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Growth Patterns of Small Manufacturing Firms Before Failure: Interconnections with Financial Ratios and Nonfinancial Variables

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Abstract

This study focuses on the pre-failure growth in total assets, debt and sales of bankrupted manufacturing firms. Based on a sample of 128 Estonian firms, it is shown that two distinct growth patterns can be outlined. When the first pattern shows a gradual decline, then the other characterizes a more eclectic growth behavior. Several classical financial ratios have significantly different values through the established two patterns. Managers' characteristics do not vary among the established patterns.

Key words: *bankruptcy, failure process, financial ratios, growth patterns, managers' characteristics*

1. INTRODUCTION

The literature about firm growth is abundant and over-exhausted in some domains. Most studies have focused on vital firms [1]. Available studies that outline different growth patterns of firms and different stages of growth clearly indicate the possibility of alternative pathways for firm development (see [2], [3]). Still, according to Whetten ([4]: 352) death of firms is probably the less studied aspect in conjunction with growth. Thus, we aim to utilize this lack of literature to detect the different pre-failure growth trajectories of bankrupted small manufacturing firms.

Firm growth is tightly connected to another stream of research, namely firm failure studies. This research domain is dominated by failure prediction studies mainly applying financial ratios statically at different points of time (see e.g. [5]). A smaller number of these studies has paid attention to the dynamics of ratio development before failure (see e.g. [6], [7]), whereas growth (depicted through the development of financial statement figures before failure) has earned very little attention in that research stream. Still, at least theoretically or based on case study evidence it has been proposed that firms can witness substantially different growth trajectories before failure ([8], [9]), thus, this aspect needs further clarification.

The objective of this paper is to study 1) the presence of different firm failure patterns based on growth rates in financial variables, and 2) the interconnections of established patterns with different financial and nonfinancial variables. The study's aim also reflects its novelty as such research has not been conducted before.

The article is structured classically. The introductory part is followed by a short literature review, focusing on the most relevant establishments in the research field so far. Then, the data and methodology part follows, after which empirical results will be elaborately presented, and main findings discussed. The article ends with conclusions and research implications.

2. A SHORT LITERATURE REVIEW

It has been noted that the most common indicator of firm level growth is sales revenue dynamics in relation to some past proxy [10]. Still, in some circumstances dynamics of a firm's assets can be a more suitable indicator of its growth [11]. Also, an important question is the capital structure choice for achieving growth (see e.g. [12]).

The context of growth in explaining different firm failure paths can be traced back to the seminal work of Argenti [8]. In this study, he established three different trajectories of firms' collapse, each associated with different growth behaviors besides varying financial health: a) failed young firms with modest growth and never becoming profitable (enough), b) excessively grown firms that collapse because of over-expansion, and, c) old firms that lose their market share and sales volume in time (i.e. witnessing constant small decline).

Still, Argenti's approach focuses on the whole lifecycle of a firm, not on the last stages before collapse. Ooghe and de Prijcker [9] reached a relatively similar conclusion based on cases of bankrupted firms, but they distinguished between two different excessively growing firm types, namely ambitious and dazzled firms. Both of those types represented established and not very young firms. While ambitious firms' growth was unsustainable from start, the other group is characterized by managers dazed of their success during the quick growth. The studies of D'Aveni [13] and Laitinen [14] have demonstrated that the dynamics of firms' financial situation can vary remarkably in the years before their failure (bankruptcy). Moreover, in Laitinen's study, the growth in total assets was also found to be an important discriminator between different failure processes. In the study by Moulton, Thomas and Pruett [15], four different failure pathways were illustrated by using the growth in total assets, total liabilities and total sales, although these variables were not applied directly in the extraction of given pathways. Thus, firm growth depicted through the development of different financial variables has earned an important role in the few studies applying it in the context of failure.

