Interrelationship Between Macroeconomic Variables with Insurance Premiums and Claims – Lessons for Indonesia and ASEAN

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Abstract

The insurance sector plays a crucial economic role by helping individuals and businesses manage risks and uncertainties. By transferring some of their risks to insurance companies, individuals and companies can reduce the likelihood of bankruptcy compared to bearing the risks themselves. This role has become increasingly important in recent decades, particularly due to climate change, financial crises, and the COVID-19 pandemic, leading to greater volatility in macroeconomic indicators. Understanding these potential risks is key to ensuring the future sustainability and growth of the insurance sector in both Indonesia and ASEAN. The research objective is to examine the relationship between macroeconomic variables and insurance and claims. Using annual panel data regression analysis, we examine the relationship between macroeconomic indicators and insurance gross premiums in a sample of 63 countries from 2010 to 2019. The macroeconomic indicators used in the model are real Gross Domestic Product (GDP), inflation, interest rates, and exchange rates. The results suggest that macroeconomic variables play a significant role in determining the performance of gross premiums and claims. Lessons learned include that real GDP, inflation, and real interest rates show a positive and significant relationship with gross premiums, while exchange rates show a negative relationship. However, the lasting impact of these macroeconomic variables on gross premiums varies from one to the other. In fact, only two variables, real GDP and inflation, have a lasting impact. The results suggest that market players should provide strong and comprehensive risk management systems to address macroeconomic turbulence. Surveillance and monitoring macroeconomic indicators are essential, especially in a macro-dependent sector.

Keywords: insurance sector, premium & claim, macroeconomic condition, panel-data estimation

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Introduction

The insurance sector plays a crucial role in the economy, especially in bearing various potential risks and uncertainties experienced by individuals and businesses. When there are unforeseen risks, individuals and companies can transfer some of their risks to the insurance sector, which should reduce the likelihood of economic agents falling into bankruptcy (Valckx et al., 2016). The role of risk coverage has become increasingly crucial in recent decades, particularly when there are potentially rising levels of risks associated with climate change (leading to increased frequency of natural disasters), financial crises, and the health pandemic (as in the case of COVID-19).

Since the outbreak and spread of the COVID-19 pandemic virus across the world, the insurance sector has played an even more important role, both in health and general insurance, such as bank credit insurance. The insurance sector has faced pressure from the weakening demand and rising claims. During the pandemic period (2020-2021), premium growth slowed to around 1.2% (compared to more than 4% per year between 2010 and 2020). Industry profits also declined by around 15% in 2019, with the sharpest decline occurring in the Asia-Pacific region (down 36%), driven by the decline in the profits of life insurance (McKinsey & Company, 2022). In Indonesia, commercial insurance premiums in 2020 reached IDR 242.46 trillion or contracted by -7.34% year-on-year (yoy) (Otoritas Jasa Keuangan, 2021).

In addition to its roles, the insurance sector also contributes significantly to the development of the rest of the financial sector. The use of insurance products can stimulate spillover effects in the adoption of other financial products, such as savings and investment products. Hence, it facilitates the country's economic development. Based on data from the Input-Output Table of Indonesia in 2016 published by Statistics Indonesia (Badan Pusat Statistik (BPS)) in 2021, it was found that in absolute terms, the industries that were most dependent on insurance were banking (±IDR 10 trillion), insurance and real estate (±IDR 4 trillion), and government services (±IDR 3.4 trillion). In other words, the backward linkages of the insurance sector to other sectors, especially banking, are significant. It demonstrates the broad-based contribution of the insurance sector to the economy. Furthermore, the scale (especially capital size) and performance of the insurance sector will determine the coverage and depth of the insurance sector in carrying out its functions and roles (Siregar et al., 2023).

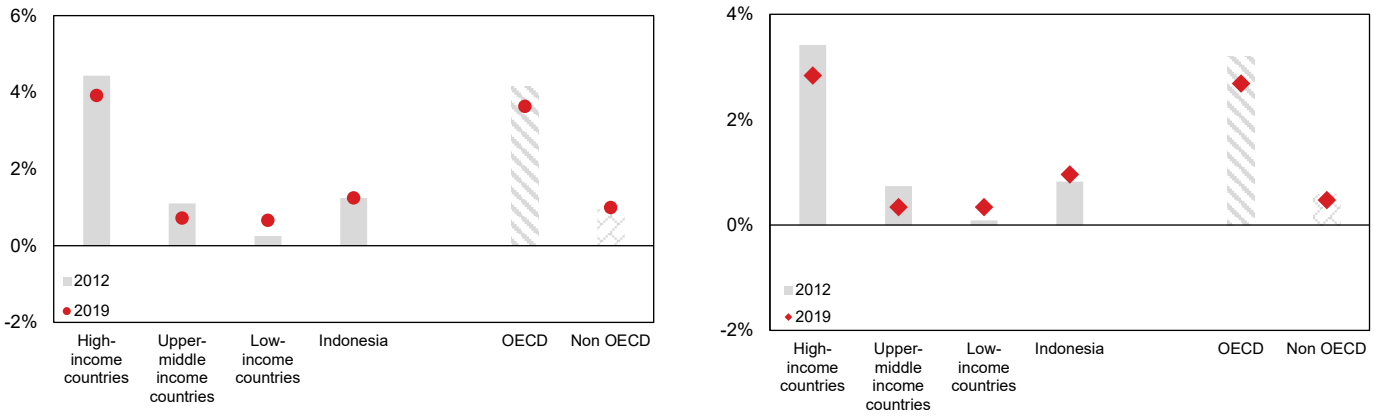
These linkages highlight the importance of a strong and robust insurance sector in supporting the overall economy. Understanding the relationship between macroeconomic variables, insurance sector premiums, and claims is crucial to ensure the sector's optimal performance and its ability to fulfill its functions and roles effectively, especially amidst a situation surrounded by various uncertainties. The recent financial turbulences have underscored the significance insurance regulators place on preventing and addressing insurance companies' performance, such as premiums and claims. The performance of insurers not only safeguards policyholders by ensuring their future financial commitments are met but also contributes to overall financial system stability. Instances of insurer failures possess the potential to disrupt the financial system and have adverse effects on the economy (see, e.g., Baluch et al. (2011) and Cummins and Weiss (2014)). Ascertaining and answering

crucial questions about the nexus between macroeconomic variables with premiums and claims have become fundamental aspects of monitoring insurance companies' conditions.

Specifically, we will build our questions based on three fundamental building-block: 1) how changes in variables, such as GDP growth and real interest rates, influence the premium and claim of insurance companies, 2) how economic conditions affect insurance markets in two groups of countries, Organisation for Economic Co-operation and Development (OECD) and Non-OECD, and 3) whether the effects of changes in macroeconomic factors on insurance premiums occur at different speeds or with varying time lags in these two economic contexts. This inquiry holds utmost importance for regulators, as well as policyholders, managers, investors, and policymakers.

Indonesia's Insurance Sector Position & General Conditions

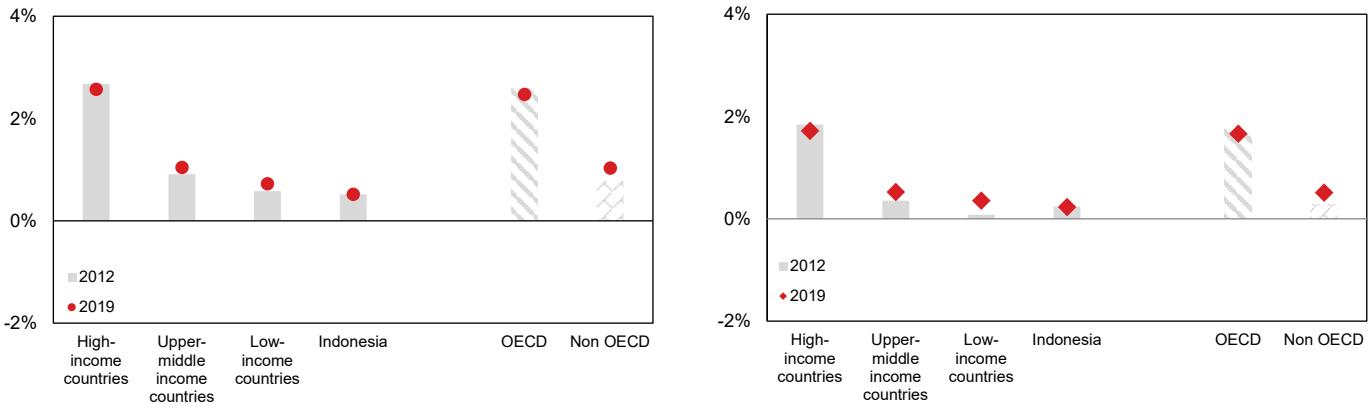
In general, there is a gap in the life insurance premium to Gross Domestic Product (GDP) ratio between high-income countries and other groups of countries. The life insurance premium to GDP ratio for high-income countries ranges between ±4% (±4.3% in 2012 - ±3.92% in 2019), while for upper-middle to low-income countries, it only ranges between ±1% (±1.1% in 2012 - ±0.72% in 2019). Indonesia is positioned similarly to the average of the upper-middle-income countries in the sample. Compared to non-OECD countries, Indonesia was above non-OECD countries in 2012, but the opposite was observed in 2019. A similar pattern was also shown on the life insurance claims-to-GDP ratio side, with Indonesia being above non-OECD countries in 2012 and 2019 (Figure 1) (OECD, 2023).



