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MACROECONOMIC DETERMINANTS OF INSURANCE COMPANIES' FINANCIAL STABILITY: THE CASE OF THE CZECH REPUBLIC

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Abstract:

The study assesses the determinants of the financial stability of the Czech commercial insurance companies within the period 2004-2019. The eight macroeconomic determinants of the financial stability of insurance are analysed for both insurers, i.e., with predominated life and non-life insurance. The generalized method of moments is used for empirical analysis. The results show four macroeconomic variables were statistically significant determinants of financial stability in the case of non-life insurers and three determinants influenced the financial stability of life insurers. The study concludes that the determinants of the financial stability of non-life insurers were different that in the case of life insurers. Moreover, the impact of several determinants is also different in case life and non-life insurers in the Czech Republic.

Key words: *Life insurance, non-life insurance, financial stability index, real Gross Domestic Product growth rate, generalized method of moments*

1. Introduction

Especially after the financial crisis, the importance of examining the financial stability not only of banks but also of insurance companies has become apparent. The financial crisis has shown the need to consider the financial stability of insurance companies and systemic risk (EIOPA 2017). Financial stability and systemic risk are two strongly related concepts. Financial stability can be defined as a state whereby the build-up of systemic risk is prevented. The systemic risk contribution of the insurance sector has risen since the crisis. However, studies providing the analysis of the main drivers of the insurance sector are scarce, at least when compared to the banking sector (Hodula et al. 2021). In addition, the financial system has become more complex (Trichet, 2005), therefore the importance of the analysis financial stability also in the insurance sector increased.

As Hodula et al. (2021) stated that a healthy and stable insurance sector is crucial for the functioning of the economy, because it contributes to the economic growth and financial stability of the financial system as a whole. In addition, insurance companies protect households and companies from losses arising from natural disasters. Moreover, by mitigating the losses during natural disasters, they help to reduce the probability of default of some investors who sometimes, are the same obligors as those of banks (Lee et al. 2016). ECB (2009) summarized these reasons and stated that insurance companies can be important for the financial system stability mainly because they are large investors in financial markets, there are growing links between insurers and banks and because insurers are safeguarding the financial stability of households and firms by insuring their risks.

Given the fact that insurance companies have become riskier (Schinasi 2006; Baluch et al. 2011), it is crucial to assess the drivers of their financial instability. There exist very few studies providing evidence of indicators of insurance financial stability (see Section 2). This gap in the literature motivates this paper. One of the contributions of this paper is to fill in the gap in the empirical literature regarding the financial stability of insurance commercial companies. To the best of our knowledge, it is the first study that examined the factors influencing financial stability in case of the Czech Republic. Moreover, for the measurement of the financial stability, we used the summary financial stability index. Several studies measured financial stability using Z-score (e.g., Pavić Kramarić et al. 2019) or indicators of financial health (e.g., Rybyšarová and Lelek 2009).

The financial stability of insurers can be influenced by both firm-specific (internal) factors and macroeconomic (external) factors. Some studies (e.g., Chen and Wong 2004) focused on examination of the effects of both factors on insurance financial stability. The paper is focused on the main macroeconomic factors, because the firm-specific factors are included in the summary financial stability index. Moreover, Chen and Wong (2004) argued that economic and market factors are important in the prediction of insurers' financial health. The macroeconomic (external) factors cannot be influenced by the insurance companies, but these indicators can influence the business of the insurance, their risks, and financial stability.

The aim of the paper is to assess the determinants of the financial stability of the Czech commercial insurance companies. We separately analysed the insurers with predomination of life and non-life insurance. Therefore, we can better distinguish the factors that can influence the insurers in which life or non-life insurance predominate. It can help insurance company management to focus on the financial health with regard in external factors.

The paper is structured as follow. First section presents the literature review and the background of the determinants of financial stability. Second section presents the methodology and data and the third part is empirical analysis and results. The last section concludes the paper and provides the summary.

