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AN OVERVIEW ON STATE OF KNOWLEDGE OF RISK AND RISK MANAGEMENT IN ECONOMICS FIELDS

Literature review

Keywords
Risk
Risk management
Evolution
Risk management tools
Chief Risk Officers

JEL Classification
G32, M10, M41, M49, O16

Abstract

The purpose of this paper is to present a history and an evolution of concepts of risk and risk management in economic, respectively financial fields, highlighting the usefulness (or not) and complexity of tools for risk assessment developed over time. The main objective of risk management is to reduce costs and increase the value of company and stakeholders gains; also, a coherent risk management strategy may improve entity capital structure which will derive in a healthy financing policy. The risk and risk management field has been developed merely after the second world war and creates the favourable context of a new C position in business chart – Chief Risk Officer. The paper will explore the etymology of term risk correlated with the uncertainty. Research on risk and risk management is not possible without taking into account the derivatives market.

Introduction

All the literature related to risk and risk management starts around 50s. Snider observed that in 1956 there wasn't any book about this topic and none universities provided courses about it. The first academic books about risk management were published by Mehr and Hedges in 1963 and Williams and Hems in 1964 (Dionne, 2013). Their content covered pure risk management, which excluded corporate financial risk. Initially, risk management was applied in insurance area, but the evolution of society imposes to use it in many other domains.

Risk is omnipresent and all pervasive in any walk of life. Risk is the potentiality that both expected and unexpected events may have an adverse impact on the capital and earnings. When we use the term "risk", we all mean financial risk or uncertainty of financial loss. If we consider risk in terms of occurrence frequency, we measure risk on a scale, with certainty of occurrence at one and certainty of non-occurrence at the other end. When the probability of occurrence or non-occurrence is equal, risk is the greatest. Risk can be broadly defined as any issue that can impact the objectives of a business entity, be it financial service or commercial.

The concept of risk began to evolve around the sixteenth century and has gradually found its way into all aspects of organizations, due to the fact that statistics and probability area had a great growth. Many people still believe that fate plays a strong role in loss-producing events and hold that "things just happen".

From a risk standpoint, since a separation between the hazard, associated risk, and the time when a loss-producing event occurs, most of us simply cannot make the connection. We have referred to this mindset as "No loss = no risk".

…PAST …

1. Etymology of term "risk"

Reviewing the existing literature and dictionaries, we find out that the etymology looks like this:

- Latin: riscum = the challenges faced by sailors on desert (sand storms); (Luhmann, 1993)
- Arabian: risq = everything that God gave you in order to take advantages; (Althaus, 2005)
- Greek: rhiza = (rocky shore) = the full of danger journey of Greek sailors on Mediterranean Sea (van Asselt, 2000)
- Italian: risico (var. rischio) = same, like Latin
- French: risque = danger, in which there is an element of chance (Littré, 1863)

Related to risk, is the term "hazard" which comes from a game of chance invented at a castle named Hasart, in Palestine, while it was under siege (Oxford English Dictionary, 1989).

As we can see, at the beginning the risk has not only negative components, eventual danger, even the possibility of gain. No matter the origin of term, the risk concept excludes the human responsibility (Titterton, 2005). In economic theory, risk refers to situations where the decision maker can assign probabilities to different possible outcomes (Knight, 1921).

2. History of risk

Solon, Greek ancient writer wrote the first approach of risk: "*There is risk in everything that one does, and no one knows where it will make his landfall when his enterprise is at its beginnings. One man trying to act effectively fails to forecast something and falls into great and grim ruination, but another man, one who is acting ineffectively a God gives good fortune in everything and escapes from his folly.* (Solon, VI century B.C cited by Keown *et. al, 2005*)

During the Renaissance, Girolamo Cardano, a sixteenth-century physician, gambler, and mathematician wrote a book titled, *Liber de Ludo Aleae* ("Book on Games of Chance") that seems to have been the first study of probability in cards, dice throwing, and gambling. According to Bernstein, other great thinkers contributed to the growing body of literature on the subject: Galileo, in about 1630, wrote a brief essay, *Sopra le Scoperte dei Dadi* ("On Playing Dice"), in part to please Cosimo II, the Grand Duke of Tuscany.

