
On the Issue of Effective Modeling of The Investment Portfolio of Insurance Companies

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Abstract: The correct formation of the investment portfolio plays an important role in increasing the efficiency of investment activities of insurance companies. The article discusses investment models developed by foreign by scientists in the formation of the investment portfolio of financial organizations, including insurance companies, and issues of their optimization.

Keywords: investment theories, mathematical and macroeconomic models, investment portfolio, capital, asset portfolio, securities.

INTRODUCTION

The period of the creation of modern investment theory can be very clearly defined. This is 1952 year, g. This is the period when Markovits' article "portfolio selection" appeared. In this article, the mathematical model of the formation of the optimal portfolio of securities of the first time was proposed, and the methods for creating such portfolios under certain conditions were shown. The main services of Markovits were the formalization of the probability of profitability and risk concept proposed in this small article. This immediately allowed to turn the problem of choosing the optimal investment strategy into a strictly mathematical language. It was he who first drew attention to the generally accepted practice of portfolio diversification and clearly demonstrated how portfolio profitability can reduce the standard deviation.

In the first half of the 60-ies, Markovits was shocked V. Sharp proposed a single-factor model of the capital market, and in this model appeared the famous "alfa" and "beta" descriptions of the first marotaba shares. On the basis of a single-factor model, Sharp proposed a simplified way to choose the optimal portfolio, which brought the issue of quadratic optimization to a linear state. Through this, it was possible to easily "manually" handle small-scale issues. Such simplification created conditions for the practical application of portfolio optimization methods. By the 70-ies, the development of software, as well as the improvement of the existing statistical techniques for assessing individual securities alfa and beta indicators and, in general, the market profitability index, led to the emergence of the first software packages to solve the problems of securities portfolio management.

Today, the Markovits model is used mainly at the first stage of the formation of an asset portfolio in the distribution of investment capital between different types of assets: shares, bonds, real estate and others. And the one-factor model of Sharp is used in the second stage, when the asset is distributed among individual assets (that is, for certain shares, bonds, etc.), as the constituent of a particular segment of the market, that is, the entered capital.

Analysis of literature on the topic.

The impact of Markovits' portfolio theory has increased significantly after its appearance in the late 50s and early 60s. D on similar topics. The works of the temple also began to occupy its place. It is worth noting that there are some differences between the approaches of the Bunda Markovits and the Tabin. Markovits' approach is consistent with Microeconomic Analysis, from his point of view, it focuses on the behavior of an individual investor who forms an optimal portfolio on the basis of an assessment of the profitability and risk of the selected assets. In addition, the original model of Markovits belonged mainly to a portfolio of securities, that is, to risky assets. Tobin also suggested that risk-free assets such as government bonds should be included in the analysis. Its approach is in essence macroeconomic, since the main object of its research is the distribution of total capital in the economy in two forms: cash (in the form of money) and non-cash (in the form of securities). Great importance in the work of Markovits was given not only to the economic analysis of the initial postulates of the theory, but also to the mathematical analysis of their consequences and the development of algorithms for solving optimization issues. The main topic in the approach of the Tabin is an expression from the omillarni analysis, which obliges investors not to keep capital in any form, for example, in the form of cash, but to form an asset portfolio.

Since 1964 year, three works or SARM (Capital Asset Price Model) have appeared, which opened the next stage of the investment theory, called the capital asset valuation model. The works of Sharp (1964), Lintner (1965), Mossin (1966) are devoted to exactly one issue. It can be seen that the Sarmga Markovis theory is a macroeconomic generalization. The main result of the SARM was the establishment of a relationship between the profitability and risk of the asset for a balanced market. At the same time, when choosing the most optimal portfolio, it is important that the investor does not take into account the "whole" risk associated with the asset (the risk on Markovis), but only the part of it that is called systemic or non-diversified risk.

