

Presenting and Evaluating the Banks Rating Model Using TOPSIS Technique

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Abstract

An appropriate rating system in banks can clarify the status and performance of banks for its users. Although many national and international rating institutions have been established, its absence is felt in our country. In a rating system, it is necessary to take into account the economic and environmental conditions of the country in order to evaluate the banks. For this purpose, in this research, 35 criteria are selected according to the opinion of 34 banking and academic experts, and using them, 15 banks in the 5-year period of 2014-2018 are ranked by the TOPSIS method. The findings show that the indicators related to financial dimensions (liquidity, profitability, capital and asset risk), qualitative dimensions (complexity and behavior of banks) and environmental dimensions (economic variables, government support and industry characteristics) are effective in the indigenous model of bank rating; In this regard, the financial health system and stock prices of banks are used to evaluate the indigenous model; The results show that the indigenous model has a positive and significant correlation with the financial health system; so that by identifying the position of the bank in the indigenous model, its position can be relatively described within the financial health system; Also, the results of the indigenous model show a positive and significant relationship with the stock prices of banks. This evidence draws attention to the proposed indicators for evaluating and rating banks.

Keywords: Banking Industry, Indigenous Criteria, Indigenous Rating, Financial Health, Market Reaction.

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1. Introduction

The rating system is a necessity for banks evaluation and comparison; as it can pave the way for an oriented competition in an efficient performance so that it can meet the needs of stakeholders and provide the way for economic stability and growth. In this way, it can protect banks from high-risk and non-operational activities which could be a problem for a healthy economy. The lack of an efficient rating system means ignoring the differences between banks, which might have numerous devastating consequences along with the most issues caused by unauthorized financial institutions for the country's economy.

On the other hand, attracting foreign investors into the country which is necessary for economic growth and prosperity, requires transparency and the required legal frameworks to satisfy banking health; these reasons have made the existence of a desired accreditation system necessary which can provide a comprehensive and logical assessment within country situation and satisfy the national and international requirements and concerns of banks. In this research, the main goal is to propose a suitable framework for creating a rating system in banks.

Banks typically use the banking health system to determine the strength of financial affordance in order to evaluate flexibility and fulfillment of financial obligations, which can result in better performance and higher transparency in banks to provide better decision-making for stakeholders. In this regard, applying various financial criteria in this system has led to considering their possible relationship with the indigenous model of rating in this research.

2. Theoretical Basics and Background

The existence of different types of loans, default risk, interference of external factors such as government, high liquidity and intrinsic risk are among the factors that increase and diversify the risk and decrease the transparency of banks' information over the other economic sectors, which causes challenges and differences in the results of ranked institutions; therefore, determining the rating model of banks requires the identification of effective factors. Hu et al. [14] and Mashayekh et al. [21] have shown that the structure of countries including the economic, legal, cultural, property and managerial issues, as well as the type and aim of rating affect the rating of banks. For this reason, countries usually design a condition-based appropriate model according to their pivotal structure and purpose.

In general, the rating institutions have two approaches in facing banks rating; financial strength or stand-alone rating and all-in-rating or credit rating. In financial strength rating, the rating institutions seek to assess the intrinsic value and performance of the bank without considering the external factors, while in the all-in-rating, in addition to the intrinsic value and performance of the bank, the impact of external factors affecting the performance of the bank is also measured; and as a result, a comprehensive assessment can be presented. This study tries to provide a comprehensive assessment for the evaluation of banks.

Despite the lack of an independent credit rating institute and indigenous rating system of banks in Iran, many national and international credit rating institutes have been established. There are three well-known international rating institutes, namely Standard & Poor's, Moody's and Fitch. Also, at the national level, we can refer to Capital Standards Rating (CSR), Investment Information & Credit Rating Agency of India Ltd (ICRA), European Rating Agency (ERA) in Slovakia and Rating Agency Malaysia (RAM). The quantitative and qualitative criteria have been used in all these national and international institutions [21].

Therefore, in this study, we try to identify the indigenous rating model based on quantitative and qualitative criteria by covering the effective factors on the structure of the country's banks in

economic, cultural and managerial aspects in order to provide an efficient and indigenous model with an applicability at the national level and compares with other international institutions.

