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# THE ART OF ACTUARIAL SCIENCE

## The Goldenson Center Perspective

By Jay Vadiveloo

In thinking about how I should frame this article, I decided it would be best to use my past 10 years of experience in managing the Goldenson Center as its basis. The Goldenson Center for Actuarial Science at the University of Connecticut has one simple mission: to engage in applied actuarial research that serves the needs of industry. While this may not be a profound mission statement on face value, if you break it down, it has several implications and built-in constraints:

- Applied actuarial research means the problems we have to solve at the Goldenson Center must come from industry and not be “dreamed up” in the ivory halls of academia. Also, applied actuarial research encompasses both traditional and nontraditional problems facing industry.
- Serving the needs of industry means that the solutions we come up with must be implementable and add value to a company. A more complex model, which is academically superior but does not necessarily add tangible, measurable value to a company’s current operations, does not fit into the Goldenson Center’s mission statement.

Given these self-imposed constraints on Goldenson Center research projects, we invariably have to go beyond traditional actuarial techniques and established theoretical models and develop our own novel approaches to problem-solving. However, while our mission statement has these built-in constraints, we have also provided a level of freedom and creativity that is unique to the Goldenson Center:

- Applied actuarial research projects undertaken by the Goldenson Center do not have to be published in academic journals. However, in order to generate industry interest in the work we do, we have published some of our research in trade journals and popular publications that are more widely read.
- In the process of coming up with implementable solutions, we have to create “new theories” or new modeling

techniques. These new techniques are never justified using academic criteria as long as they satisfy the second constraint imposed by the Goldenson Center mission statement.

Collectively, the constraints we work under as well as the freedom we allow ourselves in coming up with implementable client solutions are where the “art” of actuarial science applies for Goldenson Center projects. Let me try to illustrate this with an actual example of a project undertaken by the Goldenson Center. But, before I do this, it is important for the reader to understand that creative thinking does not magically happen in any organization, including the Goldenson Center. Unlike other academic research centers, all projects at the Goldenson Center are done exclusively by students and mainly graduate students. The only faculty member involved is me—and as more of a facilitator and guide. There are a couple of reasons for this:

- Students are readily accessible and eager to gain the real-life experience of working on Goldenson Center projects.
- Students are generally not constrained in their thinking, have excellent modeling skills, and are more open to challenging and modifying traditional, well-established actuarial models, particularly when they are made to focus on an implementable solution versus publishable research.



In order to stimulate creative and unconstrained thinking amongst team members in a project, I have tried to foster a spirit of entrepreneurship at the Goldenson Center in the following ways:

- Students work in teams and are given complete freedom in thinking.
- Team members have complete ownership of the project, from weekly client calls and meetings, formulating the problem, developing the modeling tools to come up with the solution, putting together the final report and supporting materials, and doing any final client presentations.
- Trust amongst team members and open sharing of ideas are strongly encouraged.
- Students are more motivated by the experience they obtain and the company exposure and visibility they receive.
- Students are treated equally: Each student receives a flat stipend independent of the number of hours spent or the different levels of responsibility of each team member.

I believe the underlying mission and philosophy of the Goldenson Center is how the art of actuarial science naturally emerges in the work we do. Clearly the level of art varies by each individual project, but let me illustrate with an example where we may have broken the mold of traditional actuarial thinking in coming up with a solution.

NRSI that incorporates both economic and noneconomic factors to capture retirement readiness truly illustrates the art of the actuary.

### NATIONAL RETIREMENT SUSTAINABILITY INDEX (NRSI)

This project was inspired by one of the board members of the Goldenson Center who felt that current national retirement readiness indices are developed purely from economic data. This means that in bad economic times, national retirement indices paint a dismal picture of the future retirement scene, and that makes it hard for the insurance and financial services industry to encourage individuals to plan for retirement. The challenge for the Goldenson Center was to incorporate other nonfinancial drivers of retirement readiness that could impact the measure of retirement preparedness. This raised several critical questions that we had to resolve using “out-of-the box” actuarial thinking.

