

# The Comparative Studying of Shirata Bankruptcy Forecasting Model with Iran's Business Low

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# ABSTRACT

This research has been done in order to survey the application of predictive model of shirata's bankruptcy in listed companies on Tehran's Security Exchange. Statistical society of this research includes textile companies, domestic appliance, food and drinking products except sugar. The time period of this research is from 2004-2009. The purpose of this research is acquiring a model which will be able to predict the bankruptcy of companies, and can help managers, actual and potential investors and creditors to make appropriate decisions. In this research, it has been tried to segregate the samples by presupposing 141 matter of business low, and then to survey the segregating ability of the independent variables of the model in two sample statistics by equality test of averages, T & F statistics. Then, by the use of logistic regression tests and audit analysis. It was tried to examine the models, and after acquiring adopted models with above procedures, the appropriate model was chosen, and the validity of that model was surveyed. According to the acquired results, it became obvious that shirata model has the ability to predict bankruptcy with the accuracy of 90%. Regarding this the model of this research has been acquired by presupposing 141 matter of Iran's business law; therefore, this model declares the firms status and is representative of that models adaptation with business law.

**Key words:** Forecasting, bankruptcy, shirata, Iran's business law

# 1. INTRODUCTION

Investment reassurance to investors of the important topics in financial management. And managers should also help advanced tools and techniques to assess financial management capacity and financial activities of the company can continue to take action. Real and legal persons actual and potential beneficiaries companies inclined to predict bankruptcy participate. Because if the bankruptcy, a high cost is imposed on these groups. One of the tools to prevent this, use the models are predicting bankruptcy. Different models to predict adverse financial condition of companies has been suggested each of which strengths and weaknesses of its own. Bankruptcy models can be accredited to the creditors in relation to companies and auditors in relation to diagnostic assistance activities should continue.

#### **Implication and expression research**

User groups outside organization (banks, investors, shareholders, financiers ...) and internal information for decision making need. Information needs can be done through one of the sources of financial information provider is to be estimated. They analyzed the results of corporate financial statements to increase power from your decisions are. One of the tools for analysis, using financial ratios are the ratios can indicate operational and financial conditions are firm. One of the important applications of their proportions in predicting bankruptcy is one of the major approaches in the literature is bankruptcy.

Today than the international credit assessment, the business models of disability in countries other than the mother country model (the first country in the model occurs) are also being used. And such questions of the mind to it seems that financial weakness is model can be easily from country to be transferred to other countries? In other words have the ability to transfer the model developed in the country and a certain period to another country? Should be mandatory if the models with the same variables and coefficients on the mother country of destination data can test? Whether independent variables has been used in this model in all countries and equal priority importance. The following reasons can be causes and motivations as research companies predict financial failure, as pointed.

A) The failure of financial companies has different costs, not just for shareholders but also for the direct participation of direct environment and the economy fully participate is created. Financial failure cost the company a large network of related companies and brought pressure can lead to the collapse of local economies and nations. Thus, predicting not only in terms of individual subject, but from the viewpoint of the entire community is important.

B) During the past thirty years the general economic situation even in developed countries and developing high-speed has changed. Companies have experienced a mild decreasing trend and the circumstances in which

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they operate as a significant change has been. In the fourth development plan that emphasized the frequency of privatization is needed to use new financial tools, particularly models that forecast bankruptcy capital market performance through real status disclosure helps companies, are feeling. The adjusted models with the existing environmental conditions and needs of the country, a good criterion for the correct decision about buying stock companies that are privatization, will provide.

### **Research goals**

The purpose of this study provides important indicators for evaluating the financial health of companies and the possibility of continuing their activities. Applying these indices to evaluate the possibility of continuing the necessary field activities of the company or not it provides. Find Signs in corporate bankruptcy provides the opportunity to management and decision-makers from being opened in difficult circumstances and deliberate actions to prevent to do. In summary, fitting and application of models of conditions refers to the following objectives.

A) Indices based bankruptcy prediction evaluates operational and financial performance of companies in order to take necessary measures such as privatization, restructuring, sale or even bankruptcy will be provided.

B) Evaluate the degree of compliance and accuracy prediction model according to the Trade Act and subject to Article 141 of the Companies Act.

