MOTOR INSURANCE POLICIES EXPOSURE RISK ASSESMENT

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Abstract Expired car insurance policies allow assessment of realized insured risks, while increased number of mature policies fuels actuarial modeling of price basis for the future sustainability of the insurance model. Renewed insurance contracts without changes of conditions and coverage represent approximately the same level of potential risk exposure, while any additional coverage or change of conditions pose imminent higher exposure to realization of covered risks. Such an exposure is even higher when vehicle or person freshly joins the portfolio without known previous policy or moving from another insurance company as the claims and policy history is unknown. With shopping for better price and transitions between insurance companies comes exposure for higher claim numbers due to possible concealment of pre-damaged vehicles. The aim of this research is to show the claim risk exposure difference between in-house renewals of policies and arrivals from outside sources.

1   Introduction

Studies of scientific articles and other publications have shown that many researchers do not have access to live up-to-date data in insurance processes (Pathak et al., 2005), and these data, which, as a rule, exceptionally do not represent the actual complete scope of all data of a particular period, but only a narrow set that was sent to investigators (Zeigler, 2016; Do Vale, 2012) or data from more than a decade ago (Viaene et al., 2005). Collecting, verifying and comparing the data collected is complex (Bawden and Robinson, 2008) and requires a high degree of concentration, while the amount and expanded number of sources of information, which are growing exponentially, contribute to the complexity (Bănărescu, 2015), therefore, information saturation or overload occurs (Klausegger et al., 2007), which has a negative impact on the ability to fulfill work responsibilities.

Considering the fact that automated systems are becoming ever more efficient, especially through the use of artificial intelligence, and are increasingly replacing humans in a variety of tasks (primarily in monotones, where there is a risk of numbness), this makes all the more sense in processes where humans can not develop its capabilities to such an extent that it can effectively process all available data (Karr-Wisniewski and Ying Lu, 2010).

By automatically collecting and formulating information into meaningful business intelligence and delivering it to users in real time when they need it (Khademhosseinieh and Khan, 2009), we enable process owners to make qualitatively and quantitatively sound decisions. Therefore, in order to make effective decisions in business processes, it is necessary to set up optimized data warehouses that enable automated data processing and offer efficient analytical processes, both for actuarial calculations of future exposures and to guide the business process itself throughout the life cycle of the policy.

Insurance is based on probabilistic calculations and large numbers, and actuaries maintain the system sustainability (Tennyson and Salsas-Forn, 2002) by calculating the required inflows, while damage assessors/liquidators optimize outflows. Insurance sellers, risk assessors, and product developers are moving in-between, and other support services, not least insurance investigators, support everyone else. These calculations are based on historical data, or in other words, past results. The

"glass ball" of actuaries depends on whether or not the forecast is correct. That way the insurance company will withstand the pressure of unforeseen large-scale, major or massive claims. There are two actuarial measures that can sufficiently describe the result of an insurer, seller or policy holder to such an extent that it is possible to make an indicative credit rating that guides business decisions and determines the starting points of the products and conditions under which they are offered. These two measures are the claims frequency and loss ratio that can be divided into lower levels, e.g. to the coverage level, person, vehicle, seller, sales channel, or line of business (i.e. Motor, Life, Personal, Property etc.).

Insurance operates according to the principle of burden-sharing among policy holders, but it cannot be avoided by balancing the conditions under which insurance is accessible to all, and in the fairness of distribution it cannot be held that more frequent claimants pay a little more than those who are more caring and probably also less aggressive in claiming benefits (bonuses, discounts, etc.) because of this trait. In order to implement individual treatment of clients, it is necessary to establish an extremely complex analytical structure to spread the burden evenly among insureds and to sustain solvency.

2   Problem definition

There is an operational assumption that policies with no pre-policies or with outer pre-policies have a significantly higher exposure of reported claims compared to the renewal of insurance policies (the insurance company's own pre-policies).

We wanted to check the validity of that assumption and to expose even more operationally credible evidence to eliminate possible bias that could threaten good judgment in insurance processes.

