Functions of the bonus-malus system in the motor third party liability insurance of motor vehicle owners

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Abstract: The bonus-malus system is one of the stages of the ratemaking process in motor liability insurance. The purpose of the work is to discuss the role of the bonus-malus systems in the ratemaking and to present their functions. The article reviews the measures for assessment of the ratemaking function of the bonus-malus systems and attempts to investigate the impact of preventive and marketing functions. These functions fulfil their role under the condition that the insured party is aware of the functioning of the bonus-malus system. It has been hypothesized that the policyholders choosing the insurer do not know the bonus-malus system offered to them and that increasing the knowledge about the functioning of the system intensifies the impact of its preventive function. The study was conducted on the basis of an analysis of the insurance conditions offered by the insurers on the Polish market (GIT) and a questionnaire survey. Mathematical statistics methods have been used for the analysis. The results of the research confirm the hypothesis that the insured do not know the bonus-malus system while choosing an insurer. This is the effect of not passing enough information to the client. The results allow claiming that even offering brief information about the rules of the functioning of the bonus-malus system improves the awareness of policyholders and increases the impact of the preventive function, which makes it possible to positively verify the second research hypothesis.

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1. Introduction

The term "motor insurance" refers to all insurance that applies to motor vehicles and in particular to owners of these vehicles. These include, among others, car insurance (AC) and liability insurance for motor vehicle owners related to the movement of these vehicles, called motor third party liability insurance. In Poland, according to the statutory classification (Act on Insurance and Reinsurance Activities of September 11, 2015), motor insurance belongs to Section II of Other personal insurance and non-life insurance, while motor insurance (car insurance (AC) and motor third liability insurance (OC) are respectively groups 3 and 10 of Section II. Motor third party liability insurance for motor vehicle owners and car insurance belong to the most frequently concluded insurance in Poland, as evidenced by the share of premiums from these types of insurance in non-life insurance premiums. According to data on non-life insurance (KNF, 2018) in Poland, the gross written premium[1] for motor third party liability insurance and car insurance accounted for 63.36% of the insurance premium of Section II, of which 42% is the premium for third party liability insurance and 21.36% for car insurance. The value of insurance premiums for the 10th group after three quarters of 2017 was by 3.08 billion PLN (increase by approx. 39%) higher than in the corresponding period of 2016 (KNF, 2018).

Liability insurance for motor vehicle owners is compulsory throughout Europe and its scope is unified by the European Union regulations. In Poland, the rules for the conclusion of third party liability insurance agreements for motor vehicle owners have been specified in the Act of May 22, 2003, on compulsory insurance, Insurance Guarantee Fund and Polish Motor Insurers' Bureau. Therefore, the competition between the companies is not based on modifying the product, but mainly on the insurance price and the quality of customer service. The insurer's goal is to calculate premiums that best reflect the risk represented by the insured. Too high a premium may result in a loss of customers, too low a premium may lead to anti-selection of risk in the insurer's portfolio, i.e. insurance for an increasing number of customers with a high loss ratio. However, it should be remembered that the prices on the local market and marketing policy of the insurance company have a large impact on the premiums. The insurer can lead a policy of increasing the share of premium writing on the market, which causes the lowering of prices.

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[1] According to the Regulation of the Minister of Finance of December 28, 2009 on specific accounting principles of insurance and reinsurance undertakings (Journal of Laws of 2009, No. 225, item 1825) the written premium is the amount of the premium due for the entire period of liability, regardless of its length.

The aim of the paper is to discuss the role of the bonus-malus systems in the ratemaking process and to present their functions. The article reviews the measures for assessment of the ratemaking function of the bonus-malus systems and attempts to investigate the impact of the preventive and marketing functions. These functions fulfil their role on the condition that the insured is aware of the functioning of the bonus-malus system. The paper presents selected systems operating on the Polish market. It has been hypothesized that the policyholders choosing the insurer do not know the bonus-malus system offered to them and that increasing the knowledge about the functioning of the system intensifies the impact of its preventive function. The study was conducted on the basis of an analysis of the insurance conditions offered by the insurers active on the Polish market (GIT) and a questionnaire survey. Mathematical statistics methods have been used for the analysis.

