ISSN 2090-3359 (Print)
ISSN 2090-3367 (Online)

Advances in Decision Sciences

Volume 28
Issue 2
June 2024

亞洲大學 ASIA UNIVERSITY

SCIENTIFIC & BUSINESS WORLD

Published by Asia University, Taiwan and Scientific and Business World

Long-run relationship between insurance premiums and driving factors in Mongolia

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Received: May 7, 2024; First Revision: July 11, 2024;
Last Revision: October 5, 2024; Accepted: October 16, 2024;
Published: November 4, 2024

Abstract

Purpose: The insurance industry in Mongolia is indeed expanding, though it has received comparatively less attention than other sectors within the financial industry. However, it is crucial to understand the factors that reflect and influence long-run development trends of the insurance industry, in order to actively work towards its growth and development in the future. This study examines the variables in terms of their long-run effects on the insurance industry in Mongolia.

Study design/methodology/approach: Data are sourced from the World Bank's databases. Spanning the period from 1995 to 2022, with a total of 28 observations. Johansen Cointegration rank tests, estimation of cointegrating vector, and testing of hypotheses on long-run coefficients are used to investigate the long-run relationship between insurance premiums and variables that drive them.

Findings: Our results show that price level, internet usage, and household income are the long-run variables influencing the total amount of insurance premiums in Mongolia. The long-run coefficients of these variables determine the long-run elasticities of insurance premiums. The long-run coefficient of household income is the largest and then household income is the primary factor of insurance premiums. Also, life expectancy is excluded from the cointegrating relation because zero restriction on its coefficient cannot be rejected. The role of life expectancy is ambiguous and is needed for further investigation.

Practical Implications: Based on the main results, it is imperative to focus on long-run factors influencing the aggregate insurance premium income in Mongolia. Consequently, our findings offer valuable perceptions for the insurance sector, shedding light on their influence on the development of the industry. The development of the insurance industry in Mongolia is full of challenges and uncertainties. Hence, our study is related to the practice of decision sciences, providing insights into decision-making processes in optimal ways under conditions of uncertainty faced by government officials and practitioners.

Keywords: insurance industry, Mongolia, Johansen Cointegration, insurance premiums, long-run elasticities

JEL: C30, C50, O16

1. Introduction

1.1 Insurance industry and economic development

Insurance secures its buyers who pay specific premiums to cover specific risks such as critical illness or death. Upon the occurrence of events or circumstances outlined in the insurance agreement, the insurer is obliged to provide benefits or compensation (Prodanov, et al., 2023). Consumption of insurance products may vary across lines of business and countries, as well as different kinds of risks. The insurance industry plays an important role in the financial market when it provides a variety of risk management services to the people and institutions (Gaganis, et al., 2019). The growth of the insurance industry leads to growth of the financial and other sectors of an economy (Alghalith & Polius, 2012). The insurance sector is therefore a vital part of the economy and plays a significant role in economic growth. The practical importance of growth of the insurance industry calls for more academic research as its share in the financial sector is increasing in almost every country.

There may be a correlation between insurance industry and economic growth (Pradhan, 2017). A causal relationship between performance of the insurance industry and economic growth has been found in many empirical studies, from the macro as well as micro-economic perspective, in different contexts such as OECD countries (Ward & Zurbruegg, 2000), industrialized and developing countries (Arena, 2008), Sweden (Adams, et al., 2009), China (Gao, 2018; Wang, 2019) and EU countries (Kondovski, 2021; Pradhan, et al., 2017). The ongoing discourse on the influence of the insurance market on economic growth has been quite extensive. For instance, Kjosevski (2011) reveals that the growth of both non-life insurance and total insurance has had positive and significant effects on economic growth in the Republic of Macedonia. Olayungbo and Akinlo (2016) study the relationship between insurance and economic growth in African countries, and their results indicate positive relationships for Egypt, while short-run adverse and long-run positive effects were found for Kenya, Mauritius and South Africa. Meanwhile, negative impacts were reported for Algeria, Nigeria, Tunisia and Zimbabwe. Yildirim (2015) disclosed that there exists a favorable correlation between economic development and the insurance industry in Turkey. Moreover, it is possible that there is a negative or insignificant connection between the insurance industry and the economy-at-large while an increase in macroeconomic and financial uncertainty in one economy can affect other economies (Tiwari, et al., 2021). For example, Kjosevski (2011) demonstrated that life insurance had a detrimental effect on Macedonia's economic development, while the insurance industry plays no significant role in the Albanian economy (Zyka & Myftaraj, 2014). Another study by Sharku and Kumi (2021) reveals that there is a long-term positive link between economic growth and non-life insurance in Albania, where however, there is a long-term negative link between economic growth and life insurance. More recent research by Baruti (2022) has found that the insurance industry plays a significant role in the development of financial markets in Kosovo. In addition, development of the financial industry helps reduce income inequality between emerging and least developed countries (Chisadza & Biyase, 2023). Additionally, the relationship between insurance and economic growth is diverse across countries due to varaiations such as insurance products, education, religious and cultural traditions (Din, et al., 2020).