The purpose of this research is to evaluate potential differences in the exposure potential of issued motor policies with respect to the origin of the prior policy (hereinafter referred to as the pre-policy). First, we were interested in an exposure comparison between the group of policies with the company's own pre-policies (renewal of insurance) against the group of all other policies, and against the exposure results of the whole motor portfolio. We extended our analysis to test the exposure differences between the groups of policies with transitions from individual

insurance companies in the local market against the group of renewed policies and against the group of policies with pre-policies of foreign insurers and the group of policies without pre-policies, all of them compared to the exposure results of the whole motor portfolio.

3 Methodology

We set the following starting points for the data range of the observed policies and claims:

– motor insurance policies in the observed insurance company are valid for up to one year,
– we performed an analysis for the policies between January 1st 2013 and December 31st 2018, so all of the observed policies were expired,
– a simple measure of exposure is the number of registered claims compared to the number of issued policies.

First we obtained the data of policies issued after January 1st 2013 that had valid status, then we cleaned the data of all illogicalities and mistakes, and uploaded it into the table of car policies of a dedicated analytical database. We also obtained the data of registered claims after January 1st 2013, cleaned the data of all illogicalities and mistakes, and uploaded them to the claims table of the dedicated analytical database.

To compare the groups of policies according to the origin of the pre-policies, we counted the number of all unique car policies for the observed period of six years between January 1st 2013 and December 31st 2018 with the distribution by years and the number of reported unique claims by these policies. Additional criterion was the source of pre-policies, after which we calculated the exposure for comparison between previously described groups of policies by origin of pre-policies.

The obtained data was processed in Excel with tables and graphical presentations of results by years, which enables comparison between defined groups according to the origin of the pre-policies, the sales channel, or the obligation to inspect and photograph the vehicle.

4   Preliminary results

Exposure indexation was performed for tables and graphs, and the exposure of a group of policies with own pre-policies (policy renewals) was used as the base for calculating the index.

4.1   Test of assumption: exposure comparison of a group of renewed policies (own pre-policies) vs. the group of all other policies vs. the group of all motor policies

Comparison of table data and graphical representations by year according to the origin of the pre-policy confirmed that the group of renewed policies (own pre-policy) had lower exposure compared to the group of all other policies in all years except in 2015 (*Table 1, Figure 1*), in which the renewed policies group had greater exposure. Exposure of group of all other policies has increased significantly over the last three years, with a significant jump in 2017 (*Figure 1*). Comparison of group of renewed policies against whole motor portfolio reveals that the same observation of detected trends from 2015 and 2017 (both in *Figure 1*)is applicable to comparison between renewed policies and all other policies as well.

Table 1: Exposure index distribution of groups of renewed policies vs. all other policies vs. the group of all motor policies

pre-policy source	2013	2014	2015	2016	2017	2018
POLICIES WITH OWN PRE-POLICIES	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%
ALL OTHER POLICIES	104,76%	103,92%	95,67%	110,35%	121,28%	107,83%
SUM (ALL)	101,07%	100,88%	99,14%	102,16%	105,29%	101,43%
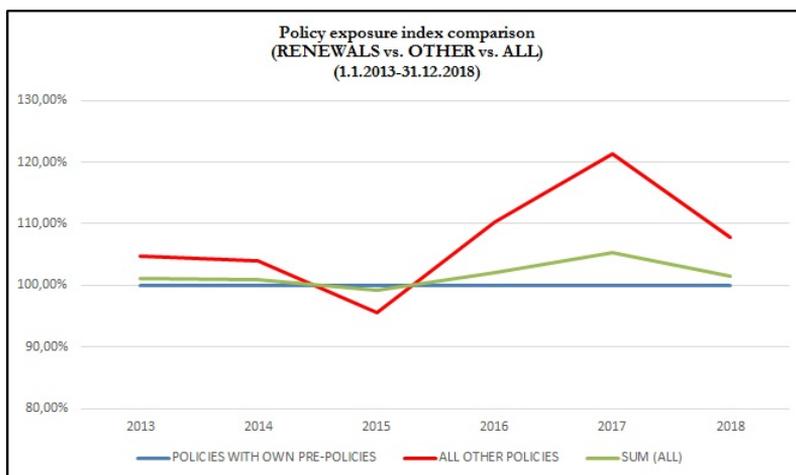
Figure 1: Policy exposure index comparison between the group of renewed policies, the group of all other policies, and the group of all policies of motor portfolio