2. The bonus-malus system as an element of the ratemaking process in the motor third party liability insurance

In the motor third party liability insurance, the ratemaking process consists of two stages. In the first one, an a priori premium (net premium) is calculated with use of actuarial methods based on known risk factors, called basic ratemaking variables (Ostasiewicz, 2000). The premium calculated in this way, increased by, among others, the costs of insurance activity and the security allowance is the so-called base premium (in GTC often called a basic one). At the second stage, called a posteriori ratemaking, the base premium is adjusted by including in it increases and discounts depending on the individual risk factors of the insured, receiving the so-called written premium. The bonus-malus system (Lemaire, 1995) is one of the elements of a posteriori ratemaking, commonly used in Europe.

The bonus-malus system makes the premium dependent on the current insurance course (the number of claims reported in the previous insurance period). The insured without the loss history go to the basic (starting) class, then depending on the number of claims, they move in subsequent insurance periods to a specific ratemaking class. The insured who did not report any damage go to classes with a lower premium or remain in the same class if they are already in the class with the maximum discount. The insured who have reported one or more damages go to an increased premium class in accordance with the rules of movement between the classes. The tariff classes differ in the amount of the premium, expressed as a percentage of the basic

premium, that is, the rate of the basic premium. The classes with a contribution rate lower than 100% are those in which there is a "bonus" (discount), the classes with a premium rate greater than 100% are the "malus" classes (with an increased premium).

By definition the *bonus-malus system* is the method of determining the individual net premium based on the loss history of the insured (the number of losses caused in the past), which meets the following assumptions:

1)   The portfolio is a fixed group of drivers (insured) divided into risk classes, called ratemaking classes. The insurance periods are of equal length and last one year.

2)   The number of ratemaking classes is finite and is equal to r. Let us denote by R = {1,2, ..., *r*} a set of ratemaking class numbers. Let us assume that number 1 class is charged with the largest increases, while the class with the r number is the class with the largest discounts.

3)   There are established rules for the transition between the classes, depending on the number of damages caused by the insured in the past. The insured client's assignment to a class in a given year depends on the class in which he was in the previous year and the number of losses caused in the previous year. The insured remain in a given bonus-malus class for at least one year. At the same time, drivers without a loss history are sent to the starting class.

4)   The number of damages in a given year for any driver from a given class is a random variable *K* with a known and constant probability distribution. The amount of damage of a single driver is a random variable *X*. Variables *K* and *X* are independent. The random variable X is the total value of claims reported in a single period of time, i.e. during the year.

5)   Each *i* - th tariff class has a base contribution rate b_i, , $i = 1, ..., r$. Vector $\mathbf{b} = (b_1,..., b_r)$ is called the basic premium rate vector. $i=1,...,r$.

3. Overview of the selected bonus-malus systems

Historically, the first bonus-malus system was created in Great Britain in 1910. The countries of Continental Europe started using the bonus-malus systems after 1960 after the publication of works on this subject in ASTIN BULLETIN (Bischel, 1960; Bűlmann, 1967).

In the case of calculating premiums in motor insurance, the legal regulations in a given country play an important role. Such regulations may concern both the ratemaking factors when determining the base premium and the bonus-malus systems themselves. In some countries, such as in Belgium, France or Luxembourg, the bonus-malus system is introduced by law. In other

countries, insurers are free to build a bonus-malus system, e.g., in Austria, Ireland, Greece, Spain, Great Britain, Germany or Poland. However, it can be noted that despite the lack of statutory regulation according to the bonus-malus system, in some countries the system is usually the same or there is a typical bonus-malus system. Such countries include among others Finland, Ireland, Japan, Germany, and Switzerland. In many countries, the reason for legal regulations, referring to the bonus-malus system are socio-economic determinants. However, it limits competitiveness in the motor insurance market and may lead to an increase in premiums.

The bonus-malus systems operating in the world are characterized by a very large diversity. This applies to the number of classes of the operating system, as well as the proportion of increase and discount classes, the rules for the transition between classes and the start class.

There can be indicated countries with very extensive bonus-malus systems, such as Belgium, France, Luxemburg, Germany or Switzerland. BM systems in these countries have more than 20 classes and specific rules for transitions between classes.