Note: OECD= Organisation for Economic Co-operation and Development

Source: World Bank (2023), OECD (2023), and IFG (2022)

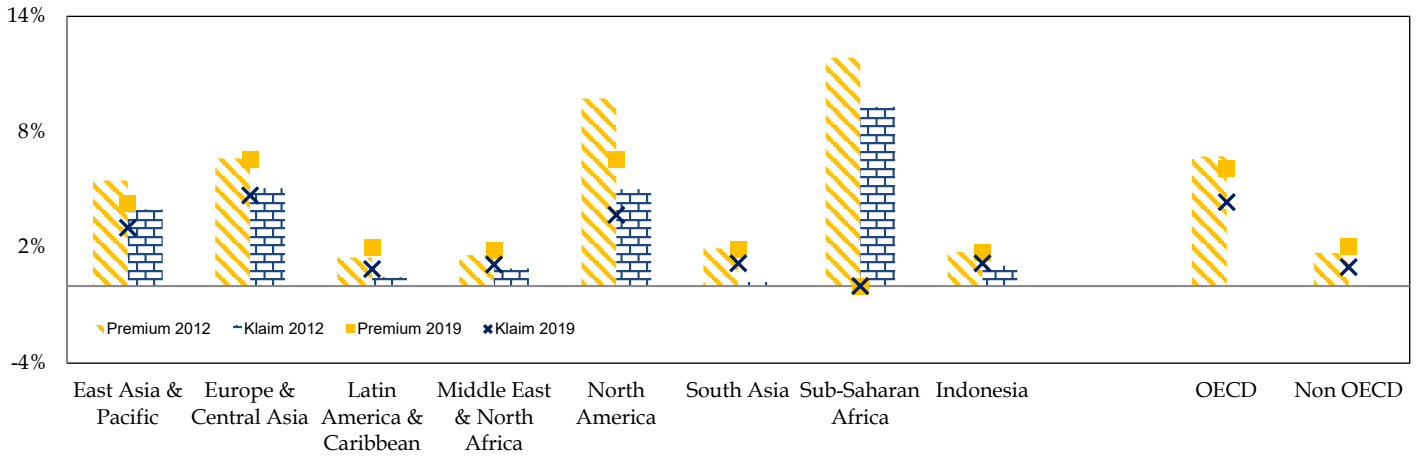
Figure 1 Life Insurance Gross Premium and Claim (% of GDP) in 2012 and 2019



Note: OECD= Organisation for Economic Co-operation and Development

Source: World Bank (2023), OECD (2023), and IFG (2022)

Figure 2 Non-Life Insurance Gross Premium and Claim (% of GDP) in 2012 and 2019



Note: OECD= Organisation for Economic Co-operation and Development

Source: World Bank (2023), OECD (2023), and IFG (2022)

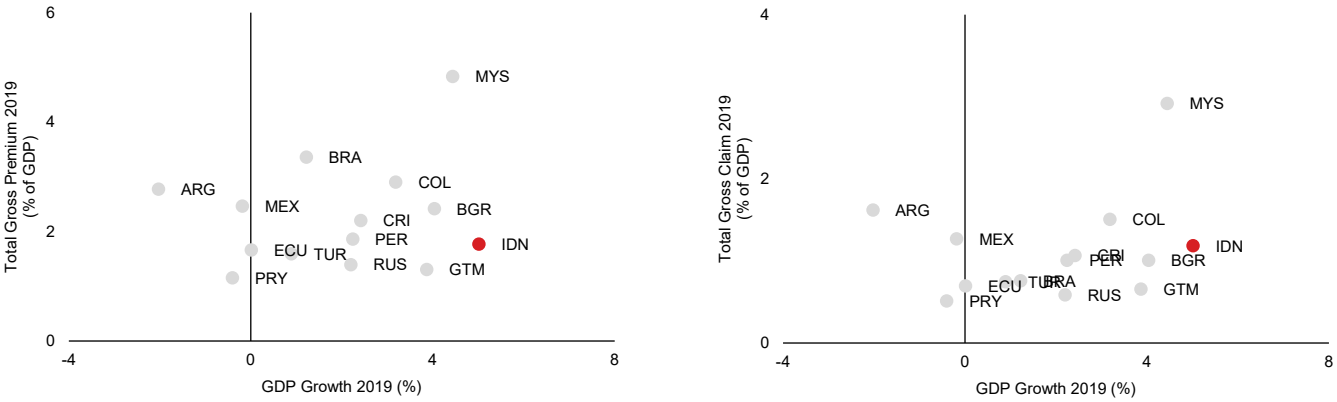
Figure 3 Average of Gross Premium and Claim (% of GDP) Based on Region in 2012 and 2019

From the non-life insurance business line, non-life insurance premiums-to-GDP also illustrate the gap between high-income countries and other countries. In Figure 2, the ratio of non-life insurance premiums to GDP in high-income countries ranges from ±2.5% (±2.68% in 2012 - ±2.57% in 2019), while upper-middle to low-income countries only range from ±1% (±0.92% in 2012 - ±1.05% in 2019) and ±0.5% (±0.58% in 2012 - ±0.72% in 2019). In contrast to life insurance results, Indonesia's position in non-life insurance is below the non-OECD group of countries and at the level of ±0.5% (±0.521% in 2012 - ±0.520% in 2019). Similar results are also seen in the claims section, both in 2012 and 2019 (OECD, 2023).

Furthermore, when viewed in a regional context, the sample average premiums in North America and Sub-Saharan regions dominated other regions with levels of approximately 7% of GDP (10% in 2012) and 13% of GDP (12% in 2012), respectively, in 2019. In terms of claims, the Europe, Central Asia, and Sub-Saharan regions had the highest levels at approximately 4% of GDP (5% in 2012) and 11% of GDP (9% in 2012), respectively, in 2019. Compared to 63 sample countries, Indonesia was positioned as a non-OECD country and falls within the Latin America, Caribbean, Middle East, and North Africa regions (Figure 3) (OECD, 2023).

Compared to other countries with similar economic performance in 2019, Indonesia recorded lower premium earnings compared to other developing countries, such as Argentina, Brazil, and Colombia, despite having the highest GDP growth rate among sample countries (Figure 4). On the other hand, in terms of claims, Indonesia recorded the fourth-highest level after Malaysia, Argentina, Colombia, and Mexico. This performance indicates that gross premiums and claims in Indonesia are still suboptimal compared to higher economic growth among other Emerging Market Economies (EMEs).

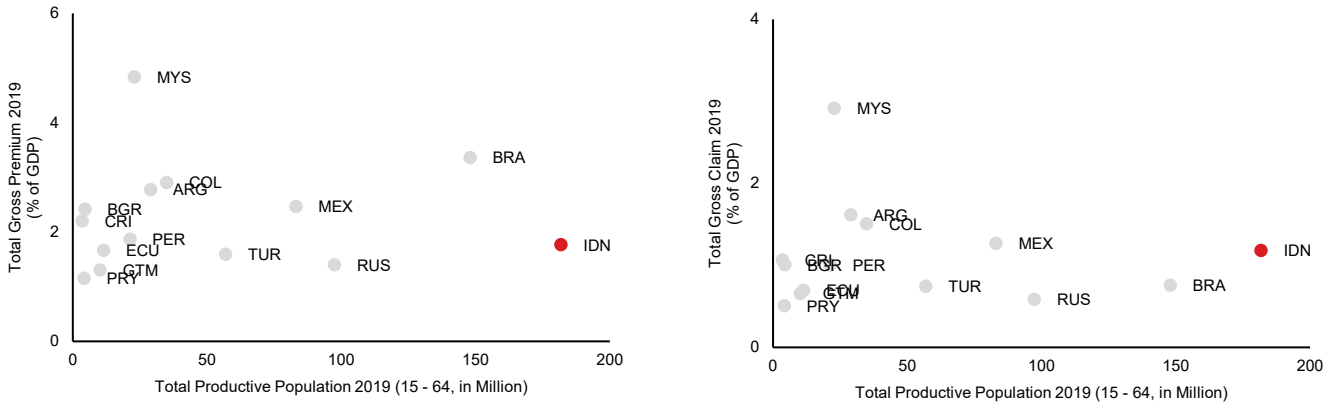
In terms of the relationship between the premium (claim) and the customer base (total productive population), the Indonesian total productive population reaches almost 200 million. However, the percentage of gross premium to GDP in Indonesia is at the level of other countries, with half of Indonesia's productive population. It indicates that Indonesia has not fully capitalized on the massive productive population. The claim figure also indicates an inline picture where the claim level is relatively low as the market has not subscribed to the insurance sector (Figure 5) (OECD 2023; World Bank, 2023).



Note: ARG = Argentina, MEX = Mexico, ECU = Ecuador, PRY = Paraguay, TUR = Türkiye, BRA = Brazil, RUS = Russian Federation, PER = Peru, CRI = Costa Rica, COL = Colombia, BGR = Bulgaria, GTM = Guatemala, MYS = Malaysia, and IDN = Indonesia.

Source: World Bank (2023), OECD (2023), and IFG (2022)

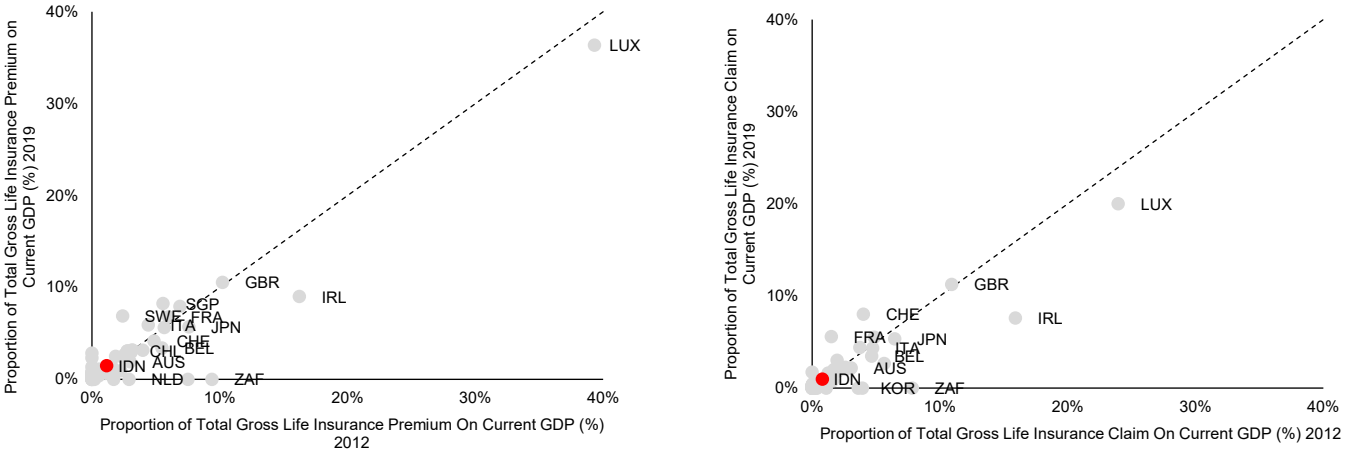
Figure 4 Gross Premium (Claim) and GDP Growth in Indonesia Vs Other Countries



Note: ARG = Argentina, MEX = Mexico, ECU = Ecuador, PRY = Paraguay, TUR = Türkiye, BRA = Brazil, RUS = Russian Federation, PER = Peru, CRI = Costa Rica, COL = Colombia, BGR = Bulgaria, GTM = Guatemala, MYS = Malaysia, and IDN = Indonesia.

Source: World Bank (2023), OECD (2023), and IFG (2022)

Figure 5 Gross Premium (Claim) and Total Productive Population in Indonesia Vs. Other Countries



Note:IDN = Indonesia, AUS = Australia, CHI = China, NLD = Netherlands, SWE = Sweden, ITA = Italy, CHE = Czechia, BEL = Belgium, SGP = Singapore, FRA = France, JPN = Japan, ZAF = South Africa, GBR = United Kingdom, IRL = Ireland, KOR = South Korea, and LUX = Luxembourg.