4.2 Extended test of assumption: exposure comparison of a group of renewed policies vs. the groups of policies with transitions from individual insurers from local market vs. the group of policies with transitions from foreign insurers vs. the group of policies without pre-policies vs. the group of all motor policies

The extended test of an assumption compares exposures between all the groups of policies by sources of pre-policies with results indicating a significantly higher exposure of policies with transitions from other insurers in the local market, with only one local insurer SLO_INS_1 having a negligible decrease in 2015 compared to policy renewals group (*Table 2, Figure 2*), which subsequently increased sharply. The extended test reveals a true picture of the exposure of groups of policies with transitions from other local insurers, with three insurers having significantly higher exposures, while for the most exposed insurer SLO_INS_5 the exposure risk decreased, which can also be attributed to the beginning of the withdrawal from the market (*Figure 2*). The sudden occurrence and the large exposure jump for the insurance company under the code SLO_INS_6 in the last year of the observed period is statistically insignificant, since it represents barely 0.11% of all policies and 0.16% of all claims (*Table 3, Table 4*), which can be attributed to entrance to the local market.

Table 2: Exposure index distribution for all pre-policy sources through observed years

Pre-policy source	2013	2014	2015	2016	2017	2018
NO PRE-POLICY	75,57%	74,11%	69,52%	85,07%	91,87%	79,99%
FOREIGN INS. CO. PRE-POLICIES	136,35%	96,63%	86,74%	66,94%	90,21%	86,99%
OWN PRE-POLICIES	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%
SLO_INS_1	113,16%	110,11%	98,35%	102,47%	126,74%	114,12%
SLO_INS_2	108,73%	107,34%	101,94%	121,56%	116,38%	122,89%
SLO_INS_3	131,78%	104,69%	106,87%	134,23%	160,28%	127,06%
SLO_INS_4	115,04%	118,45%	110,83%	123,61%	138,66%	129,23%
SLO_INS_5	164,05%	179,40%	129,45%	179,77%	131,61%	137,18%
SLO_INS_6	0,00%	0,00%	0,00%	0,00%	0,00%	149,16%

Table 3: Distribution of policies by sources of pre-policies

Pre-policy source	% of all policies					
	2013	2014	2015	2016	2017	2018
NO PRE-POLICY	5,24%	5,71%	5,47%	5,88%	6,76%	6,79%
FOREIGN INS. CO. PRE-POLICIES	0,13%	0,14%	0,18%	0,20%	0,27%	0,24%
OWN PRE-POLICIES	77,44%	77,70%	80,01%	79,13%	75,15%	81,74%
SLO_INS_1	3,16%	2,59%	2,56%	2,73%	2,79%	2,03%
SLO_INS_2	6,27%	5,75%	4,85%	4,27%	4,61%	2,96%
SLO_INS_3	0,38%	0,42%	0,33%	0,73%	1,77%	0,92%
SLO_INS_4	7,15%	7,31%	6,39%	6,69%	8,03%	4,87%
SLO_INS_5	0,22%	0,38%	0,21%	0,36%	0,61%	0,34%
SLO_INS_6	0,00%	0,00%	0,00%	0,00%	0,00%	0,11%
SUM (ALL)	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

Table 4: Distribution of claims by sources of pre-policies

Pre-policy source	% of all claims					
	2013	2014	2015	2016	2017	2018
NO PRE-POLICY	3,91%	4,19%	3,84%	4,90%	5,90%	5,35%
FOREIGN INS. CO. PRE-POLICIES	0,18%	0,14%	0,16%	0,13%	0,24%	0,20%
OWN PRE-POLICIES	76,62%	77,02%	80,70%	77,45%	71,37%	80,59%
SLO_INS_1	3,53%	2,83%	2,54%	2,74%	3,36%	2,29%
SLO_INS_2	6,75%	6,12%	4,99%	5,09%	5,09%	3,58%
SLO_INS_3	0,50%	0,43%	0,35%	0,95%	2,69%	1,15%
SLO_INS_4	8,14%	8,58%	7,14%	8,10%	10,58%	6,21%
SLO_INS_5	0,36%	0,68%	0,27%	0,64%	0,77%	0,46%
SLO_INS_6	0,00%	0,00%	0,00%	0,00%	0,00%	0,16%
SUM (ALL)	100,00%	100,00%	100,00%	100,00%	100,00%	100,00%

