Benchmark Ratio of Insurance Penetration (BRIP) as a New Relative Measure of Insurance Development and Benchmarks in Insurance

Agnieszka Pobłocka

University of Gdańsk

e-mail: agnieszka.poblocka@ug.edu.pl

ORCID: 0000-0001-8618-9921

Abstract

Aim: In various fields of science, certain patterns are used to describe and compare phenomena and reference points (benchmarks), e.g.: reference rates (benchmark rates), reference ratios (benchmark ratio), or comparative analyses (the benchmarking) (EY, 2021). In insurance, premium, density and penetration, among others, are used to describe market development. To compare insurance markets, the average is usually used, e.g. average premium, average density or penetration rate. However, the measures used are limited – premium and density do not take into account economic development – or have been 'devalued' (penetration rate is often with different premium and GDP growth rates). In effect, a new, more robust paradigm is being sought, i.e. a new insurance growth pattern.

Methodology: This paper analyses and evaluates the benchmark ratio of insurance penetration (BRIP) proposed by (Zheng et al., 2008 and 2009) as a new measure of insurance development and examined its advantages and disadvantages. The arithmetic mean was also analysed as a benchmark for comparing different insurance markets.

Findings: The BRIP indicator should be used with caution, as it strongly depends on the benchmark used for comparison. If it is adopted at the level of the arithmetic mean for the whole market, the analysis results may be incorrect when the distribution of the examined phenomenon does not have a central tendency.

Implications: The results of the study are a new contribution to the evaluation and application of the BRIP indicator in insurance theory.

Originality/value: Zheng et al. (2008, 2009) proposed the BRIP indicator as a new benchmark for the development of insurance markets, without knowing that it cannot always be applied. The author of this study fills this gap and shows when this indicator cannot be applied (DeepL-assisted translation).

1. Introduction

In insurance, to describe and compare the development of insurers or insurance markets, usually the average value from the entire market is used as a benchmark, e.g. average premium, average density or average penetration (in a country, the EU, OECD countries, a geographical region, or the world). However, is this pattern correct? Is it a good reference point and appropriate statistics?

To analyse the development of insurance markets around the world, absolute (insurance premium and insurance density[1]) and relative (penetration[2]) measures of development are calculated (Bednarczyk, 2019). However, recently[3] penetration ratio in developed markets (including the USA, Japan, Poland) is decreasing, although other measures are increasing, such as premium, insurance density, profits, and in developing markets (e.g. selected BRICS[4] countries: Brazil, India, China) is growing significantly and reaching a high level (OECD, 2023). It follows from this that the traditional paradigms of insurance market development are limited (absolute measures do not take into account economic development) or have been 'devalued' (the penetration is often characterised by different rates of change in pre-miums and GDP, e.g. in Poland). As a result, a new, more solid paradigm for comparing insurance markets is being sought, i.e. a new measure – a new international pattern of insurance development.

The aim of the work is to analyse the benchmark ratio of insurance penetration (BRIP) proposed by (Zheng et al., 2008, 2009) as a new, relative international measure of insurance development in this century. For this purpose, its structure was examined and its usefulness in practice was assessed, indicating its advantages and disadvantages. An additional aim was to analyse the development pattern (benchmark) for comparing various insurance markets as an average of the entire market, e.g. average gross premiums, average density or penetration (in a given country, a geographic region or the world – e.g. in the EU or OECD countries) to establish whether it is a good reference point, and appropriate statistics. The paper is innovative because, to the best of the author's knowledge, there has been no research on a benchmark for insurance development.

The work verified two research hypotheses: 1) the BRIP ratio (a relative measure of penetration) as a new paradigm of the insurance development pattern is an appropriate measure for comparing the development of various insurance markets around the world; 2) the average of the entire market (e.g. average gross premiums, average density or penetration) is a universal standard – an appropriate reference point for comparing various insurance markets.

To test the above statistical hypotheses, the paper was divided into three parts: the first characterised the development of the insurance market, listed its measures, stages of development and factors influencing its growth; the second analysed the current state of development of the insurance markets using known and widely used in practice measures; the third presented a new measure of develop-

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[1]   Gross premiums, gross premiums per capita.
[2]   Gross premiums/Gross Domestic Product.
[3]   In 2018-2020.
[4]   O'Neill (2001) called the BRIC countries (Brazil, Russia, India, China) dynamically developing countries, joined by South Africa in 2011. These countries, according to a 2003 forecast by the Goldman Sachs Group, are to become world economic powers by the mid-21st century. The BRIC countries are Russia, India, and China – emerging countries and future world leaders in terms of economic development, according to experts.

ment – the relative insurance market penetration ratio (the BRIC ratio). Finally, the conclusions of the study are presented.

The study was an *ad hoc* study in which secondary statistical material was published by (Insurance Europe, 2022; OECD, 2023)[5]. The research methods were a critical analysis of the subject literature and statistical methods (analyses: statistical measures – measures of central tendency; time series – rate of change).

2. Development of the Insurance Market

The development of the insurance market as "a long-term process of improving the insurance market, insurance institutions and instruments, aimed at increasing the volume of insurance transactions and increasing their effectiveness" is extremely complex (Handschke, 2009 cf. Bednarczyk, 2011). It depends on many factors, including: internal (e.g. law, supervision, consumer awareness and protection, professionnal education, alternative risk management methods) and external (e.g. economic stability, freedom of entrepreneurship, law enforcement, development of the financial sector, tax) (Bednarczyk, 2011 cf. Rozumek, 2013) and economic and financial (including wealth, disposable income per capita, saving rate, insurance price, technical rate and inflation, unemployment rate), demographic (including gender, age, place of residence, education) (Śliwiński, 2011), social and cultural (risk aversion, level of education and culture) and institutional (state policy – legal norms, tax relief) (Bednarczyk, 2019).

Market development is measured using many development measures published, among others, in international statistical databases (Eurostat, Insurance Europe, OECD), including: gross (written) premium (the so-called premium or GP), penetration rate (gross premium to gross domestic product) and insurance density[6] (gross premium per capita) (Bednarczyk, 2011; Monkiewicz, 2004, 2010). National databases (e.g. in Poland KNF, PIU[7]) also publish technical and economic ratios (e.g. financial and technical result, net and gross profit, compensation and benefits paid gross and net of equity, core capital and their sources, ROE return on equity) and combined ratio, number of insurance company and employees). Additionally, concentration ratios (share in the total gross premiums of the largest insurance companies) are used for development analyses (Handschke, 2009), the Herfindahl-Hirschman Index (the sum of the products of the constant 10,000 and the squares of the shares in the total gross written premium) (Handschke & Rozumek, 2015; Kuryłowicz & Śliwiński, 2022).

