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Determinants of Life Insurance Consumption in OECD Countries Using FMOLS and DOLS Techniques

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Abstract: This paper aims to examine the determinants of life insurance consumption in 30 OECD countries using panel data from 1996 to 2020. This study uses GDP per capita, Life expectancy, Urbanization, School education, and Health expenditure as the determinants to measure the OECD countries' life insurance consumption. Insurance density is used as a proxy for life insurance consumption. Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and causality tests are applied in this study. Our empirical results revealed that the variables urbanization, school education, and GDP per capita significantly impact life insurance consumption, whereas life expectancy and health expenditure were found to have an insignificant relationship in estimating life insurance consumption. These findings will help all insurance industry stakeholders in OECD countries in policy formulation and decision making.

Keywords: life insurance consumption; OECD countries; FMOLS and DOLS

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1. Introduction

Apart from banking, insurance is another significant sector that offers financial services. Like banks, the insurance industry deals with risks and contributes to economic growth. According to Camino-Mogro and Bermúdez-Barrezueta (2019), the insurance industry faces different risks compared to banks. However, these risks are connected to individuals and businesses seeking to reduce the chances of asset loss or health-related issues. Insurers play a crucial role in mitigating these risks, ensuring stability in the financial market and contributing to important economic indicators that provide a "sense of peace" (Oscar Akotey et al. 2013). As highlighted by Charumathi (2012), a mature and advanced insurance industry is beneficial for economic growth, as it provides funding for the infrastructure development of an economy. This allows businesses to maintain their production capacity without worrying about unexpected events. Insurance companies use the law of large numbers to pool insurance risks and this is only effective with a sufficient volume of business. Without growth, insurance firms may struggle to gather the necessary volume and their profitability will heavily depend on their ability to invest and expand (Greene and Segal 2004).

The success of the insurance industry is not only influenced by specific company traits or small economic factors. More prominent economic factors also play a role. Identifying the key factors related to the insurance sector is important as this information is valuable for insurance companies, government decision makers, and those involved in the monetary system. These factors have an impact on economic growth. Micro- and macroeconomic elements affecting insurance profitability are connected to industry-specific factors, which go beyond a company's market share and concentration index (Bourke 1989; Athanasoglou et al. 2008; Tipurić et al. 2008). The insurance industry makes significant contributions to sustainable economic development and growth by collecting public funds and acting as a major investor for businesses. Both individuals and organizations face risks, and insurance helps transfer those risks. Insurance policies promise protection for individuals

and organizations, offering assurances for future benefits. However, these policies are intangible and complex. According to Hofstede (1995) in 1995, the value of insurance policies depends on how consumers perceive them.

According to Crosby and Stephens (1987), life insurance (LI) as a service can be described as abstract, complex, and focused on uncertain benefits that may arise in future; for consumers, it is difficult to assess it as a service even after purchasing. That ambiguity and unavoidable uncertainty are part of LI consumption. Additionally, while purchasing an LI policy, consumers usually consider the offers, the agent selling the policy, and the brand image of the company. Furthermore, customers may seek culturally derived decision-making guidelines to justify their choices. In the last few decades, demand for LI has experienced phenomenal growth, significantly outperforming worldwide income growth. This development is due to widespread socio-economic changes, in particular, the increase in enrolment rates in tertiary education and life expectancy. Due to this cost of dependence, the demand for LI coverage has increased. Also, developments in the market structure have attributed to the surge in the demand for life insurance. Any increase in foreign direct investments in the insurance sector in many economies ensures a more competitive environment in the marketplace, increasing the popularity of life insurance. Furthermore, Chui and Kwok (2008) suggest that in ageing economies, there is an increased interest in financial savings for retirement, which strengthens the LI demand.

LI offers important financial benefits to both individuals and the economy. Firstly, insurance products can act as a way to save money for the long term, and these savings can be invested in various projects. LI companies have become crucial providers of funds for long-term projects, acting as financial intermediaries and contributing to the development of capital markets (Impavido and Musalem 2000; Catalan et al. 2000). Numerous studies have shown that the growth of the insurance sector also contributes to overall economic development (Ward and Zurbruegg 2000; Soo 1996; Webb 2000). Secondly, the importance of LI has grown as a method to reduce income risks for individuals, families, and communities. This is particularly relevant in response to urbanization and the formalization of economic relationships. LI serves as a way to mitigate financial risks, providing a safety net for individuals and communities.

Although quite a few studies exist on the determinants of LI consumption, many unresolved issues still need attention. To be specific, does the expenditure on social security influence LI demand? Likewise, an increase in life expectancy is related to a rise in LI consumption.

These questions were not addressed adequately by the studies so far concerned with microeconomic factors (Burnett and Palmer 1984; Fitzgerald 1987) and more to do with the insurance market in the U.S. (for example, Mantis and Farmer 1968; Chen et al. 2001). Several studies have demonstrated the benefits of analyzing LI demand across different countries. The study by Beenstock et al. (1988) relies on 10 OECD countries focusing on LI demand, covering the years 1970 to 1981, while the remaining studies (Browne and Kim 1993; Outreville 1996) are a combination of different economies. Developed and developing countries were both considered by (Beck and Webb 2002) in their sample.