The financial health means profitability and the activity continuation of economic unit [11]. This is very important for stakeholders; this issue is much more important in Iran due to the sanctions and managers' inefficiency which has led to economic disorder and financial crises as well as the bankruptcy of companies at the micro and macro levels [12]. The financial health of banks represents the state of economic development in a country [4]. In fact, the financial health is related to the activity continuation, bankruptcy, financial distress and the qualitative characteristics of accounting information (relevance and reliability) [3]. Therefore, the financial health has significant importance, as it improves the performance of investment and lending as well as identification of future problems in addition to helping policymakers in order to prevent and reduce the probability of sudden shocks and finally improve the financial resources allocation flow [11].

Therefore, considering the factors forming the proposed indigenous rating model, including the quantitative and qualitative criteria of performance and governing structure of banks, and on the other hand, regarding the performance and components of the financial health system, we can expect that the proposed indigenous model has a relative correlation with this system; The indigenous model can assess the performance of banks better according to the performance range and having more constituents than the financial health system, as the financial health is a part of the rating performance; Therefore, predicting the financial health of banks by the proposed rating model can be considered as a tool to measure the indigenous pattern. Furthermore, the rate of correlation between the results of the proposed model and the stock price, which can be due to the market reaction to the bank status, can be used as another tool to evaluate the proposed model.

MahdaviParsa et al. [6] have studied the rating of Iran banks based on corporate governance and considered the board of directors as one of the most important effective aspects of corporate governance. The results have shown that the private banks have a better status than state-owned banks.

Parsafard et al [17] have studied the independent credit rating of banks used by depositors. They have identified criteria by the CAMELS system (the most well-known system for evaluating banking and credit institutions based on six areas, capital adequacy, asset quality, management quality, profitability, liquidity, and market risk sensitivity), so 32 criteria with equal weights have been determined by Fuzzy Delphi method and they have performed rating during the period of 2012-2016 in 21 banks. The obtained results have shown that the Middle East Bank is at the first rank and Ayandeh Bank is at the last rank.

Ramezani et al. [18] have evaluated and predicted the health of selected banks in Iran using CAMELS indicators. In this respect, 20 public and private banks in the period of 2009-2013 have been studied. 17 financial ratios have been tested as independent variables by panel data regression model and stepping method; then their relation with bank health has been evaluated. The results have shown that 6 ratios with 75.2% strength are able to evaluate and predict the health of banks.

Arza et al. [2] have studied the rating of Iranian private banks using an analytic hierarchy process. To this end, they have identified criteria based on the CAMELS system. Then, the criteria's coefficient of importance has been determined by Delphi method. The results have shown that the banks of the Middle East, Pasargad, Ghavamin, Karafarin and Sina outperformed over other banks based on five-year data.

Beheshtinia et al. [13] have studied the rating model of banks in Iran. For this purpose, they have considered the balanced score card indicators and social responsibility. They have determined 6 dimensions and 25 components using Delphi method and ranked the banks using the TOPSIS method. The results have shown that the financial and social indicators are 22% and 16% effective

in rating, respectively.

Choy et al. [22] has stated that the applied criteria in rating agencies have small and large differences in terms of goals and sensitivities, which in turn has led to differences in rating results as well as differences among rating agencies; For this reason, it is recommended to have common goals for important decisions; The results also show that rating requires a broad view that it is better to include indirect factors in addition to direct ones.

Mustari et al. [10] have studied and analyzed the performance of Canara Bank in India by CAMELS method. They have tried to use the capability of CAMELS model to measure the financial satisfaction as a financial intermediary. The results have shown that Canara Bank should enhance its asset quality and consider the sustainable procedure and management stability to increase revenue.

Rahman et al. [23] have studied and evaluated the performance of selected private banks in Bangladesh using the CAMELS rating. The data of 2010-2016 have been used for analysis. The result of this analysis has shown the rating of banks based on CAMELS.

