“Dependence relationship between insurance demand and some economic, financial, and socio-demographic factors: Evidence from different groups of European countries”

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DEPENDENCE RELATIONSHIP BETWEEN INSURANCE DEMAND AND SOME ECONOMIC, FINANCIAL, AND SOCIO-DEMOGRAPHIC FACTORS: EVIDENCE FROM DIFFERENT GROUPS OF EUROPEAN COUNTRIES

Abstract

The insurance sector is a significant component of the economy and its financial system. Therefore, sound growth and protection of the insurance industry against systemic risks are critical requirements for any country's social and economic development. The paper analyzes the dependence between insurance demand represented by insurance penetration and various factors from economics, finance, socio-demographics, and institutions. The analysis is conducted within certain clusters of European countries, which are determined by functional clustering analysis concerning the magnitude and shape of the insurance penetration curves. The dependence is analyzed via linear mixed-effect models. The analysis shows significantly different dependencies between the clusters, proving the existence of different conditions for different European insurance markets, especially concerning economic growth, income, financial development, and unemployment. In contrast, interest rates, inflation, urbanization, and education do not play a significant role in these insurance markets. The institutional development seems insignificant for all clusters except for certain economies in transition. The findings imply that there is a need for countries across Europe to identify country-specific determinants of insurance. In that respect, European policymakers and managers can direct specific policies based on the identified determinants' relationship with insurance, especially in developing countries.

Keywords European countries clustering, functional cluster analysis, insurance penetration, insurance industry models, random mixed effect models

JEL Classification G22, G28

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INTRODUCTION

One of the longstanding goals of the European Union (EU) is to create a single European market (SEM), as removing economic barriers should allow for better trade flow and a larger market with more competition. This single market should also apply to the insurance sector, creating a single European insurance market (SEIM). Having stated that, the insurance sector is a significant component of the economy and its financial system, since the growth of premiums collected by insurers is based on the underwriting, business cycles as well as on gross domestic product (GDP). Therefore, sound growth and protection of the insurance industry against systemic risks are critical requirements for the social and economic development of any country. The effective development of the insurance industry is impossible without deep knowledge of the factors influencing insurance activities and demand.

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Certainly, data on insurance market characteristics show disparities that cannot be overlooked among the European countries revealing inhomogeneous patterns in terms of insurance demand. Before establishing the SEIM, it is important to learn how much insurance demand differs between the European countries and to assess which factors influence the demand behavior. On that account, this paper analyzes the insurance demand in chosen homogeneous groups of European countries with respect to some factors such as economic, financial, and sociodemographic. The homogenous groups are formed according to the insurance demand measured by two properties of insurance penetration curves, such as their magnitude and shape.

Insurance penetration is one of the most commonly used measures of insurance market demand, as it manages to connect the insurance industry of the country, viewed through the level of the gross written premiums in a given year, with its economy or its GDP in the same year. High insurance penetration shows the progress of the overall contribution of the insurance industry to the economy and the level of acceptance and priority given on insurance among the common people of the country. On the other hand, low insurance penetration shows that people of the country do not take or trust insurance as a risk management tool for the risks they face, which means that the insurance might be yet in the embryonic stage of its industry life cycle. However, one must not ignore that insurance penetration measure provides a picture of insurance industry ignoring the state of the economy (recession or expansion) in which insurance business operates.

1. LITERATURE REVIEW

Insurance demand has three essential measures: insurance premiums, the ratio of insurance premiums to population (also called insurance density), and the ratio of insurance premiums to GDP. The latter ratio, known as insurance penetration, is an important measure of a country's insurance demand (Vimala & Ramanathan, 2018). This study utilizes insurance penetration as a proxy for insurance demand. It proposes a 'triangle' of factors underlying the insurance demand covering the aspects of

1) economics and finance;
2) socio-demographics; and
3) institutions.

Studies have shown that the absence of barriers can increase the average GDP across participating markets by almost 10%. Albeit there is a "strong degree of heterogeneity across EU countries", which may make combining their economies less efficient (In't Veld, 2019). Including the insurance sector in the SEM, the study gets the SEIM. Efforts by European governments and the European Commission are in place to integrate insurance providers into the SEIM; however, this is not a straightforward process (McGee, 2020). Recent studies show that the EU insurance market remains divergent across member and non-member states, and its economics are not set significantly apart from insurance markets outside the EU (Jagric et al., 2018). Creating an SEIM would be crucial to learn how much insurance demand differs between the EU countries and to assess which factors influence this measure.

The empirical analysis is based on the dataset of 34 European countries from 2004 to 2021 and uses insurance penetration as a proxy for insurance demand. Knowing that the average level of insurance penetration in the European domestic market in recent years has been around 5%, the European countries can be divided into clusters, as shown in Dai et. al. (2021). Several explanatory variables are determined that lead to variations in the demand for insurance within the clusters of the European countries by using a linear mixed-effect statistical model, including autocorrelation, to take the time dependency of the variables into account. From this perspective, the model will deliver important insight into how the macroeconomic environment influences the insurance industry's growth and, consequently, help policymakers develop effective and feasible strategies for creating a SEIM.

