FACTA UNIVERSITATIS
Series: **Economics and Organization** Vol. 22, Nº 2, 2025, pp. 85 - 97
https://doi.org/10.22190/FUEO250429006C

Original Scientific Paper

SOCIO-ECONOMIC DRIVERS OF SUSTAINABLE INSURANCE IN THE EUROPEAN UNION: EVIDENCE FROM ADVANCED ECONOMETRIC MODEL

UDC 368:316(4-672EU))"2007/2023"
368:330(4-672EU))"2007/2023"

Mirela Cristea[1], Gratiela Georgiana Noja[2], Elena Iulia Grigorie[3]

[1]University of Craiova, Faculty of Economics and Business Administration, Craiova, Romania
[2]West University of Timişoara, Faculty of Economics and Business Administration, Timişoara, Romania
[3]University of Craiova, Doctoral School of Economics "Eugeniu Carada", Craiova, Romania

ORCID iDs:	Mirela Cristea	https://orcid.org/0000-0002-6670-9798
	Gratiela Georgiana Noja	https://orcid.org/0000-0002-9201-3057
	Elena Iulia Grigorie	N/A

Abstract. *Observing the European landscape where disparities between European Union Member States are present in terms of economic development and, in particular, the insurance sector, this research aims to analyze the impact of key socio-economic indicators on the degree of insurance penetration for the period 2007-2023. The research methodology consists of two sets of econometric models, namely, panel data analysis based on multifactorial regression models (Robust Regression, Cross-sectional time-series with Feasible Generalized Least Squares, Generalized Method of Moments with Arellano–Bond dynamic panel-data estimation, Between Regression (regression on group means), Random-effects with the Maximum Likelihood estimation, and Instrumental variables on two stage least squares), and Bayesian Network Analysis. The analysis shows a diverse relationship, suggesting that Member States with developed economies have a more advanced insurance sector. Moreover, it shows a complex relationship, both positive and negative, depending on the model analyzed. The results of the models applied in the article show various influences of human development, poverty, employment rate and inflation on insurance penetration. This article provides a comprehensive approach and understanding of how economic and social factors influence the insurance sector in the European Union and provides essential information to support the future development of the insurance sector.*

Received April 29, 2025 / Accepted May 20, 2025
Corresponding author: Elena Iulia Grigorie
University of Craiova, Doctoral School of Economics "Eugeniu Carada", Strada Alexandru Ioan Cuza 13, Craiova 200764, Romania | E-mail: iuliagrigorie99@gmail.com

Key words: *insurance penetration, European Union, economic development, social dimensions, econometric modelling*

JEL Classification: C50, F63, G22

1. INTRODUCTION

The insurance sector is a fundamental pillar of the European Union (EU) economy, playing a key role in protecting the economies and supporting overall stability. Insurance provides protection against risks related to unpredictable events (Beck & Webb, 2003), and, in the European context, where disparities between member states are evident, the insurance sector does not only offer protection against risks but also plays a crucial role in supporting economic development, having a direct influence on economic stability (OECD, 2011).

Economic diversity creates a specific economic environment and a dynamic regulatory framework, which makes it essential to understand how the insurance sectors are influenced by the economic evolution of each Member State.

The general objective of the research is to highlight the impact of the economic development of EU Member States on the insurance sector, examining how the links between insurance penetration and socio-economic indicators define a complex and particular EU economic environment. Thus, by approaching an in-depth analysis of the existing literature and the application of diverse econometric models, the aim of this article is to provide a broad picture of the complexity of the progress of the EU insurance sector. The main aim of this study is to identify the connections and relationships between different indicators of socio-economic development and insurance, providing comprehensive information on the evolution of the EU insurance sector for the period 2007-2023, and on how disparities are present in this sector.

This research uses a complex analysis approach at the level of the EU Member States. The research methodology consists of the application of two sets of advanced econometric models, namely: *(i) panel data analysis based on multifactorial regression models* - Robust Regression (RREG), Cross-sectional time-series with Feasible Generalized Least Squares (FGLS), Generalized Method of Moments (GMM) with Arellano–Bond dynamic panel-data estimation, Between Regression (regression on group means), Random-effects with the Maximum Likelihood (ML) estimation, and Instrumental variables on two stage least squares (2SLS) - to identify, from multiple perspectives, the direct implications of socio-economic indicators on the insurance sector; (ii) Bayesian Network Analysis, using Gaussian Graphical Models (GGM), to assess the overall relationships between indicators and their intensity.

Aligned with the research objective and methodology applied, the research hypotheses are: *H1. Total insurance market penetration is directly and positively influenced by social and economic dimensions at the level of the EU; H2. Insurance penetration for each insurance class – life and non-life insurance – is overall favorably interconnected with social and economic indicators.*

The integration of the results obtained in this article with other literature underpinnings may also provide additional information on the interconnections that shape the development of the dynamic insurance sector of EU member states.

