Assesment of degree of monopolization of insurance sector in Serbia in the period 2011–2020

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ASSESMENT OF DEGREE OF MONOPOLIZATION OF INSURANCE SECTOR IN SERBIA IN THE PERIOD 2011–2022

Abstract

This article deals with the matter of determining the level of monopolization in the insurance sector of Central Serbia during the period 2011–2022. The basis of the research were data on the total insurance premium of insurance companies, for which we calculated the market concentration coefficient and the Hirschman-Herfindahl Index (HHI), as the most popular and most commonly used measures of concentration. Their values show a (relatively) high level of concentration, but without clear tendencies in its movement, and with minimal decline overall. Based on the equivalent number, as the reciprocal (inverse) value of the HHI coefficient, an index called the monopoly market ratio or boundary index of market monopolization was proposed, showing the degree to which the market is monopolized. The values of this index during the observed period range from around 75 to 60, with a clear downward tendency, significantly more intense than the minimal decline in the concentration coefficient values. This indicates that the insurance market in Serbia is reducing the influence of monopolistic (and oligopolistic) structures during the given period and is becoming increasingly competitive, despite the decrease in the number of insurance companies in the first half of the observed period and their unaltered number since 2018.

Key words: *monopolization, concentration, competition, insurance, Serbia, indicators, market shares, number of companies, equivalent number.*

JEL: C38, D43, G22, L11, L84

I. Introduction

Competition, as one of the fundamental economic concepts, has been at the centre of attention in theoretical and applied research for many years, especially during the last few decades, during which the paradigm

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of the free-market mechanism has prevailed both in theory and in practice. Furthermore, the action and observance of market criteria are considered necessary not only when it comes to the real sector of the economy but when dealing with the financial sector, where they are also implied. Therefore, in our business environment, an increasing number of studies are directed towards this aspect of economic and financial tendencies.

Most generally defined as "the process of conscious competition among economic agents for the most favourable conditions of sale or purchase in the market,"[2] competition has been a subject of consideration even before the establishment of economic science. In the writings of ancient thinkers, Christian theologians, ancient Chinese philosophers, and others, issues of competition were treated in relation to the need to introduce various restrictions on capital markets, usury, determining so-called fair prices, and so on. Traditionally, the establishment of the theory of competition as a subject of scientific interest is associated with Adam Smith, considered by many as the founder of economic science, and his famous work "An Inquiry into the Nature and Causes of the Wealth of Nations," published in 1776[3], although similar issues were discussed by many philosophers before him[4]. Smith founded three approaches to competition, which are still present in economic science today: behavioural, functional, and structural.[5] Over the years, thanks to the works of numerous economists, and not only them, competition has gained renown as a model suitable for application not only in economics but also in sociology, anthropology, as well as in natural sciences (biology, ecology), and other disciplines.

Over the course of the development of market economies,

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[2] А. Д. Некипелов (ред.), *Популярная экономическая энциклопедия*, Москва: Большая Российская энциклопедия, 2003, p. 129.

[3] A. Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, translated into Serbian as A. Smit, *Istraživanje prirode i uzroka bogatstva naroda*, Beograd: Kultura, 1970.

[4] Primarily, ancient thinkers such as Xenophon, Plato, Aristotle, and in the modern era, mercantilists have been considered here. Alongside well-known and frequently cited mercantilist writers like Thomas Mun, Antoine de Montchrétien, Walter Stafford, and others, in whose works significant attention is dedicated to state protectionism as a means of restricting competition from foreign commodity producers, it is certainly worth mentioning Ivan Pososhkov. His main work, "Book on Poverty and Wealth," was published exactly 300 years ago.

[5] For more details, refer to А. А. Рязанов, Эволюция теории конкуренции, *Вестник Московского университета имени С. Ю. Витте. Серия 1: Экономика и управление*, 2017, (2), pp. 21–22.

methods and techniques for researching the competition have also evolved. Throughout a tradition spanning more than two centuries, many aspects and characteristics of competition have been analysed and explained. However, not all aspects have been fully addressed. Consequently, theory has yet to establish even a unified and universally accepted definition of the concept of competition. Accordingly, various other aspects of this complex phenomenon have not been adequately resolved. One such issue, which also represents a central concern of the theory, is the measurement of competition, as an issue that is particularly important not only in theoretical terms but also much more so in practice, relative to the implementation of results (for example, in conceiving and implementing antitrust policies or competition protection policies). In the absence of a generally accepted answer to the above question, descriptive, relative ratings on an ordinal scale are most often applied, such as strong, moderate, weak competition, etc., based on expert assessments, sociological surveys, and sometimes, in a somewhat stricter approach, on the results or consequences of competition. Such results include the number of market participants, their achieved revenue (income) and profit, i.e., assets and capital, etc. These data (results) are then used to calculate the market shares of participants in the relevant quantities at the branch level or the entire economy, which were actually achieved in the competition process. In this way, research shifts from the domain of behavioural and functional approaches to a structural approach, whose subject is the state of the market (market structure).

