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The Relationship between Insurance Market Activity and Economic Growth

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Abstract

This research examines the short- and the long-run relationship between insurance market activity and economic growth for a panel data set of 80 countries for the period 2001-2012. Insurance market is investigated as a whole and separately as life and non-life insurance sectors. The countries with different level of economic development are considered. The data is tested for stationarity and unit roots are found. Based on this conclusion cointegration and causality analysis is done. Positive cointegration relationship between the insurance sector and economic growth has been found. In addition, it has been shown that the life insurance is of greater importance to developed countries. Meanwhile, for the developing countries non-life insurance plays a more significant role. The causal relationship in most of considered cases appears to be biderictional in the long-run. In the short-run perspective the results have been found to be less univocal.

Keywords: Insurance, Economic Growth, Non-stationary Panels, Cointegration, Vector Error Correction Model

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1. Introduction

In recent decades there has been a considerable increase in the amount of research devoted to the insurance sector. The fact that this sector is rapidly developing in many countries around the world determines it as an attractive object for research. Some economists examine the insurance market as a whole, its peculiarities and the way of development. Others prefer analysing this market in the context of its relation to other parts of the economy. Despite the fact that the insurance sector is widely analysed from different sides, it still has not been fully examined specially from econometrics aspect.

Nowadays the insurance sector is viewed mainly from two perspectives. In the first case, economists investigate the situation within the insurance market. Then focus is on the demand for insurance and its determinants. From the econometrics point of view the demand function is modelled. In the second case, researchers are interested in the relation between economic growth and insurance market activity. The modelling lies within the framework of relationships between those two activities. The existing literature will be examined in Literature Review section. However, it should be pointed out that the amount of literature on the demand for insurance dominates, although, with the development of insurance markets in more countries, the interest in the relationship between insurance sector activity and economic growth has noticeably increased. This relation is of a high interest to policy makers. The information about which one in the relationship is the cause can be of help when implementing government policies. For example, if in the developing countries some specific sector of the insurance market causes economic growth, the policy makers can stimulate the economic growth through this insurance subsector. Nevertheless, the actual relationship between those processes has been hard to assess, so there is still a lot of debate going on in this area.

The focus of the current research is on the relationship between the development of insurance sector and economic growth. Due to the fact that there is no consensus found yet it is important to further analyse the question. In fact, by now the existences of the relationship between insurance market performance and economic growth has been shown by several researchers. However, the direction of the causal relation is still not clear. Some economists find that insurance market development causes economic growth; others show that the changes in gross domestic product (GDP) induce growth of the insurance sector. Also there are studies which demonstrate that the causality is actually bidirectional. So despite the amount of literature already existing on the topic the question remains open to new investigations.

The purpose of this research is to investigate the causal relationship between insurance market performance and economic growth. The analysis is based on a panel data set consisting of countries with different level of economic development. This research adds to the existing literature by considering a larger number of countries. This allows carrying out the analysis separately for countries with different level of economic development.

Another important thing to point out is that when the research in this field began, economists were looking at the insurance market as a whole. With the development of studies the insurance sector was divided into smaller subsectors according to the type of insurance policies. According to the Swiss Reinsurance Company classification, insurance sector can generally be divided into life insurance and non-life insurance, also known as property-liability or general insurance. Nonetheless, the number of studies related to life insurance dominates in the available literature.

Current analysis contributes to the existing literature by examining the insurance sector from three aspects. Firstly, the insurance market as a whole (without paying attentionto different types of insurance premium) is considered. Secondly, life and non-life insurance sectors are investigated separately. Such division gives an opportunity to obtain more accurate result, because the differences of those sectors are taken into account. It is believed that splitting the analysed group into smaller subgroups will improve the quality of the analysis. Combining observations with similar characteristics (for example non-life insurance in countries with developing economies), allows for a more precise description of the causal relationship between parameters of interest. Defining the groups in such details gives a significant input to the existing views on the causal relationship between economic growth and insurance market activity.

The remainder of this paper is organized as follows: the second section describes the literature most relevant to the investigated topic. The third section describes the data used for the analysis, paying attention to the chosen variables and the sources of the data. The fourth section describes the methodology applied in the econometric analysis. The following section provides the estimation results. In the final section conclusions are made.

2. Literature Review

At the first United Nations Conference of Trade and Development (UNCTAD, 1964) the significance of the insurance sector for the economy was recognized. Sound national insurance and reinsurance markets were announced as a necessary component for economic growth. So the analysis in this field carved out its niche in economics literature.

Initially, most of the research related to the insurance sector was focused on the functioning of the market itself. However, its relation to other sectors of the economy was also taken into account. For example, Yaari (1965) says that insurance is mainly the mechanism which aims to smooth the consequences arising when the uncertainty turns into a loss. Explaining the motivation behind the purchase of insurance, the author examines the relationship between life insurance and consumption theory. With time the studies in the insurance field become broader combining different parts of the economy. For instance, recently, the correlation between insurance and industrial organization is commonly addressed. As an example, Pope and Ma (2008) test the structure-conduct-performance (SCP) framework[2] for the non-life insurance market. They apply panel regression analysis to the data set of 23 developing countries for the period 1996-2003.

When looking at the literature related to the insurance market, the insurance sector has been mainly analysed from two different perspectives. Firstly, the dependence between development of insurance market and economic growth is examined. Secondly, the demand for insurance is estimated. However, in both cases the amount of insurance premium is most often used as a characteristic of the insurance market. The insurance premium, on the one hand, can be used as a characteristic of the market performance, and on the other, can be interpreted as quantity demanded.

According to Outerville (2013), most papers examining the relation between insurance and economic development focus on the demand side. Meanwhile, international organizations acknowledge the importance of the insurance sector for the economic development. As a result, nowadays the number of studies examining the influence of the insurance sector on economic growth is increasing. Within the insurance-growth nexus, the attention of researchers is mostly focused on the life insurance sector, while the non-life insurance receives almost no attention.

[2] "SCP hypothesis expects dominant firms in more concentrated markets to set prices that are less favourable to consumers because of smaller competitors in the market are able to imperfect competition" (Pope & Ma, 2008).

In order to get an overall picture of the research in this area, a brief introduction into both directions will be given. However, the focus of the literature review will still be on the economic growth nexus which this paper is related to.

2.1. The Demand for Insurance

The demand for insurance is analysed from different perspectives. Scientific papers related to this topic focus on income in it different forms as the main factor influencing insurance consumption. For instance, Fischer (1973) and Campbell (1980) show that life insurance is positively correlated with income. This is explained by two factors. Firstly, when income increases the purchasing of insurance becomes more affordable. Secondly, the demand for insurance is higher when income is larger.

Fortune (1973) examines the correlation between life insurance premium expenditures and national income and finds it to be positive. Meanwhile, Cummins (1973) analyses the effect of macroeconomic indicators on the U.S. life insurance industry. He concludes that total life insurance reserves and insurer administrated pension reserves are correlated with gross national product (GNP) and permanent income. Later on, the dependence of insurance premium on GDP (as one of the income indicators) has been shown. For example, Beenstock, Dickinson and Khajuria (1986) reveal dependence of life insurance demand on GDP per capita in 12 industrialized countries for the period 1970 – 1981. They continue their research by considering the non-life insurance sector (Beenstock, Dickinson & Khajuria, 1988). The analysis shows that the results previously obtained for the life insurance hold for the non-life insurance as well.

Outreville (1990) examines the dependence of non-life insurance demand on GDP per capita and some other macroeconomic parameters. He analyses cross-sectional data on 55 developing countries, looking separately at data for years 1983 and 1984. The significance of income as a factor influencing insurance consumption is confirmed while other variables do not seem to be significant. Actually, based on the obtained model, he concludes that a 1% increase in GDP leads to an increase of quantity demanded by more than 1%. This result is also confirmed in Outreville's later research for a sample of 48 developing countries for the year 1986 (Outreville, 1996).

