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FINANCIAL RATIOS AS DISCRIMINATORS BETWEEN SICK AND NON-SICK COMPANIES -A PARAMETRIC APPROACH

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Abstract
In the post liberation era, in spite of accelerated industrial growth, industrial sickness occur as a common phenomenon. The application of financial ratio analysis has become a common practice to distinguish sick companies from non-sick ones. The nature of distribution of financial ratios is a pre-requisite to choose either parametric or non-parametric statistical tests to find out financial ratios those well discriminate sick firms from non-sick firms. When majority of the ratios are found to have normal distribution, are independent and if variances between sick and non-sick firms are equal, then parametric tests can be applied. The present study is an attempt to find out financial ratios those significantly discriminate between sick and non-sick companies using parametric statistical tests. By employing Anderson-Darling Test of Normality, Spearman's Correlation and Levene's Test of Equality of Variance on selected accrual and cash flow ratios of sick and non-sick Indian firms, it was found that they were not normally distributed, independent and of equal variances. The results of the study indicate using two-sample t-test, Return on Equity and Fixed Assets Turnover Ratio consistently discriminate sick from non-sick companies.

Keywords: Industrial Sickness, Financial Ratios, Parametric Tests, Non-Parametric Tests, Discriminators.

Introduction

The term industrial sickness in India refers to the firms persistently making losses and survives, even after such accumulated losses have exceeded net worth many times (Goswami, 1996)[1]. Financial distress is a vital event and is defined as "the inability of a firm to pay its financial obligations as they mature" (Beaver, 1996)[2]. The definition of a sick industrial unit as proposed by *Sick Industrial Companies (Special Provisions) Act, 1985 (SICA)* has been considered in the present study.

Significance of the Study

Industrial sickness causes unemployment, business associates losing prospective business transactions, interests of stakeholders unprotected and loss of revenue to the government. This calls for an industrial sickness forewarning signal in place, in order to undertake precautionary measures for preventing the company from being drowned in grave sickness. The present study has become essential in the context of increasing magnitude of industrial sickness in India in terms of outstanding bank credit involved.

Statement of the Problem

Some of the earlier research studies have attempted to determine financial ratios which discriminate between sick and non-sick companies (Beaver[2], 1966; Samarakoon and Hasan[3], 2003; Gupta[4], 1983). In the past, researchers have made an assumption of normal distribution of independent variables and used parametric statistical tests. Quite a few studies namely Zulkarnain M., Mohamad Ali, Annuar and Shamsher (2006)[5] identified the non-normal distribution of independent variables by means of test of normality and applied log transformation to approximate the distribution to normal, which was found to be ineffective for a diversified industry (Beaver, 1966)[2]. In the past, there are very few studies employing parametric statistical tests on isolated and non-isolated data set to determine discriminators of corporate sickness (Angelina, 2009)[6]. The present study is an attempt to use parametric statistical tests on isolated and non-isolated data set to find out the discriminators of corporate sickness.

Literature Review

Karami, Hosseini, Attaran& Hosseini (2012)[7] employed independent sample t-test to 18 financial ratios of 45 bankrupted and 45 non-bankrupted firms belonging to various industries and found that there was a significant difference between these two groups and ratios such as liquidity (Current Assets/Current Liabilities), leverage (Total Liabilities/Total Assets) and profitability (Return On Assets, Net Income/Fixed Assets, Operating Income/Total Assets) were appropriate measures for classifying bankrupt from non-bankrupt.Leksrisakull and Evans (2005)[8] selected a sample of 89 non-failed and 46 failed firms and employed 37 financial ratios. The significance of the Wilks' Lambda statistic indicated that market value of equity/ total debt, earnings before interest and tax/total assets, retained earnings/ total assets, sales/total assets and working capital to total assets significantly discriminated sick and non-sick firms.

Samarakoon and Hasan (2003)[3] employed paired t-test to 13 distressed and 13 non-distressed firms of same size belonging to

the same industry to find out if difference between means of the variables exist. The study showed that means of the variables namely working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, market value of equity to book value of total liabilities, book value of equity to book value of total liabilities and sales to total assets in the distressed sample were vastly lower than means in the non-distressed sample.

