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The Role of Main Indicators of Earnings Quality in Estimating Credit Risk

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Abstract
When estimating credit risk by experts and analysts, financial indicators are one of the tools used. The relationship between these indicators and credit risk has been extensively investigated by domestic and foreign researchers. According to the surveys, no research has been carried out on the relationship between earnings quality and credit risk. Therefore, this study aims to investigate the relationship between the credit rating of companies listed on the Tehran Stock Exchange and their earnings quality. For this purpose, 156 companies as the sample in the period of 10 years between 2005 and 2015 were used to test the research hypotheses. In this research, Excel, Master, and Eviews software were used for data analysis. The results of this study indicate that there is a significant relationship between the credit rating of the companies listed on the Tehran Stock Exchange and their main indicators of earnings quality. The results of this research can help increase the efficiency of credit risk estimation by banks and credit rating agencies.

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Introduction

One of the ways to quantify and measure credit risk and, consequently, its proper management, is to use credit rating. Credit rating is an approach to measure the characteristics and performance of recipients of facilities based on quantitative criteria such as financial information of companies to predict the future performance of applicants for obtaining facilities with similar characteristics. Credit ratings are determined by major credit rating agencies, such as Endpoors, Fitch, Moody's, and RAM. These agencies use a variety of financial indicators to determine the credit rating of companies. One of the indicators used by these agencies in this process is the profitability ratio, which plays an important role in determining the credit rating of companies. Therefore, the amount of earnings as one of the accounting data used to calculate these indicators has special importance because most of the investors and creditors in their decision-making process use indicators that show the potential profitability of companies. Therefore, users' awareness of the reliability level of the earnings reported may help them make better decisions. Therefore, in the analysis process, both the quantity of earnings and the quality of earnings are considered. The purpose of earnings quality is the potential ground for earnings growth and the likelihood of realizing future earnings.

Therefore, the study of the relationship between earnings quality and credit risk seems necessary in assessing credit risk and rating agencies based on it.

Theoretical Principle and Background

Companies have the incentive to inform investors about their credit quality to get the highest possible price for their securities. According to the signaling theory, companies with high credit quality transfer their information to investors and receive more market value. The more effective method is to use extra-organizational specialists such as credit rating agencies that act as information brokers and show superior credit quality to the market. They make a credit assessment at a lower cost than any one of the investors do it separately because specialist analysts investigate and evaluate in the field of credit assessment. Rousseau, Stéphane, (2006).

Credit rating is of great practical importance because it affects the cost of financing the company, its financing structure, and even its ability to sustain the activity. Graham and Harvey (2001) found that considering credit rating is the second most important factor after maintaining financial flexibility in decisions related to the issuance of securities. In terms of investment, credit rating is an independent source for credit analysis at the operational level for legal purposes and limiting the costs of an agency. Gray et al (2006).

The literature on credit risk assessment states that ratings follow two goals from the perspective of investors. It approves the current financial condition of the company for investors (initial rating) and announces changes in the previous financial condition of the company (rating changes). Poon, W. & Chan, K. (2008)

Credit ratings are valuable to investors as long as make they are free from additional costs for research or monitoring publishers.

From the point of view of legislators, as well as investors, the determination of the degree of credit risk leads to saving sources which if do not exist, they must assign credit for evaluation. Specifically, legislators use rates as a threshold for determining capital expenditures and investment prohibitions in institutional portfolio collection. Cantor, R., Packer, F. (1997)

Risk assessment is determined by large credit rating agencies, such as Standard & Poor's, Moody's, and Fitch, based on the company's internal and external status.

Although the factors that they consider in the credit rating process of the company are not entirely transparent, generally include both quantitative factors such as financial ratios, and qualitative factors such as management quality, industry characteristics, the competitive position of the company, and so on. Evidence indicates that credit rating agencies use accounting system data to calculate companies' risk degree.