#### **Theoretical base**

Given that the first model, Beaver is bankruptcy prediction model. But reasons including being unvaried, was not a good measure of why researchers used a multivariate model in this regard is their most important model of Altman But despite this due to some weaknesses in this study, other models were used. One of the weaknesses Altman study using three different models for production companies, commercial service and Business, In order to resolve this case for the use of the model can be used in all companies is very important. In this regard Shirata four independent variable model was selected. Shirata model limited to specific industry and size of asset size, and companies are not as flexible model has been proposed.

## **Research Experience**

In relation to bankruptcy prediction, the first study by Thomas Vvdlak (1900) has been and Statistical research community, he was the railway industry and His research as "percentage of operating expenses to gross retained earnings" published. Lars Jambr Line (1911) ratios obtained from Thomas Vvdlak than performance and create a paper entitled "Principles of Bond Investment" presented. Arthur Vnykvr and Raymond Smith (1930 - 1935) conducted studies with the title "financial ratio analysis on bankrupt companies" found Than that for the most accurate bankruptcy status, working capital ratio is the total assets. PeymanAmini (1996-2004 )applying the model on the company accepted Fulmer Stock Exchange has done research And the study examines corporate bankruptcies expected, one and two years before the bankruptcy action has And concluded that the ability of models to predict bankruptcy rates 75% and 68% for a year and two years before the bankruptcy is. Rasul Mehdi Zadeh (2004) using the Altman model for non-bankrupt and bankrupt groups to determine the amount of type I and type II error came to the conclusion Altman model with a 81 percent confidence before corporate bankruptcy status bankruptcy prediction is correct. Additionally, type II errors on bankrupt companies, about 19 percent indicating that the model in 19 percent of cases, the companies are bankrupt, Prediction has failed, and models with 92 percent confidence Altman, non-bankruptcy state companies during the period studied, the prediction is correct. The first type of error, and about the companies that represent about 8 percent in this model eight percent of the cases, the companies that are active Nonbankrupt has predicted.

## **Research hypotheses**

1) Model was fitted Shirata in Tehran stock exchange, the ability of firms correctly classified into two groups is bankrupt and Non-bankrupt.

2) ) Independent variables used in the model are equally important in predicting Shirata not bankruptcy.

#### **Research Variables**

The study variables in Table Shirata model (1) are shown.

Row	Independent variables	Acronyms
1	Average retained earnings to average total assets	$X_1$
2	Debt and equity minus current period to the period before a	X <sub>2</sub>
3	Interest and discount expense to borrowings, corporate bond & note receivable discounted	X <sub>3</sub>
4	(Note payable + accounts payable) x12/Sales	$X_4$

Table 1. Variables related to the model Shirata

#### **Research Methods**

Since the results will be used in practical operation and In terms of methodology and research-based models such as financial research related to the past are combined.

## **Research domain**

Statistical community investigates listed companies in Tehran Stock Exchange and Study sample included textile, home appliances and food and beverage products except sugar is. Once the realm of research is 2004 to 2008.

#### Tests related to the first hypothesis

Been hypothesized to examine mean differences of the two samples Non-bankrupt bankrupt and is as follows:

$$\begin{cases} H_0 : \mu_1 = \mu_2 \\ H_1 : \mu_1 \neq \mu_2 \end{cases}$$

For testing done by separating the default, the first of two groups of independent variables bankrupt and Non-bankrupt Shirata model has been discussed. The test is whether the mean values of independent variables in the model 2004 to2007 years in two samples Non-bankrupt bankrupt and are equal to each other? This study to test the existence of two different samples based on default criteria is done. In this hypothesis represents the average bankrupt companies and represents companies Non-bankrupt is meant. The results of these compare in Table 2 are shown.

Calculations show that the average four variables Shirata model is different in two groups bankrupt these variables and the separation will Non-bankrupt. With t-test of significance in most cases the hypothesis of equality of means of independent variables in the two samples are rejected. Therefore we can say with 95% confidence that the above variables in two communities are different. Reject the hypothesis H0 shows good discriminate model variables for both the community and Non-bankrupt are bankrupt. Critical value based on test statistics and the  $\alpha$  value in Tables 2 and 3 for 2004 to 2007 years is presented.