While their study focused on identifying the impact on developing and developed countries separately, there has been no attempt to examine and identify the drivers determining the demand for LI in OECD countries. Therefore, this study focuses on identifying the factors that influence, with a particular emphasis on 30 OECD countries, thus broadening the scope of coverage. Amongst the factors considered in this study, the determinants urbanization, school education, and GDP per capita are found to be significant. In contrast, life expectancy and health expenditure are found to be insignificant in determining life insurance consumption.

This paper is structured as follows: To begin with, Section 2 deals with the extant literature review on LI consumption, while Section 3 is presented with determinants of life insurance. Next, methodology, data details, and sources are described in Section 4.

Then, Section 5 deals with the analysis results and discussion, while the conclusion, a few limitations, and the future scope of the study are presented in Section 6.

2. Literature Review

The demand for LI is typically modeled through a life cycle framework that seeks to optimize the expected lifetime utility of households. According to Fischer (1973) and Campbell (1980), households receive financial support from the insurance firms as per the product proposals in case of the untimely death of the wage-earner.

Lewis (1989), while determining LI demand, incorporated other variables like preferences of the dependents and beneficiaries. LI is used as a financial instrument against the volatility of household consumption. More so, there is much ambiguity on life expectancy, resulting in LI consumption. There are models which suggest that one of the critical factors for LI consumption is risk aversion. The positive relation between risk aversion and LI consumption-related studies has been documented and listed by Zietz (2003). Factors relevant to demographic and psychographic variables that influence LI demand were examined by Burnett and Palmer (1984). Later, Chen et al. (2001) established the impact of gender and the life cycle effect using a cohort analysis. LI acts as a substitute for conventional financial investments like bonds and equities (Fortune 1973).

Both micro- and macroeconomic factors influence demand for LI. Beenstock et al. (1988) tested the association between the macroeconomic factors and demographic variables of LI consumption in a sample of developed economies. Specifically, a positive and significant relationship between the variables age, income, life expectancy, and LI demand has been established. Further, it has been proved that the level of education is positively related to the demand for insurance (Truett and Truett 1990). Also, it has been established that the price of the insurance product, an individual's income, and their level of financial development affect the insurance demand (Outreville 1996). According to Nesterova's (2008) research, the insurance demand is positively related to a higher life expectancy, dependency ratio, and income.

On the other hand, interest rates and inflation are negatively related to the demand for insurance. Later, Çelik and Kayali (2009) verified the determinants of insurance demand and established a positive association between the variables income and population, whereas education level and inflation had a negative association. Hwang and Gao's (2003) study concentrated on demographic and macroeconomic factors on demand for insurance across China. Their study revealed that urbanization, income, and education had a significant positive impact with an insignificant positive impact on inflation. Finally, a study in the MENA region by Zerriaa and Noubbigh (2016) verified that income, inflation, GDP per capita, financial developments, and life expectancy were positively associated with demand for insurance, while social security and the dependency ratio resulted in a negative association.

Browne and Kim (1993) conducted a study on a substantial sample of not only developed, but also developing countries, where they discovered that a country's average LI consumption is a function of factors like national income, social spending, the dependency ratio, and the expected inflation rate. Likewise, Beck and Webb (2002) confirmed that the relationship between income levels for a lifetime and dependence on insurance products is positive. Though most of the studies above focused on the context of the U.S., some studies investigated the insurance demand in Asian and OECD countries. For example, Li et al.'s (2007) study in OECD countries focused on the impact of financial and socio-economic factors on insurance demand. Similarly, a study by Dragos (2014) revealed that urbanization and the level of education were significantly related to insurance consumption in the Asian region.

Several studies in the literature examined how the economic development across nations influences the demand for LI (Beenstock et al. 1988; Outreville 1990, 1996; Ward and Zurbruegg 2000; Arena 2008). Though many studies are available in the extant literature which establish the relationship between insurance demand and the growth of the economy,

many studies have concentrated on developed economies (Han et al. 2010; Chang et al. 2014) and Asian developing economies (Horng et al. 2012; Ghosh 2013). Dragos et al. (2017), in their study on LI demand estimation in European countries, proved that the variable distribution of income was not statistically significant, while Yadav and Sudhakar (2018) established, in their study in India, that the correlation between the income level and demand for insurance was statistically significant. Zerriaa et al. (2017) have proved that LI demand increases with financial development in a study carried out in Tunisia. A study in Africa involving 31 African countries using the panel data from 1996 to 2010 verified that health expenditure, financial development, and institutional quality were positively associated with insurance demand. OECD countries are taken as a sample in our study due to the availability of data and as only a few studies dealt with determining LI consumption in these select countries, considering recent data.

3. Determinants of LI

Based on the extant literature available, we have identified the five most significant socio-economic and demographic characteristics which could influence LI consumption. The identified variables are life expectancy, GDP per capita, school education, health expenditure, and urbanization. This range of socio-economic and demographic indicators impact LI consumption, and therefore, these variables are considered for the study. By considering these factors collectively, insurers can gain insights into the socio-economic environment and the potential demand for life insurance. The correlations and dependencies of these factors on LI consumption in earlier studies are discussed below.

