"Development of the insurance market in Ukraine and forecasting its crises"

AUTHORS	Viktoriia Babenko-Levada (iD)

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Viktoriia Babenko-Levada, Ph.D.
in Economics, Assistant Professor
of Finance, Banking and Insurance,
Zaporizhzhia Polytechnic National
University, Ukraine.

Viktoriia Babenko-Levada (Ukraine)

DEVELOPMENT OF THE INSURANCE MARKET IN UKRAINE AND FORECASTING ITS CRISES

Abstract

Insurance market is an important part of the financial market, the functioning of which helps to protect individuals and legal entities from the negative and stressful effects of today's unstable economic environment. The purpose of this study is to determine trends in the insurance market in Ukraine and its potential crises.

The study found that Ukraine's insurance market constantly grows, but is volatile and in a state of concentration. The dynamics of most indicators are cyclical, with a cycle length from 4,66 quarters to 14 quarters.

The randomized R/S-analysis confirmed the stability of the dynamics of Ukraine's insurance market and its fractal similarity. Fractal similarity was proved for six out of ten analyzed indicators of the insurance market. In addition, it was confirmed that at the moment of transition from one fractal to another, a trend break occurs. Thus, the emergence of crises on the insurance market of Ukraine is associated with the self-similarity of the dynamics and the coincidence of the moments of bifurcation of certain indicators in its development. A partial crisis on the Ukrainian insurance market at the beginning of 2019 coincided with the bifurcation of the number of concluded insurance contracts, determined based on the results of fractal analysis.

Calculations made it possible to conclude that potentially crisis periods for the insurance market of Ukraine fall on Q1-2 2017, Q1 2019, Q1 2020, of which only one was realized (Q1 2019). The nearest potential moments of crises on the insurance market of Ukraine may be the following periods: Q1 2023 and Q1 2026.

Keywords   insurance market, cyclicity, analysis, self-similarity, insurance payments, insurance premiums

JEL Classification   C10, C53, G22

INTRODUCTION

The insurance market is one of the most important segments of the financial market and largely determines its stability and development. At the same time, processes on the insurance market determine the processes in the real sector, since compensation for risks and threats that are realized in the real sector of the economy is provided by the insurance market. The insurance market is a specific object of study due to its heterogeneity in all forms of structuring. Within the national economy, the number of insurers on the market is limited; each insurer has its own list of priority insurance services and its own policy for forming an insurance portfolio, insurance rules, etc.

There is a territorially heterogeneous insurance market due to the uneven concentration of the company's activities in the regions of the country. In the global insurance market, heterogeneity is also determined by the socio-cultural characteristics of each region, each country, which directly affect the choice of insurance services by policyholders. The importance of insurance in the formation of funds of financial resources and their capitalization should also be taken into account.

Therefore, the task of forecasting the development of the insurance market acquires a narrow specificity. That is why an important area of research is identifying trends in the insurance market, both globally and nationally.

1. LITERATURE REVIEW

1.1. Current trends in the insurance market

Over the past 40 years, the emergence of crises on the insurance market (MAPFRE Economics Review, n.d.) has been associated with declining GDP, and dependence on GDP exists on both developed and emerging markets. At the same time, the peculiarities of the insurance market development can affect the country's economy as a whole. Crisis on the insurance market may well provoke a financial crisis. Thus, in 2008, the United States spent 182 billion dollars to save the well-known insurance company American International Group (OECD, 2020), whose debt holders were investment funds around the world.

Significant financial losses could have been avoided if the preconditions for the crisis were identified. The current economic crisis has led not to a collapse of the insurance market, but to its restructuring. Certain insurance products have become popular, the risks of which have increased significantly. Accordingly, prices for certain insurance services increased: health insurance (+35%), property insurance (+20%), and cyber insurance (+35% in the US and 29% in the UK) (Marsh, n.d.), but in the 1st quarter of 2021, for the first time there was a situation characterized by a decline in average market growth. At the same time, crisis in the global economy has led to a number of "waves" that can promote the insurance business (Amadeo, 2019): sufficient and even excessive amount of information about risks; policyholders of insurance companies; direct and wide informing of policyholders about services that can be provided by insurance companies; a wide range of analytical methods that can be used by both insurers and consulting companies; new patterns of behavior and risk categories are also emerging. These and other changes allow insurers to change the basic business model. However, they also cause asymmetry and turbulence in the market, which makes it difficult to predict its state. Global trends in the insurance market show a steady growth over the past 10 years. Even the onset of the COVID-19 crisis has not led to market collapse in most countries. In 2020, insurers did not have such high profits and high positions regarding capital as in previous periods, but in general the market situation was stable (Ogilvi, 2021). In 2019–2020, gross insurance premiums grew in both life and non-life insurance. Gross payments also increased, and their growth rates differed significantly from country to country – from 80,2% in Russia to 11,7% in Malaysia, but mostly there was no loss of insurance activity in the world. It should be noted that upward trends in the dynamics have dominated the insurance market for a long time – since 2001 (Kozmenko et al., 2009, pp. 51-52).

