Chapter 14.

INVESTMENT ACTIVITY OF INSURANCE COMPANIES: BETWEEN REGULATORY CONSTRAINTS AND MARKET REALITY

To effectively fulfil their primary function of providing economic protection against risks, insurance companies act as institutional investors that channel long-term funds into the economy. They transform a large number of small, periodic premium payments into substantial financial reserves. Due to the time lag between premium inflows and benefit outflows, the funds thus accumulated can be invested until claims fall due. Through this process, insurance companies contribute to the mobilisation of savings and the financing of public and private sector investment, supporting economic development. Their conservative investment approach, combined with the long-term nature of their liabilities, enables them to serve as stabilisers of financial markets, especially during periods of economic distress.[405] Unlike most financial market participants, insurers, especially those engaged in life insurance, are less likely to engage in pro-cyclical behaviour, such as panic-selling during market downturns.[406] Importantly, the funds managed by insurance companies ultimately belong to policyholders and must be invested in a way that ensures safety, liquidity, and the ability to meet future obligations as they come due. For this reason, the regulation of insurers' investment activity is one of the most important pillars of insurance supervision.

While investment regulation aims to ensure that insurers invest prudently and are able to meet their obligations to policyholders, regulatory approaches vary considerably. The Solvency II framework, implemented across the European Union, is based on the prudential principle, granting insurers greater flexibility in investment portfolio management while requiring robust internal risk assessment and capital adequacy. However, the effectiveness of this model is closely linked to the depth and liquidity of the financial market and the institutional maturity of both insurers and regulators.

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405 Kočović, J., Rakonjac-Antić, T., Koprivica, M., & Šulejić, P. (2021). *Osiguranje u teoriji i praksi.* Belgrade: University of Belgrade, Faculty of Economics and Business, p. 364.

406 Schich, S. (2009). Insurance Companies and the Financial Crisis. *OECD Journal: Financial Market Trends, 2,* p. 17.

In contrast, countries with underdeveloped financial markets, such as Serbia, face structural limitations that constrain the practical applicability of the prudential approach. In such environments, regulators typically rely on quantitative limits as a substitute for market discipline and as a safeguard against excessive risk exposure. This raises an important question: to what extent can the regulatory philosophy behind Solvency II be realistically applied in countries with limited investment opportunities and narrow capital markets?

The subject of this chapter is the investment activity of insurance companies, with a focus on the interaction between regulatory constraints and market conditions. The main objective is to analyse how different regulatory approaches — prudential and rule-based — shape the investment behaviour of insurers, and to what extent market underdevelopment, particularly in Serbia, imposes additional constraints beyond those prescribed by regulation.

1. INVESTMENT RISKS FACED BY INSURANCE COMPANIES

As institutional investors, insurers are exposed to a broad spectrum of investment risks that affect both portfolio performance and their ability to meet policyholder obligations. Understanding and effectively managing these risks is essential not only for protecting the solvency of individual insurers but also for maintaining trust in the insurance sector as a whole. This section provides an overview of the key investment risks insurance companies face, including market, credit, concentration, and liquidity risks.

Market risks arise from the sensitivity of asset values to fluctuations in financial variables such as interest rates, exchange rates, equity prices, and the prices of underlying instruments in derivative contracts. The key components of market risk include:

- *Asset depreciation risk* – the risk of a decline in the market value of investment assets due to adverse market movements. Insurers are especially exposed to this risk through their investments in equities and real estate, whose prices can be particularly sensitive to macroeconomic conditions and market volatility.
- *Interest rate risk* – refers to the potential for financial losses arising from fluctuations in interest rates. Insurers are particularly sensitive to this risk due to their significant exposure to long-term fixed-income securities, especially government bonds. Although such bonds offer stable and predictable income streams, their market value declines when interest rates rise, as new bonds offer higher returns. The resulting capital losses may weaken the company's solvency and its ability to meet future claims.

- *Spread risk* – the risk of a decline in the market value of fixed-income securities due to widening credit spreads. It occurs when the yield gap between a corporate bond and a risk-free benchmark (e.g. government bond) increases, often due to deteriorating credit quality or market sentiment. This can cause significant capital losses for insurers heavily exposed to corporate debt.
- *Foreign exchange risk* – the risk of a decline in the value of investment assets denominated in foreign currencies due to fluctuations in exchange rates. Insurers may be exposed to this risk when they invest in foreign securities or hold assets and liabilities in different currencies.
- *Risks associated with the use of derivatives* – insurers that use derivatives face risks associated with the timing and ability to execute contracts (liquidity risk), unexpected price behaviour of the underlying assets (basis risk), and operational risks related to inadequate internal systems, procedures and controls. While derivatives can be used to hedge market risk, they may also amplify exposure if not properly managed.

Credit risk refers to the potential for financial loss arising from the inability or unwillingness of an issuer of financial instruments held in the insurer's investment portfolio to meet its contractual obligations in full and on time. Insurers are particularly exposed to credit risk through their investments in corporate bonds, structured finance instruments, and bank deposits. The exposure level depends on the issuer's credit rating, the asset's maturity structure, the degree of investment concentration,[407] and macroeconomic conditions.

Concentration risk refers to the potential for financial losses arising from an overexposure to a single asset, issuer, sector, or geographical region. Excessive concentration undermines the benefits of portfolio diversification and can significantly amplify the impact of adverse events, such as credit deterioration or sector-specific economic shocks. Regulators may impose quantitative limits on exposures to individual counterparties or asset classes to mitigate this risk and ensure a more resilient investment portfolio structure.

Liquidity risk refers to the potential loss arising from the inability to meet current liabilities due to insufficient liquid assets. This risk materialises when an insurer is forced to borrow or sell assets under unfavourable market conditions. A common cause of liquidity shortfall is the misalignment of asset and liability maturities, when short-term liabilities are financed through long-term, illiquid

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[407] Jovović, M. (2015). Merenje rizika pri utvrđivanju solventnosti neživotnih osiguravača. *Doctoral dissertation,* Belgrade: University of Belgrade, Faculty of Economics and Business, p. 25.

investments. Non-life insurers are especially exposed to this risk because their liabilities and funding are mostly short-term.[408]

The investment risks outlined above may lead to losses in specific asset classes or reduce expected returns, ultimately undermining the insurer's capacity to meet obligations toward policyholders. For this reason, investment activity must remain subordinate to the insurer's primary function of providing financial protection. To avoid compromising solvency, investment decisions must prioritise policyholder interests and ensure sound alignment of assets and liabilities, particularly regarding maturities, currencies, and interest rate exposure. Special attention must be given to the continuous coverage of technical reserves by high-quality and appropriately structured assets.

2. FACTORS SHAPING INSURERS' INVESTMENT PORTFOLIO STRUCTURE

The main investment types for insurance companies include real estate, securities, and deposits with banks and other financial institutions.[409] The structure of an insurer's investment portfolio is shaped by a combination of general and country-specific factors. Among the general factors that apply across different countries are the security objective inherent in insurance activity and the type of insurance in which a given company is engaged.[410] These factors stem from the nature of the insurance business and influence investment decisions regardless of regulatory or market context.