Table 2. Testcomparing two groups of variables in the non-bankrupt and bankrupt in 04-05 years

Shirsts	Default	N	Ave	rage	S	D		Γ	Signif	icance	Degree of
varibles	group	1	2004	2005	2004	2005	2004	2005	2004	2005	freedom
<b>V</b> 1	Bankrupt	18	-1.58	-2.69	2.58	5.03	3 7 2	2 2 10	0.00	0.00	50
	Non	34	0.05	0.03	0.09	0.05	-3.72	-3.10	0.00		50
٧٦	Bankrupt	18	0.07	0.06	0.14	0.29	0.03	-1.76	76 0.35	0.85	50
$\Lambda L$	Non	34	0.85	0.33	3.55	0.62	-0.95				
V3	Bankrupt	18	1.47	1.46	5.56	5.61	1 30	1 3/	0.17	0.18	50
A3	Non	34	0.15	0.18	0.12	0.25	1.39	1.54	0.17	0.18	50
X4	Bankrupt	18	3.61	23.79	4.73	89.99	1 5 2	1 48	0.12	0.14	50
	Non	34	1.55	1.19	4.55	2.34	1.55	1.40	0.15	0.14	50

Table 3. Testcomparing two groups of variables in the non-bankrupt and bankrupt in 06-07 years

Shirsts	Default	N	Ave	erage		SD	· ·	Г	Signi	ficance	Degree of
varibles	group	1	2006	2007	2006	2007	2006	2007	2006	2007	freedom
<b>V</b> 1	Bankrupt	18	-4.12	-5.47	8.34	10.42	2.02	2 2 0 6		0.00	50
Al	Non	34	0.04	0.05	0.05	0.37	-2.93 -3.00	-5.00	0.00	0.00	50
X2	Bankrupt	18	-0.04	-0.34	0.25	0.22	-2.75 -1.66	1 66 0 00	0.10	50	
	Non	34	0.24	0.09	0.4	0.27		-1.00	0.00	0.10	50
V2	Bankrupt	18	0.16	0.19	0.12	0.24	1 22	1 22 0 67	7 0 10	0.50	50
Λ3	Non	34	0.12	0.15	0.08	0.15	1.32	0.07	0.19		
X4	Bankrupt	18	17.73	4992.05	58.93	2111.7	1 67	1 20	0.10	0.17	50
	Non	34	1.04	3.05	1.48	10.67	1.07	1.39	0.10	0.17	50

According to Tables 2 and 3 test statistics show that t statistics for variables in the model Shirata 2004 to 2007 years in the H1 area, is located. In other cases the model for independent variables Shirata 2004 to 2007 years of statistics within the region t H0 been accepted hypothesis is zero.

In order to test the conclusion of the independent variables against average in four years Shirata model can be used from table 4 that the hypothesis H0 rejected and the variables and parameters and is acceptable. After separation of variables and are a good poster. Also, variables and hypotheses about equality of means accepted that indicates the ability to separate users this is not a variable.

Shirsts	Wilks'	Е	df1	df2	Significan	Reject or
varibles	Lambda	Г	un	uiz	ce	accept
X1	0.867	31.573	1	206	0.000	Reject
X2	0.986	2.866	1	206	0.092	Accept
X3	0.981	3.957	1	206	0.048	Reject
X4	0.991	1.939	1	206	0.165	Accept

Table 4. Test of equality of means, two groups with the bankrupt and non-bankrupt statistics F (04-07)

## Model study Shirata using logistic regression model

Study compared four models Shirata and Finance and enter the regression model coefficients were estimated. Enter model based approach to general Shirata below is adjusted.

$$\pi(x_1, x_2, x_3, x_4) = \frac{e^{1.716 + 8.349X_1 + 0.064X_2 + 0.501X_3 + 0.004X_4}}{1 + e^{1.716 + 8.349X_1 + 0.064X_2 + 0.501X_3 + 0.004X_4}}$$

According to this model, only 20 cases of assignment errors occurred. Table 5 shows models fulfilled Shyrata Enter method with the overall accuracy of 90.4 percent and the overall error of 9.6 patients. Obtained model to the group 18 non-bankrupt companies bankrupt and non-bankrupt companies into two groups to identify bankrupt. The first type of error model above 25 percent and the second type of error model, 1.5 patients.