1.2 Development of insurance industry

Main factors that drive the development of the insurance industry need to be identified, given the established causal relationship between the insurance industry and economic progress. Outreville (1996) considers that the insurance sector should be driven by four main long-run factors, including economic, demographic, social and cultural, and institutional and market structure factors. In particular, the premium income can be determined via income levels and distribution, population size and demographic structure, the size of the public and private pension systems, ownership structures of insurance companies, as well as religious factors (Feyen, et al., 2013). Brokešová, et al. (2014) illustrates various determinants of growth of insurance industry such as inflation rate, age dependency ratio, urbanization, social security system, and criminality rate. Also, the development of the insurance industry in the selected transition countries is significantly affected by the macroeconomic environment (Brokešová & Vachálková, 2016). Another recent study by Segodi and Sibindi (2022) finds that income, unemployment, interest rates and inflation variables in Nigeria had a negative impact on life insurance demand. Previous studies suggest that the above variables have different effects on the insurance industry under different contexts and offer tailored insights into the development of the insurance industry.

1.3 Insurance development in Mongolia

No prior research has been conducted to determine the factors that influence the insurance industry in Mongolia while the development of the industry may be essential for building the Mongolian financial system and economy. Mongolia has long been situated between China and Russia and yet its economy is significantly different from those of its larger neighbors. In 1990, Mongolia embarked on a historic journey, transitioning from a centrally planned economic system to a market economy (Batmunkh, et al., 2020). Over the past three decades, this transition has led to a fundamental shift in the insurance sector, moving from the public to the private sphere and undergoing significant development. Mongolian insurance sector has been gradually evolving over the years, reflecting the country's economic growth and increasing awareness about the need for risk management among businesses and individuals. The origin and development of the commercial insurance industry, which is an integral part of Mongolia's financial market, began in 1990's. Mongolia's insurance market is still developing but as a developing country with a small population, there are enough insurance companies but few customers. However, it is essential to recognize that the complexity of financial development varies significantly in a country, depending on the level of development (Chisadza & Biyase, 2023). As of 2021, the insurance market in Mongolia comprised 15 regular insurance companies, 2 long-term insurance companies, 1 reinsurance company, 63 intermediaries, 25 loss adjusters and 2,376 agents holding licenses from the FRC (FRC-Financial Regulatory Commission, 2021). Furthermore, growth of the non-life insurance market has had a major impact on Mongolia's overall insurance market. Statistics from Financial Regulatory Commission (FRC, 2021) indicate that in 2021, Mongolia's insurance market had insurance premium income of 247.5 billion MNT, an increase of 20.7% compared to the previous year.[1]

[1] MNT (Mongolian Tughrik) is a Mongolian currency unit. In 2021, one USD was equivalent to about 2,850 MNT on average. 247.5 billion MNT were then equivalent to about 86.84 million USD.

Two crucial metrics used for assessing insurance industry development are insurance density and insurance penetration. Insurance density refers to the amount of insurance premium income per capita collected in a country. It indicates the degree of development of the insurance business and also reflects the strength of people's insurance awareness. On the other hand, insurance penetration is meaured by a country's insurance premiums as a percentage of its GDP and indicates how much the insurance sector contributes to the economy. The development of the insurance industry in Mongolia is still very low due to its low insurance density and penetration. In 2021, Mongolia's insurance penetration rate was 0.63%, with an insurance density of 72,292 MNT per person, much below the global average (FRC, 2021). Despite the availability of insurance products, insurance penetration in Mongolia has remained very low, contributing little to the economy's growth.

Even though the insurance market is relatively small, the Mongolian insurance industry has experienced fairly positive growth over the past decade, particularly due to the arrival of some new insurance companies providing new services. According to NSO statistics, the Mongolian insurance market size was 85.4 million USD in 2021 (nearly 247.5 billion MNT) and the market is predicted to increase at a compound annual growth rate greater than 10% between 2021 and 2026. Hence, despite the slow development, the insurance sector in Mongolia is poised for high growth in the future. In order to achieve this growth, it is necessary to know the indicators of the insurance industry's development. Thus, to encourage the growth of the insurance industry in Mongolia, it is important to study the factors that impact its development. Hence, the purpose of this study is to examine the long-run factors that affect the amount of insurance premiums that can reflect the scale of development of the insurance industry in Mongolia. Details of development of the insurance industry in Mongolia can be found in, for instance, Batbold and Pu (2021), Murphy and Ichinkhorloo (2024), and Tian (2023).

