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Pre-Bankruptcy Financial Performance of Firms: Do Size and Industry Matter?

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Abstract. This paper studies whether size or industry of firm influences pre-bankruptcy financial performance. The analysis of median changes in the values of financial statement variables and financial ratios of all bankrupt firms in Estonia from 2002 to 2009 shows, that some distinct differences through industries and size groups can be outlined. Still, there are more similarities than differences in the pre-bankruptcy financial performance of firms from different industries or size groups.

Keywords: bankruptcy, failure pattern, financial performance, size, industry

1. Introduction

During previous decades multitude of research has been conducted about firms' bankruptcies (and in wider perspective about firms' failures). In the context of time, available studies can be divided into pre-bankruptcy, bankruptcy proceeding and post-bankruptcy domains, whereas most of the empirical research has been done *ex post*. Majority of the literature focusing on pre-bankruptcy events covers financial perspective, mainly the difference in performance of successful and failed firms. The core of such literature is composed of creating bankruptcy prediction models, of which probably the most well-known is Altman's Z-Score model (see Altman, 1968). Less research has been focused on studying whether different failed firms are characterized by diverse pre-bankruptcy financial data. As firms with different features (e.g. differences in age, size, industry, location etc.) are expected to have varying pre-bankruptcy performance, then current paper contributes to literature by outlining the differences in pre-bankruptcy financial data (i.e. financial measures, composed of financial statement variables and financial ratios) among various firm groups. Based on the data of all bankrupt firms in Estonia in the period of 2002-2009 the direct objective of the paper is to study, whether firms in different industries and in different size groups have varying pre-bankruptcy financial performance pattern (i.e. whether changes of financial statement variables and financial ratios differ). In addition to widening theoretical knowledge of firms' pre-bankruptcy performance, current paper outlines some practical implications, both for entrepreneurs and policy makers.

2. Theoretical background of firms' pre-bankruptcy financial performance

As already outlined in introduction, one cannot find an abundance of studies focusing on the comparison of pre-bankruptcy performance of different failed firms. First group of relevant literature tries to establish distinct failure processes or patterns, both theoretically and also through empirical validation (see e.g. Argenti, 1976; Baumard and Starbuck, 2005; Chowdhury and Sheppard, 2005; Crutzen, 2009; D'Aveni, 1989; De Prijcker and Ooghe, 2008; Laitinen, 1991; Richardson et al. 1994). Although different failure trajectories are outlined in given studies, the established failure pathways are often not linked to firm characteristics like industry or size. Followingly some of the key results from given studies are outlined for current paper. Based on a selection of financial ratios, Laitinen (1991) established three distinct failure patterns (chronic, revenue financing and acute failure firms) with the conclusive remark that established patterns have varying representation through size categories and industries. In Crutzen (2009) five distinct

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failure patterns were created based on failure reasons and the research concluded, that given patterns are differently represented through industries and size (measured by number of workers in a firm) categories. The Crutzen (2009) study also outlines several differences in the changes of pre-bankruptcy financial situation for different patterns, which accompanied with the finding that patterns have varying representation through industries and size would suggest diverse pre-bankruptcy performance for firms in different industries and size categories. The second group of literature considers comparison of financial characteristics of failed and healthy firms (see e.g. Altman, 1968; Barnes, 1987; D'Aveni and Hambrick, 1988; Dimitras et al. 1996; Gilbert et al. 1990; Pindado and Rodrigues, 2004). Although majority of literature in the second group does not directly outline variation in financial statement variables or financial ratios through different categories of failed firms, the analysis of financial data of failed firms in specific studies or between studies creates clear indication that pre-bankruptcy performance of firms can have large variance, which supports the idea outlined from the first group of literature, that pre-bankruptcy performance for firms in different size categories and industries can diverge. In conclusion one can find clear indication from both viewed sets of literature, that the specifics how and to what extent pre-bankruptcy financial data of firms in different sectors and size categories varies, should be studied in more detail.

3. Empirical analysis of firms' pre-bankruptcy financial performance

3.1. Data and methodology used

The source of bankrupt firms' list and pre-bankruptcy financial data is Estonian Commercial Register (ECR). All bankrupt firms in Estonia from 2002-2009 were included in the analysis and the interval for financial information is 1999-2008, as annual financial information for three pre-bankruptcy years has been used. ECR data consists of balance sheet and profit statement data. Cash flow statement data has not been used, because given report was made compulsory in Estonia starting from 2005, which would leave six years out of ten without specific information. All firms for which data is available, have their business year matching the calendar year. Given aspect has a certain limitation for the study, as bankruptcy declaration can occur on a random day throughout the year, making the interval between last data reporting time and bankruptcy moment different for each case. Still, such limitation has been common to majority of studies outlined in theoretical overview, because laws of most countries do not demand more frequent than annual reporting. Division to industries is based on the statistical classification of economic activities in the European Community (NACE Rev. 2) and division to size groups is based on European Commission regulation 96/280/EC, which recommends using following groups outlined according to the number of workers: 1) 0 employees, 2) 1-9, 3) 10-49, 4) 50-249, 5) 250-499, 5) 500-.

