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The practice of "Solvency-II" for pension fund and non-life insurance sustainability business towards government debt

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ABSTRACT

This research was conducted to find out how insurance companies with business sustainability insure government-run pension funds, which are vulnerable to the risk of default. The research focuses on the 18 OECD countries in the period 2011 to 2022 with the Path Analysis approach. The data are retrieved from World Bank Data and OECD website database; furthermore, the data quality is guaranteed. Although this study is conducted at the end of 2024, the research data for 2023 was incomplete, so it did not fulfil the balanced panel requirement. Hypothesis testing results show that pension funds affect non-life premiums. Then pension funds have a significant effect on both government debt and non-life insurance undertakings. Furthermore, pension funds affect government debt through non-life premiums. Similarly, pension funds affect non-life undertakings through non-life premiums. If the loss value is too large, the insurance company, jointly with other insurance companies, will share the risk of compensation. This collection of insurance companies is called the Insurance Undertaking. With Solvency-II, we will be able to bridge between non-life insurance companies and the government in risk prevention. Therefore, non-life insurance companies everywhere should strictly implement risk mitigation guidelines in accordance with the provisions in their respective countries.

Contribution/Originality: Despite its importance, people rarely use Solvency-II as an observation variable. Furthermore, Solvency-II will be able to help insurance companies and the government in the overall risk prevention of pension funds. It's a matter of risk, which could happen anytime; nevertheless, risk guidance becomes important.

1. INTRODUCTION

The World Bank's website indicates that by 2050, the percentage of the global population that is 65 years old and above is expected to rise from 10% to 20%. This translates to nearly 1.3 billion individuals, with 80% residing in low-income nations. Unfortunately, only about one-third of people in these countries receive a formal retirement income. Pension schemes are essential for ensuring financial support in cases of aging, work-related disabilities, and early death of primary earners.

Pension funds contribute to encouraging long-term savings and, in turn, stimulating economic growth. Banks or non-bank financial institutions count savings deposited with them as non-tax revenue. Pension systems are also an increasingly important source of sustainable finance and a leader in greening our financial system.

A study by Jiang et al. (2022) underscores the significant impact of institutional investors as stakeholders, who exert pressure on companies to implement sustainable practices and align their operations with environmental objectives. Similarly, research conducted by Rempel and Gupta (2020) focuses on how these investors engage with companies, working collaboratively to enhance sustainability initiatives and promote positive transformation.

When examining insurance companies, it is important to recognize that the insurance industry is a crucial and deeply interlinked component of the financial system, which itself is connected to both the production system and the Earth's ecosystems, particularly within the context of the Anthropocene. Because of this, the idea of sustainability has spread in different ways throughout the insurance industry. This shows how important it is for insurance companies to look at the risks and opportunities that come with sustainability from both their asset and liability sides. Non-life insurance for catastrophic events can be vital in mitigating the effects of climate change, disasters, and other potential risks.

The idea of pensions has continuously developed, influencing both societal structures and the financial as well as non-financial aspects of well-being. Over time, pension entitlements have shifted from being a topic of political debate to one framed within the context of human rights. Pension systems have extended their coverage, offering protection beyond the workforce and throughout different stages of life, thus catering to the wider needs of the general public. Additionally, pensions are acknowledged as key contributors to economic development by enhancing labor efficiency, promoting consistent consumption patterns, and fostering a secure economic climate for investments and innovation. In today's landscape, pension plans are expected to implement both proactive and adaptive strategies to evaluate ways to reduce or adjust potential outcomes in response to unforeseen events.

Pension funds and insurance firms hold significant potential to become key actors in directing investments toward sustainable initiatives. Due to their long-term investment outlooks and fiduciary duties, these financial entities are well-suited to support sustainable development objectives (Boermans, 2023). As awareness of the interconnected risks posed by climate change and environmental damage grows, pension funds and insurance companies are increasingly acknowledging the value of integrating sustainability factors into their investment approaches.

Sun and Hu (2014) revealed that pension funds have a notable influence on the financial development of less-developed nations. An increase of 1% in pension fund assets can enhance corporate governance, improve information transparency, and boost transaction efficiency. In a similar vein, Mazreku, Morina, and Curraj (2020) discovered that the increase in gross domestic product, return on investment, pension contributions, and net asset investments had a positive impact on the performance of pension funds in Kosovo, Albania, and North Macedonia. Nevertheless, they noted that fluctuations in the exchange rate did not influence the performance of these pension funds.