The remainder of this paper is organized as follows. Section 2 reviews the published literature on factors that influence insurance premium income. Section 3 discusses the econometric methodology, and data are described in Section 4. Section 5 presents the empirical results and the last section concludes.

2. Literature review

The total premium income reflects the development level of the insurance industry. The higher the amount, the greater is the size of the insurance industry and consequently, the higher is the protection level of the economy and insured people (Li & Li, 2020). The low penetration and density rate in Mongolia can arguably be attributed to a multitude of factors, while the amount of insurance premium income increases or decreases depending on the types of risks borne by buyers and insurance companies. Previous studies have considered premium income as the dependent variable to examine the development of the insurance sector (Hwang & Gao, 2003; Zyka & Myftaraj, 2014; Li & Li, 2020).

Drawing on previous research we have selected insurance premium income as a primary indicator of development level of the insurance industry in Mongolia. Key factors influencing the amount of insurance premium income include household income, price level, internet usage and life expectancy. We include these long-run factors in our subsequent econometric study.

2.1 Household income

Among all the long-run driving factors, household income is described as the most crucial in extant literature. As insurance stands out as a specialized financial product for households, individuals are more inclined to purchase insurance products when their income exceeds their expenditure. Additionally, significant long-term correlations exist between GDP per capita and household consumption (Dilanchiev & Taktakishvili, 2021) as household income positively affects consumption (Gohar, et al., 2022). Higher income means higher opportunity cost of premature death or illness and therefore it boosts the demand for life and medical insurance, leading to greater affordability of insurance products. Feyen, et al. (2013) address the need to safeguard the potential income of spouse and children against the premature demise of married persons. Also, Beck and Webb (2003) explain that as household incomes increase, the demand for life insurance rises because the human capital of an individual increases along with income. Esho, et al. (2004) similarly find a positive relationship between income and expenditures for property liability insurance. Hence, household income positively influences both life, medical and other non-life insurance consumption. Dragos (2014) further emphasizes that income is one of the relevant factors for demand for life and non-life insurance, especially in Europe. Previous studies clearly indicate that the long-run relationship between insurance premiums and household income is positive.

2.2 Consumer price index (CPI)

Alhassan and Biekpe (2016) and Brokešová and Vachálková (2016) reveal that inflation as measured by an increase in CPI results in a decrease in consumption of life insurance. Ferezagia (2020) found that inflation had a negative effect on life insurance premiums in the Philippines. Similar conclusions were drawn from studies such as Beck and Webb (2003), Feyen, et al. (2013), Ibiwoye, et al. (2010), Kjosevski (2011), and Li, et al. (2007). These studies were conducted on various samples, and the results were consistent for both developed and developing countries. Furthermore, Wang (2019) and Paunica, et al. (2019) have studied how inflation influences the development of the insurance industry and concluded that inflation leads to expectations of price rise and reduces the demand for long-term insurance. On the contrary, Hwang and Gao (2003) find that high inflation periods coincided with higher economic growth in China and therefore inflation resulted in a positive impact on insurance demand in China. Finally, Saleh and Derbali (2020) demonstrate that external factors such as CPI have a positive impact on the performance of UK insurance companies. Since inflation has and asset returns have a positive correlation, inflation helps expand financial markets. Hence, CPI may have a positive or negative impact on insurance premiums.

2.3 Internet usage

Technological innovations have helped increase productivity, curtail costs, enhance quality and invention of new products (Akinlo, 2023). Developing countries should focus more on innovation because higher levels of innovation result in comprehensive economic growth (Khan & Pazir, 2023). There are numerous benefits of technology, one example being internet usage which allows insurance companies to promote their products and connect with customers in both urban and rural areas at lower costs. Most previous

studies have concentrated on the relationship between information technology and economic growth, with only a few exploring the connection between information technology and the insurance sector, such as Salatin, et al. (2014), that analyze the impact of Information and Communication Technology (ICT) on insurance industry during the period of 2002-2010. The study reveals that development of the insurance industry depends on the advancement of ICT. Another study by Benlagha and Hemrit (2020) investigates how insurance demand is enhanced by internet use in a sample of OECD countries and finds that internet usage help boost non-life insurance activities, although it does not affect life insurance. More recently, Akinlo (2023) discovers that internet usage promote non-life insurance in sub-Saharan Africa. Therefore, we also predict that internet usage and insurance premiums are positively related.