In fact, the dependence of insurance on various variables characterising income has been analysed for different countries across several time periods. Browne and Kim (1993) conclude that life insurance consumption per capita is positively related to GDP per capita based on a cross-sectional analysis of 45 countries for years 1980 and 1987. They find the results reasonable as life insurance becomes more affordable with an increase in income. Browne, Chung and Frees (2000) find that non-life insurance consumption is associated positively with the income level for a sample of OECD countries for the period 1986-1993. They use insurance density (average annual per capita premium) as a characteristic of the insurance market. Park, Borde and Choi (2002) focus on the link between insurance penetration (ratio of insurance premium to GDP), GNP and some other socioeconomic factors. The insurance penetration is used as the main characteristic of the insurance market. The results of their cross-sectional analysis for 38 countries for year 1997 show the significance of GNP, socio-political instability and level of economic freedom for the insurance demand. Esho et al. (2004) analyse the causal relationship between insurance consumption and real GDP for 44 countries for the period 1984-1988. They apply ordinary least squares (OLS), fixed-effects and generalized method of moments (GMM) estimations to the panel data set. Regardless of the applied method positive correlation is revealed.

The literature referring to the analysis of insurance sector from the demand side extends further. Researchers continue to examine the determinants of insurance consumption. However, this direction is not the only one to be investigated. Lately, there is an increase in studies focusing on the other aspect of the insurance market, in particular, its relationship with economic growth.

2.2. Insurance and Economic Growth

Recently economists have been focusing on the causal relationship between insurance market and economic growth. First scientific paper, related to this topic mostly paid attention to the influence of the financial sector on economic growth, whereas the impact of insurance appears only as a subpoint. For instance, Patrick (1966) discusses if economic growth is induced by the development of financial sector or vice versa using the example of developing countries. However, he only briefly speaks about the insurance market assuming it should have the same effect on the economy as the financial sector. Moreover, throughout his analysis a well-defined direction of the relationship has not been found. So the question remained opened if economic growth is supply-led through financial sector development or the financial market is demand-led trough economic development.

Later, authors started paying more attention to the insurance market specifically. Skipper (1997) suggests a review of channels through which insurers can affect economic growth. He says that there are at least seven ways through which insurance aids the economic development:

> 1) insurance promotes financial stability and reduces anxiety...
>
> 2) private insurance can substitute for government security programs...
>
> 3) insurance facilitates trade and commerce...
>
> 4) insurance mobilizes national savings...
>
> 5) insurers enable risk to be managed more efficiently...
>
> 6) insurers and reinsurers have economic incentives to help insurers reduce losses...
>
> 7) insurers foster a more efficient allocation of a country's capital...
>
> (Skipper, 1997, pp.5-6).

However, the paper itself is mostly descriptive and does not refer to any type of quantitative analysis.

When talking about modelling the above discussed causal relationship, the study by Ward and Zurbruegg (2000) should be pointed out. They analyse the hypothetical causal relation between economic growth and insurance market activity in nine OECD countries for the period 1961-1996. Real annual GDP is used as a measure of economic activity and insurance market is described by the real annual amount of insurance premium. The authors look at both short- and long-run dynamic relationships. They perform cointegration analysis and also test for causality according to Granger (1969). Their study reveals that for the majority of countries a long-run relation holds. As a result, conclusion is made that the causal relation exists. However, the direction of the relationship differs for countries in the sample. For some of them insurance market growth leads the growth in the economy, for others the situation is the opposite and some reveal bidirectional dependence. So authors conclude that the exact direction will depend on the specific characteristics of a country.

Webb, Grace and Skipper (2002) test the same hypothesis about the causal relationship as Ward and Zurbruegg (2000), but they divide the insurance sector into life and non-life insurance. The analysis is carried out for a data set of 55 countries for the period of 1980-1996. The insurance market is characterised by insurance penetration. Throughout the analysis they use the three-stage-least squares instrumental variables approach in order to cope with the endogeneity problem (situation when the explanatory variables are correlated with the error terms). The obtained results reveal highly significant correlation between the insurance market and economic growth. A similar analysis was carried out by Adams et al. (2005), who investigate the dynamics of the above mentioned relation, taking into account the historical point of view. Also the impact of banking sector is analysed. They are looking at Sweden for the period 1830-1998. According to their study, insurance sector turns out to be more dependent on economic growth than causing it during the whole examined period, while the banking sector has a predominant influence both on economic growth and on the demand for insurance. Kugler and Ofogi (2005) focus on the UK for the period 1966-2003. They investigate the long-run relationship (through Johansen's cointegration test) and Granger causality between the variables. Their empirical analysis points to the existence of the long-run relationship between GDP and the size of insurance sector. This relationship is characterised as bidirectional.

After 2005 the amount of research examining directly the relationship between the insurance and economic growth from quantitative perspective increases significantly. Economists try to show existence, direction and strength of the relationship for different groups of countries and methods used in the studies are getting more advanced. Panel data is commonly used when it comes to investigating the causal relationship between insurance and economic growth, as a step forward in the quantitative analysis compared to cross-sectional or time series analysis.

Arena (2006) aims to get a systematic estimate of the causal relation between the insurance market and economic growth. Based on a panel data set of 55 countries for the period 1976-2004 he gets estimates of the causal relation both for life and non-life insurance sectors. The data set is divided into six non-overlapping 5-year periods and the analysis is carried out for both types of insurance and groups of countries with different levels of income (low, middle and high). The results show that in both cases the insurance activity induces economic growth. However, for the life insurance the impact is significant only in the high-income countries.

Haiss and Sümegi (2008) examine the influence that insurance premium and investment have on GDP growth in Europe for the period 1992-2005 using a group of 29 European countries. A positive effect of insurance services on economic growth is revealed for most of the countries in the sample; namely, EU-15, Iceland, Norway and Switzerland. For the new EU Members the impact of non-life insurance is found to be especially significant.

Han et al. (2010) use a dynamic panel data set of 77 countries for the period 1994-2006 to evaluate the long-run relationship between insurance development and economic growth. They use insurance density as the main characteristic of the market development and real GDP per capita as an indicator of economic growth. Due to serious endogeneity (correlation between error terms and explanatory variables) authors apply two-step GMM estimator to the dynamic panel with fixed effects. They conclude that there are fairly strong evidence that there is a relationship between insurance and economic growth. The results show that insurance development contributes to economic growth to a greater extent. Also it has been found that non-life insurance has a stronger relation with GDP compared to life insurance. Both types of insurance are more significant for the developing countries.

Lee (2011) also examines the interrelationship between economic growth and insurance market activity in 10 OECD countries for the period 1979-2006. He deals with a non-stationary panel and applies panel unit root tests, heterogenous panel cointegration tests and panel causality techniques in his analysis. Strong evidence of the relation existence is found. The author implements a dynamic panel-based error correction model and finds that both short- and long-run causal relationships are present, which are estimated to be bidirectional. Continuing the analysis in this direction Lee, Lee and Chiu (2013) try to re-investigate the stationarity properties of real life insurance premiums and real GDP for 41 countries for the period 1979-2007. They also divide the sample into groups of countries with different levels of income (low, medium and high). The analysis is based on panel seemingly unrelated regressions augmented Dickey-Fuller (SURADF) test. It reveals that the variables are a mixture of I(0) and I(1) processes for different countries, so the traditional unit root tests could cause misleading results. However, authors come to the conclusion that the hypothesis of long-run cointegration relationship between GDP and life insurance premium tends to hold. Moreover, the dependence seems to be bidirectional.