There are bonus-malus systems only for discounted classes and for classes with a 100% net premium rate. Such systems operate in Brazil, Finland, Spain, Hong Kong, Ireland, Kenya, Sweden, Great Britain and Vietnam, and their characteristic feature is a small number of classes and most often the loss of discounts after the first damage.

The bonus-malus systems with only increase classes are relatively rare. An example here is the United States of America, in which the bonus-malus systems are different in individual states and mostly contain only classes with an increase and a rate of 100% net premium.

In most cases, affiliation to the bonus-malus class depends on the number of damage caused in the past, most often within one year. However, there are exceptions. Belonging to a class in some American bonus-malus systems depends on the number of penalty points that an insured has received due to traffic offenses during the three years preceding the conclusion of the policy. Only the allocation of penalty points results in quite a large diversity of systems in particular states. Also in Korea, the bonus-malus class depends on the penalty points assigned to the insured in the last year preceding the conclusion of the policy.

Most often, the starting class, to which the insured go without a loss history, is a class with a rate of 100% of the net premium. However, there are exceptions: in Belgium, for example, the starting class is a class with 85% rate, 75% in Great Britain, 140% in Germany, and 115% in Italy.

On the Polish insurance market, there are bonus-malus systems different in terms of the number of classes, premium rates and rules for the transition between system classes. The bonus-malus systems operating in Poland usually have around 11 classes, including two or three with a higher premium rate. As a rule, the discount for the non-damage course of insurance in the next year is 10%, up to the maximum discount - 60%. If in the given insurance period a damage was reported, the increase in the next period may exceed 10%. The maximum increases in premiums vary depending on the insurer (up to 260%) (Szymańska, 2014: 43-70).

The article presents three exemplary bonus-malus systems used on the Polish market (Tables 1-3). It should be emphasized that the systems presented in the article are included in the GIT of insurers. Unfortunately, most insurance companies do not publish the bonus-malus systems used, and often even agents are not familiar with the operating system.

Table 1. The bonus-malus classes and the transition rules between the classes used by PZU SA in the liability insurance of motor vehicle owners

Bonus-malus class	% of premium	Rate / period of damage-free insurance	Displacement in bonus-malus classes after each damage for which compensation was paid
1B	200	IV rate tightened	1B
1A	150	III rate tightened	1B
1	130	II rate tightened	1B
2	115	I rate tightened	1A
3	100	Basic rate	1
4	90	1 year	2
5	80	2 years	3
6	80	3 years	4
7	70	4 years	5
8	60	5 years	6
9	50	6 years	7
10	50	7 years	8
11	40	8 years	9

Source: PZU General Terms and Conditions of Insurance applicable to insurance contracts concluded from January 1, 2016

Table 2. The bonus-malus classes used by AXA Ubezpieczenia TUiR SA in third party liability insurance for motor vehicle owners

Class	Percentage of increase/discount
1	+100%
2	+50%
3	+30%
4	+15%
5	0%

6	-10%
7	-15%
8	-20%
9	-30%
10	-40%
11	-50%
12	-55%
13	-60%

* if in the previous insurance period no damage was reported, the premium is calculated using the percentage discount / increase appropriate for the next higher class Bonus / Malus,

** each damage reported in the previous insurance period results in a reduction of the Bonus / Malus class by two levels.

Source: AXA Insurance General Terms and Conditions of Insurance applicable to insurance contracts concluded from October 7, 2017

Table 3. The bonus-malus classes and the rules of transition between classes used by MTU[2] in the civil liability insurance of motor vehicle owners

Tariff class	Number of damage-free years	Discount or increase in % of the base premium	ratio	Transfer in the tariff class depending on the course of insurance in the previous one-year insurance period		
				No damage	After 1 damage	After 2 and more damages
0	Rate increased	+160%	2.00	3	0	0
1		+80%	1.60	3	0	0
2		+30%	1.30	4	1	0
3	Basic rate	0%	1	4	2	0
4	after 1 year	–10%	0.90	5	2	1
5	after 2 years	–20%	0.80	6	3	1
6	after 3 years	–30%	0.70	7	4	2
7	after 4 years	–40%	0.60	8	5	3
8	after 5 years	–50%	0.50	9	6	4
9	after 6 years	–60%	0.40	9	7	5

Source: MTU Annex 1 to the premium tariff applicable to insurance contracts concluded from October 14, 2010

4. Functions of the bonus-malus system

The bonus-malus system in motor insurance fulfils three basic functions: ratemaking, preventive and marketing (Jędrzychowska, Poprawska, 2013).

