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Insurance and economic growth nexus: New Evidence from OECD countries

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Abstract: This study tackles the debate on the relationship between insurance development and economic growth by providing new evidence on the insurance sector. Most of the existing empirical studies focus primarily on the banking sector. This article applies linear dynamic panel-data approaches to examine the nexus between insurance (life insurance, non-life insurance, and the total insurance) and economic growth in 16 OECD countries from 2009 to 2020. We show that insurance development is associated with economic growth. The relationship between life and non-life insurance premiums and economic growth is non-linear. Based on the analysis of the data, an inverted U-shaped relationship is observed between insurance premiums and economic growth, thereby supporting the hypothesis reported in the literature on the non-linear relationship between financial development and economic growth. This implies that more finance may only be better up to a point, after which it tends to harm growth. Thus, our results confirm that the relationship between the insurance sector and economic growth appears to behave like the association between the financial industry and GDP. These findings offer several useful empirical implications for insurance companies and certain perspectives that would help policymakers, governments in OECD and other regions identify important aspects that can be considered while formulating financial regulations related to insurance activities.

Subjects: Economics; Finance; Business, Management and Accounting

Keywords: insurance development; economic growth; dynamic panel modeling; nonlinearities; OECD countries

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1. Introduction

Insurance, like other financial institutions such as banks and the stock market, plays a crucial role in the growth of any country's economy. There is a risk associated with every human activity, from social life to economic activities (Din et al., 2017). The importance of the insurance sector cannot be denied due its economic prospects; approximately 6.23% of the world's GDP is devoted to insurance (Swiss-Reinsurance company, 2016). In addition, insurance companies are among the world's largest investors, with assets running into trillions of dollars. According to the United Nations (2016), insurance assets in countries monitored by the Organisation for Economic Co-operation and Development (OECD) amounted to $23.7 trillion (OECD, 2018a) in 2016, which rose to $31 trillion. As a result, the insurance sector contributes to the financing of governments and businesses because they invest in debt and equity, both in the public and private sectors. Usually, a significant portion of these investments is returned to the local economy of the nation in which insurance companies domicile or operate (Apergis & Poufinas, 2020). Based on this viewpoint, it is likely that insurance contributes to economic growth through the use of received premiums. Accordingly, all the above evidence indicates that the insurance sector's development impacts economic growth.

Nevertheless, most of the previous students who analysed the relationship between the financial sector and economic growth mainly concentrated either on the banking sector or the stock market (Levine, 2005; Horng, Chang, and Wu, 2012). However, even though the potential contribution of insurance activity to economic growth has been acknowledged, the possible relationship between insurance development and economic growth has not been as broadly examined as that of banks and economic growth (Haiss & Sümegi, 2008; Lee et al., 2017; Verma & Bala, 2013). The possible reason for this situation may be due to data availability.

The projective of this study is to investigate the link between insurance development and economic growth. To do so, we proposed the following hypotheses; insurance market activity measured by (total insurance premium, life insurance premium, nonlife insurance premium, penetration) has positive relationship with economic growth measured by (GDP per capital, labor, and Capital.).

This research extends the existing literature in three aspects. First, we applied the GMM-DIF model following the methodology employed by (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 2000). Second we use a large a dynamic panel data of 16 OECD countries for the period from 2009 to 2020. Finally, we analyse three measures of insurance development, life insurance, non-life insurance and aggregate (life and non-life insurance).

The results confirm the evidence in favour of the existence of U-shaped relationship between life and non-life insurance premiums maintain development and economic growth. This findings, support the novel view that too much finance harms economic growth. In contrast to most empirical analyses, we found that life and non-life insurance premiums have a non-linear impact on economic growth. Furthermore, with this technique, the effect of an exogenous shock can be identified by the orthogonalised response while keeping other variables immune to external shocks. In other words, it considers all the contemporary dynamics of the system.

The remainder of this paper has the following structure: Section 2 explains the related literature review and developed hypothesis. Section 3 presents the data. Section 4 describes the model and econometric approach. Section 5 discusses the empirical results. Section 6 concludes the paper.

2. Literature review

2.1. The conceptual review

Economic growth has been defined as the average growth rate of real Gross Domestic Product (GDP) per capita. Since GDP is widely used throughout the analysis, the international differences in the growth rates of per capita GDP (Feng, 1997). In this study, the real GDP per capita, is used as an indicator of economic growth. Insurance development may be considered in two aspects. On the one hand, it is a key a component of financial development, which is a part of economic growth. On the other hand, due to the significant relationship between the insurance sector and other sectors of the economy, it is viewed as a driver of long-term economic growth (Bednarczyk, 2013).

