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Article

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Financial Innovation

Provided in Cooperation with:

Springer Nature

Suggested Citation: Pradhan, Rudra P.; Dash, Saurav; Maradana, Rana Pratap; Jayakumar, Manju; Gaurav, Kunal (2017) : Insurance market density and economic growth in Eurozone countries: the granger causality approach, Financial Innovation, ISSN 2199-4730, Springer, Heidelberg, Vol. 3, Iss. 17, pp. 1-24,
<https://doi.org/10.1186/s40854-017-0065-x>

This Version is available at:

<https://hdl.handle.net/10419/176455>

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Insurance market density and economic growth in Eurozone countries: the granger causality approach

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Abstract

Background: This study examines the relationship between insurance market density (IMD) and economic growth.

Methods: We employed Granger causality technique in 19 Eurozone countries for the period 1980-2014. We use three different indicators of IMD, namely life insurance density, non-life insurance density, and total insurance density. We particularly emphasize on whether Granger causality runs between IMD and economic growth both ways, one way, or not at all.

Results: Our empirical result recognizes the presence of both unidirectional and bidirectional causality between insurance market density and economic growth. However, these results are mostly non-uniform across Eurozone countries.

Conclusions: This study holds important policy implications- economic policies should recognize the differences in the insurance market density and economic growth in order to maintain sustainable economic growth in the Eurozone.

Keywords: Insurance market density, Economic growth, Granger causality, Eurozone countries

JEL code: L96, O32, O33, O43

Research highlights for review

- This study examines the causality between insurance market density (IMD) and economic growth.
- We use 19 Eurozone countries between 1980 and 2014.
- The analysis has been done at individual country level and at Eurozone panel level.
- The study finds an evidence of Granger causality between IMD and economic growth.
- Results in the short run are mostly non-uniform with a few exceptions.

Background

Theoretical studies and empirical evidences have revealed that countries with well-developed financial systems experience faster and more stable long-run economic

growth. Normally, a well-built financial market¹ has a significant positive impact on total factor productivity, which translates into high long-run economic growth (see, inter alia, Haiss and Sumegi, 2008; King and Levine, 1993; Levine and Zervos, 1998; Levine et al., 2000). This holds true for all the sub-sectors of financial markets, such as banking sector, stock market, and insurance market. In this paper, we primarily focus on the relationship between insurance market and economic growth. The motivation for this study is based on two typical reasons. First, the coverage of insurance sector has gained less attention in the finance-growth literature, particularly in comparison to both banking sector and stock markets (see, inter alia, Lee et al., 2013a, 2013b). Second, with the process of financial liberalization and integration, we have witnessed an increasingly rapid growth in the insurance market activity during last few years, which raises the question of '*whether insurance market activity promotes economic growth.*' This adds to the empirical evidence on resolving the controversial issue between insurance market development and economic growth (see, inter alia, Boon, 2005; Chang et al., 2014).

The relationship between insurance market activities² and economic growth has been broadly discussed in extant literature.³ Most of these studies have argued that economic growth is characteristically determined by insurance market activities, with sufficient evidence presented to policymakers to this effect (see, inter alia, Arena 2006; Beck and Webb 2003; Chen et al. 2013; Lee et al. 2012; Hussels et al. 2005). However, in extant literature, the link between insurance market activities and economic growth has not been fully recognized, and most empirical results vary according to data and econometric tools (see, inter alia, Lee et al. 2013a, 2013b; Outreville 2013). There is no universally held view of the nature of causality between insurance market activities and economic growth (see, inter alia, Pradhan et al. 2017; Alhassan and Fiador 2014; Chang et al. 2014; Kugler and Ofoghi 2005; Ward and Zurbruegg 2000). Therefore, we investigate the causal nexus between the two in order to ascertain the actual fact; that is, "*How do insurance market activities cause economic growth?*" The focus of this study is on Eurozone⁴ countries during the period of 1980-2014.

The remaining paper is outlined as follows. Insurance market activities and economic growth: The theoretical basis presents the theoretical basis of insurance market activities to growth. An outline of insurance market density in the eurozone countries outlines the trend of insurance market density. Empirical strategy deliberates the empirical strategy. Empirical results and discussion presents the empirical results and discussion thereof. Finally, we conclude in Conclusion.

Insurance market activities and economic growth: The theoretical basis

Like other financial services, such as banking and stock market activities, insurance market activities play a key role in economic growth (see, inter alia, Chang et al. 2014; Ghosh 2013; Garcia 2012; Webb et al. 2005a, 2005b; Lee et al. 2012; Adams et al. 2009; Li et al. 2007; Webb et al. 2005a, 2005b; Outreville 1996). Insurance market activities serve a number of valuable economic functions that are largely distinct from other types of financial intermediaries, such as banking and stock market activities. The insurance market activities- both as a provider of risk transfer and indemnification and as an institutional investor- may contribute to economic growth in the following ways: promoting financial stability, facilitating trade and commerce,

mobilizing domestic savings, allowing different risks to be managed more efficiently, encouraging the accumulation of new capital, fostering a more efficient allocation of domestic capital, and helping to reduce or mitigate losses (see, inter alia, Pradhan et al. 2015a, 2015b; Liu et al. 2014; Lee et al. 2013a, 2013b; Billio et al. 2012; Guochen and Wei 2012; Haiss and Sumegi 2008; Skipper and Kwon 2007; Kugler and Ofoghi 2005; Ward and Zurbruegg 2000). Additionally, there may be different effects on economic growth from life and non-life insurance market activities given that these two types of insurance market activities protect the households and corporations from different kind of risks that affect the economic activity in different ways. Additionally, life insurance companies facilitate long-term investment, rather than short-term investment, as is the case of non-life insurance companies (see, inter alia, Arena 2008; Brainard 2008).

The degree to which insurance market activities are pervasive in a country is believed to be largely a function of four factors. First, the affordability⁵ of insurance; second, the amount of regulation imposed on the insurance industry by the host government; third, the amount of risk and uncertainty that the people in the society perceive in their lives; and fourth, the degree to which these individuals want to minimize these perceived risks by purchasing insurance rather than relying on the other mechanisms to hedge risks (see, inter alia, Pradhan et al. 2017; Lee et al. 2013a, 2013b; Park et al. 2002; Soo 1996).

At the empirical level, a large section of finance-growth work assesses the impact of the banking sector on economic growth. It shows that the banking sector development contributes to economic growth (see, inter alia, King and Levine 1993), and that there is a positive causal relationship between the two (see, inter alia, Levine 1999; Levine et al. 2000). Similarly, the impact of stock market on economic growth has been studied extensively, justifying the belief that stock market development contributes to economic growth (see, inter alia, Beck and Levine 2004; Caporale et al. 2004; Kar et al. 2011; Levine and Zervos 1998; Arena 2008). Nevertheless, the impact of the insurance market on economic growth has not been studied as extensively as the impacts of the banking sector and stock market.⁶ In this context, our main task is to address the following. First, we examine the existence of cointegration between insurance market activities and economic growth; second, we observe the presence of long-run and short-run direction of causality between the two; and third, we distinguish the particular effects⁷ of life and non-life insurance activities on economic growth.

The literature indicates insurance market activities contribute to economic growth to a great extent (see, inter alia, Chen et al. 2012; Adams et al. 2009; Kugler and Ofoghi 2005). However, it is possible that insurance market activities are also equally exaggerated by economic growth. This means, in practice, insurance market activities and economic growth can Granger cause each other, and hence, there is a prospect of feedback relationship between the two. Overall, there are four possible hypotheses to signify the Granger causal relationship between insurance market activities and economic growth (Pradhan et al. 2017; Alhassan and Fiador 2014; Ward and Zurbruegg 2000).

First, the *supply-leading hypothesis (SLH)*, which posits that insurance market activities are a necessary pre-condition to economic growth. Here, the Granger causality runs from insurance market activities to economic growth. The studies supporting SLH are Alhassan and Biekpe (2016), Pradhan et al. (2017, 2015), Alhassan and Fiador

(2014), Chang et al. (2014), Lee et al. (2013a, 2013b), Guochen and Wei (2012), Lee (2011), Adams et al. (2009), Kugler and Ofoghi (2005), and Boon (2005).

Second, the *demand-following hypothesis (DFH)*, which posits that Granger causality runs from economic growth to insurance market activities. The studies supporting DFH are Alhassan and Biekpe (2016), Pradhan et al. (2015a, 2015b), Chang et al. (2014), Ching et al. (2010), Guochen and Wei (2012), Lee (2011), Kugler and Ofoghi (2005), Beck and Webb (2003), and Ward and Zurbruegg (2000).

