TRADITIONAL AND ALTERNATIVE APPROACHES TO QUANTIFY THE RISK FOR BUSINESS

ANCA JARMILA GUȚĂ, GABRIELA CORINA SLUSARIUC *

ABSTRACT: *The paper proposes to present the approaches modalities of the risk to which an investor is subjected in various situations during the development of its business. The risk description is based on the idea of quantifying the probability of occurrence and severity of the event the reason for which in the approach of business risk is necessary to treat the probability distributions in the occurence of risk and their construction methods. Paper also highlights how the work of measuring risk can be realized during the development of a business.*

KEY WORDS: *risk for business; probability distributions; occurrence of risk; development of a business; types of risk; main types of loss; types of probability distributions; methods of measuring risk*

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1. INTRODUCTION

The business is an enterprise, a commercial entity or public or private sector company centered on the production of goods or services that satisfy customer needs. Or the business means a contractor, subcontractor, tenderer of services, consultant, and technical service, administrative or physical services, organized as a sole owner, in partnership, association, corporation or other entity that exists to gain from development of the activity.

A good knowledge of internal and external business environment, an awareness of phenomena, actions and events that may generate losses, the adoption of prudent behavior is the premises to a successful business. Identifying the risk is thus the first step in the development of a business on the basis of conscious, responsible activities, meaning by this that the process of continuously and systematically identified as exposures to the potential harmful factors. Is very good if an entrepreneur

* *Lecturer, Ph.D., University of Petroşani, Romania, gancajarmila@yahoo.com*
Lecturer, Ph.D., University of Petroşani, Romania, ellas7275@yahoo.com

is able to identify the potential damages on the basis of the experiences of others or even on proper history. To establish damage after the moment of its occurence is more unpleasant and certainly more expensive that to prevent its occurence. The lack of identification of potential hazards causes the fact that the damages which can be registered may represent a surprise to the firm and the unconscious retain of some risks is not the happiest initiative for the entrepreneur. But the process of identifying of potential losses should be based on its preceding "mapping".The identification of the types of risk that a firm may face is an essential step in prospects of management of contingencies but it is only the first step in a series of initiatives to be carried out to correct interiorization of entrepreneur behavior in the risky environmental. Any choice involves giving up one or more alternatives and we have already discussed the fact that the election results can not be made known accurately, for various reasons. Why it is very important before deciding on a particular option, the company should know not only the expected surprises, but also the chances of their occurrence, their impact, impact severity, the potential frequency of events and other elements. The need of risk assessment makes its presence in live of entrepreneur in several situations, namely:
- When he has to compare two or more alternatives with similar results, but with different risk levels;
- Where he must compare two or more alternatives that may prove just as risky, but bring different results;
- When there is no proper alternative, the entrepreneur must decide if he accepts or not a particular risky situation, in terms of judging their own risk acceptance criteria.

Neither the risks identification nor the losses determination is not simple problems for an entrepreneur. The description of risk and implicitly of potential damage are based on the idea of quantifying the probability of occurrence and severity of the event, so we consider opportune to begin our efforts with a brief overview of the concept of "probability distribution" and how it is used in the approach to risk in business.

2. PROBABILITY DISTRIBUTIONS

In terms of probability theory, any aleatory phenomenon is called "experience". The firm can make only two things: to create the premises of best activity, making every effort that the events take place favourably to achieve the proposed objects and then waiting for results, but sometimes it has to be limited to observing the evolution of henopmena.

For now, we will limit to note the fact that the objectives which the firm establishes at a time can be achieved or not, or can only be a part of the expected result, without discussing the perturbation factors whose action can generate the variability of results. For now, we will consider only the existence of this variability and we will see that it can take a formal description, which is called the "probability distribution".

When we build a probability distribution we must have fixed a number of elements: 1) the aleatory experience to which it corresponds; 2) the purpose of the study or surpose; 3) the time period to which the objective is valid.

For the smooth running of the business firm should be able to estimate: a) the loss generated by the occurrence of a failure; b) the number of occurrences of failures during the period of time; c) total loss, expressed monetary, as a result of failures occurred in the operation of computers, for a certain period of time well established.

It is not hard to guess that these sizes can't be specified exactly, but they represent the aleatory variables whose knowledge involves construction of distributions of afferent probabilities. One can say that when we know the number of failures occurring durring a period of time and the loss they cause each failure, total loss calculation is done immediately, as a product of the two specified sizes.

There are different types of potential losses, different categories of the exposed objects and the causes generating the damages are most diverse. When we decide to build a probability distribution for total loss of business during a period established of time we have mean the numerous combinations of categories: 1) type of waste; 2) objects (units) exhibited; 3) cause of loss.