Although it has been suggested that financial ratios behave differently in firm failure process (see [8], [16], [9]), there is little empirical evidence about this phenomenon. Studies by Hambrick and D'Aveni [17], Laitnen [14] and Moulton, Thomas and Pruett [15] indicate that financial ratios can obtain different values 1) at different stages of the failure process, but 2) also for the same stage in case of different failure processes. These findings are from one hand logical, as the varying growth rates in financial variables (e.g. assets, debt and sales) affect the numerators and denominators of different financial ratios. This is supported even more by changes in equity and net income, having often much larger dispersion. Thus, it could be deducted from the literature, that in case failing firms witness different growth patterns (including negative growth), then for at least some stages of different patterns, financial ratios also vary. Without testing the statistical significance of differences, this argument finds proof in the study of Moulton, Thomas and Pruett ([15]: 588) on the example of the return on assets.

While dynamics of different financial variables and the development of financial ratios in different failure processes have found some attention in previous studies, then so far studies on the interconnections of different growth patterns of failing firms and manager characteristics have remained mostly theoretical. Studies by Argenti [8] and Ooghe & de Prjicker [9] suggest based on case study evidence that manager characteristics vary for different failure processes. Still, there is considerably more evidence about inter-connections of different nonfinancial variables and growth of vital firms. It has been found that firms' growth varies with variables like their managers' gender, tenure and experience (see e.g. [18], [19]). Thus, based on literature it could be assumed that if failing firms witness varying growth patterns, these trajectories are also differently interconnected with manager characteristics.

Based on the literature review, we propose three hypotheses (whereas the testing of H2 and H3 must be preceded by the acceptance of H1):

Hypothesis 1 (H1): Different growth patterns can be detected among failed small manufacturing firms.

Hypothesis 2 (H2): There are significant differences in the values of financial ratios applied in Laitinen's (1991) study [14] through different growth patterns of failing firms.

Hypothesis 3 (H3). The selected manager characteristics are significantly different through different growth patterns of failing firms.

3. DATA AND METHODOLOGY

3.1 Choice of Variables and Data Sources

For characterizing the growth pathway the failing firms go through, different growth variables playing an important role in their development will be applied in this study. We rely on the study of Moulton, Thomas and Pruett [15] by choosing the following measures to explain firm growth: changes in 1) total assets, 2) total liabilities and 3) sales revenue. In the above-mentioned study, at some stage of analysis net income was also applied, but as this variable can have negative values, the growth rates can be very abnormal, which not only weakens their applicability, but can result in overall improper results. Below, the essence of the selected three variables in modelling growth patterns of failing firms is commented.

Many failure processes can be triggered by a more or less excessive drop in sales, whereas in some cases, the trigger may be over-enlargement: for instance, excessive sales growth. Still, the process of over-enlargement also eventually results in a collapse in sales. Thus, the importance of sales revenue cannot be overlooked. The dynamics of total debt is one of the most important variables in conjunction with firm failure. Most failures are more or less connected with excessive increase in debt before failure, either by using too large leverage or financing losses temporarily with loan capital. As the third variable, the development of total assets will be applied. The usage of this variable has multiple purposes in modelling growth patterns. Growth in assets reflects an increase in a firm's resource base, either through injection of additional capital (equity or debt) and/or accumulation of profit, while the reduction in it symbolizes divestment or accumulation of losses. Also, it helps to conjoin growth in debt and sales. The variables have been noted in the results part as follows to account for the growth between two pre-bankruptcy years: SALESGn – a growth in sales revenue, DEBTGn – a growth in total debt (total liabilities), ASSETSGn – a growth in total assets. The minimum n is 1, noting the growth between 1st and 2nd pre-banrkutpcy years. For capturing the growth rates, the $(Value_t/Value_{t-1} - 1)*100$ formula is applied, thus, for instance when bankruptcy occured in year 2000, the n=1 growth is calculated as $(Value_{1999}/Value_{1998} - 1)*100$. This way growth rates show the change in the value of a specific variable

between two years in percentages, thus, it becomes possible to depict growth in an easy and understandable way.

