Optimization of auto insurance management system as an important element of the automotive industry

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ABSTRACT

All over the world, car owners know that car insurance is an integral part of owning a vehicle. It will protect a vehicle from any risks.

The third party liability insurance for the damage to life, health and the property of third parties is called OSAGO.

According to analysts, in order to stabilize the situation in OSAGO market, it is necessary to raise the base tariff by 40-60% and change the territorial coefficients in the most unprofitable regions.

Research relevance: prediction is an important control function for all systems. It is important for the state and for insurance companies. 65% of Russia insurance fees are charged from auto insurance, so prediction is necessary for the state and for the insurance market as a whole.

In order to predict a price, we use ARIMA, the autoregression model and an integrated moving average model, because it is the most popular parametric time series model. The peculiarity of STATISTICA model implementation is that within the framework of one dialogue it is possible to conduct all stages of the classic Box-Jenkins scheme: model identification by the means of autocorrelation and private autocorrelation functions, parameter estimation, adequacy estimation, the prediction of future values.

As a time series, the data of the estimated average price for OSAGO and average payment for OSAGO were chosen to consider the method for the period from January 2010 to April 2017 and the values were determined for the next 11 months. After that, the graphs and the table were developed for an average price prediction for OSAGO and the average repayment for it:

After the forecast that the cost of insurance premiums in the secondary auto insurance market in the Russian Federation (at least for the near future) has a growth trend of 5-5.5%, which may be explained by the forecasted rate of inflation for the next year.

Articulo recibido: 05-11-2017
Aprobación definitiva: 06-12-2017

After the forecast it is possible to conclude that an average price for OSAGO will vary from 7400 to 9400 rubles, and average insurance payments will take the positions from 66000 to 71000 rubles.

Key words: automobile industry, automobile insurance, methods of forecasting, exponential smoothing.

1. INTRODUCTION

To date, the automotive industry is subject to a variety of trends. On the part of the government, the level of the industry regulation increases within the conditions of growing competition in the labor and capital markets. On the part of tax authorities and insurance companies, permanent changes are not in favor of an average driver [Gareeva, G.A.2016].

The accounting for depreciation of a car during the calculation of insurance payment amount for OSAGO fairly causes the greatest remarks in society. Indeed, it is the accounting for depreciation leads to the insufficiency of insurance payment amount for car repairs in the first place. Wear accounting assumes that a damaged car will be repaired using used spare parts (from other cars) or an owner will pay extra for the use of new parts [Gareeva, G.A. 2016].

The purpose of this study is to study and identify the factors that influence the change of insurance premiums, the analysis and the forecast of this market for a certain period of time.

The task is to predict insurance premiums and insurance payments from several factors in Russian Federation. The data were selected for the period from January 2010 to April 2017 as the studied indicators, n = 88; m = 8: insurance premiums (in thousands of rubles) - dependent variable y and independent variables: X1 - Insurance payments, in thousand rubles; X2 - the number of concluded contracts, in thousands; X3 - the level of payments, in %; X4 - an average accident rate; X5 - the number of claimed losses, in thousands; X6 - the number of settled losses (in thousands); X7 - average CHI (in rubles).

In order to predict a price, we use ARIMA - the autoregression and integrated moving average model - since it is the most popular parametric time series model.

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Aprobación definitiva: 06-12-2017

The Ministry of Finance prepares the law on OSAGO, about a full refund of a real cost of a car repair, the need for AUTOCASCO can be reduced or disappeared completely. The adoption of amendments is likely to lead to the increase of tariffs concerning the cost of OSAGO [Grigoreva, D.R.,Faizullina, A.G. 2016].

At the same time, in 2017, both segments wait for the growth of payments in OSAGO due to the increase of payments on new limits, in life insurance due to the onset of payment terms for medium-term life insurance contracts. Thus, insurers specializing in OSAGO and life insurance will face the growing losses and the loss in profitability of their own funds, which will have a negative impact on the ratings of insurance companies.

One can distinguish such contradictions in the development of the market: a constant decrease in tariffs and a simultaneous increase in the loss of auto insurance, the distribution of a larger share of fees to the largest companies, and the decrease of the number by the leave of small companies from the field of this service provision [Bakirov A.F. 2016], [Artamonov A.P. 2014]. The number of companies involved in auto insurance will be decreased by 5.7-10% in 2016-2017.