Karminsky et al. [5] have studied the design of banks rating model over a 15-year period; therefore, they have tested sustainability, capital market, market power, market structure, market order, geographical diversity, profit stability, income diversity, corporate governance, risk management, legal environment and operational environment such as stability in economic, efficiency, liquidity, capital adequacy, asset quality and the quality of management. The results have shown that the macro variables improve the explanatory power. In addition, the rating is influenced by the business cycle of the economy.

3. Research Questions

The questions that can be raised in this research are as follow:

- 1) What are the effective indicators in measuring the rating of banks in Iran?
- 2) What is the impact of their indicators and components on the indigenous model of banks' rating?
- 3) How is the rating of selected banks in the indigenous model?
- 4) How is the predictive power of the financial health system by the indigenous model of rating?
- 5) How is the relationship between indigenous model and stock prices?

4. Research Conceptual Models

4.1. Indigenous Rating Model

In this research, we try to provide a comprehensive and regulated framework by comparing the models of reliable rating institutions at an international level such as Moody's, S & P and Fitch. Figure 1 shows the schematic of this model.

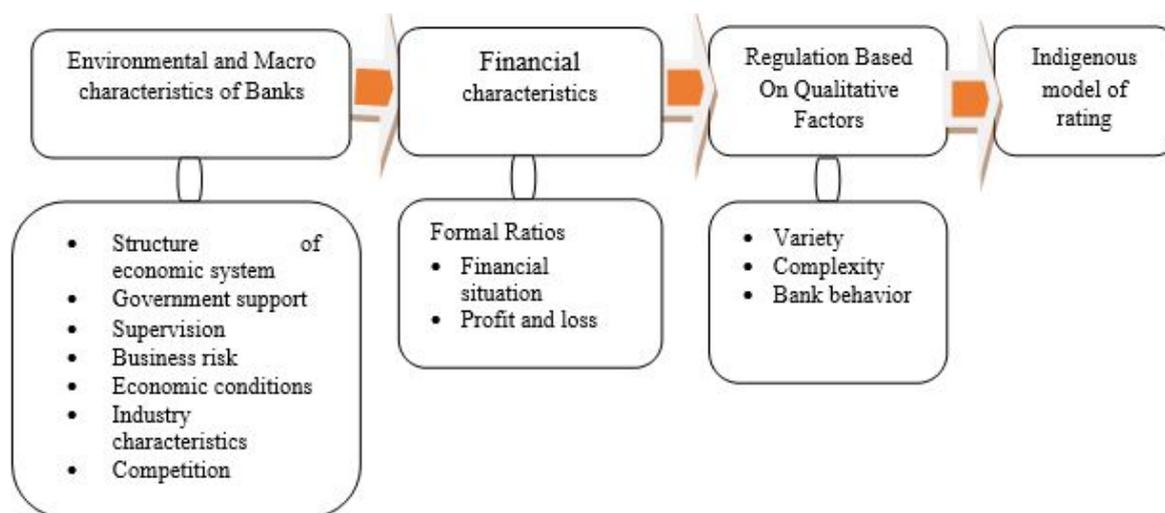


Figure 1: Indigenous model of rating

4.2. Financial Health System Model

Ahmadian [1], MirbageriHir et al. [7], Salimi et al. [19] and Arza et al. [2] have used CAMELS as a basis for measuring bank health in Iran banks. Table 1 represents the applied criteria in bank health analysis.

Table 1: The criteria applied in bank health evaluation

Criterion	Operational Definition (How to Calculate)	Effect
Capital adequacy	The result of dividing the base capital by the sum of the weighted assets to the risk coefficients in percentage	+
	The ratio of legal deposits to total deposits	+
	Property to capital ratio	-
	Debt ratio to equity	-
Asset quality	The ratio of non-current facilities to the total of granted facilities	-
	The ratio of fixed tangible and intangible assets to equity after deductible accumulated profits	-
	The ratio of total granted facilities to total assets	+
	The ratio of the cost of bad debt to the total granted facilities	-
	The ratio of bad debt reserves to the total of granted facilities	+
	The ratio of non-performing loans to total assets	-
Management quality	The ratio of obligation cost and ownership documents to non-performing loans	+
	The ratio of the cost bad debt to the total costs	-
	The ratio of net profit to the number of employees	+
	The ratio of total common and non-common income of the bank to the total costs	+
	Growth rate of granted facilities	+
	Net profit growth rate	+
Deposit growth rate	+	

