ANALYSIS OF INSURANCE MARKET DEVELOPMENT BASED ON THE S-CURVE - THE CASE OF THE WESTERN BALKAN COUNTRIES

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Abstract: One of the most commonly used measures of insurance market development is insurance penetration rate, as ratio of gross written premiums to the country's gross domestic product (GDP). Its important shortcoming is that it neglects the level of economic development of the country. The S-curve is a theoretical model describing the relationship between insurance penetration rate and GDP per capita and allowing a comparison of insurance development between countries at different stages of economic development. The paper analyzes the development level of insurance markets in the Western Balkan countries, in relation to the world average using the S-curve. The world S-curve is derived by estimating a non-linear regression model using data on insurance penetration and GDP per capita for 90 countries from 2006 to 2020. The insurance markets of the Western Balkan countries are below the world S-curve. In order to quantify insurance development gap, we calculated Benchmark Ratio of Insurance Penetration (BRIP) for each country using the world S-curve penetration level as a reference. The results show that the insurance development gap is growing in all countries of the region, except in Albania, where it is the largest. Insurance industry policy for the Western Balkans should focus on improving institutional factors in order to enable sustainable insurance growth in the long run.

Keywords: insurance market development, insurance penetration, GDP per capita, S-curve, Western Balkan countries.

JEL classification: G22, O40

1. Introduction

The developed insurance market contributes to the economic development of the country in many ways. The primary function of insurance is to preserve property, through compensation for damages caused by adverse events. Insurance protection of economic entities from various risks ensures the stability and continuity of their business and facilitates the process of social reproduction. Funds accumulated in insurance on the basis of collected premiums represent a part of national savings. A significant proportion of these funds is invested, and investments are the basic precondition for the economic development of a country. In addition to risk reduction and financial intermediation, insurance encourages economic development by fulfilling an important social function, fostering trade and entrepreneurship, and improving resource allocation. At the same time, the level of insurance development in a country is conditioned by the performance of its economy. A higher level of economic development allows more funds to be allocated for managing risks through insurance, implies greater awareness of citizens and economic entities about the role of insurance, and appears as a precondition for the realization of its functions.

The importance of the relationship between insurance and economic development is growing due to the growing share of the insurance sector in the total financial sector in almost all countries (Haiss & Sümegi, 2008). Consideration of the achieved level and manifested tendencies of insurance market development is especially important in the cases of underdeveloped and developing countries. It should contribute to the identification and implementation of appropriate activities, in order to maximize the potential of the insurance market to stimulate the economic development of these countries.

One of the basic indicators of insurance market development is the insurance penetration rate, defined as the ratio of gross written premiums to the country's gross domestic product (GDP). The approach commonly used in the analysis of the development level of a specific insurance market is a direct comparison of its penetration rate with the world average. However, such an approach is not entirely adequate. It ignores the fact that insurance penetration differs between countries that are differently developed (Zheng et al., 2009). The S-curve is a theoretical model that describes the relationship between insurance penetration and GDP per capita (as a proxy measure for overall economic development). It enables a realistic comparison of insurance development between countries that are at different stages of economic development.

This paper deals with the analysis of the development level of insurance markets in the Western Balkan countries using the S-curve. The insurance markets of Serbia, Bosnia and Herzegovina (B&H), Montenegro, North Macedonia, and Albania are characterized by many common characteristics, arising from the historical and economic similarities of these countries. The aim of the paper is to

answer the question of what is the level of development of insurance markets in the Western Balkans compared to the world average. Despite a slight increase over the last decade, the insurance penetration rate in these countries is still modest. In 2020, this rate ranged from 1.1% (in Albania) to 2.1% (in Bosnia and Herzegovina). Analysis based on S-curve should indicate whether the current values of penetration rates are in line with the level of economic development of the given countries, and how they can be increased.

To the author's knowledge, this is the first study applying the S-curve in the analysis of the level of development of insurance markets in the Western Balkan countries. In addition, the parameters of the world S-curve were estimated on the basis of the latest data, which is the contribution of this study in comparison with comparable empirical research previously conducted on the examples of other countries.