The quantitative aspect of rating from the viewpoint of Fitch focuses on publisher policies about operational strategies, goals of financial leverage, earnings policies, and financial goals. The priority is to analyze the publisher's ability to generate cash shown through profitability and coverage ratios. Fitch focuses on criteria of cash flow of profit, coverage, and leverage for financial analysis. Of course, Fitch also analyzes the structure of the capital to determine the level of dependency of the company on external financing. Fitch Ratings (2006).

From the viewpoint of Standard & Poor's, profitability is an important determinant of credit protection. A company with a higher operating margin and return on capital has a higher ability to create domestic capital, attract foreign capital, and resist business disabilities. On the other hand, coverage ratios should also be considered to evaluate the company's fixed costs. Capital structure, leverage, and asset protection ratios are other ratios used by Standard & Poor's ratios. Standard & Poor's (2001).

Moody's analyzes operating profitability, debt coverage ratios, the intensity of working capital, and cash flows to determine the company's financial position and, as a result, financial risk. It also pays attention to foreign currency risks and financial flexibility. Moody's Investor Service (2004).

Ram Rating evaluates the company's financial factors through three broad sections historical features, future financial predictions, and financial flexibility. It uses ratios of profitability, liquidity and financing structure, coverage and leverage, cash flows and financial flexibility to determine the company's financial risk. In addition, the trend and the prediction of these ratios are considered. RAM Rating (2008).

As it is seen, financial indicators, such as profitability ratios, play an important role in assessing credit risk.

Therefore, given that profit is one of the most important factors influencing economic decision-making, the users' awareness of the reliability of profit can help them to estimate profitability and credit decisions. Financial analysts are cautious in their assessment of net profit reported or profit per share of the company (without adjusting), so in determining the value of the company, only the quantity of profit is not considered, but its quality is also considered. In other words, the value of a single share does not depend on the profit of each share of the company in the current year, but depends on our expectations of the future of the company and the profitability of the coming years, and the reliability of future profits.

Although profit represents the ultimate performance of companies, but each company has an accounting system with its own accounts, which results in various profits. Therefore, it should be possible to explain the true story of these values to investors.

Some researchers also consider earnings quality as an appropriate statistic for the quality of financial reporting and state that earnings are the most important output indicator of the reporting process, which is why focusing on earnings is appropriate.

Also, focusing on the earnings quality can be justified by the fact that earnings and scales based on it exist everywhere. This criterion appears in contracts of rewards and borrowing and even payments to employees. As a result, appropriate

earnings lead to a high quality of financial reporting and ultimately lead to an optimal allocation of resources in the capital market. Francis, J., P. Olsson and K. Schipper (2006).

Considering that earnings quality is of high importance and is one of the main concepts of accounting, it has various interpretations among researchers, so there is no broad consensus among the definitions of earnings quality. Hermanns said in 2006 that the issue of earnings quality is a complex area that no scholar has been able to provide it with a unique definition.

Zhang, and Penman (2002) see the earnings quality as stable. That is, they say that the higher the earnings stability, the higher the earnings quality.

Dichev and Dechow (2002) define the earnings quality based on the adjusting of past, present, and future cash flows with accruals.

Perhaps the most complete definition is provided by Dechow et al. In 2010, based on the statement of Financial Accounting Concepts No. 1: high-quality earnings provide more information about the characteristics of the financial performance of a company for decision-makers in financial performance analysis of the company.

Earnings Quality Measurement Indicators

Indicator of Leuz et al. (2003)

In the indicator of Leuz et al. (2003), the earnings quality is measured by variables of earnings and cash flows from the measurement operation. According to this model, the value of the earnings quality is equal to the standard deviation of operating profit divided by the standard deviation of cash from operations. ‹That is:

$$EQ\ i,t = S.\ d\ OI\ i,t / S.\ d\ CFO\ i,t$$

Where:

EQ i,t = the earnings quality of company i in year t

S. d OI i,t = the standard deviation of operating profit of company i in year t

S. d CFO i,t = the standard deviation of cash from operation of company i in year t

Indicator of Penman (2001)

