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BRAIF: A Model Beyond Pension Valuation for the Colombian Army Forces

by Rodrigo Silva

In my actuarial firm, I had the opportunity to value the pension plan for the Department of Defense of my country, Colombia. In this article I'll address the model that we developed for the active uniformed personnel (AUP), which turned out to be an adequate way to describe the dynamics of the personnel and therefore, a reasonable approach to the pension valuation. It was also a useful planning tool.

In Colombia, the defense sector is composed of the Colombian National Police (CNP) and the Department of Defense (DOD, which has three forces: the Army, the Navy and the Air Force). Some of the pensions are from retirement institutes (pensions acquired after the personnel finish its military career and their survivor pensions), others are from the Police and the Department itself: disability pensions and some of the survivor pensions.

The pension regime for the AUP is a "quasi-defined" benefit, in the sense that if a given person is retired today, given his time of service since the moment he begun his career (there are different regimes), the pension can be calculated. Of course, no AUP knows for certain when he will be retired and therefore, the pension is not a "pure" defined benefit.

Developing a Common Language

The first challenge was to understand how their particular retirement system works and the rationale behind it. For example, the pension of the retired uniformed personnel (RUP) is named "retirement assignment" because at any moment, if circumstances require it, these personnel can be called to join the CNP or DOD. The behavior of their "retirement assignment" is the same as some of the components of the salaries of the AUP. In this sense, the uniformed personnel never hang up their uniforms—they can be active or quasi-retired.

The military forces have a pyramidal structure, for example, in the Army the ranks in decreasing order are: General, Major General, Brigadier General, Colonel, Lieutenant Colonel, Major, Captain, Lieutenant and SubLieutenant.[1] There are equivalent grades for the Navy and the Air Forces, similar to the ones seen in English speaking countries, but different from Commonwealth countries. In the DOD there are also professional soldiers (all are men), who have different legal regimes and benefits than the officers and sub officers.

The CNP was originally inspired by the French model of the "Gendarmerie Nationale" and of course, have different ranks than the DOD. In fact, given that even the civilian personnel that work in the CNP or in the DOD have ranks, pensions of these personnel must also be included in the valuation.

Any report from the CNP or the DOD about the AUP is always referenced in terms of ranks, which is not suitable for actuarial valuations. Therefore, we have to look for a way to convert these ranks to ages. We also had to "cut the pie" in order to get a common understanding about all the different groups, given the many divisions at the interior of the CNP and the DOD and the different legal regimes for the AUP. We designed a simple spreadsheet format in order that each division could report demographic data in aggregated form about their personnel. This is an ideal approach, as long as the data is anonymous and it does not interfere with the way each division handles the data.

It was an awesome experience to receive so many calls from different people asking about the way they manage their databases and the information that we required. I have to thank the patient and careful work of the planning divisions of both the CNP and DOD because there were times that we were flooded with information. After we were able to put everything together, we had to check if the puzzle that we finished had all the pieces, i.e., that we

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[1] http://en.wikipedia.org/wiki/General_Officer

were not leaving any group outside and that we were not repeating groups and of course, that the aggregated information made sense from many points of view: totals of people and payroll, averages, etc. The task of having complete information required many meetings, discussions and analysis.

Modeling the Dynamics of the Uniformed Personnel

According to the current laws, the active uniformed personnel are subject to many possible events in the future: disability, death and retirement. If an AUP becomes disabled or dies, the pension is from the CNP or the DOD, if none of these contingencies occur, someday the AUP will be retired or in military terms, will be called to "qualify services," it is also possible that in some circumstances, an AUP has to leave the forces without pension.