Money and financial interests drove early thinking on the topic of risk. Aristotle, in his treatise *Politics*, discusses the concept of *options* – a financial instrument that allows individuals to buy and sell goods from one another at pre-arranged prices. Options contributed to the dramatic "*tulipomania*" frenzy in Holland in the 1630s – people purchased and sold paper options instead of the actual tulip bulbs.

Futures, in use in Europe since medieval times, were another type of financial instrument that helped reduce risk for farmers and commodity buyers. In 1865, futures on products such as grain, copper, and pork bellies were sold on the Chicago Board of Trade.

Insurance – a financial tool that reduces risk for a person or party by "sharing" potential financial burdens with others (who are compensated in some way for taking on the added risk) – has roots that reach back to 1800 B.C.E. when it was used to help finance voyages by ships. An early form of life insurance was provided by trade and craft guilds in Greece and Rome. As trade expanded in the Middle Ages, new forms of insurance were used to protect farmers and traders from droughts, floods, and other disasters.

Modern era brings new changes upon risk concept: Industrial Revolution, the development of production processes and the statistics (as a new study object) develop the idea that the risk is a consequence of human behaviour excluding the

faith or luck from risk (Lupton, 1999). So, the risk becomes computable and represent the result of activities develop by people. Uncertainty – used at the beginnings of modern era – reflects the events that cannot be estimated or events really unknown (Reddy, 1996). The fine line between risk and uncertainty we find it in Keynes writings when discuss about investors behaviour in business: the lack of rational thinking is the base of uncertainty, but the risk concept means computation of probability (Knight, 1921; Tversky and Fox, 1995; Reddy, 1996).

Since the Industrial Revolution, the nature of hazards and risks has changed. Hazardous agents have grown both larger – bridges, airplanes, oil tankers, skyscrapers – and smaller – pesticides, biologically active agents made through recombinant technology, subatomic particles, and electrons moving through integrated circuits.

The first academic books about risk management were published by Mehr and Hedges in 1963 and Williams and Hems in 1964 (Dionne, 2013). Their content covered pure risk management, which excluded corporate financial risk. Initially, risk management was applied in insurance area, but the evolution of society imposes to use it in many other domains. The first use of Brownian motion in financial area by Bachelier in1900 is considered the birth of modern financial theory. The American Finance Association met in 1932 published in 1942 its first journal *American Finance,* that will became in 1946 the known *The Journal of Finance*. American Risk and Insurance Association set – up in 1932 and published, starting 1964 *Journal of Risk and Insurance*. Other important journals are *Risk Management* under Risk and Insurance Management Society association and *The Geneva Paper or Risk and Insurance* by Geneva Association.

Before the 1970s, risk management in most corporations was largely defined by the purchasing of insurance – a strategy to manage downside risk, with no attention paid to upside.

In 1975, the U.S. Nuclear Regulatory Commission, in its WASH–1400 Report (U.S. Nuclear Regulatory Commission, 1975), required the use of probabilistic risk analysis. While similar to risk assessment techniques such a failure mode effects analysis (FMEA) and other methods, probabilistic risk analysis uses experimental and actual data of failures to calculate, quantitatively, risks in a system.

In the 1990s, the U.S. Food and Drug Administration (FDA) began requiring manufacturers of certain types of foods to use a risk management method called hazard analysis and critical control points (HACCP) to identify, control, and monitor risks. The program first began with low-acid canned foods, expanded to include seafood, and then, in 2001, juices. The U.S.

Department of Agriculture also requires that meat and poultry processing plants use HACCP as a risk management process. The FDA is considering mandating that HACCP be used in most all food processing and firms (www.fda.gov).

