

Individual Choices facing Societal Changes

Can actuarial science bridge the gap between individual and collective choices?



Best Estimate(s): who will get the best one ? Cognitive biases and expert judgement applied to P&C reserving

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Outstanding claims reserving have become most of the time Best Estimate whereas they used to be appropriate. These reserves should now be equal to the best estimate of the cost of the claims not yet settled and not yet reported. Even if new reserving methods have flourished recently, the most typical ones, Chain Ladder and Bornhuetter Ferguson, remain by far the most popular methods in the actuarial world.

Choice of reserving methods, data construction or determination of the underlying hypothesis are often in the hands of the actuary and their judgment, usually called expert judgment. The leading role that judgment plays can explain why two actuaries with the same data could obtain two different Best Estimates. The assurance of a high quality expert judgment, is therefore necessary in order to ensure the quality of the estimate itself.

As anyone else, the actuary may suffer from the effect of cognitive biases which could damage the quality of their judgment. Anchoring, status quo or representativeness biases are some of the many threats to providing the best judgment and with it the best estimate. Identifying those biases and experimenting in the similar conditions to reserving is therefore necessary.

This article aims to introduce the results of a statistical study made of mock reserving cases and delivered to a group of actuaries in which they unconsciously faced cognitive biases. The results will allow to state if these biases truly have an influence and to give a first measure on the Best Estimate measure.

Key words : Expert judgment, reserving, cognitive biases, Chain-Ladder, Bornhuetter-Ferguson, statistical study, IARD

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I. Expert judgment, a key element in P&C reserving. Cognitive biases, a key threat to expert judgment.

Reserving, and more particularly outstanding claims reserving, is crucial for IARD insurance companies as a very significant part of its liabilities is made of these reserves. As a result, it is necessary to be sure of the quality of the estimate of these claims not yet settled or not yet reported. Despite a flourishing period for outstanding claims reserving methods, surveys conducted in many countries, and among them the study published by ASTIN working party in 2016 on that matter, clearly show that Chain Ladder and Bornhuetter-Ferguson remain the two methods almost universally used by the actuarial world.

Even if these methods are determinist ones, as their estimate is the result of a closed formula, their implementation leaves a large place to the actuaries and their expert judgment. Development factor selection and a priori ultimate loss ratio are the two obvious examples of decisions in these methods which require expert judgment. Moreover, the change of qualification of the level of reserves from appropriate to Best Estimate is now well in place and make the role played by the actuary's judgment often bigger. Indeed as Best Estimate these reserves must be as close as possible to the future cost of the claims and can no longer include any margin.

Given that expert judgment is at the heart of this estimate, it is necessary to ensure that this judgment is a high quality one. This judgment quality can be interpreted many ways but the one chosen here is to try to determine if actuary's judgment is biased. The human mind is not flawless and it may make systematic mistakes as soon as some circumstances occur. These mistakes, better known as cognitive biases, are unconscious mistakes and that may put judgment quality in jeopardy. That is why it is necessary to wonder if the

Best Estimate is really the best estimate of the actuary.

II. Cognitive biases, a case by case study

a. Introduction to the study

One of these cognitive biases is called anchoring. The principle of anchoring is that if somebody has been given a result, also called an anchor, before providing their own answer, this answer will inevitably be closer to this anchor than if the answer would have been provided without the anchor. This should happen no matter if the anchor value is truly relevant or not. But anchoring is only one among many biases that might influence decisions. A review of the work of A. Tversky and D. Kahneman, the two references on this topic, as well as applications of their findings to reserving, has been done in order to inventory the relevant biases. This review has also been helpful in order to understand the required environment for each bias to occur. This was necessary to be able to reproduce such situations and to measure bias effects on reserving. Even if theoretically actuaries might be influenced by many biases according to the information gathered through the academic literature review, it is necessary to set up practical situations to confirm that they exist in the context of reserving. These experiments could also be a way to measure their impact on the level of reserves and to try to figure out explanations on the differences observed between the estimates of two actuaries using the same data.

A statistical study has been sent to a group of actuaries in which they faced practical reserving situations where without knowing it, conditions of application of certain biases have been set up. It seems essential that the respondent remains unaware that biases may affect their judgment in order to avoid that they try to contain its effect and not answer as they would have done in a normal situation. The experiment was designed by simulating claims and their development in order to get databases of claims and with them build claims triangles, which are the basic input for reserving methods. This option of simulated data was also useful to shape the data to the purpose of the study. The results of the calculation by the respondents were not the point of interest but rather understanding how these results were influenced by the situation they were facing.

