Experience ratings in insurance markets: theory and evidence

Discussion on the Paper «Bonus-Malus systems with Weibull distributed claims severity»

Sergio Desantis: Head of Research and Studies – ANIA
Fellow of the Institute of Actuaries (UK)
Member of the Italian Faculty of Actuaries

December 16th, 2022 Rome

Ania
Associazione Nazionale
fra le Imprese Assicuratrici

MAIN CONTRIBUTION OF THE PAPER – 1 of 2

ALLOWANCE OF THE CLAIMS COST

With the exception of very few countries, almost all Bonus/Malus systems (**BMS**) in force throughout the world penalize the number of reported claims, without taking costs of such claims into account

PROs → With the generical applied BMS, a small material accident causes the same premium increase as a serious bodily injury event

1. It has, therefore, been particularly appreciated the effort put by the Authors to develop an approach that combines the claims frequency with the claims severity
2. Particularly, the claims severity on an accumulated basis

MAIN CONTRIBUTION OF THE PAPER – 2 of 2

DIMINISH THE BONUS HUNGER

In order to achieve a premium discount in the following year, the insureds may not report some small claims and pay the costs themselves

PROs → Some claims will be missing in the claims history of the policyholder which will reduce the level of information for the pricing of the risks

The BMS adopting the Weibull severities:

1. Provides a lower entrance premium level
2. Punishes more for fewer large-sized claims

The Authors encourage to offer a mild treatment to policyholders with many small claims, discouraging the «hunger for bonus»

OPEN ISSUE OF THE PAPER – 1 of 4

ALLOWANCE OF THE CLAIMS COST

1. **Length in the definition of the claims cost**: particularly in presence of bodily injury claims (not necessarily a large claim), it can take a very long time before the exact estimation of the damage is assessed. It can become rather complicated to determine the malus level without the exact definition of the loss (considering that a first assessment of the losses is often unreliable).

2. **Tracking the claims cost history:** if the insured decides to change company it might be slightly more complicated to exchange information between companies regarding the amount of the claims, in order to obtain an "accumulated" value of the loss.

3. **Define ex-ante the level of penalization in case of an accident:** it is difficult for an insured to know "a priori" the degree of malus since the final premium is function of a continuous variable (i.e. the amount of accumulated claims cost)

OPEN ISSUE OF THE PAPER – 2

TOO STRONG PENALIZATION IN CASE OF CLAIMS

Optimal net premiums with Weibull severities and total claim cost equal to 7.500£

	Number of claims					
Year (*t*)	0	1	2	3	4	5
0	359,6			n.a.		
1	265,6	2.624,6	3.082,1	3.022,9	2.856,7	2.704,7
2	210,5	2.080,6	2.443,3	2.396,4	2.264,7	2.144,2
3	174,4	1.723,4	2.023,9	1.985,0	1.875,9	1.776,1
4	148,8	1.470,9	1.727,3	1.694,2	1.601,0	1.515,8
5	129,8	1.282,9	1.506,6	1.477,7	1.396,4	1.322,1

Optimal net premiums with Weibull severities and total claim cost equal to *10.000£*

	Number of claims					
Year (*t*)	0	1	2	3	4	5
0	359,6			n.a.		
1	265,6	3.030,6	3.735,4	3.802,0	3.677,7	3.528,7
2	210,5	2.402,5	2.961,3	3.014,0	2.915,5	2.797,4
3	174,4	1.990,1	2.452,9	2.496,6	2.415,0	2.317,1
4	148,8	1.698,5	2.093,5	2.130,8	2.061,1	1.977,6
5	129,8	1.481,4	1.826,0	1.858,5	1.797,7	1.724,9

t=0 premium = 359,6£
t=1 and 1 claim of 7.500£ premium = 2.624,6£

Premium increases of more than 7 times

t=2 and 1 claim of 2.500£ (accumulated loss: 2 claims of 10.000£)
premium = 2.961,3£

Premium increases of ≈ 13%

OPEN ISSUE OF THE PAPER – 3

TOO STRONG PENALIZATION IN CASE OF CLAIMS

Optimal net premiums with Weibull severities and total claim cost equal to *10.000£*