2. Characteristics and significance of the S-curve for insurance markets

The S-curve model of insurance market development is based on the assumption that the income elasticity of demand for insurance is not constant. How large the relative change in gross written premium caused by the relative change in income will depend on the level of income. Low and high income levels are accompanied by low income elasticity of demand for insurance, while at income levels, in between this elasticity of demand, is relatively high. This means that the growth of insurance penetration accelerates with the growth of per capita income until a certain level of income is reached, after which the penetration grows more and more slowly.

The variability in the income elasticity of demand for insurance is explained by two key reasons. First, when a sufficiently high level of income is reached, risk management methods other than traditional insurance, such as self-insurance, captives, and alternative risk transfer techniques become effective (Haiss & Sümegi, 2008). Second, in order to reduce moral hazard, insurers put limits on their policies, so that part of the risk is borne by the policyholders. Therefore, insurance penetration cannot grow indefinitely but has an upper limit. Otherwise, if the income elasticity of demand for insurance (which is generally greater than one) was constant, after some time the total insurance premium would exceed the gross domestic product, which would not be logical (Enz, 2000).

The S-curve explaining insurance market development was firstly introduced by Enz (2000) as a three-parameter logistic function of the form:

$$Y = \frac{1}{C_1 + C_2 \cdot C_3^X} + \varepsilon \qquad (1)$$

where Y is insurance penetration (calculated as a percentage of gross written premiums to GDP), X is the real GDP per capita, C_1, C_2 and C_3 are the parameters and ε is the residual term. In order for insurance penetration to grow with GDP per capita, parameters C_1 and C_2 must be positive, and C_3 must be greater than zero and less than one.

The slope of the S-curve varies depending on the level of per capita income. First, it grows, and then, after the inflection point, it decreases. The level of GDP per capita that corresponds to the inflection point (X_{inf}) is calculated by equating the second derivative of the function (1) with zero[1] and transforming it into the form:

$$X_{inf} = \frac{\ln(C_1) - \ln(C_2)}{\ln(C_3)}. \tag{2}$$

If we denote the per capita premium by P, we can obtain income elasticity of demand for insurance $E = (\partial P/P)/(\partial X/X) = (\partial P/\partial X)/(X/P)$. Since insurance penetration is $Y = P/X = \left(C_1 + C_2 \cdot C_3^X\right)^{-1}$, the per capita premium can be expressed as $P = X \cdot \left(C_1 + C_2 \cdot C_3^X\right)^{-1}$, from which it follows that the income elasticity of demand for insurance is:

$$E = 1 - \frac{C_2 \cdot C_3^X \cdot X \cdot \ln(C_3)}{C_1 + C_2 \cdot C_3^X}. \tag{3}$$

By equating the first derivative of the function (3) with zero, we obtain an expression containing the level of GDP per capita that corresponds to the maximum income elasticity of demand for insurance ($X_{E_{max}}$):

$$1 + X_{E_{max}} \cdot \ln(C_3) + \frac{C_2 \cdot C_3^{X_{E_{max}}}}{C_1} = 0. \tag{4}$$

The S-curve allows determining the stage of development of a given insurance market. For different levels of economic development, the S-curve shows the average insurance penetration at the global level (or at the level of a certain group of countries). The position in relation to the S-curve reveals the level of development of the given insurance market compared to the average.

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[1] Since the first derivative of function (1) is $Y' = -\left(C_1 + C_2 \cdot C_3^x\right)^{-2} \cdot \left(C_2 \cdot C_3^x \cdot \ln(C_3)\right)$ it follows that $Y'' = 2\left(C_1 + C_2 \cdot C_3^x\right)^{-3} \cdot \left(C_2 \cdot C_3^x \cdot \ln(C_3)\right)^2 - \left(C_1 + C_2 \cdot C_3^x\right)^{-2} \cdot \left(C_2 \cdot \ln(C_3) \cdot C_3^x \cdot \ln(C_3)\right)$.