As a time series, the data of an estimated average price and an average payment for OSAGO for the period from January 2010 to April 2017 were chosen for the consideration of the method and the values for the next 11 months were determined. After that, the graphs and a table were constructed for an average price prediction and the average repayment for OSAGO.

After the forecast it can be concluded that an average price for OSAGO will vary from 7400 to 9400, and average insurance payments will take positions from 66000 to 71000 rubles.

2. METHODS

The forecasting of the time series was considered using the autoregression method with an integrated moving average (AutoRegression Integrated Moving Average) using Statistica 10.0 software.

The time series can be considered as a stationary one. In order to make predictions, two important parameters of the model were chosen: the order of autoregression p and the moving average order q.

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The model with two zero parameters describes white noise. To the right of the graph, the characteristic values of p are presented.

This is the probability of error of the first kind during the test of the hypothesis that our function is the realization of the autocorrelation function of white noise.

Zero values of this probability indicate that such an assumption does not agree well with reality, that is, there is a stable direct relationship between the values of the series that are close in time.

The most common models are the autoregression of the first order (p = 1, q = 0) and the moving average model of the first order (p = 0, q = 1) [Gvozdenko A.A. 2014].

The first-order autoregressive model is characterized by the following relation:

$$X(t) = \phi X(t-1) + \varepsilon_t$$

Here ε_t is white noise.

The first-order moving average model is characterized by the following relation:

$$X(t) = \varepsilon_t + \theta_1 \cdot \varepsilon_{t-1}$$

In order to make a choice between these models, it is desirable to have a more complete picture of the time series behavior. The relationship between the values of the time series can be either direct or indirect one. In order to distinguish the direct effect of one value on another, private correlations are used. Only an immediate influence of the series current value on a next value that is closest to it is significant: only the first of the specific autocorrelation coefficients is significantly different from zero. This behavior is typical of first-order autoregression processes. For a moving average process of the same order, the specific autocorrelation function decreases according to the law of geometric progression. Thus, we identify the model as a first-order autoregression model with a positive value of the parameter p [Mathematics for economists: from arithmetic to econometrics: textbook and manual for bachelors / 2012], [The market of liability insurance in Russian Federation: analysis, trends and development prospects / 2010.].

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Aprobación definitiva: 06-12-2017

The indicator of the constructed ARPSS model quality is the analysis of residues. ARPSS model describes the initial data adequately if the remnants of the model are uncorrelated, normally distributed random variables. In all areas of the city, the remains tend to a normal distribution [Abu Sharkh, M., Shami, A., Ouda, A. 2017], [Huang, T.-H., Chen, L.-B. 2016].

3. RESULTS

The result of the iterative process of the parameter f estimation, is the method equality to the value of 0.98. This is to be expected, since the same value is the correlation coefficient between the two closest (in time) values of the time series.

Figure 1 - Forecast values with 90% confidence interval for the 1st variable.

Набл. N	Прогнозы; Модель:(1,1,1)(1,1,1) Сезонный Исход.:Средняя цена за ОСАГО Начало исходных: 1 Конец исходн.: 88 **Прогноз**	Нижний 90,0000%	Верхний 90,0000%	Ст.ошиб.
89	7370,165	7052,595	7687,74	190,8609
90	7809,995	7474,071	8145,92	201,8915
91	7648,450	7145,916	8150,98	302,0247
92	8067,236	7542,207	8592,26	315,5443
93	8027,919	7360,059	8695,78	401,3866
94	8533,923	7839,519	9228,33	417,3389
95	8387,613	7559,790	9215,44	497,5247
96	8813,795	7955,152	9672,44	516,0472
97	8654,436	7666,573	9642,30	593,7092
98	9027,555	8004,560	10050,55	614,8234
99	8808,814	7658,383	9959,24	691,4129
100	9349,632	8159,816	10539,45	715,0837

Figure 2 - Forecast values with 90% confidence interval for the 2nd variable.

