THE RELATIONSHIP BETWEEN INSURANCE DEVELOPMENT AND ECONOMIC GROWTH: THE MOTOR THIRD PARTY LIABILITY INSURANCE IN THE CZECH REPUBLIC

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Abstract

The topic of this article is to present an analysis of relationship between a development of a part of insurance market and development of the economy. The article is focused on motor third party liability insurance as one of the most important part of insurance business in developed countries. There are lots of analyses focused on relationship between insurance development and economic growth. However, the effects of this mechanism vary depending on analysed parts of insurance market and they vary across countries, too. The aim of this article is to analyse total written premiums of motor third party liability insurance in the Czech Republic in years 2000–2017 in relation to macroeconomic determinant in the Czech Republic. The methodology of the article is based on the financial time series analysis. The result validates the relationship between the analyzed variables. Conclusions of the article can offered several impulses for future researchers.

Key words: time series, motor third party liability insurance, economic growth, relationship

JEL Code: C30, G22, E44

Introduction

Insurance is important for a modern economy (Kugler & Ofoghi, 2005; Outreville, 1990). However, according to Arena (2008), the role of insurance is not studied in relation to economic development, such as the relationship between economic development and the banking sector. Kjosevski (2011) points to that this area has begun to be researched in detail in recent years. Research is primarily focused on the relationship between insurance and economic growth (Cristeaa, Marcu & Cârstina, 2014).

1 The relationship between insurance and economy

Outreville (1990) focused on the empirical relationship between property and liability insurance (non-life insurance) and economic and financial developments. He tested his model on the example of 55 developing countries. More generally, Ward & Zurbruegg (2000) or Levine, Loayza & Beck (2000) evaluated the relationship. Ward & Zurbruegg (2000) examined the relationship between economic growth and insurance. They focused on nine OECD countries (Organization for European Economic Co-operation). Levine, Loayza & Beck (2000) examined the relationship between financial intermediation and economic growth. Kugler & Ofoghi (2005) examines the relationship between economic growth and insurance in the United Kingdom. Later, Arena (2008) explored the relationship between life and non-life insurance and economic development in 55 countries. Han, Li, Moshirian & Tian (2010) also compared the relationship between insurance development and economic development. They evaluated data from 77 economies in the period 1994–2005. Ćurak, Lončar & Poposki (2009) chose a smaller sample of countries. They examined the relationship between insurance and economic development in the 10 member states of the European Union. Njegomír & Stojić (2010), Kjosevski (2011), Oke (2012) and Cristeaa, Marcu & Cârstina (2014) focused on relationship in different countries. Njegomir & Stojić (2010) tested the interaction between economic growth and insurance in the Ex-Yugoslavia Region. Kjosevski (2011) made an analysis in Macedonia, focusing on the period 1995–2010. Oke (2012) focused on short-term and long-term relationships between economic growth and insurance in Nigeria. Cristeaa, Marcu & Cârstina (2014) focused on development in Romania in 1997–2012. In recent years, Zouhaier (2014) or Ul Din, Abu-Bakar & Regupathi (2017) evaluated the relationship. Zouhaier (2014) examined the relationship between insurance and economic growth in 23 OECD countries in 1990–2011. Ul Din, Abu-Bakar & Regupathi (2017) analyzed the relationship between insurance and economic growth in 20 countries around the world in 2006–2015.

In most examples, the authors came to similar conclusions. According to Levine, Loayza & Beck (2000) a positive relationship was identified. Ward & Zurbruegg (2000) also identified a positive relationship, but only in some countries. They stated that the relationship between insurance and economic development is country-specific and dependent on the conditions of the particular country under consideration. They pointed to that relations should be explored at country level. Similarly, Kugler & Ofoghi (2005) demonstrated a positive relationship between the development of the insurance market and economic growth.