Gupta, L.C (1983)[4] examined a sample containing 20 sick and 21 non sick textile companies during 1962-64 to identify the lead indicators of sickness using 63 financial ratios. On employing Discriminant analysis, it was found that net worth to short and long term debt and all outside liabilities to tangible assets were useful. Beaver (1966)[2] compared the mean values of 30 ratios of 79 failed and 79 non-failed firms in 38 industries and the results of the univariate analysis showed revealed cash flow/total debt exhibiting statistically significant warnings prior to business failure.

Patrick (1932)[9], the pioneer in the field of corporate failure selected 19 companies randomly which had failed during the period of 1920-1929 and matched with 19 successful companies using financial soundness, asset size, sales volume, product line and fiscal year as matching criteria and examined whether there was significant difference in the ratios between failed and non-failed firms at least three years prior to failure. The study showed that the net worth to debt and net profits to net worth were the best indicators of failure among the ratios used.

Zulkarnain et al. (2001)[10], Lennox (1999)[11], Ohlson (1980)[12] and Libby (1975)[13] revealed profitability as an important determinant of bankruptcy. As the companies with large profits naturally have a lower probability of bankruptcy, the relationship between profitability and corporate sickness is negative. The company's short term solvency must be measured to find out its ability to meet short term financial obligations. Majority of the studies including Mohamed, S., Li, A.J. and Sanda A.U. (2001)[14], Zmijewski (1984)[15], Ohlson (1980)[12], Deakin (1972)[16] and Beaver (1966)[2] found that Debt related ratios significantly determine corporate failure.

Objective of the Study

The objective of this study is to determine which category of financial ratios namely, accrual ratios or cash flow ratios discriminate between sick and non-sick firms.

Research Methodology

A purposive sampling was used to select 30 companies from the list of companies declared sick by Board for Industrial and Financial Reconstruction (BIFR) between the years 2010 and 2012 having financial year April-March**.** Each of these companies was paired with a non-sick company of same, or more or less of similar size in terms of market capitalization, belonging to the same industry type. A list of matching non-sick companies was generated from PROWESS Data Base maintained by Centre for Monitoring Indian Economy (CMIE). Financial ratios for the purpose of the study were calculated using financial data contained in the profit and loss account statements, balance sheets and cash flow statements for a period of five years from 2007-2008 to 2011-2012.

The financial ratios considered for the purpose of the study include accrual ratios and cash flow ratios. The number of accrual ratios consisting of fair measures of leverage and net worth, profitability, turnover and liquidity considered in the study is 21. In addition, 12 cash flow ratios including four new ones for the first time, namely, Cash Flow from Investing activities/(Cash Flow from Operating activities + Cash Flow from Financing activities) i.e. CFI/(CFO+CFF), Cash Flow Yield (CFY), Debt Coverage (DC), Cash Flow/Net working Capital (CF/NWC) have been used in the study.

Table 1: Accrual and Cash flow Ratios used in the Study

Sl. No.	Ratios	Abbreviation	Formula
Accrual Ratios			
(i) Net worth Ratios & Leverage Ratios			
1.	Proprietary Ratio	PR	Shareholder's Equity /Total Assets
2.	Debt-Equity ratio	DE	Total Liabilities / Shareholders' Equity
3.	Total Liabilities to Net Worth	TL/NW	Total Liabilities / Net Worth
4.	Current Liabilities to Net Worth	CL/NW	Current Liabilities/Net Worth
5.	Fixed Assets to Net Worth	FA/NW	Fixed Assets/Net Worth
(ii) Profitability Ratios			
6.	Return on Assets	ROA	Net Income / Total assets
7.	Return on Equity	ROE	Net Income / Equity
8.	Gross Profit Margin	GPM	Gross Profit / Total Revenue