When a country's insurance market is positioned below the S-curve, there is an insurance development gap. In accordance with the "trichotomy theoreme of insurance growth" (Zheng, Liu & Deng, 2008), in order to reach the S-curve level, insurance market development can be driven by economic and institutional factors. The effect of economic factors is reflected in the growth of GDP per capita, accompanied by an increase in insurance premiums. If the premium is increasing at the same pace as the income, we are talking about the first type of insurance growth called "regular growth", under which insurance penetration remains the same. The second type of insurance growth is called "deepening growth", when the premium grows faster than the income so that insurance penetration increases. Finally, the development of the insurance market can be caused by institutional factors (such as the quality of the legal system). Both groups of factors are important, but their significance varies depending on the level of development of the national economy. While economic factors are dominant in developed countries, non-economic factors play a more important role in the development of insurance markets in developing countries (Chang & Lee, 2012). Improving the institutional environment can reduce the insurance development gap in developing countries. The larger the gap, the more effective the institutional intervention is (Webb, 2006). The deviation of the country from the S-curve indicates the presence of factors other than GDP per capita that drive the demand for insurance. Thus, determining the position of the market in relation to the S-curve allows for detecting and measuring the insurance development gap, in order to take appropriate actions that can contribute to its reduction.

2.1. Previous empirical results

Enz (2000) was the first to estimate parameters of the S-curve for insurance markets based on data on GDP per capita and insurance penetration for 90 countries in the period from 1970 to 1998. He quantified GDP per capita at the inflection point for life (13,863 USD) and non-life (4,871 USD) insurance. The estimated maximum income elasticity in life insurance was 1.9 (a GDP per capita of 15,000 USD). In non-life insurance, the estimated maximum income elasticity was 1.5 (a GDP per capita of 9,900 USD).

Exploring the dependence between insurance and economic development, Webb (2006) empirically confirmed the S-curve model of insurance market evolution. He used data on GDP per capita and non-life insurance penetration for 59 countries from 1960 to 2000. The results show an obvious S-curve relationship between the two variables.

Using data for 95 countries over 27 years (1980-2006), Zheng, Liu & Dickinson (2008) derived the world S-curve, which they used as a benchmark in assessing the growth potential of China's insurance market. Based on the estimated world S-curve, they found that the growth rate of insurance penetration begins to

decline after GDP per capita exceeds 10,635 USD in the case of life insurance and 3,015 USD in the case of non-life insurance. The estimated maximum income elasticity in life insurance was 1.754 (a GDP per capita of 12,438 USD), while the estimated maximum income elasticity in non-life insurance was 1.425 (a GDP per capita of 7,531 USD).

Rozumek (2013) conducted an analysis of the development of insurance markets in the Czech Republic, Slovakia, Poland, and Hungary, based on the S-curve. The average value of residuals of each of the four markets from the world S-curve in the period 1993-2011 was negative, which proved the existence of an insurance development gap. Nevertheless, the analysis of trends in the residuals showed that this gap decreases over time.

Handschke & Rozumek (2015) compared the level of insurance market penetration in Eastern European countries with the average penetration in the world derived from S-curve whose parameters were previously estimated by Zheng et al. (2008). Based on data from the period 1993-2011, the authors estimated the regional S-curve for analyzed countries. They concluded that all countries, except Slovenia, are beneath the world S-curve. The largest insurance development gap was identified in Turkey, Estonia, and Greece.

3. Methodology and data

In order to derive S-curve, we estimated pooled non-linear regression model (1) with insurance penetration as the dependent variable, and GDP per capita as the independent variable. To estimate the parameters of the model, we used non-linear least squares with the Gauss-Newton method (Madsen et al., 2004). First, we derived the world S-curve using pooled data for 90 countries for the period of 15 years, from 2006 to 2020. The sample consists of 1,350 observations. *Table 1* shows the descriptive statistics of the variables.

