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REVIEW

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From failure to corporate bankruptcy: a review

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Abstract

Prior to being a simple concept, the entrepreneurial failure is a multidimensional phenomenon. To contribute to its comprehension, this paper proposes to develop a synthetic vision of failure in order to escape a behavioral and partial approach from the phenomenon while taking account of the context, the characteristics of the company, and the profile of the entrepreneur. We point out the various theories which insist upon the crucial role of the context and underline the relationships between the performance (or failure) of companies and some environmental variables. We also introduce a dynamic view of insolvency which, instead of being a clear-cut situation is better handled as a process. As a key element taken into account by potential creditors to make their decision, the final section proposes a survey of the different methods used to forecast this event.

JEL classification codes: K22; K23; L2

Keywords: Corporate bankruptcy; Insolvency; Exit; Failure

Review

Introduction

Following the bank crashes that induced one of the worst turmoil, the developed economies experienced, the European sovereign debt crisis, which had begun in 2010, continues to shape the insolvency scene. In the Western European countries, the number of corporate collapses rose year-on-year by a margin of 0.3% - from 174,463 in 2010 to 174,917 in 2011 (Mohr 2012), a historically high level. The high number of business failures together with the increasing incidence of major company collapses led to a rise in the number of insolvency-related job losses. From 1.4 million in 2010, this figure has risen to 1.5 million in 2011, corresponding to a year-on-year increase of 7.1% (Table 1 provides more precise figures on the breaking down of insolvencies by country). No industry is immune to this phenomenon. Due to their quantitative importance on the whole economy, the commerce (wholesale/retail including catering/hotels) and construction represent the highest relative contributions to the European insolvency volume. The shrinking of manufacturing industry induced by the exit of large subsidiaries or plant closures is however responsible for the larger share of job losses. Beyond the crisis, what can be said about the reasons why so many companies are distressed? To handle this question, this paper proposes a survey on the literature on entrepreneurship and industrial economy. This perspective does not aim at minimizing the role played by the business climate in the macroeconomic context. Indeed, following Wadhvani (1986), many scholars

Table 1 Insolvencies in Europe

	2011	2010	2009	2008	2007	2006	2005
Austria	6,194	6,657	7,050	6,500	6,362	6,854	7,136
Belgium	10,182	9,570	9,430	8,476	7,678	7,617	7,878
Denmark	5,447	6,461	5,600	3,709	2,401	1,987	2,497
Finland	3,005	2,864	3,310	2,612	2,254	2,285	2,278
France	49,506	51,060	55,800	49,723	42,532	40,360	41,930
Germany	30,200	32,060	34,300	29,580	29,150	34,040	36,850
Greece	452	355	360	359	524	532	612
Ireland	1,631	1,525	1,400	773	363	304	327
Italy ^a	11,792	10,089	9,098	6,498	5,518	8,827	17,150
Luxembourg	961	918	698	590	680	634	682
Netherlands	7,000	7,211	10,500	6,847	7,952	5,941	6,780
Norway	4,361	4,435	5,100	3,637	2,845	3,032	3,540
Portugal	6,025	5,144	4,450	3,267	2,123	2,400	2,300
Spain	5,752	4,845	4,900	2,528	880	853	869
Sweden	7,177	7,546	7,600	6,298	5,791	5,243	5,865
Switzerland ^b	6,661	6,255	5,215	4,222	4,314	4,528	4,751
United Kingdom	18,571	17,468	20,300	16,268	12,893	13,686	13,462
Total	174,917	174,463	185,111	151,887	134,260	139,123	154,907

^aSince 2006, the insolvency statistics compiled by the register of companies in Italy include only company headquarters and no longer the individual branches of a company.

^bSince 1/1/2008, companies can be officially closed down and deleted from the register by means of bankruptcy proceedings: Section 731b OR. Source: Creditreform Economic Research Unit (2012).

have been interested in estimating the role inflation plays in firm's default. What is at stake in this paper has more to do with the individual causes and the firm's life cycle.

Research on entrepreneurship used to insist upon business creation, firm growth, and market expansion which are then the shining side of economic activity. However, a dark side of entrepreneurial ventures exists as risks become effective and cause the failure of the firm. Exit is generally considered a sign of failure of the firm, a consequence of poor performance; firms that underperform as they compete in the market will, sooner or later, exit the market. This process is better worth knowing at least for two main reasons: firstly, the Shumpeterian concept of creative destruction, which describes the process of transformation that accompanies radical innovation, which supposes the replacement of established companies by new entrants, involves the exit of a certain number of existing firms. Besides this renewal of productive system it ensures, exit can also have a positive value since individuals who have closed down the company they owned or managed in the previous year are more likely to engage successfully in a future entrepreneurial activity. Secondly, despite the efforts and measures adopted by the USA, the rate of exit of new entrants barely decreases below 50% before their fifth birthday and the global rate of corporate bankruptcy demonstrates a rare stickiness except when the law changes. It is then essential to determine a pattern of failure and exit in accordance with these theoretical and factual dimensions.