2.4 Life expectancy

Building on the life-cycle model by Lewis (1989), life insurance consumption increases with the probability of death or to. decreases with a longer life expectancy when life expectancy is inversely related to the probability of decease. Outreville (1996), Beck and Webb (2003), and Li, et al. (2007) tested this relationship but the hypothesis of the impact of life expectancy does not have statistical significance. Zerriaa and Noubbigh (2016) reveal that life expectancy appears to stimulate life insurance demand in Middle Eastern and North African countries, attributable to the inverse relationship between life expectancy and the price of life insurance, thereby stimulating insurance consumption with a longer life expectancy. Life expectancy may then have a positive or negative relationship with insurance premiums.

3. Methodology

We adopt Johansen's (1991) maximum likelihood (ML) cointegration procedure for analysis when it has advantage of testing the number of cointegrating vectors, calculating ML estimators of cointegrating vectors and testing hypotheses on the long-run coefficients we require in our study.

We start from transformation of the g-dimensional unrestricted vector autoregressive (VAR) model with k lags, given that $t = 1, \dots, T$, where Z is the g-vector of variables under study, Π_i is the gxg matrix, and T is the total number of observations:

$$Z_t = \sum_{i=1}^{k} \Pi_i Z_{t-i} + \mu + \varepsilon_t, \quad \text{for } t = 1, \dots, T; \tag{1}$$

into the Vector Error-Correction Model (VECM) with k-1 lags:

$$\Delta Z_t = \Pi Z_{t-1} + \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \cdots + \Gamma_{k-1} \Delta Z_{t-(k-1)} + \mu + \varepsilon_t. \tag{2}$$

In Equation (2), the long-run impact matrix is $\Pi = \left(\sum_{i=1}^{k} \Pi_i\right) - I$, and $\Gamma_i = -\left(\sum_{j=i+1}^{k} \Pi_j\right)$ is the short-run cofficient matrix. It should be noted that in both Equations (1) and (2), μ is the g-vector of constants, and the g-vector of residuals is represented by $\varepsilon_t \sim (0, \Sigma)$. If Π has a reduced rank r, where $r \leq g - 1$, there are r cointegrating vectors of long-run coefficients in β.

To test the null hypothesis of at most r cointegrating vectors:

$$H_0: \lambda_i = 0, \text{ for } i = r + 1, \dots, g; \tag{3}$$

where λ_i refers to the ith eigenvalue of the restricted model, we estimate the following Trace test statistic:

$$\text{Trace} = -T \sum_{i=r+1}^{g} \ln(1 - \lambda_i), \text{ for } r = 0,1,2, \dots, g - 1. \tag{4}$$

If the null hypothesis of r = 0 is rejected by the Trace statistic against the alternative that r = g, we continue the Trace test and examine the null hypothesis of r = 1, 2, …, g-1 sequentially until the null hypothesis is not rejected. Another test statistic is known as maximal eigenvalue or λ-max statistic:

$$\lambda\text{-max} = -T \log(1 - \lambda_{r+1}), \text{ for } r = 0,1,2, \dots g - 1; \tag{5}$$

which tests that there are r cointegrating vectors under the null against the alternative that r+1 cointegrating vectors exist. Since Johansen tests suffer from small-sample bias, the small-sample adjustment is done by replacing T in Equations (4) and (5) with T-g(k-1) as suggested by Reimers (1992).

Moreover, Johansen and Juselius (1990), and Johansen (1991) propose using likelihood ratio (LR) and Wald tests for linear restrictions on long-run coefficients in β. If r = 1 and there is one restriction on a single coefficient in β, LR and Wald are asymptotically distributed as χ^2 (1).

4. Data

The dataset comprises the amount of insurance premiums, household income, CPI, internet usage and life expectancy in Mongolia (Section 2) and these are defined in greater detail as below:

1. Insurance Premiums: The total amount of premiums received by the insurance industry.

2. Household Income: This encompasses the entire income (salaries, wages, retirement income, investment gains, government transfers, and other sources) of households and all individuals aged 15 and above.

3. Life Expectancy: It refers to the expected number of years that a person is projected to live based on actuarial data.

4. Consumer Price Index (CPI): It measures the average change in prices for a specified basket of goods and services.

5. Internet Usage: It is a measure of the amount of data flowing through computers and the internet network over a given period. Expressed as a ratio, it indicates the proportion of people connected to internet using mobile phones, computers and smart devices relative to the total population.