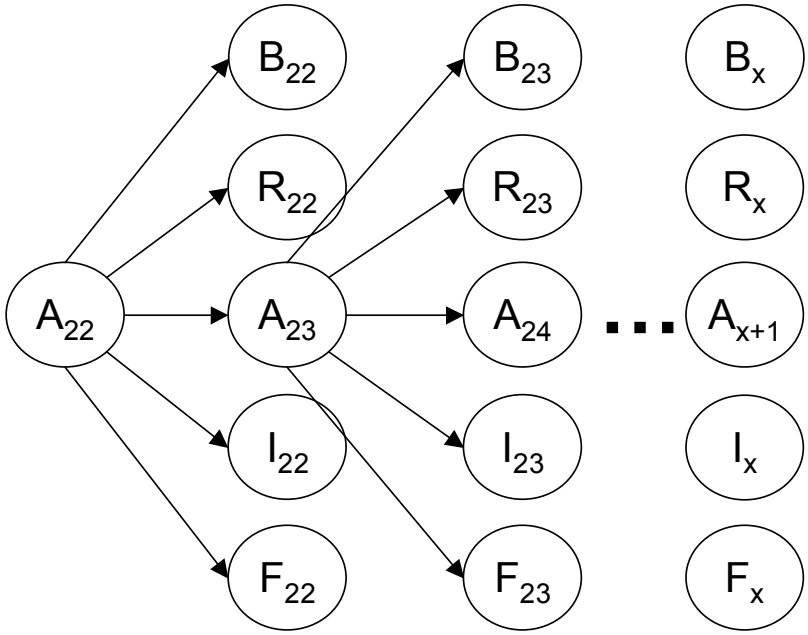
In order to describe the transition to the possible states that an AUP can face in the future, a model was proposed. We named it BRAIF for its initials in Spanish:

B: "Baja" meaning to be retired from the service without any entitlement.
R: Retirement under normal conditions.
A: Active. Meaning that the AUP will continue in service for one more year.
I: "Invalidez" in Spanish, disabled.
F: "Fallecer," to die. In fact, the possible causes of death are combat, mission and normal activity and depending on the cause, different survivor pensions will be recognized.

If for every age we can adjust the probabilities for these states, we can describe on a reasonable basis the dynamics of the AUP and for each possible path for each person (in fact, group of persons with similar characteristics), a probability can be assigned. If a terminal state (any of BRIF) is reached, an actuarial valuation is done, and after all the possibilities are taken into account, the whole valuation can be obtained.

By using this model, the terminal states are clearly identified and therefore, the reserve for each group of persons can be assigned to the corresponding entity for this future pension (in fact, "retirement assignment"). In other words, the model allows for the correct risk allocation.

If the adjustments that were made to calibrate the BRAIF model are correct, we can figure the probability that, for example, a Lieutenant of 28 years old could become a General in the future.



For an AUP of 22, the BRAIF model can be depicted as follows:

The state A was chosen to be in the middle, because it not only gives symmetry to this depiction, but is the state that puts the model in motion, it is from these states that transitions takes place.

This is a Markov chain—at any age the sum of the probabilities of leaving any of the A states are 1, the BRIF states are terminal and therefore, no more action (in terms of transition to other states) was considered after reaching any of them.

Thinking on BRAIF Terms

The probabilities of each arm of the BRAIF model are conditional probabilities, similar to the ones that can be obtained from a mortality table. This model can be seen as a mortality table with multiple decrements.

The picture of the model has a powerful effect, and illustrates the following points:

- The AUP behaves in a unique way, while they are in their military career. We cannot compare the dynamics of these personnel with any other group of personnel (at least in Colombia). In other words, we gave full credibility to the given data and the adjustments that we made.

- We don't know where any AUP will finish its career. Therefore, the obtained results are our "best estimate" of what will happen in the future, if all the uncertain future events evolve exactly as the model states.

Looking at the model that we made, we can not only get the valuation results as required by law, but also, planning can be done. If the model can project the dynamics of the AUP, it can also help to estimate the cost not only of the actual AUP but also the future ones, in terms of "retirement assignments" and salaries.

In the opinion of the planning division of the DOD, *"The BRAIF model had helped us to understand in an integrated way, the multiple possibilities that our complex regulation gives to the AUP, it can describe in a simple way the operation of the different legal regimes that the law offers, it conveys in an appropriate way, the dynamic of our AUP. I'm sure this model will help us to make better planning decisions."*

Looking at the model that we made, we have a description of a complete social security system. Like some other inventions that we have nowadays, this model was originally conceived for the military sector, but could also have civilian purposes—Social Security. Of course, the parameters should be different, but the idea of having a single model that describes the multiple benefits that are provided, is appealing.

For the future, we expect to improve the model. Some contingencies can be described in more detail, once some questions are answered. Many others arise, but thanks to a structured model, all of them can be answered. We expect to address all of them, with the aid of the common language that we developed for the BRAIF model. □

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