It can be seen that throughout decades economists continue addressing the question of relations between the insurance market activity and economic growth, but an agreement on the direction of this relationship is still not found. It also stays unclear which subsector of the insurance market is more important for economic growth and if the level of economic development in the country has influence on that. This brings us to a conclusion that insurance sector needs further research.

3. Data

Current research combines both cross-sectional and time series observations. In this paper, the panel data consists of 80 countries for the period 2001-2012. The data set contains countries with different level of economic development. The annual real GDP is used as the main characteristic of economic growth. The data is obtained from the World Development Indicators data base.

As for the insurance sector, it is characterised by the amount of annual real insurance premium. The data on premiums is taken from the Sigma (a journal published by Swiss Reinsurance Company). In order to be able to specify the differences between the insurance market subsectors not only the total amount of insurance premium is used. The study also addresses life and non-life insurance sectors by considering the amount of premium separately for each of them. Such a division helps to take into account the effect of separate insurance sectors on the economy. It is known that life and non-life insurance are differently oriented and, as a result, do not perform in the same way. This gives a reason to believe that the influence on the economic growth can also be diverse.

The logarithms of the variables (GDP and all types of premiums) are used throughout the whole analysis.

The last variable which appears in the data set is the dummy, which characterises the level of economic development in a country. It has the value of one for advanced economies. Consequently, it equals zero for emerging markets and developing economies. The allocation of countries in groups is based on the International Monetary Fund (IMF) classification. A more detailed description of the variables and the sources of data can be found in the Appendix (Table A1).

4. Methodology

The data set in this research can be characterised as a macro panel, where the number of cross-section observations (N) equals 80 and the number of time observations (T) is 12. As a first step of the analysis, it is important to investigate if the data is stationary or not as both cases requires different specific estimation methods.

4.1. Testing for Unit Roots

The number of stationarity tests for panel data has increased significantly in the last decade. One may distinguish two groups of unit root tests: the ones that assume cross-sectional independence (the first generation tests) and the ones that allow for cross-sectional dependence (the second generation tests).[3]

One of the first generation tests is the Breitung's test for unit roots. Breitung (1999) finds that LL (Levin & Lin, 1993) and IPS (Im, Pesaran & Shin, 1997) tests "suffer from a severe loss of power if individual specific trends are included". He noticed that both LL and IPS tests require $N \to \infty$ and $T \to \infty$ in the way that $N/_T \to 0$. This means that T should be

[3] see, for example, Baltagi (2013, pp. 275-276)

relatively large compared to *N*. Breitung shows that the tests perform poorly when the relation between *N* and *T* is reversed. He suggests a test statistic which outperforms LL and IPS tests in Monte Carlo simulations, especially in the cases when *N* is relatively large compared to *T*.

In this paper, the data set falls into the category of panels, where *N* is relatively large compared to *T*. This makes it reasonable to apply the Breitung's test to check for stationarity. The null hypothesis of this test is that all individuals have a common autoregressive parameter, implying that the series contain a unit root, versus the alternative hypothesis that each time series is stationary. It should be pointed out that this test can only be applied to balanced panels. However, in this paper it is not an issue as the available panel is strongly balanced.

Yet there is a major drawback of the Breitung's test. In particular, it assumes cross-sectional independence. "This assumption is restrictive, as macro time series do exhibit significant cross-sectional correlation among the countries in the panel" (Baltagi, 2013, p. 276). The second generation of unit root tests relax this assumption. One such test is the Pesaran's simple panel unit root test in the presence of cross sectional dependence. This test is chosen due to the fact that it allows for different relations between the values of *N* and *T* in the sample.

Pesaran (2003) proposes a unit root test for dynamic heterogeneous panels, called the cross-sectional augmented Dickey - Fuller (CADF) test, and it is based on the mean of individual unit root statistics. The reason for the name is that it estimates a t-statistic based on the augmented Dickey-Fuller (ADF) statistics averaged across the groups. In order to get rid of cross section dependence the ADF regressions are supplemented with the cross section averages of lagged levels and first-differences of the individual series. The null hypothesis in this test is that all series are non-stationary. The alternative hypothesis, meanwhile, states that at least some series in the panel are stationary.

4.2. Cointegration Analysis

In order to estimate the relationship between non-stationary series it is necessary to check them for cointegration. Only in case when the series are cointegrated does it make sense to estimate the parameters of the model. If cointegration between series is not present, the risk of spurious regression is high.

Pedroni (2004) suggests a number of residual-based tests to check for cointegration. He provides test statistics "for dynamic panels in which both the short-run dynamics and the long-run slope coefficients are permitted to be heterogeneous across individual members of the panel" (Pedroni, 2004, p. 597). There are two main types of tests considered: within dimension (pooled) and between dimensions (group mean). Applying the authors' method-logy, the following regression is to be considered:

$$l\_rgdp_{it} = \alpha_{0i} + \alpha_{1i}t + \beta_i l\_p_{it} + e_{it}, \qquad (1)$$

where the subscript i ($i = 1,2,...,N$) indicates the country and the subscript t ($t = 1,2,...,T$) is responsible for the time period. Here l_rgdp is the logarithm of GDP. The variable l_p represents the logarithm of the insurance premium, which can be for the whole sector or for life and non-life insurance sectors separately[4]. The coefficient α_{0i} is the country specific fixed effects, while α_{1i} represents the coefficient for the country-specific deterministic trend. The specification with a linear deterministic trend included follows Pendroni (2004). If the series turn out to have a trend then it is more realistic to assume that the trends are different between countries. The linearity is reasonable because of the relatively short time period being investigated. The dependent and explanatory variables are assumed to be integrated of same order. The null hypothesis of no cointegration is being considered. This implies that when it holds the residuals e_{it} will be integrated of the same order as the variables. The null of no cointegration will be rejected in cases when the residuals are stationary.

Pedroni suggests seven different statistics for testing the null hypothesis. Four of them are based on the within-dimension approach (panel test): v-statistic, rho-statistic, Philips-Perron (PP)-statistic and augmented Dickey-Fuller (ADF)-statistic, which implies that the alternative hypothesis is that panel members are uniformly cointegrated (have common autoregressive (AR) coefficients). The last three are based on the between-dimension approach (group test): rho-statistic, PP-statistic and ADF-statistic, permitting panel members to differ in the way they are cointegrated (individual AR coefficients). For all suggested statistics the author examines their asymptotic properties and suggests a table of critical values by carrying out a number of Monte Carlo experiments. It should also be noted that the tests do not require strict exogeneity of the explanatory variables, which is especially valuable in terms of the current research as there is a high possibility of the variables being endogenous.

If cointegration is found, then the cointegrating vector should be estimated. The cointegration regressions in models with panel data are aimed of showing the long-run relationship between the considered variables. However, due to the specific characteristic of panel data, the question of how to estimate the above named relationship arises. According to Kao (1999), the ordinary least squares (OLS) estimator is consistent, when it comes to estimating the cointegrating equation. However, the t-statistics of the OLS estimator diverges.

[4] In particular, l_p_{it} should be replaced by either l_tp_{it}, or l_lp_{it}, or l_nlp_{it}, depending on the specification being examined.

There are two main alternatives to the classical OLS when it comes to estimating the cointegration equation in panel data. First, to improve the quality of the OLS estimations Pedroni (2001) suggests a fully modified OLS (FMOLS) estimator. This estimator is constructed so that it allows for heterogeneity in the panel. The estimators are constructed in such a way that their asymptotic distributions are converging to the true value and are free from nuisance parameters. Second, Kao and Chiang (2001) propose another estimator for a panel cointegration regression: dynamic OLS (DOLS). They claim that when it comes to finite panel samples the OLS estimator of the cointegration equation has a non-negligible bias. According to Kao and Chiang in cases of finite samples the FMOLS in general does not improve over the OLS estimator. They suggest another estimator, which as well as the FMOLS, takes into account the possible heterogeneity in the data. The DOLS estimator is computationally simpler and outperforms both OLS and FOMLS for finite samples. It also helps to deal with the endogeneity bias in the regressors. Therefore, this estimator is used in the current analysis to find a numerical description of the cointgration relationship.