The financial information about the above variables was retrieved from the Estonian Business Register (EBR), which collects the annual reports of firms. From EBR, initial data about 128 bankrupt manufacturing firms was obtained. The bankruptcies had occurred in 1999-2012. The dataset encompasses the whole population of bankrupted manufacturing firms for which five consecutive pre-failure annual reports are available (see further explanation in section 3.2). For such firms growth variables can be calculated for four periods. It should be noted that in using nonfinancial variables, not all of the 128 cases can be applied due to restrictions outlined further in this section. Bankruptcy, as one subset of firm failure, was chosen because it is the most commonly used failure definition in past studies and it is easy to obtain information about that failure type. It is very difficult or even impossible to obtain information on other domains of failure from public sources (for instance, information about the non-achievement of expected rate of return).

Derived from the objective of paper, the aim is also to study whether the nonfinancial variables (characteristics of managers) vary through different patterns established by using growth variables. For studying this aspect, only those firms will be selected where there is a sole member of management board throughout the whole lifecycle. In case of multiple members of management board and also changing members in management board, it would be difficult to administer the coding of variables selected for the current analysis. As in the current dataset the sole management board member is always one of the owners, it is evident that this person has played an important role in the firm's management, although some of the firms might have hired an additional CEO. Still, such information cannot be retrieved from any of the available databases. Regarding the characteristics of the management board member, the following variables will be applied: 1) the age of manager at the time of bankruptcy (noted as MANAGE) is coded as a continuous variable; 2) the manager's gender is coded as a dummy (noted as MANGEN; 0 for male, 1 for female); 3) an additional variable is constructed to study whether the management board member has gone through a firm bankruptcy before the bankruptcy of the firm in the current analysis (noted as MANBANKR; 0 for not, 1 for yes). Besides manager characteristics, the firm's age (FIRMAGE) is calculated as time between its initial registration and the declaration of insolvency at court. Firm age is needed to control for the similar lifecycle length of companies, as younger and older firms can witness different pre-failure growth patterns. All the above variables will be afterwards regarded as "nonfinancial variables".

The different growth patterns of failing firms determined by growth variables will be studied in respect of the development of a set of classical financial ratios. For this purpose, a set of financial ratios from Laitinen's [14] study has been applied: return on assets (ROA), productivity of assets (sales to total assets; STA), operational cash flow to sales (CFS), capital structure (total debt to total assets; DA), and current ratio (current assets to current debt; CR). This set of ratios is commonly used in numerous other failure studies as well (see [20]). Some of these financial ratios have been presented in ratio format without multiplying them with 100 (they are not presented in percentages) and others in percentage form, just to simplify following the results (see Table 3). Financial information for calculating these variables is also retrieved from EBR.

3.2 **Methods Applied**

For extracting the growth patterns among the population of bankrupted manufacturing firms, a multi-stage methodology is applied. Namely, the extraction is based on the consecutive application of factor and cluster analysis (see similar application for instance in [21]). Such an approach can yield multiple useful results based on the number of factors and clusters chosen for analysis: thus, additional criteria are needed to choose between different solutions. The methodology is described below.

Firstly, factor analysis is used to extract latent variables based on the initial set of variables. This way, the variables are made independent of each other and the main hidden dimensions behind them are disclosed. Factor analysis has for instance been applied in Laitinen's [14] study to detect different failure processes of firms. Herewith we apply maximum likelihood method for factor extraction with Varimax rotation to maximize the differences of extracted factors. A common default extraction option, the principal components method, is not as good as the maximum likelihood method [24]. Still, the maximum likelihood method can have a problem referred to as the Ultra-Heywood case, i.e. communalities exceeding 1 (see e.g. [22]), being mainly caused by a small sample and/or very similar clusters. Because of this problem, only four consecutive growth rates could be included in analysis.

The number of factors will be determined manually by starting from two factors, but only those solutions will be considered where the explained variance is more than 51% because in that case the factor solution has sufficient explanatory power. There are other possibilities to determine the number of factors, the classical one being eigenvalue exceeding unity rule [24] and a more subjective visual determination based on scree plot, but those approaches have limitations as well. After the determination of different factor solutions, *k*-means cluster analysis is run with different values for *k* to establish firm clusters based on each of the factor score sets obtained from the previous analysis stage. In case there would be only one factor solution, the best *k* could be also determined with specific methodology (see e.g. [25]), but currently a different approach is needed to choose between multiple competing cluster solutions. For the final choice of cluster solution, one of the most well-known criteria, namely the Calinski-Harabasz pseudo-F (see [23]) is applied. The solution earning the maximum value for pseudo-F will be chosen as the best one.