Political risk arises when, for example, a troubled insurer puts pressure on politicians to reduce contributions or obtain temporary relief (Romaniuk, 2021). Nevertheless, Romaniuk (2021) study only focuses primarily on the US context.

While this provides a detailed analysis for one system, it limits the generalizability of findings to other countries with different pension insurance schemes. Non-life insurance is a method of "risk aversion" and "indemnity" for retirees because most retirees have other assets in the form of stocks, savings, and deposits, which are vulnerable to risk. Old research from Bodie (1989) outlines in full the main sources of retirement income risk that employees want to insure against to avoid risk are:

a) Inadequacy of replacement level-This refers to the risk that a retiree may lack sufficient income to sustain the same quality of life after retirement as they did before.

b) Longevity-This is the risk that a retiree may outlive their retirement savings. Additionally, there is a risk that Social Security benefits could be reduced before the individual reaches' their retirement age.

c) Social Security Deductions-This refers to the risk that Social Security benefits may be reduced before an individual attains retirement age.

d) Investment Risk-This refers to the chance that the retirement savings may fall short due to the poor performance of the invested assets.

e) Inflation Risk-This is the risk that inflation will diminish the purchasing power of retirement savings over time.

Global pension schemes function within a heavily regulated framework. The intricate effects of regulations and reforms have had significant consequences on major pension plans.

Governance and risk-related issues confront pension funds, requiring them to focus more on reporting investment risks. In response to the economic downturn between 2008 and 2011, pension plans are reshaping their business and operational strategies. Defined contribution plans, in particular, are under pressure from participants to provide transparent, real-time access to information about their investments and retirement benefits while minimizing costs.

Pension funds encounter difficulties in member participation, particularly given that saving for retirement tends to be a lower priority for younger generations. It is widely recognized that engagement in retirement savings within a pension plan typically increases only as individuals approach retirement age.

In relation to government debt, the pension products of employees of state-owned companies are covered by state-owned insurance companies. Therefore, there is synchronisation between pension funds, non-life insurance premiums, and government debt. In a general analysis, non-life insurance companies are state-owned, underwrite coverage, and invest in state-owned securities. The government certainly has shares or capital in these insurance companies. However, if the insurance company proves to be in default, it will affect the government debt and pension customers of state-owned companies.

Christensen, Parra-Alvarez, and Serrano (2021) discuss how insurance companies optimally select strategies for dividend distribution, investments in both secure and risky financial assets, and reinsurance arrangements, which have been extensively analyzed using stochastic control methods, as noted by Schmidli (2007). Additionally, companies can adjust premiums as a control variable. If you are looking for non-life insurance, this is usually found by multiplying the arrival rate by the expected claim size and adding a safety loading based on expected value, standard deviation, or variance.

As an alternative to these traditional premium strategies, Christensen et al. (2021) view the premium as a direct control, optimally selected to achieve a balance between the resulting portfolio size and average profit per client. Analyzing individual customers' decisions about whether to insure at a specific premium highlights the relationship between portfolio size and premium levels.

Davis, Stewart, and Knaack (2021) explained that government debt can have a negative impact on pension funds, especially in the context of financial repression. Low interest rates and government debt can reduce investment returns, making it difficult for pension funds to achieve their long-term goals. Pension funds can play an important role in national development by investing in sustainable and social impact projects. However, this must be done with careful governance to avoid depleting pension savings and ensure that investments contribute to long-term economic growth.

An ambitious initiative that began over ten years ago has been launched to align the regulatory framework within the European Union (EU) insurance sector, referred to as Solvency-II. The guidelines apply to all insurance players operating in the EU insurance market as well as insurance companies in other parts of the world that have cooperation or business with European-based insurance companies. The European Parliament and the Council have specified the legal framework in Directive 2009/138/EC.

Solvency-II is the regulatory framework that applies to all EU-authorized insurance and reinsurance undertakings. The framework sets out capital requirements, governance, risk management, and reporting standards

aimed at protecting policyholders and reducing the risk of insurer failure. The framework is risk-based, allowing both quantitative and qualitative assessments of an insurer's solvency.

Following the introduction of Solvency-II, new risk management strategies, including innovative reinsurance frameworks, have emerged in the European market, while some established methods have become more significant. So, the Opinion talks about how to use these risk-reduction strategies and gives national competent authorities (NCAs) a list of suggestions on how to make sure that everyone is supervised the same way.