The existing finance literature shows that the insurance sector has received scant attention in the finance–economic growth literature than in the banking and stock markets (Sümegi and Haiss, 2008; Verma & Bala, 2013). The theoretical and empirical finance research on the relationship between financial development and economic growth has garnered intense attention during the past few decades (e.g., Rousseau and Wachtel, 1998; Levine et al., 2000; Arcand et al., 2015; Beck & Levine, 2004; Cheng & Hou, 2022; Narayan & Narayan, 2013; Sethi et al., 2020; Zagorchev et al., 2011). Mishra and Narayan (2015) showed a positive association between financial development and growth. In contrast, Arcand et al. (2012), Law and Singh (2014), and Cheng and Hou (2022) documented a negative relationship between finance and growth. Arcand et al. (2015) reported no association between these two factors.

Several studies used different methodologies to examine the impact of financial development on economic growth, for instance, cross-sectional studies by Levine and Zervos (1998), Deidda and Fattouh (2002), Ergungor (2008), and Huang and Lin (2009) and panel data techniques applied by Rioja and Valev (2004a), Ergungor (Ergungor, 2008), Cecchetti and Kharroubi (2012) and Mishra and Narayan (2015). These studies have shown a positive association between financial development and economic growth.

Haiss and Sümegi (2008) indicated that the weak finance–growth relationship may be due to the importance of the insurance sector, though this sector was ignored in related studies. In contrast, Rousseau and Wachtel (2011) showed that the financial development and economic growth nexus is not as robust when using recent data as it was with the data from 1960 to 1989. Contrastingly, Arcand et al. (2012) documented a negative association between finance and growth using cross-sectional and panel data.

Although the relationship between the insurance market activity and economic growth has been a common debate over the past two decades, however, the empirical studies conducted on the relationship between these factors are still few compared to the extensive research on the role of the banking sector in the economic growth nexus (Haiss & Sümegi, 2008; Lee et al., 2017; Levine, 2005; Verma & Bala, 2013).

Moreover, most existing empirical studies examine insurance activity and economic growth nexus, only focusing on life insurance (J. F. Outreville, 2013). In addition, even the evidence from those studies that examined the link between the insurance industry and economic growth is inconclusive. Hatemi-J et al. (2019); and Apergis and Poufinas (2020) observed a positive linkage between the insurance sector and economic growth. Nevertheless, there is still some evidence of an adverse effect of insurance on growth, as Lee et al. (2017) reported. Therefore, the literature is inconclusive on the relationship between financial development and economic growth.

The importance of the insurance sector led to an increasing interest in research in this area. However, the empirical research examining the relationship between insurance activities and economic growth, as mentioned above, still lacks consensus (Chang et al., 2014; J. F. Outreville, 2013; Lee et al., 2013).

2.2. Theoretical framework

One prominent strand of the existing literature examines the relationship between insurance development and economic growth, corresponding to the supply-leading theory on which this study is based. This theory presumes that economic growth follows insurance development.

Existing empirical research on this view of the relationship between insurance market activity and economic growth includes Haiss and Sümegi (2008), Han et al. (2010), Pradhan et al. (2015), Lee et al. (2016), ,Apergis and Poufinas (2020) and Hemrit (2020). Another strand, the demand-following theory, assumes that insurance development follows economic growth. Existing studies supporting this thought include Outreville (1990), Beck and Webb (2003), Lee et al. (2017), Gupta et al. (2019), and Singhal et al. (2022).

2.3. Empirical review

Respecting the supply-leading theory, Webb et al. (2005) examined the effect of life and non-life insurance in 55 countries from 1990 to 1980. Their cross-sectional analysis indicates that the insurance and banking sectors significantly impact economic growth. Haiss and Sümegi (2008) used a panel data model to investigate the effect of life and non-life insurance on European GDP growth for 29 European countries from 1992 to 2005. They found a positive impact of life insurance on GDP growth in most investigated countries. Han et al. (2010) examined the association between insurance development and economic growth using generalised method of moments (GMM) models on a dynamic panel data of 77 countries from 1994 to 2005. They documented that life and non-life insurance and total (life and non-life insurance) have more impacts on developing economies than developed economies. Chen et al. (2012) also investigated the effect of insurance on economic development in 60 countries over the period 1976–2005. Their dynamic panel GMM analysis shows that life and non-life insurance positively and significantly affect economic growth. Using panel data of 34 OECD countries from 1988 to 2012, Pradhan et al. (2015) found that insurance market development, financial development and economic growth are cointegrated. Recently, Cheng and Hou (2022) demonstrated that life insurance promotes long-term economic growth, but this finding is not evident in the short term in 17 advanced European countries from 1980 to 2015. Moreover, Lee et al. (2016) applied an innovatively dynamic panel threshold model to investigate how institutional environments shape the relationship between insurance and economic growth. Their findings show a negative relationship between life insurance and economic growth in the regime with relatively unhealthy institutional environments. However, the relationship was insignificant after a certain threshold of institutional quality has been achieved.