This question is all the more important since insolvency is a cost for the whole economy. It however bears unequally on the economic agents as the small companies pay a

hard price for this renewal of the productive system. The importance of this issue is illustrated by the attention paid by the governments to the modernization of their bankruptcy regimes. Collective frameworks have been proposed by the International Monetary Fund (IMF 1999), the Organisation for Economic Co-operation and Development (OECD 1998), and the European Union (European-Commission 2007). The changes brought are however considered as not sufficient to significantly improve the system. However, what a good system should be is still a debated question among academists and practitioners. The point is that no universal agreement exists on this point even if it is broadly admitted, following Franks and Torous (1992) that bankrupt small-to-medium-sized enterprises (SMEs) fall into two categories: those that are economically distressed and not viable which should be put out from the market and those that are experiencing temporary financial difficulty and whose distress is due to peculiar events or conditions which should be supported. A performing system is supposed to be able to make a good screening of these two kinds of profiles, i.e., it allows temporarily distressed companies to be rescued and definitely compromised situations to be solved by a liquidation. As underlined by an abundant literature on this topic, the crucial stake at this stage of the insolvency path consists in minimizing the occurrence of type 1 and type 2 errors, i.e., to liquidate firms whose probability of recovery is definitely compromised whereas the companies which still have either credit or capability to restore their market share should be supported. When enacted, such a system is able to strengthen economic growth resulting from entrepreneurship. However, as deplored by Cook et al. (2012), 'the literature provides little practical guidance on how such a choice should be made' (p. 276). That is why, in a quite recent overview of bankruptcy law design, Lee et al. (2007) concluded that the topic is still 'an important but understudied area' (p. 268).

The problems most of scholar and practitioners face whenever it is questioned to define, understand, or prevent firm failure start with the definition of insolvency and its differentiation with bankruptcy. However, the definition of a borderline which separates going concerns from defaulting company is not the final purpose of research dealing with insolvency. Instead, an abundant literature is devoted to the identification of determinants of default or failure thanks to the identification of discriminant functions able to discriminate between healthy companies and firms that are likely to fail in the near future. Most of this research aims to identify the items of the balance sheet or the profit and loss account able to reflect the distress of the firm. However, focusing on the predictive signal of insolvency, this literature mainly deals with the symptoms of default and not with the causes. That is why, a growing number of work go one step beyond the question of expectation to study the causes of exit in order to prevent failure.

The remainder of the paper is organized as follows: the 'Defining insolvency' section considers the variety of definitions of insolvency and puts some order in differentiating default, insolvency and bankruptcy; 'A large variety of causes of insolvency' section presents the literature dealing with the prediction of insolvency looking at its more visible manifestations whereas the 'Different individual causes' section insists upon the efficient causes or primary sources of failure which have more to do with the productive combination and the market positioning of the company than with the financial and accounting ratios.

Defining insolvency

In his seminal paper on corporate insolvency, Armour (2001) makes a distinction between six different meanings of the term 'insolvency'. Departing from the colloquial sense of the word that has to do with an inability to pay creditors, he attempts to clarify between the accounting concepts of balance sheet insolvency, cash flow insolvency, and economic failure on the one hand and the judicial aspects of default that follow a path from insolvency proceedings and reorganization to liquidation on the other. This extensive approach to firms in distress presents the huge advantage of encompassing the diversity of possible judgments made by commercial courts in cases of corporate insolvency^a. Moreover, such a complex and refined typology of failure is hardly compatible with an empirical analysis of the phenomenon which is most of the time centered on the determination of a discriminant function able to distinguish two classes of firms according to their respective economic health (Rahman et al. 2004; Bose and Pal 2006). The problems emerge because corporate insolvency is still missing a general definition broadly accepted by the community of authors working on this topic.

Most of the time, a firm is considered as financially distressed whenever the book value of its assets is less than those of its liabilities. From this point of view, the Basel II criteria define a firm as being 'in default' when its scheduled payments are delayed for more than 90 days. This approach which is focused on a cash flow conception is advantageously complemented by a stock perspective which compares the available assets to current liabilities (Belcher 1997). If such a definition presents an indisputable use as far as one is interested in the particular situation of a specific company, the expert judgment it rests upon does not fit with the study of the general situation of a large number of companies or with the determination of a function that permits to separate operating firms from insolvent ones. To do so, a simpler but clearer definition of insolvency is required. This is the reason why most of the papers dealing with discrimination between going concerns and insolvent ones refer thus to legal rules to draw a clear separating line between these two classes. In this case, a company is thus considered as insolvent when it files for bankruptcy or when a court decides it should be liquidated.