- What noneconomic factors should be considered?
- How can these factors be quantified and incorporated into the retirement index?
- What external data sources are available to objectively quantify these noneconomic factors and ensure they are consistent?
- What reasonable approximations and proxies could be used to quantify these noneconomic factors?
- How do we handle noneconomic factors that impact the quality of retirement life but cannot be objectively quantified? This would include factors like social connectedness, a positive attitude to life, and so on.

This was one of the most challenging projects we had ever undertaken because we could not fall back on traditional actuarial principles and modeling techniques. We began by setting some axiomatic principles in our model design:

- We decided to focus on only four noneconomic factors that could be objectively quantified: state of health, level of adaptability, job satisfaction, and level of financial planning. All other noneconomic factors were excluded.
- The healthier the individual at retirement, the lower the future health care expenses at retirement and the greater the retirement sustainability.
- The more adaptable an individual, the greater the ability to generate additional income at retirement and the greater the retirement sustainability. Level of education was used as a proxy to measure individual adaptability.
- The greater the job satisfaction, the longer an individual is willing to work until retirement and the greater the retirement sustainability. The *Wall Street Journal* job rankings were used as a proxy to measure job satisfaction.
- The greater the level of financial planning, the greater the growth rate of retirement savings and the greater the level of retirement sustainability. A review of financial planning articles and publicly available financial data was used to estimate the additional asset growth rate attributable to financial planning.
- Since quantifying these noneconomic factors required judgment and approximations, wherever possible, conservative assumptions were used to determine the impact of these noneconomic factors on the NRSI.

Specifically, the student team had to come up with the following:

- Determine the appropriate public databases to project assets and liabilities at retirement in order to measure retirement readiness. The two main data sources were the Health and Retirement Study (HRS) and census data.
- Determine key actuarial estimates of mortality and morbidity as well as estimates of various economic factors, such as asset growth rates, annual living expenses before and during retirement, inflation rates, estimated age at retirement, and so on.
- Determine estimates of the various noneconomic drivers of retirement readiness and a reasonable and consistent approach to quantifying these drivers. One of the most challenging noneconomic factors to quantify was level of adaptability. We chose to associate level of adaptability with the potential of a retiree to earn part-time income during retirement and linked the level of part-time income with the level of education of the retiree. In this way, a relatively subjective noneconomic driver, such as level of adaptability could be measured and quantified in a logical and consistent manner.
- Develop an actuarial model in Excel/VBA to calculate the base and final NRSI separately for the working and retiree population using the underlying databases and modeling assumptions.

There are clearly too many details in the underlying model to mention in this article, but it is significant to note that there was sufficient complexity and enough of a theoretical framework in the NRSI construction that it became the basis of a Ph.D. dissertation for one of my students.

The implications of the NRSI are very significant:

- The NRSI was broken down into two components: (i) the baseline NRSI, which included just economic drivers, and (ii) the final NRSI, which incorporated both economic and noneconomic factors.

- While the baseline NRSI conforms to traditional retirement indices, which reflect the state of the economy, the final NRSI paints a different picture. The noneconomic factors provide a smoothing impact on retirement readiness because the final NRSI is less volatile than the baseline NRSI.
- While the state of the economy is beyond an individual's control, the noneconomic factors can be controlled and managed by an individual through education and training, healthy living and financially planning for retirement. In other words, retirement sustainability is not a manifest destiny and is within an individual's control independent of the state of the economy.

I hope this article does not leave the reader with the impression that everything we do at the Goldenson Center is an art. We do several traditional modeling projects at the Goldenson Center, such as pricing, predictive modeling, and developing individual financial planning models where students employ well-established actuarial mathematics principles to come up with a solution.

### MY INSPIRATION

I would like to end with some parting words of inspiration. When I started my academic career at Syracuse University after I completed my Ph.D. at the University of California, Berkeley, the faculty member before me had cleared the office but left behind a single book—*Zen and the Art of Motorcycle Maintenance*, by Robert Pirsig. This book has been a source of inspiration for me and embodies the underlying philosophy of the Goldenson Center. The message I have captured from this book is that however mundane or complex a given activity, you have a choice to approach it as an artist and provide a truly creative solution. This is maybe the best definition of the “Actuarial Art.” Creative solutions do not apply only to nontraditional projects, such as the NRSI, but to any work we do as actuaries—both traditional and nontraditional. ■



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