3.1. Life Expectancy

According to the model contributed by Lewis (1989), which focused on optimizing the lifetime utility of dependents, the likelihood of the breadwinner's death is likely to be associated positively with the demand for life insurance. Beenstock et al. (1988) analyzed data from 10 developed countries and found that the life insurance demand is positively influenced by income, life expectancy, and the dependency ratio. Browne and Kim (1993), Outreville (1996), and Beck and Webb (2002) tested the correlation between life expectancy and insurance consumption and found that this relationship is statistically insignificant. Furthermore, according to the Froelicher (2018) report, OECD countries have experienced sustained growth in life expectancy, with the potential for continued expansion. Life expectancy is considered one of the critical factors; as the life of an individual increases, the price of the LI product decreases, resulting in a higher consumption of insurance. Hence, we propose the following hypothesis:

H1: *There shall be a significant relationship between LI consumption and life expectancy in OECD countries.*

3.2. GDP Per Capita

GDP per capita is one of the significant socio-economic factors; many studies have considered GDP per capita as one of the determinants while measuring LI consumption. Later, a study by Arena (2008) considered GDP per capita as one of the variables while examining the link between the activity relevant to the insurance market and other variables in the context of developed and developing countries. Furthermore, Cristea et al. (2014) established that GDP per capita has a higher impact on LI growth compared to non-LI in Romania. Furthermore, several studies like Esho et al. (2004), Elango and Jones (2011), Park and Lemaire (2012), Feyen et al. (2011), Trinh et al. (2016), and Lee and Lee (2020) have established the positive association between the demand for insurance and GDP per capita, more so with regard to non-life insurance. Based on this, we propose the following hypothesis:

H2: *There shall be a significant relationship between LI consumption and GDP per capita in OECD countries.*

3.3. School Education

The proportion of the population enrolled in tertiary education serves as an alternative indicator for formal education. Enhanced education levels, as noted by Truett and Truett (1990), prompt individuals to provide increased safety coverage for their dependents. A well-educated population comprehends the advantages of life insurance (LI) more readily, fostering a greater likelihood of life insurance consumption (Browne and Kim 1993). This perspective is supported by Outreville (1996). In contrast, Duker (1969) and Auerbach and Kotlikoff (1989) have posited a contrary view, asserting that a higher level of education is inversely linked to risk aversion. Consequently, individuals with advanced education may adeptly manage risks, leading to a reduced inclination to opt for life insurance. In a study spanning 14 countries in central and southeastern Europe, Kjosevski (2012) identified GDP per capita, inflation, health expenditure, the level of education, and the rule of law as the most robust predictors of life insurance demand. Sherif and Shaairi (2013) discovered a positive association between the life insurance demand and factors such as income, Islamic banking development, education, and the size of the Muslim population.

H3: *There shall be a significant relationship between LI consumption and school education in OECD countries.*

3.4. Urbanization

According to (Neumann 1969; Outreville 1996), urbanization is all about a regular shift to industrialized economies from a rural agricultural-based economy, which results in the better development of the insurance market. Though Outreville (1996) and Beck and Webb (2002) included urbanization as one of the explanatory variables in an insurer's production function, it was found that urbanization is not a significant variable. Instead of urbanization, using population density, Feyen et al. (2011) established a positive effect on insurance consumption. Hence, we propose the hypothesis:

H4: *There shall be a significant relationship between LI consumption and urbanization in OECD countries.*

3.5. Health Expenditure

As per the report of the Institute for Health Metrics and Evaluation, health spending globally has the potential to rise significantly from its 2018 level of USD 8 trillion to approximately USD 18 trillion in 2040. This would require an estimated allocation of around 9% of the world's GDP to healthcare. Universal Health Coverage (UHC) aims to provide quality health services to all individuals without causing financial strain to them or their families. Although healthcare spending varies in countries, Poullier et al. (2002) have categorized the sum of private and public healthcare expenses as the total health expenditure.

Grossman (1972) argues that investing in health expenditure can lead to growth in the economy in the medium-to-long term, as it is considered an investment in human capital. Rivera IV and Currais (1999) support this idea, finding a positive correlation between the status of health and productivity in OECD countries during 1960–1990. Similarly, Hartwig and Sturm (2014) discovered that GDP growth was one of the determinants for determining health expenditure growth when examining data from 33 OECD countries between 1970 and 2010.

Variations in health expenditure across countries are a cause for concern, as highlighted by the OECD (2011), which notes significant disparities in the health spending shares of Gross Domestic Product (GDP) among OECD countries. Additionally, the WHO (2009) points out that government health expenditures differ significantly between Europe (76%)

and South-East Asia (34%). Several studies have focused on identifying determinants of health expenditure, including Ke et al. (2011), which suggests that health expenditure generally does not grow faster than gross domestic product, with an income elasticity between 0.75 and 0.95. Another study by Lindley and Mark (2010) proposes that life expectancy is a factor that determines health and hospital costs.