Набл. N	Прогнозы; Модель:(1,1,2)(1,0,1) Сезонный Исход.:Средние выплаты по ОСАГО Начало исходных: 1 Конец исходн.: 88 **Прогноз**	Нижний 90,0000%	Верхний 90,0000%	Ст.ошиб.
89	65719,69	63145,04	68294,34	1547,375
90	66368,74	63092,76	69644,71	1968,874
91	66886,53	62810,07	70962,98	2449,963
92	67051,23	62336,01	71766,44	2833,860
93	67615,48	62334,72	72896,25	3173,759
94	68109,97	62319,07	73900,86	3480,349
95	68751,64	62491,99	75011,29	3762,071
96	69102,07	62406,42	75797,73	4024,113
97	69074,76	61969,80	76179,72	4270,106
98	69405,21	61913,27	76897,14	4502,679
99	69980,65	62120,77	77840,53	4723,815
100	70816,64	62605,28	79027,99	4935,053

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Figure 3 - The graph of predicted and previously observed time series values and 90% confidence interval for the first variable

The graphs of the predicted and previously observed values of the time series and 90% confidence interval for the forecast of an average price of OSAGO and the average repayment for OSAGO are presented on Figure 3 and 4.

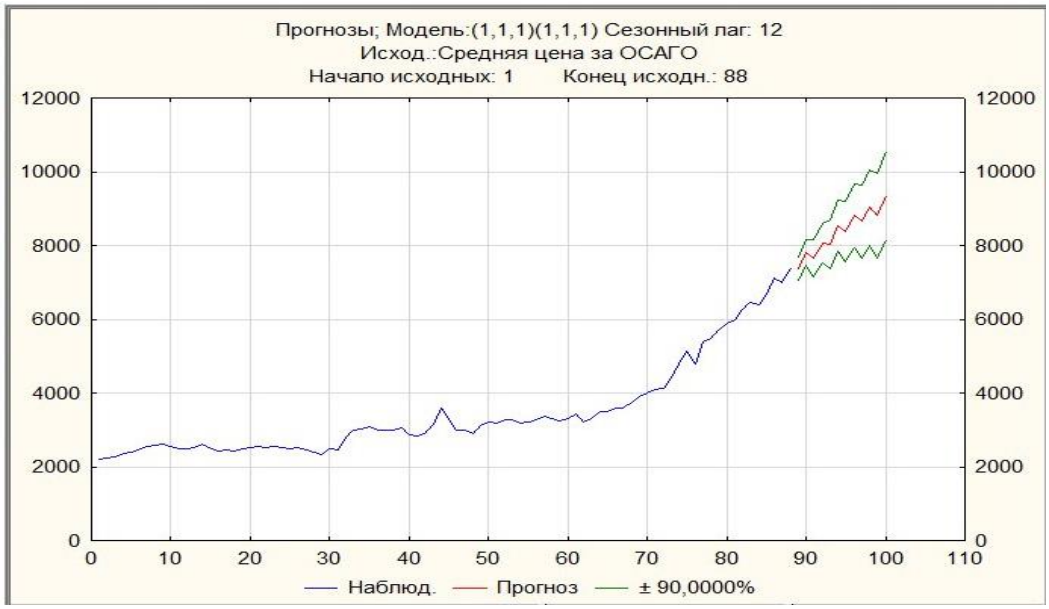
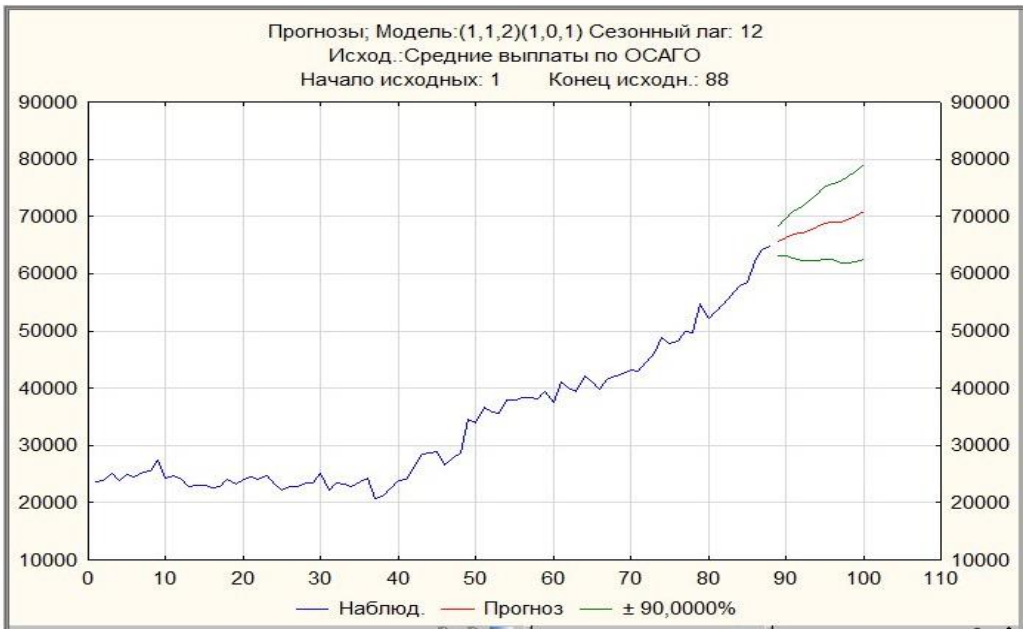