2. Literature Review

Although traditional insurance business is commonly not interpreted as a major source of systemic risk (IAIS 2011; ESRB 2015), there are substantial differences in the relation between insurance business activities and financial stability. For example, life insurers tend to be more vulnerable to lapse risk and hence, potentially face a higher liquidity risk (e.g., Cummins and Weiss 2014; Paulson et al. 2014). Due to the longer investment horizon compared to non-life insurers, life insurers are more sensitive to interest rate risk in particular (Kubitza and Regele 2017).

Every commercial insurance company is exposed to a considerable amount of risk. These risks can cause commercial insurance companies' significant problems with performance and, consequently, financial stability. These risks are related to the overall economic situation of the country. According to Vávrová (2014), the effects of inflation and unemployment rate can be included among the risks. The investment activities of insurance companies are associated with other risks. Vávrová (2014) draws attention to the volatility of interest rates, which will be reflected in a reduction in profits from investments made by commercial insurance companies. Moreover, Caporale et al. (2017) analysed the determinants of insolvency risk for general insurance companies. The authors found that the real interest rate and the change in wholesale prices have a positive effect on default intensity that could lead to a higher default probability, they found that gross domestic product (GDP) growth, real exchange rate were not the determinant of insolvency risk in United Kingdom.

Chen and Wong (2004) studied firm-specific and market factors that affect both life and non-life insurers separately and used GDP, unpredicted inflation, interest rate, change in interest rate and competitiveness as macroeconomic indicators of financial health of insurance companies in Asian countries. Authors found that the interest rate was positively related to the financial unhealthy rate. Their results were confirmed by Browne et al. (1999) who also found that insurers were more likely to face disintermediation and to become insolvent during periods of increases in long-term interest rates. Chen and Wong (2004) argued that interest income is one form of investment income for insurers. Thus, interest rate is an important variable for investment decisions, which affect the investment strategies of insurers. Similarly, Abdelraheem and Mousa (2017) found that changes in inflation rates and exchange rates affect the value of the insurance company's capital, both life insurance, and general insurance which in turn affects the insurance company's reinsurance and solvency capacity.

Sugiharto et al. (2019) suggested that high rates of interest and inflation decrease the financial health of general insurance companies. Ahlgrim and D'Arcy (2012) also confirmed that the inflation rate had a negative effect on financial health insurance companies, considered as one of the top risk lists for insurers. Sugiharto et al. (2019) added that increases in either interest rates or inflation rates cause risk-based capital of general insurance companies to decrease or have a lower level of financial health and vice versa.

In the empirical literature, the studies analysing the determinants of financial stability of insurance companies are limited. Although, several studies estimated the

determinants of financial health or solvency of insurers. E.g. Misas and Moreno (2017), Moreno et al. (2020), or Rauch and Wende (2015) analysed the factors determining the solvency of insurance companies, however these studies investigated the insurance specific factors. In addition, Puławska (2021) demonstrated that the COVID-19 pandemic has negatively affected the European insurance sector's functioning, although the result did not identify the pandemic's effect on the Z-score ratio. Even though her results show that the COVID-19 pandemic has not significantly affected the solvency of insurance companies, she concluded that regulators should consider implementing interventions if solvency ratios decrease enough for some companies to reach regulatory action levels.

Most of authors examined the determinants of the insurance companies' performance. Due to the fact that performance is one part of the financial stability summary index, we mention several of them. Research according to Kramarić et al. (2017) focused on analysing the macroeconomic variables on the performance of insurance markets in selected countries of CEE. The authors found that the real GDP per capita growth has a significant positive effect on performance. Pervan and Pavić Kramarić (2010) investigated the determinants of insurance companies' performance in Croatia. The results of the study prove that ownership, expense ratio and inflation have a negative and significant influence on profitability. In addition, Kozak (2011) investigated the profitability of the non-life insurance sector in Poland in the period of the integration process of the Polish financial system with the European markets. Additionally, the increases of the GDP growth and the market share of foreign owned companies positively impact the profitability of non-life insurance companies during the integration period. Ortyński (2016) also identified the determinants of the performance of general insurance companies in Poland. A positive relationship between the variable GDP rate and the profitability ratio of the technical activity was found. We can summarize that in most of the studies the GDP positively influenced the performance of insurers.