- **Factors on Demand for Insurance** – Various economic, institutional, and sociodemographic variables can be established that might affect in-

surance demand in any given country. Economic determinants relate to economic growth, GDP per capita, inflation, long-term interest rates, and the financial development index that aggregates several other indexes. The sociodemographic factor is a three-level factor consisting of urbanization, education, and unemployment. The institutional factor is represented by an institutional development index, which combines into a single index six dimensions.

- **Economic Growth** – One of the indicators that reveals the increase in the economic output of a country and the health of its economy is GDP growth. In general, the overall economic development would affect the insurance demand (Dorofti & Jakubik, 2015). This development may be positive; otherwise, the economy is considered to be in a recession. As an example of the role of economic growth in supporting insurance demand, Christophersen and Jakubik (2014) pointed out that the subdued economic growth of the last few years has negatively affected individuals' disposable income, which led to less insurance business and premiums. Insurers explored business opportunities in emerging insurance markets to face this business and profit stagnation at home.

- **GDP per Capita** – The income level is another relevant economic measure when examining insurance demand. GDP per capita serves as a measure of income and can be seen as the average earnings of people living in a specific country – as GDP is the sum of all transactions taking place within this country; it is also a measure of productivity. Dragos (2014) considered that the higher the income, the greater the potential loss, which is translated to a greater insurance demand to safeguard acquired property or life savings.

- **Long-term Interest Rates** – Interest rates reflect the rate of return earned on the investment of money in the nation's financial system. They are provided by government monetary policy while determining interbank loans and manifest themselves within society's institutions. If interest rates are low, credit is easy to come by, and people will tend to spend money rather than save it. If interest rates increase, the equilibrium between borrowing and saving money shifts towards saving, and economic activity is discouraged (Twinoburyo & Odhiambo, 2018). Thus, determining interest rates is intended to achieve a broad macroeconomic policy objective. As individual sectors of the economy may be more or less sensitive to changes in interest rates, the impact of such policy on these sectors will vary accordingly. Regarding the insurance industry, interest rates affect demand significantly across life and non-life sectors. For instance, when interest rates are very low, as they were one and a half years ago, there is less demand for life insurance products since insurers discourage customers by offering them low-guaranteed returns (Berends et al., 2013). On the other hand, Beck and Webb (2002) noted that higher interest rates make life insurers more profitable, which, in turn, develops a strong initiative to involve people in paying the premiums for life insurance products as they expect higher returns. However, Lenten and Rulli (2006) argued that higher interest rates drive people toward holding alternative assets seeking higher returns. Interest rate changes significantly affect non-life insurance prices, which are directly linked to the non-life insurance demand. For instance, the more expensive to access debt capital (i.e., higher interest rates), the more the individuals demand non-life insurance products to cover potential unexpected losses (Ma & Pope, 2003). The study by Millo and Carmeci (2010) revealed that interest rates and insurance demand have an inverse relationship. Furthermore, non-life insurers do not immediately realize the effect of sudden changes in interest rates as it takes some time for them to transfer this change in product price.

- **Education** – Education is a determinant that may enhance insurance demand. Treerattanapun (2011) explained that education increases the awareness of risk management and savings, improving an individual's understanding of the necessity of insurance protection. Feyen et al. (2011) found a positive relationship between education level and income and a trend toward higher spending on insurance policies. Dragos (2014) referenced other empirical papers that verified differences in the results obtained for the non-life and

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life insurance sectors. The level of education in a country is also used as a proxy for risk aversion since measuring risk attitude is not feasible (Outreville, 2013). Risk aversion in turn has shown a positive correlation with insurance demand. The higher the level of education, the greater the degree of risk aversion and, as a result, the higher the demand for insurance (Browne & Kim, 1993).

- **Urbanization** – Simionescu and Ulbinaitė (2021) observed that consumers' location is important when searching for determinants of insurance demand. As urbanization has gradually caused a decline in spontaneous solidarity, individuals find insurance services the grounds for their financial security. In this context, urbanization is expected to encourage higher levels of insurance consumption as it simplifies distribution (Hwang & Greenford, 2005). In addition, in non-life insurance, losses are greater in areas with higher urbanization rates, which encourages insurance consumption (Esho et al., 2004). As a result, urbanization rates have typically proxied this loss probability.

