Selection of an Optimal Portfolio with the Best Asset Composition in Insurance Companies in Armenia

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Ակտիվների լավագույն կազմով օպտիմալ պորտֆելի ընտրությունը ՀՀ ապահովագրական ընկերություններում

Ղազարյան Լուսինե Ե.
Ասպիրանտ, Ֆինանսական շուկաների և ինստիտուտների ամբիոնի դասախոս,
Հայաստանի պետական տնտեսագիտական համալսարան (Երևան, ՀՀ)
Մարդոյան Աշոտ Վ.
տ.գ.թ., դոցենտ, Ֆինանսական շուկաների և ինստիտուտների ամբիոն,
Հայաստանի պետական տնտեսագիտական համալսարան (Երևան, ՀՀ)

Ամփոփագիր. Ապահովագրական շուկայում մրցակցության սրման պայմաններում ակտիվների օպտիմալ կառավարումը դառնում է ապահովագրական ընկերությունների ֆինանսական կայունության և շահութաբերության հիմնական նախապայմանը: Ըստ այդմ ուսումնասիրության նպատակ է դրվել Արմենիա Ինշուրանս» ԱՓԲԸ-ի ներդրումային պորտֆելի օպտիմալացումը շահույթի մաքսիմալացման և ռիսկերի նվազեցման պայմաններում: Վերլուծությունը ցույց է տալիս, որ ներդրումային եկամուտը ունի ամենամեծ ազդեցությունը ընկերության շահույթի վրա, իսկ ապահովագրական արդյունքը հանդես է գալիս որպես կայունացնող բաղադրիչ: 2020–2024 թթ. ներդրումային ուղղությունների և եկամտաբերության ուսումնասիրության հիման վրա մեր կողմից կառուցվել է մաթեմատիկական օպտիմալացման մոդել, որը ներառում է Հայաստանի Հանրապետության Կենտրոնական բանկի կողմից սահմանված կարգավորիչ սահմանափակումները: Excel Solver-ի միջոցով ստացված օպտիմալացված պորտֆելը ցույց է տալիս, որ բարձր եկամտաբերությամբ ակտիվներում, մասնավորապես՝ վաճառքի համար մատչելի արժեթղթերում միջոցների բաժինը ավելացնելը կարող է զգալիորեն բարձրացնել ընդհանուր եկամուտը՝ պահպանելով ռիսկի սահմանները: Արդյունքներ վկայում են, որ առաջարկվող մոդելը կարող է արդյունավետորեն կիրառվել ՀՀ ապահովագրական շուկայում գործող ընկերությունների կողմից՝ նպաստելով ներդրումային պորտֆելի արդյունավետության բարձրացմանը և ֆինանսական կայունության ամրապնդմանը:
Հանգուցաբառեր և բառակապակցություններ՝ ակտիվների օպտիմալացում, ներդրումային պորտֆել, ապահովագրական ընկերություններ, ռիսկերի կառավարում, շահույթի մաքսիմալացում, ներդրումային եկամտաբերություն, տեխնիկական պահուստներ, ֆինանսական կայունություն

Подбор оптимального портфеля с лучшим составом активов в страховых компаниях Армении

