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What Drives Property Insurance Demand in Croatia?

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Abstract: *Property insurance is an important part of risk management, insurance coverage and vehicle of catastrophic losses financing. In developed countries, property insurance plays an important role in the structure of non-life premium, while in developing markets, such as Croatian, property insurance penetration is rather low. Unfortunately, the recent earthquakes in Zagreb (Croatia) and the surrounding area in 2020 have once again highlighted a large protection gap, resulting in a dominant role of government in financing catastrophic losses. The aim of this paper is to discuss and investigate the factors that determinate property insurance demand in Croatia. Using the VAR (Vector AutoRegression) methodology extended via spillover index approach, we analyse a comprehensive data set ranging from the economic, financial, social to insurance indicators. The conclusions of this research point that some of the expected drivers of insurance demand such as mortgage loans, consumer confidence and loss experience, are not important in Croatia, and that property insurance is dominantly driven by economic development.*

Keywords: property insurance demand; Croatian insurance market; VAR model; spillover effect

JEL Classification: G52, C32

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Introduction

The insurance industry in general provides some important functions for the economy and society in every country. The role and functions of insurance range from providing risk management and insurance solutions to cover perils for entrepreneurs, individuals, and the government, fostering economic development through investments and providing important solutions to the whole society such as life, pension and long-term care insurance (Skipper & Kwon, 2007). Property insurance, as a part of the non-life insurance lines, covers a wide range of perils from fire, damage, flood, earthquake, and business interruption to robbery and other similar perils. It is also an important part of the comprehensive catastrophic risk management dealing with the losses of natural or human-made disasters. A well-developed insurance sector is necessary for economic development, as it provides long-term investments that foster economic growth, while simultaneously strengthening the risk-taking abilities (Outreville, 2013).

The Croatian insurance market is still a developing insurance market. Key insurance indicators point to the developing/emerging phase of the insurance industry in Croatia. Croatian Insurance Market in 2017 stood at: 2.5% premium share in the GDP (gross domestic product), 333 USD or €296 insurance premium per capita and life insurance premium share of 32.4% in total premiums. Compared to the EU countries, where average insurance penetration was 7.1% with insurance density of 2,429 USD, suggest that there is plenty of room for improvement for Croatian insurance market. Similar cases to Croatian market are insurance markets in other Central and Eastern European (CEE) countries. An average of insurance penetration in CEE markets in 2016 was 2.37%, ranging from 1.2% in Romania to 5.12% in Slovenia. A CEE average in insurance density was 330 EUR, with a minimum of 103 EUR in Romania and a maximum value of 986 EUR in Slovenia (Insurance Europe, 2019). The share of Croatia's insurance industry in the total world insurance premium in 2017 stood at 0.03%, and it was ranked 65th in the world. In addition, the Croatian insurance market has a 0.11% share in the European Insurance Market (Croatian Insurance Bureau, 2019).

The insurance market in Croatia, like other CEE markets, is characterized by a fierce competition of both domestic and foreign-own insurance companies. Despite that fact, the structure of the total premium income is less developed, represented by the dominant share of motor insurance in a non-life portfolio. The share of other property insurance stood at 7.0%, and fire and elementary damage insurance with 6.6% in the insurance premium structure (Croatian Insurance Bureau, 2019). On the European level in 2018, property insurance market had a share of 26% in the non-life insurance portfolio with an average property premium per capita of 168 EUR (Insurance Europe, 2019). Property insurance premium per capita in Croatia was only 44 EUR, one of the lowest on the European level (Croatian Insurance Bureau, 2020).

Due to this fact, the government in Croatia is an important player in financing losses caused by natural disasters. The biggest problems in managing fiscal risks of the natural disasters in Croatia are the lack of resources, poor coordination, and inadequate response. Since the costs of natural disasters point to significant fiscal risks stemming from this source, there is a need of developing adequate instruments for the mitigation and transfer of natural disaster risks in Croatia (Primorac & Golub, 2019). Recent losses and costs caused by an earthquake in the City of Zagreb (22 March 2020, magnitude 5.3 Mw), followed by the series of earthquakes in Zagreb surrounding area (Petrinja, 28 and 29 December 2020, largest magnitude 6.4 Mw) are estimated at 17 bil. EUR (Ministry of Construction and Physical Planning, 2021), which unfortunately again stressed out the need for an adequate risk transfer mechanisms and a more important role of the insurance industry. Von Peter, Von Dahlen & Saxena (2012) present a large panel study on the macroeconomic consequences of natural catastrophes and analyse the extent to which risk transfer to insurance markets facilitates economic recovery. They conclude that it is mainly the uninsured losses that drive the subsequent macroeconomic cost, whereas sufficiently insured events are inconsequential in terms of foregone output. They emphasise a focus on risk transfer mechanisms to help mitigate the macroeconomic costs of natural catastrophes (Von Peter, Von Dahlen & Saxena, 2012).

The aim of this paper is to determine drivers of property insurance demand in Croatia. The conclusions for Croatia may also be of interest for other Central and Eastern European countries and the countries of the Western Balkans, as they have similar political histories, insurance and financial market developments and a level of insurance penetration.

Literature review

Property insurance is often viewed in terms of narrowing the protection gap. The 'protection gap' is usually defined as the uninsured portion of losses resulting from an event, namely the difference between total economic and insured losses (Holzheu & Turner, 2018). Addressing the protection gap is an important issue for governments, economy and businesses, and society. There is a growing evidence indicating that countries with greater insurance coverage penetration have faster economic recoveries from disasters and that they rebuild with greater resilience to future disasters. Research has shown that a 1% increase in insurance penetration can reduce the disaster recovery burden on taxpayers by 22% (Insurance Development Forum, 2017). Von Peter, Von Dahlen & Saxena (2012) in their research on the macroeconomic impact of natural catastrophe events concluded that countries with higher insurance penetration had lower indirect costs and a faster economic recovery than less-insured countries (Von Peter, Von Dahlen & Saxena, 2012).

