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THE APPLICATION OF THE METHOD ENVIRONMENTAL VALUE AT RISK (EVaR) IN ENVIRONMENTAL ECONOMY

Methodological articles

Keywords
Environmental Value at Risk
Volatility
Portfolio

JEL Classification
Q51

Abstract

Taking into account the fact that the methodology Value at Risk or the method VaR, which is omnipresent in investment banking and which has lately become a standard in the procedure of evaluating risks for any category of economic activities, we shall use a technique that is compatible with the VaR-market, called Environmental Value at Risk or EvaR. While the VaR- market uses a level of trust of 95%, the EvaR uses a set of levels up to 99,999%.

Thus, we shall try to analyze the variables of the method EVaR, and the way in which this model can be applied as a risk of the lack (rarity) of petroleum. This risk is not only analyzed as a unique risk of growing the prices, but also as an uncertainty risk on volatile markets, in which the price and the volatility are the main variables used by the function EVaR.

1. Introduction

Establishing the strategy of a portfolio returns to establishing what amount from the total available sum will be invested in each active from the portfolio. For this, the modern financial theory formalized a complex objective: the optimization of the correlation between profitability and risk, this new preoccupation being more and more necessary in the conditions of an increased volatility reported to the variations of the capital market, which determine a direct relationship between profitability and risk: a higher profitability accompanied by a bigger risk and the other way round.

An efficient portfolio can be defined as that portfolio which for an expected profitability presents the lower risk and the other way round, an efficient portfolio is that one which, for an assumed risk which is as low as possible, presents the highest profitability.

2. The calculation ofVaR

The value at risk (VaR) measures the maximum expected loss of a portfolio, for a coefficient of trust chosen by the manager of the portfolio.

VaR may be calculated using a simple formula:

$$VaR = Value \times Trust \times Volatility \quad (1)$$

VaR reflects three important aspects of risk management:

The distribution of probability of the future values of the portfolio (defined by medium and volatility);

The manager's aversion to risk (identified by the level of trust);

The importance of the period of holding for the manager.

The calculation of VaR is based on normal distribution. Because the medium profitability and volatility of the portfolio define its distribution of probability, it is important to know how these factors affect the VaR.

Thus, if the volatility of the portfolio rises, this will determine the flattening of the curve, which will mean a raise of the VaR. The decrease of volatility determines the narrowing of the curve, and at the same time, the decrease of the VaR.

By modifying the *medium profitability* we shall obtain a sliding of the curve on the axis of abscissas. If the period of holding is short, the modifying of the medium profitability will not have a significant impact on the calculation of the VaR. For this reason, we followed the market convention and we omitted the modifying of the medium profitability from the calculation formula of the VaR. However, if the period of holding is large, the modifying of the medium profitability will be significant and it will be included in the formula of the VaR.

A portfolio manager with aversion to risk will want to determine the VaR with a higher level of trust. By raising the level of trust, the VaR will raise too. By decreasing the level of trust, the VaR will decrease too.

Normally, volatility is reported in annual terms. In order to calculate the VaR for any holding period using an annual volatility, we shall make the following modification to the calculation formula:

$$VaR = Value \times Trustfactor \times Volatility \times \sqrt{\tau} \quad (2)$$

$$\tau = days\ of\ period \div 252 \quad (3)$$

By increasing the holding period, the VaR will rise too; by decreasing the holding period, the VaR will decrease too (Beder, 1995).

When the period of holding a portfolio is short for the calculation of the VaR we can use the matrix variance-covariance. For longer holding periods this method does not lead us to precise results. We shall obtain more accurate data through simulation, especially when we have nonlinear titles.

The aim of measuring the risk is to make sure that we have enough capital to cover the loss. The VaR of a portfolio contains important information about the position and percentage of titles, the correlation

structure, and the period of holding the portfolio.

The VaR is a way of measuring the market risk, which makes it an instrument used by the portfolio managers.

3. The structure of risks related to the deficit of petroleum

Petroleum is generally seen as a factor of risk, because this natural resource is considered a private exhaustible resource and not a public good.

The existing supply of petroleum cannot increase. As a consequence, the supplying offer is fixed. From the birth of petroleum industry in the middle of the 18th century, the economy's request for petroleum has constantly grown, becoming vital for transport and agriculture.

Thus, this natural resource covers a large range of economic fields, a fact which raises the universality of the subject.