For the available set of variables the DOLS for heterogeneous panels can be obtained by running the following regression:

$$l\_rgdp_{it} = \alpha_i + \beta_i l\_p_{it} + \sum_{j=-q_i}^{q_i} c_{ij} \Delta l\_p_{it+j} + \dot{v}_{it}, \tag{2}$$

For equation (2) Kao and Chiang (2001) state that the individual constant term α_i can be extended into general deterministic time trends such as $\alpha_{0i} + \alpha_{1i}t + \cdots + \alpha_{pi}t^p$. This possible extension is important relating to the earlier made assumption that there are country-specific time trends in the cointegration relationship. Using a country specific linear trend, $\alpha_i = \alpha_{0i} + \alpha_{1i}t$, equation (2) can written as:

$$l\_rgdp_{it} = \alpha_{0i} + \alpha_{1i}t + \beta_i l\_p_{it} + \sum_{j=-q_i}^{q_i} c_{ij} \Delta l\_p_{it+j} + \dot{v}_{it} \tag{3}$$

Here q_i allows controlling for endogeneity as show the lags and the leads of the independent variable in first differences. The choice of optimal lags and leads can be made in the classical way according to Akaike or Schwarz information criteria. The $\dot{v}_{it}$ parameter is the disturbance term, which follows the I(0) process (stationary). In this case the model is being estimated together with a constant and a linear trend, which is specified as differing between countries. It is necessary to pay attention to, "...that the DOLS t-statistics tend to have heavier tails than predicted by asymptotic distribution theory, though the bias of the DOLS t-statistic is much lower than those of the OLS and the FMOLS t-statistics" (Kao & Chiang, 2001, p. 216). Referring to this in particular and based on the aforesaid the DOLS estimator is preferred for estimating the cointegrating vector.

4.3. Causality Analysis

Cointegration analysis provides informationon whether there is a long-run relationship between the variables or not. However, it does not say anything about causality. Therefore, it is important to provide statistical estimation of the causal relation in order to determine the direction of influence between the variables. For this purpose, panel vector error correction model (VECM) based on the paper by Engle and Granger (1987) is used. In particular, this procedure allows getting estimates on both the long- and the short-run relationship between the variables. A two-step procedure is applied to estimate the VECM.

At the first stage of the procedure the long-run equilibrium coefficients are estimated. In fact the long-run relation between the variables is characterised by the cointegration regression. So the first step implies the DOLS estimation of the equation (1) to be performed. When the coefficients are estimated, it is necessary to obtain the residuals from the model as they are responsible for the deviations of the dependent variable from the long-run equilibrium:

$$ECT_{it} = \widehat{l\_rgdp}_{it_i} - (\hat{\alpha}_{0i} + \hat{\alpha}_{1i}t + \hat{\beta}_i l\_p_{it}) \qquad (4)$$

Here it is important to mention that in order for the residuals to be reliable the consistent estimators of equation (1) are necessary. One of the advantages of the DOLS estimator is that it actually can provide consistent estimates under reasonable assumptions. As a result, the obtained estimations for the ECT_{it} in (4) will be consistent, which allows us to proceed to the second step of the Engle-Granger procedure.

The second step consists of estimating the parameters, which are responsible for the short- and long-run adjustment. Following Lee (2011) and Lee, Lee and Chiu (2013) and accounting for the country-specific deterministic trends the following error correction representation is considered:

$$\Delta l\_rgdp_{it} = \gamma_{1i} + \theta_{1i}t + \lambda_1 ECT_{it-1} + \sum_{j=1}^{m} \delta_{11j} \Delta l\_rgdp_{it-j} + \sum_{j=-q_i}^{q_i} \delta_{12j} \Delta l\_p_{it-j} + u_{1it} \qquad (5)$$

$$\Delta l\_lp_{it} = \gamma_{2i} + \theta_{2i}t + \lambda_2 ECT_{it-1} + \sum_{j=1}^{m} \delta_{21j} \Delta l\_rgdp_{it-j} + \sum_{j=-q_i}^{q_i} \delta_{22j} \Delta l\_p_{it-j} + u_{2it}, \qquad (6)$$

where Δ denotes the first differences of the variables. j is the optimal lag length (chosen based on the information criteria). γ_{1i} and γ_{2i} are coefficients responsible for the country specific fixed effects and θ_{1i} and θ_{2i} refer to the country-specific time trends. Meanwhile, λ_1 and λ_2 are responsible for the long-run relationship, in particular they show the speed of adjustment with which the deviations return back to the long-run equilibrium.

According to Costantini and Martini (2010); Lee (2011); Lee, Lee and Chiu (2013) a widely used estimator for the system of equations in (5) and (6) is the dynamic panel general method of moments (GMM) estimator proposed by Arellano and Bond (1991). Their method is applicable to unbalanced panel data and permits for not strictly exogenous variables. Moreover, they demonstrate that their suggested GMM estimator works well for finite samples. This makes the Arellano - Bond estimator suitable for estimating the given model for the analysed data set.

When the VECM is estimated, it is possible to actually check for causality. The question can be approached from different time perspectives: short- and long-run. Following Lee, Lee and Chiu (2013), the coefficients δ_{12j} and δ_{21j} are responsible for the short-run causality. By testing their significance the directions of causality can be identified. Therefore, in order to see if the increase in premiums induces economic growth the significance of δ_{12j} should be tested. For this purpose t-test is used for the null hypothesis $H_0: \delta_{12j} = 0$. If H_0 is rejected then the conclusion can be made that at the given level of significance the change in premiums actually granger causes the change in GDP. In the similar manner, the null hypothesis $H_0: \delta_{21j} = 0$ is to be tested in order to see if the change in GDP granger causes the changes in the insurance premium amount.

The long-run causality can be observed when considering, together with the short-run causality coefficients, the estimates of the speed of adjustment parameters λ_1 and λ_2. Those parameters show how fast the variables return to their long-run equilibriums. In particular, λ_1 shows the speed with which change of GDP should follow in period *t* if the observation in the period *t-1* deviates from the equilibrium by ECT_{it-1}. In order to be able to investigate the long run causality a joint test should be performed. This is the so called Granger causality test, which is based on the Wald test for the joint hypothesis. The null hypothesis for equation (5) is that the change in premium does not granger cause changes of GDP. For equation (6) the null is the opposite, in particular that GDP does not granger-cause changes in the insurance premium. If the null can be rejected the conclusion should be made that at the given level of significance granger causality takes place.

5. Empirical Results

The available data set allows us to carry out the analysis in several directions. First, it is possible to examine the question of interest for the insurance market as a whole by looking at the total amount of insurance premium. At the same time the life and non-life insurance sectors can be distinguished. So it is possible to estimate the relationship between GDP and either life or non-life insurance premium. All three directions of analysis are considered in this paper. Second, the dummy of economic development allows us to distinguish between the developed and developing economies. In this paper, we analyse the whole sample and then separately the advanced economies and the emerging markets and developing economies[5].

Before starting to test the series for stationarity some words should be said about the heteroskedasticity issue. This potential problem arises as the number of cross-section units is relatively large, which implies that there is a chance of heteroskedasticity being present. In case of panel data it is hard to actually test for it as the econometric techniques in this area are still not fully developed. Nevertheless, it is still possible to get approximate results by checking for heteroskedasticity for a given year. The relationships between GDP and three types of insurance premium variables are analysed in this research. So heteroskedasticity for all three types of models is tested. The tests are carried out for three types of sample (all countries, advanced economies, emerging markets and developing economies). For each of 12 years separately simple cross-sectional heteroskedasticity tests (such as White test, for example) are performed.[6] In case of total insurance and non-life insurance premiums no heteroskedasticity has been found. Meanwhile, for the life insurance heteroskedasticity is present in all three considered types of sample. In this case, robust standards errors (heteroskedasticity consistent) will be used for all following models with the variable of life insurance premium.