Drivers of insurance demand/consumption have been extensively researched in insurance sciences both in the case of life and non-life insurance. However, most previous literature has investigated the non-life insurance industry, with premium data aggregated across all lines of non-life insurance (Holzheu & Turner, 2018). In CEE countries specifically, this topic has been explored by Dragoş, Mare & Dragoş (2019) but from the perspective of institutional drivers of life insurance consumption. They point out that the most significant institutional factor is governance effectiveness. Among the economic and demographic factors, they found that the interest rate and fiscal freedom exert a negative effect on life insurance consumption. Their findings can serve as the basis for improving governance policies in former communist countries and for creating an institutional system of proper incentives on the market. A similar study in a field of life insurance was conducted by Pivac, Marasović & Kovač (2015) on the sample of transition economies of Central Europe. Their results indicate that income growth contributes to the growth of the insurance market and that the demand for life insurance is a function of a bequest motive. The limiting factor for the development of the life insurance market is unemployment. In emerging markets underinsurance reflects the still low risk awareness and risk culture, also attributable to institutional legacies and inherent cultural peculiarities such as the decades of state monopolies (The Geneva Association, 2014).

Holzheu & Turner (2018) point out to possible key determinants in property insurance demand: economic reasons for not fully insuring, degree of development of the financial sector, institutional framework and market structure, risk and insurance perceptions. Outreville (2013) in a review of 85 empirical papers examining the relationships between insurance and economic development points to key factors of insurance demand: economic factors (income, insurance price, real interest rates, inflation), demographic factors (population size, urbanization, age structure), social and cultural factors (education/human capital, religion, risk aversion, Hofstede's cultural variables), structural factors (financial sector or banking sector development, monopolistic market, foreign companies presence, legal environment, market concentration, enforcement of property rights, political risk).

An important factor of insurance demand and consumption is a level of risk aversion. Szpiro (1985) implies that the more risk-adverse the individual is, the higher will be amount insured. Outreville (2014) points to review the empirical literature on risk aversion (and risk behaviour) with a particular focus on the insurance demand or consumption and categorizes research into two main areas: the measurement and magnitude of risk aversion, and the empirical analysis of socio-demographic variables associated with risk aversion.

Another aspect of demand for property insurance could be seen in cultural and social reasons, such as mentality or mindset. Treerattanapun (2011) in empirical analysis using blocking and bootstrapping techniques confirms the impact of culture on non-life insurance consumption. Nations with a low degree of Power Distance (PDI

[1]), a high level of Individualism, and a high degree of Uncertainty Avoidance tend to have a high level of non-life insurance consumption (Treerattanapun, 2011). Hofstede (1995) also points out that insurance is an immaterial product that is valued subjectively by its recipients. The way this is done depends on the values that dominate in a certain society and the values that have come into being through the years. He emphasizes three important values: solidarity, independence, and predictability.

Mortgage penetration, as well as access to the formal financial sector and domestic credit to the private sector, are expected to be positively correlated with property insurance penetration. Insurance requirements by mortgage lenders are a major cause for buying property coverage among private households. A higher developed mortgage market allows households to invest more in their homes, raising values that are at risk. At the same time, insurance protection of the collateral facilitates mortgage lending, since lenders would otherwise carry the risk of natural catastrophes on top of the credit risk (Holzheu & Turner, 2018).

Esho et al. (2004) point to a strong positive relationship between the protection of property rights and insurance consumption, which is robust to various model specifications and estimation techniques. Moreover, the results show the purchase of non-life insurance is significantly and positively related to loss probability and income, as well as providing weaker evidence of a negative relationship with price.

The research field is also in the role of foreign insurers, market competition and insurance demand. The relationship between the market share of foreign insurers and general liability premium density is positive and statistically significant. These results suggest that the consumption of insurance is greater in markets in which foreign insurers have a greater market share, presumably because of greater price and quality competition (Browne, Chung & Frees, 2000).

Survey of Croatian Insurance Bureau (2017) about Croatian consumer's attitudes towards insurance point to following reasons for buying property insurance: protection from risky events and uncertainty 62%, protection of their investment in real-estate from possible damage 48%, 33% because it was one of a prerequisite for a mortgage loan, and the same percentage because of successful sale initiatives of insurance companies. Experience of loss (13%) or catastrophic events (8%) were not dominant triggers for purchase of insurance. Results show that consumers' perception of property insurance prices is much higher than they are. Consumer's attitudes towards government as a saviour of a last resort in an occurrence of catastrophic loss with a 4% are not relevant for the decision to buy property insurance.

In Tables 1a and 1b we present methodological framework and obtained results of the selected literature review in case of non-life insurance demand.

Table 1a: Literature overview: Determinants of demand or consumption of non-life insurance (1)

Paper	Variables (D= dependent, I=independent)	Methodology	Period	Sample	Findings
Browne, Chung and Frees (2000) *International Property-Liability Insurance Consumption*	D: Motor vehicle premium density; General liability premium density I: Income (USD), Protective measures (% of market share of foreign insurers), Risk Aversion (enrolment ratio of third-level education), Loss probability (urbanization, %); Wealth per capita (pc)	Fixed effects panel, pooled cross-section model	1987 - 1993	25 OECD members in 1993	Income positively correlated and has a more significant effect on the purchase of motor vehicle insurance than on the purchase of general liability insurance. The market share of foreign insurers is negatively related to motor vehicle insurance consumption and positively associated with general liability insurance consumption. The relationship is statistically significant. National wealth and the form of the legal system are significantly related to insurance purchases and relations are consistent with theory.
Beenstock, Dickinson and Khajuri (1988) *The Relationship between Property-Liability Insurance Premiums and Income: An International Analysis*	D: Real premiums pc I: Income pc, Real rate of interest, Lagged real premiums pc; Country dummy variables Additionally, model 2 includes Lagged untrended unemployment.	Pooled cross-section	1970 - 1981	12 largest property-liability insurance markets: US, West Germany, Japan, UK, France, Canada, Italy, Australia, Netherlands, Sweden, Switzerland and Belgium.	1) The average propensity to insure (API) is not a good indicator of the marginal propensity to insure (MPI), 2) the MPI is considerably higher than the API, 3) the long-run MPI is greater than the short-run MPI, 4) the secular MPI is greater than the MPI, 5) MPI differ between countries, 6) property-liability insurance is a superior good and is disproportionately represented in economic growth and 7) premiums vary directly with real rates of interest.