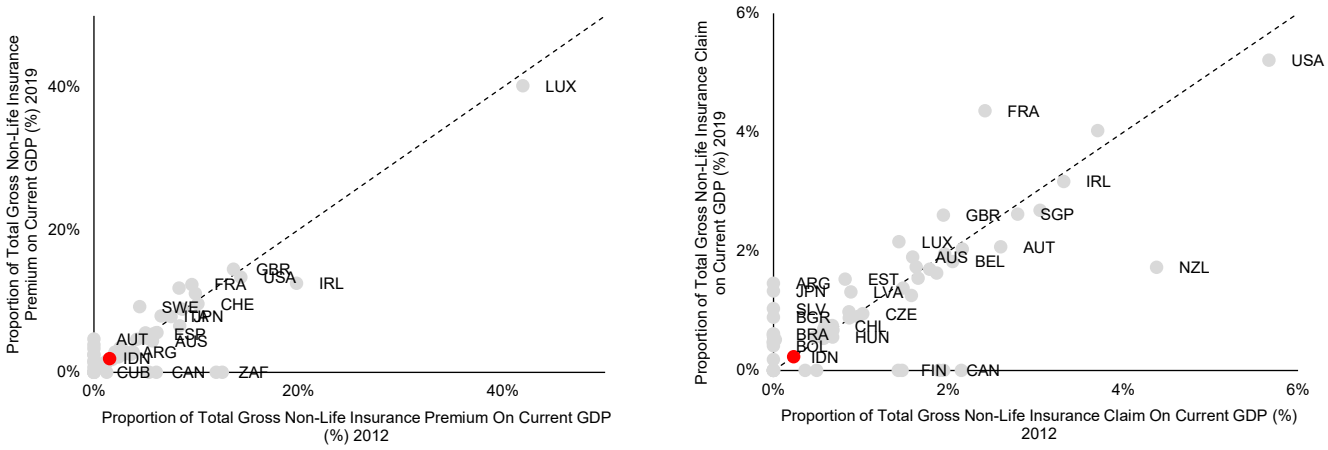
Source: World Bank (2023), OECD (2023), and IFG (2022)

Figure 6 Indonesia's Life Insurance Growth Vs. Other Countries (2012–2019)

Furthermore, in addition to the relatively lower performance of the insurance sector in Indonesia compared to other countries, the historical growth of the insurance sector in Indonesia also shows a similar trend. A comparison of the proportion of total gross life insurance premiums to GDP in 2012 and 2019 shows relatively stagnant growth performance. In 2012, the proportion of life insurance premiums to GDP was recorded at ±1.25%, and in 2019, it still reached the same level of ±1.25%. This result indicated that for almost a decade,

life insurance penetration in Indonesia did not move or stagnated. A similar trend also occurred in the claims component, where the gross life insurance claims component to GDP ranged between ±0.82% and ±0.96% over the past decade (Figure 6) (OECD, 2023).

From the non-life insurance business perspective, Indonesia's performance has been similar. The proportion of non-life insurance premiums tended to be stagnant, moving from around ±1.77% in 2012 to ±1.80% in 2019. Meanwhile, in the same period, the proportion of non-life insurance claims remained at ±0.23% (Figure 7).



Note: IDN = Indonesia, CUB = Cuba, AUT = Austria, ARG = Argentina, CAN = Canada, ZAF = South Africa, AUS = Australia, ESP = Spain, SWE = Sweden, ITA = Italy, JPN = Japan, CHE = Switzerland, FRA = France, GBR = United Kingdom, USA = United States, IRL = Ireland, BOL = Bolivia, BRA = Brazil, BGR = Bulgaria, SLV = El-Salvador, HUN = Hungary, CHL = Chile, CZE = Czech Republic, EST = Estonia, LVA = Latvia, FIN = Finland, BEL = Belgium, and NZL = New Zealand.

Source: World Bank (2023), OECD (2023), and IFG (2022)

Figure 7 Indonesia's Non-Life Insurance Growth Vs. Other Countries (2012–2019)

The analysis of Indonesia's insurance sector performance reveals its similarity to non-OECD economies. Indonesia's life insurance premium-to-GDP ratio, akin to other non-OECD countries, signifies the potential for enhancing insurance penetration. In contrast, high-income countries exhibit higher ratios, highlighting the need to bolster insurance coverage in Indonesia and similar economies. Additionally, Indonesia's non-life insurance premiums-to-GDP ratio falls below that of the non-OECD group, indicating room for strengthening non-life insurance coverage domestically. Increasing these ratios is crucial to fostering a more robust insurance landscape in Indonesia and other non-OECD nations.

Considering Indonesia's position within the ASEAN region, understanding its insurance sector's performance becomes crucial. Exploring the experiences and challenges faced by Indonesia can provide valuable insights into the growth and development of the insurance sector in ASEAN. Moreover, as ASEAN member countries share a high degree of similarity, important lessons can be learned from non-OECD economies, including Indonesia.

Analyzing Indonesia's performance and the strategies implemented to enhance insurance penetration can be a valuable reference for other ASEAN countries.

Despite Indonesia's notable GDP growth rate, the country records lower premium earnings compared to other developing economies with similar economic performance. It highlights the presence of distinct factors influencing Indonesia's insurance market, necessitating tailored approaches to address market dynamics and potential barriers. Gaining a comprehensive understanding of these specific factors enables policymakers and stakeholders to design effective strategies for stimulating insurance sector growth not only in Indonesia but also in other ASEAN countries (OECD, 2023; World Bank, 2023).

In short, Indonesia's insurance sector exhibits similarities with non-OECD economies, emphasizing the need for concerted efforts to enhance insurance penetration. As Indonesia is a part of ASEAN, there is a valuable opportunity for other ASEAN countries to learn from Indonesia's experiences and apply relevant strategies to foster their insurance sector growth. By focusing on consumer awareness, affordability, trust-building, and implementing policies to improve accessibility, Indonesia and other ASEAN nations can work together towards achieving sustainable growth and development in their respective insurance sectors.

Based on these findings, this study aims to address the following research questions:

1) What is the relationship between changes in macroeconomic variables and insurance sector premiums?
2) Are there differences in the impact of macroeconomic variables on the insurance sector in OECD and non-OECD countries?
3) Are there differences in the time response to the impact of macroeconomic variables in OECD and non-OECD countries?

The research adopts the classification of countries' income levels and geographic regions in the World Bank. We use three categories of World Bank's classification in our analysis. They are high-, upper-middle, and lower-middle-income countries. With the limited available sample, especially from the ASEAN economies, the analyses based on economic levels are divided into two groups: OECD and non-OECD countries. We use non-OECD[1] groups as a proxy for ASEAN economies. The selection of key macroeconomic variables is based on Zarnowitz (1992) that the main macroeconomic variables that play a role in the economy are GDP, exchange rate, interest rate, and inflation.

Literature Review/Analytical Framework

The literature on the impact of macroeconomic variables on gross insurance premiums, both life and non-life, is centered on four key macroeconomic variables: GDP, exchange rate, interest rate, and inflation. Both in the life and non-life insurance business, the GDP/income

[1] Four ASEAN countries are included in the non-OECD countries. They are Indonesia, Malaysia, Singapore, and Thailand

indicator shows a strong indication of a positive relationship with insurance premiums. Studies ranging from almost 50 years ago by Fortune (1973) to recent studies by Dragotă et al. (2023) reinforce the empirical findings that link income and premiums. However, there is other evidence showing a reverse relationship for certain parts of the world. There has been an indication of the S-curve phenomenon in the Asian region (Dragos, 2014; Park & Lemaire, 2011).

As for the other indicators, such as exchange rate, interest rate, and inflation, the previous study results show various impacts on insurance, suggesting specific countries or cases and sensitive periods in influencing the relationship between them (Tables 1 and 2). Although there have been many studies that look at the relationship between macroeconomic variables and insurance (among others, Dragos (2014), Tian et al. (2018), and Abhijit and Amlan (2022)), but they only focus on certain regions or, in some cases, certain countries.

Furthermore, they only focus on insurance growth by looking at the premiums and density without looking at the opposite side of the coin, the claims. In this research, we improve the existing literature by extending the breadth of our analysis by dividing our sample within its income group. Moreover, we also fill the gap in the existing literature by looking at the impact of macroeconomic variables on the claims. We believe the two additions will fill the gaps in the literature for the insurance sector.

Based on the literature review conducted, we establish the following hypotheses:

- GDP/income: There is a positive relationship between income levels and insurance sector premiums. Economic growth or income plays a crucial role in explaining insurance-related models (see Fortune (1973) and Beenstock et al. (1988)). An increase in economic growth and income, ceteris paribus, can enhance the affordability of insurance products. Consequently, more consumers are able to purchase insurance products, leading to an increase in premium income for insurance companies (see Tables 1 and 2).
- Exchange rate: The exchange rate has a negative relationship with insurance sector premiums. The weaker the local currency against the US Dollar causes the insurance premium to decline. Various studies consistently demonstrate a negative and significant coefficient for the exchange rate in all models, supporting our hypothesis. According to Singhal et al. (2020), who examined the impact of the relationship between the exchange rate and three dependent variables (gross written premium, insurance penetration, and insurance density), the relationship consistently exhibits a negative coefficient in all three models. These findings reinforce the findings of Hosseinzadeh and Daei-Karimzadeh (2017), suggesting that not only volatility but also the direction of exchange rate movements can increase uncertainty and instability, thereby reducing the willingness of the public to purchase insurance. Consequently, as a currency depreciates (relative to the US Dollar), premiums from insurance companies tend to be suppressed (see Tables 1 and 2).
- Interest rate: The interest rate has a negative relationship with insurance sector premiums. The literature on the real interest rate's effect on insurance has not been sufficiently conclusive thus far. Economists such as Beck and Webb (2003) believed that higher real

interest rates increased investment profitability for insurance companies and offered greater profitability for purchasers. In contrast, Li et al. (2007) argued that the real interest rate served as an incentive for households to postpone consumption (incentivizing higher investment or savings). As a result, consumption of insurance products slowed down, leading to a decrease in insurance premium income. In this study, we establish the hypothesis for this study following Li et al. (2007) (see Tables 1 and 2).

