LEVEN

Limited data, endless opportunities

1. BACKGROUND AND SCOPE

Due to its small population, mortality modelling in the Caribbean is challenging: of the 19 Caribbean countries in the Worldbank dataset, only 12 have life expectancy data from 1960. Data for Curacao is only available from 2006 onwards. One could therefore argue that insufficient data is available to perform a decent mortality study.

However, even larger countries suffer from the issue of changing data over time: life style and habits change (smoking used to be more popular in the past), income equality and the level of education fluctuate, and also due to emigration the proportion of local and non-local people is not constant[1]. More data therefore doesn't always imply better predictions in the dynamic world of today.

Despite limited Caribbean data, the Worldbank dataset shows a remarkable overall trend of increasing life expectancy for the Caribbean region. We agree with Deming's quote that "without data you're just another person with an opinion" and therefore believe that despite the challenges of limited data, it is far more preferable to draw conclusions on the available data, then to either use gut feeling, or following pricing behavior of competitors. However, the techniques used for mortality modelling, will differ in locations with limited data, and we will show which techniques are available for mortality modelling for smaller countries.

2. DATA AVAILABILITY AND CHECKS

The following checks have been applied to check the reasonableness of the data:

- **Insurance group level**: Comparison of number of policyholders and number of deaths between mortality study 2015 and 2017 to ensure data consistency;
- **Policyholder level**: system limitations might require the removal of a policyholder, making it look like a decease. Taking a multi-period time frame and checking for consistency on policyholder level therefore avoids mortality cases due to system limitations.

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3. DATA FITTING TECHNIQUES

Due to limited data availability several methods were applied to get a better feel for the overall mortality behavior:

1. **Least squares method**: this method compares the difference between expected (mortality table estimation) with actual (insurance company data). We applied the following two fitting techniques:

   1.1. q_x: this method is preferred in general as one can create a best fit for each age independently of another age (e.g. fitting the q_{80} is independent of q_{81}). However due to lack of data, there were instances for ages 80+ for which no mortality occurred and hence a mortality rate of 0 was implied. As a result fitting on qx implied, fitting on ages 80+ which is not the main part of the dataset. We could have applied smoothing were the qx value is a function of q_{x-1} and q_{x+1} but felt that by using excess smoothing the overall pattern of the mortality behavior would not represent the original data anymore.

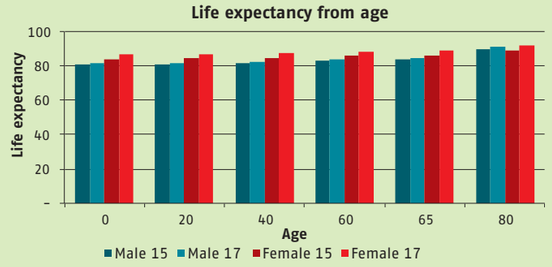
   1.2. l_x: this method compares life expectancy of the actual insurance data, with life expectancy of the mortality table. The drawback is that life expectancy for age x+1 is a function of life expectancy of age x, and hence there is no independence of fitting. However this method had the practical advantage that even when there are actual mortality rates of 0 for certain ages, this does not skew the results and hence fitting is done on the part of the data which is most populous. An additional benefit is that due to an increase in life expectancy, pricing of annuities is important which focus on life expectancy.

2. **Shape of mortality behavior**: the final method looked at similarity in the pattern of the mortality table and the actual insurance data. This method turned out to provide a good fit with the benchmarking results described in the next section.

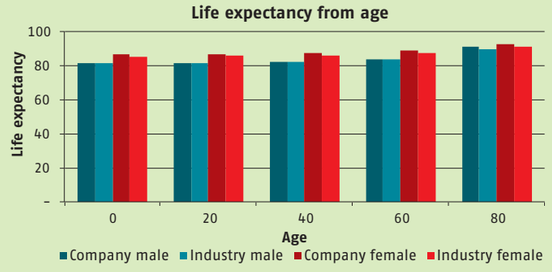
4. BENCHMARKING

Because there is limited data available, it becomes more important to benchmark the results with previous research:

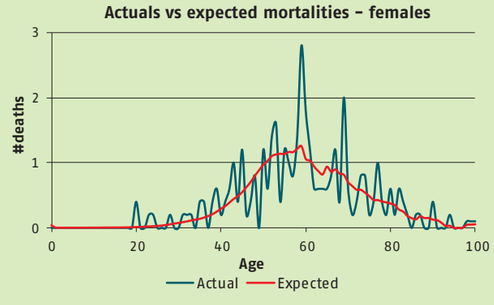
1. **Previous internal mortality study**. As the worldwide trend of an increase in life expectancy is also occurring in Curacao, we would expect to see an increase in life expectancy in the 2017 study compared to the 2015 study. This is indeed the case:



2. **An industry wide mortality study**. This 2015 study was performed by Phenox in Aruba and ex-NA. Our results are in line with the Phenox results which gives us additional comfort that the data aggregation and data analysis have been done correctly:



3. **Expected vs actual mortalities**: this check enables the best fit to be backtested with actual data and hence confirms if the fit is appropriate. As the actual data shows a more bumpy pattern compared to the expected mortality predicted by the mortality table, one can observe an overall fit, however for individual ages differences exist (see below an example for the female fit):



5. LIMITATIONS

No analysis has yet been done based on marital status of policyholders (married males are expected to live longer), income levels (higher income levels can afford better health care, increasing their life expectancy), or industry people work in. This might be a topic for further research and could provide additional opportunities for pricing segmentation (within the available legal boundaries).

6. SELLING IT TO THE BUSINESS

Data cleansing and data analyses is one part of the process, ensuring that the business is convinced to implement pricing and reserving based on new mortality assumptions is another thing. The following activities help to convince internal and external stakeholders:

- **Presentations and conferences**: not only showing the end result on premium income and reserve levels but also providing evidence that the results are sensible (worldwide and local trends, product profit analyses). Adding sensitivity and what-if analysis showing the effect on profitability when not updating mortality assumptions for actual products, will make the audience more conscience of the impact on profitability.
- **Articles**: for creating awareness at other stakeholders such as clients, external auditors and regulators. Especially when clients are aware of the effect of increased life expectancy on pricing, sales projects will run smoother as there is already awareness that the pricing of products could change at the end of the contract.

The main point of creating awareness with other stakeholders is not to support an increase in price, but to stress the importance of appropriate risk sharing: even with price changes, the insurance company is still insuring mortality and longevity risk which is one of the prime risks of policyholders which is difficult for them to mitigate by themselves. To ensure the insurance company can handle these risks both now and in the future, there needs to be an appropriate level of risk sharing between the policyholder and insurance company

7. CONCLUSION

We believe that the actuarial profession is already well placed to perform the data cleansing and analysis part of mortality modelling, but believe there are opportunities for the profession to create more awareness to other non-actuarial stakeholders than is currently done. ■

1 – Please refer to Piketty Capital in the 21st century: is the US the same country at the beginning and end of the 20th century?

References

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