The investment policy of insurance companies is based on three core principles: security, profitability, and liquidity, similar to those of other institutional investors. However, because the primary function of insurance is to provide financial protection against risk, security takes precedence over other investment principles. Due to this prioritisation, insurers tend to structure their portfolios around low-risk or relatively safe assets. As a result, technical reserves are, in

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[408] Jovović, M., Mitrašević, M., & Kočović, M. (2013). Assessment of financial strength of insurance companies in Serbia. In: *Product specifics on the markets of insurance and reinsurance,* Kočović, J. et al. (eds.), Belgrade: University of Belgrade, Faculty of Economics and Business, p. 340.

[409] Kočović et al. (2021), op. cit., p. 369.

[410] Kočović, J., Paunović, B., & Jovović, M. (2015). Possibilities of creating optimal investment portfolio of insurance companies in Serbia. *Ekonomika preduzeća, 7-8,* p. 387.

general, predominantly invested in government bonds, long-term bonds issued by state-owned enterprises, and bank deposits.[411]

The structure of insurers' investments is also determined by the nature of their liabilities, particularly in terms of predictability and duration.[412] Life and non-life insurers differ significantly in this regard.[413] In life insurance, the timing and amount of future obligations are more predictable, as benefits are contractually fixed. Liabilities are long-term in nature because contracts are generally long-term. In contrast, non-life insurance claims are uncertain in both timing and amount. Liabilities are short-term in nature because contracts are typically short-term. Accordingly, life insurers allocate a larger portion of their portfolios to long-term, less liquid assets, while non-life insurers tend to favour short-term, highly liquid investments.[414]

However, in practice, two additional factors play a critical role in shaping insurers' investment portfolios: the regulatory framework and the level of development of the domestic financial market. These factors are highly context-dependent and can vary significantly across countries.

Regulatory framework as a determinant of insurers' investment structure

Investment regulation, particularly with respect to the allocation of technical reserves, is essential for ensuring that insurers hold sufficient and appropriate assets to meet their obligations to policyholders.[415] Two main regulatory approaches can be distinguished: the principles-based "prudent person rule" and the rules-based "quantitative portfolio regulations." Table 1 provides a comparative overview of two methods, highlighting respective advantages and limitations.

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[411] Kočović, J., Rakonjac Antić, T., & Jovović, M. (2011). The impact of the global financial crisis on the structure of investment portfolios of insurance companies. *Economic Annals*, *LVI*(191), p. 145.

[412] Davis, P. (2000). Portfolio regulation of life insurance companies and pension funds. *Pension Institute Working Paper*, PI-0101, p. 4.

[413] López Domínguez, I. (2023). Insurance companies in the European Union: General criteria affecting investment policies. *Journal of Governance and Regulation*, *12*(2), 77-p. 81.

[414] Kočović et al. (2015), op. cit., p. 388.

[415] Davis, P. (2002). Prudent person rules or quantitative restrictions? The regulation of long-term institutional investors' portfolios. *Journal of Pensions Economics & Finance, 1*, p. 165.

Table 1. Comparison of regulatory approaches to insurance investments

Criterion	Prudent person rule	Quantitative portfolio regulations
Flexibility	High: Insurers have broad discretion if investments are justified as prudent.	Low: Rigid investment caps limit decision-making.
Risk sensitivity	High: Investment strategies can be aligned with each insurer's risk profile and liabilities.	Low: Rules ignore actual risk exposures or correlations.
Risk-return optimisation	High: Enables diversification and more efficient portfolios.	Low: Limits can lead to suboptimal portfolios.
Contribution to financial market development	High: Encourages innovation and demand for a wider range of financial instruments.	Low: Restrictive rules may limit market depth and innovation.
Clarity and simplicity	Lower: Requires judgment and case-by-case review.	High: Clear rules enable easy compliance checks.
Supervisory burden	High: Requires skilled supervision and detailed oversight.	Low: Compliance is mostly checked through standard reporting.
Compatibility with solvency regime	Aligned with risk-based regimes (e.g. Solvency II)	Used in rules-based regimes (e.g. Solvency I)
Market suitability	Suitable for developed markets with mature financial systems, robust governance, and skilled supervisory authorities.	More appropriate for emerging markets with less developed financial systems, evolving governance structures, and limited supervisory capacity.

Source: Authors' own compilation

The prudent person rule is a qualitative standard that requires insurers to manage their investments as a "prudent" investor would, considering the nature and duration of liabilities, overall risk exposure, and the interests of policyholders. It does not prescribe fixed limits for specific asset classes; instead, insurers are free to invest in any asset as long as they can justify the investment as prudent in the context of their liabilities and risk management. This approach grants insurers considerable flexibility in managing their investment portfolios. It allows for a broader range of asset classes, including infrastructure loans, private equity and other alternative assets, which may be excluded under strict quantitative rules. Without rigid, uniform limits, investment decisions can be tailored to each insurer's risk profile and liability characteristics. This flexibility enables insurers to pursue optimal investment strategies and adapt to changing market conditions.

By focusing on overall portfolio risk, the prudent person approach aligns with modern portfolio theory.[416] Through broad diversification, this approach enables the construction of an efficient portfolio that optimises the risk-return trade-off.

The principle-based nature of the prudent person rule allows it to remain relevant as financial markets evolve. Insurers can invest in new asset classes (e.g. green bonds) without waiting for formal rule changes, enabling more agile responses to economic shifts. From a macroeconomic perspective, this adaptability also supports financial innovation by reducing regulatory delays.

Moreover, the prudent person rule aligns naturally with risk-based supervision frameworks like Solvency II. Since risky investments already carry higher capital requirements, the prudent person approach complements this by reinforcing governance and portfolio oversight without prescribing arbitrary limits. It shifts regulatory focus toward outcomes and risk management processes rather than compliance with predefined thresholds.

Despite its merits, the prudent person rule also presents important challenges. One of them is the high reliance on the insurer's expertise and supervisory capacity. The effectiveness of the approach depends heavily on the ability of insurers to develop robust risk management systems and on the competence of supervisors to evaluate complex investment strategies.

If an insurer lacks adequately skilled investment professionals or strong internal risk controls, the application of the prudent person rule alone may not be sufficient to prevent suboptimal or even harmful investment decisions. In less sophisticated markets or companies, this could lead to excessive risk-taking or misjudgments. An insurer might be tempted to "reach for yield" or take on excessive investment risk to boost profits, thinking it can justify it as prudent. Without hard limits, there is a possibility that discipline erodes, especially if there is competitive pressure to deliver returns. Expertise, strong governance and ethical standards are needed; otherwise, policyholders could be exposed to unintended risks. Thus, prudent-person regimes must be buttressed by a strong risk culture and vigilant supervision to prevent misconduct or moral hazard.