In this indicator, the earnings quality is derived from the division of cash from operation into operating profit. In Penman's (2001) indicator, the earnings quality is calculated through the following equation.

$$EQ\ i,t = CFO\ i,t / OI\ i,t$$

Where:

EQ i,t = the earnings quality of company i in year t

CFO i,t = cash from the operation of company i in year t

OI i,t = operating profit of company i in year t

Indicator of Barton & Simco (2002)

In this indicator, the earnings quality is calculated by dividing the net operating assets at the beginning of the period into sales revenue. In an indicator of Barton & Simcoe (2002), the earnings quality is calculated as follows.

$$EQ\ i,t = BNOA\ i,t / S\ i,t$$

Where:

EQ i,t = the earnings quality of company i in year t

BNOA i,t = the net operating assets of in beginning of the period of for company i in year t

S i,t = sale of company i in year t

Indicator of Braua (2006)

According to this indicator, the earning quality is calculated based on the earnings response coefficient and adjusted earnings response coefficient.

That is:

$$EQ_{i,t} = BVE_{i,t} + EPS_{i,t} + (EPS * DE)_{i,t} + (EPS * EVAR)_{i,t}$$

Where:

EQ i,t = the earnings quality of company i in year t

BVE i,t = the book value of each share of company i in year t

EPS i,t = earnings of each share before extraordinary items of company i in year t

DE i,t= debt to equity ratio in company i in year t

EVAR i,t = percentage of variation of earning of each share in company i in year t

However, among all the information provided by the company, information related to earnings is the most important criterion for the company's performance. Hence, many studies have examined the relationship between earnings quality and the cost of capital.

Background

Maine and Leigh (2008) used the financial ratios derived from the financial statements audited, 1061 manufacturing companies, including the credit portfolio of the largest credit guaranteeing organizations in Korea, provided the performance of all companies with a single credit score. They considered the ratios of financial expenses to sales, current debts to capital, and total debt to total capital as inputs and ratios of capital to total assets and current assets to current debt as output of the model. The researchers believed that the result of the research, including the credit rating obtained using the data envelopment analysis approach, was authentic and reliable.

Marsis (2009) used the data envelopment analysis method for the credit rating of 1408 companies. He used the ratio of debt to equity, current debt to net sales, and financial expenses to net sales as input and ratio of net sales to equity, ratio of capital adequacy, and equity to assets as output of the model. This research uses the CCR model of data envelopment analysis with input-centric approach to show only 27 companies are fully efficient.

Amal et al. (2003) used the data envelopment analysis method for the credit ratings of Turkish bank customers. They used 6 financial ratios of 82 manufacturing companies, and their statistical information had a significant difference with the average industry. Among these ratios, inputs of the model include short-term bank loans / current debt, current debt / net sales, absolute value (fixed assets / equity), and it outputs include (current assets-inventory) / current debt, equity / asset, net profit / asset.

Chang et al. (2007), in research, entitled "Multi-choice approach to credit rating using the data envelopment analysis method, evaluating borrowers considering private financial projects", propose a multi-choice approach to credit rating through the data envelopment analysis in order to evaluate borrowers for private financial projects. In this research, various credit rating techniques such as audit analysis, decision trees, neural networks, and so on have been compared.

In a research, Gary et al. (2006) investigated the effect of financial and industrial variables used by Standard & Poor's on the credit rating of Australian companies. Researchers used Probit's model for the investigation. The results showed that ratios of leverage and interest coverage had the most effect on credit rating.

Liang et al. (2006) conducted research as "a data envelopment analysis from rating of loan documents of shipbuilding industry" in Taiwan. Their goal was to provide an objective and simple approach to rate bonds. Researchers used the data envelopment analysis to achieve their research goals during the 1997-2004 period. The result indicated the success of the model in the rating of bonds.

Research Hypothesis

The main indicators of earnings quality have a relationship with the credit risk of companies.

Methodology

The research suggested is deductive, inductive, deductive logically; applied in terms of purpose, regression model statistically, and post-event in terms of method.