The importance of petroleum does not only come from the dimension of the market but also from its strategic role for the countries which import and export petroleum.

Generally, the deficit of petroleum, as well as the risks caused by it, may be described in two dimensions:

(1) In the fluctuations of prices on a short term, which affect the delivery and the distribution of petroleum and which can interrupt or disturb the production processes.

Delays which appear from the deficit of petroleum lead to delays in supplying or to low productions, having as a result bigger costs or penalties of contracts.

(2) In a long-term uncertainty, regarding the future production conditions. As a result of the high prices of petroleum and of the increased volatility, the planning of precise and reliable investments is hindered both for managers and for investors. The present costs could be higher than the calculated costs. Thus, the expenses for the future investment projects cannot be calculated in a fixed manner.

It is more probable that the expected output from investments cannot be achieved and as a consequence the whole investment project cannot be made and it may be cancelled.

Thus, we can state that both short-term risks and long-term risks, related to the deficit of petroleum, can come from its availability and price.

It is considered that the risk of availability is mainly due to the restrictions imposed by nature.

In the context of the options of the scenarios for substituting petroleum, the change of technology and alternative entries are being discussed, but they have never been included in detail in the structure of risks related to the deficit of petroleum.

Other possible restrictions which are not clearly taken into account, and as a consequence they are considered to be constant, are:

- taxes, dues and other governmental measures related to the deficit of petroleum
(the rarity of the natural resource);
- changes in the customers' preferences;
- political evolutions, especially in the countries which export petroleum.

4. The Environmental Value at Risk and the deficit of petroleum

Further on, we will try to show how the model VaR can be applied in evaluating the risk of petroleum penury. This risk has not only been defined and analyzed as a singular risk of a raise of prices, but also as a risk of uncertainty and volatility of the markets. This approach is based on theories(Kiernan, 2001), which indicate the fact that the approach of the VaR is directly applicable to the price of petroleum.

The international market of petroleum is a medium of intensive capital influenced by multiple interactions which come from the wide range of products, problems of transport/ depositing and environmental regulations.

In 1993, Adelmann observes that there are three hypotheses regarding the price of petroleum:

1. the present price is the price on a long-term, a competitive one, plus an error in estimation;

2. because of the inevitable deficit, the competitive price on a long-term must increase;

3. the price is not an exact reflection of the deficit of petroleum, but it is determined by cartels.

According to the hypotheses from the efficient markets, the growth of prices would reflect the deficit of petroleum and would eventually determine the request and the offer.

The markets of natural resources do not function efficiently as a consequence of the failures of the market and of uncertainty (White, 1996). Based on these hypotheses and economic theories, the following question is asked: if a rule or a common pattern can be identified, which of these is capable of explaining the present development of the price of petroleum.

Volatility summarizes the changes of prices in time, in only one number, through which the individual definition of volatility depends mainly on the period of time used. Volatility creates uncertainty and uncertainty inhibits or confuses the investors. The volatile entry price makes difficult both for companies and for investors, the making of an investment plan which could exactly foresee the future. The petroleum market is characterized by a high level of volatility, which examines closely the volatility of the price of petroleum as well as the economic impact – shocks.

According to the empirical studies, which test the volatility of the price of petroleum and the economic impact, the shocks of volatility have asymmetrical effects on economic activity.

On a more detailed analysis, the volatility of the price of petroleum presents statistic characteristics specific to the volatility of cluster. The volatility of cluster involves shocks which influence the future hope of volatility.

Between the years 1860-1900 the price of petroleum was characterized by a very high volatility (World Business Council on Sustainable Development, 1998).

The main reasons for which the price of petroleum is characterized by a high volatility are: the uncertainty of the information about markets and unexpected events, influenced both by endogenous factors and exogenous factors. The endogenous factors for increasing volatilities can be divided into:

(1) a drop of the excess capacity of petroleum industry;

(2) regulations;

(3) behavioural exchanges.

The exogenous factors for raising volatility can be:

(1) *Uncertain and unpredictable data:* it is uncertain in what regards the short-term prognosis of the variables which influence the price of petroleum, such as consumption or economic growth. Further on, the price of petroleum is affected by a series of unpredictable variables. Both sets of data, the uncertain and the unpredictable create a false perception of the future development of the markets, and the correction of these errors causes modifications of the prices;

(2) *Speculations:* speculators try to take advantage of the volatile prices, of exploiting the arbitration possibilities, and as a consequence of a misrepresentation of the market;

(3) *Transparency*: even if there is an increase of the quantity of data information, the data related to the production and consumption of petroleum would be uncertain and hard to obtain.