Calculations and analyses of market participants' shares assume an understanding of the relationship between concentration and competition. Although its true nature is not known,[6] it is generally accepted that it is inverse, that is, higher concentration indicates lower competition, and vice versa. With this general assumption, the first question that arises is the choice of a measure for market concentration itself, followed by the question of the analytical possibilities provided by the selected measure(s). Unfortunately, both of these questions are not sufficiently illuminated or explained in most relevant studies and are generally found at the level of descriptions that existed in corresponding research during the period of the FPR/SFR Yugoslavia.[7] Given that such

[6] П. Ф. Воробьёв и С. Г. Светуньков. Новый подход к оценке уровня конкуренции, *Современная конкуренция*, 2016, 10(6).

[7] See detailed consideration in: R. Bukvić, Research on market structures in the economy of the Second Yugoslavia, *Ekonomika*, 1999, 35(1–2).

analyses are, of course, insufficient, the author has endeavoured, in his earlier works, to supplement and modify the approaches used so far, thereby providing insights into additional aspects of the investigated phenomenon.[8]

One such attempt is the following research, dedicated to determining the degree of monopolization in the insurance sector in Central Serbia. In line with the last note, a new approach will be applied, specifically an analytical tool that will, of course, require additional research and verification. Compared to previous research, the analysis has been extended to the period 2011–2022 and is based on conventional concentration coefficients, primarily the Hirschman-Herfindahl Index. The foundation for this research was laid in the author's previous work, which utilized a greater number of different concentration measures.[9] On this occasion, these, we might say, previous results have been generalized and supplemented. Subsequently, a new approach is proposed, and based on this, an assessment of the degree of monopolization in the sector is provided.

II. Methodology notes

The starting point of one of the most commonly applied approaches to assessing market competition is the actual shares of market actors, where the allocation of these shares among these actors serves as an indicator of competition. The basis of this approach lies in simple reasoning: the smaller the concentration of market shares, the less power individual actors have in the market, and therefore, the greater the development potential of competition. Such a relationship can be represented by a simplified linear model $L = 1 - C$, illustrating the aforementioned inverse

[8] In this context, the insurance section is considered in the following works: R. M. Bukvić, Decomposition of Changes in Concentration in the Insurance Sector in Serbia 2011–2020: The Impact of Changes in Market Structure and Number of Insurance Companies, *Ekonomski vidic*i, 2021, 26(3–4); R. M. Bukvić, New Approaches to Assessing the Degree of Concentration and Competition: The Example of the Insurance Sector in Serbia, XLVIII International Symposium on Operational Research, SYM-OP-IS 2021, Banja Koviljača, September 20–23, 2021, Proceedings, editors D. Urošević, M. Dražić, Z. Stanimirović, Belgrade: University of Belgrade, Faculty of Mathematics, 2021; R. M. Bukvić, Concentration in the Insurance Sector in Serbia: Changes in the Period 2011–2020 and their Decomposition, Tokovi osiguranja, 2022, 38(1).

[9] R. Bukvić, New Approaches to Assessing the Degree of Concentration and Competition: The Example of the Insurance Sector in Serbia, XLVIII *International Symposium on Operational Research*, SYM-OP-IS 2021, Belgrade: University of Belgrade, Faculty of Mathematics, 2021, pp. 93–98.

relationship between competition (L) and concentration (C) in the market. The assumption of a linear relationship should be considered too simplified; it is probably not entirely accurate. In some studies, it has been shown that this relationship is of a different, non-linear nature.[10] For the purposes of research in this paper, however, considering the specific nature of this relationship is not important; it is sufficient for us to assume its inverse character.

In the above relation, the crucial aspect is determining or measuring concentration (C). The level or degree of concentration - C, is determined based on the shares s_i of market actors in the relevant market:

$$s_i = \frac{Q_i}{Q} = \frac{Q_i}{\sum_{j=1}^{N} Q_j} \qquad (1)$$

where N represents the number of participants (usually producers) in the market, or some of the market parts (such as industry branches). Qi denotes the production volume (expressed physically or in value terms, or another quantity such as revenue, income, total assets, capital, number of employees, etc.) of the i^{th} actor in the market. The shares of the s_i in (1) can be expressed as percentages, which then reflects on the values of the concentration coefficients calculated on that basis. However, the choice of expressing shares or indicators in one way or another does not affect the construing of the results.

Since the beginning of the 20th century and the early works of Corrado Gini and Max Lorenz, the economists and statisticians have developed and utilized a variety of methods or indicators to assess the degree of concentration.[11] A significant impetus to the development of this area came along with a major economic crisis at the beginning of the fourth decade, when a vast amount of industrial statistics became available. Among the concentration measures, two indicators were most commonly used in the early stages, somewhat inversely related to each other: 1) the number of firms that account for a certain percentage (in most cases 80%) of the relevant aggregate (production, sales, revenue or income, assets, etc.).

[10] See: П. Ф. Воробьёв и С. Г. Светуньков. Новый подход к оценке уровня конкуренции, *Современная конкуренция*, 2016, 10(6), p. 6.