The general analysis of the dynamics of the Ukrainian insurance market shows its growth and concentration, despite the downward trends in the economy as a whole. Thus, with an increase in insurance premiums, payments and the number of contracts, the number of insurance companies decreases. The number of registered insurers decreased from 404 in the first quarter of 2014 to 210 in the fourth quarter of 2020, the number of life insurance companies decreased over the same period from 61 to 20. At the same time, Ukraine's insurance market is not as concentrated as, for example, the US insurance market, where all types of insurance services are provided by only 22 companies (Amadeo, 2019). The trend of concentration of the insurance market was observed in previous periods (Kozmenko et al., 2009, p. 33), when from 2000 to 2007 the number of insurance companies in the European Union decreased by 775.

In general, the insurance market of Ukraine has development patterns that correlate with the development of markets in developing countries. First of all, it concerns the problems of market development (Polinkevych & Kamiński, 2020, p. 22): economic instability in the country; insufficiency of state control over the state of the market and state regulation of prices for services; lack of effective demand; lack of insurance culture, etc. The

fall in GDP did not lead to a significant decline in insurance premiums (MAPFRE Economics Review, n.d.), as happened in the USA, Japan and Spain. The experience of developing countries (Mexico, Brazil) shows a positive impact of expansionary monetary policy on the dynamics of insurance market. At the same time, the application of lower interest rates in these countries has led to increased volatility in financial markets, which may negatively affect the insurance market.

1.2. Solving the problems of forecasting the development of the insurance market

Researchers often distinguish between two main areas in forecasting the development of the insurance market such as building a macro forecast and building a forecast for individual insurance companies/groups of companies (Nazarova, 2018).

The methodology for carrying out development forecasts of insurance companies (both individual and by groups of companies) is quite broad and meets the objectives of each study. For example, discriminant analysis, logistic regression (Lytvin, 2013), linear, exponential modeling, application of fuzzy logic tools (Serediuk, 2014), probabilistic analysis (Pozdniakova & Mamonova, 2011; Fouladvand & Darooneh, 2004), parametric econometric modeling (Proskurovych & Melnychuk, 2014), rating modeling (Gestel et al., 2007), etc. are used to predict the financial condition of an insurance company/insurance companies. For example, to predict the financial condition of insurance results, the researchers themselves note the shortcomings of using these and other models, which make their application too specific, which does not allow achieving good forecasting quality in the current conditions. The quality of forecasting often depends on the state of the national economy, random fluctuations in the insurance market, the peculiarities of the insurance company, etc.

The building of a macroforecast of the insurance market is often specified by the insurance industry, its subjects and objects (Lenten & Rulli, 2006). Holistic forecasts of the insurance market are rarely developed. Their building is based on determining the qualitative patterns of development of

the country's insurance market in parametric ratios: GDP dynamics/dynamics of collected premiums, dynamics of payments/dynamics of concluded insurance contracts, the use of correlation and regression analysis, etc. (MAPFRE Economics Review, n.d.; OECD, 2020; Marsh, n.d.; Kozmenko et al., 2009; Shkolnyk et al., 2017). There are also attempts to group countries according to the peculiarities of the insurance market. But in addition to the heterogeneity of the market, the difficulty in determining the quantitative patterns of its dynamics significantly affects a regulator and public financial policy. Therefore, the tested tools for forecasting the development of insurance companies, which are usually based on the deterministic paradigm of scientific thinking, give insufficiently reliable or short-term results. The adequacy of forecasting the dynamics of the insurance market as a whole decreases during the crisis. For example, Baluch et al.'s (2011) predictions regarding the prospects of the insurance market development after the 2008 crisis and related to the definition of systemic risk in insurance, did not come true. The insufficiency of the existing parametric models for forecasting the state of the insurance market is emphasized by Kozmenko et al. 2009 (p. 30). It is no coincidence that reviews-forecasts of the development of the insurance business give the forecast for no more than a quarter. At the same time, the methodological tools of indeterminist paradigm of scientific thinking, which makes it possible to obtain qualitative results in other areas of financial forecasting, are insufficiently used to determine the forecast values of insurance market dynamics. For example, Izzeldin (2007) models financial indicators through the variance of stochastic processes. The author forms a multivariate model of exchange rate dynamics and adapts it to daily random changes. Richards (2004) notes that the use of fractal analysis helps to overcome inconvenient features of financial time series in financial forecasting such as inhomogeneities at non-uniform intervals and scaling of proportional-symmetry relations between fluctuations at different separation distances. This is typical for the indicators of the insurance market dynamics, although not to the same extent as for the financial assets market. Schmitt et al. (2001) propose overcoming disturbances of forecasting horizons for financial time series by means of fractal analysis, calculating statistical temporal translational

invariance for exchange rate time series based on multifractal fluctuations. Timashova and Skachko (2016) emphasize the advantages of using R/S-analysis to assess the fundamental characteristics of time series, such as the presence and depth of long-term memory, trend resistance (persistence) in the use of financial time series. In this work, as in the studies by Kapecka (2013) and Sviridov and Nekrasova (2016), the authors assume that fluctuations in stock prices or financial instruments have a "long memory" and are self-similar. Dalton's (2006) dissertation compares the results of using fuzzy models to predict the stock price on time series using fractal analysis and without the use, emphasizing that the use of fractal analysis significantly improves the quality of forecasting.