Third, the *feedback hypothesis (FBH)*, which posits that economic growth and insurance market activities Granger cause each other. The studies supporting FBH are Alhassan and Biekpe (2016), Chang et al. (2014), Pradhan et al. (2014, 2015a, 2015b), Guochen and Wei (2012), Kugler and Ofoghi (2005), Ward and Zurbruegg (2000), and Beck and Webb (2003).

Fourth, the *neutrality hypothesis (NLH)*, which posits that economic growth and insurance market activities do not Granger cause each other. The studies supporting NLH are Pradhan et al. (2015a, 2015b), Akinlo (2013), Chang et al. (2014), Chau et al. (2013), Guochen and Wei (2012), and Nejad and Kermani (2012).

Table 8 presents a brief summary of the relationship between insurance market activities and economic growth (see Appendix A). The aim of our study is to validate these four claims in the 19 Eurozone countries. This kind of analysis has received less attention in the literature. This study adds to the scant literature on the insurance-growth nexus by finding an answer to the question, “Are insurance market activities in Eurozone countries “*supply-leading*,” “*demand-following*,” or “*feedback*?””

An outline of insurance market density in the Eurozone countries

As emphasized above, insurance market activities and economic growth are broadly inter-related, in the process of economic development (Pradhan et al., 2014). There are two diverse ways to address the relationship between insurance market activities and economic growth. First, the regional disparity between insurance market activities and economic growth; and second, the causal relationship between the two. This paper deals with both the issues for the 19 Eurozone countries during the period from 1980 to 2014.

This section discusses the brief profile of Eurozone countries (see Appendix B), an outline of insurance market activities in these countries, and conventional facts on the insurance markets covered in this study. The highlights of this issue will give a theoretical evidence to examine the empirical relationship between insurance market activities and economic growth in these selected countries.

It may be noted that, like banking and stock market activities, the coverage of insurance market activities is extensively wide. There are many insurance market activities that can exhibit the coverage and status of insurance market. At large, there are two important insurance market activities that exemplify the status of insurance market. These are insurance market density (IMD) and insurance market penetration (IMP). Both are again projected in three different ways, namely life insurance, non-life insurance, and total insurance (both life and non-life). This paper precisely confines its analysis to IMD⁸ activities and their causal link with economic growth in the studied Eurozone countries.

Characteristically, we intend to examine the trend and regionalization of IMD activities in the Eurozone. We highlight here three activities of IMD, namely life insurance density (LID), non-life insurance density (NID), and total insurance (both life and non-life) density (TID). A detailed discussion of these variables is available in Appendix C (see Table 9). We use annual data of these variables for both regional disparity discussion and Granger causality investigation. These were obtained from the *World Development Indicators* of the World Bank and *Sigma Economic & Research Consulting* of Switzerland.

The study first examines the trend of insurance market activities before studying the Granger causal relationship with economic growth. We present the trend of these activities in four different time periods from 1980 to 2014. These time periods are: Period 1— 1980 to 2000, Period 2— 2001 to 2007, Period 3— 2008 to 2014, and Period 4— 1980 to 2014. These four categorizations have been made with reference to the global financial crisis in the year 2007-2008. The idea is to know the trend of insurance market before and after the global financial crisis, and how the deviation of this market behaves with respect to its overall average from 1980 to 2014. We choose this particular time period on the basis of data availability in the archives.

This study presents the salient facts of three IMD activities across the 19 Eurozone countries. These countries are Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.

First, the level of life insurance density (LID) is moderately high in comparison to non-life insurance density (NID). This is true for most of the Eurozone countries.

Second, the volume of LID is relatively high in Finland, Ireland, France, and Luxembourg, while it is proportionally low in Latvia, Lithuania, Estonia, and Slovakia. This is true for all the the four time periods.

Third, the volume of NID is considerably high in the Netherlands, Luxembourg, Germany, and Austria, while it is relatively low in Lithuania, Latvia, Estonia, and Slovakia. This is again true for all the four time periods.

Fourth, the volume of TID has great intensity in the Netherlands, Finland, Ireland, Luxembourg, and Belgium, while it is low in Lithuania, Latvia, Estonia, and Slovakia. This is significantly true for all the time periods.

Fifth, the insurance density values are substantially low for Lithuania, Latvia, Estonia, and Slovakia for all the three cases and all the time periods.

Sixth, for all the three insurance density indicators, the Netherlands, Ireland, and Luxembourg record the highest values in all the four time periods.

To summarize, insurance market density (for LID, NID, and TID) is considerably low in Lithuania, Latvia, Estonia, and Slovakia, while it is relatively high in the Netherlands, Ireland and Luxembourg. Furthermore, the extent of regional disparity measured through coefficient of variation has been declining in the Eurozone countries, which is reflected across all periods (P1-P4). The figures are not reported here in order to conserve space.

These typical IMD trends are more or less similar to economic growth trend represented by per capita gross domestic product, and are considerably true for most of the Eurozone countries. In other words, like IMD, the level of economic

growth⁹ is typically high in like group of countries like the Netherlands, Ireland, and Finland and moderately low in other similar group of countries like Lithuania, Latvia, Estonia, and Slovakia. This, hypothetically, signals that IMD and per capita economic growth have a link and can cause each other in the process of economic development. In the subsequent section, we empirically authenticate this claim in the context of the 19 Eurozone countries, both at individual country level and at the panel level.

Empirical strategy

This study uses Granger causality test to recognize the evidence of the relationship between insurance market density and economic growth using the Eurozone countries over the period of 1980 to 2014. The period is chosen on the basis of the data availability of insurance market activities (IMA). We use complete archived IMA data available at the time of study, and specifically deploy this particular period (1980-2014) for Granger causality test because of its larger sample size. We propose the following two hypotheses to be tested:

H_{1A, B}: Insurance market density in any year Granger-causes economic growth, leading to the occurrence of supply-leading hypothesis of insurance-growth nexus.

H_{2A, B}: Economic growth in any year Granger-causes insurance market density, leading to the occurrence of demand-following hypothesis of insurance-growth nexus.

On the empirical front, we deploy per capita gross domestic product (GDP¹⁰), and three IMD indicators¹¹ to validate the above two hypotheses (*H_{1A, B}* and *H_{2A, B}*).

Annual data of these variables (GDP, LID, NID, and TID) were obtained from the *World Development Indicators* of the World Bank and *Sigma Economic & Research Consulting* of Switzerland. The summary statistics of these variables¹² for each country are presented in Table 1.

The study uses the following models to identify the long-run and short-run causal relationships between insurance market density and economic growth.

$$\text{Economic Growth}_{it} = \alpha_{it} + \beta_{1i} \text{Insurance Market Density}_{it} + \varepsilon_{it} \quad (1)$$

where,

$i = 1, 2 \dots N$ represents an individual country in the Eurozone panel;

$t = 1, 2 \dots T$ refers to the time period (1980 – 2014); and.

ε_{it} is an independent and normally distributed random error with zero mean and a finite heterogeneous variance (σ_i^2).

Other variations of eq. (1) are also allowed to change the dependent variable from economic growth to insurance market density. When we look for individual country analysis, the subscript ' i ' is removed from eq. (1). The parameter β_{1i} represents the long-run elasticity estimates of economic growth with respect to insurance market density.¹³ The task was to estimate the parameters in eq. (1) and conduct panel tests on the causal nexus between the two variables. It is guessed that $\beta_{1i} > 0$, which suggests that an increase in insurance market density is likely to cause an increase in economic growth. We can also guess the presence of reverse causality by interchanging the position of insurance market density and economic growth in Eq. (1). In other words, we