Table 1. Descriptive statistics

Variables	Obs.	Mean	Std. dev.	Min	Max
GDP per capita (constant 2010 USD)	1,350	22,339.33	22,254.74	649.93	111,968.35
Insurance penetration	1,350	4.49%	3.80%	0.25%	22.60%

Source: Authors' calculations.

In addition, we derived the regional S-curve using data on penetration and income levels in Serbia, Bosnia and Herzegovina, Montenegro, North Macedonia, and Albania for the same period. The regional S-curve reflects the theoretical trajectory of the average insurance penetration in the given region under the unchanged economic and institutional conditions. A comparison of the regional S-

curve and the world S-curve should indicate the difference in the insurance development level between the analyzed countries and the world average.

In order to quantify the insurance development gap and look at the dynamics of convergence of insurance markets in the Western Balkans towards the world average during the observed period, we used the Benchmark Ratio of Insurance Penetration (BRIP) defined by Zheng, Liu & Dickinson (2008). The BRIP links a country's insurance penetration (i.e. actual penetration) with the world's average penetration but at the same level of economic development at which the given country is (i.e. benchmark penetration):

$$BRIP = \frac{actual\ penetration}{benchmark\ penetration} \times 100 \tag{5}$$

Using the world S-Curve penetration level as a reference, the BRIP shows the extent to which the level of insurance penetration corresponding to the country's current GDP per capita has been reached. Therefore, the BRIP represents a relative measure of the development of a country's insurance market. It basically eliminates the effect of the level of economic development (reflected by the country's GDP per capita) from the measurement of insurance development (Wehrhahn, 2010). Compared to traditional indicators such as insurance penetration and insurance density, the BRIP reflects the "economic-adjusted insurance growth level" and as such allows for a credible international insurance comparison (Zheng et al. 2009). When the BRIP is less than 100%, it is possible to calculate the insurance development gap as $100\% - BRIP$. We have calculated BRIPs by year for insurance markets of the analyzed Western Balkan countries.

The data on annual GDP per capita for each country are taken from the World Bank database (World Bank, 2021). In order to allow for comparisons across countries and years, the values are expressed in constant 2010 U.S. dollars. The data on insurance penetration is obtained from the Sigma database, provided by Swiss Re as one of the world's leading reinsurers (Swiss Re, 2007-2021). Exceptionally, data on insurance penetration for Bosnia and Herzegovina, Montenegro, North Macedonia, and Albania are taken from the websites of the relevant national insurance supervision authorities.

4. Results

The results of the world S-curve estimation are shown in *Table 2*. The S-curve has an inflection point at GDP per capita of 13,516 USD. Up to this level of GDP per capita, insurance penetration is growing at an increasing rate. After GDP per capita reaches 13,516 USD, the growth of insurance penetration is slowing down. The maximum income elasticity of demand for insurance is 1.692 (a GDP per capita of 17,284 USD). This means that if GDP per capita increases by 1%, the premium per

capita will increase by 1.692%. At all other levels of GDP per capita, the income elasticity of demand for insurance is lower.

**Table 1. World S-curve estimation results**

Regression results	Values
C_1	12.877*** (0.369)
C_2	48.357*** (3.087)
C_3	0.907*** (0.008)
R-squared	52.96%
Adjusted R-squared	52.86%
S-curve properties	
GDP per capita at the inflection point (constant 2010 USD)	13,516
Maximum income elasticity	1.692
GDP per capita at the maximum elasticity (constant 2010 USD)	17,284

Source: Authors' calculations.
Notes: Standard errors are reported in parentheses;
*** denotes statistical significance at the 1% level.

The level of GDP per capita that corresponds to the maximum income elasticity of demand for insurance ($X_{E_{\max}}$) is different from the level of GDP per capita that corresponds to the inflection point of the S-curve ($X_{\inf}$).The reason for this is that $X_{E_{\max}}$ is based on the derivative of the S-curve according to GDP, while $X_{\inf}$ is based on the derivative of the S-curve according to GDP per capita.