Concerning the demand-following theory, Beenstock et al. (1988) investigated the relationship between property–liability insurance premiums and income using panel data from 12 industrialised countries from 1970 to 1981. They indicated that more property–liability insurance is purchased as national income increases. Browne and Kim (1993) argued that life insurance demand is associated with GDP per capita across 45 countries from 1980 to 1987. Outreville (1996) documented a similar result using the OLS test for data across 48 developing countries from 1986 to 1993. The authors show that life insurance demand is significantly associated with GDP per capita. Using OLS and a fixed effect model with data across 68 countries from 1961 to 2000, Beck and Webb (2003) found that income per capita is a robust predictor of life insurance consumption. Recently, Lee et al. (2017) analysed the non-linear linkage between life and non-life insurance and economic growth using a non-parametric framework sample of 38 countries from 1984 to 2009. Their results indicate that almost all cases show moral hazard, adverse selection and macroeconomic volatility, which are the cause of adverse partial effects of the insurance sector on growth.

The literature discussed above provides valuable empirical evidence for the insurance and growth nexus. However, in-depth investigations of the total, life and non-life insurance's influence on economic growth are minimal. Our study uses aggregated insurance premiums and their disaggregation of life and non-life insurance premiums to evaluate their potentially different effects on economic growth.

This study is different from existing works in several aspects. First, prior studies used a single proxy, either total written premiums (e.g., Ward & Zurbruegg, 2000; Lee & Lee, 2020; Benlagha

& Hemrit, 2020) or insurance penetration (e.g., Adams et al., 2009; Hou & Cheng, 2017; Kjosevski, 2012), to examine the relationship between insurance development and economic growth. In contrast, this study used the two proxies in the same study. Second, this paper is related to but differs from research by Chang et al. (2014) and Hatemi-J et al. (2019) among other few studies that analysed life, non-life and total insurance using a small sample of 10 and 7 countries, respectively). Accordingly, we apply panel data to analyse the three types of insurance in a broader set of 16 advanced OECD countries. The sample period is extended to 2009–2020 to determine whether varying effects among different groups of income economies. Thus, the findings of this study will shed new light on the existing finance literature.

The nexus between insurance market activities and economic growth varies across countries. Existing studies have shown that life insurance is critical in certain countries' economic growth, whereas non-life insurance plays a significant role in others (Arena, 2008; Haiss & Sümegi, 2008; Chang et al., 2014; Din et al., 2017; Benlagha, 2017 Cheng and Hou, 2022).

Most of the literature discussed above found a significant positive association between life and non-life insurance and economic growth (Ward & Zurbruegg, 2000; Webb et al., 2002; Arena, 2008; Haiss & Sümegi, 2008; Chen et al., 2012; Din et al., 2017; Hatemi-J et al., 2019; Cheng & Hou, 2022). The research that reported insurance's insignificant or negative effect on economic growth used either aggregate data or a different insurance proxy (e.g., Asongu & Odhiambo, 2020; Lee et al., 2016; Zouhaier, 2014). Due to the substantial difference between life and non-life insurance, combining these distinctively different insurance types may yield an insignificant or negative economic influence. Therefore, proxy choice and the segregation of life and non-life insurance are essential when examining the linkage between insurance and economic growth.

3. Research method and data

3.1. Research design

Our empirical testing strategy is to conduct the most comprehensive and robust statistical analysis the data allow. To investigate the relationship between insurance development and economic growth, we propose a modified growth model that includes insurance as a third factor that is expected positively affect the total output (see, eq. 4). The study measures insurance development using total, life, and non-life insurance premiums as the third factor in our extended growth model. In this study, we adopted a quasi-experimental research design. Several panel data constructions were used to estimate the relationship between the investigated variables.