3. Methodology and Data

The data set used in this paper was obtained from statistics of the Czech Association of Insurance Companies (CAIC), the annual report of the Czech insurance companies for insurers that were not members of the CAIC and the statistics of ECB (Statistical Data Warehouse). The data set covered the Czech insurance companies during the period 2004-2019. All data were reported on an unconsolidated basis. The insurance companies are divided into two groups. There are 20 insurers with a predominance of non-life insurance and 11 insurance companies with a predominance of life insurance. The sum of the total written premium of selected insurance companies covered more than 90% of the total written premium of the Czech insurance market. The dataset is representative. Due to some missing observations, we have an unbalanced panel of 443 observations (294 observations of non-life insurance and 149 observations of life insurance) over the period 2004-2019.

In the first step, the financial stability of the insurers was calculated. The financial stability of the insurance companies is measured using the summary financial stability index. The aggregate index is constructed as a weighted sum of selected indicators,

namely, profitability, liquidity, cost, technical provisions, and solvency. The individual indicators for each area are presented in Table 1. The aggregate financial stability index is calculated for each insurance company for each year.

Table 1 Determination of the summary index of financial stability

Area	Variables	Life insurance	Non-life insurance
Costs	Expense Ratio (ER)	x	
	Combined Ratio (COR)		x
Technical reserves	Reserve Ratio (RR)		x
	Technical Coverage Ratio (TCR)		x
	Insurance Financial Leverage (IFC)	x	x
Solvency	Solvency Ratio (SR)	x	x
Liquidity	Liquidity Ratio (LR)	x	x
Profitability	Return on Assets (ROA)	x	x
	Results of a technical account on Assets (UPA)	x	x