Profitability	The ratio of net profit to total common and non-common income	+
	The difference between the interest received from the granted facilities and the interest paid to the deposits	+
	The ratio of net profit to total assets	+
	The ratio of total fee and interest received from granted facilities to total common and non-common income	+
	The ratio of net profit to total equity	+
	The ratio of the obligation cost to the granted facilities income	-
Liquidity	The ratio of cash and quasi-cash to the total deposits	+
	The ratio of cash and quasi-cash to the demand deposits	+
	The ratio of fast-marketable investments to total investments	+
	The ratio of cash and quasi-cash to short-term liabilities and debts	+
	The ratio of total granted facilities to total deposits	-
Market risk sensitivity	The ratio of the net absolute value of currency assets to equity	-
	The ratio of the total investments and corporate bond to the total assets	-
	Beta bank stocks in Tehran Stock Exchange Market	-
	The ratio of sight deposits to total deposits	-

5. Methodology

The aim of this research is practical-developmental and it has survey-based data collection method due to applying a questionnaire. It can also be considered experimental by launching it within the selected banks.

5.1. Research Statistical Population and Samples

In this research, the banking experts are used to collect questionnaire data. In order to improve the quality and validity of this research, experts are selected with the following characteristics:

1. Having master or higher degrees in banking, accounting, finance, economy or management,
2. Having more than 10 years of management experience in the banking system or 5 years of banking industry analysis in brokerage, investment and financing companies, or
3. Be a well-known university professor with relevant work experience.

Due to the specialization of the subject and the limitation of experts, a judicial and available sampling is used to select the samples;

Therefore, by examining the experts' histories, 34 eligible experts have been selected. On the other hand, to empirically test the rating criteria, sampling has not been used due to the limited statistical population of stock exchange and off-exchange banks. For this, all the banks listed on the stock exchange and off-exchange with the following conditions in 2014-2018 have been selected:

- Their required information is available.
- They have been listed in the exchange (bourse) before 2014.
- Their financial statements have been audited.

In this case, 15 eligible banks have been selected.

5.2. Data Collection Tools and Methods and Research Data Analysis

To collect data related to theoretical basics and related works, websites and professional Persian and English publications are used. Also, the results of questionnaire are used to identify the indicators and relevant components as well as determine their influence on the rating model. To specify the positions of the given components, the experts are asked to give their opinion on the proposed rating components based on 7-point Likert Scale by Delphi method. The Delphi technique is a regular and repetitive method for public survey which uses the opinion of experts so that it minimizes the inconsistencies and has more accurate results [16]. The minimum number of 10 experts has been reported in literature [8]. As the rating criteria are determined, the data of the selected components are extracted from the audited financial statements at Codal site.

In this research, the weight of each component is obtained by the geometric mean method of the questionnaire answers to each component and TOPSIS method is used for rating. The TOPSIS method (sorting of priorities upon similarity to the ideal solution) is one of the widely used methods; This method is based on this fact that each selected factor must have the minimum distance from the ideal positive factor (most significant) and the maximum distance from the ideal negative factor (least significant), which is considered as the criterion of factors prioritization [15]. Following the pre-requisite steps, the TOPSIS method is obtained by [9]:

$$n_{ij} = \frac{r_{ij}}{\sqrt{\sum_{i=1}^m r_{ij}^2}} \tag{5.1}$$

where,

n_{ij} : Unscaled matrix components

r_{ij} : The components of the decision matrix

In the next step, the weighed scale matrix is formed by assuming the W vector:

$$W = \{W_1, W_2, \dots, W_n\} \tag{5.2}$$

$$N_D \cdot W_{n \times n} = \begin{vmatrix} V_{11} & \dots & V_{1j} & \dots & V_{1n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ V_{m1} & \dots & V_{mj} & \dots & V_{mn} \end{vmatrix} \tag{5.3}$$

where,

W: Weight of variables

N_D : Unscaled matrix

Thus, ND is a matrix in which the scores of the indices are unscaled and comparable, and $W_{n \times n}$ is a diameter matrix in which only the elements of the main diameter are non-zero.