3.2. The model and econometric approach

We apply modified economic growth by considering insurance development and characterising an economy with two production factors. Following the literature (see, for instance, Mankiw et al., 1995), we consider a model with two inputs, namely, capital and labour, and assume a Cobb–Douglas production function. Thus, production at time t is given as follows:

$$Y(t) = K(t)^{\alpha} A(t) L(t)^{1-\alpha}, \ 0<\alpha<1 \quad (1)$$

Where A denotes technology level, L represents labour and K is the capital. Then, we modify this standard Cobb–Douglas production function by adding insurance activity as the third factor that positively affects the total output. Accordingly, the modified function is written as follows:

$$Y(t) = K(t)^{\alpha} A(t) L(t)^{\beta} I(t)^{\delta} \quad (2)$$

Where I denotes the variable measuring insurance development. The linearisation of the modified Cobb–Douglas production function followed by a logarithm transformation provides the model to be estimated and presented as follows:

$$\ln Y_t = A + \alpha \ln(K_t) + \beta \ln(L_t) + \delta \ln(I_t) \tag{3}$$

The panel data model associated with Equation (2) can be presented as follows:

$$\ln Y_{it} = A + \alpha \ln(K_{it}) + \beta \ln(L_{it}) + \delta \ln(I_{it}) + \eta_i + \xi_t + \varepsilon_{it} \tag{4}$$

Where output Y_{it} is the GDP per capita of country i at time t, K_{it} is the variable representing the capital of country i at time t and L_{it} is the proxy for labour of country i at time t. η_i is the individual (country) fixed effect, ξ_t is a time-specific effect and ε_{it} is disturbances assumed to be serially uncorrelated.

3.3. Estimation technique

To measure the insurance–growth nexus, our study considers the GMM dynamic panel data approach (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 2000). By using GMM specifications, we obtain the elasticity of insurance premiums that differ from nation to nation and over time. The panel data approach has several advantages over a single time series or cross-sectional data analysis (Wahab, 2011). It provides more information with less collinearity between variables, more degrees of freedom, is more efficient and can control individual heterogeneity. It also allows us to take advantage of changes in insurance premiums, both between countries and over time. Concentrating on a group of countries instead of a single country will enable us to understand the performance of an individual country by observing the behaviour of other countries. This technique treats all variables as endogenous, allows control of fixed effects and has lagged interdependencies that are more or less missing in other econometric methods. Therefore, this approach can adequately solve the endogeneity problem that affects single-equation methods.

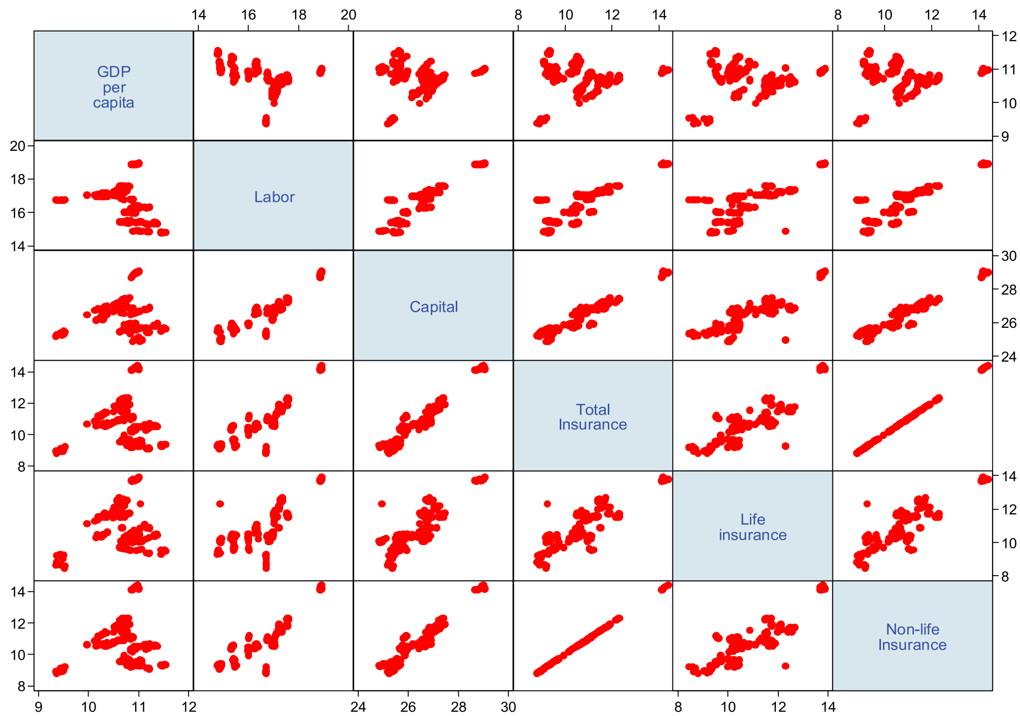
3.4. Data

The data set is constructed as a panel of country observations from the World Development Indicators (WDI) of the World Bank's database. It includes 16 OECD countries over the period 2009–2020. The choice of countries and periods was solely based on data availability. Tables A1 and A2 in the appendix report the list of countries included in the sample and the summary statistics of the variables under investigation.. The dependent variable in the model is the real per capita GDP growth rate. The set of independent variables consists of the growth rate of gross capital formation representing the capital factor and labour, measured by the labour force, in addition to the variables measuring the development of insurance activities. Figure 1 illustrates the scatter plot matrix of these variables.