According to Ćurak, Lončar & Poposki (2009), Han, Li, Moshirian & Tian (2010), Njegomír & Stojić (2010), Oke (2012), Ul Din, Abu-Bakar & Regupathi (2017) insurance sector development positively and significantly affects economic growth. Han, Li, Moshirian & Tian (2010) and Ul Din, Abu-Bakar & Regupathi (2017) noted that mainly non-life insurance is important for economic growth in developing countries. Kjosevski (2011) identified a positive relationship, except for life insurance (the negative relationship). Zouhaier (2014) also identified a negative relationship. He compared his research findings with other authors (for example, Kjosevkski, 2011).

For the assessment of the economy, the authors used mainly GDP (Gross Domestic Product) and GDP per capita (Cristeaa, Marcu & Cârstina, 2014; Ćurak, Lončar & Poposki, 2009; Han, Li, Moshirian & Tian, 2010; Oke, 2012; Outreville, 1990; Ward & Zurbruegg, 2000). For the assessment of the insurance, the authors used the development of insurance premiums (Kugler & Ofoghi, 2005; Oke, 2012; Ul Din, Abu-Bakar & Regupathi, 2017; Ward & Zurbruegg. Or the authors also used the number of insurers on the market (Oke, 2012).

For the analysis, the authors used method of least squares (Kjosevski, 2011; Outreville, 1990), correlation coefficient or linear regression (Cristeaa, Marcu & Cârstina, 2014), panel analysis (Ćurak, Lončar & Poposki, Tian, 2010) or cointegration analysis (Oke, 2012; Ward & Zurbruegg, 2000) using the Johansen test (Kugler & Ofoghi, 2005) or using Granger test (Njegomir & Stojić, 2010). Kugler & Ofoghi (2005) noted that false regression can cause data analysis problems. They also said that economic variables are often not stationary.

There is a consistent theoretical explanation of the relationship between the development of insurance and the development of the economy in the countries, but the empirical results differ across countries. At the same time, the results from life and non-life insurance also differ. It therefore seems appropriate to analyze separately the different parts of the insurance market and to focus on the sub-part of the market.

One of the important parts of the insurance is motor third party liability insurance (Tomeskia, 2012). According to Tomeskia (2012), this insurance is up to 30 % of total premiums written in non-life insurance. The aim of the article is to analyze the potential relationship between the development of this part of insurance market and economic development in the Czech Republic. The research question is whether the development of the insurance market is influenced by the development of the economy.

The aim is to provide a systematic evaluation based on time series and the use of a cointegration analysis. Data from the last 18 years is used. Data show GDP per capita and development of the motor third party insurance (determined in total written premiums).

2 Methods

The cointegration analysis is a modern method for the analysis of non-stationary variables. Cointegration analysis can be done using numerical tests or graphical methods. The numerical test can be selected – the Engle-Granger test.

Numerical cointegration analysis consisted of two basic steps. The first is a unit root test and the second is a cointegration test of two variables. The conditions have to be met before testing. It is necessary to determine an optimal lag length. It is necessary data to be stationary.

The optimal lag length can be determined using the Aikaike Information Criterion (AIC), see Formula (1) where n is the number of observations, RSS the mentioned residual sums-of-squares and k number of parameters. The criterion is recommended for fewer observations (up to 60 observations).

$$AIC = n \times log\left(\frac{RSS}{n}\right) + 2k \qquad (1)$$

The next step is to perform the unit root test. The test can determine whether the time series are stationary or non-stationary. The test can be performed using the Augmented Dickey-Fuller test (ADF), see Formula (2), where y_t is a variable, t is a trend variable, ε approximates the white noise and k is the number of optimal lag length. This test is often used.

$$\Delta y_t = \alpha + \beta_t(\rho - 1)y_{t-1} + \sum_{i=1}^{k-1}\theta_i \Delta y_{t-1} + \varepsilon_t \qquad (2)$$