5.1. Unit Root Tests

First, the stationarity of the series should be checked. For this purpose two unit root tests are applied. It should be stated that both tests are performed assuming individual linear trends. The reason for this assumption, on the one hand, is based on the analysis of individual countries, where the stationarity seems to be possible only around a trend. On the other hand, this assumption goes in line with economic theory and the research in the considered field, where the cointegration is examined with a trend (see, for example, Lee, 2011; Lee, Lee & Chiu, 2013).

Firstly, the Breitung's test with individual effects and individual linear trends as exogenous variables is being considered. The null hypothesis for this test implies that there is a common unit root process in the data. The optimal lag length is selected automatically based on the Schwarz information criterion (SIC). The lag length can vary between 0 and 1, as the observation based maximum lag length is equal to 1 (due to the relatively small time dimen-

[5] The distinction is made according to IMF classification.
[6] The results of the tests estimation are not presented in the paper due to their excessive size.

sion in the analysed panel). The t-statistics for this test are presented in Table 1 for the sample of all countries and in Table A3 (see Appendix) for developed and developing countries separately.

***Table 1**: Breitung's t-statistics for the whole sample of countries*[7]

	l_rgdp	***l_tp***	***l_lp***	***l_nlp***
Level	2,814 (0,998)	8,681 (1,000)	7,650 (1,000)	6,398 (1,000)
First differences	-6,157*** (0,000)	-6,161*** (0,000)	-7,078*** (0,000)	-3,793*** (0,0001)

As can be seen from the test results for all four variables the null hypothesis cannot be rejected at the 5% level of significance for all the countries, and for the developed and developing economies separately. When testing the series in the first differences (see t-statistics in the same tables as for the levels) at the 5% level of significance it is possible to reject the null hypothesis. The conclusion we draw form Breitung's unit root test for panel data is that it is reasonable to assume that both GDP and all types of insurance premium series are integrated of order one: I(1). This result holds when testing with all countries together and for different levels of economic development separately.

To check the obtained result for robustness, Pesaran's CADF test for unit roots is also carried out for the same series. The test is performed together with a constant and a time trend, same as for the Breitung's test. The lag length is set to one as the maximum allowed by the number of observations in the data set. The results of the test are provided in Table 3.

***Table 2:** Pesaran's CADF test*[8]

	l_rgdp	***l_tp***	***l_lp***	***l_nlp***
All countries	-2,208 (0,660)	-1,884 (0,999)	-1,967 (0,990)	-2,189 (0,173)
Advanced economies	-1,729 (0,997)	-1,568 (1,000)	-1,417 (1,000)	-1,652 (0,999)
Emerging markets and developing economies	-2,008 (0,942)	-2,108 (0,829)	-2,258 (0,504)	-2,133 (0,786)

The results in Table 2 imply that Pesaran's CADF test supports the results of the Breitung's test saying that the given series are non-stationary. As it is reasonable to assume

[7] In brackets the probabilities are presented. They are computed assuming asymptotic normality.

[8] The t-bar values are presented. In the brackets the p-values for the statistics are stated. *** indicate the coefficients which are significant at the 1% level.

that all series are non-stationary and integrated of the same order it is possible to proceed with the analysis by testing for cointegration between the variables.

5.2. Cointegration Analysis

When dealing with non-stationary data it is important to see if there is cointegration between the variables, because it is the only case, which allows modelling the relationship between non-stationary series without a risk of ending up with spurious regressions. In order to check for cointegration, Pendroni's test is performed. The trend assumption includes deterministic intercept and trend, which both vary across coutries. This assumption is made so that the analysis lies in line with the unit root tests performed earlier and according to the specification stated in the Methodology section of the current research. For this test the null hypothesis is of no cointegration. The cointegrating relationship is examined between GDP and the insurance premium variables (total, life and non-life). The tests are conducted for the whole sample and separately for the advanced economies and emerging markets and development economies. All seven tests suggested by Pendroni (2004) are conducted. They are divided into two groups, depending on the type of the statistic and the alternative hypothesis. The results are presented in Table 3 where both the statistics and their p-values are stated. It should be noted that as in the case of the unit root testing procedure the optimal lag length is chosen according to the Schwarz information criteria. For the models where the variable of life insurance premium is present the robust standard errors are used due to the problem of heteroskedasticity.

Table 3: *Pedroni's cointegration test*

	All countries		Advanced economies		Ereging markets and Developing economis	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
GDP and Total Insurance Premium						
Alternative hypothesis: common AR coefs. (within-dimension)						
Panel v-Statistic	35,613	0,000	8,452	0,000	35,019	0,000
Panel rho-Statistic	3,850	0,999	2,606	0,995	2,903	1,000
Panel PP-Statistic	-2,696	0,003	-1,467	0,071	-2,213	0,006
Panel ADF-Statistic	-3,797	0,000	-2,571	0,005	-2,863	0,000
Alternative hypothesis: individual AR coefs. (between-dimension)						
Group rho-Statistic	7,123	1,000	4,861	1,000	5,228	1,000
Group PP-Statistic	-3,926	0,000	-1,861	0,031	-3,549	0,0002
Group ADF-Statistic	-3,743	0,000	-1,925	0,027	-3,261	0,000

Table 3: *Pedroni's cointegration test (continued)*[9]

	All countries		Advanced economies		Ereging markets and Developing economis	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
GDP and Life Insurance Premium						
Alternative hypothesis: common AR coefs. (within-dimension)						
Panel v-Statistic	40,306	0,000	11,125	0,000	38,196	0,000
Panel rho-Statistic	4,255	0,595	2,520	0,994	3,379	0,999
Panel PP-Statistic	-1,511	0,071	-1,717	0,043	-0,812	0,512
Panel ADF-Statistic	-3,098	0,001	-2,426	0,008	-2,169	0,000
Alternative hypothesis: individual AR coefs. (between-dimension)						
Group rho-Statistic	7,034	1,000	4,893	1,000	5,086	1,000
Group PP-Statistic	-3,437	0,031	-2,131	0,017	-2,698	0,606
Group ADF-Statistic	-3,938	0,0001	-2,020	0,022	-3,434	0,000
GDP and Non-life Insurance Premium						
Alternative hypothesis: common AR coefs. (within-dimension)						
Panel v-Statistic	33,602	0,000	7,230	0,000	34,188	0,000
Panel rho-Statistic	4,116	0,998	3,318	0,999	2,773	0,997
Panel PP-Statistic	-2,513	0,013	0,031	0,512	-2,873	0,002
Panel ADF-Statistic	-4,878	0,000	-3,295	0,0005	-3,677	0,000
Alternative hypothesis: individual AR coefs. (between-dimension)						
Group rho-Statistic	7,074	1,000	5,168	1,000	4,914	1,000
Group PP-Statistic	-3,558	0,0002	0,269	0,606	-4,814	0,000
Group ADF-Statistic	-4,333	0,000	-2,539	0,006	-3,520	0,000

As can be seen from the table the p-values for the panel v-statistic are always close to zero. Meanwhile, both group and panel rho-statistics exhibit p-values close to one. As the author of the test says:

> ... in very small panels, if the group-rho statistic rejects the null of no cointegration, one can be relatively confident of the conclusion because it is slightly undersized and empirically the most conservative of the tests. On the other hand, if the panel is fairly large so that size distortion is less of an issue, then the panel v-statistic tends to have the best power relative to the other statistics and can be most useful when

[9] The corrected Dickey-Fuller residual variances are used for the model with the l_lp variable in order to cope with the consequences of heteroskedasticity. The optimal lag length is selected automatically based on SIC. The lag length can vary between 0 and 1, as the observation based maximum lag length equals 1. Newey-West automatic bandwidth selection is used together with the Bartlett kernel.