For Mongolia, we were able to get annual data for 28 years from the World Bank database spanning from 1995 to 2022 for our study. When all data are natural-log transformed, it can mitigate the impact of violent fluctuations and different scales of the data, and it also helps to achieve comparative consistency since the natural-log transformed values are free of unit measurements.

The descriptive statistics for the data are shown in Table 1. It is found that the data for internet usage (life expectancy) are the most (least) volatile as the data for internet usage have increased by about 6,400 times from 0.01% to 64% over the past three decades but the life expectancy has increased by only 15%, from 60 to 69 years of age. Also, the Jarque-Bera statistics show that only the data for internet usage are not normally distributed.

Table 1. Descriptive Statistics

Variable	Sample size	Mean	Std. Dev.	Min	Max	Jarque-Bera
Insurance Premiums	28	10.1241	1.6708	7.4390	12.6274	2.328
CPI	28	9.9494	0.7453	8.4514	11.0964	1.748
Internet Usage	28	1.6203	2.3671	-4.6052	4.4347	7.643**
Household Income	28	12.7464	1.1836	10.8564	14.3954	2.367
Life Expectation	28	4.1946	0.0542	4.0993	4.2781	1.641

Notes: All data are transformed into natural logarithms. The Jarque-Bera statistic is used to test the null hypothesis that the data are from a normal distribution, and it is asymptotically chi-squared distributed with two degrees of freedom. ** denotes statistical significance at the 5% level. Source: World Bank Data.

5. Empirical results

5.1 Unit root tests

We first adopt the Augmented Dickey-Fuller (ADF) test with an intercept (c) and a linear trend included in the traditional ADF equation, as shown below:

$$\Delta Y_t = c + \alpha Y_{t-1} + \beta t + \sum_{k=1}^{P} \alpha_k \Delta Y_{t-k} + u_t, \quad \text{for } t = 1, \ldots, T; \tag{6}$$

where Y_t is the variable being tested, u_t is a white noise error, and p is the lag length. We examine unit root by testing α=0 using DF t-statistic.

Results from Table 2 indicate that all series except internet usage have a unit root in level, and their first differences are stationary. Mongolia has been experiencing economic and social reform since 1990's (Park, et al., 2017; Helble, et al., 2020) and it is not surprising that structural changes exist in individual data series. Traditional ADF tests without break may lead to biased results when the data actually exhibit structural changes.

We further adopt the ADF with structural breaks (Perron, 1989, 1994), as follows:

$$Y_t = c + \theta DU_t(T_b) + \gamma D_t(T_b) + \alpha Y_{t-1} + \beta t + \sum_{k=1}^{P} \alpha_k \Delta Y_{t-k} + u_t; \tag{7}$$

where an intercept break variable $DU_t(T_b) = 1\ (t \geq T_b)$ takes the value 0 for all dates prior to the break date T_b and 1 thereafter; a break dummy variable $D_t(T_b) = 1\ (t = T_b)$ takes the value of 1 only on the break date T_b and 0 otherwise. The null hypothesis of a unit root is tested by minimizing the DF t-statistic for α =1. Also, the break date is not fixed but is estimated endogenously by minimizing the value of the t-statistic on the intercept break coefficient θ = 0 as proposed by Perron (1997).

Further, Perron (1994, 1997) suggested a class of ADF test statistics under two types of structural breaks: namely, the Innovational Outlier (IO) and the Additive Outlier (AO), which capture gradual changes over time and a sudden change, respectively. Details of ADF testing procedures under IO and AO are described in Harvie and Pahlavani (2006).

Table 2 reports the results of ADF (IO) and ADF (AO) which show that all series in level, including internet usage, are I(1), i.e., integrated of order 1 and their first differences are all I(0).

Table 2. The result of ADF unit root tests with and without breaks

	ADF		**ADF(IO)**		**ADF(AO)**	
	Level	**First Diff**	**Level**	**First Diff**	**Level**	**First Diff**
Insurance premiums	-2.403	-3.792**	0.204	-5.888***	-2.949	-4.954***
CPI	-2.376	-5.244***	-4.292	-5.566***	-3.118	-4.340**
Internet usage	-3.637**	-4.861***	-2.610	-8.083***	-1.212	-8.573***
Household Income	-1.577	-4.149**	-2.642	-4.994**	-3.070	-4.922***
Life expectancy	-1.664	-3.611*	-2.327	-7.121***	-3.150	-5.646***