The attribution of success and/or failure to small firms is thus complex, dynamic, and problematic. Broadly speaking, insolvency is defined as an incapacity to pay debts upon the date when they become due in the ordinary course of business. This definition permits to make a distinction between healthy companies as they respect their contractual commitments and distress companies which are just about to file for a petition. Such a definition, however, has a drawback. It tends indeed to create a confusion between insolvency and default mainly seen as the non-repayment of a debt by the literature devoted to the functioning of credit market. The word 'insolvency' refers then primarily to a corporate reality which is not so simple to define as far as one is concerned in differentiating defaulting firms from going concerns.

However, establishing a clear dividing line between the two previous kinds of companies is a key challenge in the proposal of a typology of companies according to their degree of robustness. It is all the more important that such a distinction is mandatory for bank in accordance with Basel II, and coming Basel III, principles and that an increasing number of research aims to propose an empirical analysis of distressed firms. To cope with these goals, two polar definitions of insolvency are currently used in economics; the first one is economic whereas the second one refers to judicial rules.

The economic conception of insolvency

According to the advocates of the economic conception, insolvency is defined as a set of situations of failure such as the non-repayment of a debt, the inability to pay dividends to the shareholders, the financial distress, etc., which can lead, or not, to the beginning of a judicial proceeding. In such an approach, the suspension of a company is then conceived like the result of a progressive process. Some authors, as Zopounidis (1995), propose a very extensive view of the phenomenon. Default is just another word to describe a company unable to make profit, whose capital does not create value mostly because the continuum of enterprise-produced good market has become inconsistent. Such a company is also defaulting because it does not contribute to solve social problems such as unemployment or purchasing power increase. This broad definition is however too large to be operating what leads another part of the literature to focus on payment problems.

Indeed, the inability to repay the due amounts is a clear signal of default allowing to distinguish safe from risky companies. This definition is adopted by Ooghe and Van Wymersch (1996). According to these authors, a company, it is said to be insolvent when it cannot anymore reach its economic goals in a socially and legally constrained environment. This distress is also characterized by the fact that, during all this process, the company is unable to fulfill in a regular way the commitment towards its various partners. Indeed, the problems which a company can encounter must be analysed as a continuous and cumulative process: the failure starts with small difficulties which are gradually transformed into more serious problems. Some works, following Beaver (1966), thus tried to propose models in which the non-payment is used like the signal of the failure of the company. Because of the low level of correct classification provided by this fuzzy definition, the term 'default' is no longer used to empirically illustrate the concept of failure.

In order to escape the blind alley resulting from the strict assimilation between insolvency and default, some authors have considered other events. A company is then considered as insolvent if it is no longer able to meet its economic, financial, and social objectives on a regular basis. Some go even further by considering that firms enter in periods of decline when they fail to anticipate, recognize, neutralize, or adapt to external and internal pressures that threaten their long-term survival. The separation between the failing companies and the others based on different performance criteria is proposed by Platt and Platt (2002). They draw a line between going concerns and distressed firms having experienced either several years of losses or decreases in the distribution of dividends or a major restructuring. Beaver (1966) is representative of this approach and defines the failure as the result of the inability of a company to meet its commitments once they have reached maturity. The results are quite poor however and become even worse when the purpose is to discriminate between profitable firms and non-profitable ones because no function properly separates the two classes. More recently, this approach has also been adopted by Bose and Pal (2006) who obtained prediction rates ranging between 65% and 75% in their attempt to separate companies *a priori* considered as financially healthy from those which are not.

The problems encountered in testing the different borderlines between viable firms and those that are going to fail come from the fact that the separation between these two situations is both porous and blurred. That is why numerous studies agree that the cessation of payments is the final step of a process, sometimes called 'a spiral of failure',

from which a firm can escape thanks to the adoption of corrective and preventive measures consisting in a modification of its operating cycle.