This part of the asset risk is closely related to the overall risk of the market in general and is quantitatively expressed by Sharp with the beta-coefficients included in its one-factor model. The rest (so-called systemic or diversified risk) is eliminated by selecting the appropriate (acceptable) portfolio. In 1977, this theory was strongly criticized in the works of Richard roll. Roll SARM suggested that it should be rejected, because he did not recognize the empirical examination at all. Nevertheless, SARM remains perhaps the most important and influential modern financial theory.

Markovis said that the investor should base his decisions on his portfolio only on expected returns and standard deviations. This means that the investor needs to predict the expected return and standard deviation of each portfolio and then choose the "Best"s based on the ratio of their IQ. In this, intuition plays a decisive role. Expected profitability can be expressed as a measure of the potential reward associated with a particular portfolio, while standard deviation can be expressed as a measure of the risk associated with that portfolio. Thus, after each portfolio is studied from the point of view of reward potential and risk, the investor must choose the portfolio that is most suitable for him.

MATERIALS AND METHODS

As we see in solving the problems that arise in the formation of a balanced investment portfolio, the universal approach does not exist; the specificity of a particular situation requires changing the main models. At present, no mathematical hardware has been developed for all possible schemes, this is due to the object mathematical complexity of the emerging models.

The task of the insurance organization is to create an optimal investment portfolio, taking into account the investment qualities and investment conditions of all the financial instruments used in it. The principles for creating an investment portfolio correspond to the established principles of the financial and credit policy for the placement of capital to a certain extent. These are investment security, profitability, investment growth and liquidity. When compiling an investment portfolio for insurers, it is possible to supplement its principles based on specific characteristics, this is the principle that the investment period corresponds to the duration of the obligations established in critical insurance conditions.

In general, due to the scientific research of foreign scientists-economists, issues of optimization of the investment model for insurance organizations are also being considered, but there is a certain disagreement in the research.

First, when drawing up an investment model of a group of authors, narrow it down to the problem of placing insurance funds only on insurance reserves, at the same time as investment sources of insurance organizations, not only the insurance reserves, but also the insurer's own funds that are not related to contractual obligations, that is, their insurance funds are accepted.

Secondly, a group of other authors use such an indicator as "insurance reserves" to evaluate an investment portfolio. The analytical indicator "insurance reserves" is conditional, the value of which depends on the chosen method of calculation, and as a result, the insurance reserves may not correspond to the amount of the insurer's obligations. The use of this indicator to describe an investment portfolio can lead to some erroneous conclusions. Insurance reserves are an account category.

Thirdly, another group of authors considers only one side of the restrictions on the placement of insurance reserves by the state. However, there are restrictions on the specific nature of insurance, that is, insurance reserves are temporarily empty funds, which can be requested at any random time due to the probable nature of the insurance liability. This effect can be determined only on the basis of the analysis of the insurance portfolio.

We assume that at the moment there is a certain amount of money for investment in the insurance organization "X", which can be put for a certain period of time, which is known as the "holding period". After the expiration of the retention period, the insurance company will sell the securities purchased at the beginning of the period, after which it will either use the income received for consumption or reinvest the proceeds to different securities (or both at the same time). Let's define: $t = 0$ - the beginning of the period; $t = 1$ - the end of the period (discrete approach).

at the time of $t=0$, the insurance organization must make a decision on the purchase of certain securities in its portfolio up to the time of $t = 1$. A portfolio is a set of different securities, so the decision is equal to the choice of the optimal portfolio from within the existing portfolios. Since the decision is taken at the time of $t = 0$, the value of the Securities in the next, period of ownership of them (and the profitability of the portfolio) is unknown. However, the insurer-analyst assesses the expected (or average) return (expected returns)of various

securities on the basis of some proposals from the investor, and then invest in the paper with the highest expected return.