Minimal studies are carried out to establish the link between insurance consumption and health expenditure. Gertler and Sturm (1997) observed that the government's public health expenditures can be reduced by increasing private insurance. Though many studies have concentrated on assessing the relationship between expenditure on health and economic growth across countries, limited studies have considered including health expenditure while determining LI consumption. Therefore, this study includes health expenditure in determining LI consumption, and we propose the following hypothesis:

H5: *There shall be a significant relationship between LI consumption and health expenditure in OECD countries.*

4. Methodology

To identify the determinants of LI consumption in the context of OECD countries, we use the annual panel data of 30 OECD countries for the time period 1996–2020. Missing data for the countries Costa Rica, Chile, Colombia, Estonia, Israel, Latvia, Lithuania, and Slovenia restricted the scope of the study to only 30 OECD countries. As the period considered for this study is until 2020, relatively, this study considers the data up to the recent year. Unlike many other studies, this study not only considers the data up to 2020, but also includes health expenditure as one of the determinants to estimate LI consumption. This study treats LI consumption across OECD countries as a dependent variable to ensure sufficient randomness and representativeness. As in several studies (Beck and Webb (2002); Kjosevski (2012)), LI density is being treated as a substitute for LI consumption in this research. Beck and Webb (2002) propose that the LI demand may be evaluated through various proxies, such as LI density, LI penetration, LI in force to GDP, or LI in private savings. According to Nesterova (2008), LI density is a suitable dependent variable as the adjustment is not needed for varying levels of economic development in cross-country analysis.

The ratio of total LI premiums collected to the total population of the country is defined as the LI density. To interpret the estimated coefficients as elasticity, all variables considered in this study were converted into a logarithmic form. The details of the variables considered and the data sources are presented in Table 1. Data for this study had come from multiple sources. LI density data are accessed from the OECD database. In addition, data relevant to independent variables were sourced from the World Development Indicators database.

Table 1. Details of study variables.

Variable	Description	Unit	Source
LDENSITYLIFE	LI density—the ratio of total LI premiums collected to the population of a given country	USD	OECD Stat
LGDPPC	Gross Domestic Product Per Capita	USD	World Bank
LLIFEEXP	Life expectancy at birth	In years	UNDP
LURBAN	Urbanization	In millions	
LSCHOOLING	School Education—Tertiary school enrollment as expressed as a percentage of the total population	Years	UNDP
LHEALTHEXP	Health Expenditure	% of GDP	World Bank

To examine the determinants of LI consumption, we employ the following economic function:

$$LDENSITYLIFE = f\{LGDPPC, LLIFEEXP, LURBAN, LSCHOOLING \text{ and } LHEALTHEXP\} \quad (1)$$

Summary statistical measures of the variables considered are given in Table 2. It may be understood from the table that the variable LURBAN has the highest mean, median, and maximum value, followed by LGDPPC. Also, it may be observed that the variable LDENSITYLIFE has the highest standard deviation with the minimum value. Jarque–Bera test results show that none of the variables considered follow a normal distribution.

Table 2. Summary statistics.

Statistic	LDENSITYLIFE	LLIFEEXP	LURBAN	LSCHOOLING	LHEALTHEXP	LGDPPC
Mean	6.56200	4.370017	16.30487	4.041082	2.100974	10.26385
Median	6.93275	4.376079	16.06319	4.127146	2.127523	10.39984
Maximum	10.8437	4.43505	19.42265	5.000793	2.824014	11.72411
Minimum	1.33078	4.213164	12.41656	2.090911	1.360359	8.02419
Std. Dev.	1.67478	0.037768	1.511107	0.450227	0.263635	0.721192
Skewness	−0.50171	−0.93263	−0.3679	−1.52661	−0.35382	−0.73624
Kurtosis	3.17557	3.799349	3.082767	6.073896	3.407246	3.250419
Jarque–Bera	32.4269	128.6914	17.13258	586.5951	20.83141	69.71592
Probability	0	0	0.00019	0	0.00003	0

The selected independent variables were used to identify the determinants of LI consumption with LI density as a proxy. Three preliminary steps were followed to analyze the panel data.

Specifically, we began by analyzing if there was cross-sectional dependence of the variables LGDPPC, LLIFEEXP, LURBAN, LSCHOOLING, and LHEALTHEXP across the panel units. Then, we examined the panel unit root using a select few tests that accommodate the existence of cross-sectional dependence. After that, Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) are used to find the cointegration relationship between LDENSITYLIFE and other independent variables, as given in Equation (1). Finally, a causality test was conducted between LDENSITYLIFE and other independent variables.

5. Results and Discussion

Table 3 illustrates the correlation matrix of variables selected for the study. Except for the correlation between LDENSITYLIFE and URBAN, all other correlations are found to be significant.

Table 3. Correlation Matrix.

Variable	LDENSITYLIFE	LLIFEEXP	LURBAN	LSCHOOLING	LHEALTHEXP	LGDPPC
LDENSITYLIFE	1					
LLIFEEXP	0.592746 ***	1				
LURBAN	−0.0404	−0.07281 **	1			
LSCHOOLING	0.130344 ***	0.473776 ***	0.161014 ***	1		
LHEALTHEXP	0.450588 ***	0.580579 ***	0.123618 ***	0.486951 ***	1	
LGDPPC	0.785356 ***	0.81267 ***	−0.24292 ***	0.294272 ***	0.635132 ***	1

*** 1% level. ** 5% level.

To start with, the chosen variable's cross-sectional dependency is assessed. The tests used are Breusch–Pagan LM, Pesaran scaled LM, Bias-corrected scaled L.M., and a Pesaran CD test. The outcomes of these tests are presented in Table 4. The tests confirmed the existence of the cross-sectional dependence of the variables at their level values.