This research was conducted to find out how insurance companies with business sustainability insure government-run pension funds, which are vulnerable to the risk of default. In addition, non-life insurance insures the pension fund risk, which is the part of government debt. The path analysis regression approach is used in this research. Solvency-II is also discussed in the research of Peleckienė and Peleckis (2014) which concluded that Solvency-II generally requires lower capital compared to Solvency-I as an insurance business sustainability measure, with no additional capital required for the European insurance industry. Research from D'Amato, Di Lorenzo, Piscopo, Sibillo, and Trotta (2024) explains climate change and the environment on the sustainability of insurance performance. Many other studies identify sustainability associated with financial performance (Bagh, Zhou, Alawi, & Azam, 2024).

In 2022, Florida-based property insurer FedNat Insurance Company was ordered into liquidation after being deemed insolvent. The primary cause of this bankruptcy was a lack of capital to cover claims and continue operations. FedNat had been struggling financially for years, largely due to significant losses from natural disasters like hurricanes. The company attempted to improve its financial position by canceling policies and raising rates, but these efforts were insufficient. In May 2022, FedNat's financial rating was downgraded, indicating increased risk. By November 2022, Florida regulators determined FedNat was insolvent and ordered it into liquidation. At the time of bankruptcy, FedNat had approximately 140,000 policies in force (CBS News, 2022).

Asimit, Badescu, Haberman, and Kim (2016) describe insurance groups (IGs) as consisting of several legal entities, known as Insurance Undertakings (IUs), which may function under various regulatory frameworks. Diversification among IGs serves as a risk management strategy, often employed to mitigate risk exposures and, as a result, lower the capital requirements within the organization. The risk exposures of individual entities typically do not exhibit perfect positive correlation, leading to some level of diversification at the group level (Keller, 2007). However, assets and liabilities are not aggregated across entities due to restrictions on cross-subsidization, particularly when different regulatory standards apply to different IUs, as well as the varying capital capabilities within the group.

The research conducted by Gatzert, Schmeiser, and Toplek (2011) examines how group diversification influences shareholder value, taking into account various group structures as well as capital and risk transfer mechanisms, while also providing a comprehensive literature review on diversification within the financial sector. Similarly, Schlütter and Gründl (2012) evaluate how group formation affects policyholder welfare. Their research is based on the idea that a certain fair risk-sharing arrangement is in place, in which the group sets premium and equity goals to increase shareholder value while taking into account how default risk affects the demand for insurance from various groups.

The study was conducted on the OECD group of countries for the period 2011 to 2022, as the data for 2023 to 2024 is not fully available. OECD countries were chosen because they consist of developed countries that have an average gross national income (GNI) of $27.53 T. The data retrieved from the World Bank Data and OECD website database. Furthermore, the data quality is guaranteed.

To support the evidence of the novelty of the research, we present previous studies in Table 1.

Table 1. Existing research.

No.	Researcher name and year	Research title	Research variables	Research results
1.	D'Amato et al. (2024)	Insurance business and social sustainability: A proposal	• Insurance premiums and benefits • Pandemic risk • Economic and social impact	Bonds can be an effective tool to manage pandemic risks and invest sustainably. This article highlights the importance of integrating ESG factors into investment decisions and developing innovative sustainable business models.
2.	Romaniuk (2021)	Pension insurance schemes and moral hazard: The pension benefit guaranty corporation should restrict the insured pension plans' portfolio policy	• Defined benefit pension plans • Pension insurance schemes • Moral Hazard • Portfolio risk	This paper concludes that imposing portfolio restrictions is necessary to address the moral hazard issues associated with pension insurance schemes. These restrictions should be specifically applied to financially distressed companies with underfunded pension plans.
3.	Bodie (1989)	Pensions as retirement income insurance	• Types of pension plans • Retirement income risks • Plan design and funding • Employer's role	This paper concludes that employer-sponsored pension plans are best understood as a form of retirement income insurance. This perspective helps explain the existence, design, and funding of such programmes. The author suggests that the various pension plan designs that exist today may be economically efficient, with defined benefit (DB) plans providing low-cost standard retirement income insurance and defined contribution (DC) plans offering flexibility.
4.	Peleckienė and Peleckis (2014)	Solvency-II assumptions for increasing the international competitiveness of the EU insurance industry	• Technical provisions • Solvency capital requirement • Minimum capital requirement • Risk models	The implementation of Solvency-II will require an integrated risk management system and stronger liquidity management to ensure effective governance and competitiveness in the insurance sector.

From the chart above, the structure models in this study differ from existing research. Therefore, the variables used and the relationship between variables in this study are a novelty. Furthermore, previous researchers have not extensively discussed the variable relationships used in this study.