The determination of a complete distribution for total loss should consider all types of potential losses, all units exhibited and all possible causes, which are related to development of a business. So, the total loss distribution should be constructed in a manner most detailed possible. In fact, this is not only difficult to realize but can be big resources consumer (time, money, energy), as we want to highlight in following example. Referring to the risk of exploitation, Irene Cişmaşu says it is evident because of the lack of correlation and perfect prediction of the results of mining activity with the components of this activity. Irene Cişmaşu defines operational risk as the probability that the incomes don't cover the expenses. The risk isn't just a probabilty, but beginning from the perception of the author we will keep the idea of the possibility of a gap between revenue and expenditures to be felt at the firm level as a loss.

Given the complexity of problem, the need for classification was evident both concerning the types of potential losses to be investigated and as the ratio of causes and exposed units. The teachers C. Arthur Williams Jr. and Richard M. Heins have proposed the combinations that we'll continue to pretend that are not only possible approach. Like any classification of complex phenomena, also that proposed by them can be perfectible. The main types of loss that the two American professors propose it to be considered are: 1) Losses in property of company; 2) Losses relating to the personnel; 3) Loss of net income.

We can say that the net revenue losses can handle either separately or in correlation with the other two types of loss because they may occur: a) directly due to some causes which affect the property of business or engaged personnel. For example, the term failure to deliver goods because of transportation bottlenecks caused by a strike. Company must pay certain penalties which will affect, obviously, the net income; b) indirectly, involving the loss of property prior and / or staff. For example, very significant damage to equipment may slow down production or it may break, so that both costs and future revenues will be affected.

The major causes that the two authors propose are mostly accidental causes, which are mentioned as examples fires, explosions, neglect, illness, death, etc. Of these, only some causes may be present in connection with a number of insured risks: negligence, for example, isn't just insurable, even if damages were caused

intentionally. By limiting the types of losses at only three units set and by classification of the exposed units and of major causes some clear categories, the professors Williams and Heins have greatly simplified the problem in the construction of the probability distribution for the total potential losses. The losses may occur during the same period of time (one month, one quarter etc.), for multiple reasons and that when they appear, the cumulative effect can be more serious than the effect generated by the same losses, appeared however in different periods (or moments). It is not to ignore the fact that, in the same period, the same exposed unit can suffer repeated losses and also the fact that an affected unit can represent a way of transmission of danger to exposed neighboring units, achieving increase damage, realizing the increase of damage with a certain speed of propagation.

2. METHODS OF CONSTRUCTION OF PROBABILITY DISTRIBUTIONS

There are two methods that experts recommend to build a probability distribution which have a general character without elimination of each entrepreneur effort to adapt to the particularity of own business.

a). Method based on historical data. The method supposes observing the previous data when the study is done, assuming that they exist and are accessible. Interested being in a certain type of loss, of some cause and for an established period, the entrepreneur should consult the company documents and to find so the number of occurrences of losses during a long period of time. In this way, he would be able to obtain information about the frequency of different levels of losses already incurred and to estimate the probability that they occur again. Moreover it is widely agreed that tremendous speed of technological evolution and the constant modification of internal and external business environment make the time for which the data remain relevant to decrease drastically. It is true that the relevant periods are too short to provide sufficient data, especially if the developer considers the calculation of the annual results.

We can give as an example a company that three years ago has made improvements and upgrades in the most important weak points of activity, where there were usually problems generating losses. Many causes of troubles were eliminated and also a number of negative effects that could exacerbate because of existing irregularities may be supposed having less severe impact. In other words, the elimination of some risk factors is obtained and therefore of the losses due to them and, in addition, the severity of remained disturbance was reduced. It is expected therefore that the potential losses which are expected after upgrading the company to be different to the negative results registered before. It is also naturally that the prognosis following be realized concerning the potential losses would be made on the basis of the recent data, which correspond to the period after the improvement work. In our example we have assumed that it is three years; if it is relevant period, the company will be based on three observations concerning the total annual losses and these data are completely insufficient in the most of situations, to draw a fair distribution of probability. Each period is characterized by a certain level of costs, either that these reffer to reparations or total replacement of damaged items. It is important, therefore, to be made an

adjustment to the values derived from historical data, that amounts considered as potential losses to be real. The probability theory comes again to support the business and provides to the disposition a range of theoretical probability distributions which, together with private data which are holded by the entrepreneur, can help in estimating loss distributions.

b). Method based on theoretical distributions. Each distribution in part models the aleatory experiences with certain characteristics, well established, so that one and the same phenomenon is not attributable to several theoretical distributions to describe its behaviour. For example, if it the firm a number "n" of units independently exposed to events generating the loss and if the probability of each occurrence of loss is the same for all units - namely p - then every connoisseur of classical probability distributions will say that the number of the occurrence of losses follows a binomial distribution or distribution Bernoulli. If the number of units n is greater than 50, the theorists of probabilities say that above assumptions lead us to thought of Poisson distribution and the examples can continue. Agreeable or not, the theoretical distributions of probability can be extremely useful when you need to evaluate the total potential losses.