We considered two measures, namely, gross insurance premiums and insurance penetration to capture the impact of insurance development on economic growth. Thus, we can assess the life, non-life and total insurance sectors. Firstly, gross insurance premiums, defined as the total insurance premiums of the reporting country, is a significant indicator of the importance of the insurance industry in the country's economy. This indicator is reported in millions of USD and measured by the sector of insurance activity (non-life and life insurance). Secondly, the variable of insurance penetration, which is an alternative way of measuring insurance development in the reporting country, is constructed as follows:

$$IP_{ijt} = \frac{IGP_{ijt}}{GDP_{it}}$$

Figure 1. The scatter plot matrix of the variables under study.



where IP_{ijt} is the insurance penetration of sector *j* in country *i* for calendar year *t*.

4. Results and discussion

4.1. Nexus between total insurance premium and economic growth

This section presents empirical results for the nexus between insurance development and economic growth. In the basic equations (eq. 4), we consider a linear relationship between the collected insurance premium and economic growth. Table 1 reports the results from the Arellano–Bond GMM-DIF and Arellano–Bover/Blundell–Bond estimations. Model 1 shows that the two estimation methods provide similar results in terms of the signs of the relationships and statistical significance. However, certain differences exist in the value of the estimated parameters.

We use two statistical tests commonly used in literature to check the validity of our estimations using dynamic panel data. In the first test, if the second-order serial correlation is statistically insignificant,$AR(2)$, and the system GMM estimator is consistent. In the second test, we verify the validity of the instruments (over-identification restrictions) using the Sargan test. The Sargan test has an asymptotic distribution of χ^2 under the null hypothesis that the instruments are valid. Based on the results of these tests, we use the Arellano–Bover/Blundell–Bond method for model estimation because all the tests show that our estimations are valid for this particular model. Consequently, the interpretation focuses on the Arellano–Bover/Blundell–Bond estimations for models 1 and 2. The results of models 1 and 2 show that the capital and labour coefficients are highly statistically significant at the 1% level. In addition, the coefficients are positive, indicating that capital and labour positively influence economic growth. These results are consistent with the economic growth theory (see, Lucas, 1988; Mankiw et al., 1995; Rebelo, 1991). In addition, the results indicate that the capital coefficient is less than the unit that confirms the required conditions in the proposed Cobb–Douglas production function. Moreover, the results show that the lagged values of economic growth $(GDP(-1))$ have a significant positive impact on actual

Table 1. Results of panel data models (Total insurance premium)

	Model 1		Model 2	
	Arellano-Bond	Arellano-Bover /Blundell-Bond	Arellano-Bond	Arellano-Bover /Blundell-Bond
Intercept	−11.17***	−2.900**	−15.58***	−11.59***
	(0.886)	(0.915)	(2.071)	(2.353)
GDP(−1)	0.352***	0.714***	0.314***	0.726***
	(0.0513)	(0.0321)	(0.0424)	(0.0442)
Capital	0.680***	0.287***	0.628***	0.285***
	(0.0335)	(0.0517)	(0.0271)	(0.0534)
Labor	0.00918***	0.0101***	0.00614***	0.00960**
	(0.00112)	(0.00178)	(0.00147)	(0.00319)
Insurance	0.00456	0.152***	1.153*	1.388*
	(0.0341)	(0.0289)	(0.454)	(0.625)
$Insurance^2$	-	-	−0.0523*	−0.0677*
	-	-	(0.0214)	(0.0288)
N.obs	144	160	144	160
N instruments	14	22	14	23
AR (2) *(P-value)*	0.1065	0.177	0.2804	0.190
Sargan Test *(P-value)*	0.0896	0.5642	0.0990	0.5562

Notes: We report tests for second-order serial correlation (AR-2) and instrument validity (Sargan). Standard errors are in parentheses. *, **, and ***significant at 10 percent, 5 percent, and 1 percent.

economic growth. Consequently, regarding its economic significance, this last result shows that our dynamic panel model specification is appropriate.

Because the current empirical study concentrates on the insurance industry and growth nexus, it will focus on the variable *insurance premium*. The estimation results of model 1 show that the coefficient of the total insurance premiums is positive and significant at the 1% significance level. Therefore, total insurance activity significantly influences economic growth.