Table 1 Literature Study for Life Insurance

Variable	Sign of Determinant		
	Positive	Negative	Non-significant/Ambiguous features
GDP	Fortune (1973), Campbell (1980), Beenstock et al. (1988), Lewis (1989), Truett and Truett (1990), Browne and Kim (1993), Outreville (1996), Ward and Zurbruegg (2002), Beck and Webb (2003), Li et al. (2007), Feyen et al. (2011), Kjosevski (2012), Dragos (2014), Dragos et al. (2017), Dragoş (2019), Singhal et al. (2020), Dragotă et al. (2022)	Segodi and Sibindi (2022)	Dragos (2014) for Non-life Density Asia
Exchange Rate	Hosseinzadeh and Daei-Karimzadeh (2017)	Li et al. (2009) - For long-term, Singhal et al. (2020), Simionescu and Ulbinaitė (2021)	Cummins et al. (1999)
Interest Rate	Fortune (1973), Beck and Webb (2003), Zerriaa and Noubbigh (2016)	Li et al. (2007)	Outreville (1996), Kjosevski (2012)
Inflation	Zerriaa and Noubbigh (2016), Olarewaju and Msomi (2021)	Fortune (1973), Browne and Kim (1993), Outreville (1996), Ward and Zurbruegg 2002), Beck and Webb (2003), Li et al. (2007), Sen and Madheswaran (2013), Olasehinde-Williams and Balcilar (2020)	Kjosevski (2012), Singhal et al. (2020)

Source: Various Studies and IFG (2022)

Table 2 Literature Study for Non-Life Insurance

Variable	Sign of Determinant		
	Positive	Negative	Non-significant/Ambiguous features
GDP	Sherden (1984), Beenstock et al. (1988), Outreville (1996), Browne et al. (2000), Esho et al. (2004), Treerattanapun (2011), Park and Lemaire (2011), Trinh et al. (2016), Tian et al. (2018), Abhijit and Amlan (2022)	Park and Lemaire (2011) – countries with a GDP higher than 20,000$	
Exchange Rate		Li et al. (2009) - For long-term and domestic insurers, Simionescu and Ulbinaitė (2021)	Colquitt and Hoyt (1997), Cummins et al. (1999)
Interest Rate	Beenstock et al. (1988), Haiss and Sümegi (2008)	Haiss and Sümegi (2008), Millo and Carmeci (2010), Abhijit and Amlan (2022)	
Inflation		Haiss and Sümegi (2008), Feyen et al. (2011)	

Source: Various Studies and IFG (2022)

Inflation: Inflation has a negative relationship with insurance sector premiums. Unlike the real interest rate, the literature on the impact of inflation on insurance premiums is more conclusive. Once again, drawing from Beck and Webb (2003), it is believed that "price stability is an important predictor of insurance consumption". Coefficients for the inflation rate are significantly negative across all specifications. Our hypothesis is based on Beck and Webb (2003). As the price level rises, insurance sector premiums tend to decline (see Tables 1 and 2).

Research Method

The estimation results utilized in this study employ panel data regression analysis, combining time series and cross-sectional data. It employs a fixed-effect approach based on an annual panel dataset of 63 countries (displayed in Table 3) from 2010 to 2019. Hence, we use the following formulas.

$$Premiums_{it} = (\beta_0 + \mu_i) + \beta_1 GDP_{it} + \beta_2 Inflation_{it} + \beta_3 Exchange\ Rate_{it} + \beta_4 Interest\ Rate_{it} + \beta_5 Incomegroup2_{it} + \beta_6 Incomegroup3_{it} + \delta_t + \varepsilon_{it} \quad (1)$$

$$Claims_{it} = (\beta_0 + \mu_i) + \beta_1 GDP_{it} + \beta_2 Inflation_{it} + \beta_3 Exchange\ Rate_{it} + \beta_4 Interest\ Rate_{it} + \beta_5 Incomegroup2_{it} + \beta_6 Incomegroup3_{it} + \delta_t + \varepsilon_{it} \quad (2)$$

In the equations, δ_i represents the entity-specific intercepts, which capture the unobserved heterogeneity, and all other terms remain the same. The Fixed Effect Model (FE) estimates the coefficients (β_1) and provides consistent estimates of the relationships of interest by accounting for time-invariant heterogeneity. We assume that the individual-specific effects are correlated with the independent variables. This assumption allows for controlling the unobserved heterogeneity but restricts the estimation to within-entity variations. It is important to note that the FE model does not estimate the effects of time-invariant variables as they are different. To determine the most appropriate panel data model for our analysis, we evaluate the fit and performance of each model and compare their respective strengths and limitations. In conducting such exploration, we use Hausman test, R-squared, Lagrange Multiplier (LM) test, 4) Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), and diagnostic tests (such as heteroscedasticity tests (e.g., White's test), serial correlation tests (e.g., Breusch-Pagan test), and normality tests (e.g., Jarque-Bera test) to assess the validity of the chosen model).

We do not include data from 2020 to 2022 in the model to exclude the impact of special stimulus and policies for COVID-19 on the insurance sector. The study aims to map the relationships between macroeconomic indicators and gross premiums. The macroeconomic indicators used in the model include GDP, inflation, interest rates, and exchange rates. Furthermore, the estimation results are also mapped based on total observations, OECD and ASEAN (proxied by non-OECD samples – from here on, we will treat Non-OECD as ASEAN), as well as static and dynamic analyses to examine potential variations in patterns across regional groups and over different time. The dynamic equations we use are as follows.

$$Premiums_{it} = \beta_1 GDP_{it} + \beta_2 Inflation_{it} + \beta_3 Exchange\ Rate_{it} + \beta_4 Interest\ Rate_{it} + \beta_5 GDP_{i,t-1} + \beta_6 Inflation_{i,t-1} + \beta_7 Exchange\ Rate_{i,t-1} + \beta_8 Interest\ Rate_{i,t-1} + \beta_9 GDP_{i,t-2} + \beta_{10} Inflation_{i,t-2} + \beta_{11} Exchange\ Rate_{i,t-2} + \beta_{12} Interest\ Rate_{i,t-2} + \beta_{13} Incomegroup2_{it} + \beta_{14} Incomegroup3_{it} + \delta_t + \varepsilon_{it} \quad (3)$$

$$Claims_{it} = \beta_1 GDP_{it} + \beta_2 Inflation_{it} + \beta_3 Exchange\ Rate_{it} + \beta_4 Interest\ Rate_{it} + \beta_5 GDP_{i,t-1} + \beta_6 Inflation_{i,t-1} + \beta_7 Exchange\ Rate_{i,t-1} + \beta_8 Interest\ Rate_{i,t-1} + \beta_9 GDP_{i,t-2} + \beta_{10} Inflation_{i,t-2} + \beta_{11} Exchange\ Rate_{i,t-2} + \beta_{12} Interest\ Rate_{i,t-2} + \beta_{13} Incomegroup2_{it} + \beta_{14} Incomegroup3_{it} + \delta_t + \varepsilon_{it} \quad (4)$$

All variables are transformed into natural logarithm form to facilitate the inference of parameter estimates as elasticity coefficients. This transformation ensures that the interpretation of the parameter (β) is equivalent to elasticity, meaning that a 1% increase in the independent variable will result in a β% change in the dependent variable. The variable descriptions are as follows:

- ltgp (natural logarithm of total gross premium at millions of USD)
- llgp (natural logarithm of total life gross premium at millions of USD)
- lnlgp (natural logarithm of total non-life gross premium at millions of USD)
- lgdpriil (natural logarithm of GDP at constant 2015 USD prices)
- lcpi (natural logarithm of consumer price index)
- ler (natural logarithm of exchange rate, local currency unit/USD)
- linterest (natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal)
- L (lag operator used for dynamic panel analysis, where L and L2 represent the lag of the independent variable at 1 and 2 time periods ago, respectively)

Additionally, the study employs dummy variables as follows:

- Income 1: high-income countries
- Income 2: lower-middle-income countries
- Income 3: upper-middle-income countries

Table 3 The List of Regions and Its Status

Country	Region	OECD/Non-OECD
Argentina	Latin America & Caribbean	Non-OECD
Australia	East Asia & Pacific	OECD
Austria	Europe & Central Asia	OECD
Belgium	Europe & Central Asia	OECD
Bolivia	Latin America & Caribbean	Non-OECD
Brazil	Latin America & Caribbean	Non-OECD
Bulgaria	Europe & Central Asia	Non-OECD
Canada	North America	OECD
Chile	Latin America & Caribbean	OECD
Colombia	Latin America & Caribbean	OECD
Costa Rica	Latin America & Caribbean	OECD
Cuba	Latin America & Caribbean	Non-OECD
Czech Republic	Europe & Central Asia	OECD
Denmark	Europe & Central Asia	OECD
Dominican Republic	Latin America & Caribbean	Non-OECD
Ecuador	Latin America & Caribbean	Non-OECD
Egypt, Arab Rep.	Middle East & North Africa	Non-OECD
El Salvador	Latin America & Caribbean	Non-OECD
Estonia	Europe & Central Asia	OECD
Finland	Europe & Central Asia	OECD
France	Europe & Central Asia	OECD
Germany	Europe & Central Asia	OECD
Greece	Europe & Central Asia	OECD
Guatemala	Latin America & Caribbean	Non-OECD
Honduras	Latin America & Caribbean	Non-OECD
Hungary	Europe & Central Asia	OECD
Iceland	Europe & Central Asia	OECD
India	South Asia	Non-OECD
Indonesia	East Asia & Pacific	Non-OECD
Ireland	Europe & Central Asia	OECD
Israel	Middle East & North Africa	OECD
Italy	Europe & Central Asia	OECD
Japan	East Asia & Pacific	OECD
Korea, Rep.	East Asia & Pacific	OECD
Latvia	Europe & Central Asia	OECD
Lithuania	Europe & Central Asia	OECD
Luxembourg	Europe & Central Asia	OECD
Malaysia	East Asia & Pacific	Non-OECD
Mexico	Latin America & Caribbean	OECD
Netherlands	Europe & Central Asia	OECD
New Zealand	East Asia & Pacific	OECD
Nicaragua	Latin America & Caribbean	Non-OECD
Norway	Europe & Central Asia	OECD
Panama	Latin America & Caribbean	Non-OECD
Paraguay	Latin America & Caribbean	Non-OECD
Peru	Latin America & Caribbean	Non-OECD
Poland	Europe & Central Asia	OECD
Portugal	Europe & Central Asia	OECD
Russian Federation	Europe & Central Asia	Non-OECD
Singapore	East Asia & Pacific	Non-OECD
Slovak Republic	Europe & Central Asia	OECD
Slovenia	Europe & Central Asia	OECD
South Africa	Sub-Saharan Africa	Non-OECD
Spain	Europe & Central Asia	OECD
Sri Lanka	South Asia	Non-OECD
Sweden	Europe & Central Asia	OECD
Switzerland	Europe & Central Asia	OECD
Thailand	East Asia & Pacific	Non-OECD
Tunisia	Middle East & North Africa	Non-OECD
Türkiye	Europe & Central Asia	OECD
United Kingdom	Europe & Central Asia	OECD
United States	North America	OECD
Uruguay	Latin America & Caribbean	Non-OECD

Note: OECD= Organisation for Economic Co-operation and Development
Source: Various Studies and IFG (2022)

Empirical Findings

Static Impact

Based on the estimation results presented in Table 4, the static approach and the total gross premium models show mixed results in relation to the hypotheses formulated. Regarding the first indicator, real GDP, the estimation results indicate a positive and significant relationship with both total and non-life gross premiums. These findings are consistent with previous studies that suggest an increase in income can enhance consumer affordability, leading to higher consumption of insurance products and premiums (Fortune, 1973; Dragotă et al., 2023). However, the results show a positive but insignificant relationship for the life insurance sector. This result suggests potential differences in the characteristics and drivers of the different insurance sectors among the sampled countries (discussed in Table 3).