- **Inflation** – Inflation refers to the increase in the cost of goods and services over time. As product prices rise, the cost of providing insurance coverage can also increase, affecting insurance companies' profitability and ability to set premiums at a competitive level (Balcilar et al., 2020). Schanz and Treccani (2023) determined that the inflation level, or any proxy reflecting such variable, has both a positive and negative impact on insurance demand. Regarding non-life insurance, high inflation times heighten risk perception and awareness of consumers, which translates into higher demand for insurance. Moreover, a shift from financial to real-estate assets is shifted to protect against losses in a rising or high-inflation environment. If the prices of properties and goods increase, customers search for higher policy limits, increasing the demand for insurance. However, inflationary episodes result in slower economic growth, resulting in lower demand for non-life insurance, especially for non-compulsory insurance policies. Additionally, lower inflation-adjusted income levels may drive customers with low-risk profiles to spend almost nothing on insurance. For life insurance, Schanz and Treccani (2023) highlighted that inflation erodes the value of future fixed benefits, making life insurance products less attractive, constraining demand, and increasing lapses and surrenders. However, considering the effects of inflation on interest rates, savings-oriented life insurance products are more attractive than investment-based insurance products as they come with higher yields and inflation-protection features. Then, the need for higher policy limits becomes apparent and may increase the insurance demand for insurance protection products. Insurance undertakings may implement strategies such as risk management, investment diversification, and cost-cutting measures to mitigate the impact of inflation on the European insurance sector. These measures can help ensure that insurance undertakings remain profitable and provide coverage to their customers at a competitive price (Basse, 2019).

- **Unemployment** – Unemployment refers to the number of people out of work and actively seeking employment (Pham & Sala, 2021). Unemployment can impact the insurance sector in several ways. For example, as unemployment rates rise, individuals are more sensitive to prices, and they may have less disposable income to spend on insurance products leading to decreased demand for insurance products and lower revenues for insurance companies. Unemployment can also lead to increased insurance claims, particularly in businesses such as unemployment insurance, disability insurance, and workers' compensation. This can strain insurance undertakings financially, potentially affecting their ability to pay claims. Furthermore, unemployment can create economic uncertainty, which can affect the overall health of the insurance industry. This uncertainty can also lead to decreased investment and slower economic growth, influencing insurance undertakings' profitability and financial stability (Balcilar et al., 2020).

Therefore, this study aims to assess the role of a 'triangle' of factors on the demand for insurance.

2. METHOD

This study used the following variables to give insight into the various economic, institutional, and sociodemographic factors affecting insurance demand across 34 European countries.

- **Insurance demand (proxy: total insurance penetration, IP)**. This is the direct domestic total (both life and non-life) premium volume as a Gross Domestic Product (GDP) percentage. The data were sourced from the Swiss Re Institute's sigma database (Swiss Re, 2022).

- **Economic growth (proxy: GDP growth, GDPGR)**. This is the annual percentage change of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 US dollars and taken from the World Development Indicators (WDI) (World Bank, 2023a).

- **Income (proxy: GDP per capita, GDP_PPP)**. This is the GDP per capita, which was the GDP divided by the midyear population at Purchasing Power Parity (PPP). Data are in current international millions of US dollars and taken from the WDI (World Bank, 2023a).

- **Interest (Long-term interest rate, INT)**. This variable is a long-term interest rate for convergence purposes with 10-year maturity provided by the statistics for EU member states. It is related to interest rates for long-term government bonds denominated in Euros for EU area member states and in national currencies for member states that have not adopted the Euro at the time of publication. The data were sourced from the Organization for Economic Cooperation and Development (OECD) and the European Central Bank (ECB) (OECD, 2023; ECB, 2023).

- **Inflation (proxy: GDP deflator, INF)**. To measure inflation, a GDP deflator (in annual %) was used, as measured by the annual growth rate of the GDP implicit deflator, showing the rate of price change in the economy as a whole. The GDP implicit deflator was the ratio of GDP in current local currency to GDP in constant local currency. Data are based on the WDI (World Bank, 2023a).

- **Financial Development (proxy: Financial Development Index, FDI)**. This is the financial development index (FDI), ranging between 0 and 1, which was a relative ranking of countries on the depth, access, and efficiency of their financial institutions (banks, insurance companies, investment funds, and pension funds) and financial markets (stock markets and bonds). It was an aggregate of two main indices (the Financial Institution Index and Financial Markets Index), which in turn were subdivided into three sub-indices: the financial depth index, the financial access index, and the financial efficiency index. Data are supplied by the International Monetary Fund (IMF) (IMF, 2023). Svirydzenka (2016) has also provided a further explanation of this index.

- **Urbanization (urban population, URBAN)**. The urban population refers to people living in urban areas defined by national statistical offices. The data were collected and smoothed by United Nations Population Division and calculated as the percentage of the total population. The data source is from the WDI (World Bank, 2023a).

- **Education (proxy: tertiary school enrollment, EDU)**. This is the gross enrolment ratio into tertiary schools for both sexes and measured the total enrollment in tertiary education, regardless of age, expressed as a percentage of the total population of the five-year age group after leaving secondary school. Data came from the WDI (World Bank, 2023a).