The fractality of the market is due to a combination of global determinism in it and local randomness, which is observed in the vast majority of financial markets. The advantage of the "market fractality" hypothesis is also its tolerance to a certain number of errors while maintaining the system's stability (Anderson & Noss, 2013).

It would be logical to assume that not only prices in financial markets have a "long memory" and are self-similar, but also the general laws of market processes are generally subject to indeterminate perception. Therefore, the use of tools in the methodology for forecasting the development of the insurance market, associated with the study of complexly organized systems of natural genesis, can qualitatively improve its results.

Therefore, the existing methods for determining the trends of dynamics are fractional and do not give adequate forecasts for long horizons. At the same time, Ukraine's insurance market is dynamic and unstable, and there is an urgent need to determine the most regular trends in its dynamics. The purpose of this study is to identify trends in the insurance market of Ukraine and the moments of its potential crisis.

2. DATA AND METHODS

The study used the following indicators: number of registered insurers (k); number of life insurance companies (l); number of concluded insurance contracts (d); assets of insurance companies, UAH million (A); paid-up authorized capital of insurance companies, UAH million (K); formed insurance reserves of insurance companies, UAH million (R); gross insurance premiums, UAH million $(GI\operatorname{Pr})$; gross insurance payments, UAH million (GIP); net insurance premiums, UAH million $(NI\operatorname{Pr})$; net insurance payments, UAH million (NIP). The source of information was the quarterly data of insurance statistics (Forinsurer, n.d.) for the period 2014–2020.

Figure 1 shows the procedure for determining potential moments of bifurcation in the insurance market.

Indicators cited cumulatively during the year (number of concluded insurance contracts, gross insurance premiums, gross insurance payments, net insurance premiums, net insurance payments) were calculated on the basis of public statistics for each quarter separately. Indicators whose face value depends on inflation (assets of insurance companies, paid-up authorized capital of insurance companies, formed insurance reserves of insurance companies, gross insurance premiums, gross insurance payments, net insurance premiums, UAH million, and net insurance payments, UAH million) are listed in 2014 prices using GDP deflator (State Statistics Service of Ukraine, 2021).

The assessment of trends in the dynamics of insurance market indicators was based on determining the parameters of approximation by linear, cyclic, exponential, exponential and polynomial dependences and checking their reliability using f-statistics. The cyclic component was determined based on Fourier analysis. Since the average level of reliability (more than 0,6 probability of approximation) was achieved for the linear and cyclic components, a complex series of dynamics was formed on the basis of two time variables (t and $t^{/}$). This allowed simultaneously taking into account the main type of dependence (linear dynamics of performance indicator of the corresponding variable t) and its cyclical fluctuations (cyclic dynamics of performance indicator for the corresponding variable measured in radians), as well as achieving a high level of reliability ($P = 0,9999$ by f – statistics), which exceeded the reliability of any other approximation.

Stage 1.
Selecting and preparing
input information

Selection of indicators of the insurance
market development
$(k, l, d, A, K, R, GIPr, GIP, NIPr, NIP)$

Translation of information
into quarterly data
$(d, GIPr, GIP, NIPr, NIP)$

Discounting of cost indicator $(A, K, R, GIPr, GIP, NIPr, NIP)$

Stage 2.
Determining trends
in the dynamics of insurance
market indicators

Calculation of linear trend parameters
$$I(t) = a_0 + a_1 \cdot t,$$
where $I(t)$ - the value of the insurance market
indicator, t - linear numbering of time periods

Calculation of Fourier series parameters
$$I(t^|) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cdot \cos(nt^|) + b_n \cdot \sin(nt^|)$$
$t^|$- periodic numbering of time periods

Formation of a complex series
$I(t, t^|)$

Authentication,
f - statistics

Stage 3.
Determining the persistence
of a number of dynamics
of insurance market indicators

Implementation R/S - analysis, obtaining
the Hirsch index (H)

$H \rangle 0,5$

$H \cong 0,5$

$H \langle 0,5$

The dynamics of the
indicator is persistent,
fractal-like

The dynamics
of the indicator
is chaotic

The dynamics
of the indicator is
antipersistent, fractal-like

Stage 4.
Calculation
of autocorrelation

Autocorrelation calculation
$$r_n = \frac{\sum_{t=2}^{n}(y_t - y_1) \cdot (y_{t-1} - y_n)}{\sqrt{\sum_{t=2}^{n}(y_t - y_1) \cdot (y_{t-1} - y_n)}}$$