The International Organization for Standardization (ISO) in the ISO Guide 73 defines *risk* as the "effect of uncertainty on objectives" (ISO, 2009). Lets be more analytically and to discuss each item of this definition proposed by ISO using the online dictionary *Oxford Dictionary* (http://oxforddictionaries.com/). First of all, risk is an *effect*, which the *Oxford Dictionary* defines as "a change, which is a result or consequence of an action or other cause." So, a risk has to have a cause and it results in a change. The reason for a risk is uncertainty. *Uncertainty* is "the state of being uncertain." Uncertain means "not able to be relied on; not known or definite."

In nowadays, the literature in the field on the aspects related to this topic of risk and risk management becomes richer. The "risk" does not exist "outside us", independent of our mind and culture, is waiting to be measured. Human beings invented the concept of "risk" to help them understand and adapt to life uncertainties. Even though these dangers are real, there is not anything like "real risk" or "objective risk" (Greifender et al., 2011).

… PRESENT...
1. Risk – as part of business
Recent decades have witnessed a massive growth in academic studies of risk and the rapid development of a risk industry (Gabe, 2013).

Lupton & Tulloch (2002) consider that the risk means to live with fear, anxiety, and vulnerability. Risk concept can be assign to any activity with unknown consequences. The findings of Blaxter (1999) show how and in which filed the researchers use risk concept:

-   Individual Health = 41 %
-   Social welfare = 16%
-   Organizations management = 10%
-   Public services = 10%
-   Financial = 8 %
-   Personal options (as individual) = 4%
-   Abstract (theory) = 11%.

The environment where the organization activates is characterized by a lot of risks (Miller, 1992), that can be summarized as follows:

Macro level
Geopolitical crisis
Financial markets collapse
Natural disasters
Mezzo level
Shift in market supply
Change in customers tastes
Scarcity or complementary goods
Micro level

Equipment failure and/or impairment

Problems with collectible

Labour safety

Managers or employees self – interest behaviour

In such environment, the risk is or should be part of business strategy, an integral component of a firm's financial health, value, and sustainability (Groening *et al.*, 2014). Within companies should be a link between goals, risk analysis and continuity of activities.

2. Risk on financial markets

The financial crisis and big losses from derivatives determined the regulatory bodies to issue rules for risk management in banks under the name Basel I (1988), Basel II (2004), Basel III (2010) and Solvency I and Solvency II (2009) for insurance companies and IAS/IFRS for accounting and to take a more comprehensive approach to risk management.

The first use of Brownian motion in financial area by Bachelier in1900 is considered the birth of modern financial theory. The increase of financial instruments (derivatives) more after 1970 is another reason of evolution of risk. The investors tried to minimize their loss by creating mixed portfolios. The most important studies about risk on financial markets were published in Journal of Finance; the researchers Markowitz, Lintner, Treynor, Sharpe, and Mossin developed Capital Asset Price Model (CAPM) and were rewarded with Nobel Prize. Black and Scholes's model is undoubtedly the most popular of these early models. These authors were the first to propose an explicit formula for the pricing of a derivative, namely an option. The bank JP Morgan developed the Risk Metrics and Credit Metrics, highlighted the idea of measuring risks in portfolio form by considering their dependencies and using value at risk quantifying aggregate portfolio risk. These models contribute to create another concept *Value at Risk* (VaR) defined as maximum value that a portfolio or company can lose during a given period of time, at a specified level of confidence (more studies uses 95% and/or 99% level of confidence).

VaR estimation is not difficult to compute if only a single asset in a portfolio is owned, and becomes very difficult due to the complexity of the joint multivariate distribution. One of the main difficulties in estimating VaR is to model the dependence structure, especially because VaR is concerned with the tail of the distribution (Hotta *et al.,* 2008).