Figure 4 - The graph of predicted and previously observed values of the time series and 90% confidence interval for the second variable



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The graphs show that the cost of insurance premiums on the secondary auto insurance market in Russian Federation (at least for the near future) tend to grow within 5-5.5%, which can be explained by the forecasted rate of inflation for the next year.

4. CONCLUSIONS

In order to compile up-to-date reviews that allow us to build a right policy for the development of any industry, they study and predict market charges. This is especially important for the insurance market, since 65% of Russia insurance premiums are charged from auto insurance, so forecasting is necessary for the state and for the insurance market as a whole. The main problem is that often the interests of both do not coincide.

On the one hand, the state, on behalf of the Central Bank, is responsible for the control of tariffs, the limits on payments, the quotas for OSAGO forms, the issue of licenses to insurance companies, which, in its turn, can not refuse any client to draw up OSAGO. On the other hand, the work of insurance companies is of commercial nature, that is, the main objective of the company is to obtain the maximum possible profit from all types of insurance.

The following methods were considered for time series analysis: multiple linear regression and multiple nonlinear regression, ARIMA - autoregression and integrated moving average model; Interrupted time series analysis - ARIMA model with intervention.

5. SUMMARY

Due to the fact that the Ministry of Finance draws up the law on OSAGO, on the full recovery of car repair real cost, the need for AUTOCASCO may be reduced or disappeared completely. It turns out that companies that received real income from CASCO will gradually move into other areas of insurance.

The adoption of amendments is likely to lead to the increase of tariffs concerning OSAGO cost.

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At the same time, in 2017-2018, both segments expect an accelerated growth of payments in OSAGO due to the increase of payments on new limits, in life insurance due to the onset of payment terms according to medium-term life insurance contracts. Thus, insurers specializing in OSAGO and life insurance will face growing losses and the loss of their own funds profitability, which will have a negative impact on the ratings of insurance companies.

One can single out such contradictions in the market development: constant reduction of tariffs and simultaneous growth of auto insurance losses, the distribution of a larger share of fees towards the largest companies, and the decrease of number through the leave of small companies from the sphere of this service provision.

The number of companies involved in auto insurance will be decreased by 5.7-10% in 2017-2018.

In order to release some funds for the change of asset structure and improve the profitability of assets, insurance companies began to optimize the costs of doing business. Optimization took place due to staff cuts, advertising costs reduction, the closure of unprofitable subsidiaries, and the reduction of commission fees.

In order to reduce the costs of commission payments to agents, insurance companies began to develop non-agent sales channels - through banks, the Internet and non-financial intermediaries.

During the market analysis, we found that an average price and an average payment for OSAGO have a polynomial trend, which means that we have a non-stationary time series, that is, its characteristics such as mathematical expectation and variance vary in time.

As a time series, the data of the estimated average price for OSAGO and the average payment for OSAGO for the period from January 2010 to April 2017 were chosen and the values for the next 11 months were determined for the consideration of the method. After the forecast it is possible to conclude that the average price for OSAGO will vary from 7400 to 9400 rubles, and average insurance payments will take positions from 66000 to 71000 rubles.

The most important factor of the long-term problems of Russian economy is the inefficiency of the state as a whole. State investments do not have business plans often, state companies experience degradation without any market competitors.

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A significant part of the economy profits can not be taxed, settling in offshore.

This group of factors can also include the inefficiency of civil society, the judiciary system, corruption, the incompetence of officials, etc. As all the factors pressing on the economy are long-term ones, the situation will not change radically in the near future.

6. ACKNOWLEDGEMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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Aprobación definitiva: 06-12-2017