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Evaluation of Islamic Banking Efficiency in Iran

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Abstract

Purpose *– In this study, it is attempted to examine the Islamic banking practice in Iran based on new scientific methods.*

Design/methodology/approach- *It is used the financial ratios demonstrating healthy or non-healthy of banks to assess the financial health of listed banks in Tehran Stock Exchange. The assessment of these ratios with use of decision tree as a non-parametric method for modeling is recommended for presenting this model. Information about the financial health of banks could be effective on the decisions of different groups of banks' financial reports users, including shareholders, auditors, stock exchange, central bank and etc.*

Findings *– the results of the study show that Decision Tree is strong approach in order to classifying Islamic banks in Iran.*

Originality/value*- So far, several studies have been conducted in various countries on the topic of this study. Considering the importance Islamic banking, it is almost the first study in Iran and the outcomes of the study may helpful to Iranian economy.*

Key words*: Islamic Banking, efficiency, Shariah, Iran*
JEL: G15, G18, G21

1. Introduction

One of the most important institutions in today society is bank. Today's, banks are so important in everyday life of people that it seems impossible to imagine life without a bank. Bank strongly linked with currency's concept is as if a heart runs money into the society's vessels; any change and chaos of this heart can paralyze the society. This huge and powerful entity plays an important role in all developed and underdeveloped countries as an influence power, authority or any power factor in all societies.

Positive and effective activity of banks can be effective on economic sectors growth and increased productions in per unit or economic development in some areas. Most of the monetary exchanges would be done by banks in today's world.

Managing the peoples' life affairs and countries' economic affairs requires banks. It is possible to have a good influence on the decisions of users according to the importance of banks in modern societies with classifying the banks based on their financial health.

In this study, we have used 36 independent variables that determine the financial health of banks. Each variable is divided into three groups of the least important, important and the most important based on the degree of its importance to have data with better quality for category.

In this study, financial health classification modeling of banks has been considered. Here, it is possible to identify effective factors in determining the financial health of banks with utilizing the data mining tools, including the analysis of each independent variable.

Decision tree-based method is selected to categorize because of the complexity of this issue. Although the decision tree-based methods have been used in various fields, they have been rarely used for classification of banks.

The structure of this article continuation is organized as follows:

In the section 2, the proposed method steps for classification are described. The process of data mining involves data collecting, preprocessing and the quality of extracted factors affecting on the classification of banks are described in section 3. Subsequently, it involves the classification results of banks and discussion on the results of section 4 and ends with collecting and presenting the suggestions in section 5.

2. Islamic Banking

The first modern experiment with Islamic banking can be traced to the establishment of the Mit Ghamr Savings Bank in Egypt in 1963. During the past four decades, however, Islamic banking has grown rapidly in terms of size and the number of players. Islamic banking is currently practiced in more than 50 countries worldwide. In Iran, Pakistan, and Sudan, only Islamic banking is allowed. In other countries, such as Bangladesh, Egypt, Indonesia, Jordan and Malaysia, Islamic banking co-exists with conventional banking. Islamic banking, moreover, is not limited to Islamic countries.

In Islam, there is no separation between mosque and state. Business, similarly, cannot be separated from the Islamic religion. The *Shariah* governs every aspect of a Muslim's religious practices, everyday life, and economic activities. Muslims, for example, are not allowed to invest in businesses considered non-*halal* or prohibited by Islam, such as the sale of alcohol, pork, and tobacco; gambling; and prostitution. In Islamic contracting, Gharar (uncertainty and risk) is not permitted, i.e., the terms of the contract should be well defined and without ambiguity. For example, the sale of fish from the ocean that has not yet been caught is prohibited. The prohibition of Gharar is designed to prevent the weak from being exploited and, thus, a zero-sum game in which one gains at the expense of another is not sanctioned. Gambling and derivatives such as futures and options, therefore, are considered un-Islamic because of the prohibition of Gharar.

