is means that variable values is different in companies that have positive EVA with companies that have negative EVA. In the following, results of hypothesis test are showed:

Table 1: Results of Independent Sample Test

Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Stock Reserve	Equal variances assumed	5.443	.020	-1.161	530	**.246**	-178.36003	153.61828
	Equal variances not assumed			-.953	213.892	.342	-178.36003	187.11134
R & D Reserve	Equal variances assumed	4.716	.030	-1.096	530	**.274**	-38280.22525	34936.77194
	Equal variances not assumed			-.956	265.931	.340	-38280.22525	40033.73474
Precautionary Reserve	Equal variances assumed	5.527	.019	-1.180	530	**.239**	-1885.67587	1598.05776
	Equal variances not assumed			-.969	214.393	.333	-1885.67587	1945.10438
Legal Reserve	Equal variances assumed	27.860	.000	-3.007	530	**.003**	-63791.21332	21214.39825
	Equal variances not assumed			-2.654	277.900	.008	-63791.21332	24033.44127
Special Reserve	Equal variances assumed	2.707	.100	.820	530	**.413**	45.29245	55.22891
	Equal variances not assumed			1.000	317.000	.318	45.29245	45.29245
C	Equal variances assumed	66.783	.000	4.053	528	**.000**	51621.25514	21562.37103
	Equal variances not assumed			3.645	297.623	.000	-8994234.62715	3075022.757551
ntrest Bearing Liabilities	Equal variances assumed	26.713	.000	-2.621	530	**.009**	-7602511.91086	2900561.80804
	Equal variances not assumed			-2.149	213.004	.033	-7602511.91086	3537410.69662
Finance Costs	Equal variances assumed	7.140	.008	1.985	529	**.048**	51621.25514	26000.94743
	Equal variances not assumed			2.394	338.576	.017	51621.25514	21562.37103
Capital	Equal variances assumed	27.939	.000	-2.925	530	**.004**	-8994234.62715	3075022.757551
	Equal variances not assumed			-2.400	213.617	.017	-8994234.62715	3746915.09803
Sum of Equity	Equal variances assumed	28.610	.000	-3.353	530	**.001**	-1391722.71628	415015.21724
	Equal variances not assumed			-2.893	254.493	.004	-1391722.71628	481141.92876
Long Term Receivables	Equal variances assumed	15.169	.000	-1.939	530	**.063**	-3291.45794	1697.83413
	Equal variances not assumed			-1.590	213.000	.113	-3291.45794	2070.62349
Nopat	Equal variances assumed	10.416	.001	-2.069	530	**.039**	-327234.9615	158136.2153
	Equal variances not assumed			-1.912	333.758	.057	-327234.9615	171189.9989
r	Equal variances assumed	9.128	.003	1.802	272	**.05**	51621.25514	26000.94743
	Equal variances not assumed			1.802	255.686	0.05	51621.25514	21562.37103
Investing	Equal variances assumed	29.743	.000	-3.475	530	**.001**	-806315.98652	232052.71853

	Equal variances not assumed			-2.958	242.438	.003	-806315.98652	272608.10652
Other	Equal variances assumed	10.416	.001	-2.069	530	**.069**	-327234.96155	158136.21539
	Equal variances not assumed			-1.912	333.758	.057	-327234.96155	171189.99890
Accumulated Profit and Loss	Equal variances assumed	15.403	.000	-2.152	272	**.032**	-163769.47312	125505.40959
	Equal variances not assumed			-2.152	136.027	.033	-163769.47312	133717.41660
Profit(Cost) After Tax	Equal variances assumed	28.610	.000	-3.353	530	**.001**	-1391722.71628	415015.21724
	Equal variances not assumed			-2.893	254.493	.004	-1391722.71628	481141.92876
Receivable Financing Facility	Equal variances assumed	26.714	.000	-2.620	530	**.09**	-7599220.45292	2900584.69992
	Equal variances not assumed			-2.148	213.004	.053	-7599220.45292	3537438.61497

Among 18 initial variables, 11 variables was confirmed, and it is means that 11 variable can be participated in prediction model of EVA by GA.