The study has been set up from the biases and by thinking how they could intervene. This approach is contrary to the one adopted by some authors who choose to explain the differences between the estimates obtained through the spectrum of the individual and their personality, such as their optimism. However this approach compared to the one based directly on the biases seems too far from the reserving methods actually used by actuaries. It requires moreover to make strong hypothesis in terms of definition of the personality of the actuary as well as in terms of the generalization of the reserving situation considered. This last hypothesis is particularly strong and difficult to hold as it is the specificity of each reserving situation itself which makes the expert judgment necessary and as a result which make the biases able to influence it. The approach through biases on the contrary builds practical situations where biases may intervene inside the reserving methods to see how the actuary may react to the situations in which their judgment might be biased.

The statistical study is therefore made of a survey and seven cases, five of which are based on either the Chain Ladder or the Bornhuetter-Ferguson method. An Excel tool was provided with the study and specifically conceived for it, helping the respondent to answer the cases. This tool has been designed to ensure that the action of the actuary in the method implementation is only focused on the expert judgment they provide. As a result, the respondent has only in each case to conduct a selection of development coefficients for the Chain Ladder or to provide the a priori ultimate loss ratios for the Bornhuetter-Ferguson.

Every case also provides a short explanation on the data provided but also some environmental context which contains most of the time the hidden elements necessary for the bias to be effective theoretically. For anchoring for example, the context given in the first case is the following sentence: "During the last 5 reserve estimations, the actuary responsible of the calculation has chosen to exclude the development factors below 4 for the first development period and those above 1.7 for the other periods." What is expected, is that the selection of coefficients will be influenced, driven, anchored by it.

In order to be able to compare the answers of the same person implementing two times the same method with the same data, two of the three triangles used in the whole study are actually used in two cases without the respondent being aware. Every bias is also measured in most of the cases between the respondents, using versions of the question asked to them. In the specific case shown above, the second version indicates that the coefficients above 4.7 for the first development year and below 1 for the other ones have been excluded historically. These two versions are a good way to see if the context had truly an effect on the answers to the case.

b. Anchoring effect : Indications to the decision

The first bias measured is the one already mentioned above which is anchoring, or the fact that an answer is influenced by a certain given result before the decision is made. Three practical cases of this bias have been included in the study. The first one is the one with the rule on coefficient selection shown just above. The results clearly indicate that this rule had an effect on the respondent's decision for the first development coefficients as half of them have chosen a selection close to the one set in the anchor/rule but have not reproduced such a choice in the other case where the same data was used. The effect is observed for the two versions of the rule, each version being respectively a high anchor and a low anchor. However the same conclusions cannot be made based on the results on the following developments despite there being an anchor in the rule for them too. It might be interpreted as a consequence of the fact that the anchor for the rest of the development periods is not specific for one development year in particular. As a result, the mind does not think of the anchor when a specific decision which involves it, occurs.

The second anchoring situation of the study is based on the idea that a first opinion on the level of reserves can be an anchor on the second opinion is made by an actuary.

However, the results obtained are too much scattered to be able to say that anchoring really takes place here. This may be due to the fact that the anchor was not directly linked to the judgment the actuary had to make as the anchor was a level of reserves whereas the respondent could only influence this result through the Chain Ladder method. An element which support this hypothesis is the fact that a large part of the respondents have refreshed the estimation obtained after a first implementation of the Chain Ladder and the refreshed result was closer to the anchor than the first one.

The third and last version of anchoring involves the Bornhuetter-Ferguson method. The respondent has been given as anchor a certain ultimate loss ratio (115% or 140%). The anchoring effect observed is quite strong with answers close to the respective anchor they received. This effect is here also confirmed with the answers given by the same actuaries on the same data in another case. In this latter case, the a priori ultimate loss ratio given by the respondents are further from the anchor.