Default Group Number of bankrupt	Group model predicted Shirata Enter method			Group mod Shirata En	el predicted ater method		Percent overall
	Number of non-bankrupt	Total	Percentage of bankrupt	Percentage of non-bankrupt	Total	accuracy in the original sample	
bankrupt	54	18	72	75%	25%	100%	90.40%
non-bankrupt	2	134	136	1.50%	98.50%	100%	20.4076

Table 5. Results obtained by using the model Shirata Enter

Final model using the Forward to the following.

$$\pi(x_1) = \frac{e^{1.813 + 8.299X_1}}{1 + e^{1.813 + 8.299X_1}}$$

The above equation shows that the variables and in this way have been removed from the equation. Table 5 shows that 18 companies bankrupt by the models classified as non-bankrupt first type of error that the model shows. Is equivalent to 25 percent of Type II error, and model 1.5 patients. Thus the overall accuracy of the model 90.4 percent and the overall error of 9.6 patients.

Table 6.Results by model, adjusted Shirata Forward method

Default Group	Group model predicted Shirata Forward method			Group mod Shirata Forv	el predicted ward method	Total	Percent overall
	Number of bankrupt	Number of non-bankrupt	Total	Percentage of bankrupt	Percentage of non-bankrupt	Total	accuracy in the original sample
bankrupt	54	18	72	75%	25%	100%	90.40%
non-bankrupt	2	134	136	1.50%	98.50%	100%	JU. <del>4</del> 070

Tables 5 and 6 show that the estimated model results Shirata Enter and Forward methods have the same accuracy.

### Model study Shirata using multivariate discriminate analysis

Similarly the model adequacy Shirata first significant independent variables of the model we have also performed at this stage this is necessary.

Biography	Wilks' lambda	Chi-square	df	Significance
Audit function to test credit is calculated with the model	0.836	36.837	2.000	0.000

Table 7. Correlation method for discriminate analysis model Shirata

Table 7 overall correlations between the data and the adequacy of the number of significant variables for Shirata model using discriminate analysis shows. Considering the adequacy of variables results in the table above and the high correlation between variables and using computational methods, discriminate function, discriminate function regression coefficients were calculated and are presented in Table 8. It should be noted that the standardized discriminate function coefficients are and gain coefficients for the main models of Table 9 Shirata should be used that have not been standardized coefficients associated with fixed amounts of presents.

Table 8. Standardized discriminate function coefficients for the model Shirata

Variables	Function						
X <sub>1</sub>	1.287						
X <sub>4</sub>	0.621						

Table 9.: Not Standard discriminate function coefficients for the model with constant Shirata

Variables	Function
X <sub>1</sub>	0.302
X <sub>4</sub>	0.000
Constant	0.316

Based on linear discriminate function values for the model will be as follows Shirata.

 $Z = 0.316 + 0.302 x_1$ 

The above equation shows that the model variables and Shirata and have been excluded from the model. These models adjusted Shirata model is that the coefficient is non-standard and thus form the above model is the same model Shirata model in which the coefficients are constant.

To compare the model accurately adjusted Shirata discriminate analysis method can be used from Table 10. Table 10 shows that the model adjusted Shirata discriminate analysis method to group the 44 bankrupt companies non-bankrupt is attributed And a bankrupt company to the group non-bankrupt attributes. Type I error of model 61.1 percent Type II error, and the 0.7 patients. Shirata model accuracy with this method, the overall 78.4 patients.

Table 10. Results obtained by model Shirata adjusted discriminate analysis method

Default Group	Predicted Group Membership			Predicted Grou	ıp Membership	Total	Percent overall
	Number of bankrupt	Number of non-bankrupt	Total	Percentage of bankrupt	Percentage of non-bankrupt	Total	accuracy in the original sample
bankrupt	28	44	77	38.90%	61.10%	100%	79 40%
non-bankrupt	1	135	136	0.70%	99.30%	100%	/8.40/0

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Coefficients obtained by comparing the model Shirata the main model and according to the results obtained using logistic regression and discriminate analysis methods can be such a comment, The model coefficients given in the study of conditions than the original model of the mother country will change and Even number of variables in the model selection is given to the original model will be different.

#### Discontinuity point of the model Shirata

Discontinuity point models Shirata audits are presented in Table 10 that the values are subject to audit.

This relationship based on mean values of two vectors and the normal population and bankrupt enterprises and the variance covariance matrix is calculated between the two groups. Meanwhile discontinuity points in the third level is the audit functions.