- **Unemployment (unemployment, total, UNEMP)**. Unemployment is the percent share of the total labor force without work but available for and seeking employment. This study used a modeled estimate from the international labor organization (ILO) with data from the WDI (World Bank, 2023a).

- **Institutional Development (Institutional Development Index, IDI)**. The Institutional Development Index (IDI) was calculated as the average of six broad governance dimensions: Voice and accountability, political stability, government effectiveness, regulatory

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quality, the rule of law, and control of corruption. The performance of each of these dimensions ranged from approximately –2.5 (weak) to 2.5 (strong). In addition, the data source is from the World Governance Indicators (WGI) (World Bank, 2023b).

The various factors outlined above and their influence on insurance demand were not studied on a per-country basis. The countries were combined in clusters using the functional clustering method described in Dai et. al. (2021). The formed clusters consider the magnitude and shape of the underlying functions of European countries' insurance penetration. Specifically, countries were placed into the following clusters:

- **Cluster 1:** Austria, Belgium, France, Germany, Ireland, Malta, Portugal, Slovakia, Switzerland, United Kingdom;
- **Cluster 2:** Cyprus, Greece, Luxembourg, Turkey;
- **Cluster 3:** Denmark, Finland, Italy, Netherlands, Spain;
- **Cluster 4:** Croatia, Czech Republic, Iceland, Romania, Slovenia, Sweden;
- **Cluster 5:** Norway, Russia, Ukraine;
- **Cluster 6:** Bulgaria, Estonia, Hungary, Lithuania, Poland, Serbia.

Consequently, for every cluster, a linear mixed-effect model with the response variable being the overall insurance penetration was calculated. The countries represented the mixed effect, while the fixed effect was determined by the exploratory variables studied. Additionally, a within-year and country sequential autocorrelation was included to account for the time-series nature of the data. This mixed-effect approach made it possible to model varying insurance penetration levels for different countries. Finally, stepwise backward analysis was used to identify all the explanatory variables influencing insurance penetration within each cluster. The significant explanatory factors, along with their calculated p-values, are presented in the results part.

Cluster analysis is a critical step in exploratory data analysis to identify homogeneous subgroups among observations. The proposed method of clustering functional data is categorized as a distance-based method and found in Dai et al. (2021). This method combines the magnitude and shape variation of the functions represented as a d-dimensional vector

$$T_i = \left(\left(T_{i1}\right),\ldots,\left(T_{id}\right)\right), \quad i = 1,\ldots,s, \tag{1}$$

in an equal manner. To convert these two different types of variations into types that are easy to be handled by our method, data transformations were used as described in Dai et al. (2020). In particular, V_1 denotes a two-step transformation that first shifts curves to have a common mean at zero, thereby eliminating magnitude variation. Then, the resulting curves are normalized by their L_2 norms to extract shape information.

If $V_1(T_{ij})$ are the curves after applying the two-step transformation V_1 on the raw curves T_{ij}, i = 1, ..., s, j = 1, ..., d the long vector becomes

$$T_i = \left(\left(T_{i1}\right),\ldots,\left(T_{id}\right),V_1\left(T_{i1}\right),\ldots,V_1\left(T_{id}\right)\right), \quad i = 1,\ldots,s, \tag{2}$$

where the first part represents the magnitude of the curves, and the second part represents the shape of the curves. Then, a set of differences was constructed

$$D_f = \left\{\begin{array}{l} dT_{ii'} = T_{ij} - T_{i'j} \quad \& \\ dV_{1ii'} = V_1\left(T_{ij}\right) - V_1\left(T_{i'j}\right), \\ i = 1,\ldots,s, \quad j = 1,\ldots,d \end{array}\right\}, \tag{2}$$

that joins the differences of possible combinations of raw and transformed curves. In the next stage, functional ordering (f_0) was applied to the joint difference set D_f to construct the dissimilarity matrix out of the measure of centrality, $M_i = 1 - f_0$. This study concentrated on functional orderings found in Myllymäki and Mrkvička (2020) that satisfy intrinsic graphical interpretation (IGI), namely, on the area rank ordering. This ordering considers the aspects of two other major orderings, extreme rank length ordering and continuous rank ordering.

3. RESULTS

The following results were obtained via the software R and the **nlme** package (Pinheiro et al., 2021) using the **lme** function for computing the linear mixed effect model. First, this model (full model) considered all factors to provide their statistical significance upon insurance demand. Table 1 summarizes the effect of all factors on demand for insurance showing the estimated coefficients and p-values of their significance tests (at the 5% significance level) under all formed clusters. The model incorporated the correlation structure of insurance penetration sampled as a time series through the AR(1) model.