Figure 1. World S-curve
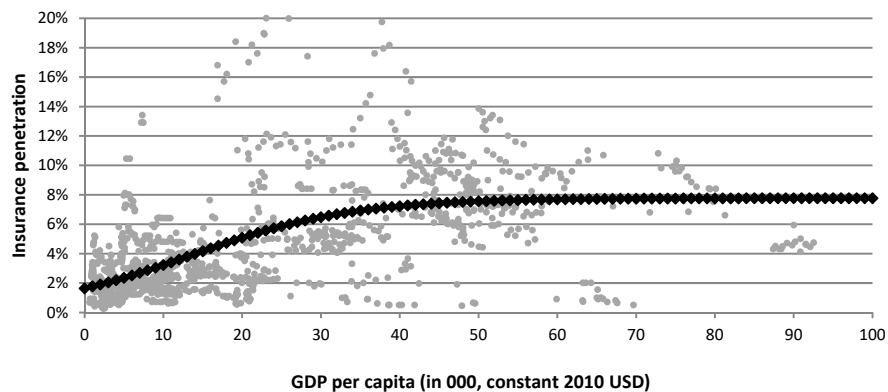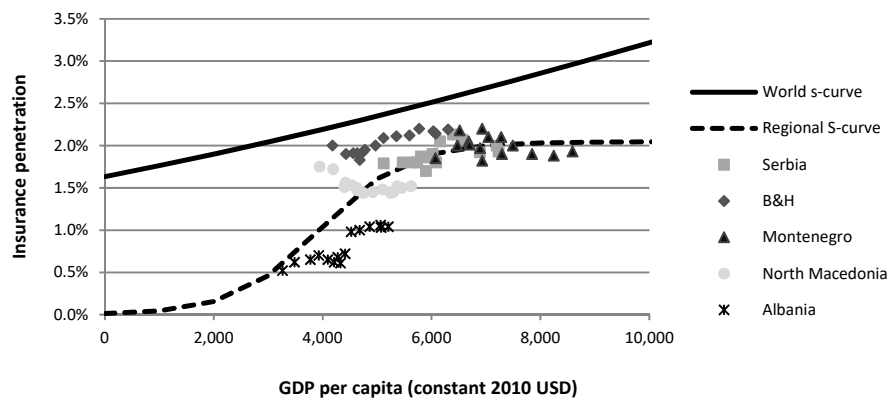

Source: Authors' calculations.

Figure 1 depicts the estimated world S-curve. As can be seen, insurance penetration increases with GDP per capita, whereby the growth rate of insurance penetration varies with GDP per capita. Deviations of individual markets from the world average reflected by the S-curve indicate that there are other factors besides income that affect the demand for insurance (Enz, 2000).

Figure 2 shows the position of the Western Balkans countries in relation to the derived world S-curve for GDP per capita values ranging from 0 to 10,000 USD. The derived regional S-curve is also shown. Since the regional S-curve is below the world S-curve, it follows that the average insurance penetration in the Western Balkans region is lower than the average world insurance penetration at a given income interval. Observed by countries, there is a deviation from the regional S-curve in the case of Bosnia and Herzegovina (upwards) and Albania (downwards).

The regional S-curve has an inflection point at GDP per capita between 2,000 USD and 3,000 USD, which means that all the observed Western Balkan countries have already entered the phase of the slow growth of insurance penetration. At the same level of economic development, the average insurance penetration in the world is still growing rapidly. Moreover, the markets of Serbia and Montenegro have already reached the upper asymptote of the regional S-curve, as the theoretical maximum average level of insurance penetration for the region. Based on the comparison of the global and regional S-curve, it can be concluded that without deepening economic growth and/or institutional progress, the average insurance penetration in the Western Balkans cannot reach the world average.

Figure 2. Regional S-curve for the Western Balkan countries

Source: Authors' calculations.