	Number of claims					
Year (*t*)	0	1	2	3	4	5
0	359,6			n.a.		
1	265,6	3.030,6	3.735,4	3.802,0	3.677,7	3.528,7
2	210,5	2.402,5	2.961,3	3.014,0	2.915,5	2.797,4
3	174,4	1.990,1	2.452,9	2.496,6	2.415,0	2.317,1
4	148,8	1.698,5	2.093,5	2.130,8	2.061,1	1.977,6
5	129,8	1.481,4	1.826,0	1.858,5	1.797,7	1.724,9

After 3 years with no other claims (t=5 and accumulated loss: 2 claims of 10.000£)
premium = 1.826,0£

Premium decreases of ≈ -40%

- In absolute terms, in 6 years with a total claims cost of 10.000£, the insured will end up in paying ≈ 12.500£. A too strong penalization might - on the contrary - enforce the bonus hunger
- On the other hand, a very rapid discount is obtained when no claims occur: in 6 years with no claims, the premiums reduces of almost 65% (from 359,6£ to 129,8£)
- In our experience, an higher degree of subsidies between insureds (with and without malus) will be beneficial for the sustainment of the MTPL insurance coverage

OPEN ISSUE OF THE PAPER – 4

THE SOLUTION FOR THE BONUS HUNGER

Optimal net premiums with Weibull severities and total claim cost equal to 7.500£

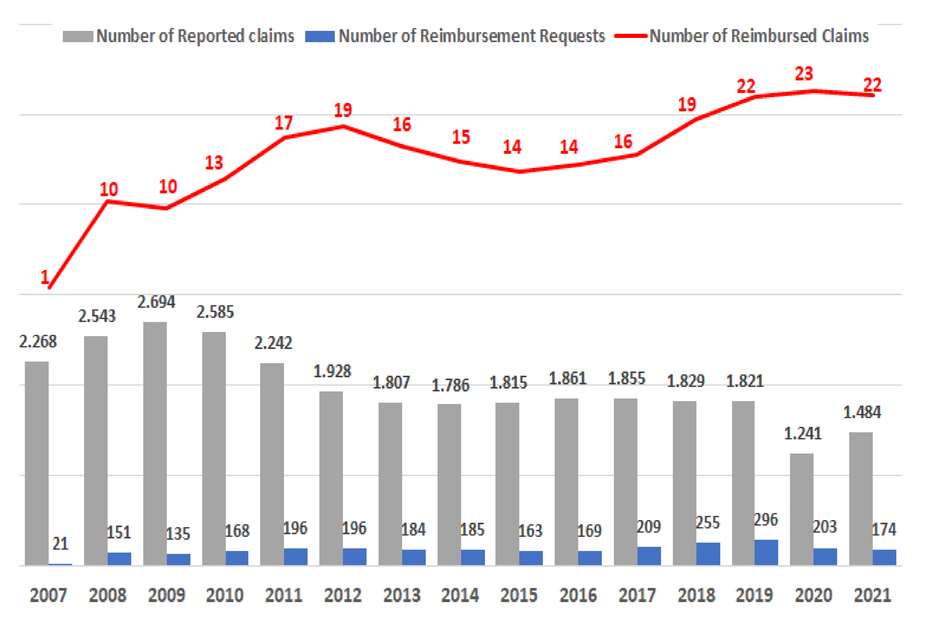
Year (t)	*Number of claims* 0	1	2	3	4	5
0	359,6	n.a.				
1	265,6	2.624,6	3.082,1	3.022,9	2.856,7	2.704,7
2	210,5	2.080,6	2.443,3	2.396,4	2.264,7	2.144,2
3	174,4	1.723,4	2.023,9	1.985,0	1.875,9	1.776,1
4	148,8	1.470,9	1.727,3	1.694,2	1.601,0	1.515,8
5	129,8	1.282,9	1.506,6	1.477,7	1.396,4	1.322,1

- The striking numerical results shows that for example 5 small property damages happened in year 1 that costs in total 7.500£, is very similar – in terms of premium paid – to a 1 medium bodily injury that again costs 7.500£…
- …but the approach – under a fixed total claims cost – that establish that the premium function is not strictly increasing with the number of claims is a bit "unrealistic" since the total claims cost – on an accumulated basis – can not remain fixed when the number of claims increases, particularly when time t is moving

THE BONUS HUNGER PROBLEM

For any MTPL market is generally more important in terms of bonus hunger the first accident, since it is quite rare to have more than 1 claim in the same year