Table 4. Cross-sectional dependency tests.

Tests	LDENSITY LIFE	LLIFEEXP	LURBAN	LSCHOOLING	LHEALTHEXP	LGDPPC
Breusch–Pagan LM	5068.543 ***	10120.06 ***	9393.469 ***	5486.57 ***	6337.742 ***	8843.605 ***
Pesaran scaled LM	156.0747 ***	327.3371 ***	302.7034 ***	170.2473 ***	199.1046 ***	284.0613 ***
Bias-corrected scaled LM	155.4497 ***	326.7121 ***	302.0784 ***	169.6223 ***	198.4796 ***	283.4363 ***
Pesaran CD	60.42601 ***	100.2495 ***	71.0869 ***	67.1292 ***	58.3816 ***	93.2646 ***

*** significance at 1% level.

According to Dritsakis (2004), the non-stationarity of the macroeconomic time series can result in unrealistic correlations between the variables employed. For the results to be dependable, the variables must remain stable (Dragoș and Dragoș 2013). The stability of the variables is evaluated using unit root tests. We used Im, Pesaran, and Shin W-stat; ADF—Fisher Chi-square; Levin, Lin, and Chu t*; and P.P.—Fisher Chi-square unit root tests for examining the stability of the variables. The outcomes of these tests are presented in Table 5, and it may be observed that all the variables considered in this study were stationary at a level that is I(0). Therefore, as all the variables are cointegrated, it is possible to explore the long-term relationship between them.

Table 5. Unit root test results.

Variables	Levin, Lin, and Chu	Im, Pesaran, and Shin W-Stat	ADF—Fisher Chi-Square	P.P.—Fisher Chi-Square
LDENSITYLIFE	−6.27332 ***	−3.06324 ***	93.4345 ***	113.468 ***
LLIFEEXP	−10.506 ***	−2.9898 ***	114.702 ***	185.493 ***
LURBAN	−4.66823 *	1.11362 *	64.5066 ***	124.357 ***
LSCHOOLING	6.24328 ***	−1.823 ***	99.1623 ***	127.192 ***
LHEALTHEXP	−2.3275 ***	1.67869 *	35.6584 *	24.2147 *
LGDPPC	−5.06399 ***	−0.77369 ***	52.6048 ***	41.6975 ***

*** 1% level. * 10% level.

To examine the cointegrated relationship of variables, we used Pedroni (1999, 2004) and also Kao (1999) tests. The results of the Pedroni test and Kao cointegration test are shown in Tables 6 and 7, respectively. The results of the Pedroni test suggest a cointegrated relationship between the variables. Further, the cointegrated relationship among the variables is also confirmed by the Kao test.

The Fully Modified Ordinary Least Squares method proposed by Paramati et al. (2017) minimizes the bias due to the application of the OLS approach.

Table 6. Results of Pedroni Cointegration test.

Measures	Statistic	*p*-Value	Weighted Statistic	*p*-Value
Panel v-Statistic	−0.54821	0.7082	−2.54177	0.9945
Panel rho-Statistic	2.647744	0.9959	3.365224	0.9996
Panel PP-Statistic	−1.78021	0.0375 **	−2.32974	0.0099 ***
Panel ADF-Statistic	−2.10787	0.0175 **	−5.29602	0 ***

*** significance at 1% level. ** significance at 5% level.

Table 7. Kao cointegration test results.

Measure	Statistic	*p*-Value
ADF statistic	−2.1001	0.0179 **

** indicate statistical significance at a 5% level.

In this study, we used FMOLS and DOLS to determine the cointegration between LDENSITYLIFE and the independent variables given in Equation (1). Unlike a few previous studies, we used only LGDPPC, LLIFEEXP, LURBAN, LSCHOOLING, and LHEALTHEXP as the determinants to measure the LICONSUMPTION in OECD countries. The estimators applying FMOLS and DOLS are presented in Table 8, and it may be observed that the relationship between LDENSITYLIFE and LURBAN is negative and significant. Hence, hypothesis H4 is supported. This finding is in contrast to a few studies which established not only a positive, but also an insignificant relationship between LDENSITYLIFE and LURBAN. Browne and Hoyt (2000), modeling the demand for property-liability insurance, used urbanization as a proxy to find regions with a higher probability of loss, but the variable was statistically insignificant. Beck and Webb (2002) estimated LI consumption across several countries using demographic, economic, and institutional determinants, including urbanization as one of the variables. Nevertheless, the study found no significant correlation between urbanization and the usage of life insurance. Urbanization may not have a significant impact on LI consumption as the majority of the people in OECD countries live in urban areas compared to other countries. The urban population in OECD countries rose from 73 to 79 per cent from 1990 to 2010 (De Backer et al. 2016). This may be because people usually migrate from rural areas to urban areas for work. To some extent, urban areas guarantee regular income; therefore, people may not opt for insurance for risk aversion.

Table 8. Determinants of life insurance demand as measured by insurance density.