[11] To see a more detailed overview of the historical development of measuring concentration, refer to: T. Roberts, When Bigger Is Better: A Critique of the Herfindahl-Hirschman Index's Use to Evaluate Mergers in Network Industries, Pace Law Review, 2014, 34(2), pp. 896 and further.

$$S_{m^*} = \sum_{j=1}^{m^*} s_j = 80\% \quad (2)$$

where m* denotes a number of enterprises looked for (the number of entities satisfying the set criterion), and 2) sum of shares of a few major enterprises on the market

$$CRn = \sum_{j=1}^{n} s_j \, , \quad (3)$$

whereby at the indicator (3), in empirical analyses, n was most commonly taken as 4, although for this or any other option, explanations were generally not provided.[12] Regardless of the specific choice for n in calculating coefficient (3), it's evident that this indicator (as a simple sum of the shares of the top n market actors) focuses on the part of the market commonly referred to as the "core," while neglecting the "periphery." However, the boundary between these two market segments has not been precisely defined or explained. Moreover, the concentration coefficient does not actually reveal what is hidden in the "core" of the market, namely, the distribution of shares among these *n* (3, 4, or 5, 8, etc.) largest market participants.

Among indicators (2) and (3), in practice, the second one, known simply as the Concentration Ratio (CRn), has retained greater popularity as more reliable and informative, but also easier to calculate. The CRn gained and long maintained major popularity and significance amongst the numerous indicators, especially after being embraced by the DOJ (Department of Justice) in their first Merger Guidelines,[13] and has until nowadays remained, with the Hirschman-Herfindahl Index (HHI) [14] the most

[12] The number 4 has often been uncritically adopted, following the monographs of the Temporary National Economic Committee (TNEC), where this number of market participants was chosen for practical reasons without theoretical explanations. See: M. A. Adelman, The Measurement of Industrial Concentration, The Review of Economics and Statistics, 1951, 33(4).

[13] See: 1968 Merger Guidelines, U.S. Department of Justice, Antitrust Division, https://www.justice.gov/ sites/default/files/atr/legacy/2007/07/11/11247.pdf. /accesed on 01.02.2024./

[14] In the literature, this coefficient is often referred to as the Herfindahl coefficient (index), although the credit should go to Albert Hirschman, who used it as early as 1945 (albeit as the square root of the expression later provided by Herfindahl, which is still used today), while Orris Herfindahl did so only in 1950. This can be highlighted as one of the most well-known examples of the so-called Stigler's Law, or Stigler's Law of Eponymy, according to the eponymous paper from 1980. See: S. Stigler, "Stigler's Law of Eponymy," Transactions of the New York Academy of Sciences, 1980, 39 (1 Series II), which states that "no scientific

commonly used concentration indicator.[15]

While calculating the concentration ratio CRn requires only a few data points, the Hirschman-Herfindahl Index is computed by considering the shares of all participants in the relevant market, and/or, the market observed. Since the sum of all shares is, by definition, equal to one, we use the squares of these shares rather than the shares themselves for calculating this coefficient.

$$HH = \sum_{j=1}^{N} s_j^2 \qquad (4)$$

This actually means that the market shares of participants are weighted by those shares themselves. The Hirschman-Herfindahl Index owes much of its popularity and acceptance among economists specializing in industrial organization to Herfindahl's mentor, George Stigler.[16] It became nearly indispensable after being included in the new Horizontal Merger Guidelines[17] in 1982.

To calculate concentration coefficient (3), it is sufficient to have data on production, revenues, etc., for only a few (largest) market actors, making it simple and easy. However, it is characterized by several significant drawbacks, that limit its usefulness (among other things, it may have the same value for different distributions of shares within the "core" of the market it focuses on). In academic papers, it is often highlighted that coefficient (4) does not have such a drawback, which would make it considerably more acceptable and useful than coefficient (3). However, considering that its values range from

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discovery is named after its original discoverer." Stigler himself pointed out (rightly) that this law belonged to Robert K. Merton (who named it the Matthew Effect; see: R. K. Merton, The Matthew Effect in Science, Science, 1968, 159(3810)), so the law can be applied even to the author who discovered it!

[15] Similar assessments can be made for market research and their conditions in our context, where from the beginnings in the late 1950s until the end of the existence of the SFR Yugoslavia, only the concentration index CRn (first CR5 and then CR4) was used in analyses. For more details, see: R. Bukvić, Istraživanja tržišnih struktura u privredi druge Jugoslavije, Ekonomika, 1999, 35(1-2). The Hirschman-Herfindahl index was first applied only in 2002 in the study by Begović et al., Antimonopoly Policy in the FR Yugoslavia, Belgrade: Center for Liberal-Democratic Studies, 2002, almost half a century after the beginning of market structure research.

[16] See: S. Calkins, The New Merger Guidelines and the Herfindahl-Hirschman Index, *California Law Review*, 1983, 71(2), p. 409.