More importantly, Muslims are prohibited from taking or offering Riba. What constitutes Riba, however, is controversial and has been widely debated in the Islamic community. Some view Riba as usury or excessively high rate of interest. But the majority of Islamic scholars view Riba as interest or any pre-determined return on a loan. The basis for the prohibition of Riba in Islam may be traced to the common medieval Arabic practice of doubling the debt if the loan has not been repaid when due. This practice in its extreme form had led to slavery in medieval Arabia because of the absence of bankruptcy legislation that protects the borrower from failed ventures. Therefore, the prohibition of Riba can be viewed as part of Islam's general vision of a moral economy.

In Islamic economics, the lender should bear the risk of the venture with the borrower because it is deemed that neither the borrower nor lender is in control of the success or failure of a venture. Thus, a unique feature that differentiates Islamic banking from conventional banking, in theory, is its profit-and-loss sharing (PLS) paradigm. Under the PLS paradigm, the ex-ante fixed rate of return in financial contracting, which is prohibited, is replaced with a rate of return that is uncertain and determined ex-post on a profit-sharing basis. Only the profit-sharing ratio between the capital provider and the entrepreneur is determined ex-ante. PLS contracts, in general, allow two or more parties to pool their resources for investment purposes and to share the investment's profit and loss.

The PLS paradigm is widely accepted in Islamic legal and economic literature as the bedrock of Islamic financing. Islamic bank financing, which adheres to the PLS principle, is typically structured along the lines of two major types of contracts: Musyarakah (joint venture) and Mudarabah (profit-sharing).

- Musyarakah contracts are similar to joint venture agreements, in which a bank and an entrepreneur jointly contribute capital and manage a business project. Any profit and loss from the project is shared in a predetermined manner. The joint venture is an independent legal entity, and the bank may terminate the joint venture gradually after a certain period or upon the fulfilment of a certain condition.

- Mudarabah contracts are profit-sharing agreements, in which a bank provides the entire capital needed to finance a project, and the customer provides the expertise, management and labour. The profits from the project are shared by both parties on a pre-agreed (fixed ratio) basis, but in the cases of losses, the total loss is borne by the bank.

Most theoretical models of Islamic banking are based on the Mudarabah and/or Musyarakah concepts of PLS. There are, however, other financing contracts that are permissible in Islam but not strictly PLS in nature. Such financing contracts, for example, may be based on Murabaha (cost plus), Ijarah (leasing), Bai' muajjal (deferred payment sale), Bai' salam (forward sale), and Istisna (contract manufacturing) concepts.

- Murabaha financing is based on a mark-up (or cost plus) principle, in which a bank is authorized to buy goods for a customer and resell them to the customer at a predetermined price that includes the original cost plus a negotiated profit margin. This contract is typically used in working capital and trade financing.

- Ijarah financing is similar to leasing. A bank buys an asset for a customer and then leases it to the customer for a certain period at a fixed rental charge. Shariah (Islamic law) permits rental charges on property services, on the precondition that the lessor (bank) retain the risk of asset ownership.

- Bai' muajjal financing, which is a variant of murabaha (cost plus) financing, is structured on the basis of a deferred payment sale, whereby the delivery of goods is immediate, and the repayment of the price is deferred on an instalment or lump-sum basis. The price of the product is agreed upon at the time of the sale and cannot include any charge for deferring payments. This contract has been used for house and property financing.

- Bai' salam is structured based on a forward sale concept. This method allows an entrepreneur to sell some specified goods to a bank at a price determined and paid at the time of contract, with delivery of the goods in the future.

- Istisna contracts are based on the concept of commissioned or contract manufacturing, whereby a party undertakes to produce a specific good for future delivery at a pre-determined price. It can be used in the financing of manufactured goods, construction and infrastructure projects.

The acceptability of the above non-PLS modes of financing, however, has been widely debated and disputed because of their close resemblance to conventional methods of interest-based financing. Many Islamic scholars, including Pakistan's Council of Islamic Ideology, have warned that, although permissible, such non-PLS modes of financing should be restricted or avoided to prevent them from being misused as a "back door" for interest-based financing.