The result of the existence of two opposing goals (increase in profit and minimize risk) is the need for diversification. The profitability of securities for a period is calculated according to the formula

$$Profitability = \frac{welfare\ at\ the\ end\ of\ the\ period - welfare\ at\ the\ beginning\ of\ the\ period}{\Delta Prosperity\ at\ the\ head\ of\ the\ AVR}; \quad (1)$$

here, "prosperity at the beginning of the period" is the cost of buying a certain type of single stock by the insurance organization at the time $t = 0$;

"Prosperity at the end of the period" - $T = 1$ the market value of the Securities in the amount calculated together with all payments paid in cash (or cash equivalent) to the owner of this securities (insurance company) within the period $t = 1$.

The investment portfolio of the Insurance Company expresses a different set of securities, the profitability of which can be calculated using the formula below.

$$D_{-}(D) = \frac{H_1 - H_0}{H_0} \quad (2)$$

here $D_{-}(D)$ - profitability %

$N_{0-t} = 0$ the total cost of the purchase of all securities included in the portfolio of the insurance organization at the time

The total market value of securities at the time of $N_{1-t} = 1$ and, moreover, the monetary income of the insurance organization from the ownership of these securities from the time of $t = 0$ to the time of $t = 1$.

(2) from, with the help of algebraic transformations we get

$$N_0(1 + D_{-}(D)) = N_1 \quad (3)$$

As can be seen from (3), at the beginning of the period, the welfare or initial welfare (N_0) and the sum of one will be multiplied by the income level of the portfolio and will be equal to the welfare of the insurance organization in the last period (N_1). The analyst of the insurance organization said that since the decision on the purchase of a portfolio should be taken at the time of $t = 0$, in most cases, he does not know what the income level of alternative portfolios will be, therefore, g. Markovis recommended that the rate of profitability associated with any portfolio be considered a random variable. Such variables have their own characteristics, one of which is the expected (or average) value, the other is the standard deviation.

According to markovis, the insurer's decision to formulate its portfolio should be based only on the expected return and standard deviations. This means that the analyst manager must evaluate the expected return and standard deviation of each portfolio, and then choose the "best" based on the ratio of the IQ. Expected profitability is a measure of the potential reward associated with a particular portfolio, while standard deviation is a measure of the risk associated with that portfolio. After each portfolio is checked for potential reward and risk, the insurer chooses the most suitable portfolio.

Currently g. The theoretical developments of markovis will help to solve such important issues as the creation of an optimal investment portfolio for the insurance company. Professional analyst-managers component consists of an information-analytical system, which has the principle of equalizing any complex analytical issue to the final number of simple analytical issues, relying on the results of modeling the securities market in a management decision support system, try to apply the latest mathematical methods in practice, at the same time, the initial set of data necessary for the In the end, for each analytical issue, a model is created, in which market behavior changes and forecasts are made. At the final stage, the news about the latest events in the cross-section of the influencing factors is analyzed, the correctness of the selected model for each specific situation is checked, and the final management decision is made. One of the important barriers that affect the wide application of these methods is the lack of initial data.

In 1952 year g. Markovis, D. Using the theories of the formation of the portfolio of tabs, as well as the research of other scientists-economists, it is possible to interpret the activities of their insurance organizations and gradually implement the optimal model of the investment portfolio.

In Table 1, a description of the different methods of creating an optimal investment portfolio of an insurance organization was considered.

Table 1: Description of various methods of creating an optimal investment portfolio of an insurance organization

