Importance of Risk Management on Financial Markets

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Abstract: Trying to define a complex concept such as risk implies a thorough analysis of the causes that lead to the impact of risk on the financial system, as well as an accurate assessment of risk. Historically, risk is a 'young' concept and at the same time one of the few business terms that directly originated in the commercial and financial environment and did not derive from military, psychological or scientific vocabulary. The concept of risk has two meanings: "monetary hazard in business" and the "danger posed by it".

Keywords: hedging funds, efficient portfolios, standard deviation or variance, derivative financial instruments, credit risk, Value-at-Risk (VAR)

1. Introduction

1.1. Risk is a key element of the modern world

While in the '70s the notion of "risk" was rather associated with natural sciences than with the financial theory of insurances, recently the concept of risk has gained importance among decision-making factors in the business world. Thus, American economists H. Markowitz [2] and W.F. Sharpe [3], winners of the Nobel Price, played the role of pioneers in the domain. The publication in 1952 of the work Portfolio Selection by Harry Markowitz in The Journal of Finance marked the beginning of the modern portfolio theory. For the first time, the relation between return and risk was included in a financial model together with the concept of rational behavior of the investors. Their studies focused on the concept of efficient portfolio and on the concept of portfolio that may or may not ensure the highest profit for a certain risk level - where the lowest risk level is calculated in relation to an expected profit. However, as scientific risk assessment methods evolved, society started to pay attention to contradictory ideas formulated with reference to the acceptance of risk and risk assessment technologies. The concept of risk has gained general connotations that led to tis usage in different domains within modern society structures.

The present paper attempts to give an answer to questions such as: why is the concept of risk so important in modern society? Why does modern society define itself as a "risky" society? Luhmann has brought a substantial instrumental contribution to the definition of this concept by considering that "risk" is a "general form whereby society opens up its future". According to Luhmann [7], "risk is a concept that must be distinguished from danger since a potential loss is caused by indecision". In short, Luhmann considers that future depends on present decisions. This approach has important connotations for risk analysis.

2. Literature review

2.1. The dilemma of decision-making

From this perspective, risk must be linked to the decision-making process. The analysis is, thus, linked to the general decision-making process under uncertain conditions. Risks do not exist objectively; they are determined by decision-making agents, whereas the parties involved in the decision-making process might perceive this fact as dangerous. As psychological studies on risk perception point out, this analysis has a significant effect on the attitude towards potential hazard. The possibility to reach consensus on risk is significantly diminished. The higher volume of information, higher transparency and active communication with the audience do not solve the matter, but rather reduce risk-related conflicts; the problem is determined by the different approaches to the phenomenon made by decision-making factors and by those who are influenced by

these decisions. As to organizations, it is essential to notice that risk is not part of the organizational know-how because organizations do not discover risks, they create them. *Does an organization take into consideration "objective" or "systemic" risk, such as the crash of a certain market?* Obviously, it does not. We could give examples such as: crises generated by certain hedging funds after 90's or Hunt brothers' attempt to corner silver market in the 70's, leading to an increase in the price of silver with 2500% from 2$ to 52$ / ounce. In both cases mentioned above, calculations of subjective risk made by decision-making factors prevailed.

How do organizations define their own risks and how do they assume risks in uncertain circumstances? Decision-making in the modern environment implies that no decision-making is in fact similar with an adopted decision: it is impossible not to make a decision. No decision-making implies a risk for decision-making factors. *How can one approach the challenge of facing a risk and administering a risk?* Risk depends on the historical organizational pattern and on the social and investment community within which it appears. Organizations that want to be protected from risk exposure must consolidate trust and credibility. The best remedy when confronted with risk is transparency and information disclosure in relation to the identification of risk and risk management.

2.2. Risk management – an ever more important concept

Modern theories of portfolio management created by H. Markowitz [2] and W.F. Sharpe [3] introduced the concepts of standard and variance deviation whereby one can measure to what extent an event can deviate from average. Before these concepts were created, risk quantification was a mere abstract notion. Variance is merely one of the possibilities of risk quantification and probably not the best one. A manager of pension funds, e.g., may grant priority to the risk of decreasing assets price. Intending to ensure payments this manager might resort to numerous formulae for risk calculation; he might also resort to Stock Exchange for using operations with derivate instruments (e.g. buying CALL options that will cover currency risk). Risk has always been related to the time span implied by the financial placement and the expected profit. E.g., a short term financial investor aims at short term volatility and the least risky investments, such as government securities with 30-year maturity. At present, risk managers make decisions according to numerous factors: the structure of the financial institution, types of placements etc.