In model 2, we propose investigating whether insurance activity and economic growth have a non-linear relationship. To provide formal evidence, we perform regression analysis using *GDP* as the dependent variable and *insurancepremium* and $insurancepremium^2$ as independent variables, addition to capital and labour. Similar to model 1, the results show that the capital and labour coefficients are positive and statistically significant (at the 1% level). Therefore, production factors positively impact economic growth. Furthermore, the findings show that the coefficient of the lagged values of economic growth $(GDP(-1))$ is also positive and significant, indicating that the dynamic panel model specification is appropriate.

Regarding the impact of insurance activity on economic growth, the results of model 2 show that the insurance premium coefficient is still statistically significant and positive after adding the new variable $(insurancepremium^2)$ to the model. In contrast, the variable $insurancepremium^2$ coefficient is negatively associated with economic growth. Consequently, the estimated dynamic panel model generates a U-shaped relationship between insurance activity and economic growth. The empirical findings are in line with the literature supporting the hypothesis of a non-linear relationship between financial development and economic growth, where finance is good only up to a point, after which it becomes a drag on growth (Shen and Lee, 2006; Law and Singh, 2014; Arcand et al., 2015). Thus, the association

Table 2. Results of panel data models (Life and Non-life)

	Model 3		Model 4	
	Arellano-Bond	Arellano-Bover /Blundell-Bond	Arellano-Bond	Arellano-Bover /Blundell-Bond
Intercept	−10.91***	−2.751**	−19.06***	−23.04***
	(0.818)	(0.967)	(1.897)	(3.878)
GDP(−1)	0.327***	0.696***	0.233***	0.469***
	(0.0515)	(0.0491)	(0.0423)	(0.0932)
Capital	0.671***	0.285***	0.591***	0.351***
	(0.0420)	(0.0593)	(0.0297)	(0.0619)
Labor	0.00927***	0.0116***	0.00480***	0.00237
	(0.00143)	(0.00246)	(0.00132)	(0.00255)
lifeInsur	0.0354***	0.0200**	1.101***	1.716***
	(0.00870)	(0.00772)	(0.261)	(0.410)
NonlifeInsu	−0.00406	−0.165***	0.962*	1.920*
	(0.0403)	(0.0306)	(0.435)	(0.808)
$lifeInsur^2$	-	-	−0.0482***	−0.0765***
	-	-	(0.0117)	(0.0181)
$nonlifeInsur^2$	-	-	−0.0422*	−0.0907*
	-	-	(0.0211)	(0.0376)
N.obs	144	160	144	160
N instruments	14	23	16	25
AR (2) *(P-value)*	0.1081	0.0110	0.6615	0.1538
Sargan Test *(P-value)*	0.0921	0.6311	0.1255	0.8717

Notes: We report tests for second-order serial correlation (AR-2) and instrument validity (Sargan). Standard errors are in parentheses. *, **, and *** significant at 10 percent, 5 percent, and 1 percent.

between the insurance sector and economic growth is similar to that between financial sectors and GDP.

4.2. Nexus between life and non-life insurance premium and economic growth

Table 2 reports the results of the models between the insurance activities considering the line of business and economic growth. This modelling focuses on the impact of life and non-life insurance, felt marginal, on economic growth. As previously mentioned and based on the results of the second-order serial correlation and the Sargan test, our interpretation focuses on the models estimated by the Arellano–Bover/Blundell–Bond estimations.

As shown in model 3, the capital and labour coefficients are statistically significant in all models, with positive signs and consistent with the economic growth theory. The coefficient of the lagged GDP is positive and is an important determinant of economic growth at conventional levels, indicating that the choice of a dynamic panel specification is appropriate. In addition, and remarkably, the life and non-life insurance coefficients are positive and negative, respectively, but are statistically insignificant determinants of economic growth. Therefore, life insurance positively impacts growth, whereas non-life insurance has a negative impact.

Turning to model 4, where the non-linear relationship between life and non-life insurance and economic growth is considered, the results also reveal that the estimated capital and labour coefficients are consistent with the economic growth theory. The dynamic panel data specification is appropriate because the lagged GDP is positive and significant at the 1% level. Similar to the results in model 3, the life insurance coefficient in model 4 is positive and significant at 1%, supporting the positive influence of life insurance on economic growth. However, the $lifeInsurance^2$ coefficient is statistically significant and negative. Thus, the estimated dynamic panel model generates a U-shaped association between life insurance activity and economic growth.

Regarding non-life insurance, in contrast to model 3, the coefficient of this variable is statistically significant and positive. In addition, the $non-lifeInsurance^2$ coefficient is statistically significant and negative. This result also confirms the U-shaped relationship between non-life insurance activity and economic growth. Overall, the results of the estimated models are primarily coherent and indicate a non-linear association between insurance activity and economic growth. This pattern of non-linear association is also confirmed when considering the insurance premium collected from different insurance business lines (life and non-life).