From a legal to a managerial perspective

The second set of papers considers failure from a legal point of view. It is then defined on the basis of judicial criteria introduced in the insolvency act enacted in a given country at a given period. Most legal rules considered a firm as bankrupt when the judge decides it is not able to make its repayments when the claims fall due (Cabrillo and Depoorter 1999). Insolvent companies always conform to this mix of legal and accounting logic. At each stage of the judicial process, accounting considerations are introduced to strengthen the rationality of the decision made by the judges. Indeed, the proceeding always begins with a cessation of payments and ends up with a liquidation or continuation plans. To fix a point of time to signal the transition from a reliable and sound company to a failing one, many scholars consider that the failure occurs from the moment a company presents to the courts the legal documents required for its liquidation or reorganization. The failure is then assimilated to the entry in the insolvency proceedings and filing for petition has to be considered as an extreme situation, i.e., an exit from the market resulting from the mismatch between the entrepreneurial project and the market conditions.

Although the meaning and nature of the proceeding may differ, the arrival in a commercial court which registers the cessation of payments gives a simple criterion to 'objectively' separate two classes of firms: those that are governed in accordance with the rules of collective proceedings and those which are still operating in an economic world dominated by the respect of contractual commitments. As in the previous set of papers, the robustness of this conception rests upon the binary choice provided by the judicial perspective: either the company is sound or it is insolvent. The judicial definition of insolvency has given rise to much research of which this entry provide only a brief glance.

Proposing an empirical analysis to check out the differences between legally insolvent firms and those only reporting financial difficulties, Agarwal et al. (2001) determine a performing function whose exact classification rates are above 93% for both groups. It appears that models relying on a legal definition and separation of businesses into two classes lead to more reliable results than the ones based upon financial performance levels. Different reasons explain this superiority. Firstly, the differences between failing and viable firms are clearer as one is closer to the cessation of payments. Secondly, the transition between an economic order, dominated by commitments and contracts on the one hand and a judicial universe in which pure market logic is supplanted by a legal order on the other, is clearer than an assessment based on corporate performance. Therefore, in the legal order, the sequence is structured by a threefold stage. Firstly, it consists in the statement of cessation of payment. Secondly, it is followed by an arbitrage between direct liquidation and rescue which depends on the particular situation of the insolvent firm and the context in which the decision is made. Thirdly, the validity of this decision is known later if the rescued firm effectively survives.

A large variety of causes of insolvency

A huge number of researches give attention to the causes of insolvency. Most of them pay a considerable interest on nonfinancial aspects as specific causes of bankruptcy (from

Baum and Mezias (1992) to Greening and Johnson (1996) or Swaminathan (1996)). These studies stress the importance of one factor, sometimes even within a specific type of company. However, even if it is widely admitted that insolvency is the result of a long and intricate process, many papers and reports insist upon the significantly higher probability of failure of specific types of companies. Size is then the first characteristic taken into consideration as a key discriminant factor. For a long time, small businesses have been a major concern for the authors involved in this field (Hall (1992) or, more recently, Back (2005) is representative of this large set). However, the changes in the characteristics of companies going bankrupt lead some other scholars to pay attention to the exit of large corporations. Indeed, the bankruptcy of American large companies in the beginning of the 2000s^b question the failure of large corporate groups. Among many reasons and following the controversial paper by Charan and Useem (2002), managerial errors is often presented as a major one whereas some others, rediscovering Kotler (1965) and considering that it can be profitable for corporate groups to abandon some activities, begin to think about bankruptcy as a business strategy. These new directions still remain rare and, as highlighted by Ooghe and De Prijcker (2008), 'most of these studies declare management characteristics to be the most critical factors in corporate bankruptcy', whereas insolvency should be seen as a process in which different causes intervene at the different stages. We examine these two points successively.

Different individual causes

Various studies have endeavoured to identify the causes of corporate bankruptcy which can be as numerous and complex than factors leading growth. A comprehensive vision of the possible causes of failure is provided by Bradley and Rubach (2002) who remind the different families of the factors identified as causes of insolvency by a survey commissioned by the Small Business Administration. Management, marketing, or financial reasons are the main ones but should be precised as additional elements intervene, such as the following:

1. Outside business conditions: includes increase in competition, insurance, and general costs of doing business
2. Financing: includes loss of capital, inability to secure new capital, and high debt
3. Inside business conditions: includes management mistakes, location, loss of clients, and trade credit problems
4. Tax: includes problems with the tax administration
5. Disputes with a particular creditor: includes foreclosures, lawsuits, and contract disputes
6. Personal: includes illness and divorce
7. Calamities: includes fraud, theft, natural disasters, and accidents
8. Other: includes buying time and involuntary bankruptcy filings

This research provides an appropriate framework to encompass the insolvency in a complex framework. Some also succeed in identifying the profile of a vulnerable enterprise whose probability to go bankrupt is higher than the 'normal' risk of failure. Everybody agrees that weak firms are naturally predisposed to go bust. The stake is then to isolate some ratios or indicators that give an accurate representation of the firm fragility. Different families of causes of insolvency may be then compounded according to

the facet of the company of concern. An exhaustive presentation is available in Caves (1998) which provides a review of prior literature.