Ultimately, this model showed the presence of more than one insignificant factor. As a result, an iterative process (stepwise-backward regression variable selection) was adopted where this study eliminated in a step-wise fashion the least significant variables to end up to a simpler and more accurate model (reduced model) with a reduced number of statistically significant factors. Table 2 summarizes the effect of those factors on demand for insurance and their p-values that revealed to be significant after employing the stepwise-backward regression process at the 5% significance level. This variable selection process was also able to find factors whose significance had initially been masked due to the correlation with other factors.

4. DISCUSSION

Interestingly, factors significantly influencing the insurance demand of the selected European countries differed considerably between country clusters. In Cluster 1, income and financial development were significant factors, while unem-

Table 1. Coefficients and p-values of factor significance tests for all formed clusters obtained before stepwise-backward regression analysis

Variable	Cl 1		Cl 2		Cl 3		Cl 4		Cl 5		Cl 6	
	coeff	p	coeff	p	coeff	p	coeff	p	coeff	p	coeff	p
Interc	0.051	0.135	0.009	0.814	–0.111	0.215	0.020	0.503	0.196	0.096	0.008	0.622
GDPGR	0.007	0.816	–0.035	0.008	–0.013	0.749	–0.011	0.178	0.060	0.009	–0.004	0.475
GDPPC	–9E–7	0.000	2E–7	0.013	5E–7	0.038	–2E–7	0.034	3E–7	0.419	–4E–7	0.000
INT	0.020	0.760	NA	NA	–0.105	0.374	0.012	0.540	NA	NA	NA	NA
INF	0.054	0.440	0.010	0.774	–0.109	0.338	0.019	0.064	–0.003	0.821	0.003	0.737
FDI	0.072	0.000	0.001	0.930	0.112	0.002	0.025	0.001	–0.023	0.342	0.037	0.000
URBAN	0.005	0.904	0.009	0.870	0.063	0.605	0.010	0.816	–0.263	0.131	0.015	0.573
EDUC	0.011	0.078	0.000	0.829	–0.009	0.177	0.002	0.569	0.005	0.382	0.004	0.362
UNEMP	–0.068	0.098	0.011	0.623	–0.001	0.991	0.022	0.275	0.355	0.028	–0.031	0.000
IDI	0.003	0.815	0.003	0.536	0.024	0.168	NA	NA	0.021	0.007	0.001	0.653

Note: NA values are present since there is no convergence of the full model, so a reduced model had to be applied.

Table 2. Coefficients and p-values of factor significance tests for all formed clusters obtained after stepwise-backward regression analysis

Variable	Cl 1		Cl 2		Cl 3		Cl 4		Cl 5		Cl 6	
	coeff	p	coeff	p	coeff	p	coeff	p	coeff	p	coeff	p
Interc	0.071	0.000	0.019	0.001	–0.027	0.026	0.035	0.000	0.020	0.033	0.018	0.000
GDPGR	–	–	–0.037	0.001	–	–	–0.015	0.037	0.063	0.001	–	–
GDPPC	–8E–7	0.000	3E–7	0.000	12E–7	0.000	–2E–7	0.000	–	–	–4E–7	0.000
INT	–	–	–	–	–	–	–	–	–	–	–	–
INF	–	–	–	–	–	–	–	–	–	–	–	–
FDI	0.059	0.001	–	–	0.086	0.004	0.022	0.001	–0.020	0.044	0.045	0.000
URBAN	–	–	–	–	–	–	–	–	–	–	–	–
EDUC	–	–	–	–	–	–	–	–	–	–	–	–
UNEMP	–0.083	0.014	–	–	–	–	–	–	0.218	0.032	–0.027	0.000
IDI	–	–	–	–	–	–	–	–	0.018	0.000	–	–

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ployment was found to be significant only after the stepwise-backward analysis. In Cluster 2, economic growth and income were significantly associated with insurance demand before and after stepwise-backward analysis. This same analysis provided evidence for the significant role played by income and financial development within Cluster 3. The significant factors in Cluster 4 were income and financial development, while economic growth proved to be significant only after stepwise-backward analysis. The Cluster 5 analysis revealed the significant influence of economic growth, unemployment, and institutional development on insurance demand, while financial development began to be significant only after stepwise-backward analysis. Lastly, the before and after stepwise-backward analysis showed that income, financial development, and unemployment are significant within Cluster 6.

Therefore, it can be seen that income has a significant impact (positive for Clusters 2 and 3 and negative for Clusters 1, 4, and 6) on demand for insurance in all clusters, except for Cluster 5. Financial development seems to be significantly positive in all clusters besides Cluster 5, in which it is found to be significant with negative signs. Moreover, financial development is not a significant factor for Cluster 2. The institutional development factor provides evidence for its positive significance only within Cluster 5, while it remains insignificant for all other clusters. Importantly, several factors did not play a significant role for all clusters: interest rates, inflation, urbanization, and education.