4.3. Insurance penetration and economic growth

In this section, insurance penetration is considered a measure for insurance development. We estimated several specifications by considering total insurance penetration and decomposing it into life and non-life insurance penetration. Most of these specifications did not provide excellent results, particularly the post-estimation tests.[1] In addition, we considered the linearity and non-linearity hypotheses as we proceeded in the previous sections. Table 3 reports the model's results describing the nexus between total insurance penetration and economic growth. The table further shows that the Arellano–Bond model is appropriate based on the post-estimation tests. Therefore, our analysis will focus on this selected model.

The results of the Arellano–Bond show that the capital and labour coefficients are statistically significant at the 1% level. The coefficients are also positive, indicating that capital and labour positively influence economic growth. Moreover, the results suggest that the lagged economic

Table 3. Results of panel data models (Total insurance penetration)

	Model 5		Model 6	
	Arellano-Bond	Arellano-Bover /Blundell-Bond	Arellano-Bond	Arellano-Bover /Blundell-Bond
Intercept	−10.17***	0.0804	−10.46***	−0.0286
	(0.705)	(0.797)	(0.649)	(0.912)
GDP(−1)	0.281***	0.754***	0.281***	0.749***
	(0.0383)	(0.0402)	(0.0393)	(0.0506)
Capital	0.674***	0.0965**	0.684***	0.103*
	(0.0178)	(0.0347)	(0.0158)	(0.0415)
Labor	0.00637***	0.0159***	0.00594***	0.0161***
	(0.000994)	(0.00274)	(0.00107)	(0.00274)
IP	−0.0659***	−0.0211***	−0.0284	−0.0491
	(0.0197)	(0.00368)	(0.0215)	(0.0369)
IP^2	-	-	−0.00719	0.00731
	-	-	(0.00559)	(0.00763)
N.obs	144	160	144	160
N instruments	13	22	14	23
AR (2) *(P-value)*	0.1979	0.0050	0.1439	0.0039
Sargan Test *(P-value)*	0.1470	0.6051	0.1364	0.6076

Notes: We report tests for second-order serial correlation (AR-2) and instrument validity (Sargan). Standard errors are in parentheses. *, **, and *** significant at 10 percent, 5 percent, and 1 percent.

growth variable (GDP (−1)) coefficient is significant and positive, revealing a positive impact of past economic growth on the actual values of the considered variable. In addition to its economic interpretation, this latest result shows that our dynamic panel model specification is appropriate. All these results are coherent with those obtained in the models estimated in the previous sections.

More importantly, the results of this modelling show that the insurance penetration coefficient is enormously significant (at the 1% significance level) and positive for both dynamic panel models reported in Table 3. These results indicate that the development in the insurance sector contributes positively to the countries' economic growth under investigation. However, in contrast, when the previous models consider insurance premiums as a proxy for insurance development, insurance development and economic growth show a linear relationship. Thus, when considering insurance penetration, the estimation of non-linear specifications does not provide satisfactory results in terms of estimated coefficient and post-estimation tests.

5. Conclusion and recommendations

Using panel data from 16 OECD countries from 2009 to 2020, this study examines whether insurance premium promotes economic growth. The Arellano–Bond GMM-DIF and Arellano–Bover/Blundell–Bond dynamic panel-data approaches are used on dynamic panel data. We found that insurance development statistically and significantly supports economic growth. The results also provide new evidence on the non-linear association between life and non-life insurance premiums and economic growth. The data analysis showed an inverted U-shaped relationship between insurance premiums and economic growth. The empirical findings indicate that economic growth increases when insurance development improves. In contrast, if insurance development exceeds the turning point, the impact of insurance on growth will turn negative, suggesting that further insurance development will not translate into increased economic growth. The results are robust to three measures of insurance indicators: total, life and non-life insurance premiums. Thus, the relationship between the insurance sector and economic growth is similar to that between financial sectors and GDP. However, when considering insurance penetration, the estimation of non-linear specifications does not provide satisfactory results in terms of the estimated coefficient and post-estimation tests. Moreover, we found that capital and labour are the most significant growth factors. In addition, the results reveal that past economic growth positively impacts the actual values of the considered variable. Therefore, our dynamic panel model specification is appropriate.

This study offers several contributions to knowledge. First, it tackles the debate on the relationship between insurance development and economic growth by providing new evidence of such a nexus in the OECD region. The study uses a data sample from 16 OECD countries (see, Table A1) for the period of 2009–2020. This sample allowed us to generate an extensive panel dataset to capture more consistent variables for our model estimation. Given that the OECD insurance markets play an increasingly significant role in the global economy, our results might also apply to emerging markets elsewhere.