Determinants	FMOLS	DOLS	Fixed Effects	Random Effects
LLIFEEXP	0.869608 (1.967348)	−4.53091 (3.661788)	1.19686 (1.295041)	−0.98981 (1.14576)
LURBAN	−0.83264 ** (0.357165)	−1.73763 ** (0.871079)	−0.89197 *** (0.233582)	−0.13250 (0.10083)
LSCHOOLING	0.483174 *** (0.111744)	0.977749 *** (0.233872)	0.471699 *** (0.072959)	0.41683 *** (0.07188)
LHEALTHEXP	−0.05954 (0.199289)	−0.03914 (0.343221)	−0.01089 (0.13472)	0.00047 (0.13314)
LGDPPC	0.994971 *** (0.09785)	1.151822 *** (0.165235)	1.007421 *** (0.065911)	1.042154 *** (0.06528)
R-squared	0.966389	0.99531	0.965529	0.603116
Adjusted R-squared	0.96472	0.982338	0.96389	0.600449

*** significance at 1% level. ** significance at 5% level. Values in parentheses denote standard error.

Among the other independent variables chosen for the study, LSCHOOLING and LGDPPC had significant positive coefficients, resulting in supporting hypotheses H2 and H3. Therefore, the increase in the values of these variables will result in an improvement in the values of LDENSITYLIFE. Regarding LGDPPC, several studies, including Cristea et al. (2014), established that GDPPC has a more substantial impact on LI growth compared to non-LI Romania. Lee et al. (2018) found that as income increases, individuals tend to consume more and invest in their human capital, which results in a greater demand for insurance to safeguard their future earnings and the anticipated consumption of their beneficiaries. Therefore, the GDPPC has a positive effect on life insurance (Hassan 2022).

Higher levels of education can be associated with a higher degree of risk aversion, leading to increased awareness of the importance of life insurance. In numerous studies (Browne and Kim (1993); Li et al. (2007); Arena (2008); Han et al. (2010); Lee et al. (2013)) the impact of risk aversion is measured using education to gauge the demand for life insurance.

Also, it may be noted that the LLIFEEXP variable's coefficient is positive in FMOLS and negative in DOLS, but has an insignificant relationship with LDENSITYLIFE. In contrast, the coefficient of LHEALTHEXP is negative, but has an insignificant relationship with LDENSITYLIFE. Hence, the hypotheses H1 and H5 are not supported. Similar to several previous studies, this study also established a positive relationship between LIFEEXP and LI consumption, though it is insignificant. Browne and Kim (1993); Outreville (1996), and Beck and Webb (2002) tested the association between life expectancy and insurance consumption and found that this relationship is statistically insignificant. Therefore, although it is anticipated that the increasing life expectancy will result in people demanding more LI and investing less in other saving instruments, like several other studies, this study also shows that the relationship between LIFEEXP and LDENSITYLIFE is found to be insignificant.

As anticipated, the relation between LDENSITYLIFE and LHEALTHEXP is negative but insignificant in this study. As the total health expenditure increases, it is obvious that LI consumption will decrease. Overall, the association between health expenditure and insurance is complex and multifaceted and depends on several factors, which include the structure of healthcare systems, the design of health insurance policies, and individual and population-level health characteristics.

The utilization of FMOLS and DOLS for parameter estimation in the model yields largely comparable results, affirming the consistency of findings between the two methods. This consistency serves to validate the reliability and robustness of the model. Also, it may be observed from Table 8 that the results of the fixed and random effects model are also more or less similar to the FMOLS and DOLS, except for LURBAN which is non-significant in the random effects model.

The regression estimation may lack consistency in the presence of an endogeneity issue. This issue emerges when an independent variable employed in the regression exhibits a correlation with the error term, thereby violating the crucial exogeneity condition essential for Ordinary Least Squares (OLS) estimation (Ullah et al. 2018). We confirmed the exogeneity of the regressors by assessing their correlation with the error term. To achieve this, we used the error terms from the regression and computed the Pearson correlation coefficients between the regressors and the residuals. As depicted in Table 9, the correlation matrix indicates that none of the regressors exhibit a significant correlation with the errors. Consequently, we conclude that the estimates from FMOLS are unbiased and consistent. The presence of multicollinearity was examined using the variable inflation factor (VIF) by performing separate regressions for each variable against all other variables and then applying the VIF formula to each one. It can be observed from Table 9 that the values of VIF are low, indicating a minimum level of multicollinearity. Therefore, the variables are likely not highly correlated with each other.

Table 9. Correlation between variables and residuals.

Variable	LLIFEEXP	LURBAN	LSCHOOLING	LHEALTHEXP	LGDPPC	Residual
LLIFEEXP	1					
LURBAN	−0.07691	1				
LSCHOOLING	0.456962	0.151593	1			
LHEALTHEXP	0.573563	0.12695	0.477658	1		
LGDPPC	0.607817	−0.24985	0.274563	0.629784	1	
Residual	−0.02626	0.00077	−0.01498	−0.01524	−0.02789	1
R-squared	0.727	0.217	0.362	0.55	0.771	
VIF	3.663	1.277139	1.567398	2.222222	4.366812	

5.1. Regional Analysis

As observed from the above, one of the significant variables that influence life insurance consumption in OECD countries is GDPPC. As per the World Bank (2022), the average GDPPC of OECD member countries is USD 43,431.3, with a minimum of USD 6624.2 corresponding to Colombia and a maximum of USD 125,006 corresponding to Luxembourg. This clearly indicates the heterogeneity present in the economic well-being across the nations. To assess the significance of the results obtained in the above model, OECD countries are grouped with more or less similar GDPPC levels. Based on the GDPPC, three groups emerged: high-income, middle-income, and low-income countries. High-income countries include Australia, Austria, Belgium, Canada, The Czech Republic, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Japan, Luxembourg, The Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the USA; middle-income countries including Greece, Hungary, Korea, Portugal, and Spain; whereas the low-income countries include Mexico, Poland, the Slovak Republic, and Turkey. The model estimators using FMOLS across the groups are presented in Table 10.