Construction
of autocorrelation function

Determination of lag length
and fractal duration

Stage 5.
Determining trends in the
dynamics of insurance
market indicators within
fractals

Determination of linear trend
parameters within first-order fractals

Authentication, f-statistics

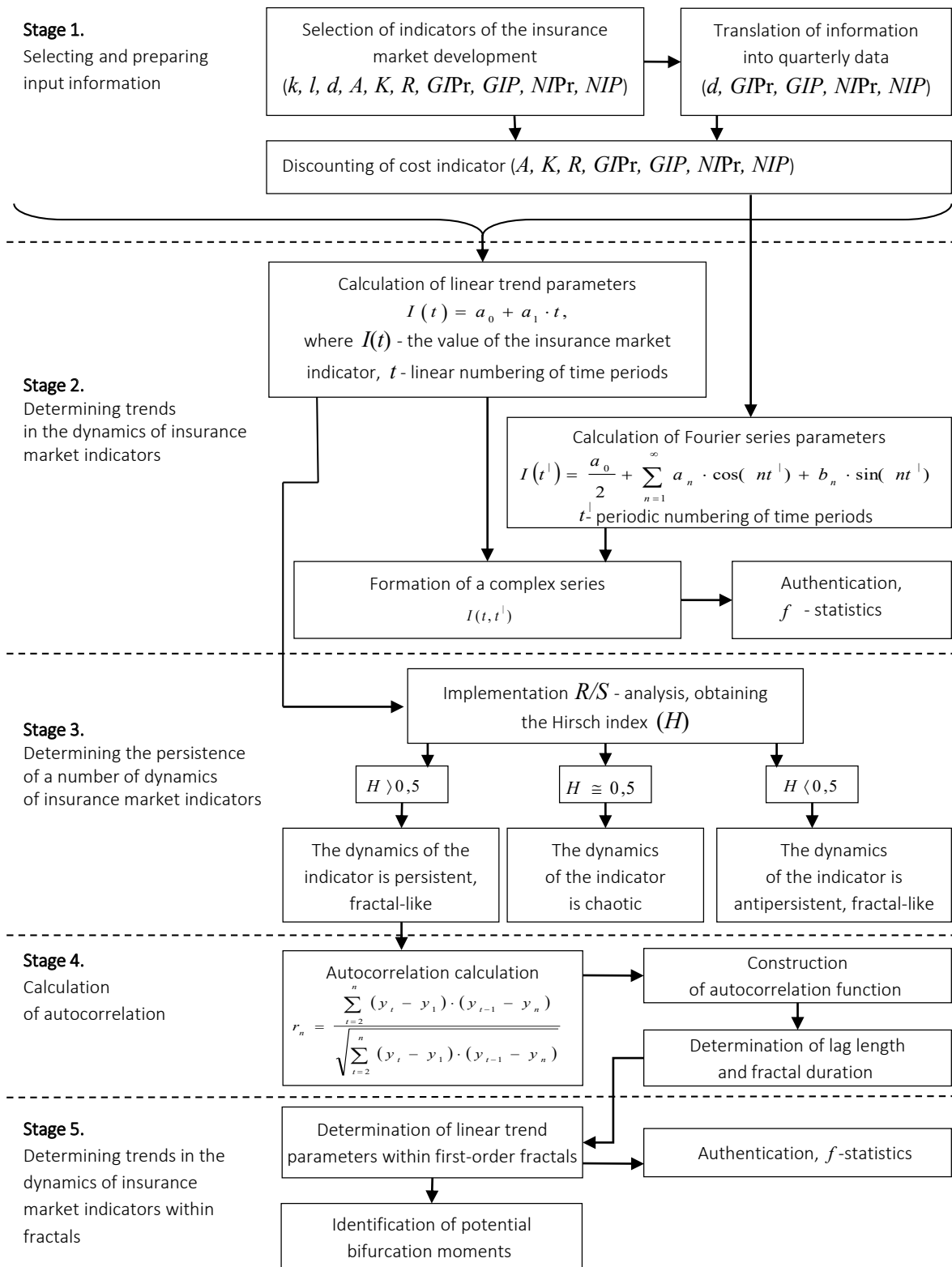Identification of potential
bifurcation moments

Figure 1. Stages of determining potential moments of bifurcation in the insurance market

It should be noted that the use of multidimensional time series to predict the development of the insurance market is used in foreign practice. Lenten and Rulli (2006, pp. 49-50), in the paper devoted to forecasting the development of life insurance in the Australian market, perceive time series of insurance indicators as consisting of different components (trend, cyclical component, seasonal and

irregular components), each of which is modeled separately. However, the results of modeling for different components are interpreted together.