Table 11.estimated detection function is calculated for models with discriminate analysis method Shirata

Group	Function
bankrupt	- 0.607
Non-bankrupt	0.321

Estimated value of Z using the data table below is calculated:

The bankruptcy probability model Shirata	Bankruptcy possibility according to shirata model
Very high	-0.607≤Z
Weak	-0.607< Z <0.321
zero	Z≤0.321

Percent overall correct prediction model method Shirata Enter, Forward and discriminate analysis were 90.4%, 90.4% and 78.4% was obtained.

According to the results of two tests, and logistic discriminate analysis can be stated that such a model obtained by logistic model, Enter, has better detection capability. And models for assessing credit obtained using logistic Enter data using 2008 years and I want to evaluate the model. As Table 12 shows the model adjusted by the method of logistic Enter Shirata obtained bankrupt companies the ability to separate right and carefully non-bankrupt 94.3% for companies is 2008 years.

Default Group	Group model predicted Shirata Enter method			Group model predicted Shirata Enter method			Percent overall
	Number of bankrupt	Number of non-bankrupt	Total	Percentage of bankrupt	Percentage of non-bankrupt	Total	accuracy in the original sample
bankrupt	16	2	18	88.90%	11.10%	100%	04.20%
non-bankrupt	1	33	34	2.90%	97.10%	100%	94.30%

**Table 12.** Results of survey for 2008 years

#### Tests related to the second hypothesis

To perform these test hypotheses of shared large correlation between variables is used.

Table 13.Importance of variables	based on a common	interclass correlation
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Variables	Function
X <sub>1</sub>	0.882
X <sub>4</sub>	-0.219
X <sub>3</sub>	-0.061
X <sub>2</sub>	0.047

Table 13 shows the importance of each of the variables in the model is Shirata order of priority. Amounts presented in the table above shows that the percentage of variability in the model by Shirata independent

variable is expressed. Table also shows that the value of variable model Shirata 0.882 had the highest effect on the value of variable model and 0.047 the lowest model is in effect.

Variables	absolute t statistics				
variables	2004	2005	2006	2007	
X <sub>1</sub>	3.719	3.18	2.935	3.61	
X <sub>4</sub>	1.53	1.477	1.666	1.39	
X <sub>3</sub>	1.394	1.342	1.317	0.668	
X <sub>2</sub>	0.931	1.757	2.755	1.657	

 Table 14: Comparison of the absolute t statistics for model variables Shirata (04-07)

Using the absolute t statistics are presented in Table 13 can also show that whatever the absolute t statistics for a variable is larger, Variable in predicting the effect of bankruptcy is that in most cases more important variables in the tables before the match and thus the second sub-hypothesis is proven. Table 13 shows that the variable in the model Shirata highest impact and lowest variable model is in effect.

So in answer to a question by which the various variables of model conditions have priorityandThe model can be Shirata concluded that this model than (retained earnings compared to the mean average total assets) is the highest importance.

## Conclusion

With all results in Shirata models using logistic models and Forward Enter method accurately predicted the overall respectively 90.4% and 90.4 using discriminate function 78.4% is, Shirata model can be stated that the logistic model is suitable Enter method. And adjusted models to assess And adjusted models to assess the validity of the data in 2008 related to textile companies, home appliances and food and drink products except sugar have used the model adjusted logistic Enter Shirata method shows These models predict corporate bankruptcy precision 94.3 percent for sample firms is 2008 years. After the first research hypothesis is accepted.

kind of test	Companies just been diagnosed	Companies that have been wrong diagnosis	Discrimination power	
logistic enter	188	20	90.40%	
logistic forward	188	20	90.40%	
discriminate analysis	163	45	78.40%	

Table 15. Results of tests adjusted model Shirata

#### The results obtained suggest

According to the final model derived variables Shirata results indicate removal X2(Debt and equity minus current period to the period before a), X3(Interest and discount expense to borrowings, corporate bond & note receivable discounted), X4((Note payable + accounts payable) x12/Sales) the final model is based on leverage, all companies are. X1(Average retained earnings to average total assets) only variable that remains is based on company profitability. Inference can be made so that Iranian firms were mostly high leverage. So this variable in predicting bankruptcy is not effective. Therefore, the obtained model study for Stock Exchange, shareholders and financial analysts to take appropriate financial decisions and capital management are recommended.

## Suggested for future research

- 1. Use other than to insert them into financial models to provide new models of research
- 2. Research conducted using research models for other industries Stock Exchange
- 3. Model test and evaluate the impact of financial crisis commenting independent auditors

4. Test models based on the financial statements and periodically assess their ability to predict the financial crisis

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