Table 1 Descriptive Statistics of Variables

Countries	Variables			
	LID	NID	TID	GDP
Austria	2.65 [0.39]	2.89 [0.25]	3.10 [0.30]	1.22 [0.04]
Belgium	2.81 [0.51]	2.81 [0.24]	3.14 [0.37]	1.22 [0.04]
Cyprus	2.29 [0.48]	2.35 [0.39]	2.63 [0.43]	1.23 [0.10]
Estonia	1.31 [0.67]	1.91 [0.53]	2.02 [0.55]	1.23 [0.40]
Finland	3.11 [0.38]	2.68 [0.23]	3.25 [0.34]	1.22 [0.11]
France	2.94 [0.49]	2.83 [0.23]	3.21 [0.35]	1.21 [0.04]
Germany	2.76 [0.33]	2.91 [0.25]	3.14 [0.28]	1.22 [0.06]
Greece	1.83 [0.55]	2.01 [0.37]	2.25 [0.42]	1.18 [0.11]
Ireland	3.03 [0.46]	2.74 [0.31]	3.22 [0.40]	1.25 [0.10]
Italy	2.46 [0.73]	2.61 [0.29]	2.89 [0.46]	1.20 [0.07]
Latvia	0.90 [0.36]	1.87 [0.47]	1.92 [0.43]	1.28 [0.24]
Lithuania	1.18 [0.52]	1.57 [0.56]	1.73 [0.53]	1.18 [0.43]
Luxembourg	3.07 [0.33]	3.19 [0.13]	3.34 [0.36]	1.24 [0.10]
Malta	2.52 [0.31]	2.47 [0.12]	2.81 [0.20]	1.24 [0.08]
Netherland	2.97 [0.33]	3.06 [0.39]	3.33 [0.36]	1.21 [0.05]
Portugal	2.64 [0.46]	2.56 [0.17]	2.92 [0.31]	1.20 [0.07]
Slovakia	1.82 [0.50]	2.04 [0.35]	2.25 [0.41]	1.27 [0.09]
Slovenia	2.13 [0.48]	2.70 [0.25]	2.81 [0.29]	1.23 [0.12]
Spain	2.33 [0.64]	2.54 [0.38]	2.77 [0.45]	1.22 [0.06]
EZP	2.55 [0.70]	2.61 [0.44]	2.90 [0.53]	1.22 [0.13]

Note 1: GDP is per capita economic growth; LID is life insurance density; NID is non-life insurance density; TID is total insurance density; and EZP is Eurozone panel

Note 2: Open values represent the mean of the variables, while [] represents the standard deviation of the variables

Note 3: Values reported here are natural logs of the variables

look forward to recognize the feasibility of feedback relationship (i.e., the bidirectional causality) between insurance market density and economic growth.

The Granger causality test (Granger, 1988) is deployed here to detect the direction of causality (bidirectional/ unidirectional/ neutrality) between insurance market density and economic growth. We deploy the following regression models to observe the direction of causality between insurance market density and economic growth.

Model 1: For individual country analysis

$$\begin{aligned}
 \begin{bmatrix} \Delta \text{Economic Growth}_t \\ \Delta \text{Insurance Market Density}_t \end{bmatrix} &= \begin{bmatrix} \mu_{1INS} \\ \mu_{2INS} \end{bmatrix} + \\
 \sum_{k=1}^p \begin{bmatrix} \delta_{11INS1k}(L) \delta_{12k}(L) \\ \delta_{21INS1k}(L) \delta_{22k}(L) \end{bmatrix} \begin{bmatrix} \Delta \text{Economic Growth}_{t-k} \\ \Delta \text{Insurance Market Density}_{t-k} \end{bmatrix} &+ \begin{bmatrix} \eta_{1INS} ECT_{1t-1} \\ \eta_{2INS} ECT_{2t-1} \end{bmatrix} + \begin{bmatrix} \xi_{1INS t} \\ \xi_{2INS t} \end{bmatrix}
 \end{aligned} \quad (2)$$

The null and alternative hypotheses are to test the following:

$$\begin{aligned}
 H_0 : \delta_{12k=0} ; \text{ and } \eta_{1k} &= 0 & \text{for } k = 1, \dots, p \\
 H_A : \delta_{12k \neq 0} ; \text{ and } \eta_{1k} &\neq 0 & \text{for } k = 1, \dots, p \\
 H_0 : \delta_{21k=0} ; \text{ and } \eta_{2k} &= 0 & \text{for } k = 1, \dots, p \\
 H_A : \delta_{21k \neq 0} ; \text{ and } \eta_{2k} &\neq 0 & \text{for } k = 1, \dots, p
 \end{aligned}$$

where, ECT^{14} is error correction term, which is derived from the long-run cointegration equation; and.

ε_{it} is an independent and normally distributed random error with a zero mean and a finite heterogeneous variance (σ_i^2).

Model 2: For panel data analysis

$$\begin{bmatrix} \Delta Economic\ Growth_{it} \\ \Delta Insurance\ Market\ Density_{it} \end{bmatrix} = \begin{bmatrix} \mu_{1INSj} \\ \mu_{2INSj} \end{bmatrix} + \sum_{k=1}^p \begin{bmatrix} \delta_{11INSik}(L)\delta_{12ik}(L) \\ \delta_{21INSik}(L)\delta_{22ik}(L) \end{bmatrix} \begin{bmatrix} \Delta Economic\ Growth_{it-k} \\ \Delta Insurance\ Market\ Density_{it-k} \end{bmatrix} + \begin{bmatrix} \eta_{1INSi}ECT_{1it-1} \\ \eta_{2INSi}ECT_{2it-1} \end{bmatrix} + \begin{bmatrix} \xi_{1INSit} \\ \xi_{2INSit} \end{bmatrix} \quad (3)$$

The null and alternative hypotheses are to test the following:

$$\begin{aligned} H_0 : \delta_{12ik} &= 0 ; \text{ and } \eta_{1ik} = 0 \quad \text{for } k = 1, \dots, p \\ H_A : \delta_{12ik} &\neq 0 ; \text{ and } \eta_{1ik} \neq 0 \quad \text{for } k = 1, \dots, p \end{aligned}$$

$$\begin{aligned} H_0 : \delta_{21ik} &= 0 ; \text{ and } \eta_{2ik} = 0 \quad \text{for } k = 1, \dots, p \\ H_A : \delta_{21ik} &\neq 0 ; \text{ and } \eta_{2ik} \neq 0 \quad \text{for } k = 1, \dots, p \end{aligned}$$

where, $i = 1, 2, 3, \dots, N$ represents a country in the panel; and $t = 1, 2, 3, \dots, T$ represents a year in the panel.

This study follows the AIC¹⁵ statistic to decide the optimum lag length of these two models. Equally, the inclusion of ECT (in both Model 1 and Model 2) exclusively depends upon the condition of order of integration and the cointegrating relationship between insurance market density and economic growth. Hence, the first requirement is to check the order of integration and cointegration between the two (IMD¹⁶ and GDP). Therefore, we first deploy unit root test and cointegration test, both at the individual country as well as at the panel level, to ascertain the order of integration and the presence of cointegrating relationship between insurance market density and economic growth.

The ADF¹⁷ unit root test is used for individual country analysis, while the LLC¹⁸ panel unit root test is used for the panel setting. In the same way, Johansen Maximum Likelihood cointegration test (Johansen, 1988) is deployed for individual country analysis, while Johansen Fisher panel cointegration test is deployed for the panel setting. The details of these two tests (Johansen and Fisher/ Maddala) are not discussed here due to space constraints and can be made available on request. Additionally, it can be noted that the evidences of cointegration and causality in the panel setting may be sensitive to the assumption of cross-sectional dependence. Hence, we deployed Pesaran (2004) test of cross sectional dependence (CD) to all the four variables. However, CD-statistics do not give any significant results. The results of these statistics are not reported in order to conserve space.

Empirical results and discussion

This section begins with the stationarity issue of variables, namely GDP, LID, NID, and TID, and their cointegrating relationships.¹⁹ First, by using the unit root tests (ADF test for individual country and LLC test for panel setting), we reject the null hypothesis of unit root at the first difference, but not for the levels (see Table 2). This indicates that insurance market density (LID, NID and TID) and economic growth (GDP) are non-stationary at the level data, but are stationary at the first difference. This is true for all the Eurozone countries, both at the individual country and at the panel setting. This suggests that insurance market development (LID, NID, and TID) and economic growth are integrated of order one [i.e., $I(1)$], which opens the possibility of cointegration between the two.

