The relationship between operating cash flow per share and portfolio default probability

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CHRONICLE	ABSTRACT
	One of the primary duties of the depositary banks is to protect themselves against any possibility of bankruptcy. This requires the identification and measurement of risks, including default risk, which is important given the nature of the activities of banks. This paper presents an empirical investigation to study the relationship between default probability and some financial figures including operating cash flow, liabilities and return of equities. The proposed study of this paper uses historical data of twenty-two firms listed on Tehran Stock Exchange over the period 2008-2012. Default probability as the dependent variable is measured by the method developed by Moody's KMV Company. The study uses linear regression model to examine the relationship between default probability and some independent variables. The results of the present study suggest that there were some reverse relationship between operating cash flow per share, return on equities and default probability. In addition, there was a direct relationship between log facilities and default probability. However, there was not any relationship between net sales and default probability.

1. Introduction

During the past few years, there have been many studies associated with default ratio of corporations (Jonsson & Fridson, 1996; Behr et al., 2007; Keenan et al., 2000). Altman et al. (2005) analyzed the association between default and recovery rates on credit assets and tried to describe this critical relationship. They investigated recovery rates on corporate bond defaults over the period 1982–2002. The econometric univariate and multivariate models indicated a substantial portion of the variance in bond recovery rates aggregated across seniority and collateral levels. They detected that recovery rates were a function of supply and demand for the securities, with default rates playing essential role.

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Lu and Tsai (2009) estimated expected default likelihood by examining three structural models presented earlier by Leland and Toft (1996), Ericsson and Reneby (1998) and Fan and Sundaresan (2000). They applied these techniques based on a sample of 628 Taiwaneses companies with capital structures over the period 1995-2006 to forecast default risk of failed firms. Their results indicated that the likelihoods of all models were well over 50%. The accuracy of forecasting for three models were calculated as 66.07%, 82.14% and 75%.

Zeitun et al. (2007) studied the impact of cash flow and free cash flow on corporate failure in the Jordanian market using two samples; matched sample and a cross-sectional time-series over the period 1989-2003. They applied LOGIT models to outline the relationship between firms' financial health and the likelihood of default. The results indicated that there was firm's free cash flow increases corporate failure. They also reported that the firm's cash flow decreases corporate failure. Firms' capital structures were fundamental in forecasting default. Capital structure was observed as the primary factor influencing the probability of default as it impacts a firm's capability to evaluate external sources of funds.

According to Helwege and Kleiman (1996) tried to find out more about different factors explaining the wide swings in the default rate on high yield bonds. They reported that differences in credit quality from year to year could be considered for much of the observed variation in default rates, but economic conditions and the age of bonds were considered as other important factors.

2. The proposed study

The proposed study of this paper uses the following to compute default probability (*PD*) (Witzany, 2009),

$$PD_{i,t} = \beta_0 + \beta_1 OCF\ Per\ Share\ _{i,t} + \beta_2\ Log\ Net\ sell_{i,t} + \beta_3 Log\ Facilities\ _{i,t} + \beta_4 Roe_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where *OCF* represents operating cash flow per share, *ROE* states for return of equities, *Facilities* are total loans and finances received, *Net Sell* also represents total net revenue reported in official statements of the firms for the proposed study. In this survey, we take natural logarithm of Net Sell and Facilities. PD is calculated by KMV-Merton model estimates the market value of debt by applying the Merton (Crosbie & Bohn, 2003) bond-pricing model. There are three hypotheses associated with the proposed study of this paper as follows,

1. The logarithm of net sales is associated with default probability.
2. The net sales have meaningful relationship with default probability.
3. Return on equities has meaningful relationship with default probability.

The proposed study of this paper has executed on shares of one of Iranian banks named Bank Mellat by taking 110 observations over the period 2008-2012. Table 1 demonstrates the summary of some basic statistics.

Table 1
The summary of some basic statistics

Variable	Number	Mean	Standard deviation	Variance	Skewness	Kurtosis
PD	110	0.54	0.25	0.06	-1.11	2.93
OCF/share	110	0.001	0.0011	0	2.04	9.34
Log Net sales	110	6.16	0.65	0.42	0.62	4.04
Log Facilities	110	5.88	0.72	0.52	-0.37	4.46
(ROE)	110	0.29	0.29	0.08	1.2	16

In addition, Fig. 1 demonstrates the results of default probability calculated based on KMV-Merton.
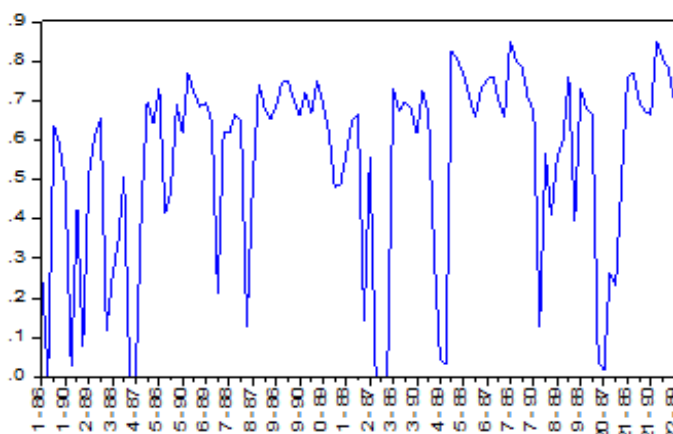
Fig. 1. Default probability

Before, we perform a regression analysis, it is necessary to make sure that all data are normally distributed. Table 2 demonstrates the results of Jarque-Bera test.