For the complexity of analysis, most of balance sheet and profit statement variables available have been used and only those, for which information is missing for some viewed group, have been excluded. From balance sheet the following variables have been used (with abbreviations in brackets): assets (*ASSETS*), liabilities (*LIABIL*), equity (*EQUITY*), current assets (*CASSETS*), cash and cash equivalents (*CASH*), accounts receivables (*RECEIV*), current liabilities (*CLIABIL*), current financial liabilities (*CFLIABIL*), accounts payables (*APAYABL*), retained earnings (*RETEARN*), net income (i.e. net profit, *NI*). From profit statement the following variables have been used: sales revenue (*SALES*), operating costs (*OCOST*), operating profit (*OPROFIT*), sum of financial income and cost (*FINCOST*), sum of operating costs, financial income and financial cost (*COST*), profit before taxation (*BTPROFIT*). The selection of financial ratios for the analysis is based on their previous usage in studies (see e.g. Dimitras et al., 1996), but also on the principle to avoid commonly faulty and misused variables. Because of previously given, for instance ROA and ROE variables have not been applied, as among other problems available financial data of firms does not disclose the actual amount of capital applied in the creation of profit or losses.

Followingly an overview of the financial ratios applied has been given: two solvency ratios ($\frac{CASSETS}{CLIABIL}$, i.e. $\frac{CA}{CL}$; $\frac{CASH}{CLIABIL}$, i.e. $\frac{C}{CL}$), three profitability ratios ($\frac{NI}{SALES}$, i.e. $\frac{NI}{S}$; $\frac{OPROFIT}{SALES}$, i.e. $\frac{OP}{S}$; $\frac{BTPROFIT}{SALES}$, i.e. $\frac{BP}{S}$) and two other ratios ($\frac{EQUITY}{LIABIL}$ measuring capital structure, i.e. $\frac{E}{L}$; $\frac{CASSETS}{ASSETS}$ measuring liquidity, i.e. $\frac{CA}{A}$). Also two additional solvency variables, i.e. balance sheet test or net assets (*Net assets = ASSETS – LIABIL*, i.e. *NETASSET*) and net working capital (*CASSETS – CLIABIL = Net working capital*, i.e. *NWC*) have been applied.

As already outlined in the introductory part, the innovation in current study is the usage of changes in financial data (not the values of financial variables and financial ratios) between the first and third year before the bankruptcy year. The change will be calculated as ($Value_1 - Value_3$) divided by $|Value_3|$, where $Value_1$ denotes the value of specific variable or ratio for the year before bankruptcy year and $Value_3$ respectively for the third year before bankruptcy year. The usage of absolute value (i.e. $|Value_3|$) in denominator is necessary, as some financial data can have negative values and this could lead to misinterpretation of changes. The change in the value of specific variable or ratio has been denoted with Δ_{13} in the following text. The third year before bankruptcy year was chosen to be the base year, as financial data available indicates that for most measures the values for second year are worse than for third year, but for the fourth year before bankruptcy year they are also worse in many cases, as current dataset includes numerous failed start-ups with lifecycle less than five years. The reason for using changes has several explanations. Firstly, changes have been scarcely used in literature, although they should have more importance than just variables or ratios when considering failure as dynamic a process. Secondly, it is evident that values of variables or ratios differ through size categories and industries, mainly because of different business models, competition, legal requirements and other reasons, but this cannot be presumed for financial data changes in the failure process.

In current study the focus is to test, whether pre-bankruptcy changes in financial data differ through industries and size categories. For those purposes a nonparametric test, Independent Samples Median Test (ISMT), will be used. Nonparametric test is applied because Kolmogorov-Smirnov Test and Shapiro-Wilk Test indicate violation of normality assumption in data, which excludes the usage of tests assuming normality without data transformations. The ISMT views, whether there is at least one sample among k samples, that has different median than others (i.e. H_0: $\Theta_0 = \Theta_1 = \Theta_2 = \ldots = \Theta_k$; H_1: the median of at least one population is different). H_1 will be accepted when asymptotic significance of the test is < 0.05 and significance will be denoted in following tables as Sig., where additionally test statistic values have been shown. The calculation mechanism of ISMT can be followed in Green and Salkind (2005). When those financial measures have been detected, where at least one median is different from others, it has been shown, which size group or industry differs from others by outlining median values for each group. This is important, as H_1 can be accepted also in case some group with very low number of cases witnesses anomalous values. Still, as the objective of current paper has been to outline specific pre-bankruptcy financial data which is different in at least one size group or industry, the analysis of medians remains descriptive and no additional statistical tests have been conducted to show size groups or industries that are similar to each other. Also, the connections between different changes of variables have been described, but not analysed statistically.