Table 4 Estimation Results of Static Macroeconomic Indicators and Gross Insurance Premiums at the Global Level

Variables	**ltgp**	**llgp**	**lnlgp**	**ltgp**	**llgp**	**lnlgp**
lgdpriil	0.89***	0.41	1.14***	0.84***	0.49	1.12***
	(0.10)	(0.31)	(0.10)	(0.10)	(0.32)	(0.10)
lcpi	1.51***	2.75***	1.12***	1.53***	2.86***	1.10***
	(0.13)	(0.40)	(0.13)	(0.13)	(0.41)	(0.13)
ler	-1.01***	-1.43***	-0.92***	-1.01***	-1.49***	-0.91***
	(0.07)	(0.22)	(0.07)	(0.07)	(0.22)	(0.07)
linterest	0.02*	0.02	0.02**	0.02**	0.02	0.02**
	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	(0.01)
2. income	No	No	No	Yes	Yes	Yes
3. income	No	No	No	Yes	Yes	Yes
Constant	-18.10***	-11.04	-23.91***	-16.88***	-13.50*	-23.27***
	(2.21)	(7.12)	(2.21)	(2.31)	(7.41)	(2.32)
Observations	273	265	271	273	265	271
R-squared	0.72	0.30	0.71	0.72	0.31	0.72
Number of cd	38	37	38	38	37	38

Note: Standard errors are in parentheses. *p<0.1, **p<0.05, and ***p<0.01. ltgp= log total gross premium, llgp= log life gross premium, lnlgp= log non-life gross premium, lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal, and cd = number of cross-sectional dependences to test. 2. income and 3. income are dummies for income level. Diagnostics results can be found at the end of the empirical analysis section.

Source: World Bank (2023), OECD (2023), and IFG (2022)

Moving on to the second indicator, inflation rate (change in Consumer Price Index (CPI)), the estimation results demonstrate a positive and significant relationship with gross premiums in all models. These findings contradict our initial hypothesis and align more closely with the findings of Zerriaa and Noubbigh (2016) and Olarewaju and Msomi (2021). These findings indicate that high inflation rates and volatility may increase the demand for risk mitigation provided by the insurance sector. Beck and Webb (2003) conducted research using a sample with high inflation rates and volatility, while Zerriaa and Noubbigh (2016) and Olarewaju and Msomi (2021) regarding the exchange rate variable, the relationship between the exchange rates and the gross premiums showed a negative and significant impact in all models. These results support the findings of previous studies, such as Singhal et al. (2020) and Hosseinzadeh and Daei-Karimzadeh (2017), who reported similar relationships. Continual depreciation and pressure on the local currency relative to the US Dollar can increase uncertainty and instability and reduce the willingness of the public to purchase insurance products.

As for the interest rate, the estimation results reveal a positive and significant relationship with gross premiums, contrary to our initial hypothesis. These findings align more closely with the findings of Fortune (1973), Beck and Webb (2003), Zerriaa and Noubbigh (2016) for life insurance, and Beenstock et al. (1988) and Haiss and Sümegi (2008) for non-life insurance. Interest rates are seen as a driver of investment profitability for insurance companies and can act as an additional factor in attracting insurance products (Table 4).

Turning to the analysis of OECD and ASEAN approaches presented in Table 5, the results obtained generally align and further elaborate the findings posted in Table 4. First, the relationship between real GDP and life gross premiums for the OECD segment shows a positive and significant relationship at the 10% level when not using income dummy variables. In contrast, the significance level for life gross premiums for the ASEAN segment remains unchanged (p-value > 10%). It suggests insensitivity in the relationship between real GDP and gross premiums to the income level of a country relative to high-income countries.[2] In other words, overall, life gross premiums for OECD countries exhibit a positive relationship, and there is no influence on income levels acrss the sampled countries.

The interest rate has contrasting effects between the case of the OECD and the ASEAN countries. In theory, based on previous research, a substitution relationship exists between savings and insurance (Menegatti & Rebresi, 2011). It implies that when interest rates increase, individuals tend to prefer saving their funds in saving instruments rather than insurance (substitution effect). Studies on the complementary relationship between savings and insurance can also be found in previous research (Redzuan et al., 2009; Beck & Webb, 2003; Savvides, 2006). However, in the same study conducted by Menegatti and Rebresi (2011), a wealth effect is also explained, meaning that under conditions of high income, the substitution effect between insurance and savings can be offset by income effects. Thus, when interest rates

[2] In this study, the sample countries are divided into four categories, namely 1 = high-income, 2 = lower-middle income, and 3 = upper-middle income. The income level dummies are constructed as a comparison to the base category, which is the high-income countries.

increase, individuals will allocate more income to savings while still maintaining demand for insurance. It may explain the differential impact of interest rates between OECD countries with relatively higher average income and ASEAN countries with lower average income. However, for ASEAN countries, these parameters are not statistically significant.

Table 5 Estimation Results of Static Macroeconomic Indicators and Total Gross Insurance Premiums between OECD and ASEAN

Variables	**ltgp**	**llgp**	**lnlgp**	**ltgp**	**llgp**	**lnlgp**
lgdpriil	0.65***	0.46*	1.04***	0.59***	0.38	1.02***
	(.15)	(.25)	(.12)	(.15)	(.25)	(.12)
lcpi	1.79***	2.64***	1.26***	1.85***	2.73***	1.28***
	(.2)	(.34)	(.16)	(.2)	(.34)	(.16)
ler	-1.04***	-1.33***	-0.95***	-1.06***	-1.36***	-0.96***
	(.08)	(.13)	(.06)	(.08)	(.13)	(.06)
linterest	0.02**	0.03*	0.01	0.03**	0.04**	0.01*
	(.01)	(.02)	(.01)	(.01)	(.02)	(.01)
2.income	No	No	No	No	No	No
3.income	No	No	No	Yes	Yes	Yes
Constant	-12.47***	-11.25*	-21.68***	-11.24***	-9.376	-21.18***
	(3.39)	(5.77)	(2.67)	(3.34)	(5.74)	(2.69)
Observations	154	147	152	154	147	152
R-squared	0.71	0.59	0.80	0.73	0.61	0.80
Number of cd	18	17	18	18	17	18

Variables	**ltgp**	**llgp**	**lnlgp**	**ltgp**	**llgp**	**lnlgp**
lgdpriil	1.07***	0.41	1.13***	1.06***	0.80	1.13***
	(.15)	(.6)	(.17)	(.16)	(.63)	(.18)
lcpi	1.34***	2.86***	1.09***	1.32***	3.02***	1.04***
	(.2)	(.8)	(.23)	(.2)	(.81)	(.23)
ler	-0.98***	-1.55***	-0.90***	-0.97***	-1.80***	-0.88***
	(.12)	(.49)	(.14)	(.13)	(.5)	(.15)
linterest	-0.01	-0.01	0.04	-0.01	-0.02	0.04
	(.02)	(.08)	(.02)	(.02)	(.08)	(.02)
2.income	No	No	No	Yes	Yes	Yes
3.income	No	No	No	Yes	Yes	Yes
Constant	-22.77***	-12.53	-24.02***	-22.64***	-23.1	-23.83***
	(3.36)	(13.79)	(3.91)	(3.69)	(14.73)	(4.26)
Observations	119	118	119	119	118	119
R-squared	0.73	0.23	0.66	0.73	0.26	0.67
Number of cd	20	20	20	20	20	20

Note: Standard errors are in parentheses. *p < 0.1, **p < 0.05, and ***p < 0.01. ltgp = log total gross premium, llgp = log life gross premium, lnlgp = log non-life gross premium, lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal, and cd = number of cross-sectional dependences to test. 2. income and 3. income are dummies for income level. The top is the representation of Organisation for Economic Co-operation and Development (OECD), and the bottom is for ASEAN.

Source: World Bank (2023), OECD (2023), and IFG (2022)

Table 6 The Dynamic Estimation Results of Macroeconomic Indicators and Total Gross Premiums at the Global Level

Independent Variables	Total					
	Total Gross Premium	Life insurance	Non-life insurance	Total Gross Premium	Life insurance	Non-life insurance
lgdpriil	0.53**	0.31	0.52**	0.54**	0.70	0.49**
	(.21)	(.87)	(.22)	(.22)	(.89)	(.22)
lcpi	0.90*	-0.78	1.41**	0.78	-1.34	1.26**
	(.53)	(2.13)	(.54)	(.54)	(2.17)	(.55)
ler	-0.91***	-1.12***	-0.89***	-0.89***	-1.11***	-0.87***
	(.1)	(.43)	(.11)	(.1)	(.42)	(.11)
linterest	0.01	0.01	0.01	0.01	0.00	0.00
	(.01)	(.05)	(.01)	(.01)	(.05)	(.01)
L.lgdpriil	-0.74	-0.20	-0.07	-0.87	0.02	-0.27
	(.54)	(2.19)	(.56)	(.55)	(2.23)	(.56)
L.lcpi	-1.05	4.38	-1.78**	-1.12	5.73	-1.99**
	(.86)	(3.53)	(.88)	(.87)	(3.57)	(.88)
L.ler	-0.02	-0.33	0.08	-0.03	-0.47	0.07
	(.13)	(.52)	(.13)	(.13)	(.52)	(.13)
L.linterest	0.00	-0.02	0.00	0.00	-0.02	0.00
	(.01)	(.05)	(.01)	(.01)	(.05)	(.01)
L2.lgdpriil	1.01**	0.17	0.69	1.13**	-0.18	0.90*
	(.46)	(1.84)	(.47)	(.47)	(1.87)	(.47)
L2.lcpi	1.63***	-1.01	1.41***	1.76***	-1.49	1.64***
	(.52)	(2.14)	(.53)	(.53)	(2.2)	(.54)
L2.ler	-0.17*	0.14	-0.23**	-0.16	0.07	-0.19*
	(.1)	(.41)	(.1)	(.1)	(.41)	(.1)
L2.linterest	-0.01	0.00	0.00	-0.01	-0.02	0.00
	(.01)	(.05)	(.01)	(.01)	(.05)	(.01)
2.income	No	No	No	Yes	Yes	Yes
3.income	No	No	No	Yes	Yes	Yes
Constant	-15.84***	-7.365	-23.41***	-15.58***	-15.19	-22.23***
	(2.82)	(11.39)	(2.88)	(2.96)	(11.86)	(2.99)
Observations	211	204	209	211	204	209
R-squared	0.74	0.21	0.72	0.74	0.24	0.73
Number of cd	36	35	35	36	35	35

Note: Standard errors are in parentheses. *p < 0.1, **p < 0.05, and ***p < 0.01. L.= Lag 1 period, L2 = Lag 2 periods, lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal, and cd = number of cross-sectional dependences to test. 2. income and 3. income are dummies for income level.

Source: IFG (2022)

In addition to real GDP and interest rates, two other indicators, namely inflation and exchange rates, do not show differences between the sample segments of the OECD and the ASEAN. The indicators of inflation and exchange rates remain consistent, both in terms of coefficient direction and significance, in influencing gross premiums.