Notes: An intercept and a linear trend are included in the test equations. The number of lag length chosen in the test equation is based on the Akaike information criteria or Modified Akaike information criteria. The breakpoint selection for ADF(IO) and ADF(AO) test statistics is based on the intercept break min t-statistic. Critical values for the traditional ADF test statistics at the 10%, 5% and 1% significance level are -3.248, -3.622 and -4.416, respectively. Critical values for the ADF (IO) [AO] test statistics at the 10%, 5% and 1% significance level are -4.376 [-3.740], -4.643 [-4.011] and -5.151 [-4.570], respectively. *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

5.2. Cointegration tests

After confirming I(1) for the above variables under investigation, the subsequent step is to assess the number of cointegrating vectors in the 5-variable VECM.[2] Table 3 shows the Trace and maximal eigenvalue statistics after the small-sample adjustment, which reject Ho: $r = 0$ at the 1% significance level but cannot reject the Ho: $r = 1$, 2, 3 and 4. Hence, there is one cointegrating relationship among the 5 variables under study. Further, Table 4 reports the results of multivariate LM test statistics (Edgeworth expansion corrected LR version and Rao F-test version) that are used to test the null hypothesis of no residual serial correlation at lag h (Edgerton & Shukur, 1999), Q and Adjusted Q statistics that are employed for testing for the null of no residual serial correlation up to lag h, and the Whtie heteroskedasticity test for testing the null of no residual heteroskedasticity. All these test statistics cannot reject the null of no serial correction and no heteroskedasticity in the residuals of VECM (except one case at the 10% level), so there are no model misspecifications in the VECM.

[2] The case of mixed-order regression is discussed in Wong and Yue (2024).

5.3. ML estimator of β and linear restriction tests

Besides the Johansen cointegration rank test, we conduct the ML estimation of cointegrating vector $\beta = (1, -\beta_0 - \beta_2, \dots, \beta_5)'$ where β_0 is an intercept, and the linear restriction test on the long-run coefficients of β. The coefficient of insurance premiums β_1 is normalized to be unity. The signs of other long-run coefficients in the cointegrating vector indicate the directions of changes in insurance premiums vis-à-vis the other 4 variables to maintain the long-run relationship. We employ LR and Wald statistics to test each of the long-run coefficients to be zero under the null hypothesis.

Table 3: Johansen Cointegrating Trace and Maximal Eigenvalue Rank Tests

Series: Insurance Premiums, CPI, Internet Usage, Household Income and Life Expectancy						
H_0	λ_i	Trace	Adjusted Trace	10% C.V.	5% C.V.	1% C.V.
$r = 0$	0.9744	159.273	95.563***	65.819	69.818	77.818
$r \leq 1$	0.6782	67.571	40.542	44.493	47.856	54.681
$r \leq 2$	0.6002	39.220	23.532	27.066	29.797	35.458
$r \leq 3$	0.3879	16.300	9.780	13.428	15.494	19.937
$r \leq 4$	0.1487	4.027	2.416	2.705	3.841	6.634
H_0	λ_r	λ-max	Adjusted λ-max	10% C.V.	5% C.V.	1% C.V.
$r = 0$	0.9744	91.701	55.020***	31.239	33.876	39.370
$r \leq 1$	0.6782	28.351	17.010	25.124	27.584	32.715
$r \leq 2$	0.6002	22.920	13.752	18.892	21.131	25.861
$r \leq 3$	0.3879	12.272	7.363	12.296	14.264	18.520
$r \leq 4$	0.1487	4.027	1.726	2.705	3.841	6.634

Notes: An intercept is included in the cointegrating vector and the VAR model. Adjusted Trace and adjusted $\boldsymbol{\lambda}$-max are the Trace and $\boldsymbol{\lambda}$-max statistics after the small-sample adjustment. The lag length of VECM is 2. The number of usable observations is 26. C.V. stands for critical value. *** denotes statistical significance at the 1% level.

Table 4: Diagnostic Testing of VECM

Residual Serial Correlation Tests				
Lag h	LRE statistic (at lag h)	Rao-F statistic (at lag h)	Q statistic (up to lag h)	Adj. Q statistic (up to lag h)
1	11.502 (0.990)	0.334 (0.993)		
2	19.122 (0.791)	0.645 (0.842)		
3	22.425 (0.611)	0.809 (0.691)	51.167 (0.244)	56.252 (0.121)
4	33.275 (0.124)	1.506 (0.196)	76.786 (0.270)	86.7526* (0.085)
5	21.148 (0.684)	0.743 (0.754)	96.317 (0.443)	111.165 (0.123)
Residual Heteroskedasticity Tests				
	339.596 (0.346)		No Cross terms	

Notes: LRE refers to likelihood ratio statistic after Edgeworth expansion correction (Edgerton & Shukur, 1999). Rao F statistic is computed using the method of Edgerton and Shukur (1999). White heteroskedasticity test equations only include the levels and squares of the original regressors. The figures in the brackets are p-values. * denotes statistical significance at the 10% level.