A randomized R/S analysis was used to determine self-similarity of the dynamics (Gachkov, 2009), which can be used to obtain the fractal dimension, determine the persistence of the dynamics and the average cycle length. The main task of this stage of analysis is to prove the persistence of dynamics and the existence of stable patterns in it. Based on the calculation of autocorrelation and subsequent building of the autocorrelation function, lags for deterministic processes or fractal length for antipersistent time series are determined. Further analysis of the dynamics of insurance market indicators was carried out within individual fractals based on the determination of linear dependencies' parameters.

3. RESULTS

Below are the quarterly results of the theoretical approximation of the lines of dynamics of Ukraine's insurance market for the period 2014–2020 (Table 1). When determining the trends in the dynamics of indicators, their compliance with

the following dependences was checked: linear, logarithmic, power, exponential, polynomial (with orders of magnitude from 2 to 4), while the level of reliability from 0.37 to 0.95 was achieved. The highest level of reliability for each of the analyzed indicators showed a linear approximation with a cyclic component.

In general, the insurance market indicators, which can be used to determine the level of its concentration (number of registered insurers, number of life insurers, number of insurance contracts), have a downward trend, which confirms the preliminary conclusion of market concentration. On the contrary, indicators of the market size grow. At the same time, the shapes of the theoretical approximation lines testify to the potential instability of the market. Thus, with the simultaneous growth of insurance companies assets, paid-up share capital and insurance reserves, their rates do not correspond to each other. The elasticity of growth of the paid-in authorized capital and insurance reserves is much lower than the elasticity of growth of assets of insurance companies, which can be caused by excessive multiplication of capital. Cyclical fluctuations of capital/assets, reserves/assets are in antiphase. The length of the period of fluctuations of these indicators differs significantly from each

Table 1. Description of lines of theoretical approximation dynamics of indicators for Ukraine's insurance market

Source: Author's calculations based on Fouladvand, Darooneh (2004) and Kapecka (2013).

Indicator	Lines of indicators' theoretical approximation dynamics		Length of the period, quarters
	Form of dependence		
Number of registered insurance companies, k	$k(t,t^{/}) = 414.16 - 7.42 \cdot t - 6.19 \cdot \cos(t^{/}) + 10.52 \cdot \sin(t^{/})$		4.66
Number of life insurance companies, l	$l(t,t^{/}) = 61.08 - 1.60 \cdot t - 1.18 \cdot \cos(t^{/}) + 1.99 \cdot \sin(t^{/})$		4.66
Number of concluded insurance contracts, d	$d(t,t^{/}) = 14525 - 366 \cdot t - 861 \cdot \cos(t^{/}) + 555 \cdot \sin(t^{/})$		5.66
Assets of insurance companies, USD mln, A	$A(t,t^{/}) = 66608 + 5259 \cdot t - 3220 \cdot \cos(t^{/}) - 18943 \cdot \sin(t^{/})$		14
Paid authorized capital of insurance companies, USD mln, K	$K(t,t^{/}) = 19786 + 630 \cdot t + 1508 \cdot \cos(t^{/}) - 1685 \cdot \sin(t^{/})$		7
Insurance reserves of insurance companies have been formed, USD mln,	$R(t,t^{/}) = 6306 + 3462 \cdot t + 3395 \cdot \cos(t^{/}) - 7951 \cdot \sin(t^{/})$		9.33
Gross insurance premiums, USD mln, $GI\,\mathrm{Pr}$	$GI\,\mathrm{Pr}(t,t^{/}) = 5235 + 1378 \cdot t + 2768 \cdot \cos(t^{/}) - 2040 \cdot \sin(t^{/})$		7
Gross insurance payments, USD mln, GIP	$GIP(t,t^{/}) = 298 + 449 \cdot t + 590 \cdot \cos(t^{/}) - 690 \cdot \sin(t^{/})$		7
Net insurance premiums, mln. ₴, $NI\,\mathrm{Pr}$	$NI\,\mathrm{Pr}(t,t^{/}) = 2128,4 + 1159,88 \cdot t + 218 \cdot \cos(t^{/}) - 4218 \cdot \sin(t^{/})$		14
Net insurance payments, USD mln, NIP	$NIP(t,t^{/}) = 882,6 + 390,5 \cdot t - 776,25 \cdot \cos(t^{/}) - 765,21 \cdot \sin(t^{/})$		4.66

other. Such dynamics also determine the market instability due to the violation of insurance companies' stability.

There is also a certain dissonance in the patterns of dynamics of gross/net insurance premiums, gross/net insurance payments. This dissonance is due to the fact that the cyclical nature of these indicators differs significantly from each other, the magnitude of fluctuations in net premiums and payments is much larger than the magnitude of fluctuations in gross premiums and payments. Thus, the overall result of this stage of the study is as follows: There is a rapid development and concentration of the insurance market in Ukraine, accompanied by instability of the market as a whole, instability of insurance companies and their financial results.