Some authors analyzed the VaR and mean-variance analysis in order to reflect the economic implications arising from choosing one of them. It seems that certain risk-averse agents to end up selecting portfolios with larger standard deviations if they switch from using variance to VaR as a measure of risk. Their research is based on two scenarios: existence or not of risk free securities on market (Alexander and Baptista, 2002). Mean-VaR criterion, at least as an approximation, is consistent with expected utility maximization. Security prices may be affected by an agent's decision to use VaR as the relevant measure of risk. Moreover, Black's zero-beta CAPM equilibrium holds if at least one agent has mean-VaR preferences while all the others have mean-variance preferences.

The internationalization of markets creates the proper fields for developing models for international portfolios of assets. The market risk of a large diversified portfolio in which the dynamic process of asset returns is distributed in normal diffusion (Hofmann & Platen, 2000). Fatemi (1984) finds that diversification of portfolios (domestic assets and foreign assets) is beneficial; others researchers, like Reeb, Kwok, and Baek (1998), conclude the opposite about the benefits (or lack thereof) for international diversification. Olibe, Michello, and Thorne (2008) argue that the systematic risk of firms depends on the degree of internationalization of those firms. Not only mixed portfolios influence the risk, but also the economic and financial environment. During the crisis, the total risk increase can be explained by the underlying accounting performance for the strictly local companies, but not for the cross-listed firms; by contrary, for non-crisis times during, the financial performance of cross-listed firms explains the risk profile of those firms (Chira and Marciniak, 2014). In case of heavy-tailed market risk factors of an option portfolio, some researchers consider that non-linear model of VaR is more accurate (Chen and Yu, 2013). Horobe and Ilie (2009) analysed the contribution of exchange rate risk to the risk of an international investor diversified in his home market and the Romanian market and observed that the risk is small, even negative, with no significant differences turbulent versus normal times. Another paper published by Horobe and Dumitrescu (2008) related to the exchange rate and the exposure to changes in the nominal and real exchanges rates of the local currencies that companies from a number of four Central and Eastern European countries (Romania, Hungary, Czech Republic and Poland) find limited evidence for contemporaneous and asymmetric exposure to nominal and real exchange rate risk in all four countries, but consistent evidence for three to four months lagged exposure. An alternative risk measure to VaR is *conditional value at risk* (CVaR), which is also known as mean excess loss, mean shortfall or tail VaR (for a given time horizon t and confidence level b, CVaR is the conditional expectation of the loss above VaR for the time horizon t and the confidence level b). The CVaR model is applied on the optimal derivatives portfolio and can be transformed into a linear programming equation (Alexander *et al.,* 2006). More sophisticated financial world became, more

complex methods are created to analyze the portfolios of assets; combining copula (methodology that describes the dependence structure of a multi-dimension random variable) with GARCH model and Student – T distribution revealed that the value at risk of portfolio is more successfully captured (Huang *et al*., 2009).

3. Quantitative methods for risk measurement
Fischer Black and Myron Scholes (along with its independent confirmation and enhancement by Robert Merton) and the introduction of Bill Sharpe's capital asset pricing model (CAPM) marked the beginning of modern risk management: the moment at which risk could start to be effectively priced and mitigated. The core concept addressed by Black and Scholes was *optionality*. Black and Scholes observed that the holders of equity in a firm with debt in its capital structure have an option to buy back the firm from the debt holders at a strike price equal to the firm's debt. Sharpe's model, the CAPM, suggests that a company's shares bundle two types of risk. Only one of these, systematic risk, is compensated by the market. Systematic risk is measured by the firm's "beta," which reflects the stock's correlation with the overall market. Sharpe argued that beta is the sole differentiator of the cost of equity across corporations. The other type of risk, known as non-systematic or idiosyncratic risk, is unique to the company. Sharpe demonstrated that these risks should not affect the company's cost of capital because investors can hold other shares and investments that diversify away this exposure.