The development of the insurance market changes over time, as there are several stages of development[8]: dormant (inactive, very weak), balanced (early growth), emerging (continuous growth), advanced (Bednarczyk, 2011; Enz, 2000 after Rozumek, 2013)[9]. To determine the current stage of development of a given market, a logarithmic S-curve[10] is determined, which is compared with

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[5]   These were the latest statistical data at the time of writing.

[6]   Namely the insurance coverage index (Herbich, 2007).

[7]   In Poland: the Polish Financial Supervision Authority and the Polish Chamber of Insurance.

[8]   A distinction is made between regular growth (when the penetration rate does not increase while GDP per capita increases) and deepening growth (when the penetration rate increases faster than GDP per capita, i.e. the gross written premium increases faster than GDP).

[9]   In practice, according to the International Monetary Fund, markets are sustainably developing and mature. Mature markets include: the USA, Canada, Western Europe (excluding Turkey), Israel, Oceania, Japan and other developed Asian economies (Hong Kong, Singapore, South Korea and Taiwan), while others are emerging markets. Poland classified as an advanced market from 2022 (Aizpun et al., 2021, p. 32; 2022, p. 37).

[10] The S-curve defined by R.L. Carter and G.M. Dickson in 1992 describes by R. Enz in 2000 as the relationship between GDP per capita income and the penetration rate (Bednarczyk, 2011, p. 90; Carter & Dickson, 1992 after: Zheng et al., 2008, p. 492; Enz, 2000, pp. 396-406 after: Rozumek, 2013, pp. 248-249; Handschke & Rozumek, 2015, pp. 203-216; Koprivica, 2022, pp. 221-236). The S-curve is not the subject of this analysis.

the standard – the average S-curve for the international market. If it is below the pattern, there is the so-called "insurance development gap", which can be closed by taking certain steps/incentives (economic or institutional factors in the development of the insurance market), e.g. legal standards, tax incentives, insurance education (Ortyński, 2010).

3. Insurance Markets and Popular Measures and Patterns of Their Development

In various fields of science, certain patterns are used to describe and compare phenomena, such as reference points[11] (benchmarks), reference rates[12] (benchmark rates), reference ratios[13] (benchmark ratio), and comparative analyses (the benchmarking) (EY, 2021). Generally speaking, a benchmark is a reference point – a pattern used in the study. The terms "benchmark" and "benchmarking" come from the English word meaning a special landmark visible from a distance. The benchmark was first used around 1842, and much later it became widely used in organizations. The American Productivity & Quality Center (APQC) defined the benchmark in 1993 as "best in class" (a pattern of excellence), i.e. the highest standard for the economic process.

In insurance the average value (usually the arithmetic mean) from the entire market (in a country, the EU, OECD, a geographical region or the world) is most often used as a benchmark to compare insurance markets, e.g. average gross premium (Figure 1), average density (Figure 2), or average penetration (Figure 3). When comparing insurance companies, the extreme (the largest or the smallest value) is most often used. However, the arithmetic mean is a classic measure and can be used as a comparison standard only when the examined feature distribution has a central tendency (it is symmetrical or moderately asymmetric), and there are no outliers (Makać & Urbanek-Krzysztofiak, 2006, p. 53), and a feature expressed on an interval or ratio scale. Hence the arithmetic mean does not always correctly describe the phenomena, especially when there is high variation[14] and asymmetry, therefore it may not always be a benchmark.

In 2020, the average gross premium in the presented 30 countries (cf. Insurance Europe) was EUR 40.7 billion, and three times higher than in Poland[15] (Insurance Europe 2022), where the total gross premium was EUR 13.61 billion (15th position in the ranking – 1.1% of the total GP). The highest premium was recorded in the United Kingdom (EUR 248.6 billion) and the smallest in Iceland (EUR 458 million), approximately 500 times lower than in Poland. This means the premium distribution was characterised by a hight dispersion[16], positive asymmetry[17] with small intensity[18] and concentration[19]. This distribution was not normal at the 0.05 significance level[20].

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[11] For example, the largest or best market participant, on the stock exchange, a model portfolio of shares.

[12] For example, WIBOR *Warsaw Interbank Offered Rate* – reference interest rate on loans on the Polish inter-bank market.

[13] E.g. average salary, average school grade.

[14] If the intensity of variation is high (variation coefficient $V > 70\%$), the arithmetic mean is not an adequate measure to evaluate the average level.

[15] In 2021, the global gross written premium amounted to USD 6.9 trillion. In 2021, Poland was listed on the world market in 35th place (40th in life insurance, 23rd in non-life insurance) according to the global SPB (Aizpun et al., 2022).

[16] The variation coefficient $V = 165\%$ (calculated in MS Excel).

[17] Third central moment $\mu_3 > 0$ (MS Excel).

[18] Third relative moment = third central moment / (standard deviation)^3 ($\alpha_3 = 0.17$); standard deviation is the unbiased estimator calculated from the sample in the MS Excel. Skewness = 2.

[19] Fourth relative moment $\alpha_4 = 0$; kurtosis = 3 (MS Excel).