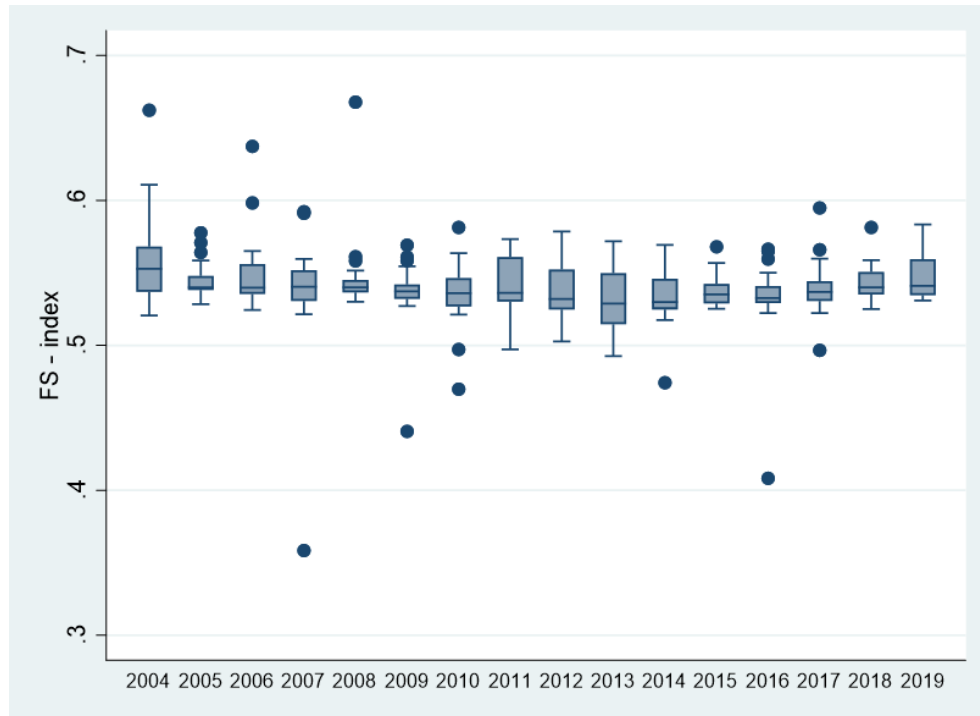
Source: authors' compilation

We applied the financial stability index separately for insurance companies that predominantly provide life insurance and non-life insurance. Figure 1 describes the development of the financial stability index of insurance companies with predominated non-life insurance during the period 2004-2019. We can say that the development of financial stability is relatively stable in the Czech insurance market during the analysed period. Even though the financial stability slightly decreased during the period 2009-2014. Although we see the differences between individual insurers. However, the Czech insurance companies did not face the significant financial instability.

When we analyse the insurance companies with predominated life insurance (presented in Figure 2), we can see that the development of financial stability is also relatively stable during the period 2004-2019. Financial stability slightly decreased during the financial crisis, but this decrease was not significant. We can say that there are also differences between individual insurers. These differences in financial stability among insurers are higher in the case of life insurers than non-life insurers.

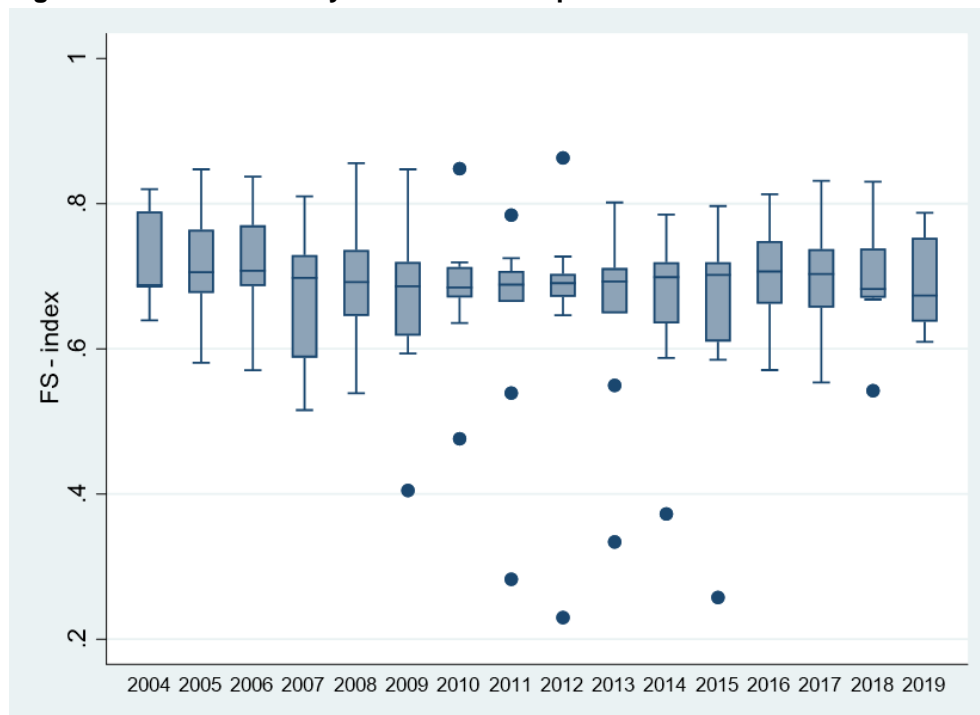
For empirical analysis, to find the determinants of insurance companies' financial stability, the dynamic panel data analysis was used. In this paper, we focused on several macroeconomic factors that can influence insurance financial stability (Table 2). The macroeconomic factors were selected based on the literature review and depending on the available data.