9.	Net Profit Margin	NPM	Net Income / Sales
10.	EBIT to Current Liabilities	EBIT/CL	Earnings Before Interest and Tax / Current Liabilities
11.	Operating Profit Margin	OPM	EBIT / Total Revenue
(iii) Turnover Ratios			
12.	Working Capital Turnover	WCTRN	Sales/Average working Capital
13.	Inventory Turnover	INVTRN	Net Sales / Average Inventory
14.	Debtors Turnover	DBRTRN	Net Sales/ Average Debtors
15.	Average Collection Period	ACP	365/Debtor Turnover ratio
16.	Fixed Assets Turnover	FATRN	Net Sales/Fixed Assets
(iv) Liquidity Ratios			
17.	Current Ratio	CR	Current Assets/Current Liabilities
18.	Quick Ratio	QR	Quick Assets/ Current Liabilities
19.	Cash Ratio	CAR	Cash & Bank Balance/Current Liabilities
20.	Inventory to Networking Capital	INV/NWC	Inventory/Net Working Capital
21.	Times Interest Earned Ratio	TIER	EBIT/Interest
Cash Flow Ratios			
22.	Operating Cash flow Ratio	OCR	Cash Flow from Operations / Current Liabilities
23.	Cash Total Debt Coverage Ratio	CTDC	Cash flow from Operations/ Total Liabilities
24.	Cash Flow to Net Worth	CF/NW	Cash Flow / Net Worth
25.	Operating Cash flow to Total Debt	OCF/TD	Operating Cash Flow / Total Debt
26.	Cash flow from Investing activities/ (Cash flow from Operating activities + Cash flow from Financing activities)	CFI / (CFO+CFF)	Cash flow from Investing activities/ (Cash flow from Operating activities + Cash flow from Financing activities)
27.	Cash Flow Margin	CFM	Cash Flow from Operations /Net Sales
28.	Cash Flow Yield	CFY	Operating Cash Flow/Net Profits
29.	Financing Policies Ratio	FPR	Cash from financing activities/ Total Assets
30.	Debt Coverage	DC	Total Debt /Cash Flow from Operations
31.	Net Income / Cash Flows	NI/CF	Net Income /Cash Flows
32.	Cash Flow to Interest	CF / I	Cash Flow / Interest
33.	Cash Flow to Net Working Capital	CF / NWC	Cash Flow / Net Working Capital

Identification of Discriminators

The objective of the study namely identification of financial ratios which significantly discriminate between sick and non-sick companies has been achieved by employing parametric statistical test namely independent two-sample t-test to isolated data set and non-isolated data set respectively.

The conditions for choosing parametric tests are (i) the sample must come from normally distributed populations (ii) the samples must come from populations with equal variances; and (iii) the observations should be independent of each other, both within and between sample groups. The parametric tests which we apply in this study examine the difference between the two group means and conclude whether there exists a significant difference between the two distributions. Test of Normality has been used to find out if financial ratios of both sick and non-sick companies were normally distributed. Spearman's correlation coefficient was used to find out if the ratios were independent ones. Test of equality of variance was carried out to observe if financial ratios have equal variances between sick and non-sick companies.

Results of Anderson-Darling Test of Normality

Anderson-Darling test of normality is used to find out if the financial ratios of sick and non-sick companies considered in the present study are normally distributed. This test has been applied individually to the mean values of financial ratios of sick and also non-sick group of companies. In this context the relevant hypothesis is framed as below:

$\mathbf{H_{N1}}$: There is no significant departure from normality.
This hypothesis has been tested for sick and non-sick companies separately.

(i) Normality Test of Financial Ratios of Sick Companies

A-Squared is the Anderson-Darling statistic which compares the empirical distribution function of the data to that of a fitted distribution. The data is normal when *p-value* is greater than *alpha (equal to 0.05).*

The results of the test indicated that all the ratios except CR has *p-value* less than 0.005. As *p-value* of all the ratios except CR is less than alpha (level of significance) of 0.05, null hypothesis is rejected. Hence, alternative hypothesis that there is a significant departure from normality is accepted at 95% confidence interval. This implies that the ratios of sick companies do not significantly represent a normally distributed population.

(ii) Normality Test of Financial Ratios of Non-sick Companies:

The distribution of financial ratios of non-sick companies is determined to facilitate achieving he stated objectives of the present study. The results indicated that except ROA_1, ROE_1, ACP_1, CAR_1, OCR_1, CTDC_1 and FPR_1, other ratios have *p-value* less than 0.005 leading to the rejection of null hypothesis. Alternative hypothesis stating that there is a significant departure from normality is accepted. In other words, ratios of the sample of non-sick companies do not exhibit normal distribution.