[20] The Kolmogorov-Smirnov statistic $d = 0.28841$, p-value < 0.05 (Calculated in Statistica).
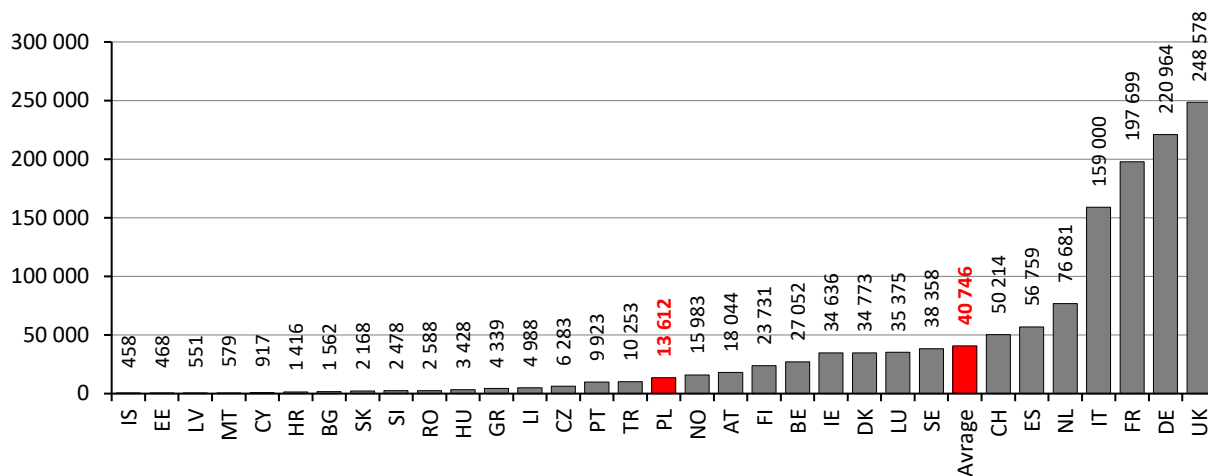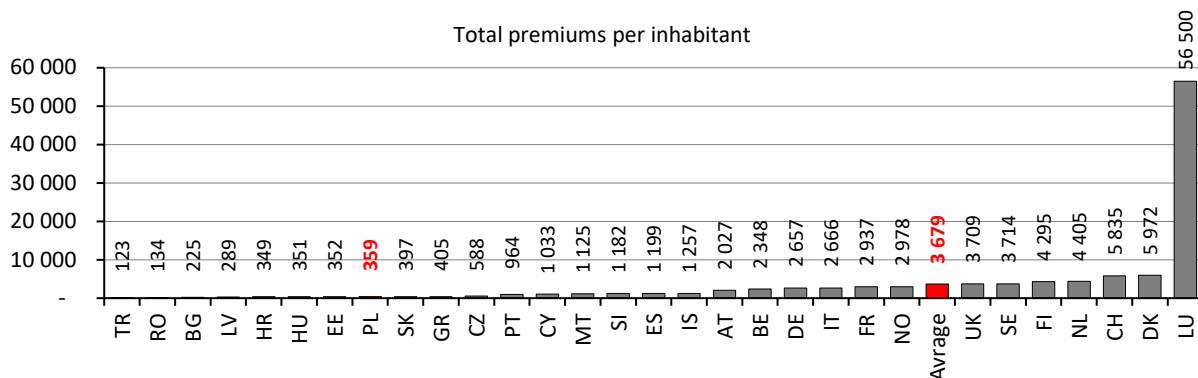
IS – Iceland, EE – Estonia, LV – Latvia, MT – Malta, CY – Cyprus, HR – Croatia, BG – Bulgaria, SK – Slovakia, SI – Slovenia, RO – Romania, HU – Hungary, GR – Greece, LI – Liechtenstein, CZ – Czech Republic, PT – Portugal, TR – Turkey, PL – Poland, NO – Norway, AT – Austria, FI – Finland, BE - Belgium, IE - Ireland, DK – Denmark, LU – Luxembourg, SE – Sweden, Average – mean in Insurance Europe countries, CH – Switzerland, ES – Spain, NL – Netherlands, IT – Italy, FR – France, DE – Germany, UK – United Kingdom. IE and LI data are from 2019.

Fig. 1. Total gross premiums in 2020 (EUR million)

Source: own work based on (Insurance Europe, 2022).

In 2020, the average gross written premium per capita in Europe was EUR 3,679 (Figure 2), which was ten times higher than in Poland where the density index was EUR 359 (23rd position in the ranking). The highest amount on insurance per capita was spent in Luxembourg (EUR 56,500, which resulted from the small number of inhabitants) and the least in Turkey (EUR 123). The distribution of insurance density was characterised by a very high dispersion[21], positive high asymmetry[22] and high kurtosis[23]. This distribution was not symmetrical and normal at the 0.05 significance level[24].

TR – Turkey, RO – Romania, BG – Bulgaria, LV – Latvia, HR – Croatia, HU – Hungary, EE – Estonia, PL – Poland, SK – Slovakia, GR – Greece, CZ – Czech Republic, PT – Portugal, CY – Cyprus, MT – Malta, SI – Slovenia, ES – Spain, IS – Iceland, AT – Austria, BE – Belgium, DE – Germany, IT – Italy, FR – France, NO – Norway, Average – country mean Insurance Europe , UK – United Kingdom, SE – Sweden, FI – Finland, NL – Netherlands, CH – Switzerland, DK – Denmark, LU – Luxembourg. *No data from IE, LI in 2020, so the study omitted these countries.

Fig. 2. Density ratio in 2020 (in EUR)

Source: own work based on (Insurance Europe, 2022).

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[21]   The variation coefficient V = 275% (MS Excel).
[22]   The third relative moment α_3 = 5; skewness = 5 (MS Excel).
[23]   The fourth relative moment α_4 = 25; kurtosis = 28 (MS Excel).
[24]   The Kolmogorov-Smirnov statistic d = 0.37707, $p < 0.01$ (Statistica).

In 2020, the average growth of the insurance market according to the penetration rate (Figure 3) was 6.8% of total GDP in Europe[25], and in Poland – 2.6% of Polish GDP[26] (22nd position), 2.6 times higher than in Poland. The greatest market development was recorded in Luxembourg (55.2% of GDP), and the least in Romania (1.2% of GDP). The distribution of the penetration rate was characterised by a high dispersion[27], positive asymmetry[28] of very high intensity[29] and high concentration[30]. This distribution was not symmetrical and normal[31] at the 0.05 significance level.