The ratemaking function consists in correction of the base premium through the system of discounts and increases to adjust the insurance price to the individual risk factors of the insured person, most often measured by the number of losses caused by the insured in previous

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[2] MTU belongs to STU Ergo Hestia

insurance periods. In the literature on the subject, many studies can be found regarding the evaluation of the ratemaking effectiveness of the bonus-malus systems (Lemaire, 1995; Szymańska, 2014).

The marketing function of the bonus-malus system is related to the actions taken by an insurance company aimed at encouraging customers with low claims to take out insurance. Indirectly, the impact of this function can be examined by measuring the insurer's contribution in the motor insurance market.

The term "insurance prevention" should be understood as any activity aimed at reduction of fortuitous damage, by limiting their size, as well as reducing the likelihood of implementation of risks. This activity can take material and non-material form. Insurers implement such prevention in a wide range because this activity brings measurable benefits to insurance companies in the form of reduced payment of claims. The material form of insurance prevention, consisting in the financing of specific preventive measures by insurance companies, does not play such a significant role in their activity as non-material prevention, also known as general or legislative prevention. A classic example of the last one is the bonus-malus system. The preventive function of the bonus-malus system is to encourage insured through discounts to safer driving, and indirectly to avoid damages. At the same time, increases in premiums are intended to discourage the generation of damage. The effectiveness of this bonus-malus system function is difficult to evaluate.

Comparing different bonus-malus systems, we ask which system is the best. From the point of view of the insured, the best system will be one that allows them to pay the lowest premiums. From the point of view of the insurance company, the best system is one that properly differentiates premiums depending on the individual risk level of the insured (the ratemaking function) and through high increases prevents excessive claims (preventive function). For both, the insured and the insurer, the ideal bonus-malus system will, therefore, be the one that best matches premium rates to the risk represented by the insured.

In actuarial literature, measures of effectiveness are used to assess bonus-malus systems (Lemaire, 1985; Lemaire, 1995; Denuit et al., 2007). Effectiveness according to the Dictionary of the Polish language (Szymczak, 1978, vol. 1: 516) is "positive result, efficiency, effectiveness, dexterity". Thus, an effective bonus-malus system is one that effectively fulfils ratemaking and preventive functions.

There is no universal measure allowing to assess the effectiveness of the bonus-malus systems understood in such a way. It is also difficult to examine the effect of the preventive function of the bonus-malus systems due to too many factors affecting the claims ratio in motor insurance.

The measures of the bonus-malus systems known from the actuarial literature can be divided into three groups: measures of ratemaking effectiveness, measures of economic efficiency and measures of stability and construction assessment of the bonus-malus systems. Table 4 presents selected measures of the system assessment and their classification. The use of most of the presented measures requires the assumption that the bonus-malus system is modelled using homogeneous Markov chains.

Table 4. Selected measures of bonus-malus systems evaluation

A group of measures	Measures
ratemaking effectiveness	**Loimaranty efficiency** (Lemaire, 1995; Loimaranta, 1972) $$\eta(\lambda) = \frac{B'(\lambda)}{B(\lambda)} \cdot \lambda = \frac{dB(\lambda)}{B(\lambda)} \bigg/ \frac{d\lambda}{\lambda}$$ $B(\lambda) = \sum_{i=1}^{s} a_j(\lambda) \cdot b_j$ - expected fixed premium for a single period after the system achieves a steady state for the insured with the risk parameter (damage intensity index) λ, where b_j is the rate in the j-th class, $\boldsymbol{b} = (b_1, \ldots ,b_s)$ is a vector of the rate of premium, and $\mathbf{a}(\lambda) = [a_1(\lambda),\ldots, a_j(\lambda)]$ is a vector, the components of which are the probabilities that the insured belongs to the j-th class after the system reaches a fixed state such that $\sum_{j=1}^{s} a_j(\lambda) = 1$.
	General (combined) flexibility (Szymańska, Małecka, 2013) $$\eta = \int_0^{\infty} \eta(\lambda)\pi(\lambda)d\lambda$$ where $\pi(\lambda)$ is the function of the density of the random variable λ
	Relative fixed expected by *RSAL* contribution level (Lemaire, 1985)