The test can determine non-stationarity. There it is necessary to adjust the time series and repeat the test. The time series can be logarithmized and purified by a Hodrick-Prescott filter, see Formula (3), where y is a variable and y_t^* is a purify variable. This time series filter removes the cyclical component.

$$\min_{\{y_t^*\}}\left[\sum_{t=1}^{T}\left(y_t - y_t^*\right)^2 + \lambda\sum_{t=2}^{T}\left[\left(y_{t+1}^* - y_t^*\right) - \left(y_t^* - y_{t-1}^*\right)\right]^2\right] \qquad (3)$$

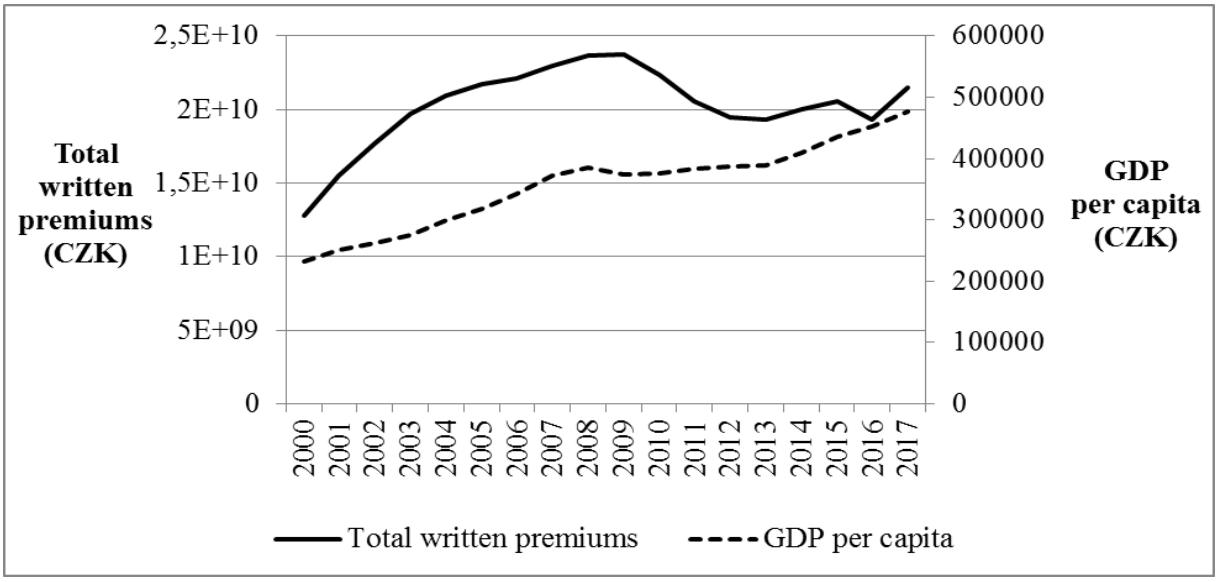
After demonstrating the stationarity of the adjusted time series, it is possible to progress with cointegration test. The Engle-Granger test can be used, see Formula (4), where e_t are estimated residue, k is the number of optimal lag length and ε_t are residue.

$$\Delta e_t = \varnothing e_{t-1} + \sum_{i=1}^{k} \alpha_1 \Delta e_{t-1} + \varepsilon_t \qquad (4)$$

3 Data

Data was obtained from SUPIN s.r.o. (total written premiums) and from The Czech Statistical Office (GDP per capita). These were secondary data. This was a complete dataset for the period 2000-2017 (see Fig. 1). The data in the Fig. 1 is given in Czech crowns (CZK).

Fig. 1: The development of total written premiums of motor third party liability insurance and the development of GDP per capita



Source: author with use SUPIN (2018), The Czech Statistical Office (2018)

4 Results

The AIC test was done. To test the relationship between GDP per capita (exogenous variable) and the development of premiums written (endogenous variable), optimal lag length was determined at 1 (see Tab. 1). The optimal lag length was used in the next calculation.