After the extraction of different growth patterns, the comparison of growth rates through established patterns is achieved by using nonparametric tests: Independent Samples Median Test (i.e. ISMT) and Mann-Whitney U Test (i.e. MWUT). Also, the patterns are compared in respect to values of five classical financial ratios noted earlier, with the purpose to disclose the differences in the financial ratio development through established patterns. This is achieved by using the same nonparametric tests as the samples are small and skewed. Finally, the study focuses on the association of nonfinancial variables and established growth patterns. This is achieved by applying the above-mentioned nonparametric test (ISMT) and a simple association test (namely, Fischer's exact test) because of the nominal nature of some variables (namely, MANGEN and MANBANKR).

4. RESULTS AND DISCUSSION

4.1 Choice of the Best Pattern Solution

As noted, the factor analysis with maximum likelihood extraction is applicable with growth rates from four years for all 128 firms. There are three different factor solutions that fit the methodology described in the previous section of the paper. Solutions with four, five and six factors have all variance explained over 51% (see Table 1), whereas the solutions with 7 and more factors cannot be calculated. The cluster analysis results are presented in maximum for four clusters, as the pseudo-F is the largest in case of 2 and 3 clusters for different factor solutions. The highest pseudo-F is achieved with the two cluster solution in case of five factors (respectively 82 and 46 cases in the clusters), thus, it is chosen as the best solution. It can also be seen that many of the 2 and 3 cluster solutions result in one group being remarkably larger or smaller than other(s). Therefore, those solutions could be suspected to include some outliers artificially created because of the predefined *k* value. The goodness of the result is also proven by the fact that the solutions with similarly high pseudo-F values have remarkably less significantly different median values of growth variables through established clusters when compared with the chosen best solution.

Table 1. Number of firms in clusters resulting from the consecutive application of factor and cluster analyses.

Number of factors	Variance explained	Number of clusters		
		2	3	4
		Number of firms in each cluster		
4	64.5%	109; 19	40; 64; 24	18; 5; 30; 75
5	72.6%	82; 46	91; 5; 32	5; 18; 47; 58
6	80.0%	64; 64	100; 20; 8	59; 5; 22; 42

The rotated factor matrix (see Table 2) provides interesting evidence about the interconnections of different factors and growth variables. Factors 1-4 follow a very distinct path in this respect. Namely, they are pairwise loaded by assets and debt growth variables from a specific year: factor 1 loads with ASSETSG2 and DEBTG2, factor 2 loads with ASSETSG4 and DEBTG4, factor 3 loads with ASSETSG3 and DEBTG3, factor 4 loads with ASSETSG1 and DEBTG1. Thus, the factors are largely different because of the simultaneous development in the values of total assets and total debt. The only factor for which sales growth has a high loading is factor 5. Thus, sales revenue development becomes important only in the year before the bankruptcy is declared.

Table 2. Rotated factor matrix.

Var.	Factor				
	1	2	3	4	5
SG1	0.213	0.036	0.008	0.124	0.968
AG1	0.030	-0.006	0.062	0.510	0.272
DG1	-0.040	-0.001	-0.042	0.994	-0.093
SG2	0.452	-0.126	0.228	0.018	0.108
AG2	0.872	-0.027	0.086	-0.117	0.104
DG2	0.814	-0.021	-0.062	0.087	0.044
SG3	0.222	0.220	0.375	-0.002	-0.040
AG3	0.094	0.028	0.978	0.181	0.033
DG3	-0.008	-0.008	0.673	-0.092	0.023
SG4	-0.113	0.315	0.136	0.021	0.002
AG4	-0.032	0.942	-0.039	0.020	0.043
DG4	0.023	0.809	-0.017	-0.054	-0.009

Notes: Extraction method Maximum Likelihood, rotation method Varimax with Kaiser Normalization. Abbreviations: SG - SALESG, AG - ASSETSG, DG - DEBTG, Var. - variable.