Number of Claims (000's) as resulted in the CONSAP Clearing House (Direct Reimbursement claims only)



Caused MTPL claims	Num. of Vehicles	% Distr. of Vehicles	Number of claims	% Distr. of Claims
0	30.439.130	96,9%		
1	932.093	3,0%	932.093	91,3%
2	37.990	0,1%	75.980	7,4%
3	3.030	0,0%	9.090	0,9%
4	545	0,0%	2.180	0,2%
5	161	0,0%	805	0,1%
> 5	76	0,0%	515	0,1%
Total	**31.413.025**	**100,0%**	**1.020.663**	**100,0%**

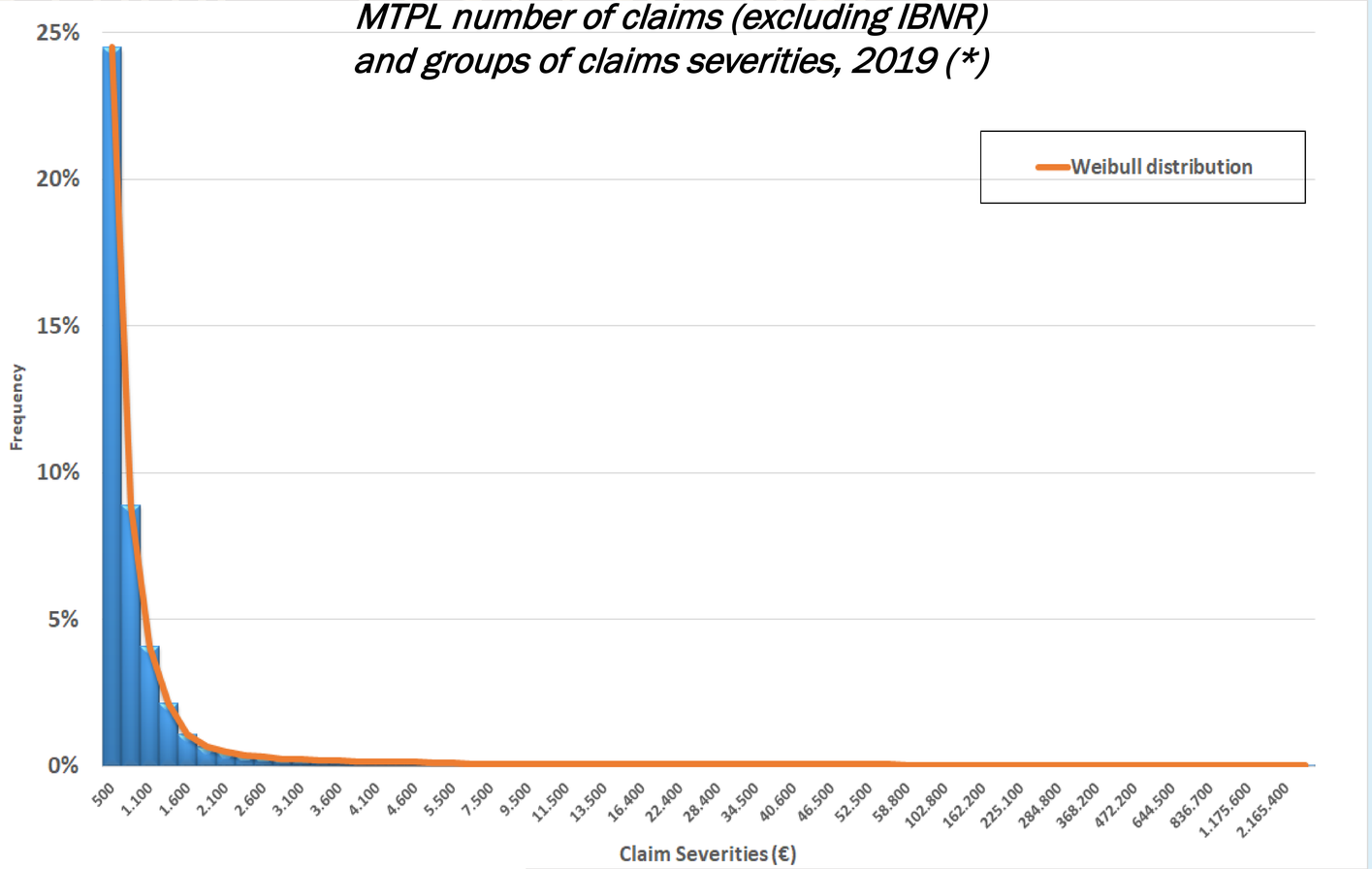
THE GOODNESS OF WEIBULL FOR THE CLAIMS SEVERITY