Tab. 1: The optimal lag lenght with constant and trend

The optimal lag length	AIC
1	43.819218
2	43.935179
3	44.061897
4	44.094677

Source: author using the Gnu Regression, Econometrics and Time-series Library

A stationarity test of time series was performed. The ADF test was used. A model with constant and trend was used. A zero hypothesis (H0: time series are non-stationary) at 95% significance level was tested. The significance level was compared with the *p*-value (see Tab. 2).

Tab. 2: Results of the ADF test

Variable	*p*-value	H0
GDP per capita	0.5224	do not reject the null hypothesis
Total written premium	0.1466	do not reject the null hypothesis

Source: author using the Gnu Regression, Econometrics and Time-series Library

The test determined non-stationarity. It was necessary to adjust the time series and repeat the test. The time series were logarithmized and purified by a Hodrick-Prescott filter. It was used the recommended λ-value for the annual time series, $\lambda = 100$. In the case of annual time series data, it is not necessary to deal with the seasonal component.

The second stationarity test of time series was performed. The adjusted data was used. A zero hypothesis (H0: time series are non-stationary) at 95% significance level was tested. The significance level was compared with the *p*-value (see Tab. 3).

Tab. 3: Results of the ADF test (results for adjusted data)

Variable	*p*-value	H0
GDP per capita	6.976e-019	reject the null hypothesis
Total written premium	6.896e-044	reject the null hypothesis

Source: author using the Gnu Regression, Econometrics and Time-series Library

In both cases it was possible to reject the null hypothesis. Adjusted time series were stationary. After demonstrating the stationarity of the adjusted time series, it was possible to continue the cointegration test. The Engle-Granger test was used. A zero hypothesis (H0: time series are not cointegrated) was tested at a 95% significance level. The Engle-Granger test offers three basic models for cointegration testing. It is a non-constant model, a model with constant, or a model with a constant and trend. A model with lowest AIC was selected – it was the model with a constant and trend. For this model the *p*-value is equal 4.73e-021. The p-value is lower than the test statistic. It is possible to reject the null hypothesis. There is the cointegration between time series.

5 Discussion

The problem of relationship between insurance and economic growth is solved by many scientists. There are currently many professional studies that focus on this topic. But there is a limited number of country-specific studies. Similarly, scientists do not focus on the relationship the relationship between the development of the economy and parts of the insurance market. Therefore was the aim of this article to analyze the part of the insurance market (the motor third party liability insurance) and to focus on this sub-part of the market in relationship to development of economy.

The research question was whether the development of the insurance market is influenced by the development of the economy. The relationship has been confirmed for the Czech Republic in years 2000–2017, based on the research results (Chapter 4). The cointegration between time series has been identified. The cointegration of time series means that the development of individual time series does not deviate in the long run. Similarly, the relationship of non-life insurance and development of the economy was identified by other scientists, for example Arena (2008) and Outreville (1990). But Koklar (2013) stated different conclusions. Koklar (2013) noted that GDP in the Czech Republic has no impact on property and liability insurance. He stated that this conclusion may be related to the undeveloped financial system in the Czech Republic.

It is important to remember that the results are conditional on the data set. They were used annual time series. More detailed data could also be used in future research. GDP per capita has been included in the research; in the future, other macroeconomic determinants could also be used.

Conclusion

The cointegration between the part of the insurance market and the development of the economy has been demonstrated. Analysis of cointegration is important in economic systems. These systems may be affected by random variances in the short term.

Not all sphere of relationship have been resolved, but the article provides new data. It is appropriate to analyze separately the individual parts of the insurance market and to focus on individual market parts.

The results may indicate the need to use tools to develop insurance. It is necessary to perceive the importance of insurance. It is appropriate to adopt conceptual decisions in this area – for example to promote competition in this area or to provide institutional support.

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