These factors seem to have no significant influence on the insurance demand of the selected European countries for several reasons. Given the decision not to distinguish between insurance businesses (life or non-life) and to choose the total insurance business, the long-term interest rate factor seems not to play a significant role in the estimation of demand for insurance. Inflation may affect the purchasing power of consumers, while it may not necessarily influence their decision to go for insurance. Urbanization can lead to changes in consumer behavior, but it may not have the same impact on demand for all types of insurance. For example, urbanization may increase demand for life insurance but not significantly impact non-life insurance. Lastly, education may not significantly affect insurance demand, as being not the only factor influencing consumer behavior. An individual with a high level of education may be more likely to understand the benefits of insurance. Still, it is not a guarantee for them to take out insurance due to the complexity of insurance products, financial constraints, or personal preferences.

On the other hand, income and financial development are directly linked to insurance demand for almost all clusters. Higher income levels can accelerate insurance product sales, while financial development can provide consumers with more insurance options and increase their confidence in insurance institutions. The coefficients on the income proxy are significantly negative in Clusters 1, 4, and 6, while they are significantly positive in Clusters 2 and 3. As can be seen, the influence of income is very mixed and varies greatly at different clusters. The different levels of income effect between products of banking or other financial institutions and insurance products may be the reason for the different impact of income on insurance across different clusters.

The parameter estimates for the financial development factor are significantly positive in almost all clusters. This suggests that the importance of financial development is high in the majority of selected European countries, which implies that the financial sectors act as an intermediary to boost insurance demand. In Cluster 5, insurance demand is negatively impacted at high levels of financial development, but the impact is reversed at lower levels. Moreover, in Cluster 2, the insignificance of the financial development factor is evident. In light of these findings, the role of financial development for countries joined in Cluster 2 and 5 seems not to be as important as in other clusters.

In terms of statistical significance, an interesting intermediate case seems to arise when linking unemployment and economic growth to insurance demand. The impact of these factors on insurance demand may vary significantly between clusters. In Cluster 1, which includes several advanced economies with robust financial systems, unemployment fluctuates over the business cycle, creating longer unemployment durations (Paul, 2011). Moreover, the coefficient related to unemployment is significantly negative, suggesting that

unemployment in this particular cluster could be disadvantageous to the insurance demand in case of an economic downturn. Clusters 2 to 4 are insignificant in terms of unemployment, illustrating that this factor seems to affect countries in these clusters similarly. In Clusters 5 and 6, which join most of the countries with emerging and developing economies, the main characteristic is the persistently high unemployment rates that could lead to households losing purchasing power and political and social instability in some countries. The unemployment model parameter for Cluster 5 is positive, while for Cluster 6 is negative in line with the results in Cluster 1. It seems that unemployment for Cluster 5 is heading in the same direction as that of insurance. One possible explanation is that individuals of these cluster countries in unemployment status and with non-economic activities may have family assistance to spend more on insurance preventing, in this way, greater financial risk despite their current economic difficulties (Brown et al., 2012).

On the other hand, insurance growth may have different levels of response to the business cycle and conditions reflected by economic growth. The coefficient values of the significant factors obtained after the stepwise-backward analysis may provide information about the response of the insurance sector to a possible adverse shock of the economies in specific clusters. For example, insurance markets in Clusters 2 and 4 (negative sign between insurance and economic growth) seem to have more resilience than insurance markets in Cluster 5 (positive sign between insurance and economic growth) during economic stress periods. This means that the underperformance of emerging and developing economies joined in Cluster 5 may put more strain on demand for insurance than is the case for the advanced economies joined in Clusters 2 and 4.

Additionally, the institutional environment may significantly shape the positive sign insurance demand in Cluster 5, which gathers two major countries with economies in transition – Russia and Ukraine. The health of institutional circumstances may indicate how the insurance industry functions or develops. Unhealthy institutional regimes could explain the deterioration of insurance growth through moral hazard, adverse selection, and the risk-taking behavior of the public. For example, the insurance sector could be damaging in countries within Cluster 5 unless institutional infrastructure is sound. In contrast, the presence or absence of a relatively sounder institutional environment becomes insignificant for the countries within the remaining clusters.

CONCLUSION

The paper's main aim was to analyze the dependence between insurance demand represented by insurance penetration and various factors from economics, finance, socio-demographics, and institutions within specific clusters of European countries, as identified using functional clustering analysis concerning the magnitude and shape of the insurance penetration curves. The data were analyzed via linear mixed-effect models. This study's findings provide new insight into the managerial implications of insurance and its significant factors. First, the insurance industry is an important economic component because of the number of premiums it collects, the scope of its investment, and, more fundamentally, the critical social and economic function it performs in covering personal and company risks. Second, the impact of the proposed factors on insurance demand may vary between country clusters due to differences in economic, financial, and other conditions present in each country cluster, such as the level of economic development, financial stability, institutional soundness, and consumer behavior. Both these points imply that there is a need for countries across Europe to identify country-specific determinants of insurance. In that respect, European policymakers and managers can direct specific policies based on the identified determinants' relationship with insurance, especially in developing countries.