	$$RSAL(\lambda) = \frac{B(\lambda) - \min_j(b_j)}{\max_j(b_j) - \min_j(b_j)}$$
	Effectiveness depending on the start class (Lemaire , 1985) $\mu_i(\lambda) = \frac{v_i'(\lambda)}{v_i(\lambda)} \cdot \lambda = \frac{dv_i(\lambda)}{v_i(\lambda)} \bigg/ \frac{d\lambda}{\lambda}$ where: $v_i(\lambda) = b_i + d\sum p_k(\lambda) \cdot v_{T_k(i)}(\lambda), \; i = 1,...,s$) b_i – means annual premium in class i, d – discount factor, $T_k(i) = j$ – transformation function, $\bar{\mathbf{v}}(\lambda) = [v_1(\lambda),...,v_s(\lambda)]$ a vector, the components of which are discounted (at the beginning of the insurance) expected premiums depending on bonus–malus C_i class. If the insured starts from the class i, then the discounted premiums are $v_i(\lambda)$
	Coefficient of variation of the expected asymptotic premium (Bonsdorff, 1992) $$V = \frac{\sqrt{Var(B(\lambda))}}{E(B(\lambda))} = \frac{\sqrt{\sum_{i=1}^{s}(b_i - B(\lambda))^2 a_i(\lambda)}}{E(B(\lambda))}$$
	De Pril Effectiveness (De Pril 1979) $e_\tau(\lambda) = \dfrac{\dfrac{dE[X_\tau(\lambda)]}{E[X_\tau(\lambda)]}}{\dfrac{dE[Y_\tau(\lambda)]}{E[Y_\tau(\lambda)]}} = \dfrac{d\ln E[X_\tau(\lambda)]}{d\ln E[Y_\tau(\lambda)]}$ for the insured with the risk parameter λ in range $[0, \tau)$
economic efficiency	**Technical result from insurance activity**
	Average optimal retention level (Lemaire,1985)
	Expected stationary premium
assessment of stability and construction	**Convergence rate** $(TV)_n = \sum_{j=1}^{s}\left| p_{ij}^n(\lambda) - a_j(\lambda)\right|$
	Class span coefficient (Meyer, 2005) $sp = \dfrac{\max_j(b_j)}{\min_j(b_j)}, \quad j \in \{1,...,s\}.$
	General stability indicator (Kordos, 1973)

$$W_t^{(1)} = \frac{1}{s} \sum_{i=1}^{s} p_{ij}(t) \quad \text{where} \quad p_{ij}(t) = \frac{n_{ij}}{n_{i,t}}, \quad i,j = 1,2,...,s, \quad \sum_{i=1}^{s} p_{ij} = 1 \quad \text{and} \quad n_{ij} \text{ stays for}$$

number of policies that have passed from i-th BM class in period t to j-th BM class in period $t + 1$; $n_{i,t}$ stays for the number of policies in class i in period t.

Indicator measuring the direction of the bonus-malus class change (Kordos, 1973)

$$W_t^{(2)} = \frac{\sum_{i=1}^{k-1} \sum_{i>j} p_{ij}(t)}{\sum_{i} \sum_{j>i} p_{ij}(t) + \sum_{i} \sum_{j<i} p_{ij}(t)} \quad \text{where for} \quad j > i \quad p_{ij}(t) \text{ are the probabilities of}$$

transition of the insured to the next BM class, i.e. to a class with a lower rate.

Measures based on the probability of balance (Jędrzychowska, Poprawska, 2013)

Policy concentration indicator in classes with maximum discount (Szymańska, 2014)

$W_k = \frac{l}{s}$ where l is the number of years required in the bonus-malus system to obtain

the maximum discount for the insured starting from the starting class,
with a damage-free insurance history; s is number of bonus-malus classes

Bonus-malus system stabilization indicator (Kochański, 2000)

$\left| \frac{B(n,\lambda) - B(\lambda)}{B(\lambda)} \right| < 0,03$ where $B(n,\lambda)$ is the average premium in the next nth year,

$B(\lambda)$ is expected fixed premium.