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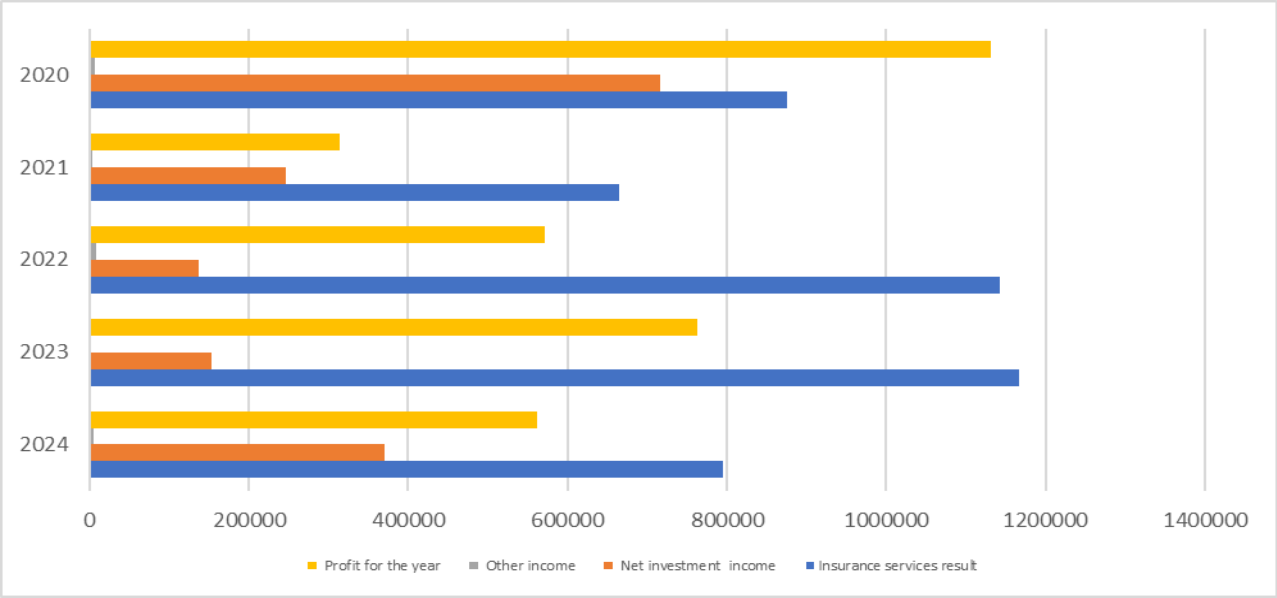
Аннотация. В условиях растущей конкуренции на страховом рынке необходимость оптимального управления активами становится основным условием финансовой устойчивости и прибыльности страховых компаний.

Целью исследования является оптимизация инвестиционного портфеля Армения Иншуранс в условиях максимизации прибыли и снижения рисков. Анализ показал, что инвестиционный доход оказывает наибольшее влияние на прибыль компании, а страховой результат выступает в качестве стабилизирующего компонента. На основе исследования направлений инвестирования и доходности за 2020–2024 годы была построена математическая модель оптимизации, учитывающая нормативные ограничения, установленные Центральным банком Республики Армения. Оптимизированный портфель, полученный с помощью Excel Solver, показал, что увеличение доли средств в высокодоходных активах, в частности, кредитах и ценных бумагах, доступных для продажи, может существенно увеличить общий доход при сохранении лимитов риска. Результаты свидетельствуют о том, что предложенная модель может эффективно применяться компаниями, работающими на страховом рынке РА, способствуя повышению эффективности инвестиционного портфеля и укреплению финансовой стабильности

Ключевые слова и словосочетания: оптимизация активов, инвестиционный портфель, страховые компании, управление рисками, максимизация прибыли, инвестиционный доход, технические резервы, финансовая устойчивость

In the context of the development of the insurance system and the intensification of competition, the need for asset management implies the use of methods that will allow insurance companies, under the conditions of a given strategy, to determine the optimal volumes, directions and interest rates of resource allocation, which becomes possible through the use of economic and mathematical modeling and forecasting methods in the management of an insurance company. For the effective application of these approaches, it is necessary to consider the theoretical foundations of investment portfolio management in international practice, in particular the development of portfolio theories, which have formed the methodological basis for assessing the risk-return ratio and are widely used by insurance companies. These classical and modern models (John Williams [**1**] Harry Markowitz [**2**] William Sharp [**3**] John Lintner [**4**] Fisher Black [**5**]) serve as a basis for optimizing the portfolio structure and are important from the point of view of further mathematical model formation. Therefore, based on the theoretical approaches and portfolio models presented above, the goal of this research is to maximize the profit of an insurance company through optimal asset allocation. Armenia Insurance ICJSC, which is a medium-sized insurance company with stable financial indicators, was selected as the research object. Its asset structure and investment policy are conducive to modeling and evaluation. In order to ensure the logical sequence of the analysis, it is advisable to present and analyze the level of profit of the insurance company at the initial stage. The analysis should be carried out not only in terms of total profit, but also by individual areas of activity: investment, insurance and other sources of income. This stage will provide an opportunity to understand the structure of profit formation and the main factors that affect the company's profitability.