Figure 1 Financial stability of insurers with predominated non-life insurance



Source: authors' calculation

Figure 2 Financial stability of insurers with predominated life insurance



Source: authors' calculation

Real gross domestic product presents a year-to-year growth of GDP gross in each country. Exchange rate (ER) is CZK to EUR rate. Inflation rate (INF) is the average percentage year on year consumer prices. Unemployment rate (UR) is an average rate in percent. The Czech Republic Government budget for Gross Domestic Product (GB) is obtained from the Czech statistical office. PRIBOR 3M (PRIBOR) is 3 months interbank reference rate in the Czech interbank market. Interest rate on loans (IR) is represented by the average interest rate of the bank loans. Population (PP) is represented by the change of the population in the Czech Republic. Financial crisis (FC) was used as a dummy variable and the financial crisis was in the period 2008-2015 in the Czech financial market. Descriptive statistics of variables are presented in Table 3.

Table 2 Descriptive statistics of variables

Variable	Mean	Std. Dev.	Min	Max
FS index non-life insurance	0.54026	0.02596	0.35851	0.66781
FS index life insurance	0.68120	0.10529	0.22988	0.86310
Real GDP	2.79357	2.88559	-4.66	6.77
Inflation rate	2.09932	1.37414	0.3	6.3
Unemployment rate	5.58537	1.95342	2.00	8.3
Government budget to GDP	-0.01800	0.01585	-0.0487	0.0129
Exchange rate	26.7966	1.83126	24.586	31.904
Population	10493.53	130.6067	10221	10694
PRIBOR 3M	1.57659	1.17515	0.29	4.5

Source: authors' calculation

For empirical analysis of the determinants of insurance, financial stability is examined using the Dynamic Panel Data Analysis. We used the econometrics software STATA 16 for an econometrics estimation. We use a dynamic linear model given by:

$$y_{it} = c + \delta y_{it-1} + \sum_{j=1}^J B_j X_{it}^j + \varepsilon_{it}, \quad (1)$$

where the variables y_{it} is the financial stability (FS) of the insurance companies i at time t , with $i = 1, \dots, N$, $t = 1, \dots, T$, c is a constant term, X_{it} 's are the macroeconomic variables and ε_{it} is the disturbance.

As a consequence, we specify a dynamic model by including a lagged dependent variable among the regressors, i.e. y_{it-1} is the one-period lagged profitability and δ the speed of adjustment to equilibrium. More concretely, in empirical application, we estimated Eq. (2):

$$FS\ insurers_{it} = c + \delta FS\ insurers_{it-1} + \beta_1 GDP_{it} + \beta_2 ER_{it} + \beta_3 INF_{it} + \beta_4 UR_{it} + \beta_5 GB_{it} + \beta_6 PRIBOR_{it} + \beta_7 PP_{it} + \beta_8 FC_{it} + \varepsilon_{it} \quad (2)$$

4. Empirical Analysis and Results

We estimate the determinants of financial stability in the Czech insurance companies. We consider separately the insurers with predominated life insurance and non-life insurance. This section presents the results of the macroeconomic determinants that influence the insurance financial stability measured by the aggregate financial stability index. For empirical analysis, we used generalized method of moments (GMM) as an estimation method in dynamic panel data analysis. The econometric analysis of our model confronts several issues.

Before the panel analysis was conducted, the stationarity of a panel dataset was tested. We tested the unbalanced panel for stationarity using a panel unit root test, especially using Levin, Lin and Chu test. In the second step, we tested the correlation coefficient of independent variables. We assessed the model using fixed effects for insurers. We verified that fixed effects are appropriate in these models as follows. The null hypothesis of Hausman model, that fixed and random effect models have no systematic differences, was rejected, and we next the suitability of the fixed effect was confirmed. Moreover, the model with fixed effect produces unbiased and steady coefficients. Furthermore, we tested the robustness of the models using Sargan-Hansen test (J test). The null hypothesis of exogenous instrument in the Sargan-Hansen test was not rejected in the model. Thus, we can confirm the validity of the estimates. It is necessary to be aware of the fact that the Hansen test could be weakened by too many instruments, especially if the number of instruments exceeds the number of groups. That is not the case in this research.