The structure of the paper includes an introduction to the research hypothesis followed by an analysis of the literature, presenting previously analyzed concepts on the addressed

problem that are the evolutionary perspectives of economic development and the insurance sector. Moreover, a systematic presentation of the methodology is ensured by presenting the data used in the study, emphasizing the importance of the econometric models applied in approaching the relationships within the analysis. The results obtained from the application of the models are presented followed by future discussions and proposals. For a clear understanding, additional information is inserted at the end of the paper as an appendix.

2. LITERATURE REVIEW

The insurance sector is a fundamental pillar of the EU economy, playing a key role in protecting the economies and supporting overall stability. Insurance provides protection against risks related to unpredictable events (Beck & Webb, 2003), and, in the European context, where disparities between member states are evident, the insurance sector does not only offer protection against risks but also plays a crucial role in supporting economic development, having a direct influence on economic stability (OECD, 2011). The interdependence between economic development and the insurance sector has long been a complex subject of study, especially in EU Member States given the distinctive nature of the economies. The literature review aims to summaries the current understanding of the interaction between economic development and the insurance sector in the EU, based on different perspectives from previous studies.

Economic indicators, such as Gross Domestic Product (GDP) per capita, poverty, inflation, Human Development Index (HDI), and employment rate, have been identified as key factors influencing growth and penetration of the insurance sector (Chang & Berdiev, 2013; Sibindi, 2015; Kaushal & Ghosh, 2018). The insurance sector contributes to economic growth by managing risks and mobilizing economies. Kondovski (2021) argued that this is particularly important in emerging states in the EU, where insurance penetration has a positive impact on economic growth.

The complex relationship between economic development indicators and insurance penetration is a sophisticated research topic that has attracted substantial scientific attention, and the specific dynamics require further investigation (Beck & Webb, 2003; Outreville, 2013; Cristea et al., 2014).

Existing empirical studies have provided mixed approaches to the complex link between economic development and insurance. Some studies emphasize that economic development leads to a greater demand for financial services, indirectly to the development of economic sectors (Sibindi, 2015; Ganić & Ridic, 2025). As economies continue to grow, demand for insurance products is increasing as individuals and businesses seek to manage risk more effectively. This trend is particularly notable in some EU member states, where rising revenues are fueling the expansion of life and non-life insurance markets (Athanasiadis et al., 2023).

The research highlighted the mixed relationships between economic development indicators and the insurance sector. Ward and Zurbruegg (2000) and the subsequent work of Lee et al. (2021) fundamentally demonstrated bidirectional causality between indicators. Analyses by Haiss and Sümegi (2008) and later by Pradhan et al. (2015) highlight significant regional disparities in the European insurance sector, particularly in terms of insurance demand.

Living standards in the Member States and the financial sectors have evolved considerably over time. Arena (2008) shows nonlinear relationships between GDP per capita and insurance penetration, and subsequent research by Feyen et al. (2011) and Han et al. (2010) identified development thresholds at which insurance demand accelerates. The authors' findings align with the research of Alhassan (2016), who suggest the presence of interactions between the stages of economic development and the development of the insurance sector.

Recent investigations focus on human development indicators. Analyses by Zerriaa and Noubbigh (2016), supported by the findings of Sawadogo et al. (2018), Levy (2019), and Cristea et al. (2021) show strong correlations between Human Development Index (HDI) and insurance penetration. Further research by Alhassan (2016) suggests the need for analyses that incorporate both economic and social development indicators.

The contributions of Pradhan et al. (2021) and Levy (2019) expanded the theoretical frameworks related to economic development and the insurance sector, while Asongu et al. (2018) and Lee et al. (2021) have improved methodological approaches. However, significant opportunities remain for the analysis of the dynamics of economic development and implicitly of the insurance sector in the context of the dynamics of the EU economies and the level of development and awareness of the population's financial education (Siminică et al., 2025).

This literature review reveals substantial progress over time in understanding the connections between socio-economic development and insurance, highlighting significant opportunities for future research.

3. DATA AND METHODOLOGY

For the analysis of the impact of socio-economic development on EU insurance sector in this research, a panel dataset covering the period 2007-2023 for the 27 EU Member States is used. The data are obtained from official sources, namely, Eurostat (European Commission, 2023), United Nations Development Programme (2023) and SwissRe (Sigma Research, 2023) and include key indicators of economic and social development and the insurance sector.

The variables employed in econometric models were grouped into two categories:

- *Insurance data:* insurance penetration degree for total insurance (ip_tot), life insurance penetration degree (ip_life), non-life insurance penetration degree (ip_non-life);
- *Economic and social indicators:* GDP per capita (gdp_cap), GDP growth (gdp_growth), Human Development Index – HDI (hdi), at-risk-of-poverty rate (poverty), employment rate, 20-64 years (emp_rate), Harmonized Index of Consumer Prices – HICP (hicp).

Table 1 summarizes variables used in the models applied.