Size, age, and activity

The analysis of the possible causes of insolvency began with the introduction of firm size, following Gibrat's law often considered in models of firm growth. Most of the researchers agree upon the fact that the smaller the firm size, the greater the chance for the firm to go bankrupt. Indeed, small firms do not have the amount of financial resources or support from creditors as a buffer for market contractions. Moreover, small organizations face difficulties in attracting the most competent personnel as they cannot offer a career development equal to large organizations. Considering companies of the US construction industry whose risk of failure increase initially with increasing age, reach a peak point and decrease thereafter as companies grow older, Kale and Arditi (1998) conclude that young failures can be attributable to inadequate resources and capabilities (relative to initial endowments). On the opposite, older failures should be attributable to a mismatch between resources and capabilities and the demands of the competitive environment. These internal processes will manifest themselves in vulnerable business models which fail to generate positive cash flow. The strength of the relationship varies with the context and, mainly, with the business climate in the industry. A non-negligible part of research then proposes models in which mortality dynamics depend on age, size, and population density mechanisms.

However, considering these structural variables as appropriate proxies to determine the probability of bankruptcy cannot satisfy those who want to determine which firms are more likely to default in order to use this information to make a right decision such as in financing or advising managers. Indeed, as it comes from the paper by Coltorti and Garofoli (2011), about the relationships between the firms' size and performances, the reality of the insolvency problem cannot simply be bordered by some general indicators. Indeed, empirical results of the analysis on the balance sheet data of medium-sized firms of the manufacturing industry in four European countries have excluded the positive relationships between the firms' size and performances (both for value added per employee and for profitability rates). This should bring more caution with the traditional and broadly admitted agreed interpretation of a positive relationship between exit and firms' size.

Progressively, other elements, more narrowly depending on the specific characteristics of the firms, have been introduced. The inspiration directly flows from the resource-based view which has principally been employed in the study of above-normal performance but is also instructive in the context of below-normal performance.

Financial causes

In contradiction with the Modigliani-Miller theorem which states that under specific assumptions, the value of a firm is unaffected by how that firm is financed, a large number of works shed some light on the role plays by the financial structure in the vulnerability of the firm. It is generally admitted that companies in cessation of payments are characterized by a lower level of long-term financial resources than sound ones. This difference is still valid, even if less visible, when one firstly compares firms that benefit from a rescue attempt to the ones that are immediately liquidated and secondly compares surviving firms to definitely bankrupt ones.

A class of bankruptcy models developed in this vein are 'risk of ruin' models (Santomero and Visno 1977). They assume that the firm has a given amount of capital (K) and that changes in K are random. Positive changes in K result from positive cash flows from the firm's operations. Losses require the firm to liquidate assets. Implicitly, this model assumes the firm is completely cut off from credit or security markets and cannot raise funds via debt or equity issues. A company goes bankrupt when the market (liquidation) value of its assets (K) falls below its debt obligations to outside creditors.

One may consider that the interest coverage and market value of equity/total liabilities are negatively correlated with the odds of corporate bankruptcy. In the same vein, the likelihood of going bankrupt increases with the leverage level and capital intensity, but decreases with the liquidity level and growth prospect of a firm. Some are also interested in the expectations and appetite of shareholders as the smaller the stock return, the greater the chance for the firm to go bankrupt. Following the pecking order theory, one can support the idea that companies prioritize their sources of financing (from internal financing to equity) according to which the principle of least effort, or of least resistance, preferring to raise equity as a financing means of last resort. Hence, internal funds are used first, and when they are depleted, debt is issued. When it is not sensible to issue any more debt, equity is issued (Myers and Majluf 1984). The ability of the firm to finance its investments by itself appears as a crucial factor for its stability. Thus, a high initial level of financial resources (equity and long-term debt) can protect the firm from a risk of failure.

Environment, sales, and market position

Other explaining variables have to do with the business and the market position of the company. The firms which are able to sell their products are less likely subject to a cessation of payments. It follows the 'Porterian' view according to which firms benefiting from a dynamic geographical or industrial environment have a higher probability of success than companies that do not benefit from such positive externalities. Indeed, business failure is all the more probable as the firm faces difficulties in selling its product which may cause a continuous decline in turnover as well as a decrease in profitability. The higher importance of the capacity to create a good customer relationship is pointed out by Shumway (2001) who finds that market variables are more useful than financial ratios in predicting bankruptcy.

The macroeconomic context exerts a strong influence on company survivability. The links between the changes in overall economic conditions and aggregate rates of corporate liquidations have been in the focus of a large number of studies based on economy-wide-level information. They conclude that economic cycles and shift in prices have a strong influence on the sales.

