FIRM FAILURE PATTERNS: THE INTERCONNECTION OF FAILURE REASONS AND FINANCIAL DATA

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Abstract. Decades of research has resulted in multifaceted studies on firm failure, being mainly focused on forecasting failure using financial data. Several studies are also viewing failure reasons and financial patterns of failure, but literature lacks of empirical studies connecting two aspects - failure reasons and pre-failure financial data. Using the dataset of all Estonian bankrupt firms from 2002 to 2009 distinct firm failure patterns are outlined. Specifically, perceived bankruptcy causes are aggregated and linked to changes in pre-bankruptcy financial data.

Keywords: firm failure, failure patterns, failure reasons, financial data.

Jel classification: G33, M10, M20

1. Introduction

Business failure topic has attracted the interest of researchers for more than half a century. Relevant literature is highly diversified, covering different fields starting from pre- and ending with post-failure aspects. The widest research domain is pre-failure subset, according to Pretorius (2008) classification including causes, preconditions, signs and prediction of failure. Two other common domains focus on failure from legal perspective (e.g. comparison of insolvency legislations, management responsibilities, efficiency of priority rules) and post failure outcomes (effects of reorganization or liquidation to different parties involved). In pre-failure subsets most of the firm level literature is devoted to discriminating between failed and non-failed firms, often establishing distinct prediction models (one of the most well-known being Altman's (1968) Z-Score). Remarkably less papers, like Hall (1992), Gaskill *et al.* (1993), Arditi *et al.* (2000), devote their attention to failure reasons. This is evidently connected to the fact that specific information is more difficult to obtain compared to financial data. A remarkably underdeveloped domain is the connection between failure reasons and pre-failure financial characteristics, where only a small number of relevant papers can be outlined. Previous is also the main factor why author has chosen that domain for current research, as it enables making contribution to existing failure literature (both, theoretically and empirically). The objective of current paper is to develop distinct failure patterns of firms based on failure reasons and pre-failure financial data. More specifically, paper seeks a connection between aggregate failure reasons and changes in financial data (i.e. financial variables and ratios). To achieve the aim, all firm bankruptcies in Estonia from 2002 to 2009 will be studied. The paper is structured as follows. After introduction, literature review will be outlined, which considers most important studies conducted so far on the topic. This is succeeded by the description of data and methodology, after which distinct failure patterns will be developed. The paper is finalized with conclusive part, which besides outlining the contribution of paper also lists several paper development opportunities. Due to length limitations for current paper some information has to be presented in contracted form.

2. Literature of firm failure patterns

As stated in introduction, there are few empirical studies considering firm failure patterns and most of the research has involved developing theoretical concepts. From terminological aspect studies vary, as for describing the same concept (connection of failure reasons and pre-failure financial characteristics) different terms have been used, like failure *patterns*, *processes*, *paths* and *trajectories*. Still, in many cases the diversity of terms also means diverse content, like in Laitinen (1991) *process* is viewed only from financial perspective. A general concept is that there can be as many different combinations of failure reasons and pre-failure financial characteristics as there are failed firms. This is evidently connected to the fact that according to Mellahi and Wilkinson (2004) there is diversity of possibilities for firm to fail. Still, as many failure cases share much in common, it is

reasonable to aggregate them, developing distinct patterns. It must also be noted that term *failure* has been differently defined through studies, being for instance addressed by Cochran (1981), Fredland and Morris (1976), Everett and Watson (1999).

Crutzen and Van Caillie (2007) divide relevant literature to static and dynamic concepts. Dynamic concept, which outlines firm failure in chronological manner linking causes and outcomes, can be found only in a few studies, when at the same time static concept is common to majority of literature. D'Aveni and Hambrick (1988) have created a model depicting average large firm bankruptcy as a downward spiral, bringing out four time intervals (up to ten years) before bankruptcy is declared. D'Aveni and Hambrick (1988) also offer a more detailed scheme for two last stages of failure. Their approach shows, that in an average case the roots of failure of large firm should originate years before failure, which is not supported by many other empirical sources (Richardson *et al.* 1994), often based on small firm examples.

One of the earliest approaches was offered by Argenti (1976), who introduced three failure models. Argenti (1976) presented that three failure types had different trajectories and were described by a different combination of causes and symptoms. He viewed failure pattern in a two dimensional way, combining firm's age and general health (five states of health were used: failure, poor, good, excellent, and fantastic). Although being highly cited, already the contemporary scholars Gold (1977) and Boisjoly (1978) have offered a lot of critique to Argenti's approach, mainly because of lacking empirical proof. Argenti's approach was developed by Richardson et al. (1994) by introducing a fourth type of failure. The approach of Richardson et al. (1994) has been used in Bollen et al. (2005) study of 60 largest bankruptcies in Europe.