The implementation of the prudent person rule imposes a significant supervisory burden. Ensuring compliance requires detailed assessments of insurers' investment processes and risk management practices, which can demand substantial time and resources. Supervisors may have to impose remedies like

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[416] Weigl, C. S. (2013). Prudent Investor Rule and Modern Portfolio Theory. *Estates, Trusts & Pensions Journal*, *33*, p. 145.

capital add-ons or investment restrictions on a case-by-case basis if they find imprudent practices. This tailored oversight is effective but costly.

Finally, the effective implementation of the prudent person rule presupposes the existence of a well-developed financial market. A broad range of investment options is essential for insurers to fully benefit from the flexibility this approach provides. In shallow and illiquid financial markets, insurers may be forced to concentrate their portfolios in a narrow set of available assets or face additional risks due to limited diversification. Thus, while the prudent person rule is well-suited to developed insurance markets, its advantages may be significantly reduced in emerging markets where governance standards, supervisory capacity, and financial market infrastructure are still evolving.

By contrast, quantitative portfolio regulations impose explicit limits on investments. Laws or regulations define how much an insurer can invest in specific asset classes or exposures, including issuers, sectors, or regions. Limits are commonly placed on holdings of assets with relatively volatile prices, low liquidity, or high credit risk.[417] This approach has been used in factor-based solvency regimes (such as Solvency I in Europe). It is still commonly used in some developing economies, where regulators mandate, for instance, a high proportion of assets to be in government bonds or bank deposits, and impose strict caps on riskier asset classes like equities or overseas investments.

One of the most notable advantages of this approach is its clarity and simplicity. Numeric thresholds offer a clear compliance framework, enabling insurers to structure portfolios easily and supervisors to detect breaches through routine reporting. This is particularly beneficial in emerging markets, where supervisory capacity may be constrained.

By capping exposures to higher-risk asset classes or single issuers, the rules automatically restrict extreme risk-taking behaviour. In markets where risk-based capital models are not fully operational, these limits function as a blunt but effective safeguard, particularly in preventing concentrations or speculative investments that could threaten solvency. Quantitative regulations can also serve broader policy objectives, such as encouraging domestic investment or limiting foreign exchange exposure, thereby supporting macroeconomic stability.

This regime promotes uniform minimum standards of prudence across the industry. Quantitative rules apply equally to all insurers. Such uniformity prevents a “race to the bottom” where some insurers might otherwise take on more risk to outcompete others. It also enhances public trust through consistent

[417] Davis (2000), op. cit., p. 24.

conservative investment behaviour across the industry. In volatile markets with weak market discipline, strict asset limits help preserve solvency. More precisely, having insurers primarily invested in domestic government bonds might reduce the chance of investment-driven failures.

However, quantitative portfolio regulations also have significant limitations. Their rigidity may prevent insurers from fully optimising investment portfolios. By focusing on the risk of individual assets, they overlook the potential for overall portfolio risk reduction through diversification. This can result in suboptimal performance, as insurers might be forced into lower-yield or less diversified portfolios. Numerous empirical studies show that explicit limits constrain investment efficiency, thereby imposing opportunity costs on insurers (and ultimately on policyholders) in terms of risk-adjusted returns.[418]

Due to their uniform nature, quantitative rules are not risk-sensitive. They apply equally to all insurers, regardless of their risk profile or liability structure. Moreover, limits are usually arbitrarily calibrated, i.e. based not on rigorous risk assessments, but on overly cautious heuristics. This approach may be suboptimal for well-capitalised insurers who could take on more risk to improve returns or asset-liability matching. Also, these rules treat all assets in a category the same and fail to account for correlations between different types of assets. As such, they may create a false sense of security: an insurer may meet all regulatory limits while still holding a portfolio that is mismatched or concentrated in hidden ways.

The static nature of quantitative rules also limits adaptability to evolving financial markets. Insurers may be unable to invest in new financial instruments until regulations are formally updated. Similarly, a limit imposed several years ago may now be too conservative, yet changing laws or regulations is often slow. Consequently, insurers may remain constrained by outdated allocation rules that no longer reflect current investment opportunities or macroeconomic conditions.

Finally, excessive reliance on quantitative rules may hinder the development of insurers' internal risk management and the broader financial market. Strict regulatory limits can shift focus from governance and expertise to mere

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[418] See more in Jones, L. D. (1968). *Investment Policies of Life Insurance Companies.* Boston: Division of Research, Graduate School of Business Administration, Harvard University; Davis (2000), op. cit.; Bijapur, M., Croci, M., & Zaidi, R. (2012). *Do asset regulations impede portfolio diversification? Evidence from European life insurance funds.* New York: Social Science Electronic Publishing; Kočović et al. (2015), op. cit.

compliance.[419] In the longer term, this can discourage the growth of a strong risk culture within the industry. From a macroeconomic perspective, if large institutional investors like insurers are restricted to government bonds, demand for other financial instruments may stagnate. This may limit the development of local capital markets and reduce insurers' contribution to long-term economic growth. Therefore, it is recommended that such restrictions be eased once appropriate risk-based supervision is in place, provided that this does not harm the interests of policyholders.[420]

These regulatory approaches directly influence the structure of insurers' investment portfolios, determining the range of permissible assets and the degree of flexibility in portfolio construction. As the analysis shows, each approach has distinct advantages and limitations. The choice between them largely depends on the level of market development. Broadly, developed markets have trended toward the prudent-person principle, while emerging markets more often rely on quantitative limits as the dominant form of investment regulation.

Impact of financial market development on insurers' investment opportunities

The level of financial market development in a country is another critical determinant of insurance companies' investment portfolio structure. In addition to regulation, the depth and breadth of the local capital market fundamentally shape insurers' investment opportunities and influence their ability to perform effective asset-liability management.

In well-developed financial markets (typically found in advanced economies), insurers can pursue more diversified and long-term investment strategies. A deep capital market provides access to various asset classes, from government and corporate bonds to equities, private debt, and alternative investments. By holding a well-balanced mix of assets, insurers can reduce their exposure to investment risks and better align their assets with their liabilities. Moreover, a wide array of financial products, such as derivatives, is available to hedge various market risks. Developed markets also tend to have deep long-term debt markets, allowing life insurers to invest in long-duration bonds that match their long-term liabilities.

[419] European Commission (1999). *Rebuilding Pensions, Security, Efficiency, Affordability - Recommendations for a European Code of Best Practice for Second Pillar Pension Funds,* prepared by Pragma Consulting, Brussels, p. 19.

[420] Shindo, T., & Stewart, F. (2021). *Developing Insurance Markets: Insurance companies and infrastructure investments.* Washington, DC: World Bank Group, p. 23.

For instance, the availability of 20- or 30-year government and corporate bonds enables insurers to lock in stable returns over time and mitigate reinvestment risk.