Statistical Sample and Population

For this purpose, information of companies listed on the Tehran Stock Exchange was collected periodically for ten years (2006 to 2015). 156 companies as samples were used to test the hypotheses of the research.

Variables

Independent Variables

1- The model used by Leuz et al. (2003) was used to calculate the earnings quality based on time series (characteristics of stability, predictability, and earnings to a value of the stock).
2- Penman's model (2001) was used to calculate earnings quality based on the relationship between earnings and cash.
3- Barton & Simco's model (2002) was used to calculate earnings quality based on the relationship between earnings and accruals.
4- Barwa's model (2006) was used to calculate the earnings quality based on the earnings response coefficient and adjusted earnings response coefficient.

Control variable

Many researchers have used financial leverage as the variable indicating the risk of the company in their models. Various research conducted has evaluated the effect of financial leverage on the performance of a company negatively. The studies show that the financial leverage of companies increases their risk (Jung, 2009, Kouh et al., 2009, Park & Lee 2009, Tai & Gou, 2007). In this research, we have considered financial leverage as the control variable.

The financial leverage is equal to debt to equity ratio (Lee et al., 2011)

Dependent variable

In this research, the credit risk of companies has been determined as the dependent variable, and for evaluation of them, only financial ratios derived from annual financial reports of companies have been used.

Input and output variables to determine the credit rating of companies

After the study of theoretical literature and background of the research, 4 input variables and 16 output variables all of the financial data have been considered for credit rating of companies through the data envelopment analysis.

The input variables include ratio of current debts to assets, ratio of long-term debts to assets, ratio of long-term loans received to assets, the equity ratio

And the output variables include the followings:

Return of investment (ROE), return on assets, net profit margin ratio, gross profit margin ratio, current ratio, operating profit margin, quick ratio, cash to current debt ratio, cash flow operation to total debt, free cash flow on debt, inventory turnover to sale ratio, asset turnover ratio, equity ratio, assets, net sales, net profit.

Testable model

$C.R = LEVERAGE + \beta_1\ LEUZ + \beta_2\ PENMAN + \beta_3\ BARTON.SIMKO + \beta_4\ BRAUA + \varepsilon$

LEVERAGE = financial leverage

C.R = credit risk

Data analysis and results from regression analysis

The best company was selected using the data envelopment analysis method, which is a non-parametric method, based on output and input ratio and then comparing the companies to each other. The rating was conducted through DEA master software.

Findings of the research

Descriptive statistics

The descriptive statistics of the main variables of the model are as follows:

Table 1: descriptive statistics of the main variables

	C.R	LEVERAGE	LEUZ	PENMAN	BARTON.SIMKO	BRAUA
Mean	0.884211	2.147194	0.956802	0.906972	1.082313	5734.497
Median	0.974700	1.554798	0.758898	0.736563	0.861284	3745.631
Maximum	1.000000	46.01448	5.994133	19.38557	5.943667	49738.61
Minimum	0.041370	-45.11283	0.001193	-19.72439	0.065864	-40579.51
Std. Dev.	0.186191	3.688995	0.845676	2.075109	0.799787	6819.962
Skewness	-2.138498	1.182345	2.052109	1.551942	2.489843	1.787684
Kurtosis	7.348286	61.40700	8.779602	30.76614	11.46543	14.44064
Observations	1560	1560	1560	1560	1560	1560

Unit Root Test (evaluation of reliability)

Null Hypothesis: Unit root (common unit root process)

Series: **C.R**

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-4403.04	0.0000

Series**: LEVERAGE**

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-11.9307	0.0000

Series: **LEUZ**

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-45.5934	0.0000

Series: **BARTON.SIMKO**

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-10.4708	0.0000

Series: **BRAUA**

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-16.5172	0.0000

Series: **PENMAN**

Method	Statistic	Prob.**
Levin, Lin & Chu t*	-6.30859	0.0000

Cointegration test

Kao Residual Cointegration Test

	t-Statistic	Prob.
ADF	5.892034	0.0000

Since the probability value for the Kao cointegration test statistic is less than 0.05, then the assumption of the absence of a long-term relationship between the variables of the model is rejected, and we conclude that the model variables are cointegrated.