Dynamic Impact

Based on the dynamic estimation results presented in Table 6, there are some similarities and differences in the response of premiums to changes in macroeconomic variables when using the total, OECD, and ASEAN samples. When using the entire sample (OECD + ASEAN), the logarithm of GDP consistently shows a positive and significant impact on all dependent variables, except for the premiums in the life insurance segment when using the total and ASEAN sample. These results are consistent with the static results obtained and previous studies (among others: Dragos (2014) and Dragotă et al. (2023)). Additionally, the estimation results also indicate that the lag of two previous periods has a significant impact on gross premiums, suggesting that insurance companies need to anticipate the lasting and persistent effects of the change in income.

Moving on to the next indicator, the logarithm of CPI, the coefficient of the relationship between the inflation rate and gross premiums shows a positive direction. It is consistent with the static results in the previous exhibit. Furthermore, the relationship between inflation and gross premiums is more persistent and lasting, as indicated by the significance level at the lag of two periods. However, only the non-life insurance segment is sensitive to the inflation rate. This result suggests that inflation only affects the insurance sector in the short term, not in the long term, as in the case of life insurance.

Turning to the exchange rate indicator, the coefficient of the relationship between the exchange rate indicator and insurance sector premiums shows negative and significant results in almost all estimation outcomes, both in life insurance and non-life insurance, using the total sample of OECD and ASEAN. The results are further confirmed at the lag of two periods, indicating significant coefficients and suggesting a persistent impact on changes in premiums. These estimation results align with the static findings obtained and the previous studies (Li et al., 2009; Singhal et al., 2020; Simionescu & Ulbinaitė, 2021). It implies that insurance companies should also anticipate the influence or lasting impact caused by the exchange rate, particularly in the non-life insurance segment.

The last indicator, the logarithm of the interest rate, shows positive (consistent with our static case) but insignificant coefficients for almost all estimation models. Our results are consistent with the findings of Outreville (1996) and Kjosevski (2012) that the coefficient of the logarithm of the interest rate shows insignificant results. Furthermore, we do not find any dynamic influence of the real interest rate on gross premiums at all lag levels and models.

Upon further examination of the OECD and ASEAN regions, both country samples exhibit similar characteristics, namely having a persistent and lasting impact, albeit on different variables. For OECD countries, the real GDP and inflation rate are observed to have persistent impacts. Meanwhile, the sustained impacts for ASEAN countries are driven by the inflation rate and exchange rate (Table 7).

Table 7 The Dynamic Estimation Results of Macroeconomic Indicators and Total Gross Premiums between OECD and ASEAN Countries

Independent Variable	OECD						ASEAN					
	Total Gross Premium	Life insurance	Non-life insurance	Total Gross Premium	Life insurance	Non-life insurance	Total Gross Premium	Life insurance	Non-life insurance	Total Gross Premium	Life insurance	Non-life insurance
lgdpriil	0.33	0.29	0.21	0.32	0.27	0.21	0.61**	0.03	0.63*	0.72**	1.02	0.67*
	(.31)	(.56)	(.19)	(.31)	(.57)	(.2)	(.3)	(1.56)	(.36)	(.33)	(1.64)	(.39)
lcpi	1.45*	1.79	1.23**	1.59*	1.97	1.33**	0.53	-0.47	1.26	0.35	-1.40	1.09
	(.84)	(1.55)	(.53)	(.86)	(1.59)	(.54)	(.85)	(4.25)	(1.)	(.87)	(4.27)	(1.02)
ler	-0.96***	-1.16***	-0.89***	-0.97***	-1.17***	-0.90***	-0.89***	-1.25	-0.92***	-0.87***	-1.29	-0.89***
	(.12)	(.22)	(.07)	(.12)	(.22)	(.08)	(.18)	(.91)	(.21)	(.18)	(.9)	(.22)
linterest	0.01	0.02	0.00	0.01	0.02	0.00	-0.01	-0.03	0.02	-0.01	-0.04	0.02
	(.01)	(.02)	(.01)	(.01)	(.02)	(.01)	(.02)	(.12)	(.03)	(.02)	(.12)	(.03)
L.lgdpriil	-1.47**	-1.87	-0.88*	-1.53**	-1.94	-0.92**	0.56	0.90	0.91	0.31	1.11	0.50
	(.71)	(1.29)	(.45)	(.71)	(1.3)	(.45)	(.84)	(4.22)	(.99)	(.89)	(4.45)	(1.05)
L.lcpi	-1.34	-0.99	-2.11***	-1.41	-1.05	-2.16***	-1.22	6.38	-2.14	-1.07	9.72	-2.25
	(1.24)	(2.33)	(.78)	(1.25)	(2.34)	(.79)	(1.27)	(6.49)	(1.49)	(1.3)	(6.65)	(1.54)
L.ler	-0.12	-0.11	-0.15*	-0.12	-0.11	-0.15*	0.34	-0.61	0.47*	0.27	-1.14	0.41
	(.13)	(.25)	(.08)	(.13)	(.25)	(.08)	(.23)	(1.22)	(.28)	(.24)	(1.24)	(.29)
L.linterest	0.00	0.01	-0.01	0.00	0.01	-0.01	0.00	-0.04	0.01	0.00	-0.04	0.01
	(.01)	(.02)	(.01)	(.01)	(.02)	(.01)	(.02)	(.11)	(.03)	(.02)	(.11)	(.03)
L2.lgdpriil	1.56**	1.37	1.83***	1.62**	1.45	1.88***	-0.12	-0.27	-0.32	0.07	-0.77	0.04
	(.65)	(1.18)	(.41)	(.66)	(1.2)	(.42)	(.71)	(3.55)	(.84)	(.76)	(3.73)	(.89)
L2.lcpi	1.79**	2.73*	1.55***	1.75**	2.66*	1.52***	1.96**	-3.68	1.92**	1.99**	-5.29	2.10**
	(.74)	(1.38)	(.47)	(.75)	(1.4)	(.47)	(.79)	(4.21)	(.93)	(.81)	(4.35)	(.95)
L2.ler	-0.12	-0.37*	0.07	-0.12	-0.37*	0.07	-0.41**	0.85	-0.62***	-0.39**	0.78	-0.57**
	(.11)	(.21)	(.07)	(.11)	(.21)	(.07)	(.18)	(.97)	(.21)	(.19)	(.96)	(.22)
L2.linterest	-0.01	0.02	-0.02*	-0.01	0.02	-0.02**	-0.03	-0.03	0.02	-0.03*	-0.06	0.01
	(.01)	(.03)	(.01)	(.01)	(.03)	(.01)	(.02)	(.09)	(.02)	(.02)	(.09)	(.02)
2.income	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes
3.income	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Constant	-6.54	3.80	-22.23***	-6.59	3.81	-22.27***	-22.11***	-18.02	-25.35***	-23.35***	-38.7	-24.74***
	(4.47)	(8.35)	(2.81)	(4.48)	(8.39)	(2.81)	(4.53)	(22.72)	(5.35)	(5.01)	(24.75)	(5.9)
Observations	110	104	108	110	104	108	101	100	101	101	100	101
R-squared	0.73	0.59	0.88	0.73	0.59	0.88	0.79	0.19	0.71	0.79	0.24	0.72
Number of cd	18	17	17	18	17	17	18	18	18	18	18	18

Note: Standard errors are in parentheses. *p < 0.1, ** p < 0.05, and ***p < 0.01. L.= Lag 1 period, L2 = Lag 2 periods, lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal, and cd = number of cross-sectional dependences to test. 2. income and 3. income are dummies for income level.

Source: IFG (2022)

How about claims?

In addition to gross premiums, the research also estimates the relationship between macroeconomic variables and gross claims. We use the same macroeconomic variables as in the previous estimations, employing the OECD and ASEAN region approaches, as well as static and dynamic inter-temporal approaches. The static estimation results regarding the relationship between macroeconomic indicators and total gross claims show similar findings to the static results between macroeconomic indicators and total gross premiums, with one exception. The relationship between the real interest rate and gross claims shows a positive but insignificant association. This result indicates that the real interest rate does not influence the fluctuations in the gross claims (Table 8).

Table 8 The Static Estimation Results of Macroeconomic Indicators and Total Gross Insurance Claims at the Global Level

Independent Variables	Total Claim	Life Insurance	Non-life Insurance	Total Claim	Life Insurance	Non-life Insurance
lgdpriil	1.56***	1.03***	1.90***	1.63***	1.15***	1.96***
	(.37)	(.33)	(.47)	(.38)	(.33)	(.48)
lcpi	2.11***	3.32***	1.81***	2.24***	3.39***	1.99***
	(.47)	(.41)	(.6)	(.48)	(.42)	(.62)
ler	-1.18***	-1.36***	-1.17***	-1.25***	-1.44***	-1.27***
	(.25)	(.23)	(.33)	(.26)	(.23)	(.33)
linterest	0.04	0.03	0.03	0.04	0.02	0.03
	(.03)	(.03)	(.04)	(.04)	(.03)	(.05)
2.income	No	No	No	Yes	Yes	Yes
3.income	No	No	No	Yes	Yes	Yes
Constant	-39.04***	-31.19***	-47.32***	-41.09***	-34.71***	-49.59***
	(8.71)	(7.73)	(11.15)	(8.96)	(7.91)	(11.48)
Observations	259	258	256	259	258	256
R-squared	0.30	0.43	0.21	0.30	0.44	0.22
Number of cd	37	37	37	37	37	37

Note: Standard errors are in parentheses. *p<0.1, **p<0.05, and ***p<0.01. lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal, and cd = number of cross-sectional dependences to test. 2. income and 3. income are dummies for income level.

Source: IFG (2022)

Upon further examination based on the division of observation samples into OECD and ASEAN (proxied by non-OECD countries), the estimation results obtained for OECD countries, in general, are similar as far as coefficient signs and significance to the static estimation results for the gross premiums in Table 4. On the other hand, the results for the ASEAN segment show mixed and less conclusive results, especially with regard to the real interest rate. The relationship between real interest rate and gross claims exhibits mixed (positive and negative) coefficient signs and insignificant test statistics between OECD and

ASEAN. OECD's economies show positive and significant results, whereas ASEAN does not, even without using an income dummy. This result indicates that the significance obtained using the total observation sample in Table 8 is influenced by ASEAN's proxy (Table 9).