What means to measure risk? A risk measure gives the amount of capital that needs to be added to a position with loss *L*, so that the position becomes acceptable to an (internal/external) regulator. What tools we need to measure the risks? In financial literature, some statistical and mathematical models are developed:
a. Variance-covariance method offers analytical solution with no simulation, but, linearization may be crude approximation; assumption of normality may seriously underestimate tail of loss distribution. This method could be easily adapted to use multivariate Student T risk factors or multivariate hyperbolic risk factors.
b. Historical simulation method uses quantile estimation to estimate VaR directly from simulated data, but some questions about precisions may arise.
c. Monte Carlo simulation method is a very general model, with no restrictions of distribution, but may be time consuming if the loss operator is difficult to evaluate, which depends on size and complexity of portfolio.
The researchers and practitioners alike improve permanently the statistical models and create multivariate models:

a. Distributional Models: in unconditional approach to risk modelling were require appropriate multivariate distributions, which are calibrated under assumption data come from stationary time series.
b. Dynamic Models: in conditional approach we use multivariate time series models that allow us to make risk forecasts.
c. Multivariate models: normal mixtures, spherical distributions and elliptical models.

3. The new job on finance field - Chief Risk Officers
The chief risk officers (CRO)are responsible for coordinating all risk management initiatives across the entire organization/entity, guiding the organization's response to the increasingly regulated and legal environment, keeping the board of directors apprised of risk issues, ensuring that risks taken do not compromise business continuity, and guiding staff.
The survey conducted by The Economists in 2005, underlines the necessity of collaboration between all C positions in order to create and manage a coherent risk strategy. A CEO or CFO is unlikely to have time to get to grips with IT network risks, or to undertake the massive exercise involved in building a picture of operational risk. By contrast, CROs can concentrate on the various aspects of enterprise risk management, gaining appropriate insight across all functions where risks may threaten the enterprise. It is not an easy task to identify and mange the risks that may occurs on business; the chief risk officers should know the environment where business is activating and have a strong knowledge in finance and accounting.

... FUTURE...
Becoming a part of business, risk gains a holistic approach and a framework as a multidirectional process. As we states all over the paper, a risk management process is the *systematic application of management policies, procedures, and practices to the activities of communicating, consulting, establishing the context, and identifying, analyzing, evaluating, treating, monitoring, and reviewing risk* (ISO, 2009).
Many different risk management processes have been proposed in the literature, which typically contain steps like:
(1) identification of risks,
(2) assessment/measurement of risks,
(3) evaluation, choice, and implementation of risk mitigation options, and
(4) monitoring of risk mitigation.
To help an entity determine its risk appetite and risk criteria, consider first the mapping that has already been done to determine occurrence and impact of risk and the assessment you have completed establishing whether it is a high,

medium, or low risk, then consider the following questions:

a) In which areas of risk should you prioritize your risk appetite?
b) Where should you allocate your finite time and resources to minimize risk exposures?
c) Which risks do you consider need early attention to reduce the level of current exposure?
d) What level of risk requires a formal response strategy to mitigate the potentially adverse impact?
e) What level of risk requires escalation to a higher authority?
f) How have you managed past events?
g) What did you learn from earlier experiences?

Risk management processes offer a structured, comprehensive, and standardized approach to manage risks, while risk management frameworks show how the risk management process can be integrated and used within an organization. Risk management processes can be divided into two main phases: *risk assessment*, in which risks are identified, analyzed, and evaluated, and *risk treatment*, which is about responding to the identified risks. There are many different tools that can be used for risk assessment; these range from simple tools to very sophisticated mathematical models. The more the world of business evolve, the new approaches will be created to face it; the *intelligent risk management* (IRM) became essential.

Conclusion

As we have seen in this abbreviated history, the evolution of risk management has been influenced by expanding knowledge and tools as well as by the hazards that need to be addressed. Current thinking regarding risk management is moving away from strict rules to comprehensive approach associated with opportunities. Risk management is an ongoing process that can help improve operations, prioritise resources, ensure regulatory compliance, achieve performance targets, improve financial stability and ultimately, prevent loss/damage to the entity.

Acknowledgement

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