Table 3 Determinants of financial stability of non-life insurers

Variable	Coefficient	Std. Err.
FS index _{t-1}	-0.16374 ^a	0.05953
Real GDP	-0.02742	0.06169
Inflation rate	0.32332 ^c	0.17719
Unemployment rate	-0.30071 ^b	0.15785
Government budget to GDP	-0.19028	0.16771
Exchange rate	0.00397 ^c	0.00210
Population change	-2.08719 ^b	0.97215
PRIBOR 3M	0.00297	0.00268
Financial crisis	0.00053	0.00450
Constant	0.53148 ^a	0.05904

Note: ^a denotes significance at 1% level, ^b denotes significance at 5% level, ^c denotes significance at 10% level

Source: authors' calculation

The results presented in Table 3 show that only four macroeconomic variables were statistically significant in the case of non-life insurers, namely, inflation rate,

unemployment rate, exchange rate and population change. The results show that the inflation rate and exchange rate positively influenced the financial stability. Although Sugiharto et al. (2019) or Ahlgrim and D'Arcy (2012) found the negative impact of inflation on the financial health of the insurers. It is necessary to note that the Czech National Bank (CNB) endeavours to keep inflation low, stable, and therefore predictable. It achieves its inflation target of 2% by setting interest rates and other monetary policy instruments. Over the last decade, the Czech economy was characterized by low inflation. Especially after 2008, the economic activity fell down, which was not accompanied by a corresponding fall in prices, and the lack of inflation when economic activity subsequently revived. To reach the inflation target, the CNB adopted the exchange rate commitment in autumn 2013, they did after monetary policy rates had been lowered to "technical zero" in November 2012, and the situation called for a further easing of the monetary conditions. The exchange rate commitment was used until April 2017 (CNB 2020).

On the other hand, the unemployment rate and population change negatively influenced the financial stability. In the case of unemployment rate, it is in line with our expectation, because the lower level of unemployment is connected with higher financial, health and stability of the insurance companies. It means that when unemployment rate increased, the financial stability of non-life insurers decreases.

Similarly, when the rate of population change decreases the insurers are more stable. Feyen et al. (2011) claim that population size determines the operating background, that is to say, the size of the market, for the non-life insurance industry. Authors assumed the positive effect on the non-life insurance consumption. It is necessary to note that we estimated the effect of the population change, not the total population. It means more less population change leads to financial stability of insurers. Although the real GDP and financial crisis were not statistically significant determinants of financial stability, therefore, we cannot say that the economic cycle influenced the financial stability of insurers in the Czech Republic. This result is in line with the economic theory, moreover Kubitzka and Regele (2017) stated that non-life insurance risks are usually not correlated with the economic business cycle and hence constitute a natural hedge. In contrast to life insurers, claim payments to policyholders require the occurrence of an insured event, which makes insurance running impossible (IAIS 2011).

Table 4 Determinants of financial stability of life insurers

Variable	Coefficient	Std. Err.
FS index _{t-1}	0.54864 ^a	0.08070
Real GDP	0.18761 ^c	0.10602
Inflation rate	0.17466	0.36931
Unemployment rate	0.51566 ^b	0.22585
Government budget to GDP	0.23459	0.35359
Exchange rate	-0.00328 ^c	0.00226
Population change	-0.24155	1.98740
PRIBOR 3M	-0.01620	0.56640

Financial crisis	0.00078	0.00910
Constant	0.33258 ^a	0.11152

Note: ^a denotes significance at 1% level, ^b denotes significance at 5% level, ^c denotes significance at 10% level