Source: Authors

Table 1b: Literature overview: Determinants of demand or consumption of non-life insurance (2)

Paper	Variables	Methodology	Period	Sample	Findings
Esho, Kirievsky, Ward and Zurbruegg (2004) *Law and the Determinants of Property-Casualty Insurance*	D: Real pc Property-Causality Insurance consumption (1995 USD=100) I: Property rights index, Real GNP pc, Risk aversion proxies (% secondary educated, uncertainty avoidance index (Hofstede 1995)), Price of insurance, Probability of loss proxies (urban population, rate of recorded property theft pc), Legal system dummies	OLS and TSLS cross section, GMM applied to panel data with lagged dependent variable	1984 - 1998	44 countries worldwide	Results differ with respect to the model. The main conclusion is that property rights are linked to the level of insurance density and that country's legal origin does not affect insurance demand.
Holzheu and Turner (2018) *The Natural Catastrophe Protection Gap: Measurement, Root Causes and Ways of Addressing Underinsurance for Extreme Events*	D: Property insurance penetration (direct premiums, %GDP) I: Consumption pc, GDP growth in the prior decade, savings, recent and previous average cat losses, mortgage penetration, domestic private sector credit (%GDP), % adults with a financial account, % adults with a home purchase loans, foreign ownership, market share of top 10 insurers, internet access, mobile phone access, property rights, % Muslim population, corruption, political risk, insurance price index, education quality, population density	Unbalanced panel with several model specifications	2000 - 2015	51 countries which account for about 90% of the world's GDP	An increased economic development drives insurance penetration by increasing income and by increasing the stock of assets at risk. Countries that went through rapid growth during the prior decade lag behind in protection compared to countries that reached comparable levels of income and consumption at a slower pace. Property insurance penetration is also driven by financial sector development, access to the formal financial sector, specifically mortgage penetration, openness to foreign competition and low market concentration.

Source: Authors.

Methodology

In order to allow for a feedback relationship between all of the variables of interest, a stabile VAR(p) model (Vector AutoRegression, p refers to the order) is observed for N variables as follows:

$$\boldsymbol{y}_t = \boldsymbol{v} + \boldsymbol{A}_1\boldsymbol{y}_{t-1} + \boldsymbol{A}_2\boldsymbol{y}_{t-2} + ... + \boldsymbol{A}_p\boldsymbol{y}_{t-p} + \boldsymbol{\varepsilon}_t, \tag{1}$$

where $\boldsymbol{y}_t$ is a vector of N variables, $\boldsymbol{v}$ is a vector of intercepts, $\boldsymbol{A}_i$ are coefficients matrices of order N, ε_t is the vector of white noise processes. It holds that $E(\varepsilon_t)=\mathbf{0}$, $E(\varepsilon_t \boldsymbol{\varepsilon}_t')=\Sigma_\varepsilon < \infty$ and for $t \neq s$ $E(\varepsilon_t \boldsymbol{\varepsilon}_s')=0$. The variance decomposition and impulse response functions are usually estimated by observing an MA(∞) representation of the model in (1). For these purposes, the VAR(p) is written in a compact VAR(1) form:

$$\boldsymbol{Y}_t = \mathbf{v} + \boldsymbol{A}\boldsymbol{Y}_{t-1} + \boldsymbol{\varepsilon}_t, \tag{2}$$

where $\boldsymbol{Y}_t = \begin{bmatrix} \boldsymbol{y}_t & \boldsymbol{y}_{t-1} & \cdots & \boldsymbol{y}_{t-p} \end{bmatrix}'$, $\quad \mathbf{v} = \begin{bmatrix} \boldsymbol{v} & \mathbf{0} & \cdots & \mathbf{0} \end{bmatrix}'$, $\quad \boldsymbol{A} = \begin{bmatrix} A_1 & A_2 & \cdots & A_{p-1} & A_p \\ I_N & 0 & \cdots & 0 & 0 \\ 0 & I_N & & \vdots & \vdots \\ \vdots & & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & I_N & 0 \end{bmatrix}$

and $\boldsymbol{\varepsilon}_t = \begin{bmatrix} \boldsymbol{\varepsilon}_t & \mathbf{0} & \cdots & \mathbf{0} \end{bmatrix}'$. The MA($\infty$) representation can be written now as:

$$\boldsymbol{Y}_t = \boldsymbol{\mu} + \sum_{i=1}^{\infty} \boldsymbol{A}^i \boldsymbol{\varepsilon}_{t-i}, \tag{3}$$

where $\boldsymbol{\mu} \equiv (\boldsymbol{I}_{Kp} - \boldsymbol{A})^{-1}\mathbf{v}$, with the polynomial form given as $\boldsymbol{Y}_t = \Phi(L)\boldsymbol{\varepsilon}_t$. $\Phi(L)$ is the polynomial of the lag operator L, and $\phi_{jk,i}$ are the coefficients in $\Phi(L)$ which are interpreted as the impulse responses of the model. As elements in $\boldsymbol{\varepsilon}_t$ are correlated, the matrix Σ_ε (variance-covariance matrix of error terms) is orthogonalized with the Choleski decomposition. This means that a lower triangular matrix $\boldsymbol{P}^{-1}$ is chosen such that $\boldsymbol{P}^{-1} \boldsymbol{\varepsilon}_t$ is a vector of orthogonalized innovations, where it holds that $E(\boldsymbol{P}^{-1}\boldsymbol{\varepsilon}_t \boldsymbol{P}^{-1}\boldsymbol{\varepsilon}_s') = 0$ when $t \neq s$ and $E(\boldsymbol{P}^{-1}\boldsymbol{\varepsilon}_t \boldsymbol{P}^{-1}\boldsymbol{\varepsilon}_t') = \boldsymbol{I}_{Np}$. Now the polynomial form is written as follows:

$$\boldsymbol{Y}_t = \Phi(L)\boldsymbol{P}\boldsymbol{P}^{-1}\boldsymbol{\varepsilon}_t = \Theta(L)\boldsymbol{u}_t, \ \boldsymbol{u}_t = \boldsymbol{P}^{-1} \boldsymbol{\varepsilon}_t. \tag{4}$$