Table 2: Input Variables of Genetic Algorithm

Variables Definition	**Variables**
Accumulated Profit and Loss	X1
Legal Reserve	X2
Intrest Bearing Liabilities	X3
Sum of Equity at the end of the fiscal year	X4
CAPITAL	X5
Capital	X6
C	X7
Finance Costs	X8
Profit(Cost) After Tax	X9
NOPAT	X10
r	X11

Research Methodology

Coding Method

At designed algorithm in this study, coding is done in the form of a matrix. Each chromosome represents a rule and the number of terms (Row of the matrix) can be from one to eleven (Number of variables that accepted in the previous step). The number of rows of each matrix represents the number of conditions of each rule and the number of columns is three. The first

column contains the variable name, the second column contains variable sign and the third column contains allowable amount (Greater than or less than) that variable can accept.

The initial population: The initial population size is 500. To make each chromosome, following steps will be done:

1. First, variable must be selected, a random number is created in the range of variables (ranging from 1 to 11) for variable selection. Variable name that is corresponded to the obtained random number, will be considered as the first condition variable, for example, if the random number that is obtained in Step 1, was 2, the second variable (legal reserve), will be selected as variable names.

2. At this step, the Operator is selected. Between 0 or 1, one number will be selected randomly. Zero indicates operator of smaller than (>) and the one indicates operator of greater than (>).

3. In the third step, the variable value is obtained in the form of random number between the highest and lowest number.

4. 1 to 3 steps are repeated until the number of conditions that is considered to Rules.

Integration Operator : In this algorithm, a single-point integration Operator is implemented and its work is like follow: after determining the two parents through the roulette wheel, a random point is selected as the point of integration and lines of two parent are exchanged between an integration point.

Mutation Operator: To apply Mutation operator, a gen is selected randomly after selecting chromosomes randomly, and a number of new range are replaced the previous range.

Fitness Function: Fitness function is designed as follows to evaluate the suitability of chromosomes or answers. The more the answer was appropriate, the more it have larger fitness value. So chromosome that is more graceful, participate more likely to produce the next generation of company and the more of its sequence is created and inappropriate chromosome are deleted.

Since the purpose of the model in this study, is prediction of negative EVA, as a result, desirability is detection power of negative EVA by algorithm.

p.fit=w1*e1-w2*e2-w3*e3;

e1: The average number of correct predictions of negative EVA in various years

e2: The average number of incorrect predictions of negative EVA in various years, this means that applies in the Rule but have positive EVA.

e3: The average number of companies that are not predictable using the Rule.

w1, w2 and w3 are coefficients that show the importance of factors that make up the fitness function. These coefficients are changeable and reviewable. So, by placing different values for the coefficients and algorithm implementation, the best value for them are Oobtained.

w1 = 0.8;

w2 = 0.175;

w3 = 0.025;

Selection Method

Chromosomes selection in the algorithm is done based on the roulette wheel, function of roulette wheel is as follows:

We assume that we have four "Solution" and the best answer was selected by the roulette wheel among them. We want a solution that is better, have a greater chance to selection.

The first work that is done in the roulette wheel, is normalization of answers, and then answers are wrote in the form of cumulative and a random number is selected, in this way, a solution that is selected, is the first answer from the beginning. In the following example , if the random number was 0.3, then Sol 1 was selected.

Solution	Fitness	P	Cp
Sol1	4	0.4	0.4
SOl2	3	0.3	0.7
SOl3	2	0.2	0.9
SOl4	1	0.1	1

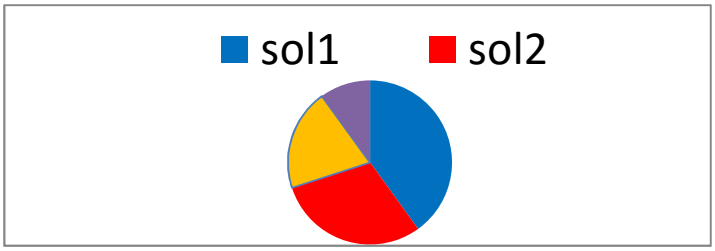


Figure 3: A demonstration of the roulette wheel

Determining of the initial parameters

To build the model, first, the number of variables of problem, the number of initial population, the maximum number of repetitions, integration and mutation rate have been specified.