Thus it has been observed that majority of the ratios of sick and non-sick companies do not come from normally distributed populations. The present study has shown that among 33 ratios of sick and 33 ratios of non-sick groups, all ratios except CR of sick companies and OCR, CTDC and FPR of non-sick companies were found to have non-normal distribution. This finding is in accordance with previous studies by Sori and Jalil(2009)[17] that 59 variables including cash flow/sales, cash flow/ net worth, cash flow/ total debt, return on assets, return on equity, current ratio, quick ratio, receivables turnover ratio, working capital turnover ratio, total assets/net worth and net income/cash flows significantly exit from normality assumptions; Brockett, Golden, Jang and Chuanhou (2006)[18] tested the assumption of normality for all the independent variables, and the results demonstrated that none of these variables were normally distributed. Rujoub, Cook and Hay(1995)[19] ound non-normality of data on performing Kolomogrov (D) statistical technique when attempted to test whether the accounting data used in his research meet the assumptions of normality. The present study refutes the findings of Ghodrati and Moghaddam (2012)[20] in which all variables were found to be normal when Kolmogrov – Smirnov test was applied.

Results of Spearman's Correlation Analysis

It is necessary to find out if the financial ratios of the two groups of companies are independent of each other. As the distribution of most of the variables have been found non-normal, spearman's correlation coefficient has been used to find out the association between the financial ratios of both the groups. In this connection, the following hypothesis was set.

$\mathbf{H_{N2}}$: The association between the financial ratios of sick and non-sick companies is zero.

The correlation coefficient is a measure of the strength of the relationship between financial ratios of sick and non-sick companies.

It has been found from the analysis that the correlation between NPM and NPM_1 has no specific p-value. Also *p-values* of correlation between all financial ratios except ACP and OCF/TD of sick and non-sick companies are found to be greater than the significant level of 0.05. Hence the null hypothesis that there is no significant association between these financial ratios of the sick and non-sick companies is accepted. In other words, these financial ratios of sick and non-sick companies are independent of each other. Whereas the ratios ACP and OCF/TD show a significant association between sick and non-sick companies.

The correlation coefficient R of all financial ratios except GPM, EBIT/CL, WCTRN, CF/NW, CFY, DC and NI/CF between sick and non-sick groups shows a positive weak linear relationship. Also the present study reveals that all ratios are independent except ACP and OCF/TD. This finding is in line with Shirata(1998)[21] that if the variables did not have a high degree of correlation, then they would have different characteristics and could assess firms from different positions and further the study proved that characteristics of the variables were independent because they were uncorrelated. In order to obtain amodel without the problems of multicollineartiy, Baninoe (2010)[22] used Pearson and Spearman's correlation coefficients and showed that all variables have fairly low correlations with each other.

Levene's Test of Equality of Variance

Levene's test of equality of variance is an inferential test statistic used to assess the equality of variances in different samples and reveals if there are significant differences between different samples.

H_{N3}:There is no significant difference between variances of financial ratios of sick and non-sick companies.
The Levene's test for equal variances has been applied to mean values of sick and of non-sick companies. It has resulted in most of the ratios having p-value greater than significant level of 0.05 and a few ratios having values less than 0.05.

The analysis indicates that variances of all financial ratios except PR, ACP and FATRN of sick and non-sick groups have p-values greater than 0.05. Therefore the null hypothesis that there is no significant difference between variances of these ratios of sick and non-sick companies is accepted. It indicates that these 30 financial ratios have equal variances in both sick companies and non-sick companies at a significance level of 0.05. Whereas there is a significant difference between variances of the ratios PR, ACP and FATRN of sick and non-sick companies.

Thus the present study shows that 30 financial ratios have shown significant difference between variances of sick and non-sick companies and three ratios namely, Proprietary Ratio, Average Collection Period and Fixed Assets Turnover ratio have shown no significant difference, which is in conformance with earlier findings of Zheng and Yanjun (2010)[23] who tested 19 financial ratios using Levene's test of Homogeneity of variance, out of which, six indicators showed significant difference in variance between failed and non-failed companies. The study also showed that remaining ratios including Net Cash Flow from Operation/Total Liability, Accounts Receivable Turnover did not show significant difference and were found to have equal variances.

Thus the results of test of normality, spearman's correlation analysis and test of equality of variance have shown that majority of the financial ratios of sick and non-sick group of companies are not normally distributed, have equal variances and all the ratios independent.