The methodology applied is based on multifactorial regression models, and Bayesian Network Analysis, by applying Gaussian Graphical Models (GGM) to identify the connections between indicators and potential interdependencies at the EU level.

The first set of models, *the multifactorial regressions*, based on panel data analysis, comprises the following regression models: Robust Regression (RREG) (model 1), Cross-sectional time-series with Feasible Generalized Least Squares (FGLS) (model 2), Generalized Method of Moments (GMM) with Arellano–Bond dynamic panel-data estimation (model 3), Between Regression (regression on group means) (model 4), Random-effects with the Maximum Likelihood (ML) estimation (model 5), and Instrumental variables

Table 1 Variables used in econometric analysis, period 2007-2023

No.	Explanation of variables	Unit of Measure (UM)	Acronym crude/logarithmic values	Source
1.	Insurance penetration – total market	% of GDP	ip_tot /log_ip_tot	Swiss Re Institute (2023)
2.	Life insurance penetration	% of GDP	ip_life/ log_ip_life	Swiss Re Institute (2023)
3.	Non-life insurance penetration	% of GDP	ip_non-life/ ip_non-life/ log_ip_non-life	Swiss Re Institute (2023)
4.	Gross Domestic Product per capita	annual United States Dollars (USD)	gdp_cap/ log_gdp_cap	European Commission (2023)
5.	Gross Domestic Product growth	annual %	gdp_growth/ log_gdp_growth	European Commission (2023)
6.	Human Development Index	Scor (from 0 to 1)	hdi/log_hdi	United Nations Development Programme (2023)
7.	At-risk-of-poverty rate	% of total population	poverty/ log_poverty	European Commission (2023)
8.	Employment rate, 20-64 years	% of total population	emp_rate/ log_emp_rate	European Commission (2023)
9.	Harmonized Index of Consumer Prices	% annual rate of change	hicp/ log_hicp	European Commission (2023)

Source: Own contribution

(IV) on two stage least squares (2SLS) (model 6). These models are used to identify the direct implications of the selected socio-economic indicators on the total insurance contribution to the GDP at the EU level – hypothesis *H1. Total insurance market penetration is directly and positively influenced by social and economic dimensions at the level of the EU.* Therefore, the dependent variable is insurance penetration degree for total insurance market, and independent variables are GDP per capita, GDP growth, HDI, at-risk-of-poverty rate, employment rate, and HICP (Table 2).

The second model, *Bayesian Network Analysis with Gaussian Graphical Models (GGM),* is used to further assess the overall interconnections between each category of insurance EU contribution to GDP, namely life and non-life insurance, and the selected socio-economic indicators - hypothesis *H2. Insurance penetration for each insurance class – life and non-life insurance – is overall favorably interconnected with social and economic indicators.* Table 2 provides an overview of the data used in both sets of econometric models.

It is observed that the data have been transformed by logarithm of variables to avoid problems such as nonlinearity and to make the interpretation of coefficients easier.

This approach was preferred because logarithmic transformation offers significant advantages in data analysis. Table 2 shows that the total penetration of insurance (ip_tot) has variability in the crude values (mean, 5.307097, standard deviation, 2.908904) being significantly stabilized after logarithm transformation (mean, 1.506042, standard deviation, 0.591769). Similarly, GDP per capita (gdp_cap), characterized by a large range (6625.03, minimum value, to 133590.1, maximum value), shows distributive symmetry after transformation (mean, 10.1975, standard deviation, 0.630462).

Table 2 Summary statistics of variables - crude and logarithmic values - used in the econometric analysis, 2007-2023

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
Crude values					
ip_tot	434	5.307097	2.908904	1.09	13.6
ip_life	406	3.051182	2.364863	0.1	9.68
ip_non-life	406	2.465764	1.440964	0.87	9.5
gdp_cap	459	32647.13	21602.35	6625.03	133590.1
gdp_growth	336	2.507625	8.047635	14.81	97.53
hdi	432	0.8821528	0.0409147	0.77	0.96
poverty	454	23.18767	7.116398	10.8	49.3
emp_rate	459	71.31111	6.213247	52.9	83.5
hicp	408	2.720479	3.215175	-1.7	19.4
N total	459				
Logarithmic values					
log_ip_tot	434	1.506042	0.591769	0.0861777	2.61007
log_ip_life	406	0.7456044	0.9509209	2.302585	2.270062
log_ip_non-life	406	0.7911861	0.4417736	0.139262	2.251292
log_gdp_cap	459	10.1975	0.630462	8.79861	11.80253
log_gdp_growth	336	0.9762145	1.137724	4.60517	4.58016
log_hdi	432	0.1264749	0.0467674	0.2613648	0.040822
log_poverty	454	3.101161	0.2865053	2.379546	3.897924
log_emp_rate	459	4.263144	0.0892612	3.968403	4.424847
log_hicp	408	0.6730127	1.056302	2.302585	2.965273
N total	459				

Source: Authors' contribution in Stata 16

The other socio-economic indicators, such as GDP growth, poverty rate and inflation, also benefit from improvements in data linearity after logarithmic transformation, reducing dispersion and increasing statistical robustness. GDP growth (gdp_growth), which initially shows high variability (14.81 to 97.53), becomes more stable in logarithmic form (mean, 0.9762145, standard deviation, 1.137724). Also, the crude values of the poverty rate (poverty) (mean, 23.18767) are effectively compressed by logarithm (mean, 3.101161), improving their distributional properties.