Noting several deficiencies in Argenti's approach, De Prijcker and Ooghe (2008) divided failure process to following stages without specifying time dimension: initial shortcomings, negative signals and financial shortcomings. In De Prijcker and Ooghe (2008) study four groups of firms were used, namely unsuccessful start-up, ambitious growth firm, dazzled growth firm and apathetic established firm. Initial shortcomings are divided into two categories, of which the first is primary trigger of failure process, which is followed by secondary causes resulting from the original deficiency. Initial shortcomings are followed by negative signals, which are measurable indicators in firm's performance. De Prijcker and Ooghe (2008) used four groups of causes (management, corporate policy, immediate environment, general environment) to describe four failure types outlined previously.

Laitinen (1991) used financial ratios of failed firms to detect different failure processes. Laitinen (1991) identified three alternative types of failure processes: chronic failure firm, revenue financing failure firm, acute failure firm. Crutzen (2009) identified five different failure patterns on the basis of literature review, expert interviews and large sample of Belgian firms: baldy-created firms, firms with growth related problems, non-reactive firms, firms serving other interests, shocked firms. D'Aveni (1989) proposed three types of decliners: lingerers, gradual decliners, sudden decliners. Baumard and Starbuck (2005) distinguish between seven categories of failing firms. Chowdhury and Sheppard (2005) identify four major stages in firm failure: decline, response initiation, transition and outcome and for the decline stage they distinguish two patterns (K-extinction and R-extinction), of which the former represents failure due to industry (i.e. external forces) and latter failure due to mismanagement. Some Baltic authors like Stoškus *et al.* (2007), Voronova (2010), Valackienė and Virbickaitė (2011) have also developed failure concepts.

Several important conclusions can be drawn from existing literature. Most of the relevant papers deal with some facet of the failure pattern. For instance, there are sources that are merely theoretical, those which empirically develop patterns based on only financial data or contrary based on failure reasons. Existing sources presenting empirical validation based on both, financial data and failure reasons, have used very small datasets, which reduces their generalization abilities. At least some of the given limitations can be faced in the empirical analysis of current paper.

3. Empirical analysis of firm failure patterns

3.1. Data and methodology

For analyzing failure patterns, whole population data of Estonian bankrupt firms from 2002 to 2009 is being used. The sources of bankruptcy reasons are the first instance court judgments. According to Estonian Bankruptcy Act (EBA) court judgment must include information about the reasons of insolvency. The viewed period is covered with two court databases, one for 2002−2005 and the other for 2006 and onwards. There are several limitations concerning the databases, e.g. the older database was not in active use by courts, there are missing cases from both databases and not all court judgments are due to different reasons publicly available. Due to previously given deficien-

cies it was possible to obtain 41 % out of all bankruptcy cases in 2002–2009. Due to additional information problems (e.g. bankruptcy reasons are not disclosed, there is no financial information available for specific firm, bankruptcy reasons are not trustworthy etc.) the study is limited to 1281 bankruptcy cases that is 31 % of the whole population. Still, for some years (e.g. 2006 and 2007) the representation is very high, being around three quarters of all cases.

Based on the perceived causes in court judgments and literature review (Baldwin *et al.* 1997, Gaskill *et al.* 1993, Hall 1992) about bankruptcy reasons, 18 different reasons are detected for analysis (Table 1), which are further classified as internal or external for the purposes of current study (Table 1). According to Boyle and Desai (1991) internal reasons are reasons originating from the internal environment of firm and that is why under management control, whereas external reasons contrary originate from external environment and are not under management control. As the first pattern development option a system will be used, where all 1281 cases will divided to three categories: 1) case is described by only internal failure reasons (400 cases, i.e. Type X), 2) case is described by only external failure reasons (545 cases, i.e. Type Y), 3) case is described by both, internal and external failure reasons (336 cases, i.e. Type Z). In empirical analysis previously given is being referred to as Classification 1.

As a development of Boyle and Desai (1991) approach, internal and external reasons are in turn divided into two categories: 1) whether specific case can be attributed to faulty management (Type A), 2) whether specific case can be attributed to non-faulty management (Type B). It can be followed from Table 1 that some of the external reasons should have been tackled by effective management and some not, whereas all internal reasons should have been manageable. As majority of the cases used have more than one failure reason presented in court judgment, data needs to be processed further in order to categorize each case to Type A or Type B group. This is achieved by stepwise algorithm consisting of following stages: 1) firstly all cases including criminal activity reason are considered Type A, 2) from remaining dataset all cases having any Type 3 reason are considered Type B cases, 3) all cases left over are considered Type A cases. Usage of previously described algorithm results in classification, where database consists of 917 cases attributed to faulty management (Type A) and 364 cases not attributed to faulty management (Type B). In empirical analysis previously given is being referred to as Classification 2.