Why is this important to research? Because it is to better introduce risk mitigation guidelines experienced by insurance companies and governments. Insurance companies and governments are not immune to risk; therefore, by discussing this theme, they will be able to convey to stakeholders that risk is real and cannot be predicted.

The paper organizes the remaining sections as follows. Section B overviews the Literature and Hypothesis Development. Section C describes the methodology, sample and data. Section D presents the research results. Section E describes Research Discussion, and Section F presents Conclusion and Limitations.

2. LITERATURE REVIEW/ HYPOTHESIS DEVELOPMENT

2.1. Pension Funds, Non-Life Insurance Premiums, and Government Debt

In the wake of the 2008 financial crisis, various quantitative risk assessment techniques have been introduced to model and manage the volatility of pension fund investment portfolios. Otranto and Trudda (2008) suggested a statistical approach to categorize pension funds into distinct risk classifications. However, their study focuses primarily on volatility as a measure of risk, ignoring other important risk factors, such as liquidity risk, credit risk, or market risk. A more comprehensive risk assessment would provide a more accurate classification of pension funds. Bianchi and Trudda (2009) analyzed the investment risk of pension funds, and they provided techniques to rebalance pension fund portfolios based on risk levels. Their research focuses on controlling short-term volatility rather than long-term pension fund solvency, which may be more relevant for pension funds. Also, the study is based specifically on Italian pension fund regulations, potentially limiting its applicability to other regulatory environments.

Impavido and Tower (2009) examine the key factors that contributed to the vulnerability of pension funds and insurance companies during the 2008 global financial crisis. They also explore how institutional investors transmit shocks to other financial sectors and the broader economy. However, their research lacks input from industry stakeholders, regulators, or policymakers, who could offer important perspectives.

Berstein and Chumacero (2006) assess the impact of value-at-risk limitations and quantitative restrictions on portfolio selection within the framework of risk-based supervision for defined benefit pension funds. Additionally, their research focuses solely on four general asset categories: domestic fixed income, domestic equities, foreign fixed income, and foreign equities. This simplification may not fully capture the complexity and diversity of investment options available with pension funds. Likewise, it primarily focuses on financial metrics and does not consider other potential benefits of investment limits, such as risk mitigation or social objectives.

Previous studies have demonstrated that public debt and risk transfers can significantly enhance risk sharing when individuals encounter uninsurable risks (Varian, 1980; Woodford, 1990). Nonetheless, Aiyagari and McGrattan (1998) found that the welfare implications resulting from changes in debt are minimal. They primarily attribute this to their selection of utilitarian welfare criteria and the specific level of transfers they considered.

Novy-Marx and Rauh (2009) identified the funding status of at-risk pension plans in the United States. They suggest that pension plans in the United States face much larger underfunding than reported and significant investment risks that are not adequately disclosed under current rules. They called for reforms to improve transparency and risk management of public pension systems. We reckon that the research mentioned above has not explored in depth the relationship between pension funds and government debt.

There is a relationship between pension funds, non-life insurance premiums, and government debt. Pension funds budgeted by the government will be affected if there is a risk experienced by banks as financial providers or from the government itself, which is not immune to risk. If the government debt is at risk, the pension fund will be delayed in receiving it, and the non-life insurance company will try to settle the compensation.

Hypothesis H_1: Pension funds have a positive effect on non-life premiums.

Hypothesis H_2: Pension funds have a positive effect on government debt.

Hypothesis H_3: Non-Life Premiums have a positive effect on government debt.

2.2. Pension Funds, Non-Life Insurance Premiums, and Non-Life Insurance Undertaking

In recent decades, there has been a significant increase in the focus on issues highlighted by financial literature, as well as by companies, regulatory bodies, and other corporate stakeholders.

Botosan (1997) examined the disclosure practices of non-financial firms, focusing on their determinants and consequences, yet this study emphasized the quantity of disclosure rather than its quality. Other research has

concentrated on the banking sector (e.g., (Baumann & Nier, 2005; Linsley & Shrives, 2006)), while a limited number of studies have started to explore the insurance industry (Klumpes, Kumar, & Dubey, 2014).

Alongside the growing academic interest in disclosure, particularly in recent years, companies have begun to acknowledge the importance of enhancing their disclosure practices to meet investors' and financial markets' demand for transparency.

Furthermore, various regulatory efforts have aimed to improve both the quantity and quality of disclosures made by financial intermediaries and insurance firms. For instance, the forthcoming Solvency-II Directive for the European insurance sector mandates that insurance companies publicly share financial information through reports directed at both regulators and the public.