Panel A of Table 5 shows that the long-run coefficients of CPI, internet usage and household income are positive, indicating a positive relationship between insurance premiums and CPI, internet usage and household income.[3] Both LR and Wald tests reject the coefficients to be zero under the null, so these coefficients are statistically significant. Insurance premiums and CPI move in the same direction in Mongolia. Similar to the case in the UK (Saleh & Derbali, 2020), when prices increase in Mongolia, individuals are generally not willing to spend and instead try to protect themselves from unexpected future inflation risks by purchasing insurance packages or by adding up insurance premiums to maintain the real value of insurance benefits (Claxton, et al., 2023). Furthermore, ICT penetration is likely to have positive impacts on insurance sector development (Nwala, et al., 2020; Bayar, et al., 2023). When telecommunications network in Mongolia is improving (Odkhuu, et al., 2020), rising internet usage with mounting ICT penetration can accelerate the growth of the insurance industry, i.e. an increase in insurance premiums. Also, higher internet usage can support digitalization in insurance industry, which helps promote insurance products, increase insurance demand and then enhance the financial performance of the insurance sector (Łyskawa, et al., 2019). In addition, individuals with higher incomes are expected to have greater affordability for insurance. Further, higher-income groups are expected to buy more insurance products to protect against risks of income lost due to premature death or health problems (Capatina & Keane, 2023). Hence, insurance products are normal goods with positive income elasticity. According to NSO statistics, Mongolia's monthly earnings per capita stood at 615 USD in December 2022, ranking lower than other countries with similar economic development. Therefore, with high potential for growth in the future, the pivotal factor for the development of the insurance industry is the income level. The higher-income customers tend to buy more insurance products, leading to a positive impact on the insurance premiums and the industry's development.

Table 5: Long Run Coefficients in Cointegrating Vector $\boldsymbol{\beta} = (\mathbf{1}, -\boldsymbol{\beta}_2, \dots, \boldsymbol{\beta}_5)'$ and linear Restriction Tests

Series: Insurance Premiums, CPI, Internet Usage, Household Income and Life Expectancy					
Series	Insurance Premiums	CPI	Internet Usage	Household Income	Life Expectancy
Panel A: Long-run coefficients without restrictions					
Long-run Coefficients	1	-0.801	-0.029	-1.017	0.798
LR	51.642*** (0.000)	31.810*** (0.000)	2.951* (0.085)	55.331*** (0.000)	0.516 (0.472)
Wald	331.487*** (0.000)	96.923*** (0.000)	5.693** (0.017)	673.837*** (0.000)	0.793 (0.373)
Panel B: Long-run coefficients with restrictions					
Long-run Coefficients	1	-0.768	-0.018	-1.013	0

Notes: β_0 is an intercept in β and it is unreported to save space. β_2, β_3, β_4 and β_5 represent the long-run coefficients of CPI, internet usage, household income and life expectancy, respecitively. The figures in the brackets are p-values. *, ** and *** denote statistical significance at the 10%, 5% and 1% level, respectively.

[3] The reported long-run estimators of β are $-\beta_i$, where i = 2, …, 5. Hence, if the reported estimates are negative (positive), it means that β_i is positive (negative).

However, the estimated long-run coefficient of life expectancy is negative and statistically insignificant. The negative sign of the coefficient aligns with Lewis (1989) but lacks statistical significance, which is consistent with the findings of Outreville (1996), Beck and Webb (2003), and Li, et al. (2007). As a consequence, life expectancy is excluded from the cointegrating vector. It means that without life expectancy, a linear combination of insurance premiums, CPI, internet usage and household income is still stationary.[4] After the coefficient of life expectancy is restricted to zero, other long-run estimators of $\beta = (1, -\beta_2, -\beta_3, -\beta_4, 0)'$ are reported in Panel B of Table 5.

When the variables of interest are natural-log transformed, the long-run coefficients of CPI, Internet usage and household income are interpreted as long-run elasticities. Hence, from the restricted cointegrating vector, the amount of insurance premium income increases by 0.768%, 0.018% and 1.013% in the long run, for every 1% increase in CPI, internet usage and household income in Mongolia, respectively. In particular, 1.013% refers to the income elasticity of insurance consumption, which is the largest compared with the other two elasticities. Hence, household income is considered as a primary factor influencing the amount of insurance premiums and the long-run development of insurance industry in Mongolia.