Total gross premium as % of GDP
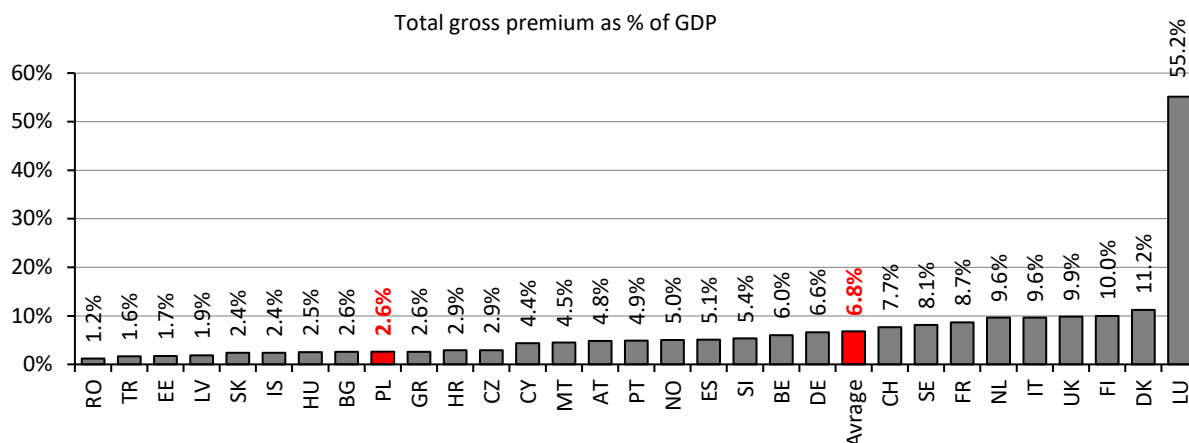
RO – Romania, TR – Turkey, EE – Estonia, LV – Latvia, SK – Slovakia, IS – Iceland, HU – Hungary, BG – Bulgaria, PL – Poland, GR – Greece, HR – Croatia, CZ – Czech Republic, CY – Cyprus, MT – Malta, AT – Austria, PT – Portugal, NO – Norway, ES – Spain, SI – Slovenia, BE – Belgium, DE – Germany, Average – average from Insurance Europe countries (taken from calculations at level 6, 4%), CH – Switzerland, SE – Sweden, FR – France, NL – Netherlands, IT – Italy, UK – United Kingdom, FI – Finland, DK – Denmark, LU – Luxembourg. *No data from IE, LI in 2020, so the study omitted these countries.

Fig. 3. Penetration rate in 2020 (in %)

Source: own work based on (Insurance Europe, 2022).

In conclusion, the arithmetic mean does not seem to be an appropriate benchmark (reference point) to describe and compare premiums, insurance density and penetration in different countries, as their distributions have a high dispersion, are asymmetric and therefore positional measures (e.g. median) are more appropriate measures to describe the average level of insurance development (and reference point). However, as can be seen from Figures 2 and 3, the density and penetration values for Luxembourg (LU) are very different from the other countries. Therefore, this country is an outlier, and Insurance Europe's insurance development can be examined without Luxembourg (for 29 countries) (Table 1).

Table 1. Measures of structure analysis, Kolmogorov-Smirnov d statistic and p-value

	Mean	Median	Standard deviation	Variation coefficient	Sequence	Kurtosis	K-S d	p-value
Density	1857.7	1 182.5	1 745.6	94	0.99	0.02	0.22083	$p < 0.1$
Penetration	5%	5%	3%	59	0.57	-0.97	0.17916	$p > 0.2$
Premiums	42374.5	10 252.9	70 602.5	167	2.05	3.12	0.28131	$p < 0.05$

Source: own study in Statistica, based on data (Insurance Europe, 2022).

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[25]   The published value by Insurance Europe was 6.8% of GDP, and from the calculations it was 6.4%.
[26]   The penetration rate in Poland in 2020 was 38.4% of the average penetration rate in Europe.
[27]   The variation coefficient V = 141% (MS Excel).
[28]   The third central moment $\mu_3 > 0$ (MS Excel).
[29]   The third relative moment α_3 = 4; skewness = 5 (MS Excel).
[30]   The fourth relative moment α_4 = 0.3; kurtosis = 24 (MS Excel).
[31]   The Kolmogorov-Smirnov statistic d = 0.30295, $p < 0.01$ (Statistica).

Table 1 shows that the distribution of premiums without Luxembourg is not normal at the 0.05 significance level, but there is no basis for rejecting the hypothesis that the distributions of penetration and density fit a normal distribution. Therefore, the arithmetic mean can sometimes be used as a benchmark. Hence, the arithmetic mean is not always an appropriate benchmark (reference point) to describe the average level of insurance development – premiums, insurance density and pene-tration – so positional measures such as quartiles for the median always would be appropriate.
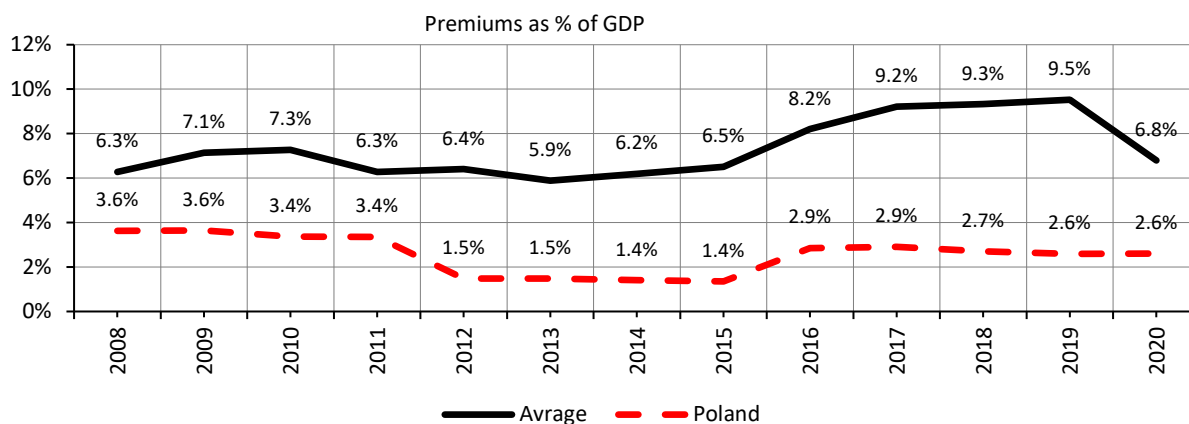

Fig. 4. Penetration rates in Europe and Poland in 2008-2020 (%)

Source: own work based on (Insurance Europe, 2022).

In the period 2008-2020, there was a continuous development of the insurance markets (premiums were always higher than GDP) according to average penetration rates in Europe and Poland, although it was 2-3 times faster in Europe (at 6.8% of GDP in 2020) than in Poland (2.6% of GDP in 2020).