Lastly, the recent upheaval in global financial markets, especially since 2008, has highlighted the need for improved communication with the broader financial community.

Solvency-II established new standardized regulations throughout the European Union, replacing 14 previously existing insurance directives. The primary goals of Solvency-II include.

- Enhancing regulation and fostering greater integration within the EU insurance market.
- Safeguarding policyholders while boosting the competitiveness of EU insurance providers.

Consequently, the primary aim of the new Solvency-II framework is to guarantee the financial stability of insurance companies and to sustain their operations during challenging periods while also protecting policyholders and preserving the overall stability of the financial system. The focus of 2011 was on adopting the necessary implementation measures.

Although the deadline for incorporating the Solvency-II Directive into the national laws of member states was established at the end of October 2012, it was later postponed due to the Omnibus II Directive, which will determine a final deadline. Thus, before Solvency-II can take effect, a set of measures addressing insurers that provide products with long-term guarantees must be integrated into this framework.

The insurance business attracts a lot of attention because it is profitable. Pension fund premiums paid to insurance companies are recorded as income.

This income is partly invested or is undetermined income. You can imagine how much premium an insurance company earns on pension fund coverage in a calendar year. This factor has led to many insurance companies being filed for legality. Thus, Solvency-II needs to be strictly enforced to prevent new, incompetent insurance companies from underwriting pension funds. By continuously adopting the applicable regulations, maintaining premium income, and good corporate governance, we will realize business sustainability in insurance companies. Research in Indonesia published by the Samosir et al. (2020) specifically states that individuals who invest in the stock market have a negative relationship with pension fund ownership, indicating that individuals prefer stock investment instruments over investing in pension funds.

Hypothesis H_4: Pension fund have a positive effect on non-life insurance undertaking.

Hypothesis H_5: Non-life premiums have a positive effect on non-life insurance undertaking.

Hypothesis H_6: Pension funds have a positive effect on government debt through premium of non-life insurance.

Hypothesis H_7: Pension fund has a positive effect on insurance undertaking through premium of non-life insurance.

3. METHODOLOGY, DATA, AND SAMPLING

3.1. Data and Sampling

Table 2 explains population, data, and samples. Data were obtained from the World Bank and OECD website databases. CPI, and government debt variables were obtained from the World Bank web access, while non-life insurance undertaking and non-life insurance premium were obtained from the OECD website database. The time span of the data used is 2011-2022. This is because the data in 2023 and 2024 are not yet available in full.

Table 2. Data and sampling.

Data	Criteria
Population	38 OECD countries
Those that do not fulfil the balanced panel	-20 countries
Sample of OECD countries used in the study	18 countries The sample fulfills the balanced panel criteria. Balanced panel is chosen because the data is complete for each cross-section year sequence. Sample collection technique using purposive sampling, with criteria: High income countries that are members of the OECD

3.2. Research Methods

The research method uses path analysis regression estimation technique. The number of OECD countries used as samples is 18 countries that have met the Balanced Panel criteria. In his book Basic Econometric, Gujarati and Porter (2009) explain that path analysis is an extension of multiple regression that allows more complex relationships between variables. Before the data is processed in this study, the Chow Test, Hausmann Test, and Lagrange Multiplier are tested to obtain the appropriate regression model, whether the Fixed Effect Model, Random Effect Model, or Common Effect Model. By getting the right regression model, data processing becomes accurate. At the end of the data processing, the mediation test was conducted.

Because there is a mediating variable in the structure of our research model, the appropriate statistical analysis technique is to use path analysis. The path analysis uses a system of regression equations to model relationships between variables. Here are the key equations involved in path analysis regression.

Basic Equation:

$$Y = \beta X + \varepsilon$$

Where:

Y is the dependent (Endogenous) variable.

X is the independent (Exogenous) variable.

β is the path coefficient and ε is the error term.

4. RESEARCH RESULTS

4.1. Descriptive Analysis

Table 3 shows the descriptive statistical analysis. The government debt variable with a value of min 11.135% of Gross Domestic Products (GDP) in Chile in 2011. Chile's fiscal policy has been in place for decades, resulting in positive budget balances in 14 of the 21 years prior to 2011. This allowed the government to accumulate assets and issue relatively small amounts of debt (Schmidt-Hebbel, 2012). Max value Government Debt in Italy in 2020. This is due to global economic uncertainty in 2020 (European Commission, 2019).