Furthermore, developed markets ensure greater liquidity, which facilitates short-term liability management. High liquidity and transparency in developed markets also support more efficient security pricing, enabling insurers to make well-informed investment decisions and accurately assess portfolio risks and returns.[421] All these factors allow insurers operating in countries with developed financial markets to optimise their investment strategies, supporting both higher investment income and stronger solvency positions over the long term.

In underdeveloped financial markets (common in many emerging and developing economies), by contrast, insurers encounter a much narrower range of investment options. These markets are often characterised by shallow equity exchanges, illiquid secondary trading of domestic government bonds, and limited corporate bond issuance. In such environments, insurers tend to concentrate their assets in a few traditional categories, primarily domestic government bonds, bank deposits and other fixed-income instruments, simply because suitable alternatives are lacking.

Moreover, insurers in many emerging markets face significant mismatches between assets and liabilities. The main obstacles to effective asset and liability management (ALM) are the shortage of long-term fixed-income instruments and the limited liquidity of local bond and equity markets.[422] The scarcity of derivatives, such as interest rate and currency swaps, further constrains insurers' ability to manage market risks effectively.

Because they are constrained mainly to bonds and cash, as assets that are generally safer but offer lower yields, insurers in underdeveloped financial markets face limited opportunities to enhance investment returns. As a result, their ability to optimise the risk-return trade-off may be considerably reduced compared to insurers operating in more developed financial environments.

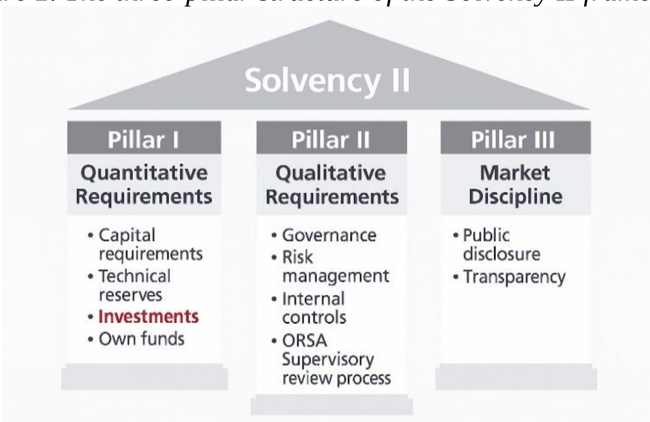
[421] Poufinas, T., & Siopi, E. (2024). Investment Portfolio Allocation and Insurance Solvency: New Evidence from Insurance Groups in the Era of Solvency II. *Risks, 12*(12), p. 21.

[422] Singh, M., & Kong, J. (2005). Insurance Companies in Emerging Markets, *IMF Working Paper,* No. 88, Washington, DC: International Monetary Fund, p. 11.

3. INVESTMENT REGULATION AND PRACTICE UNDER THE SOLVENCY II FRAMEWORK

Solvency II, the comprehensive regulatory framework governing the European insurance market, was introduced in 2016 to enhance policyholder protection and ensure the financial soundness of insurance undertakings. It is built upon a three-pillar structure comprising quantitative requirements, qualitative requirements, and disclosure and transparency. Insurers' investment activity plays a crucial role within this framework, as it is incorporated into Pillar I, alongside the rules for calculating capital requirements and technical reserves (Figure 1).

Figure 1. The three-pillar structure of the Solvency II framework



Source: Adapted from Swiss Re (2006). Solvency II: an integrated risk approach for European insurers. Sigma, 4/2006, Zürich: Swiss Re, p. 8.

One of the most significant innovations introduced by Solvency II in the regulation of insurers' investments is the adoption of the prudent person rule. Under the prior Solvency I regime, insurance laws contained lists of admissible assets and percentage ceilings, i.e. insurers were allowed to cover their technical reserves only with certain approved asset types (e.g. government bonds, rated corporate bonds, listed equities, real estate), and only up to fixed limits. Additionally, the pre-Solvency II regulation applied only to assets covering technical provisions (as opposed to all assets).[423]

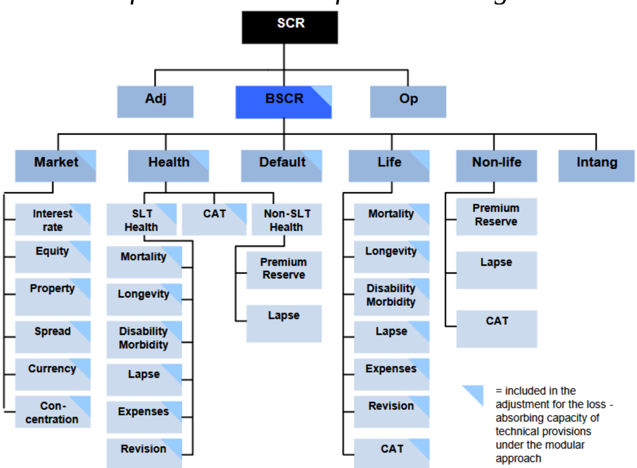
Solvency II eliminated these decades-old, strict quantitative rules, granting insurers greater freedom in managing their investment portfolios, provided they adhere to sound risk management practices. Insurers must ensure that assets are

[423] Chaplin, R. A. et al. (2024). *The Standard Formula: A Guide to Solvency II.* New York: Skadden, Arps, Slate, Meagher & Flom LLP, p. 84.

invested in a manner appropriate to the nature and duration of their liabilities, and that investment decisions take into account the security, quality, liquidity, and profitability of the portfolio as a whole.[424] This includes ensuring appropriate diversification, avoiding excessive exposure to single issuers, and conducting investments only in assets whose risks can be properly identified, measured, monitored, managed, controlled, and reported.[425]

In parallel with the shift toward qualitative standards in regulating investment activities, Solvency II imposes quantitative capital requirements to cover investment-related risks. The market risk module is a key component of an insurer's overall Solvency Capital Requirement (SCR) (Figure 2). It captures the risk of a decline in own funds due to changes in market variables such as equity prices, property values, interest rates, credit spreads, and exchange rates. These risks are measured through the standard formula or an internal model approved by the supervisory authority. The market risk module of the SCR calculation is directly affected by the structure of an insurer's investment portfolio, incentivising risk-sensitive asset allocation and diversification.

Figure 2. Standard formula modules for calculating SCR in Solvency II



Source: European Insurance and Occupational Pensions Authority (2014). The underlying assumptions in the standard formula for the Solvency Capital Requirement calculation. Frankfurt am Main: EIOPA, p. 6.

[424] Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II). *Official Journal of the European Communities*, 2009/138/EC, article 132.

[425] Ibid.