Corporate governance and shareholders

Becchetti and Sierra (2003) include a group membership dummy in a prediction model estimated on a large sample of Italian manufacturing firms, and find a negative relationship between probability of failure and business group membership between 1992 and 1997. This evidence can be enlarged. On average, firms integrated in large corporate groups are more likely to be supported by the parent company and thus less likely

to be insolvent. More recently, studying a sample of publicly listed firms in Hong Kong, He et al. (2010) insist upon the fact that the odds of going bankrupt increase with the level of restrictions imposed on corporate internal control.

All these different causes do not intervene independently in the process of failure but combine each other. It means that no single cause is by itself able to ruin a company but that involuntary exit such as bankruptcy is the result of an accumulation of events producing a sequence whose predictable end lies in bankruptcy.

In a complex process

In general, insolvency does not happen overnight. On the contrary, disruption in payments can be expected from previous signals. Empirical works try to identify these signals using either zeta score-based models or a more qualitative approach. Empirical evidence does not show a clear causal relationship between good governance practices and good corporate performance. It is almost impossible to discriminate between a favorable economic conjuncture and good practices as causes of success. Corporate insolvency will usually be a predictable result of bad corporate governance when the company is still a going concern.

Figure 1 illustrates what can be described as a cumulative scenario towards insolvency which may lead to either a direct liquidation or a judicial settlement involving the continuation of the undertaking (creditors are obliged to accept certain deadlines) or the transfer of the business (the undertaking and its main contracts are sold to a third party who accepts certain commitments).

The decline of a company begins most of the time by mismanagement and unmarketable products (Crutzen and Van Caillie 2009) which may cause a decline in sales over several years (and a correlative decrease in earnings if nothing is done to improve

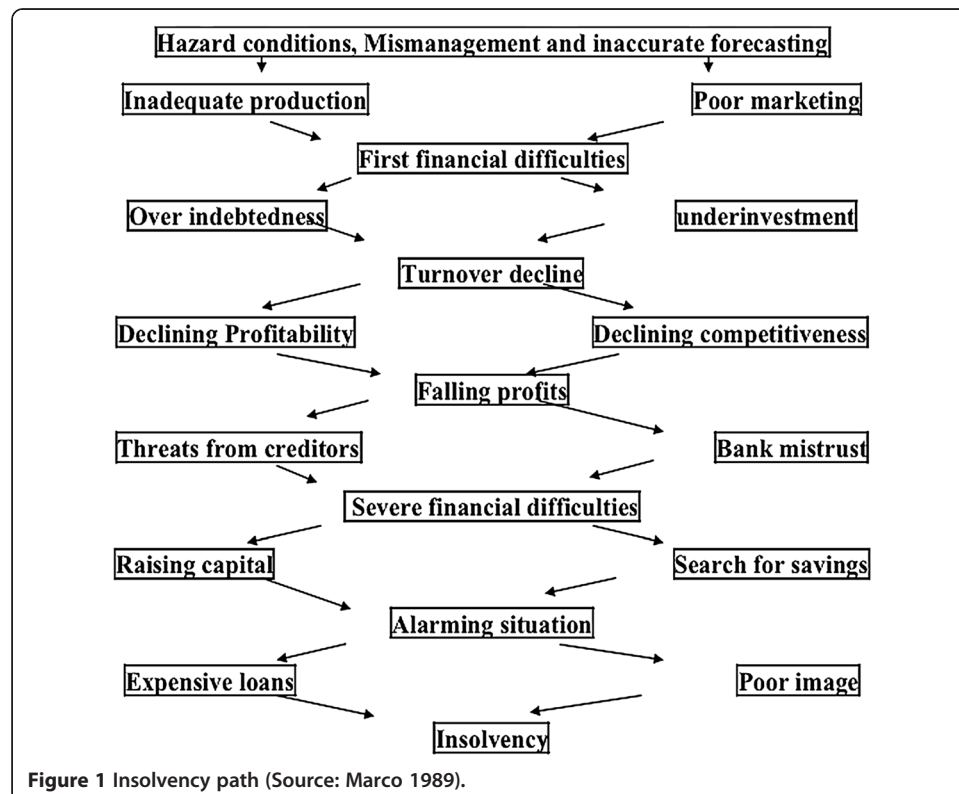


Figure 1 Insolvency path (Source: Marco 1989).