Table 3. Descriptive analysis.

Stat/Variable	Government debt. (% of GDP)	Pension fund (Investment) (Assets share of GDP)	Non-life premium (Million US$)	Non-life insurance undertaking (Unit)
Min.	11.133	0.200	452,4840	394.0000
Max.	150.848	192.300	3,501,194.0	3,198.00
Mean	63.377	36.144	127,350.4	76.74700
Std. dev	35.764	44.441	419,029.7	77.85092

The pension variable has a min value of 0.200 (assets share of GDP) in France in 2011. This is because the pension system in France is mainly based on a pay-as-you-go model, rather than a funded pension scheme. The max

value for the funded pension variable is Denmark in 2022. The reason for the high value is that Denmark has one of the most advanced pension systems in the world. The Danish pensions system combines tax-financed public pensions (defined benefit in payment) with funded and defined contribution labour market pensions (OECD, 2018, 2023).

While the min value of non-life premium variable comes from Latvia in 2011 at 452.484 million US$, because Latvia is still recovering from the 2008-2009 global financial crisis, which had a significant impact on its economy. This economic recovery phase is likely to affect the insurance market, including non-life premiums. Max value for the Non-Life Premium variable in the United States in 2022 with a value of 3,501,194.17 million US$. The USA is by far the largest insurance market in the world. Historically, life insurance was the largest segment globally, but this changed in 2017, with the non-life segment reaching a market share of around 53%. This shift likely contributed to higher non-life premiums in the USA. (Deloitte, 2024).

Variable non-life insurance undertaking with a score of min value 394 in France in 2016 as the sector faced some challenges at the time, leading to a negative outlook from rating agencies. The "low" score may be relative to the larger life insurance segment or compared to growth expectations for the non-life sector. The USA's Max. score in 2022 is 3858, which proves the USA has the largest non-life insurance market (Deloitte, 2024).

4.2. Research Data Test

4.2.1. Autocorrelation Test

Table 4 presents the results of the Durbin-Watson (4-D) value> Durbin Lower (3.939475> 1.454) indicates that there is no positive correlation, and the Durbin Watson (4-D) value> Durbin Upper (3.939475> 2.446) indicates that there is no negative correlation. It can be concluded that there is absolutely no correlation between the variables.

Table 4. Autocorrelation test.

Durbin Watson (D) value	DU value	DL value	4-D value
0.0605	2.446	1.454	3.939

Note: T= 216, K= 4.

4.2.2. Multicollinearity Test

Table 5 explains that the variables have a correlation value of no more than <10. So, it can be concluded that there is no multicollinearity between variables.

Table 5. Multicollinearity test.

Variables	Non-life premium	Pension fund	Government debt	Non-life insurance undertaking
Non-life premium	1	0.317	0.249	-0.124
Pension fund	0.317	1	-0.282	0.133
Gov debt.	0.249	0.282	1	0.208
Insurance undertaking	0.124	0.133	0.208	1

4.3. Regression Analysis

4.3.1. Regression of Pension Fund, Non-Life Premium, and Government Debt

Table 6 shows the Pension Fund variable (X) is significant on the Non-Life Premium variable (Z) with a prob value of X variable of 0.0000 (<0.05) hypothesis H1 is significant.

In addition, from Table 7, the Pension Fund variable (X) and the Non-Life Premium variable (Z) affect the Government Debt variable (Y) with a prob value. Each X = 0.0000 Z = 0.0000. Hypotheses H2 and H3 are significant.

Table 6. Regression analysis I.

Dependent variables: Non-life premium				
Variables	**Coefficient**	**Std. error**	**T-stat**	**Prob.**
C	18841.87	34851.26	0.540	0.589
Pension fund	2997.385	610.6268	4.908	0.000

Note: R squared: 0,101200.
Adj. R squared: 0.097000.

Table 7. Regression analysis II.

Dependent variables: Government debt				
Variables	**Coefficient**	**Std. error**	**T-stat**	**Prob.**
C	70.790	2.804	25.237	0.000
Pension fund	-0.321	0.051	-6.214	0.000
Non-life premium	0.00003	0.0000055	5.864	0.000

Note: R squared: 0.206537.
Adj. R squared: 0.199086.

4.3.2. Pension Fund Regression, Non-Life Premium, and Non-Life Insurance Undertaking

Table 8 shows the Pension Fund variable (X) is significant on the non-life premium variable (Z) with a prob value of 0.0000 (<0.05). Hypothesis H1 is significant.