Third, this paper investigates the non-linear linkage between insurance development and economic growth. As noted by Lee et al., 2013), Chen et al. (2012) and Lee et al. (2017), the existing literature mostly focuses on insurance-growth nexus using a conventional linear model. The study attempts to contribute to the existing body of knowledge and add to the handful of studies that have explored the non-linear relationship between the two factors and fill the literature gap. Finally, most of the existing empirical studies that have examined the relationship between financial development and economic growth focus primarily on the banking sector. Our study fills the knowledge gap by providing new empirical evidence from the insurance sector in 16 OECD countries, one of the largest regions where the independence of insurance in economic growth has become an essential public policy priority.

The results of this study have significant implications for policymakers and authorities. Firstly, the evidence collected shows that insurance development significantly influences economic growth within the OECD. This study confirms Ward and Zurbruegg's (2000) assumption that insurance activities contribute to economic growth as financial intermediaries, risk transfer, and indemnification providers by mobilising domestic savings to manage different risks efficiently. This debate reveals that the insurance function may significantly influence the economic system of OECD countries, such as the importance of developing the banking sector to their economic growth that investigated in existing literature. It also needs the development of the insurance sector due its contribution in improve economic growth in term of employment, managed assets, promoting the society stability and security. Thus, this study provides empirical implications for insurance companies and specific perspectives that would help policymakers, governments in OECD and other regions identify important aspects that can be considered while formulating financial regulations related to insurance activities.

The study provides evidence insurance development and economic growth have a U-shaped relationship. This evidence has implications for attempts to fully understand the rising tide of economic growth and insurance development, where substantial insurance development may be good up to a certain point and then hampers economic growth in OECD countries. Therefore, policymakers should focus more on ensuring that the insurance sector is strengthened in ways that will foster economic growth rather than increasing its size. Understanding the turning point in the association between insurance development and growth is also critical in confirming the efficiency of insurance development for economic growth.

To provide further valuable detailed insights into this line of literature, future research can benefit from our study by including other countries, particularly developing economies, and other insurance proxies. Considering comparative studies (i.e. developing versus developed countries) will also be interesting.

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Note
1. We reported the results of the most appropriate model. The unreported results are available on request from the authors.

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Appendixes

Table A1. List of countries considered in the panel

Country	Code	Freq.	Percent	Cum.
AUSTRIA	AUS	11	6.25	6.25
BELGIUM	BEL	11	6.25	12.50
CANADA	CAN	11	6.25	18.75
SWITZERLAND	CHE	11	6.25	25.00
GERMANY	DEU	11	6.25	31.25
DENMARK	DNK	11	6.25	37.50
SPAIN	ESP	11	6.25	43.75
FRANCE	FRA	11	6.25	50.00
UNITED KINGDOM	GBR	11	6.25	56.25
ITALY	ITA	11	6.25	62.50
KOREA, Rep	KOR	11	6.25	68.75
NETHERLANDS	NLD	11	6.25	75.00
NORWAY	NOR	11	6.25	81.25
POLAND	POL	11	6.25	87.50
SWEDEN	SWE	11	6.25	93.75
UNITED STATES	USA	11	6.25	100.00
Total		176	100.00	

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Table A2. Summary of the main variables in logarithm

Variable	**Mean**	**Std.**	**dev.**	**Min**	**Max**	**Observations**	
Log GDP							
overall	10.706	0.454	9.353	11.551	N	=	176
between	0.458	9.449	11.360	n	=	16	
within	0.087	10.433	10.897	T	=	11	
Labor							
overall	16.495	1.074	14.771	18.935	N	=	176
between	1.105	14.813	18.895	n	=	16	
within	0.028	16.419	16.579	T	=	11	
Investment							
overall	26.371	0.959	24.840	29.064	N	=	176
between	0.982	24.960	28.903	n	=	16	
within	0.103	26.019	26.637	T	=	11	
Total Insurance							
overall	10.699	1.298	8.813	14.389	N	=	176
between	1.326	8.994	14.220	n	=	16	
within	0.167	10.117	11.369	T	=	11	
Life Insurance							
overall	10.827	1.237	8.451	13.909	N	=	176
between	1.242	8.940	13.769	n	=	16	
within	0.274	9.845	12.817	T	=	11	
Non life							
overall	10.699	1.298	8.813	14.389	N	=	176
between	1.326	8.994	14.220	n	=	16	
within	0.167	10.117	11.369	T	=	11	

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