The VaR model describes the risks related to future by including implicate volatilities. Thus, the evolution of incidents and historic processes which are at the basis of the model, are used to estimate the future tendencies. In this way, the objective consists in identifying the

deficit of indicators of natural resources which can explain an appropriate past volatility of the price of petroleum.

Up until now, the markets of petroleum have ordered the price of petroleum depending on the rarity of the natural resource. Thus, it was observed that important changes of price took place, which was caused, in an artificial manner, by political conflicts, economic interventions or offer restrictions and not by the rarity of the natural resource (U.S. Energy Information Administration, 2001).

. The market has not recognized the deficit (the rarity) of the natural resource yet, and the price does not reflect this factor of risk. Even when there were new information about the exhaustion of the natural resource, the actors from the market reacted in a different manner than the one expected. However, there are serious problems related to the rarity of petroleum and the real development of the market reflects an incorrect image.

This type of market failure as well as irrelevant information, may lead to a sudden growth of prices, to an unpredicted penury and to a high level of uncertainty on the market.

The economic risk, as well as the financial risks which come from this type of sudden assigning problem is enormous. As a consequence, both the existing management system and risk evaluations must be extended, especially in what regards the long-term risks.

The inexistence of some empirical data necessary for simulating future possible scenarios, makes it impossible to identify the ex-post significant relationship between the increased deficit of the natural resource (the rarity of the natural resource), the market behaviour and the volatility of the prices of petroleum.

Thus, the accent is further on put on generating implicit volatilities. So, it is considered that the future events from the market of petroleum are generating implicit volatilities in the case in which the deficit of the natural resource was caused by man.

The companies and the fields from industry have different exposures to the risk of carbon, similar with the profile of the company's general risk (Mansley, Dlugolecki, 2001). The exposure to the risk of carbon is determined by:

1. The mix of the company's actives;
2. The necessary of petroleum as an input factor;
3. The substitution possibilities and the technical alternatives which exist in the company/field;
4. Its position in the value chain;
5. The location of its operational and sales activities.

5.Conclusions

The pattern proposed in this work – the matrix pattern of evaluating the risk of portfolio offers the necessary data for creating, correcting and systematic transformation of information about risks by economic agents, so that, based on these, to be able to estimate the relevant values of the variables associated with risks and decisive activities.

The pattern of selecting the efficient portfolio establishes, in an objective manner, the curve of investment opportunities. It is the curve of "production" that the financial market can offer to capital investors, characterized by decreasing output, in which the marginal rate of profitability decreases as assuming higher and higher risks until the maximum limit, until it gets equal to zero. Above this "saturation point" of the risk, the continuation of investment becomes unjustified, when the marginal rate becomes negative.

Both financial analysts and investors admit that there is a strong positive relationship between the results of industrial companies, sustainability, competitiveness and their financial performance. In order to integrate the durability factors in measuring the efficiency of investments or the efficiency of their own capital,

quantitative data are needed. The approach Environmental Value at Risk (EVaR) is in condition to offer precise information in this direction.

So, we propose to integrate the EVaR method in the strategic planning and in the financial analysis of the company's performance.

Possible ways of considering the rarity of petroleum as a factor of risk are:

- The inclusion of the EVaR method in the strategic planning at the level of a company;

- The incorporation of the EVaR method in evaluating the supplies;

- The inclusion of the EVaR calculations in the credit ratings of the companies;

- The inclusion of the EVaR calculations in the credit ratings of the countries and bonds;

- The development of a durable reference system.

The diversity and heterogeneity of risks, their individualization and localization represent the background on which their interaction and interactivity distinguish and manifest themselves, their codetermination and ramification, their polarization and dissemination, the assembly of the risks creating a network of risks, uncertainty and etiological in determinations, which offer them a spreading, contagion, conversion and multiplication potential, that is often dangerous for the survival of economic entities.

We can state that in contemporary economies, the economic entities of any type and size are located in a *global risk economy, of accepted and many times pronounced uncertainty*, in which the loss generated by its specific risks seem to represent the main result of such economy, its main distinguishable performance.

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