> the alternative is potentially very close to the null. The other statistics tend to lie somewhere in between these two extremes, and they tend to have minor comparative advantages over different ranges of the sample size
> Pedroni (2004, pp. 614-616).

This implies that the rho-statistic tends not to reject the null hypothesis, so the chance of the error of second type[10] increases, which makes this statistic not reliable enough to base the conclusions on.

For all the considered cointegration relationships, the panel v, panel ADF and group ADF-statistics leads us to reject the null hypothesis at the 5% level of significance, implying that there is a cointegrating relationship between the variables. This means that three out of five statistics (not taking into account the rho-statistics) confirm the presence of cointegration between all analysed variables and GDP. For most of the analysed pairs the panel and group PP-statistics also allow us to reject the hypothesis of no cointegration at the 5 or 10% level of significance. From these results, we draw the conclusion that there is a cointegrating relationship between the investigated variables.

Moving forward, it is now important to estimate the cointegrating vectors for the existing coinegration relationships. For this purpose, equation (3) is estimated using DOLS. The assumed specification of the cointegration equation (in line with panel unit roots and cointegration tests) consists of a constant and a time trend. The optimal length of lags and leads (q_i) is chosen based on the Schwarz information criteria (same as for the previously conducted tests). Together with the estimated cointegration regressions, the residuals from all the models are saved. These residuals will be used to estimate the VECM in order to test for causality.

Table 4 provides the DOLS estimates of the long-run relationship between the variables (coefficients β_i) for all types of premiums for the sample of all countries and for the developed and developing countries separately. For the models with the life insurance premium variable the robust standard errors are computed. Based on the p-values the conclusion can be made that the coefficients responsible for the long-run co-movement of the variables are significant in all considered models at the 5% level of significance.

[10] Type II error is a failure to reject the false null hypothesis.

***Table 4:** DOLS estimations of the cointegrating vector*[11]

	All countries		**Advanced economies**		**Emerging markets and developing economies**	
	Stat.	t-stat	Stat.	t-stat	Stat.	t-stat
Dependent variable: L_RGDP						
L_TP	0,162	17,283***	0,151	10,846***	0,167	13,893***
L_LP	0,075	7,339***	0,116	9,018***	0,065	5,278***
L_NLP	0,156	16,052***	0,134	8,644***	0,165	13,805***

When looking at the actual values of the coefficients in the Table 4 it can be seen that all the long-run effects turn out to be positive. This supports the earlier findings that the insurance market activity has a positive effect on economic growth. Let us consider this in a bit more details. For the insurance market as a whole it is estimated that a 1% increase in the insurance premium causes a 0,16% increase in GDP. It is interesting to see that the insurance sector activity is more important for the developing countries in general. In particular, a 1% increase of total premium causes an 0,15% increases of GDP in the advanced economies versus a 0,17% increases for the emerging markets and developing economies. This is completely in line with the findings of Han et al. (2010).

It is necessary to mention that depending on level of economic development in the country different sectors of the insurance market are more important. The life insurance sector plays a greater role for the countries with advanced economies in particular causing an 0,12% increase in GDP when the premiums increase by 1%. Meanwhile, the same premium growth causes only a 0,07% change in GDP for the developing countries. This confirms the results by Arena (2006), who concludes that the life insurance is more important for high-income countries. Furthermore, considering life insurance for the whole sample, a 1% increase in the life premium raises GDP by 0,08%, which confirms the results obtained by Lee, Lee and Chiu (2013).

For the non-life insurance sector a 1% premium increases causes a 0,16% GDP growth. This sector has a higher level of importance for the countries with emerging markets and developing economies. In particular, a 1% increase in premium leads to a raise in GDP

[11] The used panel method is pooled estimation. The optimal lag length is selected automatically based on SIC. The lag length can vary between 0 and 1, as the observation based maximum lag length equals 1. In order to avoid negative influence of the heteroskedasticity for models with the l_lp variable the coefficient covariences are computed using the sandwich method. Long-run variances (Bartlett kernel, Newey-West fixed bandwidth) are used for coefficient covariances. *** indicate the coefficients which are significant at the 1% level.

by 0,17%. Meanwhile, the same change in premiums causes only a 0,13% increase of GDP in the advanced economies countries.

5.3. Granger Causality

Now when it has been confirmed that the variables are cointegrated it is possible to estimate a panel-based VECM in order to check for causality. For the VECM given by the system of equations (5) and (6) the lag length is chosen equal to one. Again, this can be explained by the relatively small value of *T*. For the estimation of the models, the residuals from the DOLS regressions are used. The results are presented in the Table 5 for the whole sample of countries and in the Table 4A (in the Appendix) for the developed and developing economies separately.

Table 5:*VECM for the full sample*[12]

Total Insurance Premium			**Life Insurance Premium**		
	D(L_RGDP)	*D(L_TP)*		*D(L_RGDP)*	*D(L_LP)*
D(L_RGDP(-1))	0,218** (0,033) [6,588]	-0,551** (0,178) [-3,100]	**D(L_RGDP(-1))**	0,271** (0,036) [7,553]	-0,862** (0,287) [-2,999]
D(L_TP(-1))	0,086** (0,007) [13,159]	-0,091** (0,035) [-2,603]	**D(L_LP(-1))**	0,042** (0,005) [9,193]	-0,092** (0,036) [-2,533]
RTP(-1)	-0,592** (0,041) [-14,520]	0,861** (0,219) [3,930]	**LTP(-1)**	-0,513** (0,037) [-13,744]	0,775** (0,299) [2,589]

Non-life Insurance Premium		
	D(L_RGDP)	*D(L_LP)*
D(L_RGDP(-1))	0,016 (0,036) [0,453]	-0,308 (0,155) [-1,987]
D(L_LP(-1))	0,094** (0,008) [11,383]	-0,018 (0,036) [-0,502]
LTP(-1)	-2,5E-08 (1,5E-07) [-0,171]	-3E-06** (6,4E-07) [-4,751]

It is important to notice that in all nine models the coefficient for D(L_LP(-1)) is almost always significant at the 5% level, which means that in the short-run the insurance

[12] Standard errors in ( ) & t-statistics in [ ]. ** indicate the coefficients which are significant at the 5% level.

premium changes induce economic growth. The only exception is the non-life insurance sector for the whole sample. This is most likely due to the difference between the markets in developed and developing countries which makes it problematic to have them in the same sample. This argument is confirmed by the fact that when looking at those groups of countries separately the short-run causal relation coefficients are significant for both subsamples. The opposite causality partly holds. Namely, for the developing countries in the short-run, GDP does not influence insurance market activity. Meanwhile, for the advanced economies the situation is completely different, meaning that for all types of insurance GDP has an impact on the insurance sector in the short-run. It is interesting to notice that the short-run coefficients turn out to be negative. The economic explanation behind this fact can be an issue for the future research in the insurance market field. Continuing with the causality testing it is also necessary to look at it from the long-run perspective by performing the joint tests on the VECM equations. This is done by the means of the Wald test. The p-values for the joint tests are presented in the Table 6.