From the actual and benchmark (based on the derived world S-curve) penetration rates, we calculated BRIPs for each of the analyzed countries of the Western Balkans, as shown in *Table 3.* The highest value of this indicator in 2020

was achieved in Bosnia and Herzegovina (84.6%). Accordingly, the actual insurance penetration in this country reaches 84.6 percent of the average insurance penetration in the world at the same level of economic development, so the insurance development gap is 15.4%. The lowest BRIP value in the same year was achieved in Albania (44.9%). Thus, the insurance penetration rate in this market does not reach even half of the average insurance penetration in the world at a given level of GDP per capita. The insurance development gap in this country is 55.1%, although it was reduced from as much as 75% in 2006.

Table 3. Benchmark Ratio of Insurance Penetration (BRIP)
of the Western Balkan countries (2006-2020)

Indicator	Year	Serbia	Bosnia and Herzegovina	Montenegro	North Macedonia	Albania
Benchmark Ratio of Insurance Penetration (BRIP)	2006	75.5%	90.0%	73.2%	80.1%	25.0%
	2007	74.1%	84.0%	77.1%	77.3%	29.3%
	2008	75.3%	79.5%	68.1%	69.0%	30.1%
	2009	73.1%	83.7%	83.8%	66.9%	32.1%
	2010	72.8%	83.3%	77.9%	67.1%	29.4%
	2011	68.0%	83.1%	73.9%	64.0%	27.8%
	2012	74.5%	84.2%	76.3%	65.5%	30.4%
	2013	71.1%	85.2%	82.3%	62.3%	27.2%
	2014	75.4%	88.2%	78.0%	62.0%	31.9%
	2015	80.7%	87.6%	76.8%	62.5%	43.1%
	2016	82.5%	86.6%	72.2%	60.2%	43.5%
	2017	79.3%	88.8%	67.1%	60.4%	44.6%
	2018	72.0%	86.1%	64.8%	61.9%	43.6%
	2019	70.8%	85.3%	65.1%	62.0%	43.6%
	2020	73.6%	84.6%	69.5%	63.0%	44.9%
Average		**74.6%**	**85.3%**	**73.7%**	**65.6%**	**35.1%**
Average annual percentage point change		**-0.1**	**-0.4**	**-0.3**	**-1.2**	**1.4**

Source: Authors' calculations.

For each of the considered countries, we calculated the average annual percentage point change in BRIP values, which reflects the pace of reaching the world average (Handschke & Rozumek, 2015). The obtained results show that this value is positive only in the case of Albania (*Table 2*). In other words, only in Albania, the insurance development gap is narrowing (by 1.4 percentage points on average per year). At this rate of convergence, it would take about 40 years to reach the world average penetration. The average annual percentage point change in BRIP values, during the observed period, in the case of other analyzed countries is negative. This means that with unchanged economic and institutional factors, an increase in the insurance development gap in these countries can be expected. The

largest drop in BRIP during the observed period was realized in Northern Macedonia, where during 15 years, this indicator lost as much as 15 percentage points of its value.

5. Policy recommendations

The presented results of the analysis raise the question of how the identified insurance development gap in the Western Balkan countries, in relation to the world average, can be reduced or eliminated. Economic growth is generally accompanied by growth in insurance premiums. In order for the insurance penetration rate to grow, the premium must grow faster than the country's GDP. However, the opportunities for a significant increase in the rate of economic growth in the analyzed countries are drastically narrowed in the context of the global economic crisis caused by the current COVID-19 pandemic. As previously explained, according to the "trichotomy theoreme of insurance growth", a country can increase insurance penetration without economic growth, but only with institutional progress. In times of economic stagnation, it is easier to achieve institutional than economic growth (Rozumek, 2013). Hence, the recommendation for creators of the insurance industry policy for the countries of the Western Balkans is to focus on adequate institutional mechanisms, in order to overcome the insurance development gap and establish conditions for sustainable insurance growth in the long run.