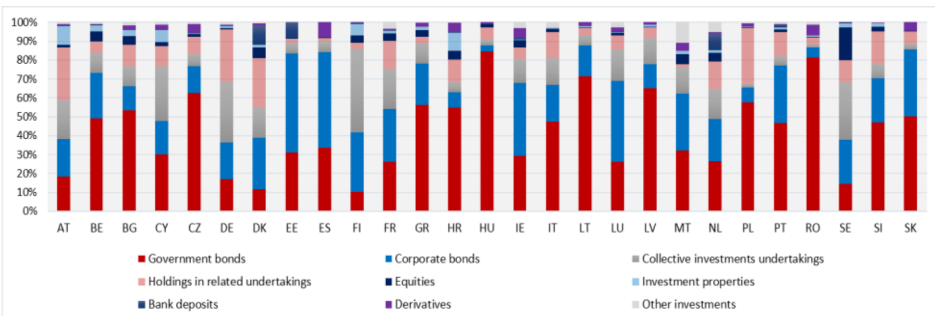
The standard formula involves the application of prescribed shocks calibrated to reflect extreme but plausible market scenarios for each market risk sub-module. For instance, the interest rate risk sub-module applies both upward and downward shifts to the yield curve. The capital requirement for each sub-module is derived by measuring the change in the value of the insurer's own funds between the base and shocked scenario. The overall capital requirement for market risk is then calculated by aggregating the capital charges from individual sub-modules using a predefined correlation matrix:[426]

$$SCR_{Market} = \sqrt{\sum_i \sum_j Corr_{i,j} \cdot SCR_i \cdot SCR_j} \qquad (1)$$

where:
SCR_i - capital requirement for market risk sub-module i,
$Corr_{i,j}$ - correlation coefficient between sub-modules i and j.

Although the prudent person rule allows insurers flexibility in investment decisions, the SCR imposes a quantitative capital charge based on the risk profile of those investments. This dual regulatory approach incentivises insurers to pursue investment strategies that optimise returns while maintaining capital adequacy and solvency. In addition to investment risk quantification, Solvency II requires insurers to conduct stress testing and scenario analysis to assess portfolio resilience and to implement hedging strategies to mitigate volatility.

Figure 3. Investment portfolio structure of EU insurers by country (data as of December 2024)



Source: Prepared by the authors based on data from https://www.eiopa.europa.eu/tools-and-data/insurance-statistics_en#balance-sheet

[426] Commission delegated regulation (EU) 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II). *Official Journal of the European Union*, L 12, article 164.

Despite the common regulatory framework under Solvency II, investment practices vary significantly across European countries. Figure 3 shows the structure of insurers' investment portfolios in EU member states at the end of 2024. In some of the observed countries, investments are heavily concentrated in government bonds, with limited exposure to other asset classes. In contrast, insurers operating in countries with more developed financial markets seem to exhibit a more diversified asset mix, including equities, investment funds, real estate, and derivatives.

To explore the differences in portfolio concentration depending on the level of financial market development, EU member states are divided into two groups. The first group includes countries with well-developed financial markets (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and Sweden), while the second group comprises those considered to have less developed financial markets (Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia).[427]

Table 2. Summary statistics of portfolio concentration indicators

EU member states with well-developed financial markets					
Indicator	**Mean**	**Median**	**St.Dev.**	**Skewness**	**Kurtosis**
HHI	2,636	2,604	600.90	0.1449	1.7953
CR3	78.24%	80.55%	8.11%	-0.3673	1.7809
Bonds share	56.12%	54.20%	16.53%	0.0608	1.3482
Government bonds share	29.10%	26.23%	15.49%	0.4412	1.7590
EU Member States with less developed financial markets					
Indicator	**Mean**	**Median**	**St.Dev.**	**Skewness**	**Kurtosis**
HHI	4,061	3,820	1467.54	0.7886	2.9175
CR3	86.77%	90.16%	7.26%	-0.6367	1.7473
Bonds share	73.19%	77.19%	12.12%	-0.5925	2.4856
Government bonds share	54.49%	55.47%	16.93%	0.0824	2.2545

Source: Authors' calculations based on data from https://www.eiopa.europa.eu

Table 2 provides summary statistics of portfolio concentration indicators for the two groups of countries in Q4 2024, including the Herfindahl-Hirschman Index (HHI), based on the distribution of asset classes within insurers' investment portfolios; the concentration ratios for the top three (CR3) asset classes; and the shares of government bonds and total bonds. As shown, insurers operating in EU member states with less developed financial markets tend to exhibit, on average,

[427] The classification relies on commonly used indicators, including capital market size, liquidity, and availability of financial instruments, drawing on sources such as the European Commission's financial development reports and EIOPA data.

higher concentration (i.e., lower diversification) in their investment portfolios. They also exhibit different variability across countries, and, for most indicators, larger asymmetry (skewness) in portfolio concentration compared to insurers in well-developed financial markets.

To examine differences in portfolio concentration indicators between two groups of EU member states, the non-parametric Mann-Whitney test and the Brunner-Munzel test are employed.[428] Since the former test is based on the assumption of homogeneity of variances, whereas the latter does not require it, tests for equality of variances are first performed for each indicator before testing the differences in portfolio concentration.[429] The results are presented in Table 3.

Table 3. Testing results for equality of variances

Indicator	Levene F statistic (*p*-value)	Brown-Forsythe F statistics (*p*-value)	
	W_0	W_{50}	W_{10}
HHI	4.39462 (0.04634)	3.03530 (0.09376)	4.03292 (0.05554)
CR3	0.48948 (0.49062)	0.28121 (0.60058)	0.50608 (0.48343)
Bonds share	4.27473 (0.04918)	3.31659 (0.08057)	4.09831 (0.05373)
Government bonds share	0.00431 (0.94818)	0.03982 (0.84344)	0.01087 (0.91777)

Note: W_0 - Levene mean-based test statistic robust to violation of normality assumption; Brown and Forsythe statistics based on robust estimators of central tendency instead of mean: W_{50} and W_{10} – statistics based on the absolute deviations of observations from the median and 10% trimmed mean of each group, respectively.
Source: Authors' calculations based on data from https://www.eiopa.europa.eu

For HHI and total bond share, the value of the mean-based Levene statistic (W_0) indicates notable variance differences at the 5% level, whereas the robust Brown-Forsythe test statistics based on median and 10% trimmed mean (W_{50} and W_{10}) suggest differences at the 10% significance level. On the other hand, in the case of the concentration ratios of the top three asset classes and the government bonds share, none of the three tests shows significant variance differences (Table 3). Given these findings, the following analysis is based on both the Mann-Whitney

428 In general, the Mann-Whitney test is used to examine whether the two populations have the same distribution (identical in shape and spread), whereas the Brunner-Munzel test does not require the assumptions of equal variances or identical distributions. See more in: Brunner, E., & Munzel, U. (2000). The Nonparametric Behrens-Fisher Problem: Asymptotic Theory and a Small-Sample Approximation. *Biometrical Journal*, *42*, pp. 17-25.

429 Brown, M. B., & Forsythe, A. B. (1974). Robust tests for the equality of variances. *Journal of the American Statistical Association*, *69*, pp. 364-367.

and Brunner-Munzel tests. Additionally, the Brown-Mood median test is employed to examine differences in the medians of observed indicators between the two groups of EU member states, with testing results in Table 4.