In order to determine the category of financial ratios namely, accrual ratios or cash flow ratios that discriminate between sick and non-sick firms, the following hypothesis is framed.

H_{N4}:There is no significant difference between mean values of financial ratios of sick and non-sick companies.
As the basic conditions are satisfied, parametric tests have been used in determining if significant difference between sick and non-sick groups exists. The parametric test namely independent two-sample t-test have been applied to isolated and non-isolated data sets individually

(i) Analysis using Independent two-sample t-test using Isolated data set
The isolated database consists of financial ratios pertaining to one, two, three and four years prior to the year of the occurrence of industrial sickness taken independently.

Table 2: Results of Independent two-sample t-test using isolated data set

S.No.	Financial ratios of sick and non-sick groups	p-values of mean difference between sick and non-sick groups in the period prior to the year of sickness			
		One year (2010)	Two Years (2009)	Three Years (2008)	Four Years (2007)
1	PR and PR_1	**0.013**	**0.000**	0.408	0.374
2	DE and DE_1	**0.019**	**0.040**	0.200	0.085
3	TL/NW and TL/NW_1	0.744	0.391	**0.034**	0.074
4	CL/NW and CL/NW_1	0.900	0.273	**0.039**	0.099
5	FA/NW and FA/NW_1	0.817	0.397	0.069	0.147
6	ROA and ROA_1	0.194	**0.013**	0.297	0.628
7	ROE and ROE_1	**0.001**	**0.009**	**0.002**	**0.007**
8	GPM and GPM_1	0.317	**0.026**	0.347	0.320
9	NPM and NPM_1	0.107	**0.003**	**0.040**	0.280
10	EBIT/CL and EBIT/CL_1	0.933	**0.045**	0.412	0.940
11	OPM and OPM_1	0.090	0.940	0.524	0.391
12	WCTRN and WCTRN_1	0.970	0.887	0.395	0.052
13	INVTRN and INVTRN_1	0.992	0.100	0.281	0.989
14	DBRTRN and DBRTR _1	0.218	0.247	0.091	0.796
15	ACP and ACP_1	0.217	0.120	0.724	0.212

16	FATRN and FATRN_1	**0.001**	**0.000**	**0.000**	**0.002**
17	CR and CR_1	0.141	0.089	0.352	**0.031**
18	QR and QR_1	0.063	**0.014**	0.216	0.314
19	CAR and CAR_1	**0.000**	**0.000**	0.394	0.207
20	INV/NWC and INV/NWC_1	0.738	0.641	0.840	0.418
21	TIER and TIER_1	0.196	0.176	0.157	0.199
22	OCR and OCR_1	0.312	0.299	0.344	0.157
23	CTDC and CTDC_1	0.371	0.549	0.292	0.303
24	CF/NW and CF/NW_1	0.711	0.206	0.137	0.938
25	OCF/TD and OCF/TD_1	0.751	0.185	0.306	0.293
26	CFI/(CFO+CFF) and CFI/(CFO+CFF)_1	0.300	0.115	0.431	0.866
27	CFM and CFM_1	0.133	0.694	0.965	0.437
28	CFY and CFY_1	0.312	0.110	0.897	0.069
29	FPR and FPR_1	0.431	0.877	0.310	0.228
30	DC and DC_1	0.330	0.406	0.390	0.198
31	NI/CF and DC_1	0.106	0.546	0.170	0.305
32	CF/I and CF/I_1	0.104	0.364	0.419	0.401
33	CF/NWC and CF/NWC_1	0.530	0.629	0.694	0.465

Note: PR represents Proprietary Ratio of sick companies and PR_1 represents Proprietary Ratio of non-sick companies and similarly for other ratios.

Independent two-sample t-test has been applied to an isolated data set, to each of the years prior to the year of sickness and p-values of mean difference between financial ratios of sick and non-sick groups have been found out. The results shows that mean difference of PR, DE, ROE, FATRN and CAR ratios between sick and non-sick companies in 1st year prior to sickness have p-value less than the significant level of 0.05. Hence null hypothesis that there is no significant difference between mean values of sick and non-sick companies is rejected and thus these ratios discriminate between sick and non-sick companies. In 2nd year prior to the year of sickness, the ratios PR, DE, ROA, ROE, GPM, NPM, EBIT/CL, FATRN, QR and CAR are found to significantly discriminate between sick and non-sick companies. The ratios TL/NW, CL/NW, ROE, NPM, FATRN ratios in 3rd previous year and ROE, FATRN and CR ratios in 4th year prior to the year of sickness indicates significant difference in their mean values between sick and non-sick companies.