[17] See: 1982 Merger Guidelines, U.S. Department of Justice, Antitrust Division, https://www.justice.gov/ sites/default/files/atr/legacy/2007/07/11/11248.pdf. /accesed on 01.02.2024.

$$\frac{1}{N} \leq HH \leq 1 \quad (5)$$

We will see that the fact that its minimum value depends on the number of market participants (N) cannot be ignored. Hence, the interpretation of coefficient (4) is significantly complicated, which also applies, to a large extent, to concentration coefficient (3). The impact of the number of participants on the size of the concentration coefficient is larger and more significant, especially in markets with fewer participants (which is actually the case for most markets in Serbia), such as the insurance market. This aspect must not be overlooked. Therefore, it is necessary to neutralize the impact of the number of participants, and for such purposes, the normalized Hirschman-Herfindahl Index is formulated and used, although not as frequently.[18]

$$HHn = \frac{HH - \frac{1}{N}}{1 - \frac{1}{N}} \quad (6)$$

Its values are, of course, within the range from 0 to 1.

Both coefficients (3) and (4) appertain to the group of the so-called concentration measures, within which a greater number of coefficients have been developed and used. They differ in the weights assigned to market shares. Coefficient (3) is an unweighted index, meaning that each share included in the index calculation has had a weight equal to one. In contrast, the Hirschman-Herfindahl Index weights these shares, as do other indices in this group. In this case, the weights are actually the shares themselves. Clearly, in this way, the Hirschman-Herfindahl Index assigns greater significance to market participants accounting for larger shares, that is, to stronger market actors. However, it is probably more important to note that this weighting does not guarantee a unique relationship between the distribution of market shares and the level (degree) of concentration. Thus, the same value of the HHI coefficient can be obtained for very different configurations of market shares, indicating different market conditions.[19]

In the practical implementation of antitrust policy (competition

[18] As per D. Fibingr, Analýza koncentrace na trhu vepřového masa v České republice, *Acta universitatis agriculturae et silviculturae Mendelianae Brunensis*, 2004, 52(3).

[19] И. А. Смарагдов и В. Н. Сидорейко, Индексы рыночной концентрации: неоднозначная информативность, *Концепт*, 2015, p. 9.

protection policy), the application of both above specified indices (3) and (4) faces challenges in identifying types (forms) of competition based on their values. These challenges in implementing antitrust policy, although not in theory, are often "resolved" by arbitrarily setting particular levels of thresholds (for example, in the case of the Hirschman-Herfindahl Index, common thresholds have equalled 1,000 and 1,800 for three types of markets). This is carried out to establish the type of competition in the observed or researched market segment based on the value of index (4) and its placement in the corresponding segment: non-concentrated, moderately concentrated, and highly concentrated markets.[20]

In this paper, the authors have presented the results obtained through the application of the discussed coefficients, primarily the Hirschman-Herfindahl Index (HHI). A more detailed examination of other coefficients and results was provided in a recent communication,[21] including different approaches regarding the logic of aggregating market shares into a single number, accompanied by some other coefficients, either less popular or simply less used (such as the Gini, Rosenblatt, Theil-Hall, and others) for these purposes. The main reason for reducing the number of indicators is not in their (good or bad) characteristics; it lies in different goals set in this paper. Here, we are not interested in distinguishing the influence of two factors (the number of participants in the market and the magnitude of the dispersion of their shares) on the size of concentration indicators, which is determined based on the nature of the indicator itself. Namely, as emphasized several times,[22] and as confirmed by elementary transformations of the coefficient (4), the Hirschman-Herfindahl concentration coefficient can be represented as the sum of two components:

[20] This division was initially defined in the U.S. in the 1997 Horizontal Merger Guidelines and was later replaced in 2010 with thresholds of 1,500 and 2,500. See: Horizontal Merger Guidelines (1997) and Horizontal Merger Guidelines (2010). In other countries that use the Hirschman-Herfindahl Index for antitrust policy purposes, different thresholds between these types of markets are defined, but they are, of course, also set arbitrarily.

[21] R. Bukvić, New approaches to assessing the degree of concentration and competition: an example from the insurance sector in Serbia, *XLVIII International Symposium on Operational Research*, SYM-OP-IS 2021, Beograd: University of Belgrade, Faculty of Mathematics, 2021, pp. 93–98.

[22] С. Б. Авдашева и Н. М. Розанова, *Теория организации отраслевых рынков*, Москва: Издательство Магистр, 1998; И. А. Смарагдов и В. Н. Сидорейко, Индексы рыночной концентрации: неоднозначная информативность, *Концепт*, 2015, 9.

$$HH = N\sigma^2 + \frac{1}{N} \quad (7)$$

where σ^2 is variation (dispersion) of market shares s and N is the number of market participants. This has two conflicting implications. Firstly, expression (7) demonstrates the ambiguity in interpreting the value of the Hirschman-Herfindahl coefficient, which must not be overlooked.[23] The second implication pertains to the fact that expression (7) offers the possibility of distinguishing between the impact of market share variance (i.e., changes in market structure) from the number of market participants on changes in the level of concentration.[24] This distinction served as the basis for the research whose results we presented in the previous paper.[25]

Starting from the Hirschman-Herfindahl coefficient, as one of the most commonly used measures of market concentration, analyses can branch out in various directions and aspects. One possible yet underutilized approach is based on transforming the current market into one with an equal number of actors, i.e., equivalent actors.[26] This concept revolves around the idea of an equivalent count, defined as the inverse (reciprocal) value of this coefficient

$$Ne = \frac{1}{HH} \quad (8)$$

which is, as we can see, given as a cardinal number. What does the equivalent number represent? Let's look at expression (6) and assume that all participants in the observed market have equal strength, i.e., they have equal s_i market shares. In that case, the value of the coefficient (6), that is, (4), will reduce to 1/N, which is also its theoretical minimum. Therefore, the

[23] In the hypothetical example of Smaragdova and Sidorejko (Market Concentration Indices: Ambiguous Informativeness, Concept, 2015, 9), even in the case of equal market shares for all market players, the value of the Hirschman-Herfindahl index (HHI) would be 2,000 for five market actors and 1,000 for ten actors. Thus, in the first case, according to the usual thresholds for distinguishing market structures, the market would be classified as highly concentrated, while in the second case, it would be classified as unconcentrated, which is obviously absurd.