The crude values of the inflation rate (hicp) vary substantially (mean, 2.720479, standard deviation, 3.215175), with high positive skewness, compared to the values obtained after the logarithmic transformation, thus reducing the dispersion (mean, 0.6730127, standard deviation, 1.056302). It can be seen that the crude values of the HDI (hdi) vary (between 0.77 and 0.96), and, after the logarithmic transformation, it shows a lower relative mean (0.1264749), reflecting minor changes, but maintaining a low variability, as expected for an index with limited values.

4. Results and Discussions

4.1. Results of multifactorial regression models

The results of the first set of the applied regression models - RREG (model 1), Cross-sectional time-series with FGLS (model 2), GMM with Arellano–Bond dynamic panel-data estimation (model 3), Between Regression (model 4), Random-effects with the ML

estimation (model 5), and IV with 2SLS regression (model 6) - highlight the complex relationships of socio-economic development indicators (independent variables) and the insurance penetration degree for the total EU insurance market (dependent variable) through a multivalent approach (Table 3).

Table 3 Results of the multifactorial regression models, dependent variable- Insurance penetration degree – total

Variables	(1) log_ip_tot	(2) log_ip_tot	(3) log_ip_tot	(4) log_ip_tot	(5) log_ip_tot	(6) log_ip_tot
main						
log_gdp_cap	0.597***	0.488***	0.0475	0.224***	0.0352	0.488***
	(0.0669)	(0.0644)	(0.0393)	(0.0590)	(0.0576)	(0.0652)
log_gdp_growth	-0.0909***	-0.0992***	-0.00962	-0.0146	-0.00626	-0.0992***
	(0.0196)	(0.0189)	(0.00703)	(0.00869)	(0.00739)	(0.0192)
log_hdi	1.828	2.690**	-1.547	-1.563**	-2.624***	2.690**
	(1.013)	(0.975)	(0.850)	(0.583)	(0.517)	(0.988)
log_poverty	-0.0326	-0.0639	0.0664	0.281**	0.247**	-0.0639
	(0.111)	(0.107)	(0.0979)	(0.0901)	(0.0780)	(0.108)
log_emp_rate	-0.230	-0.252	0.0683	-0.393*	-0.232	-0.252
	(0.303)	(0.291)	(0.255)	(0.154)	(0.133)	(0.295)
log_hicp	-0.0203	-0.0248	-0.0154*	0.00167	-0.00537	-0.0248
	(0.0225)	(0.0217)	(0.00598)	(0.00896)	(0.00762)	(0.0220)
L.log_ip_tot			0.249**			
			(0.0790)			
_cons	-3.159	-1.756	-0.00761	-0.181	1.022	-1.756
	(1.666)	(1.604)	(1.296)	(1.000)	(0.880)	(1.625)
sigma_u						
_cons					0.701***	
					(0.101)	
sigma_e						
_cons					0.113***	
					(0.00513)	
N	274	274	158	274	274	274
R^2	0.647					0.637

Standard errors in parentheses: * p < 0.05, ** p < 0.01, *** p < 0.001
Source: Authors' research in Stata 16

The results presented in Table 3 demonstrate a predominantly positive relationship between GDP per capita (log_gdp_cap) and insurance penetration for the total EU insurance market (log_ip_tot) – models (1), (2), (4) and (6) - revealed by statistically significant positive coefficients. These findings suggest that the economic development of the EU economies positively correlates with insurance sector development, aligning with Haiss & Sümegi's (2008) findings of the development of the revenue-based insurance sector. However, for our results, the effect becomes insignificant in other models, indicating potential nonlinear relationships and contextual variability.

Moreover, consistently negative relationships emerge across models for GDP growth (log_gdp_growth), contradicting traditional growth-development hypotheses (Snooks, 1999; Arena, 2008; Cristea et al., 2014; Alhassan, 2016). This negative correlation suggests different dynamics of the EU Member States, where rapid economic growth might

temporarily destabilize insurance penetration (log_ip_tot). Related results are presented by Pradhan et al. (2015), supporting the observation that economic transformation can create short-term market uncertainties.

The Human Development Index (log_hdi) coefficient demonstrates substantial variability across models' analysis, revealing a non-linear relationship with insurance penetration (log_ip_tot). Models (2) and (6) show positive and statistically significant coefficients, while models (4) and (5) exhibit negative relationships, as Zerriaa and Noubbigh's (2016) and Cristea et al. (2021) proposed the multidimensional nature of human development's impact on insurance sectors.