Table 9 The Static Estimation Results of Macroeconomic Indicators and Total Gross Insurance Claims between OECD and ASEAN

	OECD					
Independent Variables	**Total Claim**	**Life Insurance**	**Non-life Insurance**	**Total Claim**	**Life Insurance**	**Non-life Insurance**
lgdpriil	1.23***	1.33***	1.44***	1.24***	1.35***	1.42***
	(.3)	(.28)	(.43)	(.3)	(.28)	(.43)
lcpi	1.49***	2.12***	1.20**	1.49***	2.10***	1.22**
	(.41)	(.38)	(.59)	(.41)	(.38)	(.6)
ler	-1.10***	-1.26***	-1.08***	-1.10***	-1.26***	-1.08***
	(.16)	(.15)	(.23)	(.16)	(.15)	(.23)
linterest	0.04*	0.05***	0.01	0.04*	0.05***	0.01
	(.02)	(.02)	(.03)	(.02)	(.02)	(.03)
3.income	No	No	No	Yes	Yes	Yes
Constant	-27.05***	-33.09***	-32.09***	-27.10***	-33.52***	-31.77***
	(6.77)	(6.32)	(9.76)	(6.86)	(6.4)	(9.89)
Observations	154	154	152	154	154	152
R-squared	0.47	0.60	0.29	0.47	0.60	0.29
Number of cd	18	18	18	18	18	18

	ASEAN		
Independent Variables	Total Claim	Life Insurance	Non-life Insurance
lgdpriil	2.55***	2.93***	1.63**
	(.79)	(1.)	(.69)
lcpi	2.04**	1.89	3.31***
	(.98)	(1.23)	(.86)
ler	-1.10*	-1.17	-1.19**
	(.66)	(.82)	(.58)
linterest	0.00	0.03	-0.04
	(.1)	(.13)	(.09)
Constant	-64.91***	-74.64***	-48.51***
	(18.6)	(23.49)	(16.29)
Observations	105	104	104
R-squared	0.30	0.23	0.43
Number of cd	19	19	19

Note: Standard errors are in parentheses. *p<0.1, **p<0.05, dan ***p<0.01. lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal, and cd = number of cross-sectional dependences to test. 2. income and 3. income are dummies for income level. The top is the representation of Organisation for Economic Co-operation and Development (OECD), and the bottom is for ASEAN.

Source: IFG (2022)

Finally, we also conduct estimations using a dynamic approach to examine whether there are time effects or persistent impacts between macroeconomic variables and gross claims. The estimation results, overall, indicate that only the exchange rate for the total gross claims and the gross claims in the life insurance segment, as well as the lag-2 inflation indicator for gross claims in the non-life insurance segment, show some significance. This result suggests that gross claims cannot be comprehensively explained by macroeconomic variables. As expected, these findings also suggest that the gross claims are largely influenced by non-macroeconomic factors, such as health (such as pandemic), mortality rate, accident rate, climate, and others (Table 10).

Table 10 The Dynamic Estimation Results of Macroeconomic Indicators and Total Gross Insurance Claims at the Global Level

Independent Variables	Total Claim	Life Insurance	Non-life Insurance
lgdpriil	0.51	0.90	0.79
	(.88)	(.78)	(1.1)
lcpi	1.95	2.34	1.44
	(2.05)	(1.8)	(2.56)
ler	-0.83**	-0.10***	-0.74
	(.4)	(.35)	(.51)
linterest	0.02	-0.01	0.02
	(.05)	(.04)	(.06)
L.lgdpriil	-0.11	-0.93	-0.48
	(2.29)	(2.03)	(2.86)
L.lcpi	2.08	1.34	4.64
	(3.37)	(2.98)	(4.21)
L.ler	-0.54	-0.38	-0.52
	(.48)	(.43)	(.61)
L.linterest	0.00	0.00	-0.03
	(.05)	(.04)	(.06)
L2.lgdpriil	1.69	1.52	2.21
	(1.9)	(1.67)	(2.36)
L2.lcpi	-2.02	-0.55	-4.39*
	(2.08)	(1.84)	(2.59)
L2.ler	-0.01	-0.29	0.00
	(.38)	(.33)	(.47)
L2.linterest	0.01	0.02	0.00
	(.05)	(.04)	(.06)
2.income	0.27	0.39	0.28
	(.3)	(.27)	(.38)
3.income	0.00	0.16	-0.07
	(.26)	(.23)	(.32)
Constant	-52.12***	-41.80***	-62.77***
	(11.78)	(10.4)	(14.73)
Observations	204	203	201
R-squared	0.34	0.44	0.26
Number of cd	36	36	35

Note: Standard errors are in parentheses. *p < 0.1, **p < 0.05, and ***p < 0.01. L.= Lag 1 period, L2 = Lag 2 periods, lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal, and cd = number of cross-sectional dependences to test. 2. income and 3. income are dummies for income level.

Source: IFG (2022)

Diagnostics and Robustness Test

To ensure and test the stability and consistency of our models above, we also conduct diagnostics and robustness tests in this section. Starting with the selection of our static and dynamic models, between three models, which are Pooled Ordinary Least Square (POLS), Random Effect Model (RE), and FE, we use the Hausman test to see whether unique errors (ε_i) are correlated with the regressors. Our null hypothesis is that the unique errors are not correlated with the regressors. The test result is provided in Table 11.

From the result in Table 11, we can see that the standard errors are, in fact, correlated with the regressors with Prob. > Chi-square at 0.000 for both static and dynamic models. These results indicate that the standard errors correlate for static and dynamic models. Consequently, we cannot use RE and FE to overcome the correlated errors.

Additionally, to conduct further evaluation and ensure the fitness and performance of each model, we also check for other diagnostics: serial correlation and heteroskedasticity. These diagnostic results are summarized in Table 12 to compare their respective strengths and limitations.

In Table 12, the result for the static model indicates that the model has serial correlation and heteroskedasticity problems. In contrast, the result for the dynamic model indicates a serial correlation problem but no heteroskedasticity. To anticipate and remedy these drawbacks, we conduct the works of White (1980, 1984), Huber (1967), Arellano (1987), Froot (1989), and Rogers (1993) to relax the assumption of independently distributed residuals. Their generalized estimator produces consistent standard errors if the residuals are correlated within but uncorrelated between clusters. We adopt their approaches and set the panel identifier from the countries variable to obtain standard errors that are consistent with heteroskedasticity and autocorrelation.

Table 11 Serial Correlation & Homoskedasticity Test

	Observation	Null Hypothesis	F-Statistics	Prob>F	LR Statistics	Prob>Chi-square
Static Models:						
Wooldrige Test	269	No 1st-Order Correlation	66.01	0.00		
CS-TS FGLS Regression	269	Homoskedastic			238.40	0.00
Dynamic Models:						
Wooldrige Test	269	No 1st-Order Correlation	40.63	0.00		
CS-TS FGLS Regression	269	Homoskedastic			-226.15	1.00

Note: CS-TS FGLS = Cross-Section Time Series Feasible Generalized Least Squares

Source: IFG (2022)

Table 12 Hausman Test Result for Static and Dynamic Model

	Fixed Effect Model	Random Effect Model	Difference	Standard Error
Static Models:				
lgdpriil	0.89	1.21	-0.32	0.11
lcpi	1.51	0.27	1.24	0.13
ler	-1.01	-0.21	-0.8	0.08
linterest	0.02	0.03	-0.01	0.002
Chi-square	117.54			
Prob>Chi-square	0.0000			
Dynamic Models:				
lgdpriil	0.533	0.700	-0.167	0.097
lgdpriil(-1)	-0.776	-0.857	0.081	0.051
lgdpriil(-2)	1.051	1.356	-0.305	0.078
lcpi	0.928	0.318	0.610	0.095
lcpi(-1)	-1.093	-1.677	0.584	0.219
lcpi(-2)	1.657	1.497	0.160	0.221
ler	-0.918	-0.387	-0.531	0.063
ler(-1)	-0.012	-0.051	0.039	0.018
ler(-2)	-0.178	0.258	-0.436	0.052
linterest	0.009	0.017	-0.008	0.003
linterest(-1)	0.000	0.017	-0.016	0.002
linterest(-2)	-0.009	-0.003	-0.006	0.002
Chi-square	81.75			
Prob>Chi-square	0.0000			

Note: . lgdpriil = natural logarithm of GDP at constant 2015 USD prices, lcpi = natural logarithm of consumer price index, ler = natural logarithm of exchange rate, local currency unit/USD, and linterest = natural logarithm of interest rate in percentage. The interest rate is first converted to a decimal.

Source: IFG (2022)

Conclusions

The growth and strength of the insurance sector are crucial for a country. A robust insurance sector can absorb and mitigate unexpected risks that may arise from various sources. Individuals, corporations, and even government offices lacking the ability to bear such risks can transfer a portion of their risks to the insurance sector. Thus, it can safeguard economic agents from bankruptcy and systemic risks leading to loss, recessions, or crises. In this study, we examine the relationship between key macroeconomic variables and the insurance sector. We consider four macroeconomic indicators (GDP, inflation, exchange rate, and interest rate) as independent variables and gross premiums and claims as dependent variables.

The estimation results using FE panel data indicate that macroeconomic variables play a significant role in determining the performance of the gross premiums and claims. The relationships between these variables vary, both in static and dynamic approaches. Real GDP generally exhibits a positive and significant relationship with gross premiums. It also happens in inflation and real interest rates. On the other hand, the exchange rate shows a negative relationship, suggesting that a depreciated exchange rate can decrease public spending on

insurance products. Overall, the relationship between gross premiums and macroeconomic variables does not differ significantly between the OECD and ASEAN samples, except for the real interest rate. Consumers in OECD countries with superior financial literacy and higher wealth seem to be able to make the necessary adjustments to the impact of the real interest rates on their insurance portfolios. In contrast, there is no response on the insurance policy decision to movements in real interest rate for the case of the ASEAN. In terms of time response, only two variables, real GDP and inflation, exhibit lasting impacts on gross premiums.

Regarding static gross claims results (without lag variables), the static estimation results are generally similar to the static result of gross premiums (Table 4 and 9), except for the impact of real interest rate on gross claims. In dynamic estimations, macroeconomic variables cannot effectively explain the movements in claims.

The results of our analysis underscore the importance of market players in the insurance sector establishing robust and comprehensive risk management systems to navigate macroeconomic turbulence effectively. Given the significant impact of macroeconomic variables on the performance of gross premiums and claims, it is crucial for insurers to monitor and analyze these indicators closely. By doing so, insurers can proactively respond to changes in the macroeconomic environment, thereby mitigating potential risks and capitalizing on emerging opportunities. Surveillance and monitoring of macroeconomic indicators become particularly critical in a sector like insurance that is highly influenced by macroeconomic conditions. Insurance companies should continuously assess and update risk management strategies to align with changing macroeconomic dynamics. It includes developing mechanisms to anticipate and mitigate the impact of fluctuations in GDP, inflation, exchange rates, and interest rates on the insurance market.

Furthermore, market players should focus on enhancing their capacities in analyzing and interpreting macroeconomic data to make informed decisions. It can involve strengthening their analytical capabilities, leveraging advanced technology and data analytics, and fostering collaborations with research institutions and experts in macroeconomics. By adopting a proactive approach and integrating robust risk management systems with ongoing monitoring of macroeconomic indicators, insurers can better position themselves to navigate periods of economic uncertainty and volatility. It is particularly relevant in light of recent global shocks, such as the COVID-19 pandemic and geopolitical conflicts, which have demonstrated the need for insurance companies to be resilient and responsive in the face of evolving macroeconomic conditions.

For future works, non-macroeconomic factors such as health, climate, and others have to be considered to understand the fluctuations behind the insurance gross claims. Those non-macroeconomic factors have their unique relationship to gross claims, whether its persistency, lag, magnitude, and scale. Dissecting the relationship for each factor will be important in modelling the gross claims.