The indicator of the expected fixed premium taking into account the relative stabilization time of the *Wsk* system (Szymańska, 2014)

$Wsk = \frac{B(\lambda)}{t_s}$ where: $B(\lambda)$ – expected fixed premium, t_s – the time of system

stabilization in years

Source: own study

In the literature of the subject, many works can be found on the evaluation of the ratemaking function, which is why the presented study focuses on examining the remaining functions of the bonus-malus system.

5. Advantages and disadvantages of the bonus-malus systems

The bonus-malus systems have their advantages and disadvantages. The advantages are that they allow diversifying premiums depending on the individual loss of the insured. They also

play, as mentioned, a preventive function. Potential premium increases to some extent affect the behaviour of drivers and reduce the number of damages. However, the bonus-malus systems are also criticized. Many actuaries believe that this system contradicts the basic idea of insurance, according to which the risk should be spread evenly among the insured in a given portfolio. According to critics, the bonus-malus system also introduces economic instability caused by the weakening of theoretical rules for the calculation of premiums and is often the cause of the financial imbalance of the insurer due to the high concentration of policies in discounted classes causing a decrease in the average premium paid by the insured. This is the result of too mild systems operating on the market. But the market is forcing the insurers to be so gentle. The system performing the marketing role cannot be too restrictive if the insurer wants to win new customers and keep the existing ones. However, it is hard to disagree with the opinion that the bonus-malus system is not the only cause of the financial imbalance of insurers in the case of motor insurance. Many experts say that premiums are for example not indexed properly. Another disadvantage of the bonus-malus systems mentioned in the literature is the tendency not to report damage of low value, i.e. appetite discounts (called *hunger for bonus*), which distorts the schedule of number and size of claims. However, on the other hand, it is considered that the phenomenon of appetite for discounts is positive. Insurance companies have lower claims handling costs and many of them use the bonus-malus system (Taylor, 1997). The more restrictive the bonus-malus system is, the stronger is the effect of hunger for discounts. In the past, insurance companies were afraid of using the bonus-malus systems with strict penalties for the insured causing a lot of damage due to the possibility of losing a client who could change the insurer after reporting the damage. However, currently, there are databases to check the course of insurance for a specific customer.

6. Empirical study

The aim of the analysis was to evaluate the preventive and marketing function of the bonus-malus system and to investigate whether passing even brief information on the principles of functioning of the systems improves the impact of these functions. The survey was conducted on the basis of a questionnaire completed by clients of a certain multiagency concluding motor third party liability insurance in November 2017. The study was conducted in two groups: the test group (50 respondents) and the control group (75 respondents). In the test group, the

respondents who agreed, read the information on the rules of the bonus-malus system, in the control group the respondents were asked the following four questions:

(1) Do you have knowledge about the rules of functioning of the bonus-malus systems (what is the bonus-malus system and how it works, how it affects the premium, are the systems offered in Poland the same)?

(2) Do you know what the system of increases and discounts is like in the insurance company (how big increases or discounts they have, what will be the increase for a damage and what the discount for damage-free driving, in how many years will they get the maximum discount for damage-free driving) with which you have concluded the insurance contract?

(3) Do you try to drive more carefully for fear of having the insurance premium increased?

(4) Is the discount / increase offered by the insurer for damage-free driving deciding in making the choice of the insurer?

For each question, the respondents marked responses on the five-point Likert scale (1-no, 2-rather no, 3-I have no opinion, 4-rather yes, 5-yes) (Bedyńska, Cypryańska, 2013:164).

Table 5. The arithmetic mean by groups and question numbers

| Group	Question 1	Question 2	Question 3	Question 4
Control	1.84	3.35	3.27	3.88
Test	4.38	3.80	4.24	4.22

Source: own calculation

Figures 1 and 2 present the structure of the test and control groups in terms of respondents' knowledge about the bonus-malus systems. In the control group, as many as 43% have no knowledge about the bonus-malus systems, 36% do not know anything about it, and 17% have no opinion. In the study group, after a short training, there are no respondents who do not know about the bonus-malus systems.