[24] С. Б. Авдашева и Н. М. Розанова, *Теория организации отраслевых рынков*, Москва: Издательство Магистр, 1998.

[25] R. M. Bukvić, Concentration in the insurance sector in Serbia: Changes in the period 2011–2020 and their decomposition, *Tokovi osiguranja*, 2022, 38(1).

[26] M. O. Finkelstein and R. M. Friedburg, The Application of an Entropy Theory of Concentration to the Clayton Act, *Yale Law Journal*, 1967, 76(4), pp. 689.

reciprocal value of the Hirschman-Herfindahl coefficient is the number of market participants of equal size and strength (equal shares) that generate the given value of the HHI (the minimum in this case, or any value in the general case)[27]. In other words, the equivalent number can be interpreted as the effective number of participants in the market, or in any other process, such as in an electoral competition[28]. This is exactly how the equivalent number is interpreted by the mentioned 1982 Guide[29] and it should not be confused with the common understanding of the term "effective," which is also encountered in academic texts.

Since the boundaries of the HH coefficient have been presented by range [1/N, 1], with the minimum when all participants have equal shares and the maximum in the case of only one market participant (complete monopoly), the boundaries of the equivalent number are given by range [1, N]. The equivalent number will have its minimum value (Ne = 1) in the case of a complete monopoly, and maximum value (Ne = N) in the case of equality among all market participants.[30]

It is clear from this that the difference (N - Ne) will indicate how far the specific market situation is from the state of complete equality of all market participants, which we can conditionally designate as a state of perfect competition. This difference will lie within the range [0, N - 1], taking the minimum value (N - Ne = 0) in the case of perfect competition, and the maximum value (N - Ne = N - 1) in the case of a complete monopoly.

Further to the foregoing, we can propose a coefficient that will indicate the deviation of a specific market from the state of perfect competition, that is, the degree of market monopolization. We will obtain this coefficient by normalizing the difference (N - Ne):

$$RMB = \frac{N-Ne}{N-1} \tag{9}$$

whose values, clearly, will range from 0 (when Ne = N), in the case of perfect

[27] M. A. Adelman, Comment on the H Concentration Measure as a Numbers-Equivalent, *The Review of Economics and Statistics*, 1969, 51(1), pp. 100.

[28] To read: The Inverse Herfindahl–Hirschman Index as an „Effective Number of" Parties, is.R() in R bloggers, December 17, 2012, *https://www.r-bloggers.com/2012/12/the-inverse-herfindahl-hirschman-index-as-an- effective-number-of-parties/*. accessed: 01.04.2024.

[29] See: III. HORIZONTAL MERGERS, A. Concentration and Market Share, 1. General Standards, c) Post-Merger HHI Above 1800.

[30] If the number of participants in the market is large, that would correspond to perfect competition, but not when that number is small.

competition to 1 (when Ne = 1), in the case of a complete monopoly. The RMB coefficient, or ratio, therefore, indicates the extent (area, or boundaries) of market monopolization, which is greater the closer its value is to figure one. It is also evident that its complementary coefficient (1-RMB) indicates the domain of competition in that market.

III. Overview of Level of Concentration in Insurance Sector in Serbia 2011–2022

The observed 2011 to 2022 period was marked by significant changes in the insurance market in Serbia[31], primarily reflected in the reduction in the number of insurance companies in the first part of the period (up to and including the year 2018). The number of companies ranged from 27 (in 2011) to 28 (in 2012 and 2013) and then dropped down to 20 (in the last five years), with a tendency to further decline. In relative terms, the reduction in the number of companies was very significant, but it was stopped in 2018. Among the companies operating in this sector, four have transacted exclusively the reinsurance business. In the subsequent analyses, the authors have focused on insurance companies, using data from the National Bank of Serbia, which have been presented in the reports titled "Total *Premium and Distribution of Premium by Insurance Companies*" for the observed years, as they did in their previous, already cited papers.

As we have already emphasized in the aforementioned papers, the characteristics of competition in the insurance sector, as well as in other parts of the financial sector, make the use of achieved revenue as a criterion inadequate, which is commonly used in the real sector of the economy (in addition to the physical volume of production, which has no analogue in the financial sector). Therefore, it is of primary significance to select the variable based on which concentration (and consequently, competition) will be defined. This issue is essentially resolved by Serbian current regulations (*Law on Protection of Competition*, Article 7), according to which the total premium for all types of insurance is used to assess the degree of concentration in this sector.[32] The authors have

[31] In the reports of the National Bank of Serbia, data for Kosovo and Metohia are not available, so the insurance sector of Serbia in this study does not cover the entire Republic of Serbia.