However, the main result of this stage of the study was that all indicators of Ukraine's insurance market have the same type of dynamics. At the same time, the duration of periods within which the same dependence is repeated for each indicator differs significantly. The shortest period of fluctuations (4,66 quarters) had indicators of the number of registered insurers, the number of life insurance companies and net insurance benefits, the longest (14 quarters) – indicators of assets of insurance companies and net insurance premiums. Given the obtained results, it could be assumed that the onset of crises in Ukraine's insurance market is a consequence of coincidence of cyclical components in the dynamics of different indicators according to their contingency patterns. Therefore, numerical methods failed to identify the correspondence of cyclical fluctuations in the dynamics to the onset of crisis periods in the Ukrainian insurance market. B. Mandelbrot's statement "…all periodicities are "artifacts", not a characteristic of the process, but rather an aggregate result that depends on the process itself, the length of the sample and the economist's judgments" is extremely appropriate here (Mandelbrot, 1977).

Accordingly, it was suggested that the emergence of crises in the Ukrainian insurance market is associated primarily with the similarity of the dynamics and the coincidence of the moments of bifurcation of certain indicators in its development. The dynamics of the paid authorized capital

of insurance companies $(H = 0.4999)$ is defined as anti-persistent, while the memory of this series is rather short (4-5 quarters). For other characteristics, the dynamics is determined to be persistent at H, which is close to 0,7. It should be noted that it is inherent in natural processes within complex systems (Ehanova & Kallys, 2017, p. 21), and the dynamics of the analyzed indicator at such value of the Hirst index should be fractal-like.

Based on this result and given the results of calculating autocorrelation in time series, the duration of first-order fractals was determined for the indicator of the number of registered insurers, the number of life insurance companies, gross insurance payments, net insurance premiums, net insurance payments (12 quarters), and the number of insurance contracts (7 quarters). For indicators of insurance companies assets, formed insurance reserves, and gross insurance premiums, the length of the series did not allow determining the duration of the first-order fractal. For the same indicators there is a "long memory", lasting at least 14 quarters. Other works also note the influence of time on the results of determining the quantitative patterns in the dynamics of the insurance market. For example, Kozmenko et al. (2009, p. 53) note the existence of annual lags in the dynamics of indicators in the development of insurance markets of Germany and Ukraine: 5 years – for gross insurance premiums, the volume of per capita insurance premiums, the volume of gross insurance premiums for non-life insurance; 4 years – for the number of insurance companies; 3 years – for the ratio of gross insurance premiums to GDP; and 2 years – for the amount of per capita insurance premiums.

Comparing the dynamics of empirical data gives their high similarity in first-order fractals for almost all indicators of the insurance market. For example, Figure 2 shows the dynamics of empirical values for gross insurance payments in first-order fractals.

Theoretical approximations of dynamics, determined from empirical data for fractals of the first order, have a strictly linear shape and at the time of transition from one fractal to another change the tilt angle to the axis x (Table 2). If we assume that market crises are realized at the time of tran-
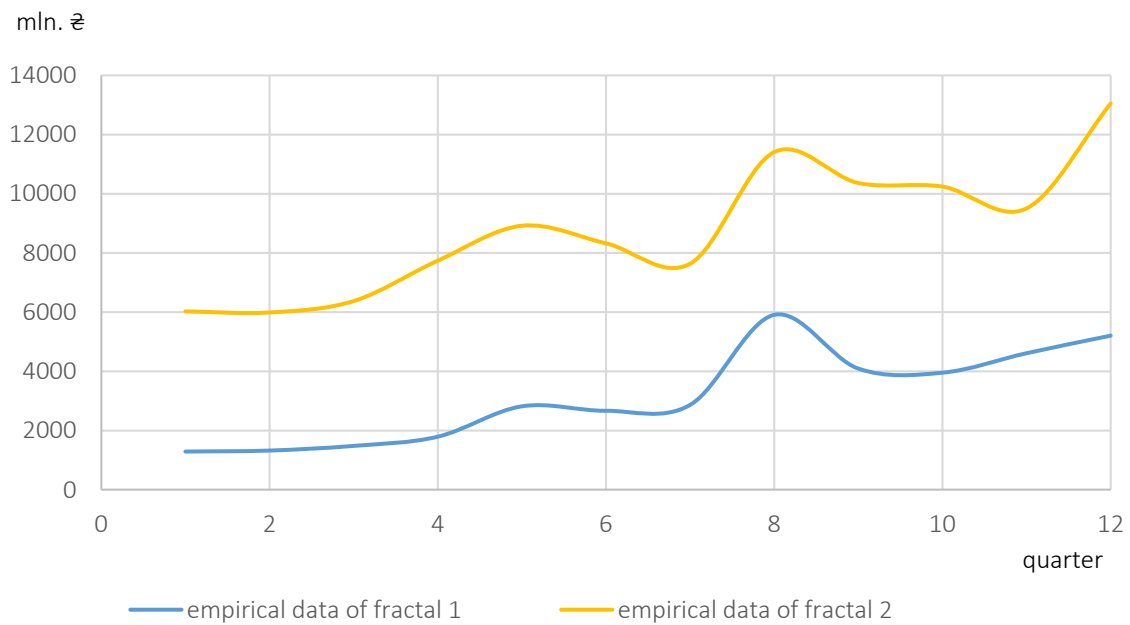
Figure 2. Dynamics of the volume of insurance payments in the Ukrainian insurance market for first-order fractals 2014–2020 in the period

sition from one fractal to another and are characterized by significant transformations of the dynamics, then significant changes in trends occur only for the number of insurance contracts in the transition from fractal 3 to fractal 4.