Table 1. Typology of failure reasons for current study (compiled by author)

Types of aggregate failure reasons	Specific failure reasons in court judgments
Internal (failure attributed to faulty management) – Type 1 reasons	1) risky behavior, 2) insufficient equity capital, 3) unprofitable activities, 4) nonperforming accounts receivables, 5) management problems, 6) inability to finance operations and investments, 7) failed investment, 8) failed business plan, 9) low quality product, 10) criminal activity
External (failure attributed to faulty management) – Type 2 reasons	1) increase in competition, 2) decrease in demand, 3) increase of input prices, 4) overall economic recession
External (failure not attributed to faulty management) – Type 3 reasons	1) action of cooperation partners, 2) failure of affiliated or associated firm, 3) change in some regulation, 4) unexpected event (e.g. natural disaster, theft)

Pre-bankruptcy financial data of firms was obtained from Estonian Commercial Register (ECR). ECR data includes balance sheet and profit statement data, but cash flow statement data has not been applied, because given report became compulsory in Estonia starting from 2005. The business year of all firms matches calendar year. As most of the literature considers failure reasons in connection with changes in financial data, this is also followed in current analysis. More specifically, the aim is to study whether different aggregated failure reasons are characterized by different financial failure process, not different level of financial performance. Data from first, second and third pre-bankruptcy year has been chosen for analysis and three types of changes have been calculated. Specifically, changes in financial data (consisting of financial variables and financial ratios) between first and second, second and third, first and third pre-bankruptcy year have been applied. The change is calculated as $\dfrac{Value_n - Value_m}{|Value_m|}$, where n and m denote specific pre-bankruptcy years, whereas n<m. The usage of absolute value (i.e. $|Value_m|$) 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 financial variable or ratio has been denoted with Δnm in the following text, e.g. $\Delta 13$ means change in the value of variable or ratio between first and third pre-bankruptcy year.

In order to conduct complex analysis, most of balance sheet and profit statement variables noted in literature available have been used. Exclusions have been made in case of those variables which are underrepresented in order to conduct proper statistical analysis. 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 operating costs, financial income and financial cost (COST), profit before taxation (BTPROFIT). The selection of financial ratios for the analysis is mostly based on their usage in previous studies like Dimitras et al. (1996) and Pindado and Rodrigues (2004), but still several financial ratios with possible misinterpretation problems have been excluded. Followingly financial ratios applied have been listed: two solvency ratios $(\dfrac{\text{CASSETS}}{\text{CLIABIL}}$, i.e. $\dfrac{\text{CA}}{\text{CL}}$; $\dfrac{\text{CASH}}{\text{CLIABIL}}$, i.e. $\dfrac{\text{C}}{\text{CL}})$, three profitability ratios $(\dfrac{\text{NI}}{\text{SALES}}$, i.e. $\dfrac{\text{NI}}{\text{S}}$; $\dfrac{\text{OPROFIT}}{\text{SALES}}$, i.e. $\dfrac{\text{OP}}{\text{S}}$; $\dfrac{\text{BTPROFIT}}{\text{SALES}}$, i.e. $\dfrac{\text{BO}}{\text{S}})$ and two other ratios $(\dfrac{\text{EQUITY}}{\text{LIABIL}}$ measuring capital structure, i.e. $\dfrac{\text{E}}{\text{L}}$; $\dfrac{\text{CASSETS}}{\text{ASSETS}}$ measuring liquidity, i.e. $\dfrac{\text{CA}}{\text{A}})$. Also two additional solvency indicators, 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.

In current study the focus is to test, whether pre-bankruptcy changes in financial data differ through firms having different failure reasons outlined previously (i.e. firstly, are there any differences between Type X, Y and Z, and secondly, are there any differences between Type A and B). 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 vio-

lation 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. H0: $\Theta 0 = \Theta 1 = \Theta 2 = \ldots = \Theta k$; H1: at least one population median is different). H1 will be accepted when asymptotic significance of the test is ≤ 0.05. Test statistics and significance will be outlined in the next section of the paper. The exact calculation mechanism of ISMT can be followed for instance in Sheskin (2007).