2.3. The concept of risk management

Risk management is a quite recent phenomenon. Managers started to discuss about risk after 90's. This is the reason why only departments who made financial transactions with derivative instruments had to implement a risk management system. The introduction of risk management in the financial sector implied several stages [1]. Subsequently, these systems were extended to other financial services. Today market risk management or credit risk represents a combined concept. Financial risk management is quite complex due to the fact that implied risks are independent and dynamic. E.g., a recession might generate effects both on the market risk and volatility but it might induce bankruptcy as well by increasing operational and systemic risk. If risk management implies these interrelations, we deal with an integrated risk management [1]. Nowadays, risk is analyzed and measured with complex computerized systems. Ironically, they generate a new type of risk: model risk. Implementation of these models quite often represents black boxes; consequently, they may be implemented only by specialists who need an enormous quantity of data and who must be aware of the limits implied by these models. The use of derivative financial instruments through Stock Exchanges simplifies and increases the efficiency of risk management; specialists offer consultancy for understanding the functioning of mechanisms and for ensuring continuous financial flows [3]. In order to benefit from a competitive risk management system, organizations are up to date with the latest implementation models. In the financial sector there are many initiatives that are meant to impose an open attitude towards risk and the techniques used for measuring and managing risk. In June 2004, the Basel Committee has finalized a revision of Basel I. Owing to the development of risk evaluation methods which increased the complexity of banking operations, as well as the lack of operational risk in Basel I, the Basel II accord was issued at the end of 2003. From that point on, the banks had three years to implement the Basel II accord. The deadline for implementation was set for the end of 2006, with credit and operational risk set for 2007 [4]. The changes brought by Basel II affect in most part the risk evaluation methods. Thus, the methods used for measuring credit risk are the most advanced, those for market risk are unchanged, and those for operational risk are introduced for the first time [5].

Following are some more industry critics regarding the new Accord:

- The implementation of a risk management system can be very expensive;

- It is possible that "cascade" events take place when multiple institutions, using the same risk metrics (VaR, for example) effectuate similar operations. This behavior has been connected to the 1987 crash, and there is a probability that financial regulation amplifies market trends;

-Regulation can give a false sense of security.

In the non-financial system, there are a few differences. Departments specialized in risk management require high operational costs, which are impossible to be supported by small and medium enterprises. In order to counterbalance the effects of a volatile market, small and medium enterprises may use services of the Stock Exchange for initiating transactions with derivate financial instruments. Organizations must have a pro-active policy for the implementation of risk management at all decision-making levels. The setting up of a risk management department requires high costs, which may only be supported by large organizations.

2.4. Risk evaluation. Risk value (Value at Risk - VAR)

VAR (Value at risk) is a recent and quite popular product used for measuring risk. Risk quantification with VAR is used for preventing maximum exposure of financial institutions to risk. VAR indicates excessive losses that may be incurred with a pre-established probability. Even if this probability is low, it exists, however. Unfortunately, managers have the tendency to neglect this aspect, as well as the volume of extreme potential losses. In managing financial risk VAR is a good but incomplete indicator, however.

2.5. Credit portfolio risk management

For investment banks, credit portfolio risk is associated with rates of losses in transaction portfolio – uncertainty related to losses in the credit activity evaluated in terms of bankruptcy or payment incapacity. Modern credit portfolio risk management refers to this aspect and it assumes that the key factors are: concentration of debtors, industries and countries in terms of volatility in the future exposure and financial instability [6]. The purpose of credit portfolio risk management is to diminish risk and / or to increase profit for a transaction portfolio. In order to accomplish this, banks have to be capable of monitoring exposures to counterparts, financial instruments and maturities so that they might have a general overview over risk and identify the concentration of these elements. The flexible structure of these portfolios may be ensured through individual transaction assignments.

If correctly implemented, risk management systems which activate credit portfolio risk management bring about two benefits [8]:

- *Reduced global portfolio risk:* this objective can be reached through the increase of a collateral network of clauses that might concentrate risk management according to factors like: industry, geographical location and assets maturity.

- *More business opportunities without limits of increase:* an overview approach to portfolio implies distribution of partners, financial instruments and maturities for the entire enterprise. This approach is extremely important for investment banks that function internationally.