The state and its institutions have an important role in creating a favorable environment for the affirmation of the insurance sector in developing countries. In the Western Balkans, some progress has been made in recent decades in the field of institutional conditions for the operation of insurance companies. First of all, the legal framework is harmonized with the legislation of the European Union and an appropriate supervision function has been established. This has contributed to the stability of the sector and the better protection of the interests of policyholders and insurance beneficiaries. On the way from the centrally planned to the market economy, these markets opened for the entry of foreign capital, which was accompanied by a decline in market concentration and enrichment of supply. Nevertheless, there is certainly room for further improvement. The state is expected to further enhance legislation and regulations, as well as to develop market infrastructure, through investment in databases, market regulation, increasing risk-taking capacity, and promoting insurance. As a rule, the insurance development gap appears precisely in countries with inadequate infrastructure and/or insufficient capacity of the insurance market (Webb, 2006).

A prerequisite for accurate risk measurement and determination of adequate insurance premium is *collecting and sharing data on losses and exposures*. The portfolios of individual insurers in developing countries are relatively small, which appears to be a limiting factor for calculating premiums in line with real risks, as

well as for developing new insurance products. Therefore, the formation of an industry-wide database, wherein the state should play an important role, appears as an imperative for the further development of these insurance markets.

Eliminating unfair competition requires *strengthening insurance market discipline*. This is especially important in countries with the relatively underdeveloped capital markets and without insurance company's financial ratings that augment transparency, as is the case with the Western Balkan countries. Market discipline is one of the pillars of the Solvency II regulatory framework in relation to which these countries redefine their insurance legislation and regulations.

The role of the state is particularly important in fostering insurance against catastrophic risks, including the growing pandemic risk. Due to limited capacity, insurers are not willing and/or able to provide coverage for catastrophic risks under relatively favorable conditions without state assistance. Thus, an adequate model for managing these risks is *public-private partnerships*, in which the private sector provides insurance, while the state subsidizes premiums and administrative costs and provides reinsurance (Kočović et al., 2020).

Also, the state should *improve the relevant legislation* as a precondition for the introduction of new products on the market, such as index-based insurance. In order to encourage the development of life and voluntary pension insurance, it is necessary to redefine the tax treatment of insurance premiums and make it more favorable.

Finally, in order for insurance to develop, especially in countries lacking an insurance culture, it is necessary to *raise insurance awareness in society*. Public authorities can contribute to raising the level of insurance understanding by informing citizens about the risks and importance of insurance for their management, disseminating knowledge on insurance mechanisms and products through education programs, as well as by acquainting consumers with their rights and obligations towards insurance providers (OECD, 2007). Such government intervention should facilitate the implementation of initiatives aimed at strengthening insurance education taken by insurance companies and their associations, intermediaries, and other private stakeholders.

All these measures have the potential to contribute to the growth of insurance penetration in the Western Balkan countries, even in the absence of economic growth. This creates the conditions for neutralization of the insurance development gap and for reaching the world average penetration at a given level of economic development. In the end, we should not forget that it is not enough just to reach the world average, but to strive to be better than the average.

5. Conclusion

The S-curve model of insurance market development assumes that the income elasticity of insurance demand varies with the stage of economic development. Consequently, insurance penetration (as the ratio of gross written premiums to the country's GDP) grows with GDP per capita, but different levels of GDP per capita are accompanied by different rates of insurance penetration growth. Insurance penetration growth is slower in low-income and high-income countries and faster in middle-income ones.

In this paper, we derived the world S-curve based on data on insurance penetration and GDP per capita for 90 countries over the period 2006-2020. By positioning the insurance markets of the Western Balkan countries in relation to this curve, we have determined their level of development in relation to the world average, taking into account the level of economic development of these countries.

The conducted analysis shows that there is an insurance development gap in the Western Balkan countries in relation to the world average. This gap is the smallest in Bosnia and Herzegovina and the largest in Albania. Nevertheless, Albania is the only one among the analyzed countries in which the insurance development gap is narrowing over time. Without significant economic growth and/or institutional progress, insurance penetration in the Western Balkan countries cannot reach the world average.