The forecast error variance decomposition is estimated by using the model in (4). The error of the h-step forecast is estimated via the expression $\boldsymbol{Y}_{t+h} - E(\boldsymbol{Y}_{t+h}) = \sum_{i=0}^{h-1} \Theta_i \boldsymbol{u}_{t+h-i}$. Every element in the difference is calculated as:

$$y_{j,t+h} - E(y_{j,t+h}) = \sum_{i=0}^{h-1} (\theta_{j1,i} u_{1,t+h-i} + \ldots + \theta_{jK,i} u_{K,t+h-i}) = \sum_{k=1}^{K} (\theta_{jk,0} u_{k,t+h} + \ldots + \theta_{jk,h-1} u_{k,t+1}), \quad (5)$$

with the mean squared error $E\left(y_{j,t+h} - E(y_{j,t+h})\right)^2 = \sum_{k=1}^{N} (\theta_{jk,0}^2 + \ldots + \theta_{jk,h-1}^2)$.

The variance decomposition of every variable in the model, $\omega_{jk,h}$ (the proportion of the *h*-stop forecast error variance of the *j*-th variable due to shocks in variable *k*) is calculated as:

$$\omega_{jk,h} = \sigma_j^{-1} \sum_{i=0}^{h-1} \left(e_j^{'} \Theta_i e_k\right)^2 / \sum_{i=0}^{h-1} \sum_{k=1}^{N} \theta_{jk,i}^2, \quad (6)$$

in which $\boldsymbol{e}_j$ and $\boldsymbol{e}_k$ are the *j*-th and *k*-th column of matrix $\boldsymbol{I}_{Np}$. The numerator is the contribution of the *k*-th variable shocks to the forecast error of the *j*-th variable in the model, whereas the denominator is the mean squared error forecast of the variable *j*. The mentioned Choleski decomposition is dependent upon the ordering of variables in the model. Thus, a more generalized approach is to use the generalized forecast error variance decomposition (GFEVD, Pesaran and Shin, 1998). The decomposition of variances in the VAR model in this case is as follows (Lütkepohl, 2006) [2]:

$$\omega_{jk,h} = \sigma_j^{-1} \sum_{i=0}^{h-1} \left(e_j^{'} \Phi_i \sum\nolimits_{\varepsilon} e_k\right)^2 / e_j^{'} \Phi_i \sum\nolimits_{\varepsilon} \Phi_i ' e_j \quad (7)$$

and can be used instead of impulses defined for the Choleski decomposition. We chose to use the decomposition in (7). Both (6) and (7) can be used to construct the total spillover index of course, depending on whether the researcher has a good explanation on the variable ordering (equation (6)), or not (equation (7)).

As the empirical part of the paper deals with the extension of the VAR model, i.e. the Spillover index of Diebold and Yilmaz (2009, 2012), the following steps are done in order to estimate the shock spillovers between the variables in the model. Values from equations (6), i.e. (7) are used to estimate the total spillover index as:

$$S = \sum_{\substack{j,k=1 \\ j \neq k}}^{N} \omega_{jk,h} / \sum_{i=0}^{h-1} \sum_{j,k=1}^{N} \omega_{jk,h} 100\%. \quad (8)$$

Value obtained in (8) is interpreted as the sum of fractions of the *h*-step ahead error variance forecast of variable *j* in the model as a result of shocks in the *k*-th variables in the total forecast error variance. Furthermore, the received spillovers from other variables to the *j*-th one can be estimated via formula:

$$S_{j\bullet,h} = \frac{1}{N}\sum_{\substack{k=1 \\ j\neq k}}^{N} \omega_{jk,h} 100\%, \tag{9}$$

as well as the spillover from the variable *j* to others via:

$$S_{\bullet j,h} = \frac{1}{N}\sum_{\substack{k=1 \\ j\neq k}}^{N} \omega_{kj,h} 100\%. \tag{10}$$

This can be done for every pair of variables in the model, as well as net indices can be estimated via detracting (9) from (10). For more details on the VAR methodology, as well as the spillover indices can be found in Lütkepohl (1993, 2006, 2010), Diebold and Yilmaz (2009, 2012) or Urbina (2013).