Although not directly comparable, the number of different growth patterns established in the current study is smaller than the number of different failure processes established in previous literature. For instance, in studies by Argenti [8], D'Aveni [13] and Laitinen [14] three different failure processes have been detected whereas in the study by Ooghe and de Prjicker [9], the number of processes was four. A novel study by Laitinen and Lukason [26] found the number of processes to range even from six to seven depending on the analyzed country. This points to the fact that manufacturing firms can be very similar in respect to growth behavior before bankruptcy emerges. Still, all the studies noted before have applied data from multiple sectors.

4.2 Values of Growth Variables and Financial Ratios through Established Patterns

Below, the dynamics of growth rates and financial ratios is commented through the established two patterns (clusters). Table 3 reports the median values for the variables as the samples are small and skewed. The total assets of firms in cluster 1 (C1) have constantly grown except for the pre-bankruptcy year, for which a considerable drop appears. In the last year, firms in C1 have also decreased the level of debt, but the decrease of assets (due to quickly accumulating losses) has been quicker. The growth in total assets and debt has been synchronized for all studied years, that is, the growth rates have the same signs. For C1 firms, the growth in total assets and debt have guaranteed a modest rise in

sales for some years in the past, but during the last years of performance there has been no effect and decreases in sales are witnessed for both years preceding the bankruptcy year. Thus, based on growth rates it can be said that C1 firms become gradually over-leveraged and the collapse after exceeding a critical point is therefore imminent. This is supported by gradual drops in ROA and CFS, which also reduces their liquidity (CR). Despite of that, the productivity of assets (STA) remains almost constant throughout the period. Thus, the financial ratios also provide evidence of a gradual decliner pathway. The growth pattern for cluster 2 (C2) firms differs from that of C1, being more eclectic for total assets and debt. It can be seen that through quick total assets growth, which in turn is achieved by high growth in debt, firms manage to boost their sales. Still, clear signs of over-enlargement appear two years before bankruptcy, and, because of that, sales and both accrual and cash flow based profitability (ROA and CFS) also drop. Firms increase their debt considerably and therefore also leverage in the last year before bankruptcy, but this dramatically worsens all the ratio values, resulting in an imminent collapse.

Thus, it can be said that the two growth patterns established for failing firms are: a) firms losing their sales volume and becoming over-indebted gradually, and, b) quickly growing firms, witnessing high over-indebtedness and sales' collapse before bankruptcy. The study of financial ratios offers additional proof for the suggested scenarios. Also, Hypothesis 1 has found support through the establishment of different growth patterns for failing firms. The results complement several previous studies ([8], [13], [14], [9]) in the context of manufacturing firms. Namely, the lengthily poorly performing firm type seems not to be represented among small manufacturing firms, and on the contrary, the collapse for established firm types is either gradual or sudden. This finding is also logical, as small firms normally do not have resources to finance lengthy unprofitable activities. An interesting finding is also that for an over-enlarged firm the symptoms of failure appear earlier than for a gradual decliner which has positive cash flow from its main activities even in the year before failure. The start of bankruptcy proceeding cannot be an issue here, as the median proceeding starting month is the same for both clusters.

The conducted nonparametric tests show multiple differences in growth rates, especially nearer to failure. In case of ISMT, the following growth rates are significantly different at $p<0.05$: SALESG1, SALESG3 and SALESG 4; ASSETSG3; DEBTG1, DEBTG2 and DEBTG3. For MWUT, all growth rates noted previously are also significantly different at $p<0.05$, but additionally also ASSETSG2 is different. Thus, in case of both nonparametric tests more than a half of the growth variables are significantly different.

Table 3. Median values of growth variables and financial ratios through two patterns (clusters) accompanied with nonparametric tests results.