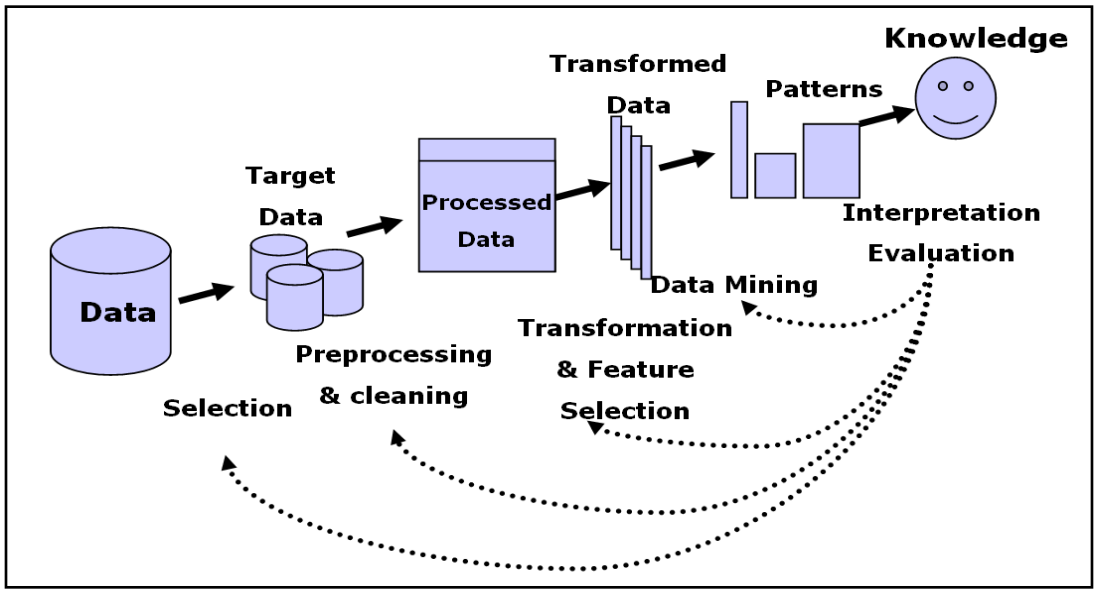
The Iranian financial system has gone through a structural change since 1984 when the central bank of the Islamic Republic of Iran officially adopted the interest free banking system.

Proposed method

Figure 1 portrays the general framework of the proposed method for classifying the bank in this study. This method includes the data mining steps and decision tree modeling for the category.

Data are preprocessed from the accepted banks of stock exchange in the first step of data mining. This is done by obtaining 36 financial ratios considered as independent variables in this research. Classification will be more useful with classifying the importance degree of each of these variables. Next, a feature selection algorithm is applied to the data set to extract the main variables affecting on the

classification of the banks from among all the data set variables. One model is presented for classifying the banks according to the decision tree- based financial health in the modeling step. Figure 1. Data mining process



3. The decision tree

Decision tree is one of the most useful methods used for inductive inference. Decision tree is a monitored and controlled learning method implemented with using a division and resolution strategy. In this way, the learned function is displayed as a decision tree sometimes turned into a set of if-then rules to increase the degree of human readability. These algorithms create a tree based on the learning set, in which each internal node shows a test on an attribute; each branch represents the conclusion of the assessment and each label maintains a class. A decision tree consists of a series of internal decision nodes, terminal nodes and root.

While a decision tree is used for classification, it will be called classification tree. Superiority criterion of a separator can be determined by impurity measure. A pure isolator divides the data into corresponding sub-branches, so that each branch contains data belonging to a class.

Decision tree is built from top to bottom and can be used for classifying the testing data. This algorithm is a toothily search in which the previous selections will not be reviewed. Decision trees have many applications in the computer systems and one of them is related to data classification.