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Figure 1. Structure of the control group according to the answer to question 1: Do you have knowledge about the rules of functioning of the bonus-malus systems?
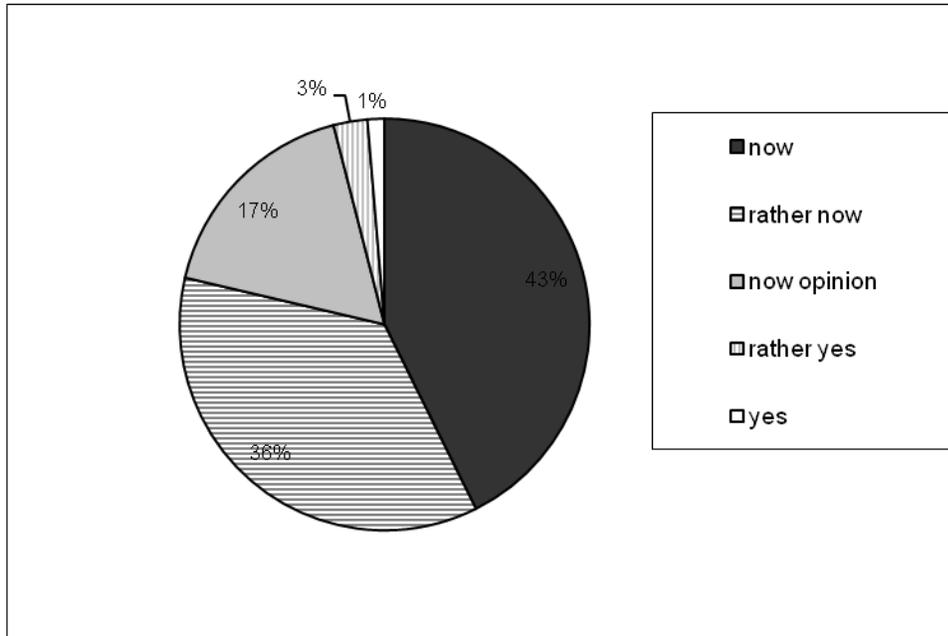
Source: own calculation

Figure 2. Structure of the test group according to the answer to question 1: Do they have knowledge about the rules of functioning of the bonus-malus systems?

Source: own calculation

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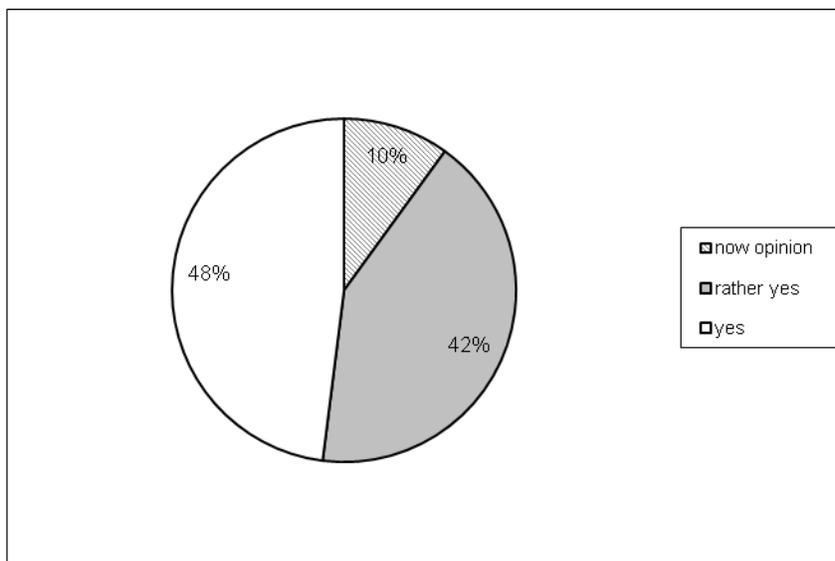
The study assessed whether the respondents, after receiving information on the general principles of the bonus-malus system from the insurance agent, actually have more knowledge on the subject. In order to assess the impact of the factor (information on the rules of functioning of the bonus-malus system), the t-Student's test was used (Domański, 1990: 114; Bedyńska, Cypryańska, 2013: 180-185) for independent samples using the SPSS package - the results are presented in Table 6.