Empirical analysis

Data description

In the empirical analysis, we observe how different economic, financial, social and insurance variables impact the demand for property insurance. For the purpose of the empirical analysis, quarterly data has been collected for the following variables: gross domestic product (GDP), seasonally adjusted, Consumer Confidence Index (CCI), housing loans total (HLOANS), central government bond yields (INTRATE), active population (ACT), settled claims for home insurance (LIQ), and gross written premium on property insurance (GWP). The selection of variables reflects the specifics of the Croatian market and the availability of the data. We presume that greater GDP, number of active population, housing loans, settled claims for home insurance and growth of consumer confidence index should have a positive impact on the insurance demand, while the greater interest rate should presumably have a negative impact. Greater GDP suggests economic growth and higher income, leading to a greater insurance demand and consumption. More active population reflects greater employment which leads to an increase in spending, as well as savings, and the insurance consumption and affordability. Increasing figures of housing loans should also be a positive factor for insurance demand for two reasons: firstly, they foster residential construction market, and secondly, credit institutions require property insurance as a prerequisite for mortgage loans. Finally, greater settled claims should mean that people have previously experienced a loss regarding their property, which should increase the awareness of the possibility of loss and the importance of property insurance. On the other hand, greater bond yield should lead to greater interests and reduced demand for housing loans, and indicate a deterioration of the economic situation and the conditions on the financial market in the country, leading to a situation where demand for insurance decreases. The last factor, the consumer confidence index shows the change of the optimism about the future, where increased optimism could presumably lead to an increased insurance demand due to a higher confidence in the insurance companies. The period observed in the study ranges from 2008Q1 to 2019Q4. The details on the variables and the sources of the data are given in Table 2. We excluded the following years of data, due to two earthquakes that hit Croatia in 2020, alongside the COVID-19 shock, which could distort the results. Literature has shown that insurance take-up rates are affected after earthquakes (see Cai and Song, 2017), alongside increasing insurance premiums (Yuzva et al., 2018) and business volume of insurers (Aseervatham et al. 2017). Moreover, the empirical analyses that tries to estimate economic models and deal with forecasting are affected with the coronavirus shock, due to great changes in important time series such as GDP dynamics. Although some comparisons of what to do in empirical analyses exist (Lenza and Primicieri, 2020; Ng, 2021), there is still no consensus on what to do, as it depends on the goal of the study. As this paper is not focused on forecasting, we opted to drop the period after 2019 for now. These two shocks are very different compared to the slower dynamics of the GFC and thus should be modelled differently.

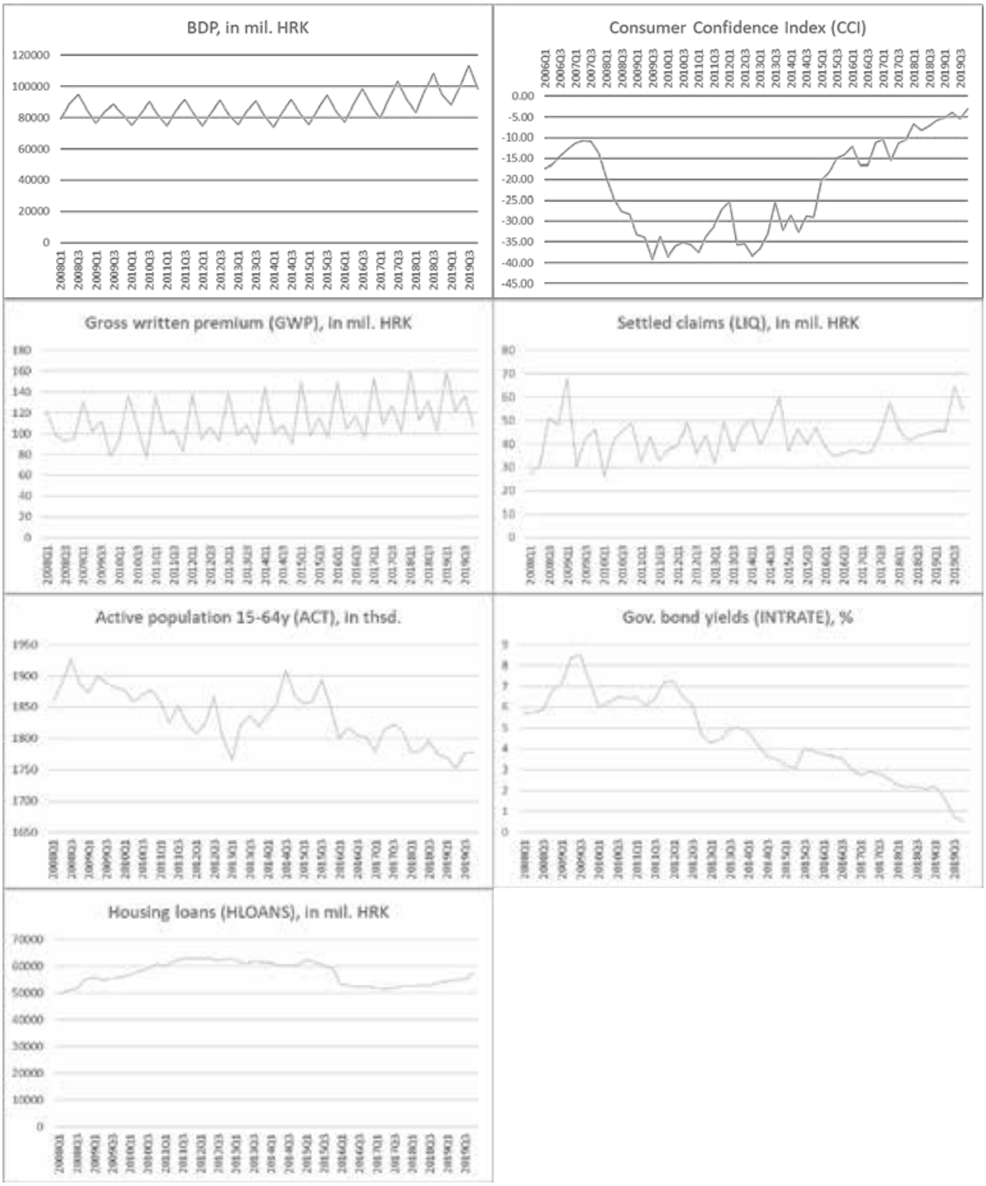
Table 2: Names and descriptions of variables

Variable	Description	Source
GDP	Gross domestic product, by expenditure approach, current prices, in millions HRK	Croatian Bureau of Statistics
CCI	Consumer Confidence Index, reporting on the consumer perception of the changes in the next 12 months as regards everyday economic issues (1999M1=100), a 3-month average	The Croatian National Bank (HNB)
HLOANS	Housing loans total, a 3-month average (in millions HRK)	The Croatian National Bank (HNB)
INTRATE	Central government bond yields on the secondary market, gross of tax, with around 10 years residual maturity, a 3-month average	EUROSTAT
ACT	Active population (15 – 64 years) (in thousands)	EUROSTAT
LIQ	Settled claims for home insurances and insurances against fire and natural disasters excluding industry and crafts, gross amount, in HRK	Croatian Insurance Bureau (HUO)
GWP	Gross written premium for property insurance (home insurances and insurances against fire and natural disasters excluding industry and crafts), gross amount, in HRK	Croatian Insurance Bureau (HUO)

Source: Authors.