Decision tree construction is an important data mining problem. Over the last decade, decision tree construction over disk resident datasets has received considerable attention (Jin and Agrawal, 2003). Furthermore, classification is especially attractive in a data mining environment for several reasons. First, due to their intuitive representation, the resulting classification model is easy to assimilate by humans. Second, classification trees are non-parametric. Classification tree construction algorithms do not make any assumptions about the underlying distribution and are thus especially suited for exploratory knowledge discovery. Third, classification trees can be constructed relatively fast compared to other methods. Last, the accuracy of classification trees is comparable or superior to other classification models (Gherka, Ramakrisnan and Ganti, 2000).

Gehrka et al., (1999) introduce a new scalable algorithm BOAT for constructing decision trees from large training databases. BOAT is faster than the best existing algorithms by a factor of three while constructing exactly the same decision tree, and can handle a wide range of splitting criteria. Beyond improving performance, BOAT enhances the functionality of existing scalable decision tree algorithms in two major ways. First, BOAT is the first scalable algorithm that can maintain a decision tree incrementally when the training data set changes dynamically. Second, BOAT greatly reduces the number of database scans, and offers the flexibility of computing the training database on demand instead of materializing it, as long as random samples from parts of the training database can be obtained. In

addition to developing the BOAT algorithm and proving it correct, they have implemented it and presented a thorough performance evaluation that demonstrates its scalability, incremental processing of updates, and speedup over existing algorithms.

Zhou et al., (2008) present a KD-tree algorithm capable of achieving real time performance on the GPU. The algorithm builds KD-trees in BFS order to exploit the large scale parallelism. The constructed KD-trees are of comparable quality as those built by off-line CPU algorithms. They also demonstrated the potential of their KD-tree algorithm in three applications involving dynamic scenes: GPU ray tracing, GPU photon mapping, and point cloud modeling (Zhou et al., 2008). Moreover, using high-quality KD-tree is essential for achieving interactive ray tracing performance. Therefore, the goal is building a KD-tree as fast as possible minimizing its quality degradation.

A typical KD-tree construction proceeds in a top-down fashion by recursively splitting a current node into two sub-nodes using the following sequence of tasks.

- Generate split plane candidates at some locations;
- Evaluate cost function using SAH at each location;
- Pick the optimal candidate (with lowest cost) and perform split into two child nodes;
- Pass over geometry to distribute it among children;
- Repeat recursively (Lawrence and Wright, 2001).

CART is an increasingly popular form of statistical analysis available through widely used statistical packages, such as S-Plus. CART operates by recursively splitting the data until ending points, or terminal nodes, are achieved using preset criteria. CART therefore begins by analyzing all explanatory variables and determining which binary division of a single explanatory variable best reduces deviance in the response variable. A wide variety of classification options are available for image processing, and no single classification solution will always perform best. Incorporating ancillary data into rule-based classifications, however, has been shown to be an effective approach in certain circumstances. We developed and demonstrated a method for creating and executing such a classification system without extensive a priori expert knowledge. This method, based on CART analysis, was easily implemented using commonly available image processing and statistical software (Jin and Agrawal, 2003).

Chen et al., (2002) deal with the activity-sensitive clock tree problem. We have presented the method of determining the control signals such that their transitions are reduced. By using modules' activity information, the clock tree construction algorithm and local ungating technique have been introduced for power savings. It has been shown that node difference plays an important role in low-power clock tree design.

Given a set of pins and a set of obstacles on a plane, an obstacle-avoiding rectilinear Steiner minimal tree (OARSMT) connects these pins, possibly through some additional points (called Steiner points), and avoids running through any obstacle to construct a tree with a minimal total wire length. The OARSMT problem becomes more important than ever for modern nanometer IC designs which need to consider numerous routing obstacles incurred from power networks, prerouted nets, IP blocks, feature patterns for manufacturability improvement, antenna jumpers for reliability enhancement, etc. Consequently, the OARSMT problem has received dramatically increasing attention recently. Nevertheless, considering obstacles significantly increases the problem complexity, and thus most previous works suffer from either poor quality or expensive running time (Lin et al., 2007).