In the next step, the positive ideal solution (A^+) and the negative ideal solution (A^-) are obtained as follows:

$$A^+ = \left\{ \left(\max_i V_{ij} | j \in J \right), \left(\min_i V_{ij} | j \in J' \right) \quad i = 1, 2, \dots, m \right\} = \{V_1^+, V_2^+, \dots, V_j^+, \dots, V_n^+\} \tag{5.4}$$

$$A^- = \left\{ \left(\min_i V_{ij} | j \in J \right), \left(\max_i V_{ij} | j \in J' \right) \quad i = 1, 2, \dots, m \right\} = \{V_1^-, V_2^-, \dots, V_j^-, \dots, V_n^-\} \tag{5.5}$$

So that, $J = \{j = 1, 2, \dots, n|j\}$ is desirable indicators

$J' = \{j = 1, 2, \dots, n|j\}$ is undesirable indicators

V_{ij}^- : Negative ideal

V_{ij}^+ : Positive ideal

In the next step, the distances of each item from the ideals are calculated by the Euclidean method:

$$d_{i+} = \left\{ \sum_{j=1}^n (V_{ij} - V_j^+)^2 \right\}^{0.5}, \quad i = 1, 2, \dots, m \tag{5.6}$$

$$d_{i-} = \left\{ \sum_{j=1}^n (V_{ij} - V_j^-)^2 \right\}^{0.5}, \quad i = 1, 2, \dots, m \tag{5.7}$$

Finally, the relative proximity of A_i to the ideal solution is calculated as follows:

$$Cl_{i+} = \frac{d_{i-}}{(d_{i+} + d_{i-})}, \quad 0 \leq cl_{i+} \leq 1, \quad i = 1, 2, \dots, m \tag{5.8}$$

where, Cl_{i+} is the distance of each variable from the positive ideal.

As shown in (5.5), if $A_i = A^+$, then $d_{i+} = 0$ and $Cl_{i+} = 1$, if $A_i = A^-$, then $d_{i-} = 0$ and $Cl_{i+} = 0$. So, the closer the A_i to the ideal positive (A^+), the closer the value of Cl_{i+} will be to 1 and the farther the A_i to the positive ideal (A^-), the closer the value of Cl_{i+} will be to zero. Therefore, the available components can be rated in descending order of Cl_{i+} .

Next, in order to compare the rating results of indigenous components with rating based on banking health indicators, the regression equation and variance analysis are used to determine the correlation. Regression refers to the prediction of the value of a dependent variable on the values of one or more independent variables. To measure the predictive power of financial health using the indigenous model, the following simple linear regression model is used.

$$FAB_{i,t} = \beta_0 + \beta_1 IRMB + \epsilon_{i,t} \tag{5.9}$$

where,

$FAB_{i,t}$: Bank financial health criteria

$IRMB_{i,t}$: Criterion of indigenous rating model

$\epsilon_{i,t}$: Regression model

Finally, the Spearman correlation test is used to examine the relationship between the indigenous rating model and the market stock prices.

6. Research Findings

6.1. Research Reliability

The reliability of the variables means that the variance and mean of the variables over time and the covariance of the variables during different ages are constant. Therefore, using these factors in the model does not cause false regression. For this purpose, the methods of Levin, Lin & Chu, Im, Pesaran & Shin W-stat and Hardi have been used for reliability of research variables [20].

Table 2: Reliability test of indigenous model variables

Test	Value	Probability
Levin, Lin & Chu	- 36.8366	0.000
Im, Pesaran & Shin	39.648	0.000
Hardi	5.86896	0.000

The probability is at a significant level of 0.000, so it can be said that the reliability of the data is acceptable and the results of data analysis are reliable.

6.2. Proposed Indigenous Rating Components

By analyzing the questionnaires filled by bank experts on the existence and importance of each component in the structure of the Indigenous model in the form of the proposed components and studying the existence of required data for each component in Tehran Stock Exchange, finally the indicators and components of financial instruments, Islamic banking, political conditions of the bank and the observance of the rules have eliminated; therefore, 35 of the 52 components have been identified and determined; Then, by extracting the questionnaire data and using the geometric mean method, the weight of each component in the model has been determined. Table 3 shows the results of this process.