Table 3: Table of the Initial Parameter of Genetic Algorithm Input

The number of Variables	nvar=11; % number of varible
The number of initial population	npop=500; % number of population
Integration rate	pc=0.7; %Percent of crossover
The number of integration process	ncross=2*round(npop*pc/2);
Mutation rate	pm=0.3; %Percent of mutation
The number of mutations process	nmut=round(npop*pm);
The maximum number of iterations	maxiter=300; % max of iteration

The number of problem variables is 11 that is extracted from SPSS test in previous step.

The initial population of model included 500 chromosomes.

Integration rate that is considered in this model, was 0.7. As a result, 0.7 * 500 means 350 merger children will be expected in each iteration.

Mutation rate was considered 0.3. As a result, 0.3 * 500 means 150 mutation children will be expected in each iteration.

Algorithm stop condition

First, a number of iteration is considered to algorithms, it is changeable and adjustable in model code. But the algorithm might reach to the point that continue of algorithm does not have improvement in the response. In this case, if the answer were unchanged after 80 repeated, algorithm was stoped.

Using the Matlab software Edition 2012 and considering the mentioned fitness function and initial population of 500, genetic algorithms process was carried out and GA selected the following variables as variables that have the highest resolving power of group of companies with positive and negative EVA after 300 iterations.

Research Findings

The software output is as follows.

==========

BEST Solution =

9	0	5.2818e+06
10	0	1.338e+07
2	0	6.0604e+06
7	1	0.13198
6	0	4.5874e+07
11	0	0.49898

==========

BEST Fitness =74.8

Finally, a law that algorithm generate to predict negative EVA, is as follows.

If $x9<5.2818\times10^{6}$ and $x10<1.338\times10^{7}$ and $x2<6.0604\times10^{6}$ and $x7>0.13198$ and $x6<4.5874\times10^{7}$ and $x11<0.49898$

then EVA(next year) < 0

By replacing the variable names rules are as follows:

If

Profit(Cost) After Tax	<	5.2818×10^{6}
NOPAT	<	1.338×10^{7}
Legal Reserve	<	6.0604×10^{6}
C	>	0.13198
Capital	<	4.5874×10^{7}
r	<	0.49898

Then EVA is negative in the next year.

Designed algorithm has been given with about 1200 data related to 2006 to 2009 years. Forecast accuracy on training data has been given in the separate years in the following table. Also, forecast accuracy on the experimental data has been shown in the following table.

Table 4: Accuracy of the algorithms in different years

	Training				Experimental	
Year	2007	2008	2009	2010	2011	2012
Accuracy	0.88372	0.85401	0.85065	0.86188	0.83482	0.82047

As can be seen, accuracy of the model in training is more than experimental years. The results show that Genetic Algorithm model could provide favorable results in prediction of future status of accepted companies in Tehran Stock Exchange using their financial statements. So, the nineteenth hypothesis of this study that expresses the ability of genetic algorithm for prediction of company's EVA, is approved.

Conclusion

People always are looking for ways to be aware of the future and organize it in accordance with their desire. Necessary of future understanding, is predicting the future. Prediction can be used in the field of accounting and financial sciences like any other science.

Investors logical worries about return of principal and profit of their capital caused that in this study, is paid attention to EVA forecast as a basis for evaluating the performance of companies. One of the ways that can be used as proper utilization of investment opportunities and also prevention of waste of resources, is EVA forecast. In this way, first, companies can be informed about their performance in the future by providing the necessary warnings, so they can take appropriate measures by this warnings and second, investors can recognize optimal investment opportunities from undesirable opportunities and invest their resources in appropriate opportunities and places.

so, In this study, is tried using the provided information in the financial statements of companies that accepted on the Tehran Stock Exchange, one model is provided to EVA forecast using Genetic Algorithm as one of the capable techniques that are without any preconditions and assumptions about the distribution of the data. The results showed that companies's EVA in Iran is predictable with reasonable accuracy and created model by the genetic algorithm have high capable of EVA forecast.

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