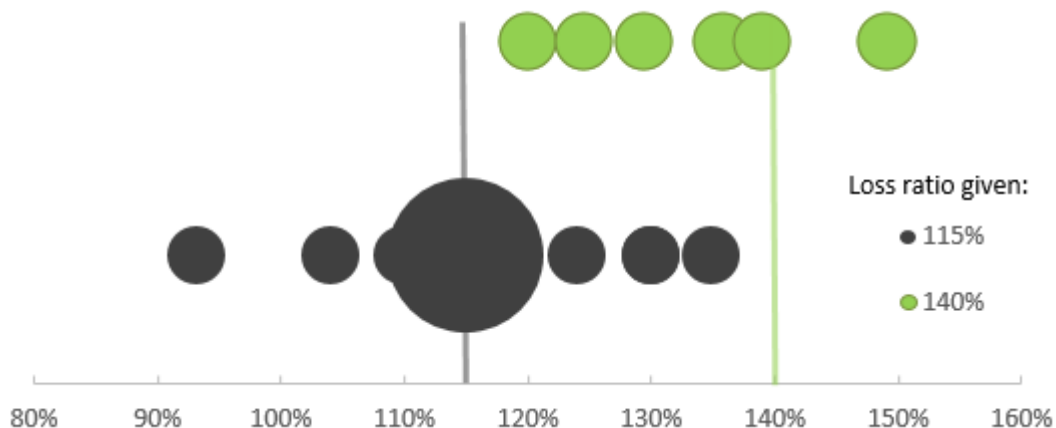


Figure 1 – Ultimate loss ratio used depending in the “anchor” loss ratio

c. Status quo : accept or reject first opinion ?

The principle of the status quo bias is that an individual will not be willing to take the responsibility to modify a previous decision taken by another person and thus will choose status quo over the decision to change it. In the study, the respondents had been given a case of a coefficient triangle where a selection had already been done by a pseudo-actuary. To make it interesting, some of the coefficients selected in it would not have been normally excluded. It was interesting to see if the respondent put them back in the estimation and as a result modify the a priori selection or if they will choose the status quo. The respondent could have received two different instructions for this case: whether to execute a review of the work of the first actuary or to make their own estimate using the selection given or not. The actuaries who receive the "estimate" instructions, which implies a lower commitment, clearly preferred the status quo and let the a priori selection

as it was. On the contrary almost every respondent who had received the other instructions have put back in the estimation the coefficients which would not normally have been in the selection (coefficients 1, 2 and 4).

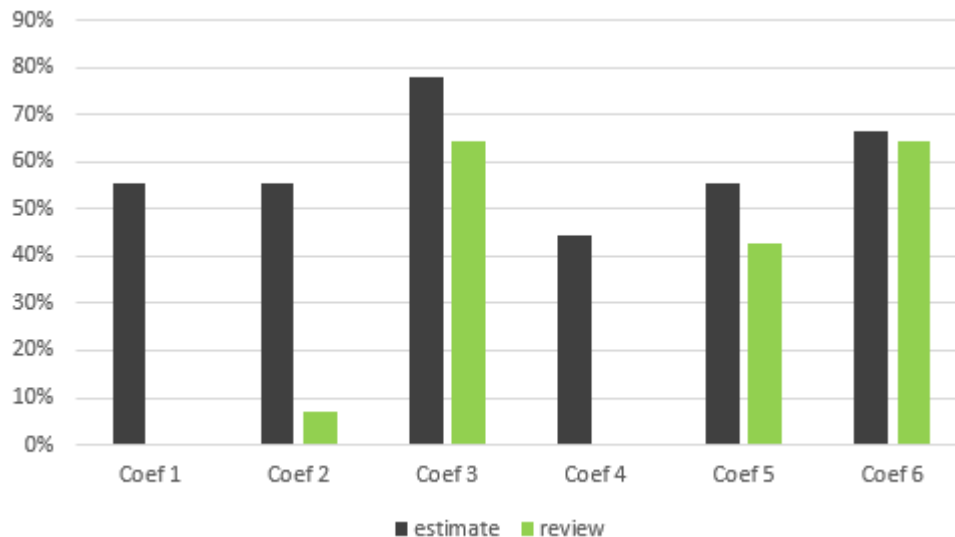


Figure 2 – Proportion of respondent that excluded coefficient already selected depending on the rule they were given to

d. Representativeness bias : prejudices over rationality

The representativeness bias is based on the idea that the judgment on a person or an event is partly shaped by the prejudices a person has built through time and experience, by the manner they represent it in their mind. An actuary could for example develop prejudices of how the claims of a certain guarantee should developed and think that this development scheme should be met again in the future. In the last case of the study, the claims triangle is mentioned as being made of claims from a home guarantee while all the other cases were about automotive liability. Moreover, in order to be able to compare the actuary's decisions, the data of this last case was also used in another one. Unfortunately almost every respondent did not notice the change of guarantee involved in the last case, making it impossible to test the effect of representativeness bias.

e. Illusion of visibility : obvious over coherent

However, the failure of the plan shown in the last paragraph has helped to show how the attention of the participant had diminished case after case. The familiarity acquired through cases made them assume that the situation will be the same over and over and they no longer pay close attention to the information provided in the case. It is one of the two aspects of the illusion of visibility when an individual jumps to conclusions based on the familiarity acquired through time and does not pay attention to new information or change of situation.