Furthermore, from the Table 9, shows Pension Fund Variable (X) and the non-life premium variable (Z) influence the insurance undertaking variable (Y2) with a prob value. Each X = 0.0064 Z = 0.0091 are less than (0.05) so that hypotheses H4 and H5 are significant.

Table 8. Regression analysis I.

Dependent variable: Non-life premium				
Variables	**Coefficient**	**Std. error**	**T-stat**	**Prob.**
C	18841.87	34851.26	0.540	0.589
Pension fund	2997.385	610.6268	4.908	0.000

Note: R squared: 0.101200.
Adj. R squared: 0.097000.

Table 9. Regression analysis II.

Dependent variables: Non-life insurance undertaking				
Variables	**Coefficient**	**Std. error**	**T-stat**	**Prob.**
C	68.626	6.686	10.263	0.000
Pension fund	0.339	0.1234	2.753	0.006
Non-life premium	-3.45E-05	1.31E-05	-2.631	0.009

Note: R squared: 0.049144.
Adj. R squared: 0.040216.

4.3.3. Mediation Test

Table 10 shows the results of the mediation variable test. The P-value that is obtained in Framework 1 is 0.0000001 (<0.05) with a T-statistic value of 5,75192905, so it can be concluded that variable X has a significant effect on variable Y1 through variable Z. Hypothesis 6 is significant.

Furthermore, the P-value in Framework 2 is 0.00868916 (<0.05) with a T-statistic value of -2.6240477, it can be concluded that variable X has a significant effect on variable Y2 through variable Z. Hypothesis 7 is significant.

Table 10. Mediation test results.

Testing variables	**T statistic**	**Std. error**	**P-value**
Pension funds, non-life premium, and gov debt.	5.751	0.105	0.000
Pension fund, non-life premium, and non-life undertaking.	-2.624	0.247	0.008

5. DISCUSSION

According to the agreement, retirees will receive payments from the government-managed pension fund. However, this financing can be sourced from government liabilities because basically, government-managed pension funds are also partly used to run the wheels of government. Non-life insurance plays a crucial role in mitigating risks that could constrain the government's ability to payout. Furthermore, retirees desire a guarantee of financial security. So, non-life insurance acts as a mediation between pension funds and government debt.

Although private pension guarantees can result in considerable costs, it is typically governments that bear the largest pension liabilities due to their unfunded commitments to pay defined benefit pensions. The idea of implicit pension debt (IPD) acknowledges that both employees and retirees have claims against the government, both presently and in the future, that are comparable to those of government bondholders. Public pension promises are often given contractual status in practice, if not in a legal sense, due to the "insurance" terminology often used to describe such schemes. In fact, constitutional protections have been used in many countries to prevent governments from reducing the value of accrued pension wealth. In this sense, it can be argued that social security programmes impose more severe fiscal constraints than other government programmes (Kane & Palacios, 1996). Their study may oversimplify the complexities of pension systems across different countries by attempting to apply a uniform approach to measuring implicit pension debt. Additionally, while their study mentions private pension guarantees, it doesn't delve deeply into how implicit pension debt affects private sector pension plans.

Investment strategies, financial focus, and the idea of "implicit pension debt" all have something to do with government debt. This shows how important it is for pension funds to be carefully managed and governed in order to be sustainable. Financial sustainability is crucial for the optimal operation of insurance organizations, as it ensures that insurers can fulfill their obligations promptly and completely. As such, a key priority is to establish a robust risk management strategy that minimizes risks to the financial stability of the insurance company. This approach can facilitate the efficient utilization of available resources and capabilities to meet organizational objectives.

For non-life insurance organizations, the insurance and pension sector represent a significant part of the financial system, consisting of thousands of entities globally. This industry directs substantial amounts of savings into various financial markets and is vital for providing long-term funding to different economic sectors. Among institutional investors, the asset holdings of insurance companies and pension funds are considerably larger than those of mutual funds, and they far surpass the assets held by hedge funds and sovereign wealth funds. Most investments in the insurance sector are concentrated in the life insurance segment, which recorded total investments of $18.7 trillion by the end of 2009, in contrast to $3.9 trillion in the non-life segment. European institutions held $10.4 trillion in insurance assets, representing almost half of the worldwide total of $22.6 trillion in insurance assets (Global Insurance Review 2010 and Outlook 2011/12 (Swiss Re, 2010)).

