

Estimating Outstanding Claims in General Insurance

Exercise 7

We continue working with the data you received.

- For the Accident portfolio, use Benktander's method to estimate outstanding claim payments.
- For the Liability portfolio, use Benktander's method to estimate outstanding claim payments.

Note

Benktander's method is usually presented as a mix of the Chain ladder method and Bornhuetter-Ferguson's method. The general formula of its predictions is

$$\bar{N}_{jd} = p_j \tilde{\theta}_j \pi_d^*$$

with

$$\tilde{\theta}_j = \pi_{\leq J-j}^* \left(\frac{N_{j, \leq J-j}}{p_j \pi_{\leq J-j}^*} \right) + (1 - \pi_{\leq J-j}^*) \theta^* = \pi_{\leq J-j}^* \theta_j^* + (1 - \pi_{\leq J-j}^*) \theta^*$$

We have called θ_j^* the “chain ladder estimate” and θ^* the “Bornhuetter-Ferguson estimate”.

It is not necessary to do both a complete Chain ladder calculation and a complete Bornhuetter-Ferguson calculation in order to do Benktander's method. In fact, it is preferable to use only one (either CL or BF) as the starting point.

- The delay pattern π^* could come from the CL method (via development factors) or the BF method (via delay-specific claim rates) or from some other source.
- The grossed-up estimate $\theta_j^* = N_{j, \leq J-j} / p_j \pi_{\leq J-j}^*$ we always call a “chain ladder estimate”, including when the delay pattern has been estimated in another way than through development factors.
- An average θ^* to use as “Bornhuetter-Ferguson estimate” in Benktander's formula, can be calculated by the weighted average

$$\theta^* = \sum_{j=1}^J X_{j, \leq J-j} / \sum_{j=1}^J p_j \pi_{\leq J-j}^* = \sum_{j=1}^J p_j \pi_{\leq J-j}^* \theta_j^* / \sum_{j=1}^J p_j \pi_{\leq J-j}^* .$$

This way of calculating an average θ^* is sometimes called the «Cape Cod» method. Make sure you know it for the exams.

Exercise 8

Combining company statistics with an industry development pattern

Another example from real life ...

You have been asked to estimate the ultimate claim cost of a small portfolio of long-tailed insurance that has been running for seven years only – with small volume in the first years, but growing rapidly. The company has given you its premiums and an incomplete triangle of reported claim cost. This is what you have been given.

Reported claims		Development year						
Accident year		0	1	2	3	4	5	6
2004	#N/A	#N/A	#N/A	0	0	0	22 210	
2005	#N/A	#N/A	11 310	11 310	847 185	1 437 913		
2006	#N/A	303 664	1 346 415	2 723 648	3 463 779			
2007	433 794	2 289 531	4 116 833	6 033 828				
2008	1 346 130	5 863 393	7 119 684					
2009	12 903 951	20 982 174						
2010	9 063 342							

Premium	
Accident year	
2004	398 138
2005	1 364 612
2006	8 972 171
2007	17 468 748
2008	24 524 745
2009	37 324 794
2010	55 677 306

A quick glance convinces you that the company's reported claims alone are useless for estimating a development pattern, given the long-tailed nature of the business. Paid claims would be even worse, because they are still close to zero.

Fortunately you have access to 19 years of well-organised industry statistics, shown below.

Industry statistics - reported claims in millions

	Development year																		
Acc. year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1991	144	344	455	513	583	633	680	733	760	795	847	856	880	910	914	926	925	941	955
1992	175	327	452	577	655	732	806	851	904	948	962	1030	1017	1041	1053	1060	1065	1070	
1993	153	321	451	536	646	739	821	884	913	952	1062	1063	1062	1060	1069	1071	1097		
1994	178	358	526	662	791	902	938	987	1017	1061	1118	1099	1149	1156	1179	1203			
1995	191	395	588	806	961	1035	1090	1134	1216	1286	1286	1283	1284	1289	1298				
1996	205	501	726	959	1060	1128	1210	1297	1384	1419	1423	1421	1430	1483					
1997	241	551	818	994	1097	1230	1343	1453	1475	1483	1524	1541	1550						
1998	316	704	955	1106	1225	1378	1519	1591	1599	1628	1654	1667							
1999	341	683	936	1087	1263	1441	1496	1504	1529	1542	1571								
2000	379	754	819	1052	1271	1322	1355	1355	1400	1421									
2001	351	656	881	1090	1167	1212	1257	1305	1338										
2002	409	741	998	1172	1168	1242	1296	1298											
2003	427	766	1023	1036	1121	1188	1241												
2004	401	747	885	1011	1040	1114													
2005	460	733	936	1046	1096														
2006	390	679	917	1061															
2007	468	771	997																
2008	512	910																	
2009	561																		

You can use the industry statistics to estimate a development pattern for reported claims, using the chain ladder method. Be careful to check whether the average development pattern of 19 years can be used, or whether you should use only development patterns from more recent years. You may assume that there will be no more reported claim development after delay 18.

When you have estimated the industry development pattern, estimate the company's ultimate claims using the traditional methods: Chain ladder, Bornhuetter-Ferguson, Benktander. This amounts to completing the table below.

Accident year	Company			Industry						
	Exposure p	Dev. to	Reported X	pi(cum.)	Theta_CL	Theta_BF	Theta_Benkt.	Ult._CL	Ult._BF	Ult._Benkt.
2004	398 138	6	22 210							
2005	1 364 612	5	1 437 913							
2006	8 972 171	4	3 463 779							
2007	17 468 748	3	6 033 828			1)				
2008	24 524 745	2	7 119 684							
2009	37 324 794	1	20 982 174							
2010	55 677 306	0	9 063 342							
Total	145 730 514		48 122 931		1)					

- 1) You cannot use the standard way of calculating the Theta_BF because the company statistics has too few development years. Use instead a weighted average of the Chain ladder thetas, given by

$$\theta^* = \sum_{j=2004}^{2010} X_{j, \leq 2010-j} / \sum_{j=2004}^{2010} p_j \pi_{\leq 2010-j}^* = \sum_{j=2004}^{2010} p_j \pi_{\leq 2010-j}^* \theta_j^* / \sum_{j=2004}^{2010} p_j \pi_{\leq 2010-j}^*$$

The Bornhuetter-Ferguson method with Theta_BF in this way is also known as the “Cape Cod method”.