On the other hand, poverty (log_poverty) presents intriguing, statistically inconsistent relationships. Model (4) and model (5) uniquely demonstrate positive and significant coefficients, suggesting potential unfavorable interactions between poverty (log_poverty) and insurance penetration (log_ip_tot) – the more poverty rises, more insurance penetration in GDP increases, which is not the expected implication. Alhassan and Biekpe (2016) similarly observed complex poverty-insurance market relationships, emphasizing the need for nuanced interpretational frameworks.

Varied effects across models show for the employment rates (log_emp_rate), with insignificant negative and positive coefficients. However, model (4) shows a significant negative relationship with the EU insurance contribution to GDP, indicating an inverse dynamic between employment rates and the development of the insurance sector, as shown in the study of Lee et al. (2021), who suggest that contextual factors significantly mediate relationships between these indicators.

Also, inflation (log_hicp) consistently demonstrates a negative and statistically significant coefficient (model (3)) in relation to insurance penetration in GDP (log_ip_tot), which reveals a favorable relationship between these variables, being adverse with the findings obtained by Ćurak et al. (2013).

Therefore, the first hypothesis, *H1. Total insurance market penetration is directly and positively influenced by social and economic dimensions at the level of the EU,* is partially fulfilled, only for GDP per capita and inflation. Unfavorable implications for the EU total insurance penetration in GDP were induced by GDP growth, poverty and employment. As regards human development, measured by HDI, there are inconsistent results, favorable and unfavorable, which require further in-depth analysis, by specific groups of the EU countries (developed and developing countries).

4.2. Results of Bayesian Network Analysis using Gaussian Graphical Models

The second econometric model, *Bayesian Network Analysis using GGM*, complements the regression-based approaches by capturing the inherent complexity and intensity of the relationships between socio-economic development indicators and insurance penetration for each distinctive class of insurance, life and non-life insurance. This modeling technique enables the exploration of interdependent pathways and indirect and global effects, providing a more nuanced understanding of these dynamics.

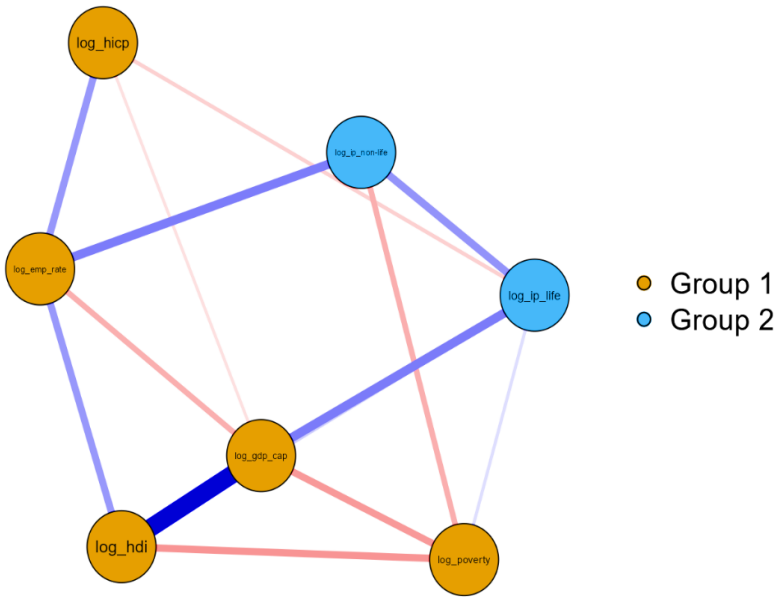

Fig. 1 Bayesian Network Analysis results by applying the GGM, life and non-life insurance classes, 2007-2023
Source: Authors own research contribution in JASP 19

GGM analysis (Fig. 1, completed by Table A1, Table A2 and Fig. A1 from Appendix) demonstrates a direct positive association between GDP per capita (log_gdp_cap) and life insurance penetration (log_ip_life), supporting the findings from previous studies (Arena, 2008; Beck & Webb, 2003). This relationship aligns with established theories on the link between economic development and financial intermediation, underscoring the pivotal role of income levels in driving the EU insurance sector.

It can be seen, also, a favorable link between inflation (log_hicp) and life insurance penetration (log_ip_life), given by negative pathway between them, supporting the same effect observed in the regression models for the total insurance market (model (3) in Table 3). This finding is opposite with the insights from Ćurak et al. (2013), highlighting the negative impact of high inflation on the insurance sectors.

Moreover, a favorable interplay between employment rate (log_emp_rate) and non-life insurance penetration (log_ip_non-life) is revealing. This reflects the complex association between labour market performance and insurance dimension, for total market and, in particular, for non-life insurance class, as we demonstrated from the previous regression analyses (model (4) in Table 3). These findings are supported by contextual complexities noted by Lee et al. (2021), in their examination of employment-insurance sector relationships.