In the next step, using cointegration test (Johansen Maximum Likelihood cointegration test for individual country and Johansen and Fisher/ Maddala cointegration for panel settings), we find that IMD and GDP are cointegrated, suggesting the existence of long run relationship between insurance market density and economic growth. This finding is consistent with the findings of several earlier studies (see,

Table 2 Results of Unit Root Test

Countries	Variables			
	LID	NID	TID	GDP
Austria	2.57 [−5.44*]	2.50 [−3.59*]	2.69 [−3.61*]	0.30 [−5.44*]
Belgium	2.78 [−2.27**]	1.64 [−3.89*]	2.30 [−3.59*]	−0.17 [−10.2*]
Cyprus	1.66 [−5.23*]	3.49 [−2.79*]	2.18 [−4.87*]	−0.59 [0.22]
Estonia	0.70 [−2.60*]	0.78 [−4.57*]	0.92 [−4.27*]	−0.89 [−5.58*]
Finland	2.52 [−3.68*]	2.49 [−3.32*]	2.44 [−3.05*]	−0.49 [−6.19*]
France	1.24 [−2.32*]	2.26 [−3.70*]	1.55 [−2.64*]	−0.26 [−6.21*]
Germany	3.01 [−3.38*]	2.45 [−3.40*]	2.75 [−3.36*]	−0.35 [−5.63*]
Greece	1.06 [−2.17**]	2.06 [−3.52*]	1.34 [−2.96*]	−0.12 [−5.61*]
Ireland	1.81 [−3.87*]	1.11 [−3.95*]	1.77 [−3.60*]	−0.08 [−5.91*]
Italy	4.06 [−2.98*]	2.53 [−3.41*]	4.03 [−6.45*]	−0.67 [−7.37*]
Latvia	1.21 [−2.79*]	1.11 [−1.78***]	1.33 [−1.68***]	−0.41 [−4.59*]
Lithuania	0.92 [−3.10*]	1.40 [−3.18*]	0.84 [−3.18*]	−0.74 [−3.70*]
Luxembourg	1.82 [−4.92*]	2.27 [−2.55*]	2.02 [−4.00*]	−0.23 [−6.52*]
Malta	−0.17 [−1.38***]	0.26 [−5.82*]	1.63 [−3.74*]	−0.13 [−6.43*]
Netherlands	1.68 [−4.11*]	2.36 [−4.25*]	2.53 [−4.08*]	−0.12 [−6.53*]
Portugal	2.50 [−3.67*]	1.28 [−3.01*]	3.00 [−3.74*]	−1.60 [−5.04*]
Slovakia	1.41 [−1.89***]	1.18 [−2.20**]	1.49 [−2.04**]	−0.15 [−6.24*]
Slovenia	0.70 [−1.71***]	1.55 [−2.57**]	1.29 [−2.17**]	−0.46 [−4.99*]
Spain	0.61 [−4.93*]	1.26 [−2.80*]	1.54 [−4.26*]	−0.09 [−6.31*]
EZP	4.39 [155.1*]	5.54 [184.4*]	5.41 [167.8*]	21.7 [486.9*]

Note 1: GDP is per capita economic growth; LID is life insurance density; NID is non-life insurance density; TID is total insurance density; and EZP is Eurozone panel

Note 2: Open values represent the ADF statistics of the variables at the level data, while [] represents the ADF statistics of the variables at the first difference data

Note 3: ADF is Augmented Dickey Fuller test statistics

Note 4: The investigation is done at three levels- no trend and intercept, with intercept, and with both intercept and trend. The results are more or less uniform; however, the reported statistics in the table present the ADF statistics at no trend and no intercept

Note 5: * is statistical significance at 1% level; ** is statistical significance at 5% level; and *** is statistical significance at 10% level

inter alia, Petkovski and Jordan 2014; Pradhan et al. 2017). However, cointegration between GDP and IMD does not exist in some Eurozone countries. These exceptions are Cyprus, Finland, Greece, Latvia, Lithuania, Malta, Slovakia, and Slovenia (see Table 3). A summary of these findings has been highlighted in Table 4.

The next step is to determine the direction of causality between insurance market density and per capita economic growth. The Granger causality test, based on vector error correction model (VECM²⁰), was deployed to test the direction of Granger causality between insurance market density and per capita economic growth. The estimated results of this section are reported in Tables 5, 6 and 7. Table 5 reports both short-run and long-run estimates²¹ of VECM/VARM, while Tables 6 and 7 report the summary of short-run Granger causality results.

Table 5 reports the presence of a long-run equilibrium relationship between insurance market density and economic growth, while Tables 6 and 7 report the short-run Granger causality between the two. The analysis is based on three individual indicators of insurance market density (such as LID, NID, and TID) and economic growth. With respect to long-run equilibrium relationship, we find the

Table 3 Results of Cointegration Test

Countries	Variables (with GDP)					
	LID		NID		TID	
	λ_{Tra}	λ_{Max}	λ_{Tra}	λ_{Max}	λ_{Tra}	λ_{Max}
	$r = 0; r = 1$	$r = 0; r = 1$	$r = 0; r = 1$	$r = 0; r = 1$	$r = 0; r = 1$	$r = 0; r = 1$
	$[r \leq 1; r = 2]$	$[r \leq 1; r = 2]$	$[r \leq 1; r = 2]$	$[r \leq 1; r = 2]$	$[r \leq 1; r = 2]$	$[r \leq 1; r = 2]$
Austria	22.5** [3.77]	18.7** [3.77]	22.2** [2.02]	20.1** [2.02]	21.95** [2.65]	19.3** [2.65]
Belgium	17.2** [1.87]	15.35** [1.89]	13.8 [1.68]	16.1** [1.68]	15.5** [1.69]	13.8 [1.69]
Cyprus	11.3 [3.79]	7.49 [3.79]	13.4 [3.07]	10.3 [3.07]	11.1 [2.80]	8.28 [2.80]
Estonia	18.8** [2.41]	16.4** [2.41]	20.4** [1.62]	18.8** [1.62]	13.7 [2.07]	11.6 [2.07]
Finland	13.9 [1.22]	12.6 [1.22]	14.9 [2.62]	12.3 [2.62]	14.2 [1.42]	12.8 [1.42]
France	18.4** [4.62**]	15.7** [4.62]	15.5** [3.84]	15.5** [4.62**]	17.0** [3.18]	13.8 [3.18]
Germany	24.8** [3.25]	21.5** [3.25]	23.8** [3.03]	20.8** [3.03]	24.3** [3.06]	21.2** [3.06]
Greece	14.5 [3.23]	9.29 [3.23]	12.9 [0.69]	12.3 [0.64]	12.2 [1.37]	10.9 [1.37]
Ireland	20.6** [3.29]	17.3** [3.29]	17.5** [3.78]	8.69 [3.78]	19.2** [3.46]	15.7** [3.46]
Italy	22.0** [4.01**]	18.0** [4.01**]	18.5** [5.36**]	18.5** [5.36**]	19.9** [4.11**]	16.9** [4.11**]
Latvia	13.7 [0.70]	13.0 [0.70]	10.3 [2.06]	8.18 [2.06]	8.37 [1.58]	6.79 [1.58]
Lithuania	46.8** [10.9**]	35.9** [10.9**]	20.1** [2.28]	17.8** [2.28]	39.6** [13.0**]	126.6** [13.0**]
Luxembourg	16.4** [0.39]	15.9** [0.39]	11.9 [0.32]	11.6 [0.32]	12.9 [3.15]	9.76 [3.15]
Malta	13.8 [3.15]	9.68 [3.15]	17.0** [4.38**]	14.6** [4.38**]	16.1** [2.67]	14.5** [2.67]
Netherlands	22.2** [5.45**]	16.8** [5.45**]	17.9** [0.34]	17.5** [0.34]	18.3** [1.80]	16.5** [1.80]
Portugal	17.6** [3.84**]	15.2** [3.84**]	12.6 [1.73]	10.9 [1.73]	16.4** [1.08]	15.3** [1.08]
Slovakia	22.7** [3.94**]	18.8** [3.94**]	10.2 [2.32]	7.90 [2.32]	12.6 [3.13]	9.49 [3.13]
Slovenia	13.9 [2.12]	12.8 [2.12]	12.4 [2.65]	11.7 [2.65]	13.5 [3.38]	12.2 [3.38]
Spain	13.8 [3.00]	9.79 [3.00]	12.0 [3.29]	8.70 [3.29]	14.1 [3.91]	10.2 [3.91]
EZP	170.0** [113**]	136** [113**]	109** [77.3**]	94.4** [77.3**]	141** [91**]	117** [91**]

Note 1: GDP is per capita economic growth; LID is life insurance density; NID is non-life insurance density; TID is total insurance density; and EZP is Eurozone panel

Note 2: r is the co-integrating vector

Note 3: The cointegration test conclusions are reported on the basis of Johansen and Juselius test

Note 4: ** is statistical significance at 5% level

Note 5: The Johansen test follows the assumptions 'no trend and no intercept'