In 2018-2020, penetration rates in developed markets (including Poland, the USA, Japan) decreased, although other measures – premium, insurance density, profits – increased, and in emerging markets they usually increased and reached high levels, e.g. in selected BRICS countries: Brazil, India, China (OECD, 2022). In 2020, compared to 2008, the average penetration rate in Europe increased by 0.5 percentage points, from 6.3% to 6.8% of GDP, and in Poland it decreased by 1% (from 3.6% to 2.6% of GDP), with an increase in gross written premiums (Figure 4). This was the reason for the change in the growth rate of gross premium and GDP. As a result, the penetration rate was devalued and should be used with care, especially when there are significant changes in values and directions, in the rate of change in the premium and GDP.

4. Relative Penetration Rate – BRIP Ratio

The benchmark ratio of insurance penetration (BRIP) is a proposed new measure of insurance development. It is a relative penetration ratio presenting the level of development of a certain insurance market in relation to the benchmark level of insurance development for the entire market, defined by (Zheng i in., 2008, 2009) as:

$$\text{BRIP} = \frac{\text{actual penetration}}{\text{benchmark penetration}} \cdot 100\%, \tag{1}$$

where: actual penetration is the penetration rate for a given market; benchmark penetration is the benchmark penetration rate for the entire market, e.g. European or world mean penetration ratio (benchmark penetration is the world – mean insurance penetration at a country's economic level).

The BRIP ratio, according to its authors, is a new paradigm for assessing the level of development of a given market in relation to the reference market as the "economic-adjusted insurance growth level", the measure applied by (Handschke & Rozumek, 2015) to insurance data without analysis of its construction.

From the data collected for the 29 countries in (Insurance Europe, 2020) (Table 1), the distribution of BRIP_IE is characterised by moderate dispersion[32] and small positive asymmetry[33] and normal distribution[34]. This means[35] that the arithmetic mean can be used as a benchmark and 12 countries were above the European mean and 17 countries were below the mean of 74 % (Figure 5). In Poland, in 2020, the development of the insurance market was recorded at 38% BRIP_IE (the mean of BRIP in 'Insurance Europe' countries). Therefore as many as 62 percentage points were missing from the average market development in Europe (Figure 6).
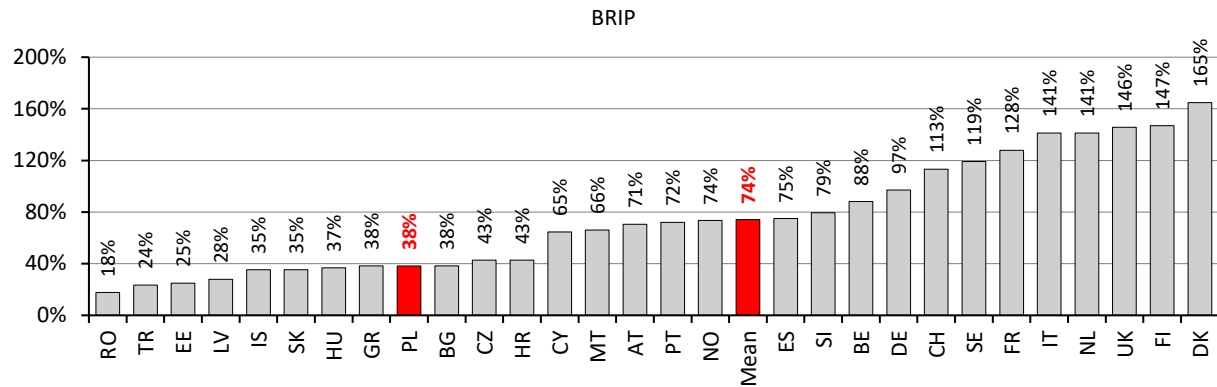
RO – Romania, TR – Turkey, EE – Estonia, LV – Latvia, IS – Iceland, SK – Slovakia, HU – Hungary, GR – Greece, PL – Poland, BG – Bulgaria, CZ – Czech Republic, HR – Croatia, CY – Cyprus, MT – Malta, AT – Austria, PT – Portugal, NO – Norway, Mean – Insurance Europe average, ES – Spain, SI – Slovenia, BE – Belgium, DE – Germany, CH – Switzerland, SE – Sweden, FR – France, NL – Netherlands, UK – United Kingdom, FI – Finland, DK – Denmark. Luxembourg was an outlier, so the BRIP was calculated on the basis of 29 countries.

Fig. 5. Relative penetration ratios in the 29 countries (Insurance Europe, 2020) (%)

Source: own work based on (Insurance Europe, 2022).
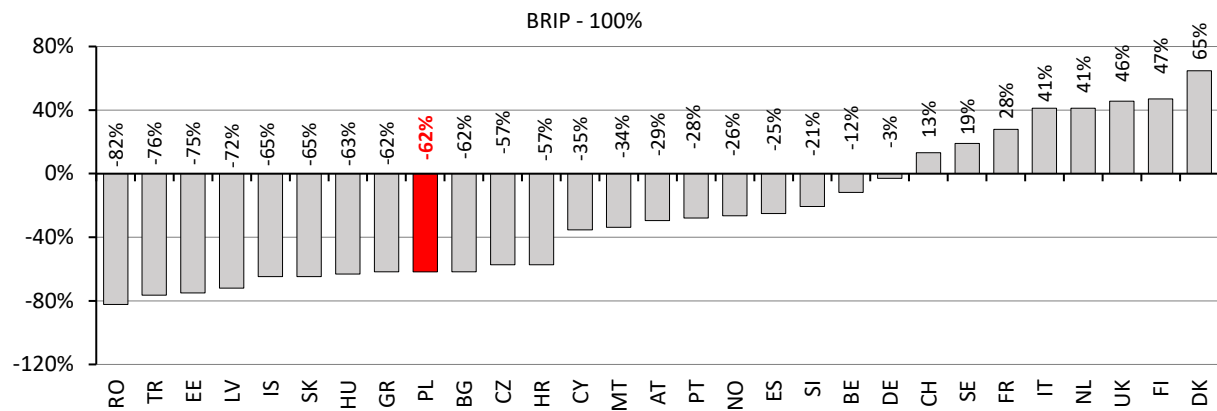
Key as in Figure 5.