Another aspect of this bias is the fact that the attention might be caught by one aspect, making it blind to the rest. In the study, at a certain development period a claims triangle has two high coefficients. One of them is moderately high at this level of development (>2) and thus expert judgment is necessary to decide if it should be kept in the selection or not. The other is very high (>18) and is highly likely to be withdrawn by all the respondents. Moreover in another case the same coefficient triangle is used with the exception that this huge coefficient has been replaced by a "moderate" one. The idea here is to see if the respondent is trapped by the illusion made by the huge coefficient on the development, as it makes all the other coefficients look as if they were quite low. If the respondent excluded of the selection the moderately high coefficient in the second case but not in the first, it will be likely that the illusion has been effective. The results clearly show that illusion has worked as almost half of the respondents made this illusion choice and only 13% excluded it in both cases. The rest of the participants did not exclude the moderately high coefficient in any of the cases.

f. Confirmation bias: new information to confirm the decision

The principle of the confirmation bias is that a person will interpret any new information, whether it is relevant or not, as a way to confirm the decision they made. In two successive cases, the respondent was asked to do an expert judgment on the level of claims above which a claim should be considered as a major one. In the first case the only information available was the level of claims of the five largest claims for the past three years. In the second one the participant received a complementary piece of information, the average cost of claim recorded by the company over the past three years. The aim here was to see if the respondents have modified their judgment between the two cases or considered this new information as a confirmation of their judgment. The results were for almost exactly half the participants a confirmation of their first decision and for the other half, an answer much lower than the first one. The fact that half the respondents have not been influenced by confirmation bias might be explained by the effect of an other bias. According to this other bias for any new information, an actuary will modify their judgment in order to show that they take into account this information, whether it is relevant information or not. The opposite effect of these two biases might explain the uniformity of the distribution of the two types of answers.

g. Heuristic of availability : memory as probability

The easier it is to remember a certain event, the more likely it is perceived, that is the basic principle of the heuristic of availability. The respondent was asked in the survey to estimate the level of loss an insurer is likely to suffer from a certain types of events knowing that these events incurred an average loss of 16 million each year for the past five years. These events can either be terrorist attacks or industrial catastrophes. Terrorist



attacks obviously plays here the role of the event easily available to the mind and the industrial catastrophes the role of the control event. The answers clearly show that the bias takes effect as most of the respondents with the terrorist version of the case estimated a loss for the next year largely higher than the average loss given in the instructions. On the other hand actuaries of the control group largely concurred to an estimate around this average loss.

Estimated loss (in millions)	Industrial catastrophes	Terrorist attacks
<10	0%	13%
10-15	13%	0%
15-18	75%	20%
18-20	0%	20%
20-25	13%	20%
>25	0%	27%

Figure 3 - Proportion of respondents for each estimated level of losses and each event

III. A study with its limits and uncovered fields

Other biases such as framing, which is the fact that a judgment will depend on the way the issue of the decision is presented and particularly if it is presented in terms of gains or losses, have also been tested. But for this one in particular, no sustainable conclusion could have been made based on the answers.

Otherwise, it has also been possible to see how actuaries react when they are free to implement several methods for a single reserving exercise and how they develop the different estimations obtained. Even if a large part of them effectively implement the two methods, as soon as they have reserving experience, only a few of them chose the simple solution of picking the mean of the two as their estimate, but rather preferred to effectively select one of the two results. This observation is contrary to the prejudice that most actuaries systematically choose the mean as soon as it is possible to do so. A last interesting point which can be noticed from respondents' answers is how different two Best Estimates made by the same actuary can be on the same data and how scattered the different Best Estimates obtained by a group of actuaries can be. It shows how the objectivity in the Best Estimate is actually quite subjective.

Nevertheless, it is necessary to point out the limits of the study in terms of likelihood of the situations given to the respondents, as well as in terms of representativeness of the group of respondents. Another limit could be to ponder the fact that the effects measured are truly bias effects and not a consequence of some specificity in the data despite the precautions taken while building the cases. Moreover it would have been interesting to set up other experiments which could not fit within the format of the study but would enable to test the effect of several other biases identified in the academic literature

review. Among them are the biases involving group decisions and particularly the authority bias. According to its principle, the weight given to a certain judgment will be higher if the one who made it holds a certain position in terms of authority or power.



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