the market position). In the worst case, the falloff in turnover results in a decrease in profitability, followed by a deterioration of operating conditions which are at the origin of a solvency crisis. At this stage of the vicious circle, the company's managers have a strong incentive to accept less favorable market conditions (rebates or longer terms of payment, etc.) in the hope of restoring sales and profitability. Such a reaction can however be counterproductive as it can cause an increase in trade debts and inventories, especially in the manufacturing industry. As a consequence, the company may be short of cash and, therefore, may face a liquidity crisis which could lead lenders to practice credit rationing and increase interest rates since the simultaneous increase of indebtedness and decrease in self-financing deteriorates the probability of repayment of such a debtor. Subject to a shortage of financial resources, to a decrease in the EBIT aggravated by an inability to repay the claims once they fall due, the company may decide to file a petition for bankruptcy before the creditors decide to present one to the commercial court. Once one of these two possible events happens, the insolvency turns into bankruptcy. The arrival in a judicial world changes the rules of the game drastically as the first consequence of this switch lies in the automatic stay that halts actions by creditors trying to collect debts. The stake is thus no longer to decide whether the company should repay or not all the claimants but, instead, to make a decision concerning how much debtors should repay in case of rescue or liquidation. The arguments in favor of each solution may differ according to the institutional context on the one hand and the company situation on the other.

Forecasting and preventing failure

Understanding and predicting company default has been an area of extensive research for at least 40 years. The literature exploring corporate failure started with the simple univariate discriminant analysis approach, pioneered by Beaver (1966). His univariate analysis of a number of bankruptcy predictors states that a number of indicators could discriminate between matched samples of failed and non-failed firms for as long as 5 years prior to failure. His published sample contains 79 companies which failed during the years 1954 to 1964 from 38 industries. Beaver concludes that cash flow to debt ratio is the single best predictor. Models of that kind are appealing in their simplicity, but their main disadvantage lies in their inability to account for the coexisting effects of many different indicators of default.

Since Altman (1968), most of the models devoted to prediction of insolvency have tried to determine the best function to distinguish reliable companies from those that will possibly default in the near future. Altman selected 33 publicly traded manufacturing companies which were declared bankrupt under Chapter X between 1946 and 1965 and matched them to 33 companies using a stratified random sample based on their assets and industry. His famous Z score^c using five financial ratios^d correctly differentiated 94% of failed companies and 97% of the non-failed companies with data 1 year out from failure. This good performance contributed to the popularity of this approach. Many contributions followed the one by Altman (among many, one can cite Deakin (1972) or Blum (1974)). Their main purpose consists firstly to identify explanatory variables of default and to estimate their contribution, estimating the coefficients that make it possible to accurately classify a set of firms in two *a priori* defined categories.

Its performance rests upon the innovative use of multiple discriminant analysis in the field of economics and finance. Multiple discriminant analysis is a statistical technique used to classify an observation into one of several *a priori* groupings dependent upon the observation's individual characteristics. It is used primarily to classify and/or make predictions in problems where the dependent variable appears in qualitative form, for example, bankrupt or non-bankrupt. From this venerable models, an unmeasurable number of variants have been tested, either the number of indicators compounding the final score was changed to improve the fitness of the index, or the formula was adapted to fit better with peculiar situations such as specific activities (services, start-ups, ...) or markets (emerging, blue ships, ...). Another generation of risk index models introduces the concept of indexing the individual failure-predicting indicators; however, their approach shares the same weaknesses of univariate analysis and provides largely arbitrary risk metrics.

Since the implementation of a linear function, numerous refinements have been proposed. They mainly concern the estimation technique and consist in the implementation of semi-parametric (logistic) or non-parametric (neural networks) techniques^c. The logistic procedure fits linear logistic regression models for binary or ordinal response data using Maximum Likelihood estimations and compares the estimated samples whereas artificial neural network systems attempts to assign proper weights to the respective inputs by a 'genetic algorithm' optimization procedure to allow for the correct deduction of the ultimate outcome. Regardless, the result is always the same: once validated, the function becomes a predictive model of insolvency. The crucial point is that this method requires a strict definition of failure resulting from a review of the literature and knowledge of default organization prior to any empirical analysis. Two polar points of view coexist in the literature: an economic and a judicial one.

Despite their growing success, neural networks are still criticized due to the lack of transparency concerning the estimation process: they are even suspected to be 'black boxes' what is a real weakness whereas accuracy and information disclosure is required from banks in determining the exposure at risk. That is why the judgement is still balanced. On the one hand, neural networks, when effectively implemented and validated, show potential for forecasting and prediction. On the other hand, a significant portion of the neural network research in forecasting and prediction still lacks validity. Anyway, currently, several of the major commercial loan default prediction products are based on neural networks. For example, Moody's Public Firm Risk Model (Online: www.moodyskmv.com) is based on neural networks as the main technology. Many banks have also developed and are using proprietary neural network default prediction models.