Fig. 6. Relative penetration ratios – 100% in 2020 (in %)

Source: own work based on (Insurance Europe, 2022).

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[32] The variation coefficient V = 59% was calculated in the MS Excel.

[33] The third central moment $\mu_3 > 0$; α_3 = 0.6, skewness = 0.6 (MS Excel).

[34] At the 0.05 significance level, there is no reason to reject the null hypothesis that the distribution of the penetration rate of the 29 'Insurance Europe' countries (excluding Luxembourg) follows a normal distribution (Kolmogorov-Smirnov d statistic = 0.16716, $p > 0.2$; Statistica).

[35] If the distribution of penetration rates has a central tendency, the benchmark penetration rate can be the mean of penetration rate.

If the penetration rate of a given market (numerator from formula (1)) is lower than the benchmark ratio (denominator from formula (1)), there is a so-called 'penetration gap' and then BRIP-100% describes the distance to the standard, i.e. how many points percent is missing from the standard (the average level) in the study[36]. For example, Romania is missing 82 percentage points (%), and Germany 3% to the mean penetration in Europe. However, is the relative penetration rate (2) an appropriate measure of the international insurance growth pattern? Formula (2) shows that:

$$\text{BRIP} = \frac{\frac{GP}{GDP}}{\frac{\overline{GP}}{\overline{GDP}}} \cdot 100\% = \frac{\frac{GP}{GDP}}{\frac{\sum GP}{n}} \cdot 100\% = \frac{\frac{GP}{GDP}}{\frac{\sum GP}{\sum GDP}} \cdot 100\% = \frac{\frac{GP}{\sum GP}}{\frac{GDP}{\sum GDP}} \cdot 100\% = \frac{share\ in\ \ GP}{share\ in\ \ GDP} \cdot 100\%, \quad (2)$$

where: *GP* is the gross premium, *GDP* is the gross domestic product, $\overline{GP}/\overline{GDP}$ is the average gross premium ($\overline{GP} = (\sum GP)/n$) divided by the average *GDP* ($\overline{GDP} = (\sum GDP)/n$), share in *GP* is a share in the total gross premium, share in *GDP* is a share in the total gross domestic product.

Thus

$$\text{BRIP} = \frac{\text{penetration}}{benchmark\ penetration} \cdot 100\% = \frac{share\ in\ \ GP}{share\ in\ \ GDP} \cdot 100\%, \quad (3)$$

where: *GP* is the total gross premium, *GDP* is the total gross domestic product.

Formula (3) shows that the BRIP ratio is the share of SPB in (divided by) the share of *GDP*. This definition has no benchmark and no requirement that the penetration and BRIP distributions under consideration should be symmetric (normal) or moderately asymmetric. This means that the BRIP indicator can always be used and does not require the arithmetic mean as a benchmark.

Formulas (2) and (3) show that if for a given market the share in the total premium is higher than the share in the total *GDP*, then the BRIP ratio will be higher than 100%, and there will be an increase for a given market compared to the benchmark BRIP ratio and a dynamic development of the insurance market[37]. If the BRIP ratio for a given market is lower than 100% (than the benchmark BRIP – mean in IE countries), there will be a smaller increase for a given market compared to the benchmark BRIP ratio. This does not mean that there will be a decline in the development of the insurance market, but there will be a 'BRIP gap' (relative penetration gap – the so-called gap to the average level) showing how many percentage points are missing for the benchmark BRIP ratio (which is for example the mean of the entire market) (see Figure 7). In such a case, the growth rate of insurance in a given country is slower than the growth rate of the benchmark (the mean of the entire market). Why? This results from the adopted pattern (the mean of penetration rate) of the entire market. However, can the benchmark be always at the average level if the penetration distribution does not have a central tendency? (compare Figure 3 and Table 1[38])

The relative penetration ratio (BRIP) in Poland in 2008 was 58%[39] of the mean penetration rate in Europe (BRIP_IE), i.e. the so-called 'penetration gap' to the mean level (i.e. distance to the benchmark) was 42 pp. (100%–58%), and in 2020 the BRIP ratio was 38%[40], i.e. the "penetration gap" to the average Insurance Europe level was 62 pp. (100%–38%). Therefore, the Polish insurance market was moving away from the average in Europe (the maximum difference occurred in 2015 –79 percentage points), hence the development of the insurance market in Europe was growing faster than in Poland.

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[36] Relative gain – the distance of the penetration rate from the benchmark penetration rate, relative to the benchmark penetration rate. Statistically, this is the rate of change according to the (single-base index) benchmark penetration ratios.

[37] For example, in Switzerland, Sweden, France, the Netherlands, Italy, Great Britain, Finland, Denmark, Luxembourg, see Figure 6.

[38] In Figure 3, for the 30 countries (cf. Insurance Europe), the distribution is not normal and in Table 2 for the 29 countries, the distribution is normal.

[39] BRIP_2008 (for penetration rate) = 3.6% / 6.3% * 100% = 57.8%.

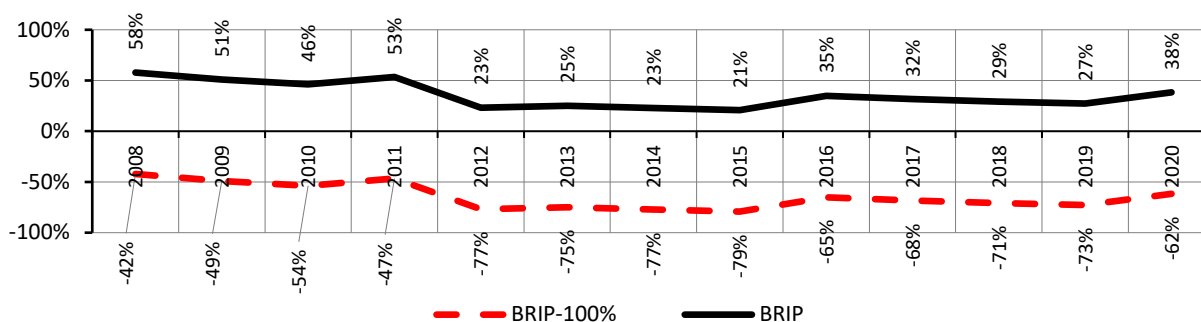[40] BRIP_2020 (for penetration rate) = 3% / 5.9% * 100% = 38.4%.