Figure 1. *Company revenue structure* [**6**]



The chart was compiled by the author using the company's annual financial statements.

A study of Figure 1 shows that the company's profit level has fluctuated significantly over the past five years. The highest profit was recorded in 2020 (1,130,948 thousand AMD), and the lowest in 2021 (313,357 thousand AMD). This indicates that the company's profit is quite sensitive to changes in some income. The result of insurance services generally shows an increasing trend: after 2021, it increased significantly and reached its maximum in 2023 (1,167,127 thousand AMD). However, the high level of insurance income has not always been accompanied by a proportional increase in profit. Net investment income acts as the main determinant of profit. In particular, in 2020 it amounted to 716,453 thousand AMD, which also coincided with the maximum profit indicator. And in 2022–2023, in the conditions of a sharp decrease in investment income, the company's profit also decreased, indicating their direct dependence. Other income is relatively small and has an almost insignificant impact on the overall result: their maximum level is 7,928 thousand drams, which is very small compared to insurance and investment income. Thus, the preliminary analysis shows that investment income in particular has a decisive impact on the company's profit, while the insurance result plays a more stabilizing role, and the impact of other income is very insignificant. Therefore, it is important to separate and study the structure of the company's investment portfolio, the dynamics of investment directions and their level of profitability. The study of the investment portfolio allows:

- to identify the main instruments in which the company's free funds are concentrated,
- to assess the riskiness and profitability of the portfolio,
- to determine the compliance of investments with the norms and restrictions set by the Central Bank of the Republic of Armenia,
- to reveal the strengths and weaknesses of the portfolio structure.

Thus, the study of the investment portfolio is not only necessary from the point of view of understanding the sources of profit, but also makes it possible to analyze the effectiveness of the company's asset management and their role in ensuring overall financial stability. The analysis stage is an important basis for assessing the effectiveness and applicability of the optimization model. At the preliminary stage of the analysis, before developing the optimization model, let's conduct a study of how and in which directions the company allocates reserves. According to public reports, the company's assets are invested in the following directions with the following returns in 2020-2024.

Table 1. *Company's investment directions*

	2020	average return 2020	2021	average return 2021	2022	average return 2022	2023	average return 2023	2024	average return 2024
Bank deposits	47304	1.4	30100	2.1	43118	1.5	49566	1.34	70074	0.98
Loans granted	50332	11	50332	11	50292	11.2	50261	11.26	152026	12.4
Securities available for sale					9691670	8.26	5191757	9.8	6478941	10
Cash held by the company	3432495	8.12	2703308	7.68	3497360	8.26				
Pledged under repurchase agreements	7008288	8.12	7297953	7.68	6194310	8.26	4453627	9.8	1328490	10
Securities held to maturity	20356	9.5								
Cash	83043		67541		63981		115796		114864	
Total investments	**10641818**		**10149234**		**19540731**		**9861007**		**8144395**	
Net investment income	**369991**		**153257**		**136560**		**245985**		**716453**	

Traditionally, insurance companies concentrate a significant part of their assets in low and medium-risk financial instruments, ensuring stable profitability and control over liquid assets. The data presented below indicate the structure of the company's investment portfolio and the dynamics of profitability over the past five years.