[32] M. Kostić provided other arguments for using this variable in: M. Kostić, Analysis of supply concentration in the insurance sector of Serbia, *Industrija*, 2009, 37(2).

also opted for that variable, considering that they were interested in the insurance sector as a whole. However, it is clear that for certain purposes, it is desirable (and sometimes necessary) to use other variables (total non-life insurance premium and total life insurance premium), as M. Dimić did in her doctoral dissertation.[33]

Let's first look at some relevant results that we presented in our previous paper[34], for the than observed period. We shall generally determine concentration using the mentioned indices – the concentration ratio (CRn) and the Hirschman-Herfindahl Index (HHI). This general picture will be supplemented and, in a certain sense, verified by the Linda indices. The Table 1 shows the values of the concentration indices CRn across four indicators (CR3, CR4, CR5, and CR8) and the Hirschman-Herfindahl Index relating to the observed period. The concentration index values here are given in percentages, meaning that the shares (1) were multiplied by 100. This, of course, does not change anything in terms of the meaning and significance of the indicators or the construing of the presented values.

Table 1. Values of CR3, CR4, CR5, and CR8 concentration indices, and Hirschman-Herfindahl Index in insurance sector in Serbia* 2011 to 2022

Year	Concentration index					Year	Concentration index				
	CR3	CR4	CR5	CR8	HH		CR3	CR4	CR5	CR8	HH
2011	63.1	72.1	77.4	88.6	1551	2017	59.8	71.5	77.2	88.6	1543
2012	62.4	71.6	77.3	87.5	1596	2018	61.0	72.6	78.4	89.7	1597
2013	59.8	70.3	75.8	85.6	1495	2019	59.7	71.4	77.8	89.3	1545
2014	60.6	70.8	76.5	87.7	1495	2020	59.1	71.0	77.6	88.7	1526
2015	61.2	70.9	76.1	87.5	1558	2021	57.7	69.0	75.9	87.3	1468
2016	59.5	70.2	74.9	86.2	1496	2022	56.6	68.0	75.0	87.1	1435

* Without Kosovo and Metohia
Source: Stated according to the data of the National Bank of Serbia in the publications titled„Total premium and premium distribution of insurance companies" for the relevant years.

The values of indices presented in Table 1 indicate a (relatively) high degree of concentration, regardless of highlighted issue of determining

[33] M. Dimić. *Analiza nivoa koncentracije u bankarskom sektoru i u sektoru osiguranja u zemljama centralne i istočne Evrope*, doctoral dissertation, Beograd: Singidunum University, 2015.

[34] R. Bukvić, New Approaches to Assessing the Degree of Concentration and Competition: Example of the Insurance Sector in Serbia, XLVIII *International Symposium on Operational Research*, SYM-OP-IS 2021, Belgrade: University of Belgrade, Faculty of Mathematics, 2021, pp. 93–98.

the boundaries between low, medium, and high concentration (or any other classifications), which in fact does not enable precise determination of such a degree. The values of the CR3 index range, with minor fluctuations, at around 60%, the concentration indexes CR4 cover just over 70% of the total premium amount, whereas the CR5 covers over three-quarters. Based on this, it can be considered that what is commonly referred to as the "core" of the market lies within these parameters. The results presented in Table 2, obtained by another methodological approach (Lerner indices), confirm this. Within this identified "core," two insurance companies stand out, with shares of around 26% and 20%, respectively, with a slight downward trend. On the other hand, but also entirely in line with this, it is obvious that the CR8 index has little informative applicability in terms of our environment (its value being only slightly less than 90% in all years), which can be expected due to the relatively small number of participants (insurance companies) and significant market shares of the largest ones. One more observation based on the results presented in the Table 1, which should be particularly emphasized, is the fact that there was no clear tendency in movement of the values of the concentration indexes used throughout the entire observed period. This could suggest that the "core" of the market was quite stable during that period, and changes within the "core" (considering the values of the CR3, CR4, CR5 indexes) were not particularly highlighted.

Figure 1. Insurance market concentration in Serbia*: Hirschman-Herfindahl and normalized Hirschman-Herfindahl Indexes 2011–2022

* Without Kosovo and Metohia
Source: Composed based on the data of the National Bank of Serbia.

A somewhat different picture emerges based on the values of the Hirschman-Herfindahl Index (see Figure 1). If the threshold between moderately and highly concentrated markets is accepted as the value of this index of 1,800, as prescribed in the 1982 Guidelines, the insurance market in Serbia during the observed period of 2011–2022 would have to be classified as moderately concentrated. Obviously, this is, at least to some extent, contrary to the information derived from the values of CRn concentration indexes, especially CR4 and CR5. Based on this, we can reiterate that for the market classification, or their structures, it is not sufficient to use a single indicator (index), but rather a combination of multiple indexes or methodological procedures.