Table 4. Testing results for portfolio concentration differences

Indicator	Mann-Whitney U statistic (*p*-value)	MW prob.*	Brunner-Munzel statistic (*p*-value)	BM prob.*	Median test – Fisher exact *p*-value
HHI	160.0 (0.0008)	0.879	5.61 (0.000)	0.8712	0.001
CR3	146.0 (0.0063)	0.802	3.42 (0.002)	0.8022	0.016
Bonds share	143.5 (0.0095)	0.788	3.28 (0.003)	0.7885	0.087
Government bonds share	164.5 (0.0001)	0.904	7.19 (0.000)	0.9038	0.005

Note: For Mann–Whitney and Brunner–Munzel tests, both the value of test statistic and exact p-value for small samples are reported. Median test p-values are 1-sided Fisher's exact probabilities, since at least one expected count was less than 5.

* Estimated probability that a randomly chosen value of the indicator from the group of less-developed financial markets is greater than the value from the group of well-developed financial markets.

Source: Authors' calculations based on data from https://www.eiopa.europa.eu

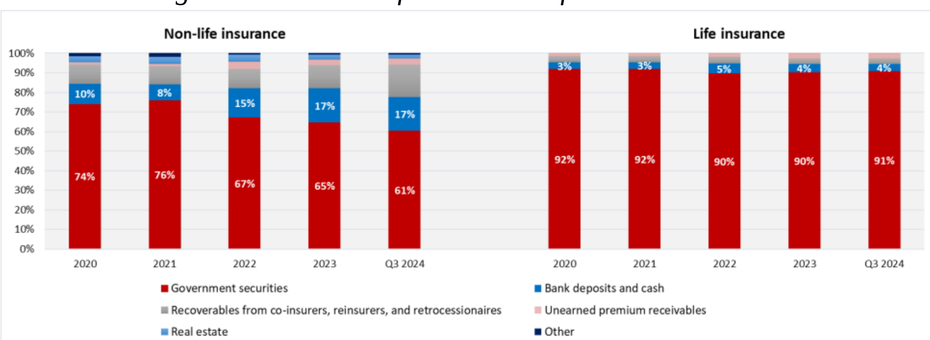
According to the results of the two non-parametric tests, it can be concluded that the differences in all four portfolio concentration indicators are significant between the two groups of countries at a 1% significance level, indicating a substantial gap in the distributions. These findings are further supported by the results of the median test, based on 1-sided Fisher's exact p-values. Median values are higher in less-developed financial markets for the Herfindahl–Hirschman index and government bonds shares at the 1% level, while for CR3 at the 5% level, and for total bonds shares at the 10% significance level. Furthermore, both the estimated Mann-Whitney and Brunner-Munzel probabilities, varying from 0.79 to 0.90, indicate considerably higher portfolio concentration (i.e., lower diversification) among insurers operating in EU countries with less-developed financial markets than in well-developed ones. All previous findings from the analysis of EU member states confirm that, even within a harmonised regulatory framework, portfolio composition varies significantly across financial markets with different levels of development.

4. INVESTMENT OPPORTUNITIES AND CONSTRAINTS FOR INSURANCE COMPANIES IN SERBIA

Insurance companies operating in Serbia are required to hold the assets covering technical reserves in accordance with quantitative portfolio regulations that define both eligible asset types and maximum exposure limits. Limits are defined as percentages of the value of technical reserves, both for total exposures to a particular asset class and for exposures to a single issuer (Table 5). Foreign placements of assets covering technical reserves are permitted only under restrictive conditions, requiring prior approval from the National Bank of Serbia and limited to 25% of the minimum prescribed monetary amount of the insurer's share capital.[430]

The structure of assets covering the technical reserves of Serbian insurance companies varies depending on the type of insurance (Figure 4). According to data for Q3 2024, non-life insurance technical provisions of all insurers were primarily invested in government securities (60.5%), bank deposits and cash (17.1%), and recoverables from co-insurers, reinsurers, and retrocessionaires (16.6%). Over time, the share of government securities has gradually declined, while the shares of the other two asset categories have increased.[431] By contrast, the investment portfolio of life insurers is more concentrated, and its structure has remained relatively stable over time. The largest portion of the portfolio (91% as of Q3 2024) is allocated to government securities.[432]

Figure 4. Structure of investment of technical reserves



Source: Prepared by the authors based on data from https://www.nbs.rs

[430] Law on Insurance, *Official Gazette of the Republic of Serbia*, No. 139/2014, 44/2021, article 137.

[431] National Bank of Serbia (2024). *Insurance sector in Serbia: third quarter report 2024*, Belgrade: National Bank of Serbia, p. 10.

[432] Ibid, p. 11.

Table 5. Types of assets eligible to cover the technical reserves of insurance companies in Serbia

Types of assets		**Limitations in relation to technical reserves**	
		Individual investments	Total investments
Securities issued or guaranteed by the Republic of Serbia, EU, or OECD member states, or their central banks		Without limitations	
Securities issued by international financial organisations of which the Republic of Serbia is a member		Without limitations	
Securities issued or guaranteed by autonomous provinces or local government units		≤ 35%	≤ 10%
Debt securities traded on the organised domestic market		≤ 35%	≤ 5%
Debt securities not traded on the organised market, issued by a domestic legal entity		≤ 3%	≤ 0.5%
Shares traded on the organised domestic market		≤ 25%	≤ 5%
Shares not traded on the organised market, issued by a domestic legal entity		≤ 5%	≤ 1%
Equity stakes in companies based in the Republic of Serbia		≤ 5%	≤ 1%
Investment units of investment funds (only for life insurance linked to investment funds)		≤ 100%	≤ 50%
Real estate and other real property rights	life non-life	≤ 30% ≤ 20%	≤ 10% ≤ 7%
Deposits with banks in the Republic of Serbia		≤ 20%	≤ 5%
Cash in currency, coins, or bank accounts	life non-life	≤ 7% ≤ 10%	≤ 5%
Recoverables from co-insurers, reinsurers, and retrocessionaires in non-life insurance		Without limitations	
Unearned premium receivables	non-life	≤ 10%	
Investment units of open-ended alternative investment funds	non-life	≤ 5%	
Policy loans secured by the surrender value of life insurance contracts	mathem. reserve	≤ 20%	

Source: Prepared according to Decision on Investment of Insurance Funds, Official Gazette of the Republic of Serbia, No. 55/2015, 111/2017, 149/2020, 137/2022 and 82/2024, articles 3-5.