Variable	Cluster 1 (n=82)	Cluster 2 (n=46)	Total (n=128)	Variable	Cluster 1 (n=82)	Cluster 2 (n=46)	Total (n=128)
ROA1*+	-12.27%	-46.29%	-20.16%	SALES1*+	485 574	243 525	346 962
ROA2	-2.78%	-5.69%	-3.33%	SALES2	529 330	405 522	457 653
ROA3+	0.16%	3.56%	0.69%	SALES3	633 504	431 056	474 183
ROA4	1.96%	6.80%	3.33%	SALES4	567 521	333 336	476 181
STA1+	2.43	2.04	2.29	ASSETS1	280 928	144 895	216 351
STA2	2.24	2.72	2.43	ASSETS2	334 956	152 987	236 906
STA3	2.55	2.75	2.63	ASSETS3	270 286	180 790	232 867
STA4	2.53	2.86	2.75	ASSETS4	264 393	130 215	189 224
CFS1	1.65%	-1.09%	0.77%	SALESG1*+	-6.19%	-48.13%	-15.26%
CFS2	2.56%	0.61%	1.82%	SALESG2	-0.63%	-2.59%	-0.76%
CFS3	3.83%	4.56%	4.43%	SALESG3*+	11.17%	28.93%	13.94%
CFS4	3.34%	2.06%	2.84%	SALESG4*	7.11%	20.59%	10.88%
DA1	0.91	0.96	0.94	ASSETSG1	-15.15%	-20.08%	-17.18%
DA2+	0.82	0.68	0.79	ASSETSG2+	1.72%	-4.50%	0.15%
DA3	0.77	0.70	0.75	ASSETSG3*+	2.05%	31.81%	9.03%
DA4	0.77	0.75	0.77	ASSETSG4	12.95%	13.40%	12.98%
CR1	0.65	0.54	0.63	DEBTG1*+	-3.53%	19.63%	3.15%
CR2*+	0.79	1.15	0.91	DEBTG2*+	12.57%	-2.45%	6.26%
CR3*+	0.78	1.24	0.89	DEBTG3*+	2.61%	40.52%	10.40%
CR4	0.93	1.06	0.98	DEBTG4	7.17%	9.96%	7.39%

Notes: Some variables are reflected as numbers and some as percentages. Sales and assets in euros. The $p<0.05$ differences for ISMT marked with superscript asterisk (*) and for MWUT with plus (+). The number behind each ratio notes the specific pre-bankruptcy year, for growth rates it means a change between two pre-bankruptcy years (e.g. 1 is change between 1st and 2nd).

Table 4. Descriptive statistics of nonfinancial variables.

Variable	Cluster 1			Cluster 2			Total		
	Mean	St.dev.	Median	Mean	St.dev.	Median	Mean	St.dev.	Median
MANGEN	0.19	0.40	0	0.20	0.41	0	0.19	0.40	0
MANBANKR	0.25	0.45	0	0.20	0.41	0	0.23	0.43	0
MANAGE	53.38	6.63	53.41	47.13	8.72	44.15	50.36	8.22	51.00
FIRMAGE	9.25	2.99	8.92	9.48	2.89	9.29	9.34	2.95	9.08

Notes: age of firm available for all 128 cases, other variables for 31 cases.

The conducted ISMT and MWUT indicate that multiple financial ratios are also significantly different through two clusters at $p<0.05$. Namely, clusters differ for some years in respect to liquidity, accrual based profitability and leverage, as was already disclosed in the earlier analysis. Still, the differences are less frequent than for growth rates, thus, in the taxonomy of failure processes developed based on growth rates, they have better explanatory power than financial ratios. Hypothesis 2 can be accepted in case of four ratios out of five, as in case of those there is at least one year for which the nonparametric tests show significant differences through established patterns. Firms in clusters are not significantly different in respect to operational cash flow to sales ratio.

4.3 Interconnecting growth patterns and nonfinancial variables

The descriptive statistics in Table 4 show that 21% of managers in the current study are women and also 21% of managers have gone through a firm bankruptcy before. Thus, in other words, the majority of managers are males with no previous connection with firm failure. The average age of the manager at the time of bankruptcy is ca 50 years and although not noted in Table 4, most firms have one or two owners (many managers are therefore also sole-owners).

For studying the interconnections of nonfinancial variables and established growth patterns, different statistical tests were conducted. For the two binary variables (MANGEN and MANBANKR), the Fisher's exact tests were run to study the relevant interrelationships. The results of the tests show, that the associations are statisticaly not significant at $p<0.05$ (see also Table 5 for the analysis summary). Thus, it can be concluded that the manager's gender and previous bankruptcy experience are not differently associated with the growth patterns of failing firms.