6. Conclusion

Mongolia, as a representative developing country with an immature insurance industry, presents an interesting case to explore the main factors influencing insurance premiums and the industry's development in the long run. When all variables under consideration are I(1), we adopt Johansen's (1991) ML estimation procedure in the analysis which includes testing the number of cointegrating vectors, estimating the ML estimator of β, and imposing linear restriction on β simultaneously.[5] Over the sample period of 1995 to 2022, we find that one cointegrating vector exists where insurance premiums, CPI, internet usage, and household income enter with the exclusion of life expectancy. The corresponding coefficients are all positive and are considered as long-run elasticities of insurance consumption with respect to CPI, internet usage, and household income. The main results show that it is imperative to focus on long-run factors influencing the premiums of the insurance industry in Mongolia. Consequently, these findings offer valuable insights into the insurance sector, shedding light on their influence on the development of the insurance sector in Mongolia.

To investigate the development of insurance more deeply in future research, the total insurance premium income needs to be divided into life insurance premiums and non-life insurance. We can examine how different variables affect both life and non-life insurance consumption and how the growth of the insurance sector as a whole is affected by both life and non-life insurance products in diverse ways (Dragos, 2014; Camino-Mogro & Bermúdez-Barrezueta, 2019; Etudaiye-Muhtar & Agboola, 2021). Additionally, in our study, life expectancy is excluded from the cointegrating relation. However, we can try to investigate

[4] With the exclusion of life expectancy, we adopt Trace and λ-max tests with the small-sample adjustment on the 4-variable VECM for analysis and obtain the same result of cointegration.

[5] Cointegration analysis of nonstationary variables can avoid spurious results. However, results from the regression of stationary series (Wong, et al., 2024; Wong and Yue, 2024) or nearly nonstationary series (Cheng, et al., 2021) may still be spurious.

separately how life expectancy is related to life insurance and non-life insurance. Epidemiological and health insurance is an important example of non-life insurance (Nkeki & Iroh, 2024). Longer life expectancy may positively affect medical insurance consumption even though it may be negatively related to life insurance consumption. Given that Mongolia's life expectancy is 69 as of 2022, which is not considered high globally and it may rise with an increase in income in the future. This underscores the importance of recognizing the effect of life expectancy on various kinds of insurance products, which can offer insights into diverse insurance needs.

Also, the correlation between income levels and insurance penetration is noteworthy in Mongolia. A deeper exploration of specific income brackets contributing significantly to the limited customer base is required. Cultural attitudes towards insurance, intertwined with the level of financial literacy, emerge as pivotal factors influencing market dynamics. Moreover, a thorough examination of government policies and regulations, economic stability, and the competitive landscape in the insurance market is needed to unravel the complexities of this issue. Moreover, education is related to income and insurance consumption. It is important to explore the correlations between education, income, life, and non-life insurance demand (IONCiCĂ, et al., 2012; Outreville, 2015; Kajwang, 2022).

The severe air pollution in Mongolia raises concerns about its potential impact on the financial market, particularly in the insurance sector. This prompts us to investigate how air quality may influence the insurance industry, complementing other relevant studies. For example, studies by Li, et al. (2021) and Yang, et al. (2022) reveal that financial development has a negative and significant impact on CO_2 emissions, whereas in the energy sector, rising temperatures, increased rainfall, and more frequent natural disasters have led to diminished financial efficiency (Nguyen & Nguyen, 2024). Similarly, Yadav (2022) highlights that companies with stronger ESG (Environmental, Social, and Governance) scores tend to outperform those with lower scores in terms of stock performance in the midst of economic uncertainty. In future research, it would be intriguing to broaden our analysis by incorporating the association between both financial development and insurance development with CO_2 emissions in Mongolia.

This study focuses on the long-run equilibrium in the Mongolian insurance industry. For future research, we suggest incorporating tests for short-run dynamics and Granger causality (for example, Bai, et al., 2018) within the VECM framework in order to increase the depth of the analysis.

The development of the insurance industry in Mongolia is full of challenges and uncertainties. Hence, our study is related to decision sciences (Chang, et al., 2018; Tisdell, 2018; Tuan, et al., 2022), providing insights into decision-making processes in optimal ways under conditions of uncertainty.

Declarations

Conflict of interest on behalf of all authors, the corresponding author states that there is no confict of interest.

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