Table 6. T-Student's test results for independent samples

Variable	Levene's test of homogeneity of variance		Mean equality test			
		F	Significance	t	df	Two-sided significance
Z1	Equality of variance was assumed	2.13	0.147	-17.053	123	0.000
	Equality of variance was not assumed			-18.090	121.599	0.000
Z3	Equality of variance was assumed	8.573	0.004	-6.381	123	0.000
	Equality of variance was not assumed			-6.952	122.772	0.000
Z4	Equality of variance was assumed	4.761	0.031	-2.102	123	0.038
	Equality of variance was not assumed			-2.220	120.913	0.028

Z1-variable knowledge of BMS operation rules, Z3-variable careful driving, Z4-variable choice of the insurer
Source: own calculation

Table 7. U Manna-Whitney test results for independent samples

Null hypothesis	Significance	Decision
The distribution of Z1 is the same in the test and control group	0.000	We reject H_0
The distribution of Z3 is the same in the test and control groups	0.000	We reject H_0
The distribution of Z4 is the same in the test and control groups	0.059	There are no grounds to reject H_0

Source: own calculation

The results allow claiming that even brief information about the rules of functioning of the bonus-malus systems improves the awareness of the insured. The results indicate that a greater knowledge about the bonus-malus system do rise the impact of the preventive function. The impact of the marketing function is not clear. This function will work if the system is competitive on the market, and it is difficult to assess if systems cannot be compared.

In order to assess the scale of the factor's impact, the scale of this interaction was measured with a measure of the size of the effect of g- Hedges (Hedges, 1981: 107) The scale of impact of the information factor on the state of knowledge about the bonus-malus systems and more careful driver behaviour is strong (coefficients above 3).

8. Conclusions

The research confirmed the hypothesis set in the introduction that the scale of impact of the preventive function depends on the knowledge about the bonus-malus systems. A worrying phenomenon on the Polish motor insurance market is the lack of information on the functioning bonus-malus systems and the low awareness of the insured on this subject. This means that it is not only more difficult to assess the directions of changes of this stage of ratemaking, or the effectiveness of operating systems, but above all the client is not aware of potential increases and discounts. This weakens the preventive function of this instrument. Unfortunately, the insurers are responsible for this situation. Only legal regulations that oblige insurers to include a bonus-malus system in the GTC could provide a solution to this situation.

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Funkcje systemu bonus-malus w ubezpieczeniach odpowiedzialności cywilnej posiadaczy pojazdów mechanicznych

Streszczenie

System bonus-malus jest jednym z etapów procesu taryfikacji w ubezpieczeniach komunikacyjnych OC. Celem pracy jest omówienie roli systemów bonus-malus w taryfikacji oraz przedstawienie ich funkcji. W artykule dokonano przeglądu miar oceny funkcji taryfikacyjnej systemów bonus-malus oraz podjęto próbę zbadania oddziaływania funkcji prewencyjnej i marketingowej. Funkcje te spełniają swoją rolę pod warunkiem, że ubezpieczający ma świadomość funkcjonowania systemu bonus-malus. Postawiono hipotezy, że ubezpieczający wybierając ubezpieczyciela nie znają oferowanego im systemu bonus-malus oraz, że zwiększenie wiedzy na temat funkcjonowania systemu potęguje oddziaływanie funkcji prewencyjnej. Badanie przeprowadzono na podstawie analizy ogólnych warunków ubezpieczenia (OWU) ubezpieczycieli na polskim rynku oraz badania kwestionariuszowego. Do analiz wykorzystano metody statystyki matematycznej. Wyniki badań potwierdzają postawioną hipotezę, że ubezpieczeni nie znają systemu bonus-malus wybierając ubezpieczyciela. Jest to efekt niedoinformowania klienta. Wyniki pozwalają twierdzić, że nawet krótka informacja o zasadach funkcjonowania systemów bonus-malus poprawia świadomość ubezpieczających oraz zwiększa oddziaływanie funkcji prewencyjnej, co pozwala pozytywnie zweryfikować drugą postawioną hipotezę badawczą.

Słowa kluczowe: system bonus-malus, ubezpieczenia komunikacyjne OC