3.2. Analysis of results and discussion

The ISMT ran shows that for measures listed in table 1 there is at least one group that has different median value compared to other groups, i.e. H_1 is accepted. Tables 2 and 3 additionally list the median values, which allow analysing which groups remarkably differ from others.

Table 1. Financial data changes significantly different in at least one industry (i.e. sig. < 0.05) or in at least one size group (i.e. Sig. < 0.05)

Significantly different changes in at least one industry			**Significantly different changes in at least one size group**		
Measure	**Sig.**	**Test statistic**	**Measure**	**Sig.**	**Test statistic**
$\Delta_{13}ASSETS$	0.021	29.5	$\Delta_{13}ASSETS$	0.005	12.8
$\Delta_{13}LIABIL$	0.000	42.6	$\Delta_{13}CASSETS$	0.041	8.3
$\Delta_{13}CASSETS$	0.034	27.8	$\Delta_{13}CASH$	0.013	10.9
$\Delta_{13}CLIABIL$	0.002	37.8	$\Delta_{13}RECEIV$	0.000	19.5
$\Delta_{13}OPROFIT$	0.028	28.4	$\Delta_{13}APAYABL$	0.008	11.9
$\Delta_{13}\frac{CA}{CL}$	0.038	27.3	$\Delta_{13}SALES$	0.003	14.1
			$\Delta_{13}OPROFIT$	0.005	12.7
			$\Delta_{13}FINCOST$	0.022	9.6
			$\Delta_{13}\frac{CA}{CL}$	0.000	19.7
			$\Delta_{13}\frac{C}{CL}$	0.015	10.5

An important finding of the study is that for majority of financial data changes used in the analysis the values for different size groups and for different industries have no statistical difference. More specifically, in case of different industries, 5 out of 17 financial variable changes have at least one different median value and the same is 1 out of 9 for financial ratio changes. In case of different size categories the same figures are 8 out of 17 for financial variable changes and 2 out of 9 for financial ratio changes. The results, that at least some medians of financial variables differ, could be expected according to literature overview outlined in chapter 2 of current paper. As table 1 indicates, then there are some financial measures, in case of which H_1 is accepted for both grouping options (i.e. for both, size groups and industries). Notably, such measures are $\Delta_{13}ASSETS$, $\Delta_{13}CASSETS$, $\Delta_{13}OPROFIT$ and $\Delta_{13}CA/CL$. There are also some other generalized conclusions from the research. We see that industry and size do not have any influence on pre-bankruptcy profitability changes, capital structure changes, liquidity changes, but also on the changes of equity, retained earnings, net income, profit before taxation, operating costs and total costs.

Table 2. Median values for measures of table 1 in different size groups

Measure / Size group (number of workers)	**1-9 (460)**	**10-49 (243)**	**50-249 (43)**	**250 and more (2)**	**Total (748)**
$\Delta_{13}ASSETS$	-30%	-19%	-9%	-43%	-25%
$\Delta_{13}CASSETS$	-34%	-19%	-11%	-72%	-28%
$\Delta_{13}CASH$	-77%	-59%	-51%	-88%	-71%
$\Delta_{13}RECEIV$	-60%	-20%	-24%	-25%	-49%
$\Delta_{13}APAYABL$	-1%	23%	39%	24%	3%
$\Delta_{13}SALES$	-26%	-7%	-11%	-42%	-17%
$\Delta_{13}OPROFIT$	-169%	-236%	-292%	-62%	-192%
$\Delta_{13}FINCOST$	97%	66%	-11%	-103%	86%
$\Delta_{13}\frac{CA}{CL}$	-61%	-43%	-32%	-66%	-53%
$\Delta_{13}\frac{C}{CL}$	-88%	-79%	-74%	-91%	-85%