The reason is following: if for the determination of aleatory variable "total loss" by the method of historical data it is necessary a big volume of information, often difficult to obtain, when it exists already sketched a behavior through a theoretical distribution of probability are also necessary relatively few of the data for estimating its exact characteristics. Depending on the possibility of their use in the assessment of the risk at enterprise level, the probability distributions can be classified as:

A. Binomial distribution with two states. Known as the Bernoulli distribution, it models the following aleatory experience: from n urns with identical structures, containing white balls and black balls in a certain proportion, is one draw. The number of white balls obtained is followed as a result of these n draws, the number which certainly can not be known before the end of the experience.

If in each urn there are a white balls and b black balls is easy to see that the total a + b of balls in urn the probability that on an extraction occurs a white ball is $p = \frac{a}{a+b}$. The binomial distribution is helpful in assessing the number of occurrences of loss which makes it possible to determine the total potential losses, providing we know the loss caused by each occurrence.

B. Poisson's scheme and the number of occurrences of loss. Mathematical model assumptions differ from those of the binomial scheme in only one place, namely in terms of structure in n urns. Poisson's scheme is applied to determine the number of occurrences of potential losses and corresponding probabilities, if: 1. in the company there are n units exposed independently at a certain type of loss, for some reason and a fixed time interval; 2. each unit is exposed to loss once; 3. the probability of occurence of loss for the unit and is $p_{i,}$ i = 1, n. Let's illustrate, considering that an entrepreneur has concluded a number of identical contracts with the customers so that the entire production of which he disposes at a moment may be sold. There is possibility that just before delivering goods to customers they denounce the contract and, for now, the entrepreneur marks losses of incomings.

C. Poisson Distribution. Poisson distribution is often used to determine the number of occurrences of an event within a specified time, or within a certain area. For example, the number of failures occurring in one hour on a production line, the number of repairs to be made for a car 50.000 kilometers of distance covered, or number that doesn't correspond to weight standards of 200 bags resulted from a packaging line. To use the Poisson distribution it requires that two conditions are met: 1. the occurrence probability of the event is the same for any two intervals (of time, space, etc.) of the same length; 2. the occurrence or non-occurrence of event in any period are independent of the occurrence or non- occurrence in any event period. Not always we meet in practice all the conditions necessary for the fact that a theoretical tool could be applied, in this way lightening the studies undertaken at the firm level. For a micro-enterprise, it is possible that the existence of at least 20 units exposed to the same type of loss, of the same cause and in a specified time couldn't be realized.

D. Normal distribution. Identically as the Poisson distribution, the normal distribution can be used to describe the evolution of a aleatory phenomenon as such, or to approximate a binomial distribution.

3. METHODS OF MEASURING RISK

In all professional work may be met the assertion that once it was determined the probability distribution, we can begin to measure the risk based on several known numerical values named average, dispersion, standard deviation, percentage, coefficient of variation. When the company aims to quantify the risk, it considers that in the future to be sheltered from some shortcomings. Nobody can guarantee to an entrepreneur who registered the previous year a total loss of 300 m.u. that in the coming period will register as much, or double, or third. There in the assessment of losses an aleatory component enough uncomfortable, without having to consider possible errors arising from approximations to the data. Once considered data summaries, it is possible that the accuracy to estimate the average value and other measures referred of risk fall, more or less.

Putting the problem in a general context, we believe that the existence of dispersion is an important asset when a decision-maker has to choose between two or more possibilities with an aleatory result and which leads to similar average values. The unpleasant aspect of this size takes the fact that it is difficult to assign to him a specific meaning. Unfortunately, we can not always get detailed information concerning the aleatory phenomenon studied, only using the average value and standard deviation taken as such. The dispersion and implicity the standard deviation aren't useful whenever two probability distributions have the same average value and we face with choosing between them.

Average and dispersion that we presented above are helpful when you need to compare two probability distributions which have the same expected value or the same data variability. The reality is, however, more complex than the theorists would like and nobody can guarantee that the entrepreneur will have to decide between variants that have approximately identical averages about or similar dispersions (risks). In a firm can be raised the problem of choosing between two actions of following type: 1.

promoting a new product on the market; 2. improving an existing product. For such a choice, the entrepreneur has no weapon at this time.

The average values are significantly different, as well as dispersions, so another measure is needed to compare the risks of the two initiatives. It's coefficient of variation, defined as the ratio between standard deviation (σ) and average (w), expressed in percentages: $\text{The coefficient of variation} = \frac{\sigma}{m} \cdot 100\%$

The information that we provide that coefficient is the percentage which represents the standard deviation of the average of aleatory variable. Although, in essence, both coefficients of variation have small values, we can say comparatively that the first variant is less risky. Unlike to dispersion and standard deviation, the utilization of coefficient of variation as measure of risk imposes certain restrictions on the aleatory variable describing the phenomenon studied.