The only surprises are the groups of policies without pre-policies and policies with transitions from foreign insurers as their exposure lays moderately to significantly lower in comparison to the exposure of renewed policies.
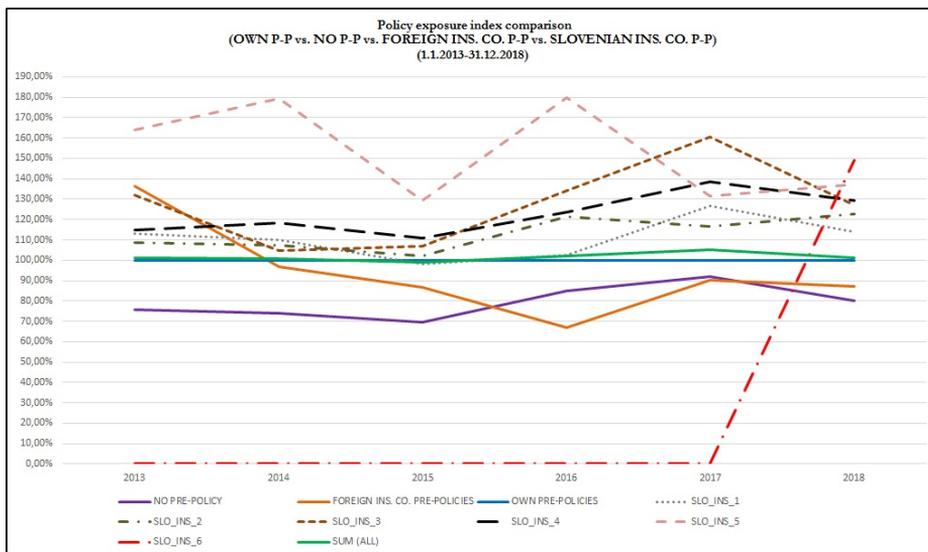
Figure 2: Policy exposure index comparison between the group of renewed policies, the groups of policies with transitions from individual insurers from local market, the group of policies with transitions from foreign insurers, the group of policies without pre-policies, and the group of all policies of motor portfolio

Comparing assumption to the results from both analysis we can conclude that the operational assumption derived from practical experience generally holds true when observing exposure of group of all other policies vs. exposure of group of renewed policies, even more confirmed by comparison of groups of policies with transitions from other insurers in the local market which have from a moderate to a significantly higher exposure ratio compared to renewed policies, while a group of policies with no pre-policies and a group of policies with transition from foreign insurance companies have a moderately to significantly lower exposure ratio compared to renewed policies.

5   Future development and research

The simple measure of exposure is based on historical data and has some useful predictive value for the likelihood of reporting claims for future policies, which can be used for preventive measures such as inspection of vehicles upon admission to insurance. The stated predictive value of exposure has proved to be useful in practice, especially combined with damage history of the vehicle, customer and agent / broker, the age of the vehicle and with presence of the high exposure insurance cover added to the policy as well.

There are more than just the assumption of increased exposure of policies with outer pre-policies vs. renewed policies, especially in the direction of differences between internal and external distribution channels policies exposures, differences between distribution channels without obligation for initial inspection and photographing of insured vehicles vs. the rest of distribution channels where inspections and photographing of the vehicles are mandatory, the issues with age and make of the vehicles, influence of age of insureds on exposure and of course prejudice against many partners or customer groups from specific national backgrounds.

As the present analysis has shown, these assumptions can also be biased, at least to some degree and therefore they need to be addressed and investigated for more accurate and correct handling at all stages of the life cycle of insurance policies.

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