A graphical depiction of the variables described in Table 2 is presented in Figure 1.

Figure 1: Variables used in the analysis (2008Q1-2019Q4)



Source: Authors

Main results

In the first step, all the variables were transformed to the year-on-year growth rates, as all of them were found to be non-stationary on usual levels of significance [3]. The growth rates are used in the VAR model, so that stationarity condition is met. That is why the variables presented in Table 2 are renamed into DL_var or D_var (where D stands for first difference, L for logarithm and var is the abbreviation of the variable). Some variables were only differenced (D) and some were transformed via the two mentioned transformations (DL). Therefore, the differenced and log variables should be interpreted as the rate of growth of the original variable, whereas differenced variables represent the growth of the concerned variable. Furthermore, the VAR model allows for all the variables to be endogenous, so in this is a natural first step in the analysis. The optimal lag length of p has been chosen based on the evaluation of several criteria presented in Table 3. Although 3 out of 4 criteria show that the optimal lag is 3, the strictest one (SC) indicates that lag 1 is enough. Since we follow parsimony, due to not having too much data for the variables of interest, we decided to estimate a VAR(1) model and test all diagnostics. If it is satisfactory, we proceed with the selected lag of 1.

Table 3: Optimal lag length criteria for VAR model

Criteria	FPE	AIC	SC	HQ
Lag:	3	3	1	3

Note: FPE, AIC, SC and HQ indicate Final prediction error, Akaike, Schwartz and Hannan - Quinn information criteria respectively.

Source: Authors' calculation.

The diagnostics of the VAR(1) model is shown in Table 4. It values indicates that all of the diagnostics is satisfying. Thus, we move on to the rest of the analysis [4].

Table 4: Diagnostics checking of VAR(1) model

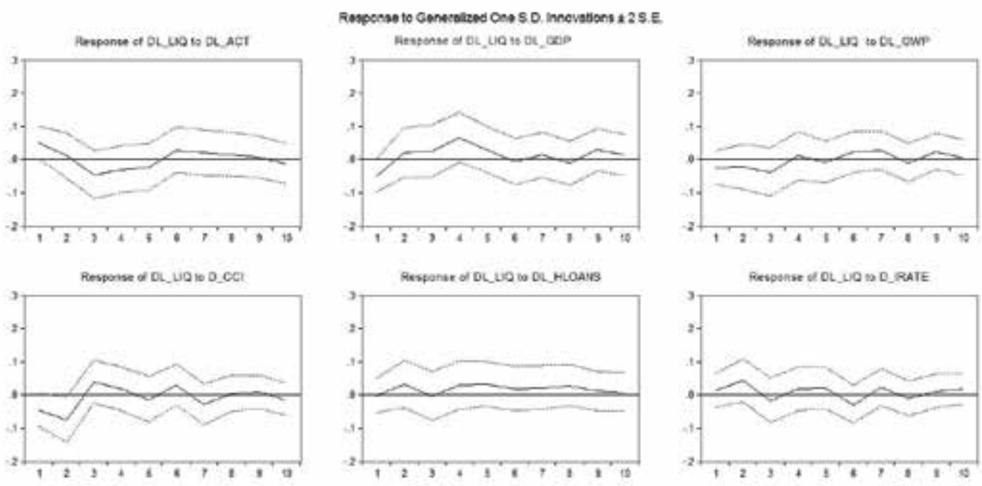
Test	Result
Autocorrelation, LM(2); LM(4)	45.59 (0.616); 68.17 (0.036)
Normality test, JB	315.07 (0.190)
Heteroscedasticity, ChiSq	602.71 (0.145)

Note: LM denotes serial correlation LM test, 2 and 4 denote orders. JB denotes Jarque - Bera multivariate normality test and ChiSq denotes the Chi square multivariate test for heteroscedasticity. p-values are given in brackets.

Source: Authors' calculation.

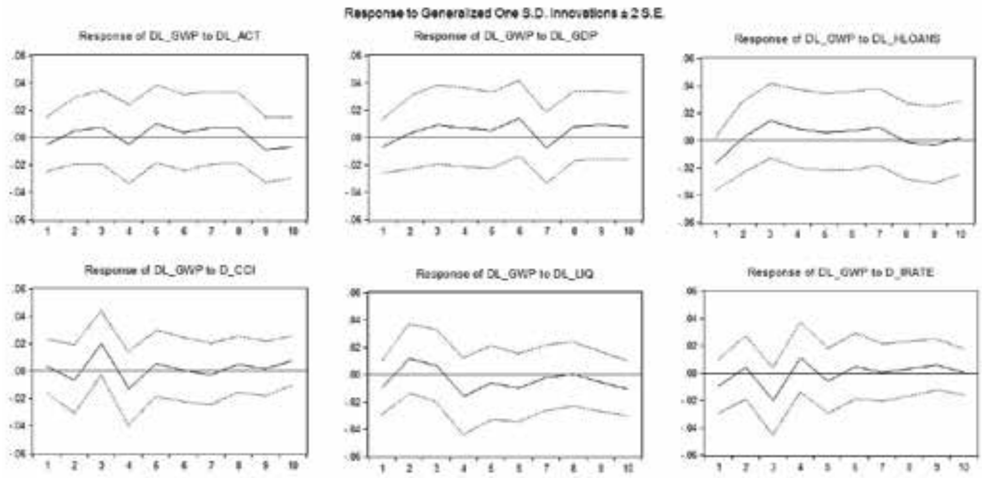
Since the most interesting results to the shocks in the rest of the variables (listed in Table 2) are responses of the rates of growth in settled claims (DL_LIQ) and gross written premium for property insurance (DL_GWP) for home insurances and insurances against fire and natural disasters, we depict the impulse response functions solely for them. Figure 2 consists of the IRF (impulse response functions) of variables of interest. The blue lines indicate the point estimates of $E(y_{j,t+h})$ in the VAR model, whereas the red dashed lines indicate the 95% CIs (confidence intervals). The IRFs were constructed based on the generalized forecasted error variance decomposition, so that the ordering of the variables is not relevant. As can be seen from Figure 2, the DL_LIQ variable (growth rate of settled claims) does not respond to any of the other variables in the model. Furthermore, Figure 3 depicts the responses of variable DL_GWP (rate of growth of the gross written premium for property insurance), which also does not respond to any of the shocks in the system.