Andrew and Morgan (1986) described the digraph method of fault tree construction and its application to the process stream of a butane vaporizer. It is shown that an accurate, well-structured fault tree can be produced for a process system that incorporates a number of control loops.

4. Variables subset selection algorithm

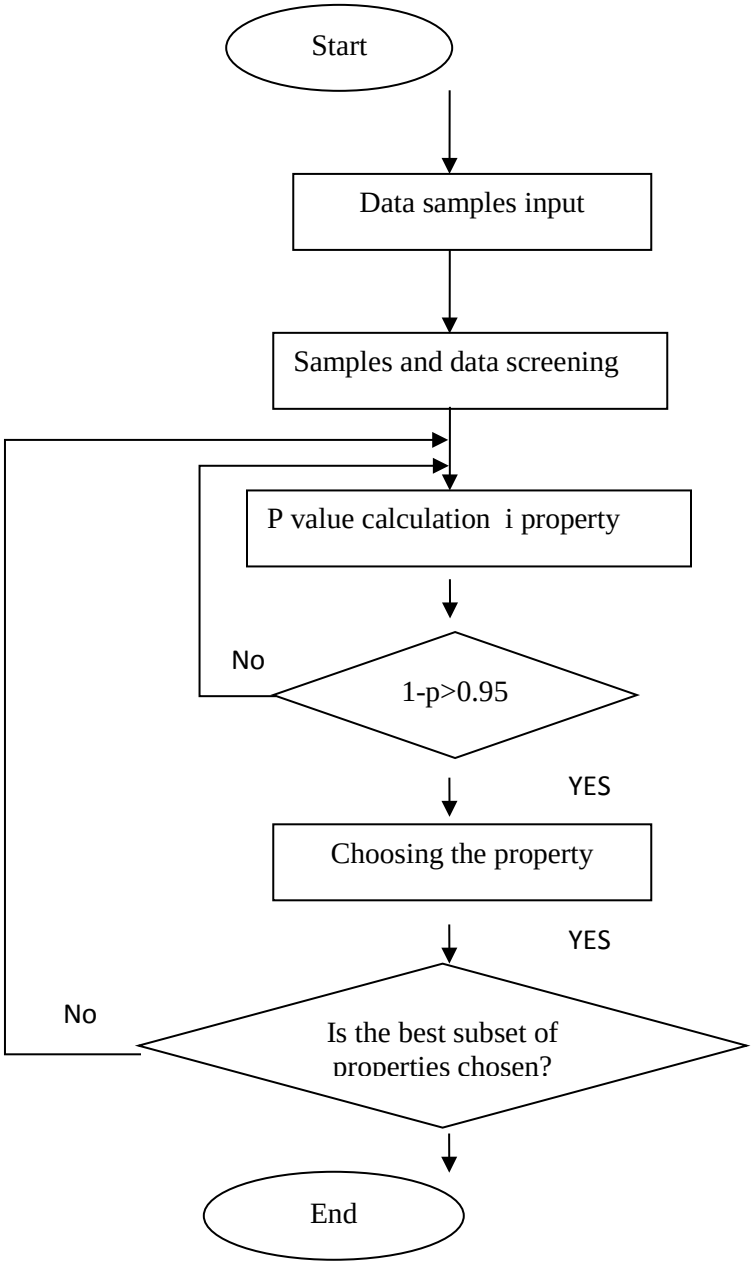
If we can study variables group instead of separately, we will get more data. Some data table columns may mistakenly be deleted or some variables may be considered more useful when we usually examine the variables separately, but they are weak in terms of predictive power of variables. Variables subset selection algorithm includes three steps in this study as follows:

Screening: it includes cancellation of less important variables (variables that do not have useful information for estimating or difficult data samples).