The structure of assets covering insurers' technical reserves indicates the dominance of government bonds (particularly in life insurance), a significant presence of other forms of admissible assets beyond those explicitly defined by law (primarily recoverables from co-insurers, reinsurers, and retrocessionaires in non-life insurance), and a general underutilisation of the full range of investment possibilities permitted under regulatory limits. Instruments such as money market securities, municipal bonds, corporate bonds, equities, and investment fund units are practically absent, while the share of real estate remains well below the permitted maximum. Thus, quantitative portfolio regulations do not, in practice, determine the actual composition of Serbian insurers' investment portfolios. Rather, the main constraints on insurers' investment activity stem from the underdevelopment of the domestic capital market and the absence of an active money market.

Table 6. Trading activity on the Belgrade Stock Exchange – regulated market

Year	Equity trading volume (billion RSD)	Bond trading volume (billion RSD)	Number of transactions	Market capitalisation (billion RSD)
2024	3.3	33.1	19,086	472.4
2023	3.1	17.8	19,391	416.5
2022	9.9	26.8	19,945	257.1
2021	2.9	34.7	14,003	320.7
2020	3.6	43.7	15,734	287.4

Source: Prepared by the authors based on data from https://www.belex.rs

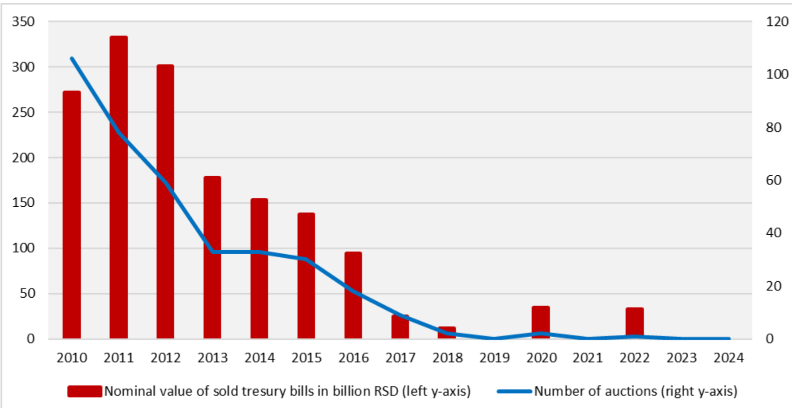
The number of shares traded daily on the Belgrade Stock Exchange is very small, and trading volumes are symbolic. Since the global financial crisis of 2008, there has been a continuous trend of companies delisting from the exchange, resulting in a steady decline in the number of available shares. In 2024, less than 10% of the total turnover on the regulated market was related to shares, while the remainder was generated by government bonds (Table 6). The total turnover on the Belgrade Stock Exchange in 2023 amounted to around RSD 20 billion, which roughly corresponds to the annual increase in insurers' technical reserves during the same year. Clearly, such trading volumes are insufficient to meet insurers' demand for eligible assets.

The Central Securities Depository registers 13 corporate bonds,[433] most of which were issued under the government support program for companies during the COVID-19 pandemic. Only three issuers have listed their bonds for secondary

[433] http://www.crhov.rs/?Opcija=5&TipHartije=kratkorocne (accessed 25.4.2025)

trading on the exchange;[434] the rest are traded through private placements. The Capital Market Development Strategy through 2026 envisions the development of the corporate bond market in Serbia.[435] In line with this, a primary issuance of five-year corporate bonds by a domestic private company was completed in April 2025, marking the first primary trading of financial instruments on the organised market in over a decade.[436] However, it should be noted that a well-functioning corporate bond market requires not only credible corporations as issuers but also a strong government bond market. In Serbia, the secondary market for government bonds is not sufficiently liquid, as trading is predominantly decentralised. In 2024, only around 10% of secondary market transactions occurred on the stock exchange, while the remainder were over-the-counter (OTC).[437] As for other long-term instruments, no municipal bonds are currently in circulation. Moreover, insurers in Serbia do not have access to financial derivatives for hedging market risks.

Figure 5. Treasury bills auctions, 2010-2024



Note: Euro-denominated treasury bill values were converted to dinars at the official middle exchange rate on the issuance date.

Source: Prepared by the authors based on data from https://javnidug.gov.rs

Among money market instruments, only treasury bills are issued in Serbia. However, their issuance has been declining (Figure 5). Over the past five years, they have been issued only three times - once in 2022 and twice in 2020.[438] These

[434] https://www.belex.rs/trzista_i_hartije/hartije/obv (accessed 25.4.2025)

[435] Capital Market Development Strategy for the Period 2021-2026, *Official Gazette of the Republic of Serbia*, No. 102/2021

[436] https://www.belex.rs/trgovanje/vesti/100476 (accessed 24.4.2025)

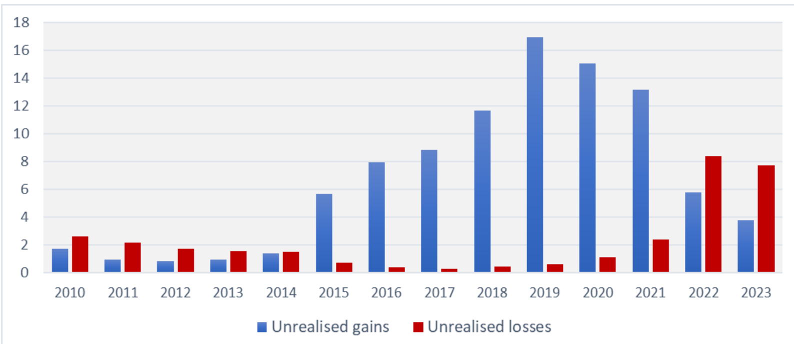
[437] Authors' calculations based on data from https://javnidug.gov.rs/rsc/tistorijsko.

[438] https://javnidug.gov.rs/rsc/istpregledprimtrgovanja (accessed 24.4.2025)

securities have since matured and are no longer in circulation. Other types of money market instruments, such as commercial papers, certificates of deposit, and bankers' acceptances, are virtually nonexistent. The availability of such instruments would be highly beneficial for insurers, primarily because they are important for maintaining liquidity. Furthermore, treasury bills are theoretically the only instruments that provide complete protection against inflation risk. As short-term instruments maturing every few months, they enable proceeds to be regularly reinvested at current market interest rates. In contrast, long-term bonds, when held to maturity, lock in yields determined at the time of issuance, which may be lower than prevailing rates later on.[439]

Given the underdevelopment of the domestic financial market, insurance companies are effectively constrained to rely on government bonds as the main financial instrument for covering their technical reserves. However, the pronounced concentration in government securities raises concerns regarding insurers' exposure to interest rate risk and the potential sensitivity of their financial position to both upward and downward movements in interest rates.