Table 6: *Granger causality tests*

All countries			**Advanced economies**			**Emerging markets and developing economies**		
Total	*Life*	*Non-life*	*Total*	*Life*	*Non-life*	*Total*	*Life*	*Non-life*
Dependent variable: D(L_RGDP)								
0,000	0,000	0,000	0,000	0,002	0,004	0,000	0,000	0,000
Dependent variable: D(L_P)								
0,002	0,003	0,047	0,001	0,001	0,000	0,062	0,082	0,041

Based on the test results the following conclusion can be made. First of all, no matter which sample or subsample is being analysed all three types of premium considered granger cause economic growth in the long-run. When looking at the opposite direction of the relationship (based on the possibility to reject the null) it can be said that in most cases the economic growth is a granger cause of the insurance activity. However, it should be pointed out that in the long-run the GDP growth does not induce increase in the life-insurance activity in the developing countries. Our conclusion is that the long-run causal relationship between economic growth and insurance market activity is bidirectional in the majority of the investigated cases.

6. Conclusions

The question of a relationship between insurance market activity and economic growth has been debated increasingly in the recent decade. The question of their long-run interaction and causal relationship still has not found an univalent opinion. This research was aimed to put some light on the topic. The aim was to see if there is a long-run relationship between the insurance premiums as a characteristic of the insurance market and GDP as the characteristic of economic growth. The analysis was conducted for the life and non-life insurance sectors separately as well as for the insurance market as a whole. Countries with different level of economic development were taking into consideration. In particular, the subsamples of advanced economies and emerging markets and developing economies were considered.

The unit root tests showed that the data is non-stationary even with respect to a trend. The cointegration tests for the series were carried out. The conclusion has been made for all considered pairs of variables that the long-run relationship between them is present. For the advanced economies, life insurance sector turned out to be of most importance. A 1% increase in the amount of real life insurance premium causes a 0,12% increase in real GDP. Meanwhile, the non-life insurance sector turned out to be more important for emerging markets and developing economies. Here a 1% increase of real insurance premium induces a 0,17% growth in real GDP. When talking about the insurance market as a whole it should be pointed out that the development of this sector is more essential for the developing countries compared to the developed once.

The causality analysis based on the panel vector error correction model revealed a bidirectional relationship for the majority of investigated cases. However, for the life insurance sector in the developing countries the relationship appeared to be strictly one-sided. In this case economic growth granger causes the insurance market activity and not vice versa. For the advanced economies both life and non-life insurance sectors were shown to engage with the economic growth in a double-sided relationship.

To conclude it can be said that during the analysis a fairly strong relationship between economic growth and insurance market has been found both for developed and developing countries. However, the importance of particular type of insurance differs significantly depending on the development level of the country. Some more light has been brought to the topic of causality in the relationship between insurance market activity and economic growth as well. The relationship for most cases is characterised as bidirectional. This conclusion is important from the policy makers perspective as it clearly shows that the insurance sector can be used as a stimulus for economic growth only partly because in turn its activity depends on economic growth. Also the importance of the non-life insurance sector for developing countries implies that in those countries more attention should be paid to this sector in the first place when it comes to policy implementations. So the current research both provides information for the practical purposes and contributes to the existing literature by adding new evidence of causal relationship between insurance market activity and economic growth.

7. References

Adams, M., Andersson, J. & Lindmark, M. (2005). The Historical relation between banking, insurance and economic growth in Sweden: 1830 to 1998., working paper, Umeå University, Faculty of Social Sciences, Department of Economic History, Available Online: http://neumann.hec.ca/gestiondesrisques/dim/Papers/Adams.pdf [Accessed 13 April 2014]

Arellano, M. & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *The review of economic studies*, vol. 58, no. 2, pp.277–297

Arena, M. (2008). Does Insurance Market Activity Promote Economic Growth? A Cross-Country Study for Industrialized and Developing Countries, *The Journal of Risk and Insurance*, vol. 75, no. 4, pp.921–946

Baltagi, B.H. (2013). Econometric Analysis of Panel Data, UK: John Wiley & Sons Ltd

Beenstock, M., Dickinson, G. & Khajuria, S. (1986). The determination of life premiums: An international cross-section analysis 1970–1981, *Insurance: Mathematics and Economics*, no. 5, pp.261–270

Beenstock, M., Dickinson, G. & Khajuria, S. (1988). The relationship between property-liability insurance premiums and income: an international analysis, *Journal of risk and Insurance*, vol. 55, no. 2, pp.259–272

Breitung, J. (1999). The local power of some unit root tests for panel data, Discussion Papers, Interdisciplinary Research Project 373: Quantification and Simulation of Economic Processes, vol. 1999, no. 69, Available Online: http://nbn-resolving.de/urn:nbn:de:kobv:11-10046584 [Accessed 13 April 2014]

Browne, M., Chung, J. & Frees, E. (2000). International property-liability insurance consumption, *Journal of Risk and Insurance*, vol. 67, no. 1, pp.73–90

Browne, M. & Kim, K. (1993). An international analysis of life insurance demand, *Journal of Risk and Insurance*, vol. 60, no. 4, pp.616–634

Campbell, R. (1980). The demand for life insurance: An application of the economics of uncertainty, *The Journal of Finance*, vol. 35, no. 5, pp.1155–1172

Costantini, V. & Martini, C. (2010). The causality between energy consumption and economic growth: A multi-sectoral analysis using non-stationary cointegrated panel data, *Energy Economics*, vol. 32, no. 3, pp.591–603

Cummins, J. (1973). An econometric model of the life insurance sector of the US economy, *Journal of Risk and Insurance*, vol. 40, no. 4, pp.533–554

Engle, R. & Granger, C. (1987). Co-integration and error correction: representation, estimation, and testing, *Econometrica: journal of the Econometric Society*, vol. 55, no. 2, pp.251–276

Esho, N., Kirievsky, A., Ward, D. & Zubruegg, R. (2003). Law and the Demand for Property-Casualty Insurance Consumption, *Journal of Risk and Insurance*, vol. 71, no. 2, pp.265–283

Fischer, S. (1973). A life cycle model of life insurance purchases, *International Economic Review*, vol. 14, no. 1, pp.132–152

Fortune, P. (1973). A Theory of Optimal Life Insurance: Development and Tests, *The Journal of Finance*, vol. 28, no. 3, pp.587–600

Haiss, P. & Sümegi, K. (2008). The relationship between insurance and economic growth in Europe: a theoretical and empirical analysis, *Empirica*, vol. 35, no, 4, pp.405–431

Han, L., Donghiu, L., Moshirian, F. & Tian, Y. (2010). Insurance Development and Economic Growth*, *The Geneva Papers on Risk and Insurance Issues and Practice*, vol. 35, no. 2, pp.183–199

Im, K. S., Pesaran, M. H. & Shin, Y. (1997).Testing for Unit Roots in Heterogeneous Panels. Cambridge: University of Cambridge.

Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data, *Journal of Econometrics*, vol. 90, no. 1, pp.1–44

Kao, C. & Chiang, M. (2001). On the estimation and inference of a cointegrated regression in panel data, *Advances in econometrics*, no. 15, pp.179–222

Kugler, M. & Ofoghi, R. (2005). Does insurance promote economic growth? Evidence from the UK, *Money Macro and Finance (MMF) Research Group …*, (July), pp.0–27, Available Online: http://repec.org/mmfc05/paper8.pdf [Accessed 24 May 2014].

Lee, C. (2011). Does insurance matter for growth: Empirical evidence from OECD countries, *The BE Journal of Macroeconomics*, vol. 11, no. 1

Lee, C.-C., Lee, C.-C. & Chiu, Y.-B. (2013). The link between life insurance activities and economic growth: Some new evidence, *Journal of International Money and Finance*, no. 32, pp.405–427

Levin, A. T. & Lin, C. F. (1993). Unit root tests in panel data: New results. *University of California at San Diego, Economics Working Paper Series*.