Table 3: Indicators and weights associated with indigenous model rating components

Aspects	Components	Sub-components	Measurement Way	Effect	Weight	
Environmental and macro characteristics of banks	Government support	Extent of ownership in the government	Government ownership ratio	-	0.017	
	Economic variables	Gross domestic product Growth (GDP)	$GNP = C + I + G + (X - I) + NFP$		+	0.029
		Credit terms	Bank share ratio of GDP		+	0.030
		Exchange growth rate	$/ \Delta \hat{e} = / \Delta p - / \Delta p^*$		-	0.013
		Guaranteed interest rate	Guaranteed interest rate announced by the Central Bank		+	0.029
		Inflation rate	Inflation rate announced by Statistics Center		-	0.030
	Banking industry features	Competition rate	Herfindahl-Hirschman Index		+	0.031
		Concentration	Duggan Herfindahl-Hirschman Index		+	0.030
		Market share	The ratio of bank asset to total bank asset		+	0.033
			The ratio of bank deposits to total bank deposits		+	0.033
			Ratio of shares divided by total shares of banks		+	0.033

Quantitative characteristics	capital	Capital adequacy ratios		Capital to assets ratio	+	0.035
				Debt to equity ratio	-	0.013
	Asset risk	Asset Quality Ratios		Non-current facilities to total granted facilities ratio	-	0.018
				Total granted facilities to total assets ratio	+	0.035
	Profitability	Profitability ratios		The difference between the ed interest on the granted facility and the interest paid on the deposits	+	0.033
				Net profit to total equity ratio	+	0.032
	Liquidity	Liquidity ratios		Cash and cash equivalent to total deposits ratio	+	0.034
				Cash and cash equivalent to short-term liabilities and debts ratio	+	0.035
				Total granted facilities to total deposits ratio	-	0.033
	Other financial characteristics	Bank risk assessment ratios		Absolute value of foreign currency assets to equity ratio	-	0.029
Qualitative characteristics	Variety of Banks Activities	Percentage of revenue to the type of provided service		Revenue of services to total revenue ratio	+	0.032
		Geographical distribution		Number of branches	+	0.032
	Complexity of Banking Activities	Ownership structure	Institutional owners	Ownership of legal entities ratio	-	0.033
			Real owners	Ownership of real entities ratio	+	0.011
			ownership Concentration	Total shares of real or legal persons with more than 5% shares	-	0.031
		Consistency of accounting methods with international standards		Compliance of the Bank's Financial Statements with International Financial Reporting Standards	+	0.031
	Banks behavior	Banking governance criteria		audit quality	+	0.005
				Transparency and information disclosure	+	0.033
				Independence of the Board	+	0.032
				Management Ownership	+	0.032
profits and rewards division policies		Dividend interest per share	+	0.032		
		Bonus paid	+	0.031		
Quality of accounting information	Reduce agency costs		Over-investment	-	0.029	
	Reduce information asymmetry		Reporting delay	-	0.029	

6.3. Banks Rating in Designed Indigenous Model

After identifying the effective components and their weight in the indigenous model structure, the data related to the components have been extracted; Then, the banks rating has been performed by TOPSIS method for the consecutive years of 2014-2018; The mean 5-year period has also been used to create more explanatory power and have a longer-term view and a more accurate prediction of the banks' status.