Fig. 7. Relative penetration ratio and relative penetration ratio – 100% in Poland in 2008-2020 (in %)

Source: own work based on (Insurance Europe, 2022).

The BRIP ratio does not show whether the insurance market is emerging, developing or developed. Since 2021, Poland has been one of the developed countries in terms of insurance (Aizpun et al., 2021, Appendix Table II), and the BRIP ratio since 2012 has been at a lower level than in the first decade of the 21st century. Therefore, it seems a mistake to accept the mean penetration rate in Insurance Europe countries (BRIP_IE) as a development model, especially since the distribution of the penetration rate is not always symmetrical. The benchmark penetration ratios could be based on positional measures of central tendency or a log S-curve model of insurance growth.

Comparing the penetration rates (Figure 3) with the relative penetration rates (BRIP ratios, see Figure 6), it turns out that the hierarchy in the development of insurance markets in the studied (Insurance Europe) countries has not changed very much. However, the authors of the BRIP measure for international data noted that for China (and emerging economies Brazil and India), the BRIP ranking is higher than the rankings of traditional rates (density and penetration). For the United States, and some developed countries, e.g. Japan, the United Kingdom, France and Germany, the BRIP ranking is lower than the rankings of traditional rates (premium, density and penetration). For this reason, BRIP seemed to its authors to be a more appropriate measure for international insurance comparisons. However, the distribution of the BRIP ratio and penetration rate (central tendency) were not examined in that study), which is crucial when the arithmetic mean is the benchmark.

Finally, for a deeper analysis and comparison of the results from Figures 3 and 6, the penetration rate in OECD countries was additionally examined (Figures 8 and 9). In 2020, the average growth of the insurance market in OECD countries according to the penetration rate was recorded at 9.4% of GDP, 3.6 times higher than in Poland where this rate recorded as 2.6% of GDP (29th position in the ranking). The greatest market development occurred in Luxembourg (30.9% of GDP), and the smallest in Turkey (1.5% of GDP). This means that the distribution of the penetration rate in all OECD countries (Figure 8) was characterised by high dispersion[41] and high positive asymmetry[42], and was not normal at the 0.05 significance level[43], hence the mean is not a good benchmark.

However, when Luxembourg (outlier) is removed from the data, such a distribution is characterised by lower dispersion[44], small positive asymmetry[45] and conformity to a normal distribution at the 0.05 significance level [46]. There is nothing wrong with using the arithmetic mean as a benchmark, and the same conclusion was reached for the Insurance Europe data.

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[41] The variation coefficient V = 86% was calculated in MS Excel.
[42] The third central moment $\mu_3 > 0$; α_3 = 2.6, skewness = 3 (MS Excel).
[43] The statistic d-Kolmogorov-Smirnov = 0.19017, p-value < 0.15 (Statistica).
[44] The variation coefficient V = 61% (MS Excel).
[45] The third central moment $\mu_3 > 0$; α_3 = 0.07, skewness = 0.7 (MS Excel).
[46] The statistic d-Kolmogorov-Smirnov = 0.16706, p-value > 0.2 (Statistica).
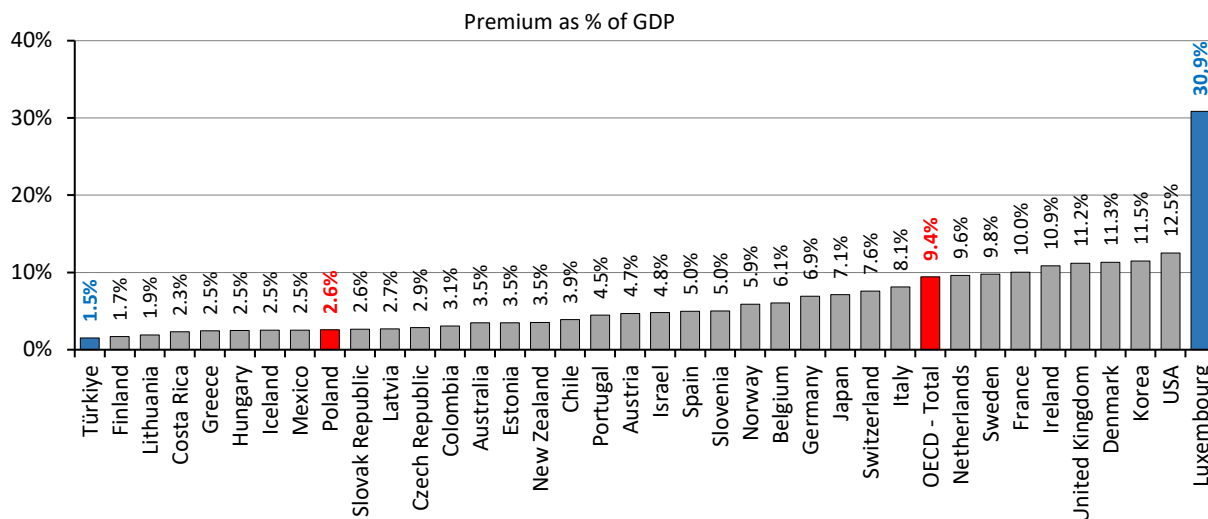
Fig. 8. Penetration rates in OECD countries in 2020 (%)
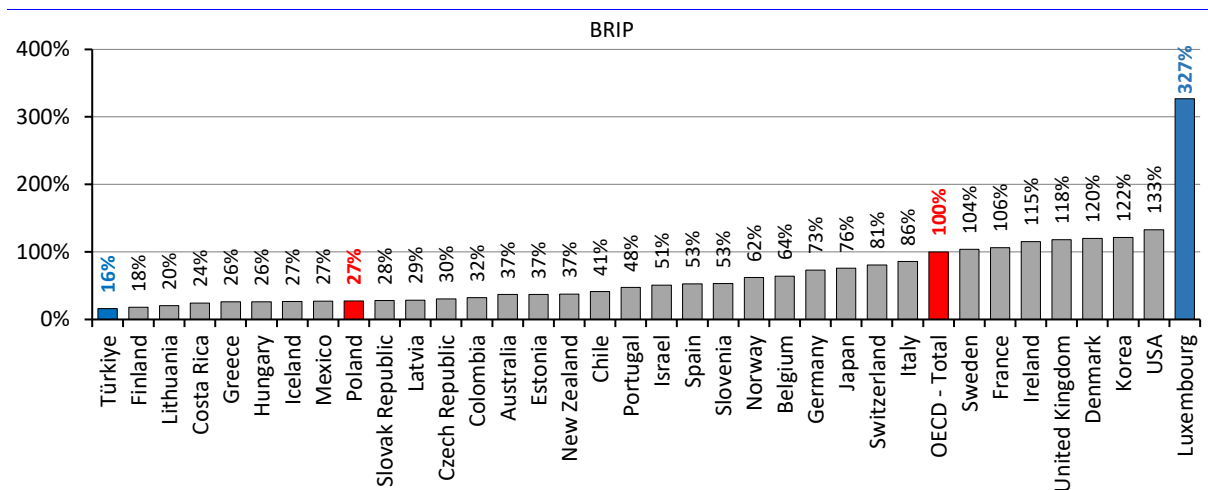
Source: own work based on (OECD, 2023).