The stated values of the Hirschman-Herfindahl Index are presented in Figure As already highlighted, the values of this index are greatly affected by the number N (number of participants in the market). The figure illustrates such a conclusion - as can be seen, there is a significantly lower level of concentration expressed through the normalized index, calculated according to formula (6). For a country like Serbia, where the majority of markets are characterized by a small number of participants, such a conclusion must be constantly kept in mind, whereas any research in the future should focus more on the use of that index.

The values of the indexes presented in the Table 1 above, indicate that there might be an oligopolistic structure, with the concentration of high market shares within a smaller group of companies. To verify this possibility, we applied a different methodological approach, common in the practice of a relevant antitrust body in the European Union (European Commission for Competition). It is about the index (more precisely - system of indexes) developed by the Commission's collaborator in Brussels, Remo Linda[35]. Linda proposed an index with the following general pattern:

$$IL_m = \frac{1}{m(m-1)} \sum_{i=1}^{m-1} \frac{m-i}{i} \cdot \frac{CRi}{CRm-CRi} \qquad (10)$$

from where, for each value of m, a separate expression (formula) is obtained, or a separate index, whereas the resulting indexes form a range, as a starting point for analysing the deviation of markets from perfect competition. The indices given by expression (10) are intended precisely for

[35] R. Linda, *Methodology of concentration analysis applied to the study of industries and markets*, Brussels: Commission of the European Communities, 1976.

testing the existence of oligopolistic structures, without using any arbitrarily set boundaries for this purpose, as is otherwise done when using other concentration indicators. The values of the indices themselves indicate whether an oligopoly exists in the given market in both perfect competition markets, where the values of the indexes will constantly decrease (ILm+1 > ILm for all m), and in the oligopolist market, contrary to this, the violation of that regularity. According to theoretical considerations, an oligopoly can be either firm (with 3–5) or loose (with 7–8 market actors).

The values of the Linda indices in the observed period are given in the Table 2. As can be seen, these values precisely illustrate, for each year, the interruption of the decreasing tendency of the range, thus indicating the existence of a (firm) oligopoly, although there are certain variations amongst individual years. The series of decreasing values of these indexes, namely, are interrupted in each of the observed years, however, not in the same order. In most cases, this occurs with the fifth consecutive index (IL5 > IL4) – sometimes even earlier - and in the last two years, with the sixth. All of this leads to the aforementioned conclusion about the existence of an oligopolistic structure. Therefore, in most years, an oligopoly has been formed by four companies, and in two years (2015 and 2016), the structure suggested a duopoly. Finally, in the last two years, the oligopoly has expanded (IL6 > IL5), and it consisted of five companies, but still remained within the bounds of a firm oligopoly.

Table 2. Values of Linda index in Serbian* insurance sector 2011–2020

IL	Year											
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
IL2	0,7089	0,7272	0,7011	0,5840	0,5759	0,5772	0,6302	0,6434	0,6150	0,6723	0,6748	0,7092
IL3	0,4703	0,5966	0,5828	0,5240	0,6102	0,5977	0,6107	0,6175	0,6042	0,6056	0,6103	0,6089
IL4	0,4911	0,5403	0,4840	0,4692			0,4620	0,4718	0,4586	0,4548	0,4636	0,4570
IL5		0,5488	0,5189	0,4997			0,5009	0,5066	0,4736	0,4661	0,4553	0,4435
IL6											0,4921	0,4759

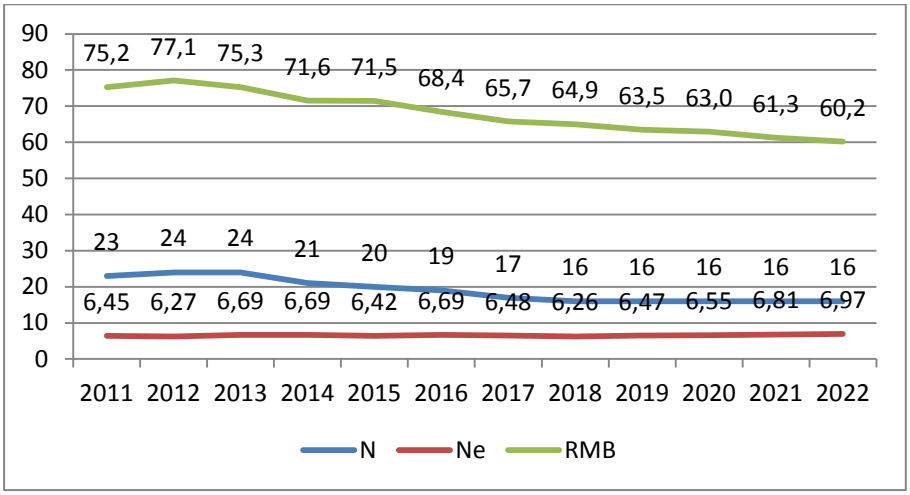
* Without Kosovo and Metohia
Source: Composed based on the data of the National Bank of Serbia in the publications titled „*Total premium and premium distribution of insurance companies*“ for the relevant years.