3.2. Results

ISMT has been applied on all financial data changes outlined in previous section of the paper. The test is ran for two different classifications given previously to find out, whether different aggregate failure reasons are connected with different changes in financial data. Testing 75 changes of financial variables and ratios indicates that there is only one median value that is different for groups of Classification 1. Namely, $\Delta_{23}SALES$ has ISMT test statistic value 7.518 and asymptotic sig. 0.023. The group, where failure is attributed to only external reasons (Type Z), has different median value (-0.0413) than the other two groups (0.0853 and 0.0572) for $\Delta_{23}SALES$. This concluded that cases fully or partially attributed to internal failure reasons show small rise in sales between second and third year before bankruptcy declaration year, whereas for cases attributed to only external reasons small decline in sales is characteristic for the same period. Still, differences in median values are not large. As there was only one indicator out of 75 that had different median value through three groups of Classification 1, it can be said that the environment (internal or external or both of them) from where failure originates, does not have important connection with pre-failure financial performance.

Analysis is followed by applying ISMT for groups of Classification 2. Table 2 outlines that in case of 9 indicators out of 75, medians are statistically different. This proves, that Classification 2 (i.e. whether failure can be attributed to faulty management or not) serves as remarkably better discriminator than Classification 1 and allows establishing distinct failure patterns, as several medians for two groups differ a lot (Table 2).

Results in Table 2 allow outlining following pattern. Firm failure cases, where failure can be attributed to faulty management (Type A) witness in comparison to those, where failure is not attributed to faulty management (Type B), remarkably

slower drop in profitability ($\Delta13\frac{NI}{S}$, $\Delta13\frac{BP}{S}$), in different levels of profit ($\Delta13NI$, $\Delta13OP$, $\Delta13BTP$) and in retained earnings ($\Delta12RETEARN$). Similarly to Classification 1, Type A witnesses small rise in sales ($\Delta23SALES$) and Type B a slight drop. Both groups witness reduction of cash ($\Delta23CASH$), but for Type A the decrease is practically nonexistent. At the same time Type B witnesses serious reduction of financial liabilities ($\Delta13CFLIABIL$), when for Type A there is slight rise.

Table 2. Medians for statistically different variables for Classification 2 groups (compiled by author)

Statistically different financial variable and financial ratio changes	ISMT test statistic and asymptotic sig. value	Medians for Type A cases	Medians for Type B cases
$\Delta_{23}CASH$	4.164 (0.041)	-0.0242	-0.2579
$\Delta_{23}SALES$	7.409 (0.006)	0.0806	-0.0315
$\Delta_{12}RETEARN$	4.107 (0.043)	-0.1754	-0.5031
$\Delta_{13}CFLIABIL$	13.756 (0.000)	0.0082	-0.8589
$\Delta_{13}NI$	6.932 (0.008)	-1.7777	-3.6867
$\Delta_{13}BTP$	6.932 (0.008)	-1.7582	-3.6867
$\Delta_{13}OP$	3.862 (0.049)	-1.3282	-2.9827
$\Delta_{13}\frac{NI}{S}$	4.196 (0.041)	-2.5300	-4.4300
$\Delta_{13}\frac{BP}{S}$	4.196 (0.041)	-2.5050	-4.4300

Outlined results would allow to theorize the following. Cases where firm failure is attributed to faulty management are described by more gradual decline in firm profitability and drop in profit compared to non-faulty management cases. Previous leads to quicker drainage of retained earnings and cash balance for the latter case. In faulty management cases leverage is increased to cover gradually accumulating losses. In non-faulty management cases sales figures drop due to contraction of market, whereas in faulty management cases sales figures are even increased despite increasing unprofitability of business.

4. Conclusions

There is large variety of literature about firm failure, but a relatively underdeveloped domain is theoretical and empirical analysis of firm failure patterns. Most of the available literature is divergent, ranging from purely theoretical concepts to empirical analysis. A remarkable gap in literature is the lack of large scale validation of failure patterns using both, failure reasons and financial data.

Using all publicly available court judgments of firm bankruptcies and pre-bankruptcy financial data, current paper aimed to develop distinct failure patterns. Failure reasons in court judgments are collected and aggregated in two different ways. Based on balance sheet and income statement figures, changes in pre-bankruptcy financial data are calculated. Independent Samples Median Test is applied to test, whether different bankruptcy causes are characterized with different pre-bankruptcy changes in financial data.

Paper outlines, that out of 75 different financial data changes used, only one is different in case of using classification of external and internal failure causes. Contrary, when attributing causes to faulty management or non-faulty management, distinct failure patterns can be outlined. Namely, given two groups are characterized by different changes in profitability, profit, cash balance, sales, retained earnings and financial liabilities.

Paper could be developed in several ways, like using different classification of bankruptcy reasons, connecting different financial variable and ratio changes, financial data changes could be viewed in connection with financial data, more sophisticated statistical analysis could be applied. Beside previously given there are additional elaboration possibilities, but current paper has served its purpose, as it was proven that in case of different aggregate failure reasons, changes in financial data differ, allowing to build distinct failure patterns.

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