- Bank deposits. The volume of bank deposits increased from 47,304 thousand AMD to 70,074 thousand AMD from 2020 to 2024. However, the average profitability gradually decreased from 1.4% to 0.98%. This trend shows that the company, despite the increase in the volume of deposits, has suffered a decrease in the profitability of bank funds, possibly due to low interest rates.
- Loans provided. This direction has maintained a stable and high profitability for the company, averaging 11–12.4%. The volume of this

segment of the portfolio in 2020 was 50,332 thousand drams, and in 2024 it reached 152,026 thousand drams, indicating the company's active interest in high-yield debt instruments. Available-for-sale securities. In 2022–2024, available-for-sale securities made up a significant part of the investment portfolio, up to 9,671,670 thousand drams in 2022, and 6,478,941 thousand drams in 2024. The average yield was stable, within 8.26–10%. This indicates that the company purposefully uses securities to ensure high profitability, while maintaining high liquidity.

- Securities held by the company and securities pledged under repurchase agreements. The volume of securities held by the company in 2020–2022 amounted to 3,432,495 thousand drams, and securities pledged under repurchase agreements - from 7,008,288 thousand drams to 1,328,490 thousand drams in 2024. This direction provided an average return of 7.68–10%, demonstrating the stability of the company's approximate portfolio profitability and risk reduction strategy.
- Securities held to maturity. This direction was a declining investment vehicle - 20,356 thousand drams in 2020, but the average return is quite high - 9.5%, which indicates that the company has chosen a strategy of a certain share of high-yield, but longer-term investments.
- Cash. The volume of cash resources fluctuated from 83,043 thousand drams in 2020 to 114,864 thousand drams in 2024, without an average return, this direction mainly serves to maintain liquidity. The total volume of the investment portfolio in 2020–2024 fluctuated from 10,641,818 thousand drams to 8,144,395 thousand drams in 2024. The structure of the investment portfolio indicates that the company consistently balances high- and low-yielding directions, aiming to jointly ensure stable profitability and minimal risk. This analysis allows us to conclude that the company actively uses government bonds, high-yield loans and liquid securities to control its financial risks and increase the overall investment return. Then, let's move on to developing an optimization model, based on which the portfolio will be reshaped, aiming to ensure maximum profit under conditions of restrained risk. As a result of the practical application of the model, it is necessary to compare the initial and optimized results to find out to what extent and what qualitative changes are recorded in terms of profit size and stability.

Now, according to the mathematical formulation of the optimal asset portfolio planning problem, we are required to find this vector of assets:

$$C=(C_1, C_2, C_3, ..., C_n),$$

in which case the insurance company will be ensured the maximum level of portfolio profit under conditions of restrained risk, that is:

$$S=\sum_{ά=1}^{n} C_{ά} \cdot E_{ά} \rightarrow \max_{C_{ά},\ ά=1,m}.$$

- where: S is the maximum return on the portfolio,
- C is the amount of funds allocated to the asset portfolio,
- n is the total number of different types of assets, that is, how many different categories the insurance company can invest in (for example, government bonds, bank deposits, etc.),
- ά is the index of a particular asset, which represents a separate type of asset within the portfolio. a takes values from 1 to n, where each number represents a different asset.
- C_a is the amount of investment in the ath asset in the insurance company's investment portfolio model or the share of that asset in the portfolio.
- E_a is the percentage return on the ath type of asset of the insurance company.

While solving the optimization problem, one should also take into account the restrictions applied by the Central Bank of the Republic of Armenia. All and separately taken assets equivalent to the technical reserves formed by the insurance company (reduced by the share of reinsurers) can be allocated in clear directions and amounts, which can be expressed by the following mathematical conditions:

General restrictions. Since only a maximum of 3 percent of the funds can be kept as cash, it turns out that the company must invest the remaining funds in assets of no less than b_1%, i.e. [7]

$$\sum_{a=1}^{n} C_{a}, \% \geq 97\%$$

(An insurance company must invest at least 97% of technical reserves in assets, the cash amount must not exceed 3%).