The presentation of Fanti and Gori (2012) states that the level of pension contributions plays an important role in shaping the accrual of human and physical capital, which is an important driver for economic expansion. However, their research treats fertility as exogenous, while it may be influenced by economic factors, including pension systems themselves. Vere (2011) study investigated the labour market and revealed a substantial influence of pension remuneration on the level of labour engagement. Although this study establishes a relationship between Social Security income and labor supply, but it doesn't deeply explore the mechanisms through which this relationship operates. Furthermore, Ehrlich and Kim (2007) present a different view, illustrating that the increased demand for pension contributions correlates with a marked decline in family birth rates and propensity to save, signalling a broader socio-economic impact that extends beyond the scope of the labour economy. In contrast, their research does not fully account for cultural differences across countries that may influence marriage and fertility decisions independently of social security systems. In addition, the theoretical model makes some simplifying assumptions (e.g., homogeneous workers) that may limit its real-world applicability.

Non-life insurance and pension funds have a close relationship. Both pension funds and non-life insurance involve spreading risk. Non-life insurance companies receive many small regular payments to cover various risks, such as property damage or liability claims. Similarly, pension funds manage accumulated assets to meet future pension obligations, which involves managing and spreading investment risk to ensure that the fund can meet its obligations over time. The significance of the industry in different countries can be evaluated based on its size in relation to the overall financial system. In this context, the financial system is estimated as the aggregate of total assets held by depository banks along with the market capitalization of stocks and bonds, as outlined in the World Bank's Financial Structure and Development Database, in addition to the total investments from insurance companies and pension funds, based on OECD data, presented in constant prices. While national variations in data definitions complicate cross-country comparisons, several general insights can still be drawn.

Insurance companies generate income from insurance premiums, while pension funds, as long-term investments, and profitable businesses. Insurance companies that will engage in this business are subject to Solvency-II. The insurance company will always adopt this treaty, taking into account the detailed supervision and regulation of insurance companies, even if they operate outside the European continent.

Recent research related to the implementation of Solvency-II by Pieter Groen and Oliinyk (2022) discusses that the implementation of Solvency-II, insurance companies tend to reduce investment in equities and switch to safer assets such as bonds. Equity investments fell by around 1% after Solvency-II but then increased again by 1.5-2% until the end of 2021. Overall, Solvency-II has encouraged insurance companies to be more prudent in asset allocation and risk management. Despite the initial adjustment, the performance of the property and casualty insurance sector has been relatively stable post-Solvency-II, with some variations between lines of business.

Insurance companies should consider the sustainability impact of their investments, aligned with the objectives of the European Green Deal. This includes assessing the potential risks and long-term benefits of investments related to environmental, social, and governance (ESG) factors. The framework encourages insurers to contribute to sustainable economic activities, although it does not mandate sustainable investments.

A cohesive internal risk control and enterprise risk management framework, actively supported and frequently reviewed, will be necessary for the rollout of Solvency-II. The risk management function will play a vital role in establishing robust internal risk governance within insurance firms. Continuous management of assets and liabilities will be essential for effective risk management in the insurance industry. Additionally, liquidity management needs to be enhanced as a complement to maintaining capital adequacy, with increased oversight of large insurance groups receiving greater emphasis.

6. CONCLUSIONS, IMPLICATIONS AND LIMITATIONS

6.1. Conclusion

Non-life insurance premiums can bridge pension funds to government debt and non-life insurance undertakings. Insurance premiums are a step to anticipate risks and a source of business for insurance companies. The more risk that is borne, the larger the premium that needs to be paid will also be, directly proportional to the risk. Insurance companies are said to be successful in managing coverage if the ratio of claims is smaller than the amount of premium received; of course, from a wide audience, insurance business opportunities are profitable.

The enforcement of Solvency-II within the insurance sector is essential for ensuring business sustainability and effective governance. As experts and regulatory authorities from all EU member states work on the implementation measures for the Solvency-II Directive, it is crucial to familiarize both the insurance industry and policyholders with the benefits of the new regulatory framework. This involves clarifying how the proposed Solvency-II requirements will affect their financial resources.

In the end, does every country in that part of world have running risk mitigation direction and guidance? Every stakeholder in insurance companies and governments across the world can answer this question.

6.2. Implications

Solvency-II will be able to bridge the gap between insurance companies and the government in the overall risk prevention of pension funds. Therefore, insurance companies located anywhere must carry out risk mitigation according to the provisions in their respective countries.

6.3. Suggestions and Limitations

Future research could include all OECD countries and could also compare the economic sectors in other regions such as ASEAN or the Arab League to gain a better perspective. Also, the year of the study can be extended to 2024 when the data is available.

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