Figure 2: Impulse response function of DL_LIQ to shocks in other variables



Source: Authors.

Figure 3: Impulse response function of DL_GWP to shocks in other variables)



Source: Authors.

The results are confirmed in the Ganger causality test, in which we found almost no causality in the VAR model. Table 5 depicts only the significant results of the Granger test. Causality exists to some extent from growth rate of the gross written premiums (DL_GWP) to GDP growth rate (DL_GDP) and vice versa, as well as from growth of the consumer confidence index (D_CCI) and housing loans (DL_HLOANS) to government bond yield (D_IRATE).

Table 5: Granger causality test results for VAR(1) model

Dependent variable	Excluded variable	Chi Sq (p-v)
DL_GDP	DL_GWP	7.62 (0.006)
DL_GWP	DL_GDP	8.57 (0.003)
D_IRATE	D_CCI	4.75 (0.029)
D_IRATE	DL_HLOANS	3.36 (0.067)

Note: Chi Sq is the empirical chi square value, with the corresponding *p*-value in brackets. The null hypothesis is that the excluded variable does not Granger cause the dependent variable.

Source: Authors' calculation.

Next, we move on to the spillover indices in Table 6. The results are interpreted as follows. For each variable listed in the first column in Table 6, columns 2 - 7 show the amount (in %) of the variance that can be explained via shocks in other variables, in the whole observed period. By observing the values on the diagonal in Table 6, it is obvious that the greatest amounts of variances are explained by the shocks in the variables themselves. However, the most interesting part refers to the rows regarding the variable DL_GWP (growth rate of the gross written premium) where 22.6% of variance is explained via shocks in the variable DL_GDP (growth rate of the GDP). These results again confirm the importance of the economic growth for the property insurance demand expressed through the property premium income. The results also indicate that 22% of the growth rate in the housing loans total (DL_HLOANS) variance is explained via shocks in the change of consumer confidence index (variable D_CCI) which points to the connection of the consumer confidence and granted mortgage loans. On the other hand, results show that the variance of the insurance demand (DL_GWP) cannot be explained via shocks in CCI. The similar results were expected in case of the insurance demand (DL_GWP), as seen in (Outreville, 2014), but results show that this is not the case of the Croatian market according to this research. The second row from the bottom in Table 6 shows how much a shock in a certain variable contributes to variances of other variables, while the last column shows an amount of explained variance from shocks in other variables. The total (overall) spillover index is bolded in the last cell of Table 6, and is equal to 30.5%, which indicates a moderate spillover between all the variables in the system. The small spillovers are confirming the lack of interrelationship between the observed variables, as confirmed by the previous results. By looking at the results in Table 6, the economic policy makers can obtain insights into which variables can influence or determine growth rates of gross written premiums (DL_GWP) or growth rates of settled claims (DL_LIQ) the most.

Table 6: Total spillover table for the VAR(1) model

	DL_ACT	**DL_ GDP**	**DL_ GWP**	**D_ CCI**	**DL_ HLOANS**	**D_ IRATE**	**DL_LIQ**	**From Others**
DL_ACT	91.7	2.2	3.6	0.2	0.2	2.1	0.0	8.3
DL_GDP	0.6	70.5	12.3	1.0	12.4	2.5	0.7	29.5
DL_GWP	1.0	22.6	71.0	2.2	2.4	0.7	0.2	29.0
D_CCI	0.5	16.5	5.0	66.1	2.6	9.0	0.3	33.9
DL_HLOANS	3.4	3.3	1.3	22.0	67.0	2.8	0.1	33.0
D_IRATE	0.7	13.4	0.7	21.9	15.8	46.2	1.3	53.8
DL_LIQ	2.4	11.7	7.2	1.1	1.9	1.9	73.8	26.2
Contribution to others	8.6	69.6	30.1	48.4	35.4	18.9	2.7	213.8
Contribution including own	100.3	140.1	101.0	114.5	102.4	65.2	76.5	30.5%

Source: Authors' calculation.

Discussion

The research in this paper reveals some of the specific and rather interesting relationships in the Croatian property insurance market. The Croatian insurance market is a developing market that is highly liberalized, with strong domestic and foreign competition. Among all non-life insurance lines, property insurance does not represent an important market share, as is evident on developed insurance markets. If we take into account the economic situation in Croatia, the structure of the financial sector, the level of financial literacy, mentality and risk aversion, together with the increasing role of the government as a saviour in times of need, results are not very surprising.

Despite the literature review, that is suggesting the expected determinates of the property insurance demand, Croatian property insurance market seems not to behave in an expected manner. This is especially evident in a couple of cases. First, the impact of natural catastrophes on the property premium is not strong nor significant. This result is not in line with the most of the literature that suggests that the experience of a loss or claim would increase property insurance demand in the future (Holzheu & Turner, 2018). Lazo et al. (2014) find that personal experience is a key determinant of disaster mitigation behaviour; for example, people are more likely to evacuate from hurricanes if they have a previous experience with evacuations. However, these results are in line with the survey research result suggesting that catastrophic losses are not an important reason in a decision to buy property insurance (Croatian Insurance Bureau, 2017). The results are surprising especially given the fact that a great flood happened in Croatia in Posavina in spring 2014, causing great damages estimated at 297,6 million EUR (European Commision, 2014).