Source: authors' calculation

Table 4 presents the factors that influenced the financial stability of insurers where life insurance predominated. In this model, only three factors were statistically significant. Only real GDP, unemployment rate, and exchange rate. The results are very surprising, because it showed that the exchange rate negatively influenced the financial stability. Although, this result could be connected with the foreign exchange interventions of the CNB in the Czech Republic during 2013-2017 as it mentioned above. On the other hand, the real GDP and unemployment rate positively influenced the insurance financial stability. When the unemployment rate increase it was connected with the increase of financial stability. This finding may mean that life insurance covers risks to adverse life situations and unemployment represents this situation. According to Šídló (2010), life insurance is arranged in times of fear and concern for the future of the individual or family. It can therefore be said that in times of high unemployment, people will be more interested in life insurance products.

We found that the financial stability is positively influenced by economic cycle and in economic growth the financial stability is better. Moreover, Hodula et al. (2020) found that insurance sector premiums comove closely with the business cycle owing to its strong, positive and statistically significant relationship with real GDP growth. Therefore, it can be connected with the financial stability of insurers. In addition, several previous studies (e.g., Christophersen and Jakubik 2014) found the positive impact of GDP on insurance profitability. E.g. Berhe and Kaur (2017) explained that economic growth can facilitate the profitability of insurance companies mainly through increasing the need for financial services, thereby increasing insurers' cash flows and profit margins. Whenever the economy gets prosperous, then the need for insurance services will definitely increase and this can ultimately result in high returns or profit margin to the insurers. The profitability is closely connected with the financial stability, in our model, one important part is insurance profitability (see Table 1).

5. Conclusion

The aim of the paper was to assess the macroeconomic determinants of the financial stability of commercial insurance companies. The analysis covers the data of the Czech commercial insurance companies during the period 2004-2019. The study focuses on the selected macroeconomic determinants separately for insurance companies with predominated life and non-life insurance.

The results show that while four macroeconomic variables were statistically significant determinants of financial stability in the case of non-life insurers, three determinants influenced the financial stability of insurers with predominated life insurance.

We found that the inflation rate and exchange rate positively influenced the financial stability of insurers with predominated non-life insurance. On the other hand, the unemployment rate and population change negatively influenced the financial stability of these insurers. It means that when the unemployment rate increased, the financial stability of non-life insurers decreases. Similarly, when the rate of population change decreases, the insurers are more stable. We cannot confirm that the economic cycle influenced the financial stability of non-life insurers in the Czech Republic. On the other hand, real GDP positively influenced the financial stability of insurers with predominated life insurance. Moreover, the exchange rate negatively influenced the financial stability and unemployment rate positively influenced the insurance financial stability of life insurance companies.

The results show that the financial stability of insurers with predominated life and non-life insurance is influenced by different determinants. Moreover, in case of the development of macroeconomic factors, the financial stability of life and non-life insurers can be different (for example, the case of unemployment rate or exchange rate).

Although the interest rate was not statistically significant determinant of insurers' financial stability, it is necessary to state that the analysed period was connected with a low interest rate in the Czech Republic. Malovaná et al. (2020) suggested that low interest rates may undermine the solvency of insurance companies and or ESRB (2015) added that the scenario of a prolonged low-interest rate environment in conjunction with a drop-in asset prices is considered to be one of the most destabilizing events for European life insurers and the real economy as well. However, since 2020 in the Czech Republic, the interest rate has increase, the supervisory authorities as well as the management of insurers could focus the attention on the insurance stability. As Malovaná et al. (2020) pointed, if a period of low interest rates ends with a sudden rise in rates, insurance policyholders may withdraw their funds ahead of maturity (surrender). This will become a source of liquidity vulnerability for insurance companies (CGFS 2018). Moreover, the COVID-19 pandemic situation can also negatively influence the financial stability of insurance companies. Even though the financial crisis was not a statistically significant determinant of financial stability of insurers, the pandemic crisis is significantly different in nature from the 2008 financial crisis. Therefore, the supervisory institution as well as the insurers management should focus on the financial health of the insurance companies in the Czech Republic.

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