In its definition, the average value appears at the denominator of the fraction and as such, to be meaningful, must be that $m \neq 0$. Even where m is not zero but it has very small values, no matter how small would be the value of σ can reach extremely high values of the coefficient of variation and, as such, its use isn't necessarily relevant. To avoid such situations, professionals have chosen to use this measure only for distributions whose results are positive.

The study of potential losses brings to the attention of the analysts positive sizes, expressed mostly monetary. The problems can appear when the study directs towards the area of rentability of financial assets, where some titles can have evolutions with results both positive and negative.

4. MEASURES OF RISK FOR PARTICULAR SITUATIONS

For considering applicable this distribution, we need n independent units exposed to loss in a period of established time, each unit being exposed exactly once with probability equal to: m = np. The dispersion will be noted with σ^2 and, for this case is: $\sigma^2 = np(1 - p)$. The standard deviation calculated as radical of dispersion is: $\sigma = \sqrt{np(1-p)}$. Finally, the coefficient of variation has the form:

$$\text{Coefficient of variation} = \frac{\sqrt{np(1 - p)}}{np} = \sqrt{\frac{1-p}{np}}$$

Given that the probability value is between 0 and 1, should be considered the extreme values:

- If p = 0, then certainly no exposure unit will not mark a loss and so it makes no sense to ask any question of some potential losses. In this situation, otherwise almost impossible in practical terms, the binomial nature hasn't any importance or other kind of probability distribution, simply because there is no distribution. The zero probability denotes an impossible event as how the one probability shows a sure event, both cases being completely outside of aleatory notion. Thus, for p = 0 we get an average of zero losses, which is reason enough to not calculate any coefficient of variation. The standard deviation is also zero, meaning that an event which will not happen doesn't require risks.

- Therefore, for p = 1 we obtain the maximum loss of all exposed units. Let's see what each of other measures of risk becomes. Apparently surprising, dispersion, standard deviation and the coefficient of variation are zero. Namely, without risk. And in fact, the things are like this because in this case the entrepreneur doesn't have to fear that the loss could be less than the maximum possible. From this perspective, the risk is zero: the maximum exposure is certain.

The formulas of calculation that we have presented are helpful in estimating the average number of occurrences of loss, the risk that this number is other than that anticipated of value m and for binomial distribution we can judge things more deeply. Looking the coefficient of variation, we will see that at the denominator of the fraction which defines it appears n. In assumption that the value of p remains unchanged, we see that the size of coefficient of variation depends on the change of n, meaning that an increase of the number of units exposed generates a decrease of risk quantified in this way: $n_1 > n_2 \Rightarrow \frac{1}{n_1} < \frac{1}{n_2} \Rightarrow \frac{1-p}{n_1 p} < \frac{1-p}{n_2 p} \Rightarrow \sqrt{\frac{1-p}{n_1 p}} < \sqrt{\frac{1-p}{n_2 p}}$.

From the dispersion formula or standard deviation we can observe that these increase with increasing of n. It is perfectly true, but equally true is the increase average value with increasing of number of units exposed, making impossible a comparison of the situation only on basis of analysis of average and dispersion. Consequently, the only relevant measure, which can explain the modifications that appear together with the increase of n, remains the coefficient of variation that indicates that relative risk decreases: $risc1 = \sqrt{\frac{1-p}{n_1 p}}$, $risc2 = \sqrt{\frac{1-p}{n_2 p}}$, $\frac{risc1}{risc2} = \sqrt{\frac{n_2}{n_1}}$.

The ratio $\frac{risc1}{risc2}$ shows us that together with this increase of the risk decrease in inverse relationship to square root of this growth. To be more precise, if the number of units exposed has increased 100 times, then the relative risk decreases by only 10 times, that the previous one. This method of increasing the unit exposed is particularly important and widely applied by insurance institutions and this is a very good reason for an entrepreneur to try to apply it. In business practice however problems may occur problems. Any increase of the units exposed to risk presumes the most times the costs of their acquisition.

REFERENCES:

[1]. Cişmaşu, I.D. (2003) *Riscul, element în fundamentarea deciziei*, Editura Economică, Bucureşti

[2]. Colson, G. (1995) *Gestion du Risque*, E.A.A., Lille

[3]. Grinold, R.; Kahn, R. (2000) *Active Portofoliu Management*, Second Edition, MacGraw-Hill, New Zork, Capitolul 3

[4]. Danu, M.C. (2000) *Riscul în afaceri*, Editura Plumb, Bacău

[5]. Prunea, P. (2003) *Riscul în activitatea economică*, Editura Economică, Bucureşti