Table 2
The results of Jarque-Bera test

Variable	Jarque-Bera	
	Statistics	Sig.
Default probability	22.7	0
OCF	261	0
Log of Net sales	12	0.002
Log of Facilities	30	0
ROE	813	0

As we can observe from the results of Table 1, all data are normally distributed when the level of significance is five percent. Fig. 1 shows a sample of residuals.
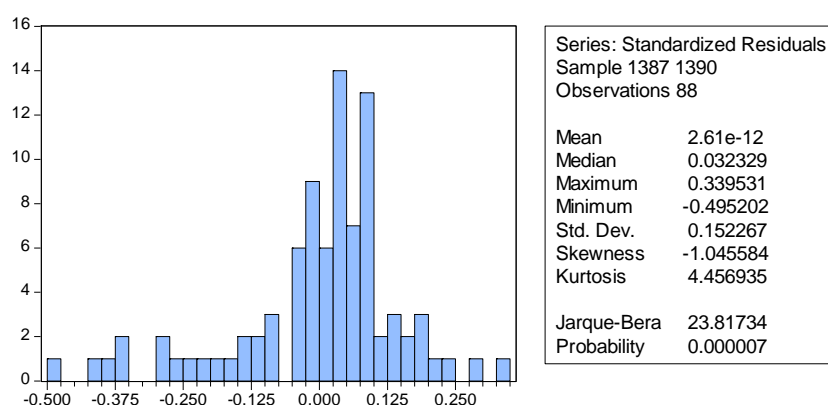

Fig. 1. The plot of standardized residuals

Before we perform regression analysis, we need to make sure all data are stationary and this could be accomplished through different tests such as augmented Dickey Fuller (ADF) or LLC tests. Some people argue the validity of ADF for small observations and recommend other indicators for testing stationary test. In this paper, we propose to use LLC test to find out whether the nature of data is stationary or not. Table 3 demonstrates the results.

Table 3
The results of LLC test

Variable	LLC	
	Statistics	Sig.
DF	-10.6	0
OCF/share	-4.42	0
Log (Net Sales)	-9.27	0
Log (Facilities)	-9.36	0
ROE	-7.28	0

In order to choose between Pooled model or Fixed effect model, the proposed study uses Chow test and the results indicated that we need to use Pooled model. Next, we need to make sure there are linear relationships among independent variables. Table 4 demonstrates the results of correlation ratios.

Table 4
The summary of correlations among independent variables

Variable	PD	OCF/share	Log (Sales)	Log(Facilities)	ROE
PD	1				
OCF/share	0.05	1			
Log (Sales)	-0.4	0.17	1		
Log(Facilities)	-0.37	0.19	0.28	1	
ROE	0.16	0.24	0.22	0.2	1

The results of Table 3 clearly show that there were not strong correlations among variables.

3. The results

In this section, we present details of our findings on the implementation of the regression equation.

$PD_{i,t}$ = -7.7 OCF Per Share $_{i,t}$ -2.25 Log Net sell$_{i,t}$ + 5.16 Log Facilities $_{i,t}$ -0.02 Roe$_{i,t}$ +ε$_{i,t}$

S.D. (2.88)	(1.44)	(2.45)	(0.01)
t-value 14.67	-1.56	2.109	-2.24
Sig. 0.00	0.12	0.03	0.0254

F-value = 47 Sig. (0.00)   Durbin-Watson = 2.31

(2)

Based on the results of Eq. (2), we are now able to examine various hypotheses of the survey.

3.1. The first hypothesis: The relationship between PD and OCF per share

The first hypothesis of the survey examines the relationship between default probability and operating cash flow per share. Based on the results of Eq. (2), the coefficient of OCF/share is equal to -7.7, which is statistically meaningful when the level of significance is five percent and we can conclude that as the operating cash flow increases, we may expect the chance of default probability will be reduced.

3.2. The second hypothesis: The relationship between PD and net sales

The second hypothesis of the survey examines the relationship between default probability and logarithm of net sales. Based on the results of Eq. (2), the coefficient of log of net sales is not statistically meaningful when the level of significance is five or even ten percent and we cannot

conclude that there is any relationship between these two variables. Therefore, the second hypothesis of the survey is not confirmed.

3.3. The third hypothesis: The relationship between PD and ROE

The third hypothesis of the survey examines the relationship between default probability and ROE. Based on the results of Eq. (2), the coefficient of ROE is equal to -0.02, which is statistically meaningful when the level of significance is five percent and we can conclude that as the operating cash flow increases, we may expect the chance of default probability will be reduced.

4. Conclusion

In this paper, we have presented an empirical investigation to study the relationship between operating cash flow per share, logarithm of facilities as well as return on equities. The proposed study has been applied on shares of one of Iranian banks and using regression analysis, the study has confirmed a reverse relationship between PD with OCF as well as ROE. However, the study did not find any meaningful relationship between probability default and logarithm of net sales. Table 5 shows details of our findings.

Table 5
The summary of testing various hypotheses of the survey

Hypothesis	Independent/Dependent		Regression analysis			
	Independent	Dependent	$\beta = 0$	$\beta \neq 0$	Relationship	Result
Main	Operating per share	Default probability	✘	✔	-	Confirmed
First	Log of Net sales	Default probability	✔	✘	-	Not confirmed
Second	Log of Facilities	Default probability	✘	✔	+	Confirmed
Third	ROE	Default probability	✘	✔	-	Confirmed

Acknowledgement

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