$$C_{Cash} \leq 3\%$$

$$C_{Central\ Bank\ bond} \leq 100\%$$

Restrictions on investing in corporate and international securities

$$C_{International\ AAA-rated\ government\ and\ corporate\ bonds,international\ government-issued\ @bonds} \leq 40\%$$

$$C_{\text{International AAA-rated government and corporate bonds,single entity}} \leq 5\%$$

$$C_{\text{Securities of financial and non-financial organizations resident in the Republic of Armenia}} \leq 40\%$$

$$C_{\text{Securities of financial and non-financial organizations resident in the Republic of Armenia,one subject}} \leq 10\%$$

Bank deposits, loans

$$C_{\text{bank accounts}} \leq 100\%$$

$$C_{\text{bank accounts, One subject}} \leq 20\%$$

$$C_{\text{Loans to insurance,investment and credit organizations}} \leq 20\%$$

$$C_{\text{Loans to insurance,investment and credit organizations,single entity}} \leq 5\%$$

Repo agreements

$$C_{\text{Securities purchased under repo agreements}} \leq 50\%$$

$$C_{\text{Securities purchased under repo agreements,single entity}} \leq 10\%$$

Shares in investment funds

$$C_{\text{Shares in investment funds}} \leq 5\% \leq 100 \text{ մլն դրամ}$$

The above conditions are the constraints for the optimal modeling of the investment portfolio of an insurance company, which must be observed in accordance with the regulations of the Central Bank of Armenia. In addition to the restrictions of the Central Bank, we also propose restrictions taking into account the standard deviation of the portfolio.

σp - (Portfolio standard deviation) shows how volatile the return on an insurance company's investment portfolio is.

$$\sigma p = \sqrt{\sum_{i=1}^{n} \sum_{j=1}^{n} C_i \cdot C_j \sigma_{ij}} \leq risk\ level$$

Where σ_{ij} is the correlation matrix of asset returns.

The formulas present the limit values of the standards set for insurance companies as of 2024, but over time these restrictions may be changed by the Central Bank. In case of changes, theoretically there will be no problems with the application of the model, since by entering the above-mentioned objective function and all the restrictions currently in force, we will obtain a possible option for the optimal allocation of assets for the insurance company. Since the task is to determine the maximum profit through the optimal allocation of available funds in permissible assets, the maximization of income has been defined as the objective function. Accordingly, let's enter all the formulas into the Excel system and then solve the problem using the Solver function of Excel. Here is a comparative table of the initial and optimized options of the portfolio for 2024.

Table 2. *Indicators of the company's optimized portfolio*

Investment Direction	Initial Portfolio	Profitability	Optimized Portfolio	Optimized Yield
Bank deposits	**70,074**	**0.98**	**50,000**	**490**
Loans granted	**152,026**	**12.4**	**160,000**	**19,840**
Securities available for sale	**6,478,941**	**10**	**6,500,000**	**650,000**
Securities held by the company	**–**	**–**	**0**	**0**
Securities pledged under repurchase agreements	**1,328,490**	**10**	**1,350,000**	**135,000**
Cash	**114,864**	**0**	**104,395**	**0**

As we can see, the volumes of some areas in the optimized portfolio, especially loans and securities available for sale, have been increased, which allows for higher profitability while maintaining risk limits. As a result of such an allocation, the company will receive maximum profit, taking into account possible risks and limitations.

Conclusion

Thus, the application of such an optimal asset management model, taking into account the peculiarities and limitations of the RA insurance market, will allow companies operating in the RA insurance market to optimally allocate reserves and receive maximum profit as a result of the allocation and at the same time ensure a sufficient level of liquidity to pay insurance benefits. The application of such an optimal portfolio model will allow insurance companies operating in the RA insurance market to increase profitability, contributing to the development of the capital market. The introduction of such a model can serve as a methodological basis for all insurance companies, which will make it possible to assess, form and optimize the asset portfolio, complying with both international best practices and the regulations and risk management requirements set by the Central Bank of the Republic of Armenia.

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