Table 4 Summary of Cointegration Test Results

Cointegrated			Not Cointegrated		
Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
Austria (1)	Austria (1)	Austria (1)			
Belgium (1)	Belgium (1)	Belgium (1)			
			Cyprus (0)	Cyprus (0)	Cyprus (0)
Estonia (1)	Estonia (1)				Estonia (0)
			Finland (0)	Finland (0)	Finland (0)
France (2)	France (2)	France (1)			
Germany (1)	Germany (1)	Germany (1)			
			Greece (0)	Greece (0)	Greece (0)
Ireland (1)	Ireland (1)	Ireland (1)			
Italy (2)	Italy (2)	Italy (2)			
			Latvia (0)	Latvia (0)	Latvia (0)
Lithuania (2)	Lithuania (1)	Lithuania (2)			
Luxembourg (1)				Luxembourg (0)	Luxembourg (0)
	Malta (2)	Malta (1)	Malta (0)		
Netherlands (2)	Netherlands (1)	Netherlands (1)			
Portugal (2)		Portugal (1)		Portugal (0)	
Slovakia (2)				Slovakia (0)	Slovakia (0)
Slovenia (0)	Slovenia (0)	Slovenia (0)			
Spain (0)	Spain (0)	Spain (0)			
EZP (2)	EZP Panel (2)	EZP panel (2)			

Note 1: Case 1: cointegration between *LID* and GDP; Case 2: cointegration between *NID* and GDP; and Case 3: cointegration between *TID* and GDP

Note 2: GDP is per capita economic growth; LID is life insurance density; NID is non-life insurance density; TID is total insurance density; and EZP is Eurozone panel

Note 3: 0 stands for absence of cointegration between insurance market density (LID/ NID/ TID) and per capita economic growth, 1 stands for presence of one cointegrating vector between insurance market density (LID/ NID/ TID) and per capita economic growth, and 2 stands for presence of two cointegrating vectors between insurance market density (LID/ NID/ TID) and per capita economic growth

Note 4: Parentheses indicate number of cointegrating vector(s)

Note 5: Results are derived on the basis of Table 3 results

presence in a few situations and absence in other situations. This is true while studying Granger causality from insurance market density (LID/NID/TID) to per capita economic growth, and vice versa. On the other hand, we have an experience of divergence in the context of short-run Granger causality between insurance market density and economic growth. The results of this section are presented below.

Case 1: Between life insurance density and per capita economic growth

For Belgium, Cyprus, Estonia, Finland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, and Portugal, there is a unidirectional causality from life insurance market density (LID) to economic growth (GDP) [$LID = > GDP$]. This supports the *supply-leading hypothesis* (SLH^1) of insurance market-growth nexus (see column 5 of Table 6). This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2017), Alhassan and Fiador (2014), Webb et al. (2005a), Chang et al. (2014), Guochen and Wei (2012), Lee (2011),

Table 5 Results of Test from the Vector Error Correction Model for Long-Run Causality

Countries	Dependent Variables		
	LID/ GDP	NID/ GDP	TID/ GDP
Austria	- 0.19/ -3.34**	-0.41/ -3.40**	-0.33/ -3.35**
Belgium	-01.3/ -3.90**	-0.12/ -3.13**	0.25/ -3.50**
Cyprus	----/ ----	----/ ----	----/ ----
Estonia	0.23/ -3.29**	-2.91/ -3.22**	-0.94/ -3.85**
Finland	----/ ----	----/ ----	----/ ----
France	-0.84/ -3.67**	-0.49/ -3.30**	-0.74/ -2.95**
Germany	1.37/ -4.99**	1.40/ -4.95**	1.39/ -4.96**
Greece	----/ ----	----/ ----	----/ ----
Ireland	2.39/ 0.82	1.78/ -1.23	2.33/ 0.14
Italy	2.05/ -3.24**	2.03/ -1.62	2.26/ -3.08**
Latvia	----/ ----	----/ ----	----/ ----
Lithuania	----/ ----	----/ ----	----/ ----
Luxembourg	0.63/ -2.05	----/ ----	----/ ----
Malta	----/ ----	----/ ----	----/ ----
Netherlands	0.62/ -2.58	-0.86/ -2.95**	-1.77/ -3.63**
Portugal	-0.80/ -2.88**	----/ ----	0.44/ -3.67**
Slovakia	----/ ----	----/ ----	----/ ----
Slovenia	----/ ----	----/ ----	----/ ----
Spain	-2.02/ -2.34	----/ ----	----/ ----
EZP	-11.98**/ -3.76**	-10.10**/ -3.49**	-10.9**/ -4.27**

Note 1: GDP is per capita economic growth; LID is life insurance density; NID is non-life insurance density; TID is total insurance density; and EZP is Eurozone panel

Note 2: The figures are the t-coefficients of lagged error correction term

Note 3: ** is statistical significance at 5% level

Arena (2008), Kugler and Ofoghi (2005), and Catalan et al. (2000). For, Germany, Greece, Slovakia, and Slovenia, we find the presence of unidirectional causality from economic growth to life insurance density [GDP = > LID]. This supports the *demand-following hypothesis* (DFH^1) of insurance market-growth nexus. This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2015a, 2015b), Chang et al. (2014), Guochen and Wei (2012), Lee (2011), Ching et al. (2010), and Catalan et al. (2000). Furthermore, for Ireland, Italy, and the European Zone panel, there is a bidirectional causality between life insurance density and economic growth [LID <= > GDP]. This supports the *feed-back hypothesis* (FBH^1) of insurance market-growth nexus.²² This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2015a, 2015b), Chang et al. (2014), Guochen and Wei (2012), and Kugler and Ofoghi (2005).

Case 2: Between non-life insurance density and per capita economic growth

For Cyprus, France, Lithuania, Luxembourg, the Netherlands, and Slovenia, there is a unidirectional causality from non-life insurance market density (NID) to economic growth [NID = > GDP], offering support to the *supply-leading hypothesis* (SLH^2) of insurance market-growth nexus. This finding is consistent with the

Table 6 Granger Causality Test Results for the Short run

Countries	Possible Granger Causalities			Granger Causality Inferences
	GDP vs. LID	GDP vs. NID	GDP vs. TID	
Austria	1.70/ 1.48	1.17/ 3.46**	1.15/ 2.74	NLH ¹ , DFH ² , NLH ³
Belgium	5.90**/ 0.50	1.23/ 0.78	3.20**/ 0.71	SLH ¹ , NLH ² , SLH ³
Cyprus	4.83**/ 0.12	7.89**/ 2.05	5.84**/ 0.10	SLH ¹ , SLH ² , SLH ³
Estonia	12.1**/ 0.34	7.20**/ 17.1**	15.9**/ 1.88	SLH ¹ , FBH ² , SLH ³
Finland	3.81**/2.68	5.04**/ 5.83**	4.40**/ 3.01**	SLH ¹ , FBH ² , FBH ³
France	1.81/ 0.61	5.68**/ 1.70	3.25**/ 0.05	NLH ¹ , SLH ² , SLH ³
Germany	0.51/ 3.39**	0.75/ 3.35**	0.61/ 3.57**	DFH ¹ , DFH ² , DFH ³
Greece	0.74/ 7.21**	1.69/ 8.93**	1.39/ 8.60**	DFH ¹ , DFH ² , DFH ³
Ireland	17.4**/ 4.12**	0.64/ 3.19**	8.82**/ 4.10**	FBH ¹ , DFH ² , FBH ³
Italy	10.5**/ 4.64**	0.69/ 3.15**	5.46**/ 5.60**	FBH ¹ , DFH ² , FBH ³
Latvia	4.93**/ 0.19	6.24**/ 4.68**	5.19**/ 3.41**	SLH ¹ , FBH ² , FBH ³
Lithuania	10.9**/ 2.96	8.20**/ 0.81	3.93**/ 3.42**	SLH ¹ , SLH ² , FBH ³
Luxembourg	4.70**/ 1.91	3.86**/ 0.02	4.85**/ 0.94	SLH ¹ , SLH ² , SLH ³
Malta	4.95**/ 2.04	0.41/ 5.35**	0.14/ 6.70**	SLH ¹ , DFH ² , DFH ³
Netherland	4.95**/2.04	3.60**/ 1.63	10.8**/ 5.44**	SLH ¹ , SLH ² , FBH ³
Portugal	3.81**/ 1.12	1.78/ 8.85**	3.89**/ 2.85	SLH ¹ , DFH ² , SLH ³
Slovakia	1.13/ 4.62**	1.64/ 6.96**	3.81**/ 8.47**	DFH ¹ , DFH ² , FBH ³
Slovenia	0.74/ 4.40**	3.41**/ 2.52	3.03**/ 2.73	DFH ¹ , SLH ² , SLH ³
Spain	1.61/ 2.46	3.23**/ 7.55**	0.31/ 7.72**	NLH ¹ , FBH ² , DFH ³
EZP	18.63**/ 4.23**	5.78**/ 6.25**	4.13**/ 6.23**	FBH ¹ , FBH ² , FBH ³