Teaching method	Description of methodology
Sharp methodology	1. introduction of the concept of " beta - coefficient " as a measure of market risk of assets 2. investment portfolio management postulates 3. The portfolio of ordinary shares provides the highest expected return; the limit effect of the stock on the portfolio risk takes into account the share of the stock at the risk of its portfolio, and not its own risk; 3. 4. "risk decomposition— on the basis of which the link between financial

	instruments and risks stands
T.V. Methods of Pokazannikova (nomz. the dis. materials)	<ul style="list-style-type: none"> i. i. 1. Limitations: ii. - - total cost of insurance reserves by types of insurance; iii. - - share in the portfolio of assets used in the coverage of insurance reserves; iv. ii. - own funds that the insurance company uses as investment resources; v. iii. - profitability of assets; vi. the iv. – list of allowed items (possible values field); vii. v. - list of possible issuers; viii. - percentage of individual investments (all or by strictly defined); ix. - the percentage of the individual issuer (all or strictly defined) x. 2. Two methods of forecasting: xi. - imitation; xii. - analytical xiii. 3. Step-by-step implementation of the proposed model xiv. 4. Optimization of the income that can be obtained in the conditions of the entered restrictions to the maximum
V.E. Method of Janov (nomz. the dis. materials.)	<ul style="list-style-type: none"> 1. Typical tasks-determination of goals and selection of management strategies 2. Formation of the collection and accounting of information on financial assets included in the optimal portfolio 3. To examine the effectiveness of different options for portfolio formation. 4. Omillarni research and analysis leading to changes in portfolio structure. 5. Updating the portfolio (rotation), setting the deadlines for the purchase and sale of assets 6. Long-term insurance of insurance reserves, the criteria for placement by types of insurance in addition to life insurance 7. Laying out linear programming issues
Methodology of insurance companies	<ul style="list-style-type: none"> i. i. 1. Distribution of fixed-size reserves by investment directions (portfolio structure) ii. ii. 2. Dependence of the type of backup with the norm value (minimum, recommended) iii. iii. 3. Indicators of the direction of investment activity: iv. the iv. - relative profitability; v. - profit share; vi. - possibility of return on investment funds
Method of factor and Cluster analysis	<ul style="list-style-type: none"> the vi. 1. Identify critical ome and their impact on the equity rate it's vii. 2. Drawing up scientific-based forecasts of the dynamics of the movement of securities it's viii. 3. Maximizing the profit from investments at a certain level of risk 4. Separation of securities into separate clusters in accordance with the dynamics of profitability4. 5. Drawing up a common matrix based on the forecast 4. i. 6. Fox automation in the processing of a kind of ahborot from electronic databases 5. 7. To determine the share of securities in the portfolio volume in order to maximize profitability
Methodology in accordance with the insurance reserves of insurers (15.12.2008. 1882-number)	<ul style="list-style-type: none"> 1. Separate calculation of the optimal investment portfolio in terms of contracts other than life insurance and life insurance contracts 2. Degree of conformity between normative and real coefficients 3. Multiple variability of calculations

RESULTS AND DISCUSSIONS

The analysis of the data in the table shows that the main focus of investors-insurers, who want not only to save money from high inflation rates, but also to make money, will focus on other market segments, in particular, corporate and National Bonds. With government securities and corporate bonds considered as financial instruments with different levels of risk, the difference between them is not so great.

But many bonds are circulating in the market, so the most difficult task for the investor is to choose. Many bonds are unsuitable for investment, and the reasons for this are different: the inability to buy them simply on the market, the lack of quotations for buying and selling, etc. Such bonds include, above all, those that do not belong to the market, that is, a significant part of them are acquired by "affiliated" entities.

In some cases, low liquidity of bonds occurs due to the lack of desire to support the secondary market in the underwriter, low emission volume, high risks or low profitability due to the fact that the investor's interest in bonds is sluggish. Earnings on government bonds are lower than expected inflation, and the only advantage of such bonds is the low investment risk and relatively high liquidity.

The development of the insurance industry in many respects depends on the development of other financial institutions and the instruments used by them to serve the introduction of the assets of the insurance organization. The potential possibilities of the stock market and the Securities Market allow to diversify the assets of insurance organizations in terms of risks, the timeframe of instruments and their liquidity. In the implementation of this priority direction of the development of the insurance industry, the creation of organizational and methodological framework for the formation of the general and private investment sub-portfolios of the insurer is of particular importance.

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