The case study: Italian data

Groups (range of claims severities in €)	Number of claims	%
Up to 750 €	451.524	24,7%
751 ---| 1.000	179.146	9,8%
1.001 ---| 1.250	154.168	8,4%
1.251 ---| 1.500	138.829	7,6%
1.501 ---| 1.750	156.653	8,6%
1.751 ---| 2.000	118.670	6,5%
2.001 ---| 2.250	77.682	4,3%
2.251 ---| 2.500	63.056	3,5%
2.501 ---| 2.750	46.525	2,5%
2.751 ---| 3.000	40.382	2,2%
3.001 ---| 3.250	34.650	1,9%
3.251 ---| 3.500	29.163	1,6%
3.501 ---| 3.750	24.765	1,4%
3.751 ---| 4.000	22.298	1,2%
4.001 ---| 4.250	20.364	1,1%
4.251 ---| 4.500	17.928	1,0%
4.501 ---| 4.750	15.462	0,8%
4.751 ---| 5.000	15.930	0,9%
5.001 ---| 6.000	50.015	2,7%
6.001 ---| 7.000	33.912	1,9%
7.001 ---| 8.000	25.614	1,4%
8.001 ---| 9.000	19.987	1,1%
9.001 ---| 10.000	15.509	0,8%
10.001 ---| 11.000	12.030	0,7%
11.001 ---| 12.000	9.504	0,5%
12.001 ---| 13.000	7.754	0,4%
13.001 ---| 14.000	7.013	0,4%
14.001 ---| 15.000	5.881	0,3%
15.001 ---| 18.000	12.152	0,7%
18.001 ---| 21.000	7.341	0,4%
21.001 ---| 24.000	4.533	0,2%
24.001 ---| 27.000	3.383	0,2%
27.001 ---| 30.000	2.392	0,1%
30.001 ---| 33.000	1.859	0,1%
33.001 ---| 36.000	1.329	0,1%

Groups (range of claims severities in €)	Number of claims	%
36.001 ---| 39.000	1.252	0,1%
39.001 ---| 42.000	956	0,1%
42.001 ---| 45.000	655	0,0%
45.001 ---| 48.000	694	0,0%
48.001 ---| 51.000	596	0,0%
51.001 ---| 54.000	472	0,0%
54.001 ---| 57.000	400	0,0%
57.001 ---| 60.000	392	0,0%
60.001 ---| 90.000	1.967	0,1%
90.001 ---| 120.000	1.077	0,1%
120.001 ---| 150.000	494	0,0%
150.001 ---| 180.000	354	0,0%
180.001 ---| 210.000	278	0,0%
210.001 ---| 240.000	178	0,0%
240.001 ---| 270.000	203	0,0%
270.001 ---| 300.000	170	0,0%
300.001 ---| 350.000	209	0,0%
350.001 ---| 400.000	222	0,0%
400.001 ---| 450.000	137	0,0%
450.001 ---| 500.000	156	0,0%
500.001 ---| 600.000	315	0,0%
600.001 ---| 700.000	260	0,0%
700.001 ---| 800.000	225	0,0%
800.001 ---| 900.000	185	0,0%
900.001 ---| 1.000.000	127	0,0%
1.000.001 ---| 1.500.000	359	0,0%
1.500.001 ---| 2.000.000	135	0,0%
2.000.001 ---| 2.500.000	50	0,0%
> 2.500.000 €	24	0,0%
Total	**1.827.403**	**100%**

MTPL number of claims (excluding IBNR) and groups of claims severities, 2019 (*)



$$f(x) = \frac{c}{2} x^{-\frac{1}{2}} e^{-c\sqrt{x}}, x>0$$

Shape parameter: Italian: 0,65 vs Authors 0,50
Scale parameter: Italian: 0,033 vs Authors 0,0211

(*) Based on a sample of insurance companies accounting for 87% of written premiums