Since the duration of the fractal for this indicator is 7 quarters, the bifurcation period corresponds to the time interval of the first quarter of 2019, which is accompanied by crises in the Ukrainian insurance market. Therefore, potential crisis moments in the development of the market can be

Table 2. Theoretical approximation of lines of the insurance market dynamics by first-order fractals

Indicator	Lines of theoretical approximation dynamics of indicators		Changing the angle of inclination to the axis of x
	Fractal 1	**Fractal 2**	
Number of registered insurance companies, k	$k1(t) = 417,66 - 7.96 \cdot t$	$k2(t) = 320,90 - 6.71 \cdot t$	-1.3^0
Number of life insurance companies, l	$l1(t) = 63.42 - 1.89 \cdot t$	$l2(t) = 39.16 - 1.34 \cdot t$	-8.83^0
Number of concluded insurance contracts, d	$d1(t) = 3287 + 4032 \cdot t$	$d2(t) = 11004 + 940 \cdot t$	$+0.04^0$
	$d2(t) = 11004 + 940 \cdot t$	$d3(t) = 15611 + 1258 \cdot t$	-0.015^0
	$d3(t) = 15611 + 1258 \cdot t$	$d4(t) = 27907 - 850 \cdot t$	-180^0
Gross insurance payments, USD mln, GIP	$GIP1(t) = 644 + 388,16 \cdot t$	$GIP2(t) = 5252 + 545,53 \cdot t$	-0.04^0
Net insurance premiums, USD mln, $NI\,Pr$	$NI\,Pr\,1(t) = 3505,73 + 930,14 \cdot t$	$NI\,Pr\,2(t) = 14978 + 1381 \cdot t$	-0.02^0
Net insurance payments, USD mln, NIP	$NIP1(t) = 619,65 + 370,48 \cdot t$	$NIP2(t) = 5852,66 + 464,29 \cdot t$	-0.03^0

considered the period when one or more of its characteristics approach the time of change of one fractal to another. Obviously, the convergence of potential bifurcation moments for a large number of indicators is of great importance. For example, in Ukraine's insurance market such convergence occurred in the following periods: Q1-2 2017 (five indicators), Q1 2020 (four indicators). Potential bifurcation moments will be Q1 2023 (four indicators) and Q1 2026 (five indicators). At the same time, it should be noted that crisis situations are not always realized in periods of transition from one fractal to another. The "trigger" for the emergence of real crises may be a certain "black swan" event and/or publicity. In particular, Melnyk et al. (2021, p. 26) note that in late 2022 – early 2023 the reformatting of the insurance market of Ukraine is highly probable due to changes in financial standards and a similar transformation of the banking sector in 2014–2015.

It is also noted that during this period, there will be a significant reduction in the number of insurance companies. This is confirmed by the calculations. However, in addition to the number of insurance companies, bifurcations are expected in terms of the number of life insurance companies, gross insurance payments and net insurance premiums. These processes will be preceded by a sharp change in the number of concluded insurance contracts (Q3-4 2022).

4. DISCUSSION

Globalization and the development of global economic relations have determined the close cooperation of both commodity and financial markets. Accordingly, there is coordination in the dynamics of financial markets of different countries and mutual subordination of their development. National markets of different countries are affected by the same (or similar) factors. Crises that occur in some markets are often induced in others. All this applies to the insurance market.

The development of national insurance markets has common patterns defined by the specifics of insurance services as a main product and the peculiarities of the modern economic environment. Features of realization of insurance services deter-

mine the relatively higher risks of insurance companies and the need for more detailed justification of the cost of goods, the structure and volume of insurance portfolios, methods and extent of interaction between insurance companies. The current economic environment is quite unstable, economic agents are exposed to increasing risks, which leads to an increase in demand for insurance services. For Ukraine, these patterns of the insurance market development are exacerbated by the fact that its national market has not passed the stage of formation, it is characterized by intensive processes of concentration and structuring. Therefore, the general patterns of both the global insurance market and the national insurance market in Ukraine determine its upward dynamics with significant instability.

Currently, the task of obtaining forecasts of potential crisis periods in the insurance market development is extremely important.