The network analysis, built in Fig. 1, shows an intriguing insight into the relationships between poverty (log_poverty), human development (log_hdi), and life and non-life insurance penetration (log_ip_life and log_ip_non-life). An indirect positive path emerges between poverty (log_poverty) and life insurance penetration (log_ip_life), contrasting with the previous regression findings, but aligning with non-linear dynamics observed by Alhassan and Biekpe

(2016). Therefore, the EU poverty level favorably influenced non-life insurance contribution to GDP, and unfavorably, life insurance component (with lower intensity than non-life insurance class), being in line with the results obtained by Cedric and Ronald (2024) for life and non-life insurance market in Africa.

Therefore, the second hypothesis, *H2. Insurance penetration for each insurance class – life and non-life insurance – is overall favorably interconnected with social and economic indicators*, is fulfilled only for non-life insurance segment, while for life-insurance is partially fulfilled (in relation to poverty).

To put in a nutshell, the application of multifactorial regression models, considering panel data analysis, and Bayesian Network Analysis (GGM) provide essential information for observing and understanding the potential impact of economic and social factors on the insurance sector - both on the total and each insurance class.

5. CONCLUSIONS

Research into the relationship between socio-economic development indicators and their impact on the insurance sector at the EU level has demonstrated the existence of a complex and diverse regional economy. Using econometric methods, such as panel data analysis based on multifactorial regression models, as well as network analysis, for the disclosure of the relationship intensity analysis, this research highlights the dynamics of insurance sectors within the economies of the EU Member States.

The results of this study show that EU Member States, the more developed economies they have, the higher GDP per capita they register and an increase of the insurance sector. However, the analysis presents nuanced results, and the intensity and direction of the relationships vary depending on the models applied and the regional contexts.

Multifactorial regression models showed mixed results regarding the impact of socio-economic development on the total insurance sector, while the GGM analysis highlighted complex associations between socio-economic development and life and non-life insurance sector indicators. The challenge of obtaining different perspectives emphasizes the need for multidimensional analytical frameworks and an in-depth analysis by group of EU countries.

The methodological approach proved to be adequate in capturing the complexity and linearity of the link between socio-economic development and insurance. Overall, the findings of this research show the nuanced, context-dependent nature of the relationship between socio-economic development and the insurance sector at EU level, both on the total, and life and non-life insurance sectors.

Accordingly, it is essential to further investigate the potential contextual effects that could further shape the understanding of these dynamics – such as digital transformation – and the integration in the analyses of other advanced modeling techniques to provide additional information, such as structural equation modelling or other econometric models. Ensuring a continuity of research in this field is essential for a more detailed understanding of the factors and mechanisms that shape the future development of the insurance sector at the level of EU Member States.

REFERENCES

Asongu, S. A., Akpan, U. S., & Isihak, S. R. (2018). Insurance and inequality in sub-Saharan Africa: Policy thresholds. *International Journal of Social Economics, 45*(10), 1432–1448. https://doi.org/10.1186/s40854-018-0114-0

Alhassan, A. L. (2016). Insurance market development and economic growth: Exploring causality in 8 selected African countries. *International Journal of Social Economics, 43*(3), 321–339. https://doi.org/10.1108/IJSE-09-2014-0182

Alhassan, A. L., & Biekpe, N. (2016). Determinants of life insurance consumption in Africa. *Research in International Business and Finance, 37*, 17–27. https://doi.org/10.1016/j.ribaf.2015.10.016

Arena, M. (2008). Does insurance market activity promote economic growth? A cross-country study for industrialized and developing countries. *Journal of Risk and Insurance, 75*(4), 921–946. https://doi.org/10.1111/j.1539-6975.2008.00291.x

Athanasiadis, S., Sulista, M., & Mrkvicka, T. (2023). Dependence relationship between insurance demand and some economic, financial, and socio-demographic factors: Evidence from different groups of European countries. *Insurance Markets and Companies, 14*(1), 110–120. http://dx.doi.org/10.21511/ins.14(1).2023.10

Beck, T., & Webb, I. (2003). Economic, demographic, and institutional determinants of life insurance consumption across countries. *The World Bank Economic Review, 17*(1), 51–88. https://doi.org/10.1093/wber/lhg011

Cedric, M., & Ronald, D. (2024). Examining the effect of insurance development on economic complexity: Evidence from Africa. *The Journal of International Trade & Economic Development,* 1–25. https://doi.org/10.1080/09638199.2024.2396938

Chang, C. P., & Berdiev, A. N. (2013). Natural disasters, political risk and insurance market development. *The Geneva Papers on Risk and Insurance - Issues and Practice, 38*(3), 406–448. https://doi.org/10.1057/gpp.2013.14

Cristea, M., Marcu, N., & Cârstina, S. (2014). The relationship between insurance and economic growth in Romania compared to the main results in Europe – a theoretical and empirical analysis. *Procedia Economics and Finance, 8*, 226–235. https://doi.org/10.1016/S2212-5671(14)00085-9

Cristea, M., Noja, G. G., Drăgoi, D., & Andriţoiu, L. C. (2021). Insurance development and life quality in the European Union countries: An empirical assessment. *Facta Universitatis, Series: Economics and Organization, 18*(4), 313–324. https://doi.org/10.22190/FUEO210616022C

Ćurak, M., Džaja, I., & Pepur, S. (2013). The effect of social and demographic factors on life insurance demand in Croatia. *International Journal of Business and Social Science, 4*(9), 65–72.