Credit portfolio risk management is also used for measuring product risk. VAR is a technique used for assessing the likelihood that losses may surpass a pre-established value. The question which VAR tries to answer is: *How likely is it for a natural or legal person to lose X dollars in the next "t" months?* VAR partially answers this answer. If a firm announces that its daily risk value amounts at 1 million dollars while having a trust level of 99%, this means that under normal market conditions the firm cannot lose more than 1 million dollars; the probability in this case is 99%, i.e. there is only 1% probability for losses to exceed 1 million dollars. VAR measures portfolio sensitivity to potential changes on the market, it establishes equivalence between the risk posed by different products, and it estimates risk on the basis of portfolios. The method is used by treasury departments and fund administrators in financial institutions, as well as by all organizations. As one can notice, a single figure can assess the organization's risk exposure. If the management of this organization agrees with the risk level, it can pursue its activity with the same risk exposure; if risk exposure is too high, the organization portfolio can be modified so that it reduces risk. VAR measures risk at different levels from simple to complex portfolios. The concept was initially used only by financial institutions to be later on used in non-financial institutions so that it finally led to the creation of the concept known as "risk gain".

The last years' financial practice can be analyzed for understanding VAR evaluation:

In 1989 the newly elected president of the J.P. Morgan Investment Bank, Sir Dennis Weatherstone, did not know the total risk to which his firm was exposed; thus, he required that daily at 4.15 p.m. his employees should present a report as regards the risk to which the firm was exposed, as well as an adequate risk prevention measurement. Thus, in October 1994, the Risk Metrics Department was set up in J.P. Morgan Investment Bank; this department was run by Till Guldimann and it was specialized on study and risk analysis; the risk prevention measure taken by the department was value-at-risk (VAR). The department – which was initially set up for freely informing and training business partners thanks to the success it enjoyed and also for leveraging opportunities – separated in 1998 from the mother organization and it became Risk Metrics Group, which was specialized in consultancy and software. The success of VAR was also due to the importance assigned to it by the Report drawn up by the Group of the 30 (1993), as well as to the 1996 Amendment of the Basel Agreement, which recommended that central banks should use VAR to determine the minimum limit of capital necessary for a commercial bank to cover the market risk exposure. The group's method implied the evaluation of the organization portfolio as a linear combination of several hundreds of risk factors, whose co-variance matrix was updated daily on the basis of historical data. Daily VAR could be calculated with a trust level of 95% on the basis of assessing the portfolio value in relation to each risk factor and the supposition that the portfolio value was normally distributed.

VAR is at present one of the most used risk assessment methods. One of the reasons why this method has become popular is the fact that – when applied –bankruptcy was avoided. Here are a few famous examples of bankruptcy:

- *Orange County Case:* illustrative for how a municipality can lose 1.6 billions of dollars while investing in financial markets. This was the largest loss ever recorded by a local government investment pool, and led to the bankruptcy of the county [8]. This loss was the result of unsupervised investment activity of Bob Citron, the County Treasurer, who was entrusted with a $7.5 billion portfolio belonging to county schools, cities, special districts and the county itself.

- *LTCM case – Long Term Capital Management:* illustrates how a famous investments fund, which had two Noble Prize winners in the management team, can lose 4 billions of dollars of the invested capital in a few months.

- *Metallgesellschaft AG: A Case Study* - indicates how 1.5 billions of dollars were lost by making transactions on the petroleum futures market.

- *Barrings:* the oldest British bank at the time – due to a young broker's transactions (Nick Leeson, 28 years old) "succeeded in" losing 1.3 billions of dollars.

All these cases disturbed financial markets in time and were the result of the incorrect analysis of existing risks. The more complex businesses, the higher incurred potential losses; thus, risk management is essential nowadays. VAR is considered as one of the most appreciated methods of risk assessment, but it must not be used exclusively; it should rather be used together with other measures for an accurate evaluation. There are several statistical methods which can be used for assessing risk and which are hierarchically organized in relation to the complexity and speed of VAR evaluation programs:

(a) Delta-normal (parametrical) method – which implies the normal distribution of risk factors.

(b) The method of historical simulation – which historically estimates efficiency and determines the percentage of portfolios for which the modification of "t" months' value is less than "X" dollars.

(c) Monte Carlo Method – consisting in Monte Carlo simulations.

In the next few lines we are going to exemplify the assessment of VAR through the historical method. The method consists in historically assessing the portfolio evolution, while using present predominant values and a temporal series of portfolio evolution. Thus, one determines the portfolio distribution, whereas distribution is not a parameter to be introduced. This temporal series only represents the evolution of a hypothetical portfolio, while using the current position. The disadvantage lies in the fact that the method predicts future evolution while considering past and thus reducing the number of possibilities. The method contradicts theoretical models according to which assets prices are Markov processes, in which future levels of prices depend only on today's price and not on past prices (a Markov process is a particular type of stochastic process where only the present

value of a variable is relevant for predicting the future; the past history of the variable and the way that the present has emerged from the past are irrelevant).