Outreville, J. (1996). Life insurance markets in developing countries, *Journal of Risk and Insurance*, vol. 63, no. 2, pp.263–278

Outreville, J. (1990). The economic significance of insurance markets in developing countries, *Journal of Risk and Insurance*, vol. 57, no. 3, pp.487–498

Outreville, J. (2013). The relationship between insurance and economic development: 85 empirical papers for a review of the literature, *Risk Management and Insurance Review*, vol. 16, no. 1, pp.71–22

Park, H., Borde, S.. & Choi, Y., 2002. Determinants of insurance pervasiveness: a cross-national analysis. *International Business Review*, 11(1), pp.79–96. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0969593101000488.

Patrick, H. (1966). Financial development and economic growth in underdeveloped countries, *Economic development and Cultural change*, vol. 14, no. 2, pp.174–189

Pedroni, P. (2001). Fully modified OLS for heterogeneous cointegrated panels, *Advances in econometrics*, no. 15, pp.93–130

Pedroni, P. (2004). Panel cointegration: asymptotic and finite sample properties of pooled time Sseries tests with an application to the PPP hypothesis, *Econometric Theory*, vol. 20, no. 3, pp.597–625

Pesaran, M. (2007). A simple panel unit root test in the presence of cross-section dependence, *Journal of Applied Econometrics*, no. 3, pp.265–312

Pope, N. & Ma, Y. (2008). The market structure–performance relationship in the international insurance sector, *Journal of Risk and Insurance*, vol. 75, no. 4, pp.947–966

Skipper, H. (1997). Foreign insurers in emerging markets: Issues and concerns, Available Online: https://iifdc.org/pubs/skipper.pdf [Accessed 24 May 2014]

UNCTAD (1964). Proceedings of the United Nations Conference on Trade and Development, First Session, vol. 1, Final Act and Report, United Nations

Ward, D. & Zurbruegg, R. (2000). Does insurance promote economic growth? Evidence from OECD countries, *Journal of Risk and Insurance*, vol. 67, no. 4, pp.489–506

Webb, I., Grace, M. & Skipper, H. (2000). The effect of banking and insurance on the growth of capital and output, working paper, Center for risk management and insurance Available Online: http://rmictr.gsu.edu/Papers/WP02-1.pdf [Accessed 25 May 2014]

Yaari, M. (1965). Uncertain lifetime, life insurance, and the theory of the consumer, *The Review of Economic Studies*, vol. 32, no. 2, pp.137–150

8. Appendix

8.1. Table A1: Description of the Variables

Variables	Name	Unit of measure	Sources
Real Gross Domestic Product	rgdp	US Dollars at constant prices (2005) and constant exchange rates (2005) in millions	UNCTAD:UNCTADstat, World Development indicators (for Lichtenstein)
Total Insurance Premium	tp	US Dollars at constant prices (2005) and average exchange rate for the financial year in millions. Conversion to real values is made through CPI with 2005 index base.	Sigma, volumes from 2002 till 2012; UNCTAD:UNCTADstat; IMF World economic outlook, April 2014.
Life Insurance Premium	lp		
Non-life Insurance Premium	nlp		
Dummy of economic development	advec	1 if an advanced economy and 0 if an emerging market or a developing economy	According to IMF classification: World economic outlook, April 2014

8.2. Table A2: List of Countries included in the Panel Dataset

Advanced Economies		Emerging Markets and Developing Economies		
Australia	Luxembourg	Algeria	Jamaica	PR China
Austria	Malta	Argentina	Jordan	Romania
Belgium	Netherlands	Bangladesh	Kenya	Russia
Canada	New Zealand	Brazil	Kuwait	Saudi Arabia
Cyprus	Norway	Bulgaria	Lebanon	Serbia
Czech Republic	Portugal	Chile	Malaysia	South Africa
Denmark	Singapore	Colombia	Mauritius	Sri Lanka
Finland	Slovakia	Costa Rica	Mexico	Thailand
France	Slovenia	Croatia	Morocco	Trinidad and Tobago
Germany	South Korea	Dominican Rep.	Nigeria	Tunisia
Greece	Spain	Ecuador	Oman	Turkey
Hong Kong	Sweden	Egypt	Pakistan	Ukraine
Ireland	Switzerland	Hungary	Panama	United Arab Emirates
Israel	Taiwan	India	Peru	Uruguay
Italy	United Kingdom	Indonesia	Philippines	Venezuela
Japan	United States	Iran	Poland	Vietnam

The names of the countries according to the Sigma Journal,
published by Swiss Reinsurances Company

8.3. Table A3: Breitung's Unit Root Test

Advanced economies	***l_rgdp***	***l_tp***	***l_lp***	***l_nlp***
Level	1,798 (0,964)	8,141 (1,000)	7,484 (1,000)	5,693 (1,000)
First differences	-5,554 (0,000)	-3,631 (0,0001)	-3,697 (0,0001)	-3,208 (0,0007)
Emerging markets and developing economies	*l_rgdp*	*l_tp*	*l_lp*	*l_nlp*
Level	2,337 (0,990)	4,403 (1,000)	3,256 (0,999)	3,743 (0,999)
First differences	-3,849 (0,0001)	-4,097 (0,000)	-6,1777 (0,000)	-2,513 (0,006)

In brackets the probabilities are presented.
They are computed assuming asymptotic normality.

8.4. Table A4: VECM for Developed and Developing Countries

Advanced economies			*Emerging markets & developing economies*		
Total Insurance Premium			**Total Insurance Premium**		
	D(L_RGDP)	*D(L_TP)*		*D(L_RGDP)*	*D(L_TP)*
D(L_RGDP(-1))	0,272** (0,056) [4,822]	-0,921** (0,268) [-3,443]	**D(L_RGDP(-1))**	0,188** (0,041) [4,604]	-0,435 (0,233) [-1,865]
D(L_TP(-1))	0,0475** (0,012) [4,124]	-0,218** (0,055) [-3,982]	**D(L_TP(-1))**	0,101** (0,008) [12,631]	-0,047 (0,046) [-1,030]
RTP(-1)	-0,623** (0,063) [-9,875]	0,979** (0,299) [3,270]	**RTP(-1)**	-0,573** (0,052) [-10,861]	0,858** (0,301) [2,853]
Life Insurance Premium			**Life Insurance Premium**		
	D(L_RGDP)	*D(L_LP)*		*D(L_RGDP)*	*D(L_LP)*
D(L_RGDP(-1))	0,289** (0,058) [5,014]	-1,054** (0,324) [-3,251]	**D(L_RGDP(-1))**	0,265** (0,045) [5,833]	-0,705 (0,405) [-1,742]
D(L_LP(-1))	0,029** (0,009) [3,149]	-0,279** (0,052) [-5,436]	**D(L_LP(-1))**	0,045** (0,005) [8,281]	-0,049 (0,048) [-1,011]
LTP(-1)	-0,604** (0,062) [-9,712]	1,155** (0,349) [3,308]	**LTP(-1)**	-0,493** (0,047) [-10,486]	0,421 (0,420) [1,003]
Non-life Insurance Premium			**Non-life Insurance Premium**		
	D(L_RGDP)	*D(L_NLP)*		*D(L_RGDP)*	*D(L_NLP)*
D(L_RGDP(-1))	0,257** (0,061) [4,241]	-1,354** (0,282) [-4,797]	**D(L_RGDP(-1))**	0,191** (0,041) [4,669]	-0,437** (0,214) [-2,041]
D(L_NLP(-1))	0,037** (0,013) [2,909]	-0,034 (0,060) [-0,574]	**D(L_NLP(-1))**	0,105** (0,009) [12,158]	-0,019 (0,045) [-0,431]
NLTP(-1)	-0,538** (0,064) [-8,412]	1,180** (0,298) [3,964]	**NLTP(-1)**	-0,573** (0,051) [-11,140]	0,7823** (0,269) [2,903]

Standard errors in ( ) & t-statistics in [ ]
** indicate the coefficients which are significant at the 5% level