Figure 6. Unrealised gains and losses of insurers (in RSD billions), 2010-2023



Source: Prepared by the authors based on data from [*https://www.nbs.rs/sr_RS/finansijske-institucije/osiguranje/poslovanje/*](https://www.nbs.rs/sr_RS/finansijske-institucije/osiguranje/poslovanje/)

The rise in interest rates leads to a decline in the market value of existing bonds in portfolios classified as available for sale, resulting in unrealised capital losses, which will be realised if the bonds are sold before maturity.[440] During the most

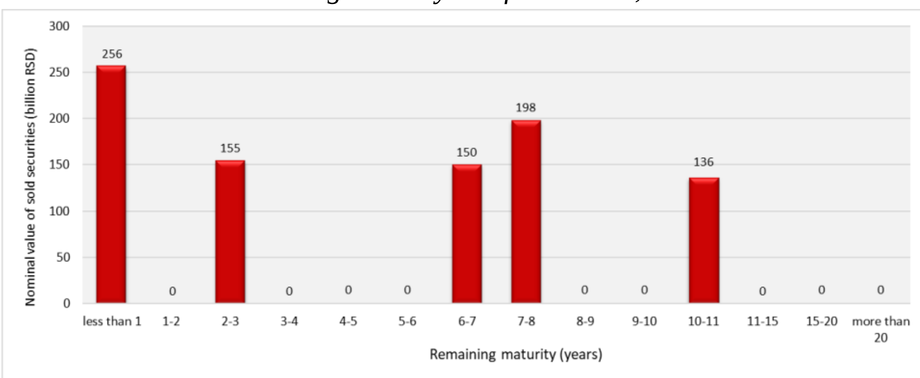
[439] Koprivica, M. (2022). The impact of inflation risk on life and non-life insurers. In: *Development of modern insurance market – constraints and possibilities*, Kočović et al. (eds.), Belgrade: University of Belgrade, Faculty of Economics and Business, pp. 255-271.

[440] See more in: Kočović, J., Koprivica, M., & Mitrašević, M. (2024). Impact of rising interest rates on insurance companies. In: *Transformation of the insurance market –*

recent phase of interest rate increases in 2022 and 2023, insurers in Serbia recorded unrealised losses that significantly exceeded unrealised gains, thereby reducing their capital levels (Figure 6).

Declining interest rates also pose a threat to the capital adequacy of insurers. When interest rates fall, the value of assets increases (due to the dominance of fixed-income instruments), but the present value of insurers' liabilities also rises. If assets and liabilities were perfectly matched in terms of maturity, their values would increase at the same rate, leaving the capital position unchanged. In practice, however, this is rarely the case due to the general scarcity of long-term fixed-income instruments (i.e., with maturities exceeding 10 years). Most life insurers exhibit a negative duration gap, meaning that the maturity of their liabilities exceeds that of the assets intended to cover those liabilities. As a result, liabilities are more sensitive to interest rate changes; therefore, when rates rise, the increase in the present value of liabilities exceeds the increase in the value of assets, leading to a reduction in the insurer's available capital.[441]

Figure 7. Outstanding government securities denominated in dinars by remaining maturity as of March 11, 2025



Source: Prepared by the authors based on data from [*https://javnidug.gov.rs/rsc/istpregledprimtrgovanja*](https://javnidug.gov.rs/rsc/istpregledprimtrgovanja)

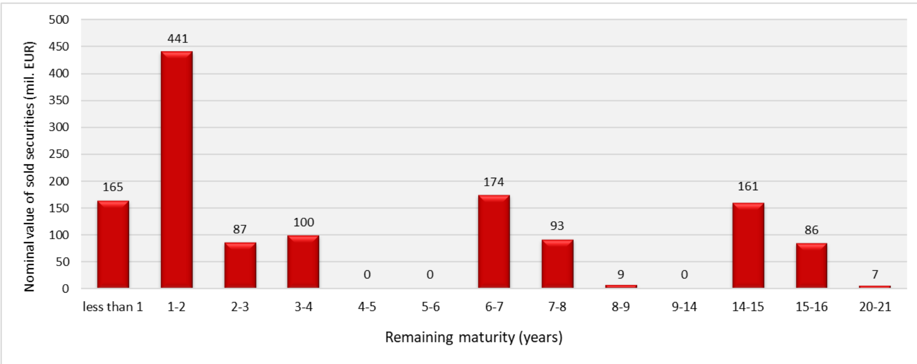
Figure 7 shows the maturity structure of outstanding dinar-denominated government bonds as of March 11, 2025. Nearly 30% of the total nominal value matures within one year, and an additional 17% falls into the two-to-three-year

responses to new challenges, Kočović, J. et al. (eds.), Belgrade: University of Belgrade, Faculty of Economics and Business, pp. 3-21.

[441] Koprivica, M., & Balleer, M. (2020). Prospects of the insurance sector in a low interest rate environment. In: *Insurance Market After COVID-19*, Kočović, J. et al. (eds.), Belgrade: University of Belgrade, Faculty of Economics and Business, p. 146.

bracket. There are no outstanding bonds with remaining maturities beyond eleven years. The shortage of long-term instruments significantly limits the capacity of institutional investors, especially life insurers, to invest in assets that reflect the long duration of their liabilities.

Figure 8. Outstanding euro-denominated government bonds by remaining maturity as of March 11, 2025



Source: Prepared by the authors based on data from https://javnidug.gov.rs/rsc/istpregledprimtrgovanja

Figure 8 depicts the maturity structure of outstanding euro-denominated government bonds, which appears slightly more diversified but remains limited in volume. Approximately 46% of these securities mature within the next two years, while those with maturities beyond 15 years account for less than 8% of the total. The total value of bonds with remaining maturities over 15 years is below EUR 100 million, which is low compared to the mathematical reserves of Serbian insurers, amounting to over EUR 1 billion at the end of 2024.[442]

This shortage of long-term government bonds across different maturities prevents insurers from building investment portfolios aligned with the duration of their liabilities, particularly in life insurance, where obligations often extend over several decades. Even under ideal conditions, where insurers could fully allocate their assets to the currently available government bonds, asset-liability duration matching would remain unachievable. The resulting duration mismatch increases insurers' exposure to interest rate risk, undermining their capital adequacy and solvency.

* * *

[442] https://www.nbs.rs/export/sites/NBS_site/documents/osiguranje/tromesecni/T6_IV_2024.pdf (accessed 30.4.2025)

While the prudent person rule underlying Solvency II implies greater flexibility and risk sensitivity in investment regulation, its effectiveness largely depends on the maturity and depth of the financial market, as well as the institutional capacity of both insurers and regulators. In countries with less developed financial markets, weaker corporate governance and limited supervisory resources, giving insurers full investment freedom could be dangerous. In these cases, quantitative rules remain a necessary safeguard to ensure asset quality and risk control in the absence of broad diversification and advanced risk modelling capabilities.

Insurance companies in Serbia are required to cover their technical reserves with eligible assets within prescribed limits. However, the structure of their investments is primarily shaped by the reality of the domestic financial market, which remains underdeveloped across all key segments, including the money, capital, and derivatives markets. This not only hampers efficient capital allocation but also impedes asset-liability management aimed at mitigating interest rate, currency, and liquidity risks. In such conditions, insurers cannot fully assume their role as institutional investors. Therefore, the main constraint on their investment activity stems not from regulatory rules, but from market underdevelopment.