Table 4: Banks rating by the proposed indigenous model

Bank	2014		2015		2016		2017		2018		5-year period	
	CL	R	Average	Rank								
Eghtesad Novin	0.418	11	0.497	7	0.473	4	0.442	6	0.477	9	0.46	6
Ansar	0.439	7	0.472	11	0.464	6	0.416	12	0.529	2	0.462	5
Parsian	0.439	6	0.525	2	0.471	5	0.424	10	0.49	7	0.468	3
Pasargad	0.502	1	0.602	1	0.521	1	0.45	5	0.506	5	0.514	1
Tejarat	0.336	15	0.48	8	0.473	3	0.458	3	0.498	6	0.445	11
Middle East	0.426	9	0.478	9	0.445	11	0.431	8	0.507	4	0.456	8
Sina	0.429	8	0.521	3	0.452	8	0.458	2	0.477	10	0.467	4
Saderat Iran	0.426	10	0.437	14	0.461	7	0.441	7	0.49	8	0.451	10
Mellat	0.483	2	0.503	6	0.448	10	0.397	14	0.434	14	0.451	9
Karafarin	0.453	5	0.503	5	0.478	2	0.429	9	0.534	1	0.478	2
Post Bank of Iran	0.383	14	0.426	15	0.361	15	0.4	13	0.458	12	0.404	15
Ayandeh	0.48	3	0.509	4	0.405	13	0.388	15	0.44	13	0.442	12
Hekmat Iranian	0.408	12	0.442	13	0.452	9	0.469	1	0.521	3	0.457	7
Day	0.402	13	0.476	10	0.437	12	0.451	4	0.415	15	0.435	13
Saman	0.453	4	0.458	12	0.394	14	0.418	11	0.459	11	0.435	14

The ratings show that the banks of the Pasargad, Karafarin and Parsian are the closest to the positive ideal and, as a result, they have the higher rates in the mean 5-year period. And banks of Day, Saman and Postbank are the most distant from the positive ideal and therefore have a lower rank.

6.4. Banks Rating with Financial Health System

The financial health system consists of 32 financial criteria, where table 5 shows the ratings of banks by selected and average years with these criteria.

Table 5: Banks rating based on financial health system

Bank	2014		2015		2016		2017		2018		5-year period	
	CL	R	Average	Rank								
Eghtesad Novin	0.445	10	0.476	8	0.484	8	0.582	4	0.576	5	0.51	5
Ansar	0.450	9	0.484	6	0.475	11	0.504	10	0.543	9	0.490	10
Parsian	0.439	11	0.570	1	0.604	1	0.542	8	0.587	2	0.545	1
Pasargad	0.488	2	0.490	3	0.488	6	0.544	7	0.543	8	0.510	4
Tejarat	0.430	12	0.405	14	0.491	4	0.599	2	0.611	1	0.50	6
Middle East	0.459	6	0.487	5	0.471	12	0.584	3	0.486	14	0.495	9
Sina	0.402	15	0.453	12	0.448	13	0.551	6	0.534	11	0.474	12

Saderat Iran	0.429	13	0.447	13	0.484	9	0.570	5	0.584	3	0.499	7
Mellat	0.472	3	0.374	15	0.317	15	0.464	15	0.549	6	0.427	15
Karafarin	0.469	4	0.497	2	0.512	2	0.538	9	0.580	4	0.518	2
Post Bank of Iran	0.469	5	0.490	4	0.507	3	0.610	1	0.512	13	0.515	3
Ayandeh	0.458	7	0.473	9	0.484	7	0.486	11	0.546	7	0.489	11
Hekmat Iranian	0.453	8	0.483	7	0.476	10	0.482	12	0.448	15	0.468	14
Day	0.568	1	0.473	10	0.441	14	0.476	14	0.539	10	0.497	8
Saman	0.414	14	0.453	11	0.488	5	0.479	13	0.518	12	0.469	13

According to the geometric mean column, Parsian, Karafarin and Postbank banks are ranked at first to third ranks, respectively.

6.5. Correlation and Predictive Power of Results

In this research, the data panel method is used to fit the regression model. In order to measure the panel data versus pooling data, F-Limer test (determination of heterogeneity) is used; Then, the relationship between indigenous rating model and financial health system is evaluated by Hausman test (determination of fixed or random effects), t-test, F-Fisher and determination coefficient. A simple linear regression model is used to measure the predictive power of financial health using the indigenous model.

Table 6: F-Limer test to determine panel or pooling method

Test statistics	Degrees of freedom	Significance level
2.255127	13.35	0.0279

The results of F-Limer test indicate that the data panel method is suitable for estimating the model; therefore, the Hausman test is used to determine the fixed or random effects in Table 6.