Note 1: GDP is per capita economic growth; LID is life insurance density; NID is non-life insurance density; TID is total insurance density; and EZP is Eurozone panel

Note 2: FBH is feedback hypothesis between per capita economic growth and insurance market density; SLH is supply leading hypothesis from insurance market density to per capita economic; DFH is demand following hypothesis from per capita economic growth to insurance market density; and NLH is neutrality hypothesis between per capita economic growth and insurance market density

Note 3: ¹: Granger causality between LID and GDP; ²: Granger causality between NID and GDP; and ³: Granger causality between TID and GDP

Note 4: ** is statistical significance at 5% level

Note 5: The reported figures are Wald test statistics

findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2017), Alhassan and Fiador (2014), Chang et al. (2014), Guochen and Wei (2012), Lee (2011), Arena (2008), Kugler and Ofoghi (2005), Webb et al. (2005a), and Catalan et al. (2000). For, Austria, Germany, Greece, Ireland, Italy, Malta, Portugal, and Slovakia, we find the presence of unidirectional causality from economic growth to non-life insurance density [GDP = > NID], lending support the *demand-following hypothesis* (DFH²) of insurance market-growth nexus. This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2015a, 2015b), Chang et al. (2014), Guochen and Wei (2012), Lee (2011), and Catalan et al. (2000). Furthermore, for Estonia, Finland, Latvia, Spain, and the European Zone panel, there is a bidirectional causality between non-life insurance density and economic growth (NID < => GDP), testifying the presence of *feedback hypothesis* (FBH²) of insurance market-growth nexus. This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2015a, 2015b), and Chang et al. (2014).

Table 7 Summary of Granger Causality Test Results

Supply-leading hypothesis of insurance-growth nexus			Demand-following hypothesis of insurance-growth nexus		
Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
Belgium		Belgium		Austria	
Cyprus	Cyprus	Cyprus	Germany	Germany	Germany
Estonia		Estonia	Greece	Greece	Greece
Finland				Ireland	
	France	France		Italy	
Latvia				Malta	Malta
Lithuania	Lithuania			Portugal	
Luxembourg	Luxembourg	Luxembourg	Slovakia	Slovakia	
Malta			Slovenia		
Netherlands	Netherlands				Spain
Portugal		Portugal			
	Slovenia	Slovenia			
Feedback hypothesis of insurance-growth nexus			Neutrality hypothesis of insurance-growth nexus		
Case 1	Case 2	Case 3	Case 1	Case 2	Case 3
	Estonia		Austria		Austria
	Finland	Finland		Belgium	
Ireland		Ireland	France		
Italy		Italy	Spain		
	Latvia	Latvia			
		Lithuania			
		Netherlands			
		Slovakia			
	Spain				
EZP	EZP	EZP			

Note 1: Case 1: Granger causality between *LID* and GDP; Case 2: Granger causality between *NID* and GDP; and Case 3: Granger causality between *TID* and GDP

Note 2: GDP is per capita economic growth; LID is life insurance density; NID is non-life insurance density; TID is total insurance density; and EZP is Eurozone panel

Note 3: Results are derived on the basis of Table 6 results

Case 3: Between total insurance density and per capita economic growth

For Belgium, Cyprus, Estonia, France, Luxembourg, Portugal, and Slovenia, there is a unidirectional causality from total insurance market density (TID) to economic growth [$TID \Rightarrow GDP$], lending support to the *supply-leading hypothesis* (SLH^3) of insurance market-growth nexus. This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2017), Alhassan and Fia-dor (2014), Chang et al. (2014), Guochen and Wei (2012), Nejad and Kermani (2012); Kugler and Ofoghi (2005), Boon (2005), and Ward and Zurbruegg (2000). For, Germany, Greece, Malta, and Spain, we find the presence of unidirectional causality from economic growth to total life insurance density [$GDP \Rightarrow TID$], thus supporting the *demand-following hypothesis* (DFH^3) of insurance market-growth nexus. This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), Pradhan et al. (2015a, 2015b), Chang et al. (2014), and Guochen and Wei (2012). Additionally, for Finland, Ireland, Italy, Latvia,

Lithuania, the Netherlands, Slovakia, and the European Zone panel, there is a bi-directional causality between total insurance density and economic growth ($TID \rightleftharpoons GDP$), supporting the *feedback hypothesis* (FBH^3) of insurance market-growth nexus. This finding is consistent with the findings of earlier studies by Alhassan and Biekpe (2016), and Pradhan et al. (2015a, 2015b).

We have also studied the relationship between insurance market activities and economic growth at the multivariate level by deploying three additional variables, such as financial depth,²³ government consumption expenditure, and young dependency population. Here, we observe six cases, depending upon the deployment of three insurance market activities (life insurance density, non-life insurance density and total insurance density), and two financial depth indicators. The results of this section are reported in Appendix D (see Tables 10–11). The findings of this multivariate analysis are more or less similar to the findings of bivariate analysis. In the long-run, we find economic growth tends to converge to its long-run equilibrium path in response to changes in insurance market activities and three macroeconomic indicators.²⁴ This is relatively true for all these six cases considered. However, in the short-run, we find both bidirectional and unidirectional Granger causality between economic growth, insurance market activities, financial depth, government consumption expenditure, and young dependency of population among our panel of countries.

Conclusions

This study explored the nexus between the insurance market and economic growth for the Eurozone countries using time series data from 1980 to 2014. The focal message from our study for both policymakers and researchers is that implications drawn from research on per capita economic growth that excludes the dynamic interrelation of these two variables will be imperfect. It is the conjoined back-and-forth relationship between insurance market and economic growth, that is, the stand point of our study and directs future research in this field.

Our study finds mixed evidence on the interrelationship between insurance market density and economic growth in the Eurozone countries, both at the individual country level and at the panel setting. On some occasions, insurance market density leads to economic growth, lending support to *supply-leading hypothesis* of insurance market-growth nexus. On other occasions, economic growth leads to insurance market density, providing support to *demand-following hypothesis* of insurance market-growth nexus. For countries that support the *supply-leading hypothesis*, we could argue that insurance market activities are fully developed in those countries, and hence, contribute to economic growth. However, in countries that support the *demand-following hypothesis*, we may argue that insurance market activities in these countries, even though growing during this period, are either deficient or have impacted economic growth indirectly, possibly through other financial indicators like banks and stock markets. The latter part is, in fact, beyond the scope of this study. There are also situations, where insurance market density and economic growth are interdependent on each other, offering support to the *feedback hypothesis* of insurance market-growth nexus. In addition, there are also cases, where insurance market density and economic growth are independent of each other, lending support to

the *neutrality hypothesis* of insurance-growth nexus. These findings are on the lines of Chang et al.²⁵ (2014), Guochen and Wei²⁶ (2012), and Pradhan et al.²⁷ (2015a, 2015b).

Finally, the study suggests that in order to promote per capita economic growth, attention must be paid to policies that promote the insurance market. This requires an efficient allocation of financial resources combined with wide-ranging movement in the insurance market. Furthermore, establishing a well-developed financial system, particularly with reference to the insurance market, can facilitate further investment and easier means of raising capital to support economic development. Given the possibility of reverse causality or bi-directional causality on some occasions, policies that increase economic growth (such as steps to increase investment) would be desirable to bring insurance market development. Therefore, it is recommended that the government be proactive if it aims to develop the insurance market and integrate it with economic growth.

No doubt, in the globalization era, many developing countries have recognized the importance of financial market development for high economic growth. Accordingly, there has been a change of strategy to refine their financial system. Earlier studies mostly focused on both banking and stock markets and their link with economic growth to stimulate the financial development. However, there is now a need to concentrate on the insurance market by eliminating some of the hindrances in the insurance market-growth nexus, such as tax and regulatory framework, and drive towards more insurance market activities.

To summarize, government must be attentive in its attempts to bring stable financial environment in order to promote the link between insurance market and economic growth. This study is restricted to insurance market density only, and particularly in a bivariate framework of insurance-market growth nexus. It is also one of the major limitations of this empirical investigation. Future studies can include insurance market penetration and other relevant variables, like interest rates or other financial indicators, to gain better inference of the link between the insurance market and economic growth.

Endnotes

¹It involves the development of banking sector, stock markets, and insurance markets. However, a majority of the studies largely focus on banking sector and stock markets; and neglect the insurance market (see, inter alia, Azman-Saini and Smith, 2011).

²They have emerged as a vital component of new marketplace financial restructuring (see, inter alia, Cristea et al., 2014).