In conclusion, our findings emphasize the importance of market players in the insurance sector maintaining strong and comprehensive risk management systems to address

macroeconomic turbulence effectively. By closely monitoring macroeconomic indicators and continuously updating their strategies, insurers can enhance their ability to withstand market fluctuations and capitalize on growth opportunities. This proactive approach is vital for ensuring the long-term stability and growth of the insurance sector amidst global uncertainties.

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References

Abhijit, M., & Amlan, G. (2022). Role of economic factors in property liability insurance consumption: Empirically examining the Indian market. *Studies in Business and Economics, 17*(1), 112–129. https://doi.org/10.2478/sbe-2022-0008

Arellano, M. (1987). Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics, 49*(4), 431–434. https://doi.org/10.1111/j.1468-0084.1987.mp49004006.x

Baluch, F., Mutenga, S., & Parsons, C. (2011). Insurance, systemic risk, and the financial crisis. *The Geneva Papers on Risk and Insurance-Issues and Practice, 36*, 126–163. https://doi.org/10.1057/gpp.2010.40

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

Beenstock, M., Dickinson, G., & Khajuria, S. (1988). The relationship between property-liability insurance premiums and income: An international analysis. *The Journal of Risk and Insurance, 55*(2), 259–272. https://doi.org/10.2307/253327

Browne, M., & Kim, K. (1993). An international analysis of life insurance demand. *The Journal of Risk and Insurance, 60*(4), 616–634. https://doi.org/10.2307/253382

Browne, M. J., Chung, J. W., & Frees, E.W. (2000). International property-liability insurance consumption. *The Journal of Risk and Insurance*, 67(1), 73–90. https://doi.org/10.2307/253677

Campbell, R. A. (1980). The demand for life insurance: An application of the economics of uncertainty. *The Journal of Finance, 35*(5), 1155–1172. https://doi.org/10.1111/j.1540-6261.1980.tb02201.x

Colquitt, L. L., & Hoyt, R. E. (1997). Determinants of corporate hedging behavior: Evidence from the life insurance industry. *The Journal of Risk and Insurance, 64*(4), 649–671. https://doi.org/10.2307/253890

Cummins, J. D., Lewis, C. M., & Phillips, R. D. (1999). Pricing excess-of-loss reinsurance contracts against cat as trophic loss. In K. A. Froot (Ed.), *The financing of catastrophe risk* (pp. 93–148). University of Chicago Press.

Cummins, J. D., & Weiss, M. A. (2014). Systemic risk and the U.S. insurance sector. *Journal of Risk and Insurance, 81*(3), 489–528. https://doi.org/10.1111/jori.12039

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

Dragos, S. L., Mare, C., Dragota, I. M., Dragos, C. M., & Muresan, G. M. (2017). The nexus between the demand for life insurance and institutional factors in Europe: New

evidence from a panel data approach. *Economic Research-Ekonomska Istraživanja, 30*(1), 1477–1496. https://doi.org/10.1080/1331677x.2017.1325764

Dragoş, S. L., Mare, C. & Dragoş, C. M. (2019). Institutional drivers of life insurance consumption: A dynamic panel approach for European countries. *The Geneva Papers on Risk and Insurance - Issues and Practice, 44*, 36–66. https://doi.org/10.1057/s41288-018-0106-3

Dragotă, I. M., Cepoi, C. O., & Ştefan, L. (2023). Threshold effect for the life insurance industry: Evidence from OECD countries. *The Geneva Papers on Risk and Insurance - Issues and Practice*, 48, 799–820. https://doi.org/10.1057/s41288-022-00272-8

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

Feyen, E., Lester, R., & Rocha, R. (2011, February). *What drives the development of the insurance sector? An empirical analysis based on a panel of developed and developing countries*. The World Bank. https://openknowledge.worldbank.org/bitstream/handle/10986/3339/WPS5572.pdf?sequence=4&isAllowed=y

Fortune, P. (1973). A theory of optimal life insurance: Development and test. *The Journal of Finance, 28*(3), 587–600. https://doi.org/10.2307/2978631

Froot, K. A. (1989). Consistent covariance matrix estimation with cross-sectional dependence and heteroskedasticity in financial data. *The Journal of Financial and Quantitative Analysis, 24*(3), 333–355. https://doi.org/10.2307/2330815

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

Hosseinzadeh, M., & Daei-Karimzadeh, S. (2017). Investigate the effect of exchange rate volatility on demand for life insurance in Iran. *International Journal of Economics and Financial Issues, 7*(2), 166–174.

Huber, P. J. (1967). The behavior of maximum likelihood estimates under nonstandard conditions. *In Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability* (pp. 221–233).

IFG. (2022). *Nexus antara variabel makroekonomi terhadap premium dan klaim industri asuransi - Perbandingan antar negara.* Unpublished manuscript.

Kjosevski, J. (2012). The determinants of life insurance demand in Central and Southeastern Europe. *International Journal of Economics and Finance, 4*(3), 237–247. https://doi.org/10.5539/ijef.v4n3p237

Lewis, F. D. (1989). Dependents and the demand for life insurance. *The American Economic Review*, *79*(3), 452–467.

Li, D., Moshirian, F., Nguyen, P., & Wee, T. (2007). The demand for life insurance in OECD countries. *Journal of Risk and Insurance, 74*(3), 637–652. https://doi.org/10.1111/j.1539-6975.2007.00228.x

Li, D., Moshirian, F., Wee, T., & Wu, E. (2009). Foreign exchange exposure: Evidence from the U.S. insurance industry. *Journal of International Financial Markets, Institutions and Money, 19*(2), 306–320. https://doi.org/10.1016/j.intfin.2008.01.003

McKinsey & Company. (2022, February 15*). Creating value, finding focus: Global insurance report 2022*. https://www.mckinsey.com/industries/financial-services/our-insights/creating-value-finding-focus-global-insurance-report-2022

Menegatti, M., & Rebessi, F. (2011). On the substitution between saving and prevention. *Mathematical Social Sciences, 62*(3), 176–182. https://doi.org/10.1016/j.mathsocsci.2011.09.002

Millo, G., & Carmeci, G. (2010). Non-life insurance consumption in Italy: A sub-regional panel data analysis. *Journal of Geographical Systems, 13*, 273–298. https://doi.org/10.1007/s10109-010-0125-5

OECD. (2023, May 31). *OECD insurance statistics 2022*. OECD iLibrary. https://doi.org/10.1787/0512c106-en

Olarewaju, O., & Msomi, T. (2021). Determinants of insurance penetration in West African countries: A panel Auto Regressive Distributed Lag Approach. *Journal of Risk and Financial Management, 14*(8), 1–15. https://doi.org/10.3390/jrfm14080350

Olasehinde-Williams, G., & Balcilar, M. (2020). Examining the effect of globalization on insurance activities in large emerging market economies. *Research in International Business and Finance, 53*. https://doi.org/10.1016/j.ribaf.2020.101228

Otoritas Jasa Keuangan. (2021, November 19). *Statistik perasuransian 2020*. https://ojk.go.id/id/kanal/iknb/data-dan-statistik/asuransi/Pages/Statistik-Perasuransian-2020.aspx

Outreville, J. F. (1996). Life insurance markets in developing countries. *The Journal of Risk and Insurance, 63*(2), 263–278. https://doi.org/10.2307/253745

Park, S., & Lemaire, J. (2011). Culture matters: Long-term orientation and the demand for life insurance. *Asia-Pacific Journal of Risk and Insurance, 5*(2). https://doi.org/10.2202/2153-3792.1105

Redzuan, H., Rahman, Z. A., Sakinah, S., & Adid, S. H. (2009). Economic determinants of family takaful consumption: Evidence from Malaysia. *International Review of Business Research Papers*, *5*(5), 193–211.

Rogers, W. H. (1993). Regression standard errors in clustered samples. *Stata Technical Bulletin 13*, 19–23.

Savvides, S. (2006). Inquiry into the macroeconomic and household motives to demand life insurance: Review and empirical evidence from Cyprus. *Journal of Business & Society*, *19*(1/2), 37–79.

Segodi, M. P., & Sibindi, A. B. (2022). Determinants of life insurance demand: Empirical evidence from BRICS countries. *Risks, 10*(4), 1–14. https://doi.org/10.3390/risks10040073

Sen, S., & Madheswaran, S. (2013). Regional determinants of life insurance consumption: Evidence from selected Asian economies. *Asian-Pacific Economic Literature, 27*(2), 86–103. https://doi.org/10.1111/apel.12024

Sherden, W. A. (1984). An analysis of the determinants of the demand for automobile insurance. *The Journal of Risk and Insurance, 51*(1), 49–62. https://doi.org/10.2307/252800

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

Singhal, N., Goyal, S., & Singhal, T. (2020). Insurance–growth nexus: Empirical evidence from emerging Asian markets. *Transnational Corporations Review, 12*(3), 237–249. https://doi.org/10.1080/19186444.2020.1756170

Siregar, R. Y., Rohman, I. K., & Luviyanto, A. N. (2023, January 16). *Hubungan perbankan dan asuransi: Fenomena struktural atau temporal?* Indonesia Financial Group. https://ifgprogress.id/wp-content/uploads/2023/01/Econ.-Bulletin-Issue-23-Hubungan-Perbankan-dan-Asuransi-January-2023-1.pdf

Tian, L., Jiang, S. J., Pan, G., & Zhang, N. (2018). Non-life insurance price dynamics: evidence from the Chinese insurance market. *Economic Research-Ekonomska Istraživanja*, *31*(1), 171–187. https://doi.org/10.1080/1331677x.2018.1424557

Treerattanapun, A. (2011). *The impact of culture on non-life insurance consumption*. Wharton Research Scholars Project, University of Pennsylvania.

Trinh, T., Nguyen, X., & Sgro, P. (2016). Determinants of non-life insurance expenditure in developed and developing countries: An empirical investigation. *Applied Economics*, *48*(58), 5639–5653. https://doi.org/10.1080/00036846.2016.1181834

Truett, D. B., & Truett, L. J. (1990). The demand for life insurance in Mexico and the United States: A Comparative Study. *The Journal of Risk and Insurance, 57*(2), 321–328. https://doi.org/10.2307/253306

Valckx, N., Chan-Lau, J. A., Feng, A., Huston, B., Impavido, G., Jobst, A. A., ... & Yan, K. (2016). The insurance sector-trends and systemic risk implications. In *Global Financial Stability Report*. International Monetary Fund.

Ward, D., & Zurbruegg, R. (2002). Law, politics and life insurance consumption in Asia. *The Geneva Papers on Risk and Insurance - Issues and Practice, 27*, 395–412. https://doi.org/10.1111/1468-0440.00181

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica 48*, 817–838. https://doi.org/10.2307/1912934

White, H. (1984). *Asymptotic theory for econometricians*. Academic Press.

World Bank. (2023, December 20). *World development indicators*. https://doi.org/10.57966/6rwy-0b07

Zarnowitz, V. (1992). *Business cycles: Theory, history, indicators, and forecasting*. University of Chicago Press. https://doi.org/10.7208/chicago/9780226978925.001.0001

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