The second interesting finding relates to mortgage activity and the demand for personal property insurance. Due to an open and liberalized financial sector, a construction boom and economic growth, mortgage activity has been very important in Croatia. It was expected that mortgage loans and credit activity, together with real-estate market activity, will strongly influence personal property insurance. Research reveals that this is not the case. However, 22% of the growth rate in the mortgage activity variance is explained via shocks in the change of consumer confidence index, which points to the connection of the consumer confidence and granted mortgage loans.

Moreover, it was expected that the variance in the insurance demand might be explained by the shocks in the consumer confidence index (CCI), as seen in Outreville (2014), but results show that this is not the case in the Croatian market according to this research.

Possible explanations for this type of atypical behaviour of property insurance demand in Croatia could be seen in the expectation of post-disaster assistance provided by the government which may reduce the demand for private insurance (Browne & Hoyt, 2000), in both developed and emerging markets. For example, one study of US homeowners (Kousky, Michel-Kerjan & Rachky, 2013) finds that a 1 USD increase in the average aid grants decreases average insurance take-up by about 6 USD. This indicates that the most of the property owners in Croatia rely on the financial help of the government in case of catastrophes, which is a social belief inherited from the previous socio-economic system.

Also, the level of financial education and literacy, as well as confidence in the insurance industry, play an important role. According to the research of Croatian National Bank (CNB) and Croatian Financial Services Supervisory Agency (CFS-SA), financial literacy among Croatian financial services consumers is quite low. The evident proof of this statement are perceptions of Croatian consumers about property insurance prices. In addition, only 47% of consumers have confidence and trust in insurance companies in Croatia (Croatian Insurance Bureau, 2017). The increase in the level of the financial literacy and financial capacity in Croatia should bring insurance products closer to the population, raise awareness of the responsibility for private property, and thus be beneficial for the property insurance demand.

On the other hand, some findings are consistent with the previous research. The growth of the gross written premium due to the economic development (in terms of GDP growth) is in line with the most previous results (Outreville, 2013, Ćurak & Kljaković - Gašpić, 2011). This result again points out to the necessity of economic development for insurance demand boost expressed through the property premium income. This result is somehow expected and not surprising.

Conclusion

Croatian insurance market, as a small and a developing market, is influenced by similar trends as other CEE markets in terms of economic and financial sector development, as well as insurance markets trends and competition. As literature review suggests, other factors, such as risk aversion, experience of a loss, mentality and cultural factors and the role of a government as a safety net, play an important role. By using the VAR(1) model, the spillover effects between quarterly data on gross written premiums on property insurance (as an indicator of demand for property insurance) and gross domestic product, consumer confidence index (3-month average), total housing loans balance, government bond yields, and active population aged 15-64, were examined. The data covers the period from the 2008 to 2019. The data for the period after 2019 was excluded due to two earthquakes that hit Croatia in 2020, alongside the COVID-19 shock, which could distort the results. The research found some interesting findings which are contrary to the findings of the previous research. Specifically, the research results of this paper suggest that some of the expected drivers of property insurance demand such as mortgage loans, general consumer confidence and the experience of a loss are not the drivers for the property insurance demand in Croatia. Research indicates that the economic growth, as expected, is the most important prerequisite for property insurance uptake. A part of the explanation for these findings may lie in the mentality and the lack of confidence of consumers in the insurance market, as well as consumer perception of property insurance prices and rather unsatisfactory financial education. The recent earthquakes in Zagreb and the surrounding area, unfortunately, caused huge losses and again raised a problem of insurance gap in the property insurance. In this example, catastrophic losses caused by an earthquake fell on a government budget and had a negative effect on public debt and public finance, and consequently on the economic growth. Thus, this development once again accentuated the importance for the private property insurance and raises a need for a policy response towards the insurance market or building collective insurance schemes in order to deal with catastrophic losses. In the part of the insurance industry, a new approach to consumers, especially to new generations, is needed in a part of a product development, product placement, the use of a technology, and generally in all parts of business conduct. It is also important that the regulatory framework and government policy highlights the importance of the individual responsibility for private property to avoid overuse of government as a safety net.

Declarations

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Conflicts of interest/Competing interests

There is no conflict of interest/Competing interests.

Availability of data and material

The data that support the findings of this study are partly openly available in the website of Statistical Office of European Comunities (Eurostat) and Croatian National Bank, while some of the data is from a private dataset, obtained directly from insurance Croatian Insurance Bureau.

Code Availability

The computer program results are shared through the tables in the manuscript, code available upon request.

Authors' Contributions

Jakša Krišto – conceptualization, validation, resources, supervision, writing original draft & reviews; Margareta Gardijan Kedžo – investigation, data curation, writing original draft & reviews; Tihana Škrinjarić – methodology, formal analysis, writing original draft & reviews.

NOTES

[1] Power Distance (PDI) is the degree of inequality among people which the population of a country can accept that inequality. Individualism (IDV) measures the degree to which people in a country prefer to act as individuals rather than as members of groups. Uncertainty Avoidance (UAI) scores tolerance for uncertainty.

[2] The Generalized Impulse Response Functions (GIRFs) are computed by shocking only the *i*-th element in the innovation vector and the effect of other shocks is detracted out, as follows: $GI_y(h, \delta, I_{t-1}) = E(y_{t+h} \mid \varepsilon_{jt} = \delta_j, I_{t-1}) - E(y_{t+h} \mid I_{t-1})$, and δ is some known vector.

[3] Unit root tests details are available upon request.

[4] Furthermore, all the characteristic polynomial roots are within the unit circle. This makes the model sable and suitable. Detailed results are available upon request.

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