Furthermore, it is essential to note that the results of this study are limited to the specific countries and time periods analyzed and may not generalize to other countries or periods. Additionally, other factors, such as cultural differences, insurance regulations, and demographic factors, may also impact

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insurance demand in different countries and contribute to the observed differences between clusters. Further research is needed to fully understand the factors influencing insurance demand and determine whether these findings could be generalized to other countries and time periods. Overall, the results of this study highlight the complexity of the factors influencing insurance demand and the importance of considering multiple factors and their interactions to gain a comprehensive understanding of insurance markets.

AUTHOR CONTRIBUTIONS

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REFERENCES

1. Aussilloux, V., Bénassy-Quéré, A., Fuest, C., & Wolff, G. (2017). *Making the best of the European Single Market.* Bruegel. Retrieved from https://www.bruegel.org/policy-brief/making-best-european-single-market
2. Balcilar, M., Gupta, R., Lee, C., & Olasehinde-Williams, G. (2020). Insurance and economic policy uncertainty. *Research in International Business and Finance, 54*, 101253. https://doi.org/10.1016/j.ribaf.2020.101253
3. Basse, T. (2019). The impact of the financial crisis on the dividend policy of the European insurance industry: Additional empirical evidence. *Zeitschrift Für Die Gesamte Versicherungswissenschaft, 108*(1), 3-17. https://doi.org/10.1007/s12297-019-00429-w
4. Beck, T., & Webb, I. (2002). *Determinants of life insurance consumption across countries* (Policy Research Working Papers). https://doi.org/10.1596/1813-9450-2792
5. Berends, K., McMenamin, R., Plestis, T., & Rosen, R. (2013). The sensitivity of life insurance firms to interest rate changes. *Economic Perspectives,* 37(2), 47-78. Retrieved from https://www.chicagofed.org/publications/economic-perspectives/2013/2q-berends-mcmenamin-plestis-rosen
6. Brown, J. R., Goda, G. S., & McGarry, K. (2012). Long-term care insurance demand limited by beliefs about needs, concerns about insurers, and care available from family. *Health Affairs, 31*(6), 1294-1302. https://doi.org/10.1377/hlthaff.2011.1307
7. Browne, M. J., & Kim, K. (1993). An international analysis of Life Insurance Demand. *The Journal of Risk and Insurance, 60*(4), 616. https://doi.org/10.2307/253382
8. Busemeyer, M. R., & Iversen, T. (2020). The Welfare State with private alternatives: The transformation of popular support for Social Insurance. *The Journal of Politics, 82*(2), 671-686. https://doi.org/10.1086/706980
9. Christophersen, C., & Jakubik, P. (2014). *Insurance and the macroeconomic environment* (Financial Stability Report). Retrieved from https://www.eiopa.europa.eu/publications/insurance-and-macroeconomic-environment_en
10. Dai, W., Athanasiadis, S., & Mrkvička, T. (2021). A new functional clustering method with combined dissimilarity sources and graphical interpretation. *Computational Statistics and Applications*. https://doi.org/10.5772/intechopen.100124
11. Dai, W., Mrkvička, T., Sun, Y., & Genton, M. G. (2020). Functional outlier detection and taxonomy by Sequential Transformations. *Computational Statistics & Data Analysis, 149*, 106960. https://doi.org/10.1016/j.csda.2020.106960
12. Dorofti, C., & Jakubik, P. (2015). *Insurance sector profitability and the Macroeconomic Environment*. Retrieved from https://www.eiopa.europa.eu/publications/insurance-sector-profitability-and-macroeconomic-environment_en
13. Dragos, S. L. (2014). Life and non-life insurance demand: The different effects of influence factors in emerging countries from Europe and Asia. *Economic Research-Ekonomska Istraživanja,*