Table 10. Groupwise FMOLS Estimators.

Determinants	Coefficients	Std. Error	*p*-Value
High-Income Countries			
LLIFEEXP	5.7891	3.529	0.101
LURBAN	−0.9451	0.543	0.083 *
LSCHOOLING	0.2084	0.196	0.289
LHEALTHEXP	0	0.282	1
LGDPPC	0.7131	0.136	0 ***
R-squared	0.9473		
Adjusted R-squared	0.9445		
Middle-Income Countries			
LLIFEEXP	−3.59	2.272	0.117
LURBAN	−0.168	0.875	0.849
LSCHOOLING	0.39	0.141	0.007 ***
LHEALTHEXP	−0.281	0.264	0.291
LGDPPC	1.277	0.127	0 ***
R-squared	0.965		
Adjusted R-squared	0.962		

Table 10. *Cont.*

Determinants	Coefficients	Std. Error	*p*-Value
Low-Income Countries			
LLIFEEXP	−3.581	3.239	0.272
LURBAN	−0.1	0.504	0.844
LSCHOOLING	0.649	0.144	0 ***
LHEALTHEXP	−0.114	0.534	0.831
LGDPPC	1.479	0.204	0 ***
R-squared	0.952		
Adjusted R-squared	0.947		

*** 1% significance level. and * 10% significance level.

The results indicate that life insurance consumption across different economic groups of countries is a function of the independent variables considered in the model, with the variables LGDPPC and LSCHOOLING being significant, as in the overall model considered above. However, LURBAN, which was found to be significant in the overall model, is found to be insignificant in the regional analysis. This may be due to the fact that individual OECD countries have unique characteristics and social, economic, and regulatory contexts that can influence the relationship between urbanization and life insurance consumption. Cultural perspectives on life insurance can be influential as well. Some countries may have a better cultural acceptance of insurance as part of financial planning. Also, this may be due to the fact that urbanization may not be uniform across countries in the economic group of countries. The process of urbanization frequently comes with improved educational opportunities. Elevated levels of education can foster a deeper comprehension of financial planning and risk management, motivating individuals to view investing in life insurance as a wise financial choice. This is evident from the fact that LSCHOOLING is significant in medium-income and low-income countries, not in high-income countries.

5.2. Panel Causality Analysis

According to the theory of the demand for life insurance, consumption depends on various factors such as income, risk aversion, family size, social security, wealth, and mortality rate. Some of these factors may also affect or be affected by the variables life expectancy, GDPPC, school education health expenditure, and urbanization. Therefore, there might be some causal relationships between life insurance consumption and these variables. Several studies have explored the causal relations between life insurance consumption and economic development, as well as other related variables. Trinh et al. (2023) established that cultural factors, public health spending, economic freedom and financial development, human development, life expectancy, the dependency ratio, and the Muslim region are the major determinants of life insurance consumption. According to Mathew and Sivaraman (2017), in a study focused on the cointegration and causality between macroeconomic variables and life insurance demand in India, the real rate of interest and income are negatively related to life insurance consumption. Contrary to these findings, Segodi and Sibindi (2022) discussed the presence of a positive causal relationship between life insurance and economic growth, whereas the life insurance demand was negatively affected by income, unemployment, interest rates, and inflation variables in BRICS countries. A study in the context of Indonesia by Haryanto et al. (2021) proved that economic growth and education on urbanization have strong causality in VECM. The findings indicate that life expectancy in Cameroon is positively and significantly influenced by private health expenditure, whereas public health expenditure does not exhibit a significant impact on life expectancy. Causality tests reveal a bidirectional causality between private health expenditure and life expectancy and a unidirectional causality between life expectancy and public health expenditure (Nkemgha et al. 2021). The findings of the study by (Kabir

2008) indicate that many explanatory variables were found to be statistically insignificant, suggesting that key socio-economic factors such as per capita income, education, health expenditure, access to safe water, and urbanization may not consistently exert influence on life expectancy in developing countries.

So, we performed the panel non-causality test suggested by Dumitrescu and Hurlin (2012) on the panel data set. Then, using the individual's statistic, we computed the average to derive W-statistics. The heterogeneous causality test results for LDENSITYLIFE using independent variables are reported in Table 11. The causal relationships among LDENSITYLIFE and most of the independent variables are not only bidirectional, but also statistically significant. This implies that both variables have a mutual impact, meaning changes in one variable will cause variations in the other. On the other hand, the relationships between LDENSITYLIFE and LURBAN, and LSCHOOLING and LGDPPC are unidirectional and insignificant.