Table 7: Hausman test

Test statistics	Degrees of freedom	Significance level
0.065624	1	0.7978

The results show that the random effects are suitable for estimating the model; so, the regression model is fitted by the data panel method with random effects where the results are given in Table 7.

Table 8: Results of regression model fitting and coefficient estimation

Variables	Symbol coefficient	Coefficients	standard error	test t	Significance level	Result
Fixed coefficient	β_0	0.325473	0.1058855	3.073825	0.0041	
Indigenous rating model	β_1	0.332888	0.162493	2.04863	0.0404	Direct and significant
General results of the model	Coefficient of determination		Durbin-Watson Test		F-Statistics	Significance level
	0.457871		0.013455		2.111452	0.03664

The results show that Fisher’s statistic with 2.111, is higher than the corresponding statistic; therefore, the fitted model is significant and has acceptable performance. The coefficient of determination indicates that 45.78% of the changes in the financial health criterion can be explained based on the indigenous rating model. Also, the value of the Durbin–Watson statistic is 2.013, which indicates that there is no correlation between the error terms. The regression coefficient with 0.95 confidence shows that the criteria of the indigenous model have a direct and significant effect on the financial health of banks; And as the bank’s rank increases in the indigenous model criteria, the bank’s rank in the financial health criterion also increases.

6.6. Comparison of Indigenous Model Ratings with Market Stock Prices

First, the Kolmogorov–Smirnov test is used to identify the normality of data distribution, which is shown in Table 9.

Table 9: Kolmogorov–Smirnov normalization test

Variable	Average	Standard deviation	Kolmogorov-Smirnov test	Significance
Indigenous rating model	0.49267	0.101049	0.189	0.000

According to the obtained results and the significance of the test, Spearman’s non-parametric test is used to investigate the correlation between rank and market price, shown in Table 10.

Table 10: Rating correlation with stock price by Spearman test

Spearman test	Coefficient of variation	Rank
Correlation coefficient with price changes	1.000	-0.231
Significance		0.037
Number		82
Correlation coefficient with rank changes	-0.231	0.000
Significance	0.037	
Number	82	

The findings indicate that the higher the rank (closer to one), the higher the price.

7. Discussion, Conclusion and Future Works

The findings show that in addition to the financial dimensions, it is necessary to consider the qualitative and environmental dimensions in the evaluation and rating of banks; It is also recommended to consider the impact of the components on the model for better evaluation, since assuming the importance of the components as the same means ignoring the economic, political and banking system differences that can lead to misleading results. These results are consistent with the rating of the well-known institutions such as Moody’s, S&P and Fitch, as well as the national ratings of countries such as Pakra in Pakistan and Ram in Malaysia.

The rating results have shown that among the selected banks, Pasargad and Karafarin have the first and second ranks and the post bank has the last rank which has almost the same results as the researches of Parsafard et al. [17] and Salimi et al. [19] (the rating of banks is the same in some cases and close to each other in the other ones, compared to the existing researches).

According to the research findings, the ratings obtained from the indigenous model with the financial health system are relatively close, so that by determining the bank’s rating in the indigenous

model, its position within the financial health system can be predicted relatively; therefore, it can be said that there is a good correlation between them. These results are reasonable and expected. Given that in addition to the criteria of financial health, other criteria have been used in the indigenous model, it can be expected that the results of this model are more logical and real and can be used by decision makers for various purposes.

Along with another test of the effectiveness of the designed indigenous model in this study, the possible relationship between the obtained ratings and the market share price has been examined. The findings have shown that there is a positive and significant relationship between them, so it can be concluded that a bank with better rank in the indigenous model also has a higher price in the market, which can indicate better bank performance. Therefore, it can be expected that the results of the rating are reasonable and reliable.

The lack of reliable data about some factors have led to their exclusion, which could have led to better results in the rating model. The components of Islamic banking, political conditions, financial tools as well as laws observance are among the items that have been excluded due to the lack of data in this research. Therefore, it is recommended that reliable data are used along with other criteria in banks evaluation, given the great importance of the impact of these components on the rating of banks in developing countries such as Iran. Furthermore, it is recommended that the rating is performed in other industries, such as insurance and competing industries in order to meet the increasing requirements of customers for decision making.

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