4-5- Evaluation of collinearity of independent variables

Covariance Analysis: Ordinary
Sample: 2006 2015
Included observations: 1560

Correlation Probability	LEVERAGE	LEUZ	PENMAN	BARTON_SIMKO	BRAUA
LEVERAGE	1.000000 -----				
LEUZ	-0.072822 0.0040	1.000000 -----			
PENMAN	0.051386 0.0424	-0.106784 0.0000	1.000000 -----		
BARTON_SIMKO	-0.067920 0.0073	0.096250 0.0001	-0.023985 0.3438	1.000000 -----	
BRAUA	-0.155025 0.0000	0.135182 0.0000	-0.067436 0.0077	-0.135349 0.0000	1.000000 -----

Variables of correlation between variables of the research indicate that there is no very high correlation between the independent variables (the maximum value of correlation between variables of LEUZ and BRAUA is -0.151) and there is no problem regarding collinearity.

F-Limer test

Redundant Fixed Effects Tests
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.848542	(155,1399)	0.0000

Since the probability value of the Limer test is less than 0.05, then the null hypothesis based on the presence of pooled regression (regression without constant or random effects) is rejected, and therefore the proper model for estimating the model has constant or random effects and is not pooled.

Hausman test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	30.922477	5	0.0000

Given that the probability value of the Hausman test is less than 0.05, then the statistical assumption that the model has random effects is rejected. Therefore, eventually, we conclude the model has constant effects on sections (companies).

Heteroskedasticity test (White test)

The results of the heteroskedasticity test are as follows:

Heteroskedasticity Test: White			
F-statistic	3.406314	Prob. F(20,1539)	0.0000

Since the value of the F statistic is significant (the probability value is less than 0.05), we conclude that the null hypothesis on homoscedasticity is rejected. Therefore, it is necessary to apply the correction to our model; we have done that. So we put the Coeff covariance method in the panel model settings on the cross-section weights (PCSE) option. This will change the method of calculating the standard error of the coefficients and, consequently, the T-Student statistic and the relevant significant levels are corrected regarding the heteroskedasticity.

Estimation of the model

Forecasting Equation:

==========

C.R = C(1)*LEVERAGE + C(2)*LEUZ + C(3)*PENMAN + C(4)*BARTON_SIMKO + C(5)*BRAUA + C(6) + [CX=F]

And results of estimating the regression model are as follows:

Dependent Variable: C.R
Method: Panel EGLS (Cross-section weights)
Sample: 2006 2015
Periods included: 10
Cross-sections included: 156
Total panel (balanced) observations: 1560
Linear estimation after one-step weighting matrix
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEVERAGE	0.001008	0.000269	3.749604	0.0002
LEUZ	0.000941	0.000321	2.931957	0.0034
PENMAN	-0.000151	0.000256	-0.587683	0.5568
BARTON_SIMKO	0.000109	0.000291	0.374150	0.7083
BRAUA	5.25E-07	1.24E-07	4.221211	0.0000
C	0.878155	0.001233	712.3295	0.0000

Effects Specification

Cross-section fixed (dummy variables)			
	Weighted Statistics		
R-squared	0.391129	Mean dependent var	3.163796
Adjusted R-squared	0.321494	S.D. dependent var	6.596565
S.E. of regression	0.167323	Sum squared resid	39.16761
F-statistic	5.616843	Durbin-Watson stat	2.188090
Prob(F-statistic)	0.000000		
	Unweighted Statistics		
R-squared	0.207275	Mean dependent var	0.884211
Sum squared resid	42.84368	Durbin-Watson stat	2.227599

Analysis of the regression model

The value of the F statistic and the probability value for the total model is 5.616 and 0.0000, respectively showing the significance of the model in the total model.