IV. Assessing the degree of monopolization in insurance sector

As previously mentioned, this part of the paper will focus on

assessing the degree of monopolization in the insurance sector during the observed period of 2011–2022. Section II provides necessary theoretical and methodological notes, while Section III offers a general overview of the concentration level. Here, based on what has been already presented, empirical analysis is conducted, along with an assessment of the degree of monopolization based on the proposed methodology, namely the RMB indicator.

Figure 2. Number of participants in market (N), equivalent number (Ne), and monopoly power index (RMB) in insurance market in Serbia* 2011–2022



* Without Kosovo and Metohia
Source: Composed based on the data of the National Bank of Serbia.

Let us first take a glance at the summarized results (Figure 2). We shall notice that the values of the equivalent number are quite stable, even though the number of participants (insurance companies) decreased until 2018. In the last two years, the values of the equivalent number have reached their maximum for the entire period. Albeit in some years (2012, 2015, 2017, and 2018) these values may have even recorded a decline, this has not affected the general growth tendency. This already indicates that the insurance market in Serbia (central part) has been gradually moving towards tightening the market conditions, or greater impact of competition. The values of the calculated RMB index more than confirm such a conclusion. Starting at 75.2 in the starting year 2011, it decreased to 60.2 in the final year of 2022, with a steady downward tendency (with the only exception in 2012, when a slight

increase was observed). Such movement of the index indicates that the insurance market in Serbia (central part) has become increasingly competitive during the given period, despite a significant decrease in the number of insurance companies (until 2018) and their subsequent unchanged number. Considering the pronounced fluctuations of the number of insurance companies, it is obvious that the values of dispersion of market shares of these companies contributed more to the movement of the proposed RMB index, resulting in a reduction of market share concentration. Based on the values of concentration indexes used in this study, such an unequivocal conclusion could not have been derived, and therein lies one of the key values of the research conducted here.

As a conclusion, we can state that the obtained results appear logical. Although the Hirschman-Herfindahl Index represents the basis for the RMB index, there is a relatively low correlation between them (0.42), indicating that the calculated RMB index brings new information to a significant extent, which has not been present in the Hirschman-Herfindahl Index. It should be noted that the time frame used in the conducted research (12 years) is too short for the calculated correlation to be deemed reliable, but its value is still indicative. Nevertheless, certain caveats should be considered, primarily regarding the influence of the number of participants in the market on its structure. This has been emphasized several times in the foregoing text and certainly requires further investigation and verification. However, this put aside, it would still be desirable to conduct similar research based on the concept of the equivalent number and other concentration indexes.

V. Final remarks

Contemporary economic theory observes the concept of competition as an essential factor for increasing competitiveness and efficiency in business, not only in the real sector but also in infrastructure activities, including the financial sector and, within it, the insurance sector. This approach to competition in the financial sector has become increasingly evident in the papers composed by our researchers, who have analysed the concentration and competition using both standard and newer methods. The number of such research papers and the applied methodological procedures, has been slightly greater in the banking sector than in the insurance sector so far, but the latter has received increasing attention. All of this can be positively evaluated.

The presented paper first provides an overview of the degree and

changes in concentration in the insurance sector using standard indicators (market concentration index and Hirschman-Herfindahl index). The main findings are supported by the values of the Linda index, confirming the assumption of an oligopolistic market structure in all years considered. In the next section of the paper, an assessment of the degree of monopolization in the insurance sector in Serbia (Central part only) during the period 2011–2022 was carried out based on a proposed new procedure. The research results in this paper indicated a relatively high level of concentration, suggesting the existence of an oligopolistic market structure, specifically a "firm" oligopoly. There were no significant changes in the level of concentration (and competition) during the observed period, but certain minor changes in the values of calculated indexes and a slight tendency of their decline have been spotted. It should be emphasized that during the observed period, the number of insurance companies significantly decreased (from 23 in 2011, and 24 in 2012 and 2013, to 16 in the last five years), which theoretically might not be considered positive in terms of competition. Namely, the assumption is that a decrease in the number of participants by definition leads to a reduction in market competition. However, the decrease in the number of companies in the insurance sector during the analysed period did not have a significant impact on the level of concentration; on the contrary, the structure, i.e., the distribution of market shares among insurance companies, primarily affected its magnitude. Therefore, the relatively significant decrease in the number of companies did not result in an increase in the level of concentration.

All the above confirms the fluctuations of the proposed monopolization degree coefficient of the market, which was relatively high throughout the period but constantly declining. The decline of this coefficient in the period observed has even been more pronounced than the (slight) decrease in the concentration index. This fact clearly neutralized the effects of the decrease in the number of insurance companies, simultaneously creating the environment for a more significant impact of competition amongst the insurance companies – and this certainly can be deemed a positive tendency.

Given the fact that there still is a relatively small number of studies devoted to concentration and competition in the insurance sector in Serbia, it is necessary to reiterate that we recommend further research, like that conducted in previous papers of the authors hereof. Of course, it is desirable to use different methodological approaches while conducting

such kind of research. This is necessary for a more comprehensive understanding of this complex phenomenon, especially since it has been shown that the most commonly used methods have certain, greater or lesser, shortcomings, and that attempts to overcome them constantly lead to new methodological solutions. Such new solutions are always worth testing in our conditions, especially when it comes to a complex problem like market competition.

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