³See, for example, Alhassan and Biekpe (2016); Liu and Lee (2014); Guo and Huang (2013); Chang et al. (2013); Altunbas and Thornton (2013); Ghosh (2013); Garcia (2012); Chang and Lee (2012); Azman-Saini and Smith (2011); Guochen and Wei (2012); Lee (2011); Han et al. (2010); Nektarios (2010); Webb et al. (2005); Enz (2000); Moshirian (1999); Outreville (1990); Wasow and Hill (1986); and Beenstock et al. (1986).

⁴Eurozone is a group, instituted in 1957, when the Treaty of Rome created the European Economic Community. This group is a subset of European Union that has fully incorporated the Euro as their sole national currency (see, inter alia, Pegkas 2015). The choice of

this group, for our empirical investigation, is mostly due to lack of literature in this problem area, and the subsequent data availability for the insurance market activities.

⁵Beck and Demirguc-Kunt (2009) find that life and non-life insurance density increase with the income level of the country. However, the trend of life insurance coverage is more income-elastic than non-life insurance. Therefore, the inclusion of financial depth of a nation is an equally important consideration for research (see, inter alia, Enz 2000).

⁶Exceptions are Pradhan et al. 2014; Hassan et al. 2011; and Andersson et al. 2010 (see, Table 8 for more details).

⁷Both life and non-life insurance activities promote economic growth in their own way. This is because factors affecting life insurance activities are normally different from those of non-insurance activities (see, inter alia, Pan et al. 2012).

⁸The consideration of IMD over IMP is due to paucity of research in this area (see, inter alia, Park et al., 2002). Additionally, since we consider per capita gross domestic product as an indicator to economic growth while studying the Granger causality between the two (see details in Empirical strategy), the choice of insurance market density is a better combination in comparison to insurance market penetration.

⁹The trend of economic growth is not reported here due to space restrictions and can be made available on demand.

¹⁰It is considered as a percentage change of per capita gross domestic product.

¹¹It includes LID, NID, and TID. The detailed discussion is available in Appendix C (see Table 9).

¹²All these variables were converted into their natural logarithms for estimation purposes.

¹³This includes the individual involvement of LID, NID, and TID separately (see Table 9).

¹⁴The inclusion of ECT in the regression model depends upon the presence of cointegration between insurance market density (LID/ NID/ TID) and economic growth. ECT needs to be removed in the estimation process, if the insurance market density and economic growth are not cointegrated.

¹⁵AIC stands for Akaike Information Criterion (Akaike, 1974).

¹⁶IMD involves the deployment of LID, NID, and TID, separately.

¹⁷ADF stands for Augmented Dickey Fuller test (Dickey and Fuller, 1981).

¹⁸LLC stands for Levine-Lin-Chu (Levine et al., 2002).

¹⁹We have three cases to observe the cointegration relationships between GDP and IMD, depending upon the deployment of three IMD indicators, namely LID, NID and TID. These three cases are: Case 1 — between GDP and LID; Case 2— between GDP and NID; and Case 3— between GDP and TID).

²⁰It is used with the condition that both IMD and GDP are cointegrated. However, simple vector autoregressive model (VARM) is deployed for the absence of cointegration between the two.

²¹The availability of ECT is in the case of VECM only.

²²The detailed discussion of these hypotheses are available in Pradhan et al. (2015a, 2015b).

²³It includes both liquid liabilities (LIQ) and private credit by deposit money banks and other financial institutions (PCO).

²⁴It is judged on the basis of the significance of error correction term.

²⁵In the context of 10 OECD countries for the period 1979-2006.

²⁶In the context of China for the period 2006-2011.

²⁷In the context of G-20 countries for the period 1980-2011.

Appendix A: Review of Literature between Insurance Market Activities and Economic Growth

Table 8 Summary of Studies on the Relationship between Insurance Market Activities and Economic Growth

Research Reviews	Study Area	Time Period	Inferences
Adams et al. (2009)	Sweden	1830-1998	SLH
Akinlo (2013)	Nigeria	1986-2010	NLH
Alhassan and Biekpe (2016)	8 African countries	1990-2010	DFH, SLH, FBH
Alhassan and Fiador (2014)	Ghana	1990-2010	SLH
Arena (2008)	56 countries	1976-2004	SLH
Avram et al. (2010)	93 countries	1980-2006	SLH
Beenstock et al. (1986)	12 OECD countries	1970-1981	DFH
Boon (2005)	Singapore	1991-2002	SLH
Catalan et al. (2000)	14 OECD countries	1975-1997	DFH, SLH
Chang et al. (2014)	10 OECD countries	1979-2006	SLH, DFH, FBH, NLH
Chau et al. (2013)	Malaysia	1970-2002	NEH
Chen et al. (2012)	60 countries	1976-2005	SLH
Ching et al. (2010)	Malaysia	1997-2008	DFH
Esho et al. (2004)	44 countries	1984-1998	DFH
Ghosh (2013)	India	1990-2008	SLH
Guochen and Wei (2012)	China	2006-2011	SLH, DFH, FBH, NLH
Haiss and Sumegi (2008)	29 European countries	1992-2005	SLH
Han et al. (2010)	77 countries	1994-2005	SLH
Jahromi and Goudarzi (2014)	Iran	1981-2011	FBH
Kugler and Ofoghi (2005)	United Kingdom	1966-2003	DFH, FBH
Lee et al. (2013a, 2013b)	6 Developed countries	1979-2007	SLH
Lee (2011)	10 OECD countries	1979-2006	SLH, DFH
Pradhan et al. (2014)	G-20 countries	1980-2012	DFH, FBH
Pradhan et al. (2015a, 2015b)	34 OECD countries	1980-2011	SLH, DFH, FBH, NLH
Ward and Zurbuegg (2000)	9 OECD countries	1961-1996	DFH
Webb et al. (2005a)	55 countries	1980-1996	SLH

Note 1: SLH is supply-leading hypothesis, indicating unidirectional causality from insurance market to economic growth; DFH is demand-following hypothesis, indicating unidirectional causality from economic growth to insurance market; FBH is feedback hypothesis, indicating bidirectional causality between insurance market and economic growth; NLH is neutrality hypothesis, indicating absence of causality between insurance market and economic growth

Note 2: OECD is Organization for Economic Cooperation and Development; and G-20 means the elite Group of 20 countries

Appendix B: Brief Profile of Eurozone

Historically, Eurozone was officially formed on first January, 1999 in order to extend the European Union's provisions on its internal market to countries in the European Free Trade Area. This group is also called the euro area, a monetary union of 19 of the 28 European Union (EU) member states which have adopted euro as their common currency. The other nine members of the European Union continue to use their own national currencies, although most of them are obliged to adopt euro in future. The aim of this group is to extend support to promote a

continuous and balanced strengthening of trade and economic relations between the Eurozone member states, with similar conditions of competition and common rules in the internal market. The study chooses the sample of Eurozone countries to test the insurance-growth nexus. This sample has been chosen for the following reasons:

- First, the prevalence of common currency and hence, single member states cannot easily engineer a currency devaluation or any other financial strategy in order to stimulate economic growth (see, for instance, Baum et al. 2016). Hence, studying the linkage between insurance and economic growth in Eurozone countries more meaningful, as it is a homogenous cluster.
- Second, we focus on Eurozone because the countries must coordinate their economic, financial, and fiscal policies closely, much more so than other European Union (EU) member states (see, for instance, Baselga-Pascual et al. 2015; Bouheni and Hasnaoui 2017).
- Third, the insurance coverage is usually very high in Eurozone countries. It is approximately 35% of the total worldwide premium, which is the highest in the world followed by North America (30%) and Asia (28%).
- Fourth, the investment portfolio of insurance sector is also very high in Eurozone, which is equivalent to almost €1117 billion; also, the total benefits claimed are about €952 billion.
- Fifth, in Eurozone, some of the countries like France, Germany, the Netherlands, and Italy are considered as the biggest European markets for insurance (see, for instance, IES, 2014).

Appendix C: Definition of Variables

Table 9 Definition of Variables Relating to Insurance Markets and Economic Growth

Variables	Definition
LID	Life insurance²⁸ density: It is the direct domestic life premiums per capita (in US Dollars).
NID	Non-life insurance²⁹ density: It is the direct domestic non-life premiums per capita (in US Dollars).
TID	Total insurance density: It is the direct domestic premiums, both life and non-life per capita (in US Dollars).
GDP	Economic growth: It is the per capita gross domestic product (in US Dollars).
LIL	Liquid liabilities: It is the ratio of liquid liabilities (broad money supply) to gross domestic product.
PCO	Private credit: It is the private credit by deposit money banks and other financial institutions to gross domestic product.
GCE	Government consumption expenditure: It is the government consumption expenditure as a percentage of gross domestic product.
YDP	Young dependency population: It is the ratio of younger dependents-people younger than 15 years- to the working-age population.