Table 3. Median values for measures of table 1 in different industries

Industry / Measure	$\Delta_{13}ASSETS$	$\Delta_{13}LIABIL$	$\Delta_{13}CASSETS$	$\Delta_{13}CLIABIL$	$\Delta_{13}OPROFIT$	$\Delta_{13}\frac{CA}{CL}$
A - Agriculture, forestry and fishing (41)	-41%	-1%	-37%	14%	-233%	-56%
C - Manufacturing (182)	-24%	13%	-34%	23%	-185%	-48%
D - Electricity, gas, steam and air conditioning supply (4)	-38%	11%	-17%	2%	-456%	-66%
E - Water supply; sewerage; waste management and remediation activities (3)	-26%	92%	-94%	92%	21%	-74%
F - Construction (182)	-2%	57%	-1%	72%	-245%	-52%
G - Wholesale and retail trade; repair of motor vehicles and motorcycles (256)	-34%	8%	-35%	12%	-216%	-46%
H - Transporting and storage (69)	-33%	1%	-36%	24%	-205%	-54%
I - Accommodation and food service activities (50)	-47%	29%	-54%	52%	-252%	-80%
J - Information and communication (19)	-24%	29%	-18%	34%	-105%	-46%
K - Financial and insurance activities (3)	311%	60%	168%	60%	-2873%	-31%
L - Real estate activities (62)	-14%	10%	-17%	28%	-107%	-51%
M - Professional, scientific and technical activities (50)	-25%	26%	-39%	42%	-45%	-69%
N - Administrative and support service activities (36)	-40%	34%	-30%	114%	-369%	-71%
P - Education (7)	0%	22%	-16%	22%	-178%	-41%
Q - Human health and social work activities (2)	463%	11790%	55%	129252%	-7081%	-73%
R - Arts, entertainment and recreation (7)	-84%	-7%	-68%	28%	-172%	-66%
S - Other services activities (16)	-19%	44%	-55%	119%	-135%	-88%
Total (989)	-25%	17%	-30%	28%	-190%	-54%

Tables 2 and 3 outline the medians of measures that are statistically different at least for one group (the number of firms in specific group has been given in brackets after the group). From given tables one can see some anomalous values, where the representation of group has been very small (i.e. the median value is

determined only by a couple of cases). Such examples from table 3 are: industry "financial and insurance activities" with three cases and industry "human health and social work activities" with two cases. In case of table 2 such example is the group of firms having equal or more than 250 workers, which is represented with two cases.

When viewing different size groups, then two groups (group of 10-49 workers, i.e. group 2, and group of 50-249 workers, i.e. group 3) have similar medians of changes for all measures except for $\Delta_{13}FINCOST$. The difference in most cases is created by the smallest (1-9 workers, i.e. group 1) and largest (250 and more workers, i.e. group 4) group. As table 2 indicates then groups 1 and 4 tend to have larger medians of financial data changes for most of the statistically different measures. More specifically, groups 1 and 4 are described with quicker drainage from assets ($\Delta_{13}ASSETS$), current assets ($\Delta_{13}CASSETS$) and cash ($\Delta_{13}CASH$), faster drop in sales ($\Delta_{13}SALES$), speedier decrease in solvency ($\Delta_{13}CA/CL$ and $\Delta_{13}C/CL$). At the same time groups 2 and 3 witness much quicker accumulation of losses ($\Delta_{13}OPROFIT$).

As some industries have very low representation in the dataset (six industries having even below ten cases), then it is reasonable to discuss the results of those industries having more than fifty cases. When narrowing the discussion in previously given way, then table 3 shows that drop in assets varies from -2% (construction) to -47% (accommodation and food service activities). The same tendency is followed by drop in current assets. This is probably connected with the fact, that markdown in accounts receivables in construction industry is done just before or even after bankruptcy has been declared. At the same time construction sector witnesses highest pre-bankruptcy rise in liabilities, which is logically followed by the fact that it has the highest increase level for current liabilities also. Most of the industries witness high drop in profit, whereas professional, scientific and technical activities being the most modest faller among larger industries. All large industries show drop in solvency, ranging from 46% to 80% drop, whereas accommodation and food service activities being the highest faller.

4. Conclusion and limitations

Previous analysis showed that through industries and size categories of firms there are some changes in financial variables and financial ratios that are statistically different. This finding contributes to literature by proving that dependent on industry and size, firms go through somewhat different failure process in financial sense. Previous is also accompanied by the finding that as for majority of changes of financial statement variables and financial ratios used, there are no differences between size groups and industries, then failure processes of firms in different size groups or in different industries have also remarkable similarities. That is why the usage of pre-bankruptcy changes in financial data provides valuable information for describing both, similarities or divergences in failure processes.

Current study also outlines several practical implications. For instance policy makers can change the rules in some industries or size groups stricter, e.g. to avoid quick drop in solvency or quick accumulation of losses. Different stakeholders of firms (e.g. managers, creditors) can elaborate their early warning systems of financial difficulties by introducing industry and size specific effects.

As for every study, current research has also several limitations and development possibilities, which can be addressed in follow-up papers. Some of the limitations have already been outlined in previous sections and they will not be repeated here. One domain of study is to link changes in the values of financial measures to initial scale of those variables, by outlining whether decline in different industries or size groups emerges from more or less healthy stadium. Secondly, changes in financial measures applied for current analysis (and if necessary accompanied by financial variables and ratios themselves) could be viewed in interconnection to each other, this way testing whether some unique financial failure patterns emerge through combining different data. Lastly, larger dataset would allow disaggregating firms in specific industry to different size groups, as with current data available it is not possible, as some size categories and industries have very low representation.

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