27(1), 169-180. https://doi.org/10.1080/1331677x.2014.952112

14. ECB. (2023). *Long-term interest rate statistics for EU Member States.* Retrieved from https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/long_term_interest_rates/html/index.en.html
15. Esho, N., Kirievsky, A., Ward, D., & Zurbruegg, R. (2004). Law and the determinants of property-Casualty Insurance. *Journal of Risk and Insurance, 71*(2), 265-283. https://doi.org/10.1111/j.0022-4367.2004.00089.x
16. 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* (Policy Research Working Papers). https://doi.org/10.1596/1813-9450-5572
17. Franzetti, C. (2021). *Pricing export credit*. Springer.
18. Hwang, T., & Greenford, B. (2005). A cross-section analysis of the determinants of life insurance consumption in mainland China, Hong Kong, and Taiwan. *Risk Management and Insurance Review, 8*(1), 103-125. https://doi.org/10.1111/j.1540-6296.2005.00051.x
19. IMF. (2023). *Financial development index database*. Retrieved from https://data.imf.org/?sk=f8032e80-b36c-43b1-ac26-493c5b1cd33b
20. In't Veld, J. (2019). The economic benefits of the EU Single Market in goods and services. *Journal of Policy Modeling, 41*(5), 803-818. https://doi.org/10.1016/j.jpolmod.2019.06.004
21. Jagric, T., Bojnec, S., & Jagric, V. (2018). A map of the European Insurance Sector – are there any borders. *Economic Computation and Economic Cybernetics Studies and Research, 52*(2), 283-298. https://doi.org/10.24818/18423264/52.2.18.17
22. Jarrow, R. A. (2021). The economics of insurance: A derivatives-based approach. *Annual Review of Financial Economics, 13*(1), 79-110. https://doi.org/10.1146/annurev-financial-040721-075128
23. Lenten, L. J., & Rulli, D. N. (2006). A Time-series analysis of the demand for life insurance companies in Australia: An unobserved components approach. *Australian Journal of Management, 31*(1), 41-66. https://doi.org/10.1177/031289620603100104
24. Ma, Y., & Pope, N. (2003). Determinants of international insurers' participation in foreign Non-Life Markets. *The Journal of Risk and Insurance, 70*(2), 235-248. https://doi.org/10.1111/1539-6975.00058
25. McGee, A. (2020). *Single market in insurance: Breaking down the barriers*. Routledge.
26. Millo, G., & Carmeci, G. (2010). Non-life insurance consumption in Italy: A sub-regional panel data analysis. *Journal of Geographical Systems, 13*(3), 273-298. https://doi.org/10.1007/s10109-010-0125-5
27. Myllymäki, M., & Mrkvička, T. (2020). *GET: Global envelopes in R*. Retrieved from https://arxiv.org/abs/1911.06583
28. OECD. (2023). *Long-term interest rates*. Retrieved from https://data.oecd.org/interest/long-term-interest-rates.htm
29. Outreville, J. F. (2013). *Risk aversion, risk behavior and demand for insurance: A survey.* (ICER Working Paper Series No. 11). https://doi.org/10.2139/ssrn.2363877
30. Paul, S. (2011). On the measurement of unemployment in the developing and developed countries. *International Journal of Development and Conflict, 1*(3), 365-377. https://doi.org/10.1142/s2010269011000233
31. Pham, B. T., & Sala, H. (2021). Cross-country connectedness in inflation and unemployment: Measurement and macroeconomic consequences. *Empirical Economics, 62*(3), 1123-1146. https://doi.org/10.1007/s00181-021-02052-0
32. Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D., & R Core Team (2021). *nlme: Linear and Nonlinear Mixed Effects Models*. R package version 3.1-152. Retrieved from https://cran.r-project.org/package=nlme
33. Schanz, K., & Treccani, P. (2023). *The return of inflation: What it means for insurance*. Retrieved from https://www.genevaassociation.org/publication/socio-economic-resilience/return-of-inflation-what-it-means-for-insurance
34. Simionescu, M., & Ulbinaitė, A. (2021). The relationship between insurance market and macroeconomic indicators in the Baltic States. *Journal of Baltic Studies, 52*(3), 373-396. https://doi.org/10.1080/01629778.2021.1920440
35. Svirydzenka, K. (2016). *Introducing a new broad-based index of Financial Development* (IMF Working Papers No. 16/5). https://doi.org/10.5089/9781513583709.001
36. Swiss Re. (2022). *Swiss Re sigma database*. Zurich: Swiss Re Institute, Swiss Re Management Ltd. Retrieved from https://www.swissre.com/institute/research/sigma-research/data-explorer.html
37. Treerattanapun, A. (2011). *The impact of culture on non-life insurance consumption*. Retrieved from https://repository.upenn.edu/wharton_research_scholars/78
38. Twinoburyo, E. N., & Odhiambo, N. M. (2018). Monetary policy and economic growth: A Review of International Literature. *Journal of Central Banking Theory and Practice, 7*(2), 123-137. https://doi.org/10.2478/jcbtp-2018-0015
39. Vimala, B., & Ramanathan, K. A. (2018). Insurance Penetration and Insurance Density in India - An Analysis. *IJRAR- International Journal of Research and Analytical Reviews, 5*(4), 229-232. Retrieved from http://ijrar.com/upload_issue/ijrar_issue_20542543.pdf
40. World Bank. (2023a). *World development indicators*. Retrieved from https://datatopics.worldbank.org/world-development-indicators/
41. World Bank. (2023b). *Worldwide governance indicators*. Retrieved from http://info.worldbank.org/governance/wgi/

http://dx.doi.org/10.21511/ins.14(1).2023.10