Note: Insurance density means direct domestic premiums in USD (for life/ non-life/ total) per thousand population

²⁸Life insurance is a form of insurance coverage that pays out premiums to the insured or their specified beneficiaries upon any incident (see, iter alia, Lee and Chiu 2012; Lee et al. 2012; Pan et al. 2012)

²⁹Non-life insurance essentially consists of insurance policies that protect the insured against losses and damages other than those covered by life insurance such as property, motor, marine, transport, pecuniary loss, and aviation (see, iter alia, Chen et al. 2013; Lee et al. 2012; Pradhan et al. 2015a, 2015b)

Appendix D: Multivariate Analysis

Table 10 Panel Unit Root Test Results

Variables	Unit Root Test Statistics					
	LLC			ADF		
	LD	FD	IN	LD	FD	IN
LID	5.88	−10.0*	I [1]	2.46	164.4*	I [1]
NID	5.82	−11.4*	I [1]	2.64	188.5*	I [1]
TID	6.77	−10.8*	I [1]	1.55	173.4*	I [1]
GDP	−0.30	−24.8*	I [1]	19.1	546.4*	I [1]
LIL	4.93	−18.6*	I [1]	2.53	425.6*	I [1]
PCO	3.59	−9.47*	I [1]	6.64	150.8*	I [1]
GCE	0.97	−17.4*	I [1]	17.9	336.9*	I [1]
YDP	0.81	−6.50*	I [1]	19.9	100.7*	I [1]

Note 1: LID is life insurance density, NID is non-life insurance density, TID is total (both life and non-life) insurance density, GDP is per capita economic growth, LIL is liquidity liabilities; PCO is private credit by deposit money banks and other financial institutions, GCE is government consumption expenditure, and YDP is young dependence population

Note 2: LD stands for level data, FD stands for first difference data, LLC stands for Levine-Lin-Chu test (Levine et al. 2002), IPS stands for Im-Pesaran-Shin test (Im et al. 2003), and ADF stands for ADF-Fischer Chi-square test (Maddala and Wu 1999)

Note 3: * denotes significance at the 5% level

Note 4: I [1] stands for integrated of order one

Table 11 Panel Cointegration Test Results

Cases	Variables Included	Kao ADF Test
Case 1.1	GDP, LID, LIL, GCE, YDP	−2.63 [0.00]
Case 1.2	GDP, LID, PCO, GCE, YDP	−2.39 [0.00]
Case 2.1	GDP, NID, LIL, GCE, YDP	−5.80 [0.00]
Case 2.2	GDP, NID, PCO, GCE, YDP	−3.77 [0.00]
Case 3.1	GDP, TID, LIL, GCE, YDP	−5.05 [0.00]
Case 3.2	GDP, TID, PCO, GCE, YDP	−3.78 [0.00]

Note 1: LID is life insurance density, NID is non-life insurance density, TID is total (both life and non-life) insurance density, GDP is per capita economic growth, LIL is liquidity liabilities; PCO is private credit by deposit money banks and other financial institutions, GCE is government consumption expenditure, and YDP is young dependence population

Note 2: ADF is augmented Dickey Fuller statistics

Table 12 Granger Causality Test Results

	Short Run Granger Causality			Long Run Granger Causality		
	Δ GDP	Δ LID	Δ GCE	Δ YDP	Δ LIL	ECT _{−1}
<i>Case 1.1: VECM with GDP, LID, LIL, GCE, YDP</i>						
Δ GDP	−	9.78*	10.3*	18.3*	1.83	−0.85*
Δ LID	2.05	−	4.99*	3.98*	1.24	−0.11
Δ GCE	12.9*	2.12	−	9.65*	1.79	−0.06
Δ YDP	0.48	0.45	4.62*	−	1.79	−0.001
Δ LIL	5.74*	1.80	4.82*	9.63*	−	−0.09
<i>Case 1.2: VECM with GDP, LID, PCO, GCE, YDP</i>						
	Δ GDP	Δ LID	Δ GCE	Δ YDP	Δ PCO	ECT _{−1}
Δ GDP	−	5.69*	13.1*	14.9*	0.20	−0.85*
Δ LID	2.09	−	3.71**	9.54*	5.68*	−0.09
Δ GCE	17.3*	1.86	−	9.89*	0.28	−0.05

Table 12 Granger Causality Test Results (Continued)

ΔYDP	1.05	1.12	4.77*	–	1.37	–0.001
ΔPCO	6.19*	5.69*	0.89	0.40	–	–0.11
<i>Case 2.1: VECM with GDP, NID, LIL, GCE, YDP</i>						
	ΔGDP	ΔNID	ΔGCE	ΔYDP	ΔLIL	ECT_{-1}
ΔGDP	–	1.92	9.93*	17.4*	1.62	–0.79*
ΔNID	4.50*	–	1.05	1.57	0.15	–0.18
ΔGCE	15.3*	9.75*	–	6.67*	2.15	–0.06
ΔYDP	0.92	10.0*	4.78*	–	2.12	–0.001
ΔLIL	2.09	3.09***	3.36***	8.57*	–	–0.07
<i>Case 2.2: VECM with GDP, NID, PCO, GCE, YDP</i>						
	ΔGDP	ΔNID	ΔGCE	ΔYDP	ΔPCO	ECT_{-1}
ΔGDP	–	1.30	12.5*	17.4*	0.47	–0.81*
ΔNID	6.53*	–	0.45	6.25*	4.02*	–0.18
ΔGCE	17.8*	9.73*	–	7.75*	0.18	–0.05
ΔYDP	2.33	9.23*	5.02*	–	0.81	–0.002
ΔPCO	2.78	17.8*	0.15	0.37	–	–0.09
<i>Case 3.1: VECM with GDP, TID, LIL, GCE, YDP</i>						
	ΔGDP	ΔTID	ΔGCE	ΔYDP	ΔLIL	ECT_{-1}
ΔGDP	–	2.26	10.6*	20.1*	1.99	–0.83*
ΔTID	3.69**	–	4.25**	2.54	0.62	–0.17
ΔGCE	15.1*	6.96*	–	7.62*	2.44	–0.06
ΔYDP	0.55	3.95***	4.79**	–	1.74	–0.001
ΔLIL	3.61***	0.16	3.88***	9.95*	–	–0.08
<i>Case 3.2: VECM with GDP, TID, PCO, GCE, YDP</i>						
	ΔGDP	ΔTID	ΔGCE	ΔYDP	ΔPCO	ECT_{-1}
ΔGDP	–	1.09	13.6*	18.3*	0.37	–0.84*
ΔTID	6.16*	–	1.33	3.59**	5.36*	–0.17*
ΔGCE	19.2*	5.83*	–	8.40*	0.11	–0.06
ΔYDP	1.56	4.32**	4.75*	–	1.09	–0.001
ΔPCO	3.67***	15.9*	0.28	0.11	–	–0.09

Note 1: GDP is per capita economic growth, LID is life insurance density, NID is non-life insurance density, TID is total (both life and non-life) insurance density, LIL is liquidity liabilities; PCO is private credit by deposit money banks and other financial institutions, GCE is government consumption expenditure, and YDP is young dependence population.

Note 2: *, **, and *** indicate statistical significance at 1%, 5%, and 10% respectively.

Note 3: VECM: vector error-correction model; and ECT_{-1} : lagged error-correction term.

Note 4: The values of ECT_{-1} are the estimated coefficients, while the remaining values against other variables are *Wald* Chi-square.

Note 5: The basis for determination of long-run causality lies in the significance of the lagged ECT coefficients.

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Received: 20 September 2016 Accepted: 2 September 2017

Published online: 23 September 2017

Acknowledgements

The authors thank the editor and reviewers of this journal for their insightful comments and suggestions, which has improved the quality of this paper.

Funding

This paper does not have any funding.

Authors' contributions

All authors have equal contributions. All authors read and approved the final manuscript.

Competing interests

We declare that authors have no conflict of interest with respect to Funding Source Declaration, Author Agreement, and Permission Note for the submission paper "Insurance Market Density and Economic Growth in Eurozone Countries: The Granger Causality Approach" by Rudra P. Pradhan, Saurav Dash, Rana P. Maradana, Manju Jayakumar, and Kunal Gaurav to the possible inclusion in 'Financial Innovation'.

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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Received: 20 September 2016 Accepted: 2 September 2017

Published online: 23 September 2017

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