Classification: it includes sorting the remaining variables and assigning rating to them

Selection: identifying features important subsets for applying in the model. Figure 2 shows the variables subset selection algorithm general form.

Figure 2. Variables subset selection algorithm general form



5. Data mining process

Usable data are extracted by the financial lists and attached finical notes. The mentioned financial statements are obtained by the websites of www.Codal.ir and www.Rdis.ir. This research statistical society is consisted of all listed bank in Tehran Stock Exchange and sampling is based on random deletion method. In current study the sample society includes all listed banks with the availability of financial data; including 9 bank for 4 years; a total of 36 years, during 2008 to 2011.

6. Data analysis method

At first, data analysis method begins with the financial ratios calculation using the excel software and then banks are classified by decision tree modeling to classify the health of the banks.

On the other hand, the research has faced with limitations due to the lack of access to all financial statements of banks between the years of 2008-2011 and lack of sufficient data on financial statements and attached notes of financial statements for calculating the ratios.

Hence, the problem provides us with a useful model by "checking the effective variables in classifying the banks". Thirty-six variables are above the minimum amount of importance according to the Table 1.

Table 1. Variables of the study

Number	Description of the Ratios	Importance	Status
1	Nonperforming assets to total assets	1	Lower is better
2	Loans and commitments to total deposits	2	higher is better
3	Core deposits to total deposits	1	higher is better
4	Total operating expense to total operating income	3	Lower is better
5	Net loans to total assets	2	higher is better
6	Other real estate owned to total assets	1	higher is better
7	Loans to insiders to net loans	1	Lower is better
8	Total securities to total assets	1	higher is better
9	Undivided profit and capital reserve to total assets	2	higher is better
10	Return on average total assets	3	higher is better
11	Commitments to total assets	2	Lower is better
12	Jumbo time deposits to total deposits	1	higher is better
13	Net loans to total deposits	1	higher is better
14	Total nonperforming and restructured loans to gross loans	1	Lower is better
15	Nonperforming loans to net loans	1	Lower is better
16	Jumbo time deposits to net loans	1	higher is better
17	Return on equity	3	higher is better
18	Return on total assets	3	higher is better
19	Total assets	2	higher is better
20	Cash and due to total assets	1	higher is better
21	Restructured loans to gross loans	1	Lower is better
22	Personnel expense to total operating income	3	Lower is better
23	Nonperforming loans to primary capital	2	Lower is better
24	Total interest expense to total operating income	3	Lower is better
25	Interest rate swaps to total deposits	1	Lower is better
26	Nonaccrual loans to gross loans	1	Lower is better
27	Noninterest income to total operating income	2	higher is better
28	Earnings assets to total assets	3	higher is better
29	Provision for loan and lease loss to total assets	2	Lower is better
30	Total operating income to total assets	3	higher is better

31	Interest-bearing deposits to total deposits	1	higher is better
32	Nonperforming loans to total assets	3	higher is better
33	Total interest expense to total assets	2	Lower is better
34	Allowance for loan and lease loss to net loans and leases	3	higher is better
35	Past due loans to gross loans	1	Lower is better
36	Public deposits to total deposits	1	Lower is better

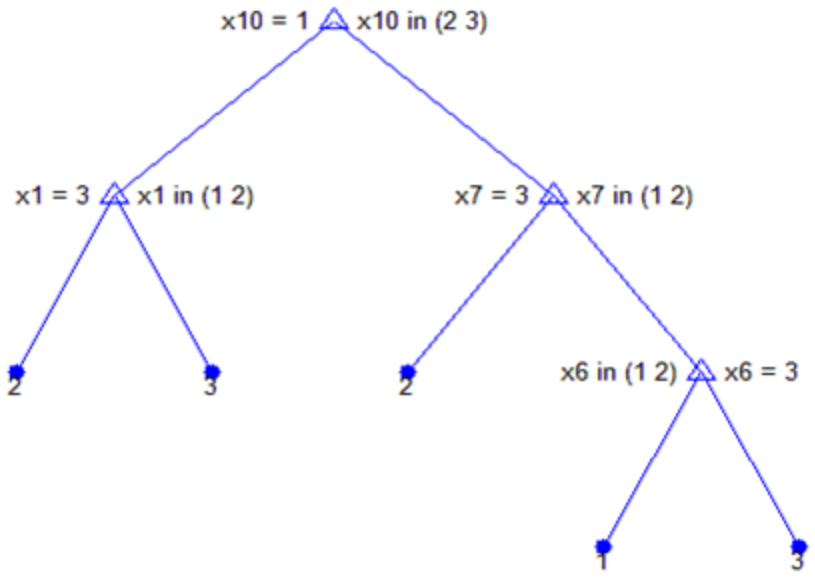
7. Decision tree based classification model