Monte Carlo simulation, like historical simulation, re-evaluates instruments according to market changes. The difference consists in the way scenarios are generated. Monte Carlo generates hypothetical scenarios, while historical simulation uses real past modifications of the market as scenarios. A relevant fact, worth being mentioned, is that – for a portfolio which has predominantly non-linear exposure – simulation will generate a more correct result than any other VAR method. According to a statistics made in 1997 by SFA (Securities and Futures Authority) in the USA, the predominance of VAR calculation methods was the following one: the parametrical method was used in 42% of the cases, historical simulation - in 31% of the cases, and other methods - in 4% of the cases. *A practical VAR calculation example indicates the efficiency of this indicator.*

Supposing we have $100 million invested in medium term assets (US Treasury, with 10-year maturity). How much can this investment lose in a month? 1million? Without giving an answer to this question, investors cannot decide whether their potential yield compensates the assumed risk. In order to give an answer, one has to analyze the characteristics of these financial assets on a middle term. The evolution of the monthly yield obtained from January 1962 to December 2004 indicates that yield oscillates from a minimum of -5.27% up to a maximum of + 6.31%. We can create and analyze the histogram of these values from the lowest one to the highest one. One can notice that there is only one value above 6%, which was recorded between 5.5% and 4.5% etc. We can distribute yields so that we can count events in each subinterval. For each recorded yield we can calculate the probability of obtaining a low yield. We can choose a high trust level while trying to identify a point for which there is a probability of 5% and thus we are going to identify a low yield level. The searched number is -1.75%, which represents 5% of the total number of months, 25% of the 503 months. The standard deviation could also result from our example. We are thus able to calculate VAR for a $100 million portfolio. There is a probability of 5% for the portfolio to increase under $100 million - 1.75%, i.e. with $1.75 million. Risk value is of $1.75 million.

3. Conclusion

Under normal market conditions, the maximum value with which a portfolio can decrease in a month is $1.75. The assessment of market risk through the VaR method, respecting the Basel II provisions, must meet certain conditions: the daily evaluation of the market risk related to the interest rates and capital instruments of the transactions portfolio; use a trust level of 99%, use an instant price shock equivalent to a price associated movement of 10 days and it will consider a period of minimum one year for making historical observations. At the same time, the bank will estimate the effects of the correlation between the different categories of risk factors (interest rates, exchange rates, prices of capital instruments and goods, including the volatility of options in each category of risks factors); however, VAR figures will have to be calculated for the different risk categories on the basis of a simple sum. *We enumerate some of the advantages brought by <u>VAR</u>:*

- VAR characterizes portfolio exposure to market risk, as well as the probability of a negative evolution.

- It measures risk using a fundamental measurement unit: dollar!

- Investors may decide whether they feel safe with this risk level. If the answer is no, the same process used for calculating VAR may be used for risk adjustment while identifying the riskiest positions; derivate instruments may also be used, such as futures options, in order to hedge the unwished risk.

- VAR is a flexible risk measurement instrument. It may consider different time spans and trust levels.

- VAR incorporates risk in a single figure.

- In general, VAR is used to determine the capital which a bank is obliged to have in order to indicate that it is protected from different risk factors.

- VAR, or an equivalent measure, is an indispensable measure used for researching financial markets.

Limits of VAR

- It does not indicate the maximum amount that a company may lose; it only indicates the maximum that a market may lose under normal market conditions;

- It does not include operational risk. For example, when the bank uses a mathematical model for calculating market value of futures contracts on the basis of the interest rate, due to a possible calculation error, the mathematical model may lead to losses. This exposure is not considered.

- It does not include liquidity risk. It may lead to the impossibility to pay and it may generate lack of information as to a margin call for futures positions (see Metallgesellschaft case).

- It does not give information as to profitability and the yield of an investment.

- VAR cannot record all accrued losses.

- VAR method is insufficient for measuring the performance of certain transactions, except for the situation when a certain risk tolerance has been established.

- VAR is based to a large extent on normal distribution curve; it lacks the characteristics of an extremely critical market.

We can conclude that VAR helps efficiently allot resources so that exposure to a single risk source would be eliminated. It helps managers evaluate their market activity as correctly as possible and assess the extent to which they increase or decrease risk through pursued operations. At the same time, VAR helps market regulatory institutions establish the capital necessary for covering the exposure of a financial institution to market risk.

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