There are many ways to obtain forecasts about the direction (future state) of individual financial processes (financial phenomenon). To make these predictions, different methods are selected in accordance with the tasks facing researchers. When forecasting the course of processes in insurance, problems arise associated with determining the status of individual insurance companies (groups of companies). Forecasting results relate to one or two aspects of the functioning of companies. That is why a wide range of models are used, which allow obtaining high-quality results, including the forecasting of crises possibilities. However, even with such limited output data and forecasting results, it is often difficult to build models for long-term horizons, as insurance companies' incomes are usually deterministic and costs are stochastic.

It is even more difficult to determine the quantitative patterns of the insurance market development as a whole. In particular, fortuity has a much greater impact on market dynamics as a whole than on the state of individual insurance companies. At the same time, the processes in the insurance market remain partially determined. The insurance market is constantly in a state of transformation, subject to significant influences from other segments of the financial market. Forecasts for the future state of the insurance market are made

for short time horizons and often contain significant errors. A good example is trend models presented in this study, which are built on the basis of linear and cyclic dependencies. Given the high level of reliability, these models did not allow determining the potential moments of crisis on the Ukrainian insurance market.

At the same time, the use of fractal analysis and R/S analysis, as part of it, gave more fruitful results. The choice of fractal analysis to forecast potential crisis moments in the development of the insurance market was due to the quality of other financial forecasts obtained with its help. However, the fact was taken into account that the existing applications of fractal analysis to the implementation of financial forecasts are limited and relate primarily to price dynamics on the securities markets. Therefore, it was important to check the adequacy of forecasting crises in Ukraine's insurance market using fractal analysis.

Given the complex nature of processes on the insurance market, there is an urgent need for further research in the field of forecasting potential crisis moments by using fractal analysis. In particular, new results can be obtained for fractals of different orders on different indicators according to the fractal dimension. It is also advisable to identify the causes of incomplete fractal dimensions in the dynamics of the insurance market. To obtain forecasts of market development without identifying the moments of potential crises, it makes sense to check the existence of parametric relationships between indicators of insurance market development in fractals of different dimensions.

Therefore, to obtain more complete results on forecasting potential crisis moments in the insurance market (and possibly in other financial markets), it makes sense to expand the use of fractal analysis.

CONCLUSION

The insurance market accumulates the most effective protection tools against the growing number of dangers and threats. However, currently the development trends of Ukraine's insurance market show its instability and dependence on destructive external influences. In this regard, the aim of the study was to identify trends in the development of the Ukrainian insurance market and its moments of potential crises.

This study shows that the general patterns of dynamics of Ukraine's insurance market have shown its growth and concentration even in crisis conditions. At the same time, the insurance market development is accompanied by its instability and the emergence of systemic preconditions for the formation of crises. It was also noted that the dynamics of the main indicators of Ukraine's insurance market is cyclical with a cycle length from 4,66 to 14 quarters. However, the analysis of cyclic fluctuations of dynamics lines did not reveal a coincidence of crisis periods in the development of the insurance market and the periodicity of theoretical lines of dynamics. It was concluded that the formalization of parametric dependencies, the construction of simple or complex trends will allow forecasting the state of Ukraine's insurance market only for short horizons.

According to the results of a randomized R/S-analysis, the dynamics of all indicators of Ukraine's insurance market (except for the indicator of paid authorized capital) is persistent and fractal-like, and it is linear within each fractal of the first order. Therefore, the moments of transition from one fractal to another (within one order) are potential moments of bifurcation. For the entire group of analyzed indicators of the insurance market development, such potential moment of bifurcation was realized only once – in the first quarter of 2019, when there was a break in the dynamics of the number of concluded insurance contracts. During the same period, the crisis phenomena in the Ukrainian insurance market were most pronounced. There are three potential moments of bifurcation during the same period: in Q1-2 2017, in Q1 of 2019, and in Q1 2020. The calculations made it possible to conclude that the following periods will be potential moments of bifurcation of Ukraine's insurance market – the first quarter of 2023 and the first quarter of 2026.

Also, according to the results of the study, it can be concluded that the identified cyclical indicators of the insurance market are conditional and associated with the fractal similarity of their dynamics.

AUTHOR CONTRIBUTIONS

Conceptualization: Viktoriia Babenko-Levada.
Data curation: Viktoriia Babenko-Levada.
Formal analysis: Viktoriia Babenko-Levada.
Funding acquisition: Viktoriia Babenko-Levada.
Investigation: Viktoriia Babenko-Levada.
Methodology: Viktoriia Babenko-Levada.
Project administration: Viktoriia Babenko-Levada.
Resources: Viktoriia Babenko-Levada.
Software: Viktoriia Babenko-Levada.
Supervision: Viktoriia Babenko-Levada.
Validation: Viktoriia Babenko-Levada.
Visualization: Viktoriia Babenko-Levada.
Writing – original draft: Viktoriia Babenko-Levada.
Writing – review & editing: Viktoriia Babenko-Levada.

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