Decision tree is one of the powerful and common tools to classify and predict. In this way, classification is done within the rules and answers finding for questions and question and answer process will continue to complete the classification and create the decision tree and is used to predict in the model after classifying. Generally, the decision tree creation is composed of two stages:
Growth phase and tree creation includes links and branches of the links and is consisted of low significance independent variables assigned to significant groups based on the target variable (dependent). Branching includes choice of failure / break point by choosing a variable that is able to select the next best new branches.

The stopping and pruning step of the tree is accompanied with the aim of minimizing the prediction error, stop of the rules calculating the development of branches in the nodes and pruning involves removing of the branches having little effect on estimated values resulted in the final model. Selection of the failure / break point and branch point creation in the tree are important. There are different methods for selecting the point of failure/break. The way chosen in this study is called card method. Indexes card is in dual in implementation algorithm and is only branched according to the independent variable. Each parent node is divided into two child sub-groups based on the similarity between its members. Consequently, the members of each node are more pure than their parents.

8. Implementation results

The suggested banks classification model was fitted to the obtained data sets.
Figure 3 shows the pruned tree structure of the problem. Some examples of the rules obtained from the tree in Table 2 are presented. These rules are in the form of "if - then", it means that each longitudinal direction from beginning to end creates a rule for estimating the target variable by the sub-conjunction of the rule.
Figur 3. Decision tree



X10: Return on average total assets.
X1: Nonperforming assets to total assets.
X7: Loans to insiders to net loans.
X6: Other real estate owned to total assets.

Table 2. Obtained rules from the tree

Node x10:
If x10=1
Then, the x1 node occurs
Node x 7:
If x7=3
Then, the x6 node occurs

The resulted classification of based on the rules derived from decision tree is presented in Table 3.

Table 3. Classification of sample society

Cluster Number:	**Cluster 1**				**Cluster 2**				**Cluster 3**			
Year:	2008	2009	2010	2011	2008	2009	2010	2011	2008	2009	2010	2011
EGHTESAD NOVIN	X	X	X	X								
PARSIYAN	X	X	X	X								
KARAFARIN	X	X	X	X								
MELAT									X	X	X	X
PASARGAD	X	X	X	X								

POST BANK									X	X	X	X
TEJARAT									X	X	X	X
SINA					X	X	X	X				
SADERAT					X	X	X	X				

Table 4 presents more details of the study findings.

Table 4. The results of the study

Cluster Number:	**Cluster 1**	**Cluster 2**	**Cluster 3**
EGHTESAD NOVIN	**4**		
PARSIYAN	**4**		
KARAFARIN	**4**		
MELAT			**4**
PASARGAD	**4**		
POST BANK			**4**
TEJARAT			**4**
SINA		**4**	
SADERAT		**4**	

10. Conclusion

In this study, a nonparametric method based on decision tree is proposed to classify and categorize the financial health of the banks. Model input of the data mining process is extracted according to the related data to the banks listed in the Tehran Stock Exchange. The results of this model are useful from several perspectives. The first view helps to identify weaknesses in the banks and draws a realistic picture of it. In the second view, users can use the more effective variables in determining the financial health of the banks and useful decisions are made to achieve the desired goal based on it.

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