European Commission. (2023). *Eurostat database*. Retrieved from: https://ec.europa.eu/eurostat/data/database. Accessed on: 16 November 2024.

Feyen, E., Lester, R., & Rocha, R. (2011). What drives the development of the insurance sector? An empirical analysis based on a panel of developed and developing countries. *World Bank Policy Research Working Paper,* 5572. https://doi.org/10.1596/1813-9450-5572

Ganić, M., & Ridic, G. (2025). *A panel cointegration analysis of insurance development and FDI nexus.* In M. Kour, S. Taneja, E. Ozen, K. Sood & S. Grima (Eds.), Financial landscape transformation: Technological disruptions (Emerald Studies in Finance, Insurance, and Risk Management) (pp. 1–16). Leeds: Emerald Publishing Limited. https://doi.org/10.1108/978-1-83753-750-120251001

Haiss, P., & Sümegi, K. (2008). The relationship between insurance and economic growth in Europe: A theoretical and empirical analysis. *Empirica, 35*(4), 405–431. https://doi.org/10.1007/s10663-008-9075-2

Han, L., Li, D., Moshirian, F., & Tian, Y. (2010). Insurance development and economic growth. *The Geneva Papers on Risk and Insurance - Issues and Practice, 35*(2), 183–199. https://doi.org/10.1057/gpp.2010.4

Kaushal, S., & Ghosh, A. (2018). Banking, insurance and economic growth in India: An empirical analysis of relationship from regulated to liberalized era. *Journal of Financial Economic Policy, 10*(1), 17–37. https://doi.org/10.1108/JFEP-03-2017-0022

Kondovski, H. (2021). The innovative impact of insurance for economic growth: The evidence from new EU member states. *Economics, 9*(2), 109–122. https://doi.org/10.2478/eoik-2021-0024

Lee, H. S., Chong, S. C., Yap, S., Sia, B. K., & Chen, Y. X. (2021). Does economic freedom in host countries lead to increased non-life insurance development?. *SAGE Open, 11*(4), 21582440211054486. https://doi.org/10.1177/21582440211054486

Levy, S. (2019). Social insurance, human development and social cohesion. *Journal of Human Development and Capabilities, 20*(3), 280–296. https://doi.org/10.1080/19452829.2019.1612548

OECD (2011). *OECD Journal: Financial Market Trends*. OECD Publishing. http://dx.doi.org/10.1787/fmt-v2011-1-en

Outreville, J. F. (2013). The relationship between insurance and economic development: 85 empirical papers for a review of the literature. *Risk Management and Insurance Review, 16*(1), 71–122. https://doi.org/10.1111/j.1540-6296.2012.01219.x

Pradhan, R. P., Arvin, M. B., Nair, M. S., Hall, J. H., & Bennett, S. E. (2021). Sustainable economic development in India: The dynamics between financial inclusion, information and communications technology

development, and economic growth. *Technological Forecasting and Social Change, 169*, 120758. https://doi.org/10.1016/j.techfore.2021.120758

Pradhan, R. P., Arvin, M. B., & Norman, N. R. (2015). Insurance development and the finance-growth nexus: Evidence from 34 OECD countries. *Journal of Multinational Financial Management, 31*, 1–22. https://doi.org/10.1016/j.mulfin.2015.02.001

Sawadogo, R., Guérineau, S., & Ouedraogo, I. M. (2018). Life insurance development and economic growth: Evidence from developing countries. *Journal of Economic Development, 43*(2), 1–28.

Sibindi, A. B. (2015). Corporate governance practices of the insurance industry in South Africa. *Corporate Ownership & Control, 12*(2), 426–434. https://doi.org/10.22495/cocv12i2c4p2

Siminică, M., Zaharia, A., Lădaru, G. R., Cîrciumaru, D., & Dobrotă, C. E. (2025). Determinants of the actual financial knowledge–multivariate logistic regression. *Journal of Applied Economics*, *28*(1), p.2482546. https://doi.org/10.1080/15140326.2025.2482546

Swiss Re Institute (2023). *Sigma research – World insurance series*. Retrieved from: http://swissre.com/institute/research/sigma-research/World-insurance-series.html (Accessed on: 18 October 2024).

United Nations Development Programme (2023). *Human Development Reports.* Retrieved from: https://hdr.undp.org/data-center/human-development-index#/indicies/HDI (Accessed on: 18 October 2024).