Secondly, the interconnection of two continuous variables (MANAGE, FIRMAGE) and established growth patterns has been studied. For that purpose, ISMT has been conducted to study whether in case of different patterns the continuous nonfinancial variables differ. The conducted ISMT showed that the medians of above-mentioned variables are not significantly different through the established growth patterns at $p<0.05$.

Based on previous results, Hypothesis 3 is rejected, as it was disclosed that the established patterns do not relate differently to management characteristics. The results offer interesting insights to literature. Namely, it was shown that the growth patterns before failure do not differ for firms ran by females or males. It is even more astonishing that the growth patterns in case of managers having previous bankruptcy experience and those not having it do not differ, either. It could have been assumed that managers having previous bankruptcy experience could foresee problems better, thus firms ran by them would follow different patterns than those ran by managers without failure experience. The age of firms witnessing different patterns is very similar, indicating that it cannot explain the presence of different growth patterns. Thus, the patterns are robust to firm age. The median firm age in Table 4 also shows that the best solution selected incorporating financial data from five years covers more than half of the lifecycle for a median firm.

Table 5. Tests about the interrelation of growth patterns and nonfinancial variables.

Variables in test	Test results
MANGEN*CLUSTER	Fischer's exact test p-value 1.000 (2 sided); 0.641 (1 sided)
MANBANKR* CLUSTER	Fischer's exact test p-value 1.000 (2 sided); 0.539 (1 sided)
MANAGE*CLUSTER	ISMT p-value 0.206
FIRMAGE*CLUSTER	ISMT p-value 0.493

Note: variable CLUSTER means whether a firm is in either C1 (coded as 0) or C2 (coded as 1).

5. CONCLUSION

This study focused on different growth patterns of failing firms in their pre-failure stage. So far different development trajectories of failing firms have been detected either based on financial ratios or multivariate bankruptcy model scores, but no specific attention has been set on the pre-failure growth behavior. Still, based on previous empirical examples it could be assumed that growth behavior of failing firms is not homogenous.

The paper applied data of 128 Estonian bankrupt manufacturing firms through a five year pre-bankruptcy period. Based on growth rates in total assets, debt and sales, two distinct growth patterns were detected by using factor and cluster analysis. One of the patterns marks a gradual decline through studied years, while the other shows a more eclectic growth path: the fluctuations in growth rates are much larger and therefore the final collapse is very sharp. The financial ratios applied in Laitinen's [14] study have a few significant differences through the two established patterns. One of the patterns has, similarly to growth rates dynamics, very large fluctuations in the ratio values, but the other shows a more gradual decline of values before collapse. Interestingly, the studied

management characteristics do not vary through the established patterns.

The study can be elaborated in several ways. For instance, the paper could benefit from a larger sample and inter-country comparison. Also, as firms in this analysis are quite small and young, it would be interesting to study whether the established patterns also characterize old and large manufacturing firms. One of the study's implications is that as (pre-failure) growth patterns of failing firms can vary, established bankruptcy prediction models might not perform equally well in case of different patterns. Also, as the paper demonstrated, managers' characteristics have no impact on performance, thus, creditors should be cautious in treating different managers (for instance those having previous bankruptcy experience or not) differently.

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Šeme rasta malih proizvodnih kompanija pre neuspeha: međusobne veze sa finansijskim proporcijama i nefinansijskim varijablama

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Apstrakt

Ovaj rad se fokusira na rast ukupne imovine, duga i prodaje bankrotiranih proizvodnih kompanija neposredno pre bankrota. Na osnovu primerka od 128 estonijskih kompanija, pokazuje se da se mogu istaći dve odvojene sheme rasta. Kada prva shema pokazuje postepeni pad, onda drugu karakteriše eklektičnije ponašanje rasta. Nekoliko klasičnih finansijskih proporcija pokazuju značajno različite vrednosti putem dve uspostavljene sheme. Menadžerske karakteristike ne variraju među uspostavljenim shemama.

Ključne reči: *bankrot, proces neuspeha, finansijske proporcije, sheme rasta, karakteristike menadžera*