(ii) **Analysis using Independent two-sample t-test - Non-isolated data set**

Independent two-sample t-test has been applied to a non-isolated data set containing mean values of the ratios of sick and of non-sick companies over the entire period 2007-2010 prior to the year of sickness and p-values of mean difference of these ratios between sick and non-sick companies have been computed.

The non-isolated database include financial ratios over a period of time in four observation periods namely one year, one, two, three and four years taken together prior to the year of sickness.

Table 3: Results of Independent two-sample t-test Non-isolated data set

S.No.	p-values of mean difference of financial ratios between sick and non-sick groups over the entire period (2007 – 2010) prior to the year of sickness	p-value
1	PR and PR_1	0.729
2	DE and DE_1	**0.034**
3	TL/NW and TL/NW_1	0.876
4	CL/NW and CL/NW_1	0.442
5	FA/NW and FA/NW_1	0.708
6	ROA and ROA_1	0.216
7	ROE and ROE_1	**0.000**
8	GPM and GPM_1	0.154
9	NPM and NPM_1	0.085

10	EBIT/CL and EBIT/CL_1	0.316
11	OPM and OPM_1	0.119
12	WCTRN and WCTRN_1	0.426
13	INVTRN and INVTRN_1	0.469
14	DBRTRN and DBRTRN_1	0.175
15	ACP and ACP_1	0.972
16	FATRN and FATRN_1	**0.000**
17	CR and CR_1	0.109
18	QR and QR_1	**0.049**
19	CAR and CAR_1	**0.006**
20	INV/NWC and INV/NWC_1	0.952
21	TIER and TIER_1	**0.046**
22	OCR and OCR_1	0.061
23	CTDC and CTDC_1	0.311
24	CF/NW and CF/NW_1	0.930
25	OCF/TD and OCF/TD_1	0.237
26	CFI/(CFO+CFF) and CFI/(CFO+CFF)_1	0.119
27	CFM and CFM_1	0.616
28	CFY and CFY_1	0.251
29	FPR and FPR_1	0.344
30	DC and DC_1	0.164
31	NI/CF and NI/CF_1	0.415
32	CF/I and CF/I_1	0.076
33	CF/NWC and CF/NWC_1	0.621

The results shows that mean difference of DE, ROE, FATRN, QR, CAR and TIER ratios between sick and non-sick groups over a period of four years prior to the year of sickness have p-values less than 0.05. Hence the null hypothesis is rejected and alternate hypothesis that there is a significant difference between mean values of financial ratios of sick and non-sick companies is accepted.

Findings of the study

Thus the results of isolated data set and non-isolated data set using independent two-sample t-test indicate ROE and FATRN as commonly emerging ratios. The results of the present study is in line with the earlier studies; Wiebel (1973)[24] found inventory turnover and debt to asset ratios as good individual predictors and six other ratios including liquidity measures were effective in discriminating among the paired groups; Karami, Hosseini, Attaran & Hosseini (2012)[7] found ratios such as liquidity (Current Assets/Current Liabilities), leverage (Total Liabilities/Total Assets) and profitability (Return On Assets, Net Income/Fixed Assets, Operating Income/Total Assets) were appropriate measures for classifying bankrupt from non-bankrupt. Leksrisakull and Evans (2005)[8] indicated that market value of equity/ total debt, earnings before interest and tax/total assets, retained earnings/ total assets, sales/total assets and working capital to total assets significantly discriminated sick and non-sick firms. Samarakoon and Hasan (2003)[3] showed that the working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, market value of equity to book value of total liabilities, book value of equity to book value of total liabilities and sales to total assets significantly discriminating distressed from non-distressed firms.

Conclusion

The present study reveals that Leverage and Net worth ratios, Profitability, Turnover ratios, Liquidity and debt and income related cash flow measures significantly discriminates between sick and non-sick companies. Thus the financial ratios are simple and powerful tools discriminating sick from non-sick firms belonging to the same industry. Similar studies can be conducted by considering sick and non-sick companies of different industries belonging to different time periods.

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