Table 11. Panel causality test results.

Causality Path	W-Stat	Zbar-Stat	*p*-Value
LLIFEEXP → LDENSITYLIFE	3.11983	1.8674	0.0618 *
LDENSITYLIFE → LLIFEEXP	4.29984	4.40075	0 ***
LURBAN → LDENSITYLIFE	5.04796	6.0068	0 ***
LDENSITYLIFE → LURBAN	2.9187	1.4358	0.1511
LSCHOOLING → LDENSITYLIFE	4.8774	5.64143	0 ***
LDENSITYLIFE → LSCHOOLING	2.64535	0.84877	0.396
LHEALTHEXP → LDENSITYLIFE	3.75137	3.22324	0.0013 ***
LDENSITYLIFE → LHEALTHEXP	5.17116	6.27136	0 ***
LGDPPC → LDENSITYLIFE	5.11153	6.14334	0 ***
LDENSITYLIFE → LGDPPC	2.30387	0.11566	0.9079
LURBAN → LLIFEEXP	3.48327	2.64768	0.0081 ***
LLIFEEXP → LURBAN	11.0688	18.9328	0 ***
LSCHOOLING → LLIFEEXP	8.72197	13.8945	0 ***
LLIFEEXP → LSCHOOLING	5.21052	6.35585	0 ***
LHEALTHEXP → LLIFEEXP	5.65069	7.30085	0 ***
LLIFEEXP → LHEALTHEXP	5.32583	6.6034	0 ***
LGDPPC → LLIFEEXP	4.84796	5.57749	0 ***
LLIFEEXP → LGDPPC	4.13287	4.04228	0 ***
LSCHOOLING → LURBAN	7.39945	11.0552	0 ***
LURBAN → LSCHOOLING	9.44806	15.4533	0 ***
LHEALTHEXP → LURBAN	5.61235	7.21852	0 ***
LURBAN → LHEALTHEXP	5.7522	7.51876	0 ***
LGDPPC → LURBAN	5.04317	5.99657	0 ***
LURBAN → LGDPPC	4.67005	5.19554	0 ***
LHEALTHEXP → LSCHOOLING	4.92312	5.73885	0 ***
LSCHOOLING → LHEALTHEXP	3.80763	3.34403	0 ***
LGDPPC → LSCHOOLING	4.74465	5.3557	0 ***
LSCHOOLING → LGDPPC	3.86397	3.46498	0 ***
LGDPPC → LHEALTHEXP	5.82946	7.68465	0 ***
LHEALTHEXP → LGDPPC	3.19478	2.02833	0.0425 **

*** 1% level. ** 5% level. * 10% level.

6. Economic and Policy Implications

The GDP per capita of the country will have several economic implications on the demand for life insurance. A higher GDPPC normally indicates a higher average income of individuals in a country, and as the disposable income increases, citizens may afford more life insurance premiums, resulting in more demand for LI consumption. Countries with better GDPPC usually invest more in education and human capital development. The educated population of the country would be able to better understand the concepts of financial planning and risk management and, therefore, will not hesitate to invest more in LI consumption. Also, economic prosperity is a function of GDPPC, resulting in more employment opportunities and benefits. This will ensure many employers invest in employees' life insurance.

While economic prosperity is often linked to a stable regulatory environment and strong social security systems, the existence of these systems does not necessarily reduce the demand for life insurance. Instead, it can act as a complement to life insurance coverage. Also, a carefully designed and flexible regulatory framework is essential for creating an environment that encourages fair practices, safeguards consumers, and boosts the uptake of insurance products. Striking a balance between consumer protection and market efficiency is pivotal in establishing a resilient and enduring insurance market.

7. Conclusions

To the best of our knowledge, there has not been a comprehensive exploration of the determinants of LICONSUMPTION in OECD countries using FMOLS, DOLS, and causality tests with recent data. This study aims to fill this gap in the literature by focusing on OECD countries. The determinants considered for measuring life insurance consumption in OECD countries include LGDPPC, LLIFEEXP, LURBAN, LSCHOOLING, and LHEALTHEXP. Additionally, LLIFEDENSITY is used as a proxy for measuring life insurance consumption. This study utilizes annual panel data from 1996 to 2020, covering 30 OECD countries.

The findings indicate that the determinants LURBAN, LSCHOOLING, and LGDPPC are all significant in estimating life insurance consumption. However, LLIFEEXP and LHEALTHEXP are found to be insignificant determinants. Furthermore, the panel non-causality test results reveal a bidirectional and statistically significant relationship between LDENSITYLIFE and most other included variables, suggesting mutual influence. On the contrary, the relationship between LDENSITYLIFE and LURBAN, LSCHOOLING, and LGDPPC is unidirectional and insignificant.

One limitation of this study is the exclusion of essential determinants like the GDP growth rate, inflation rate, dependency ratio, and Gini index for measuring insurance consumption. Additionally, this study is limited to OECD countries, and the significant determinants of life insurance consumption are established using FMOLS and DOLS. Generalizing the results to non-OECD countries may not be appropriate, given the diverse range of nations in terms of income levels, development, and regional characteristics. Future research could focus on a group of countries with similar socio-economic characteristics.

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