Nowadays there is a wide range of default prediction models, i.e., models that assign a probability of failure or a credit score to firms over a given time horizon. The literature on this topic has developed especially in connection with Basel II, which allows banks to set up an internal rating system, that is, a system to assign ratings to the obligors and to quantify the associate probabilities of default. The requirement of the microregulation of the banking system and the increasing need of more accurate expectations on the exposure at the loss of financial institutions are probably going to push up research on firm insolvency. Nevertheless, a better knowledge on the causes of firms' failure is not only wished for an improvement of financial sphere functioning. It can also encourage firm interest and company advisors to implement better practices of growth (Levratto and Paraque 2011).

Companies themselves may be interested in getting information about their own situation. Instead of being only a tool used by outsiders to make their decision about the opportunity to lend money to companies, managers themselves can use the prediction of failure as a signal. Indeed, the preparation of a business strategy may require instruments for evaluating the possible outcomes of the new orientations decided by the board. Simulations can thus be added to the tool box at the disposal of the managers to determine which possibility is less risky.

But some external uses of insolvency prediction models may also be proposed. Indeed, development agencies are increasingly faced with the question of evaluating the efficiency of their support to the companies. A double constraint bears on their action: avoiding the risk of dilution of their assistance on the one hand, and finding a satisfying mix between long term but highly uncertain results and short term but often limited to solvency consideration outcomes on the other hand. These economic development organizations can thus be interested in having at their disposal an evaluation method that allows them to consider simultaneously short-term perspectives with medium-term considerations that have something to do with survival.

From an academic point of view, one may thus consider that the existence of firm-specific failure determinants offers support to the resource-based theory of the firm, and contributes a more fine-grained perspective to the study of organizational ecology.

Conclusion

Over the past 35 years, corporate insolvency has been at the origin of a broad and in-depth literature aiming at embracing legal and industrial features. Seen as a promising way to have at disposal prediction models possibly used by banks, the firm exit has increasingly become a fashionable topic. The crisis intensified the problems faced by creditors to screen the potential borrowers and boosted the research in this field. The increasing number of works is especially visible in two fields. An empirical analysis of firm exit or default determinants which tends to provide a better knowledge of explanatory variables on the one hand and a methodological perspective mainly consisting in testing new techniques on the other. In these two fields, the progress is really perceptible.

Despite the significant progress done, two challenges remain to be tackled. The first one deals with the fact that bankruptcy is more of a continuum than a dichotomous variable. Whereas the other one has to do with the role of the institutional context what makes it difficult to build a general model of bankruptcy prediction. Lets us comment on each one briefly.

A new way of evaluating predictions has to be developed to renew the usual binary way to discriminate companies. The necessarily slow transition from a safe and operating company to an insolvent and bankrupt one is not reflected by the one vs. zero solution usually adopted. Creditors and lenders use starts with a list of companies without *a priori* knowledge of how many are/will be bankrupt and then the model is asked to classify each. The models should reflect these multiple solutions what seems to support logistic techniques able to cope with different alternative situations.

The second stakes come from the fact that exit and insolvency are highly sensitive to the legal and macroeconomic contexts. To depart from the determinist view which

characterizes parametric models, scholars tend to prefer non-deterministic ones. However, they tend to hide the reason why firms fail. In the future, one can expect that semi-parametric models will be preferred, even if that requires intensive tests to improve their reliability as prediction tools. It is the price to pay to get a comprehensive model of exit.

Endnotes

^aThe term insolvency is commonly confused with bankruptcy whereas they refer to close but different situations. Strictly speaking, both insolvency and bankruptcy deal with liabilities exceeding assets. However, insolvency refers to a financial state and bankruptcy to a distinct legal concept, a matter of law.

^bThe bankruptcies of Enron, WorldCom, Global Crossing, Kmart, Polaroid, Arthur Andersen, Xerox, Qwest, etc. are representative of the weakness of the principle 'too big to fail' in the manufacturing and service industries.

^cThe Z-score is a quick way to assess the solvency of an organization - it can indicate current and potential financial distress. A Z-score of less than 1.8 indicates a high probability of financial failure. Whereas a Z-score of greater than 3.0 indicates a low probability of financial distress.

^dWorking capital/total assets, retained earnings before interest and taxes/total assets, equity market value/book value of total debts, and sales/total assets.

^eOhlson (Ohlson 1980), as a pioneer of the use of logit models, and the paper on neural networks by Rahimian et al. (1996), only published in 1996 but written in 1991, are representatives of the use of these new methods for bankruptcy prediction.

Competing interests

The author declares that she has no competing interests.

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