Ward, D., & Zurbruegg, R. (2000). Does insurance promote economic growth? Evidence from OECD countries. *The Journal of Risk and Insurance, 67*(4), 489–506. https://doi.org/10.2307/253847

Zerriaa, M., & Noubbigh, H. (2016). Determinants of life insurance demand in the MENA region. *The Geneva Papers on Risk and Insurance - Issues and Practice, 41*(4), 491–511. https://doi.org/10.1057/gpp.2016.1

APPENDIX

Table A1 Summary of Network, GGM, life and non-life insurance market

Number of nodes	Number of non-zero edges	Sparsity
7		14 / 21

Source: Authors' contribution to JASP 19

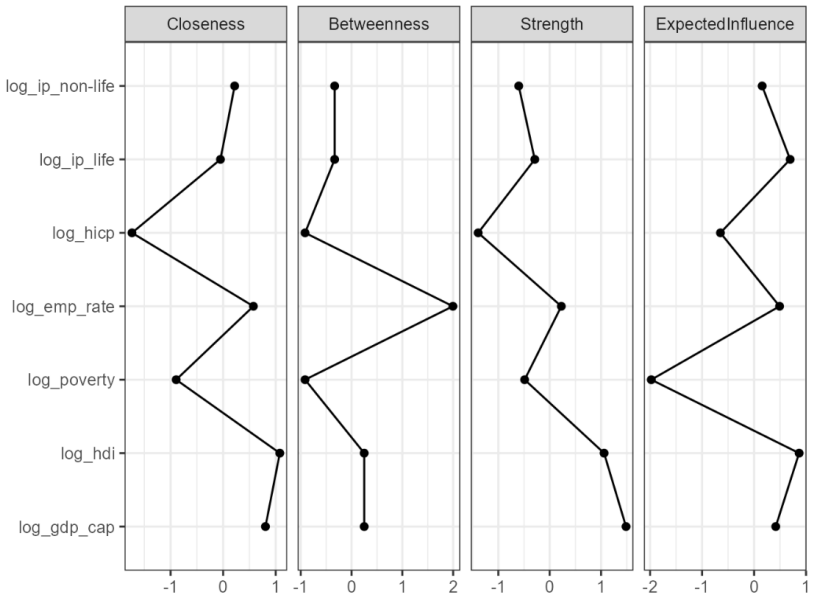

Fig. A1 GGM, centrality plot, life and non-life insurance market
Source: Authors own research contribution in JASP 19

Table A2 GGM, centrality measures per variable, life and non-life insurance market

	Network			
Variable	Betweenness	Closeness	Strength	Expected influence
log_gdp_cap	0.249	0.805	1.486	0.417
log_hdi	0.249	1.078	1.059	0.867
log_poverty	-0.915	-0.893	-0.487	-1.977
log_emp_rate	1.995	0.576	0.227	0.491
log_hicp	-0.915	-1.734	-1.392	-0.647
log_ip_life	-0.333	-0.051	-0.290	0.694
log_ip_non-life	-0.333	0.219	-0.602	0.155

Source: Authors own research contribution in JASP 19

SOCIO-EKONOMSKI POKRETAČI ODRŽIVOG OSIGURANJA U EVROPSKOJ UNIJI: DOKAZI IZ NAPREDNOG EKONOMETRIJSKOG MODELA

Posmatrajući evropski pejzaž u kojem su prisutne razlike između država članica Evropske unije u smislu ekonomskog razvoja, a posebno sektora osiguranja, ovo istraživanje ima za cilj da analizira uticaj ključnih socio-ekonomskih pokazatelja na stepen penetracije osiguranja za period 2007-2023. Istraživačka metodologija se sastoji u dva seta ekonometrijskih modela, naime, panel analiza podataka zasnovana na multifaktorijalnim regresijskim modelima (Robust Regression, Cross-sectional time-series with Possible Generalized Least Squares, Generalized Method of Moments with Arellano-Bond dynamic panel-data esestimateation, Between Regression (regression on group means), Random-effects with the Maximum Probability estimation, and Instrumental variables on two stage least squares), i Bayesian Network Analysis. Analiza pokazuje raznolik odnos, što ukazuje na to da države članice sa razvijenim ekonomijama imaju napredniji sektor osiguranja. Štaviše, pokazuje složen odnos, i pozitivan i negativan, u zavisnosti od analiziranog modela. Rezultati modela primenjenih u članku pokazuju različite uticaje ljudskog razvoja, siromaštva, stope zaposlenosti i inflacije na penetraciju osiguranja. Ovaj članak pruža sveobuhvatan pristup i razumevanje kako ekonomski i socijalni faktori utiču na sektor osiguranja u Evropskoj uniji i pruža osnovne informacije za podršku budućem razvoju sektora osiguranja.

Ključne reči: *penetracija osiguranja, Evropska unija, ekonomski razvoj, društvene dimenzije, ekonometrijsko modeliranje*