Insurance markets in the Western Balkan countries are not saturated and the potential for their growth certainly exists. In order to use this potential, it is necessary to provide adequate institutional conditions. Neutralizing the insurance development gap requires further regulatory improvements (which will enable the introduction of new insurance products) and market infrastructure development (through collecting and sharing insurance data, strengthening market discipline, public-private partnerships in catastrophic risk insurance, and raising insurance awareness in society), wherein the state and its institutions play an important role. In this way, it is possible to increase the level of insurance penetration in given countries even without economic growth. The usefulness of this conclusion comes to the fore in the context of the global economic crisis caused by the current COVID-19 pandemic when it is not realistic to expect a significant increase in insurance premiums that would be caused by economic growth.

This research represents a solid starting point for several future directions of research. Concerning econometric estimation of the S-curve, we used pooled cross-section and time-series data, following the approach of previous empirical research. In order to allow for country heterogeneity, a fixed effects panel regression model can be estimated. Derived world S-curve can be used to determine the current level of development of the insurance markets in other countries in relation to the world average. In order to further analyze the development level of insurance markets in

the Western Balkan countries, the S-curve can be estimated separately for life and non-life insurance, as well as for relevant groups of countries (e.g. EU member states) for comparison purposes. Also, a possible future direction of research is the extrapolation of the calculated Benchmark Ratio of Insurance Penetration (BRIP) of the analyzed insurance markets, in order to predict the future pace of their development.

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ANALIZA RAZVIJENOSTI TRŽIŠTA OSIGURANJA NA OSNOVU SIGMOIDNE FUNKCIJE NA PRIMERU ZEMALJA ZAPADNOG BALKANA

Apstrakt: Jedna od najčešće korišćenih mera razvijenosti tržišta osiguranja je penetracija osiguranja, kao odnos ukupne fakturisane premije osiguranja i bruto domaćeg proizvoda zemlje. Njen važan nedostatak je taj što zanemaruje nivo ekonomskog razvoja zemlje. S-kriva je teorijski model kojim se opisuje veza između penetracije osiguranja i BDP-a po glavi stanovnika i koji omogućuje poređenje razvijenosti osiguranja između zemalja u različitim fazama ekonomskog razvoja. U radu se analizira nivo razvoja tržišta osiguranja u zemljama Zapadnog Balkana u odnosu na svetski prosek, primenom sigmoidne funkcije ili S-krive. S-kriva za svet je izvedena ocenjivanjem nelinearnog regresiong modela, koristeći podatke o penetraciji osiguranja i BDP-u po glavi stanovnika za 90 zemalja u periodu od 2006-2020. Tržišta osiguranja zemalja Zapadnog Balkana nalaze se ispod S-krive za svet. Kako bi se odredio jaz u razvijenosti osiguranja, izračunali smo referentni koeficijent penetracije osiguranja (BRIP) za svaku zemlju, koristeći nivo penetracije S-krive za svet kao referentni. Rezultati su pokazali da jaz u razvijenosti osiguranja raste u zemljama u regionu, izuzev Albanije gde je najveći. Politika razvoja sektora osiguranja za Zapadni Balkan bi trebalo da se fokusira na poboljšanje institucionalnih faktora kako bi se omogućio održivi razvoj osiguranja na duži period.

Ključne reči: razvoj tržišta osiguranja, penetracija osiguranja, BDP po glavi stanovnika, S-kriva, zemlje Zapadnog Balkana

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Marija Koprivica (née Jovović) PhD, is an associate professor at the Faculty of Economics, University of Belgrade. She was born in 1983 in Nikšić. She graduated from the Faculty of Economics in Belgrade in 2007, finished her master's studies in 2009, and defended her doctoral dissertation on "Risk measurement when determining the solvency of non-life insurers" in 2015. She is engaged in the courses Financial and Actuarial Mathematics and Actuarial Models in Insurance at the basic academic studies, at the courses Financial Mathematics, Actuarial Mathematics, Accounting of Insurance Companies and Risk Management at the master's studies, and at the course Financial Mathematics 1-D at the doctoral studies at the Faculty of Economics in Belgrade. Her scientific research opus refers to the application of modern actuarial and financial-mathematical models in the field of insurance and financial markets. She has published a significant number of scientific papers in these fields in scientific journals, monographs and proceedings.