Meanwhile, the value of the adjusted determination coefficient (adjusted R-squared) is 0.321 based on which we find that the model has explained more than 32 percent of changes in the dependent variable, that is, C.R.

4-12- Test of research hypothesis

Considering the results of the regression model, it can be seen that the coefficients of BRAUA and LUEZ, and LEVERAGE are significant. Because the value of the t-student of these three coefficients is higher than the critical value and their probability value is less than the error coefficient of 0.05.

Therefore, we conclude that (earnings quality based on time series), and (earnings quality based on earnings response coefficient and adjusted earnings response coefficient) and financial leverage have a relationship with the credit risk of companies. In other words, the earnings quality based on two indicators of the four indicators mentioned in the research hypothesis have a relationship with credit risk and therefore the research hypothesis is confirmed.

Evaluation of fit of the model

Autocorrelation of the remainder

The Durbin-Watson stat value is 2.227, which is within the allowed range of 1.5 to 2.5, indicating that there is no auto-correlation between error sentences and the model has a good fit from this viewpoint.

Collinearity of independent variables (variance inflation factor-VIF)

We used the correlation coefficient table to study the existence or non-existence of collinearity between independent variables. However, since only bi-collinearity can be evaluated through the correlation coefficients, we use the inflation variance factor for the identification of multicollinearity. The test results in Eviews software are as follows:

Since the values of Centered VIF is less than 5, we conclude that there is no strong multicollinearity.

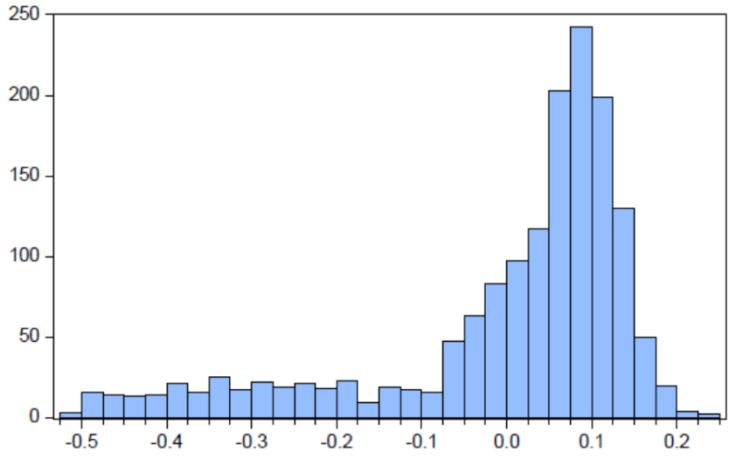
Durbin Watson Stats and Histograms of the remainders

The Durbin-Watson stat value is 2.255, which is within the allowed range of 1.5 to 2.5, indicating that there is no auto-correlation between the error sentences and that the model has a good fit from this viewpoint.

Also, the histogram of the remainders of the model is as follows:

Variance Inflation Factors
Sample: 1 1560
Included observations: 1560

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LEVERAGE	1.61E-06	1.387611	1.036301
LEUZ	3.09E-05	2.380837	1.043816
PENMAN	5.00E-06	1.210451	1.016200
BRAUA	4.88E-13	1.829867	1.071686
BARTON_SIMKO	3.45E-05	2.947697	1.040682
C	0.000123	5.805873	NA



The almost bell-shaped histogram of the remainders in the image above illustrates the acceptable fit of the model.

Discussion and conclusion:

An effective tool needed by banks to estimate customers' credit risk is the customer credit rating system. When estimating credit risk by experts and analysts, financial indicators are one of the tools used. The relationship between these indicators and credit risk has been extensively studied by researchers. According to the surveys, no research has been carried out on the relationship between earnings quality and credit risk. Therefore, this research will help to increase the efficiency of credit risk estimation by banks and credit rating agencies. Therefore, using the results of the research, it can be found that credit rating agencies should also pay attention to the earnings quality, in addition to financial ratios which are part of the determinants of credit rating of companies.

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