Fig. 9. Relative penetration ratios in OECD countries in 2020 (in %)

Source: own work based on (OECD, 2023).

The distribution of the BRIP rate in OECD countries (without Luxembourg) in 2020 was characterised by moderate dispersion[47] and small positive asymmetry[48] and this was normal at the 0.05 significance level[49]. Hence, there is no objection to using the arithmetic mean as a benchmark of BRIP ratio. In 2020, the development of the insurance market in Poland was recorded at 27% of BRIP_OECD[50], which means that the average development in OECD countries was short by as much as 73 percentage points[51] (Figure 9).

To sum up, is the BRIC ratio a 'good' measure of insurance market development when it shows the development of a given market relative to a benchmark – the average of OECD or IE countries? The answer is no, because these distributions do not always have a central tendency.

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[47] The variation coefficient V = 61%.

[48] The third central moment $\mu_3 > 0$; third relative moment α_3 = 0.05, skewness = 0.78 (MS Excel).

[49] The statistic d-Kolmogorov-Smirnov = 0.17831, p-value > 0.2 (Statistica).

[50] Average penetration rate in OECD countries.

[51] The average penetration in Insurance Europe countries was 62% points short of BRIP_IE.

5.   Conclusion

The conducted analyses show that traditional paradigms of insurance market development are undoubtedly limited, and the relative penetration rate (BRIP) is an alternative measure of insurance market development. However, the proposed development pattern of insurance markets – the BRIP ratios – strongly depends on the adopted comparison pattern, and if it is adopted at the level of the arithmetic mean for the entire market, the analysis results may be incorrect when the distribution of the examined phenomenon (penetration rate) does not have a central tendency. Therefore, the BRIP measure should be used with caution, as it undoubtedly requires deeper research.

The study showed that when Insurance Europe's data included Luxembourg, the distributions of gross written premiums, insurance density ratios, penetration and relative BRIP penetration rate had high dispersion, were asymmetric and did not follow a normal distribution, so the arithmetic mean could not be used as a benchmark. However, after removing Luxembourg (outlier) from the data, the distributions of the penetration rate and the BRIP rate had small dispersion, little asymmetry and followed a normal distribution (symmetric), allowing the arithmetic mean to benchmark, however the distribution of gross premiums was not normal (symmetric), so the arithmetic mean should not be used as a benchmark. From the OECD data, the distribution of the penetration rate with Luxembourg was asymmetric. However, after removing Luxembourg (outlier) from the data, the distributions of the penetration rate and the BRIP rate had little asymmetry and followed a normal distribution (symmetric), allowing the arithmetic mean to benchmark.

The study also showed that the distributions of gross premium, density, penetration and relative penetration do not always have a central tendency, so that the arithmetic mean is not a universal reference point (positional measures such as quartiles – the median would be appropriate). As a result, there are some reasons to reject the first hypothesis and the second hypothesis. The conducted research does not exhaust the topic and will be continued in the future.

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Względna miara rozwoju ubezpieczeń BRIP i benchmarki w ubezpieczeniach

Streszczenie

Cel: W różnych dziedzinach nauki do opisu i porównywania zjawisk używa się pewnych wzorców, punktów odniesienia (*benchmarks*), np. stóp odniesienia (*benchmark rate*), wskaźników referencyjnych (*benchmark ratio*) czy analiz porównawczych (*the benchmarking*) (EY, 2021). W ubezpieczeniach do opisu rozwoju rynku ubezpieczeń stosuje się m.in. składkę, wskaźniki gęstości i penetracji, a do porównywania rynków najczęściej używa się średnią arytmetyczną (np. średnią składkę, średni wskaźnik gęstości czy penetracji). Jednak używane miary są ograniczone (składka i wskaźnik gęstości nie uwzględniają rozwoju gospodarczego) lub uległy „dewaluacji" (wskaźnik penetracji to miara względna często o różnym tempie wzrostu składki i PKB). W efekcie poszukuje się nowego paradygmatu.

Metodyka: W pracy badano i oceniano zaproponowany przez Zhenga i in. (2008, 2009) względny wskaźnik penetracji – wskaźnik *Benchmark Ratio of Insurance Penetration* (BRIP) jako nową miarę rozwoju. Analizowano także średnią arytmetyczną jako punkt odniesienia do porównywania różnych rynków ubezpieczeń.

Wyniki: Wskaźnik BRIP powinien być stosowany ostrożnie, gdyż jest silnie uzależniony od przyjętego wzorca porównań. Jeśli będzie to średnia arytmetyczna z całego rynku, to wyniki analizy mogą być obarczone błędem (średnia nie powinna być stosowana jako punkt odniesienia, gdy rozkład badanego zjawiska nie ma tendencji centralnej).

Implikacje: Wyniki pracy są nowym wkładem do oceny i zastosowania wskaźnika BRIP w teorii ubezpieczeń.

Oryginalność/wartość: Zheng i in. (2008, 2009) zaproponowali wskaźnik BRIP jako nowy wzorzec rozwoju rynków ubezpieczeń, nie wiedząc, że nie zawsze można go stosować. Autor opracowania uzupełnia tę lukę i wykazuje, kiedy nie można stosować tego wskaźnika.

Słowa kluczowe: rynek ubezpieczeń, rozwój rynku ubezpieczeń, benchmark, względny wskaźnik rozwoju ubezpieczeń BRIP