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Actuarial Job Market: Overcoming the Matthew Effect

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Abstract

Actuarial companies and university actuarial programs strive to attract gifted students. The brightest students demand a well-rounded actuarial education. This includes the knowledge necessary for successfully passing actuarial exams and for developing practical skills that will serve the students well when they start their careers. Gaining working actuarial experience is especially important today when the entry-level actuarial market has become saturated and students need to be able to distinguish themselves from their peers. We will present several projects for actuarial students that are designed to develop specific technical and business skills relevant to both actuarial consulting and the insurance industry. These projects have been field-tested to enhance existing actuarial programs as well as to provide practical skill sets necessary for successful job searching.

Introduction

Any actuarial program focuses on attracting gifted students. As the entry-level actuarial job market gets more saturated, universities are changing their approach to actuarial education. In addition to preparing students for actuarial exams and keeping the industry connections, they start offering actuarial research and internship programs that develop the students' essential practical skill sets necessary to be competitive in the job market.

Becoming an Actuary: Old School and the New Approach

One becomes an actuary by passing professional exams administered by an actuarial society and by developing practical skills while working at an actuarial organization. Traditionally, a university actuarial program was focused on the first goal by preparing the students for actuarial exams. The second objective was fully achieved after graduates started working at an actuarial company. Just a decade ago several successfully passed actuarial exams, good interviewing skills and an internship would yield a student a respectable entry-level actuarial position. Also, to find that position, graduates sought the services of an actuarial job search group.

Now with more and more actuarial programs at universities all over the country and the world, just having exams and an internship isn't enough. The entry-level actuarial job market has become saturated and the students need to better distinguish themselves in a sea of practically identical candidates flooding that market. Now providing entry-level job search services has become all but extinct. Actuarial companies have elected not to support actuarial recruitment firm services at the entry level. Why pay large service fees that can reach up to 30% of the candidates negotiated first year salary when they can have their pick of fresh candidates from the flood of new applicants? As a result, actuarial recruitment firms have shifted their efforts from placing job candidates at all levels to becoming top heavy: helping find actuarial positions only for designated actuaries or for already working actuarial students with certain level of practical experience.

Entry Level Actuarial Job Market: What Makes a Difference?

In an effort to place our own graduates in actuarial positions, we asked recruiters and employing actuaries what the students should do to distinguish themselves. Recruiters and hiring managers unanimously voiced the need for practical experience and technical skills. Often cited was experience building actuarial models using a working knowledge of Excel, Access and related computer languages such as VBA, SAS, and SQL. Answering one common job interview question: "What actuarial projects did you participate in and what did you learn?" successful students should demonstrate their understanding of a working field by describing how they solved practical problems with the help of actuarial techniques.

The Matthew Effect

Here we have what a sociologist Robert Merton back in the 60-ties called the Matthew effect (or accumulated advantage), the phenomenon where "the rich get richer and the poor get poorer". The exact quote from the book of Matthew Chapter 25 Verse 29 is: "To those who have much, much will be given. But from those who have little, all will be taken away". What does that mean for actuarial graduates? Candidates with experience are more likely to get jobs and obtain even more experience and students with the same level of education but lacking experience are going to have a really hard time getting a job, thus obtaining even less experience.

How can we, as universities, help our students overcome this effect?

Actuarial Research and Internship Programs

One approach is to offer actuarial research or internship programs. In fact, having such programs has become a focus for many universities in recent years. The goal of these programs is to make the students' transition into the business world as smooth as possible.

In this paper we propose three projects that will develop the students' practical technical and business skills. They are related to three common working actuarial fields: a pension practice in a consulting firm, a health practice in an insurance company, and a research and development group in a department store.

Project 1. Comets, Inc.

The first project is designed to simulate a real world experience of a client team in the pension practice of a benefits consulting firm. The purpose of the project is to teach students business and technical skills necessary to successfully assist a client with their basic pension needs.

Students involved in this project play the role of "consultants" working with a specific "client" and, being at UT Dallas, we call this client Comets, Inc. The students will go through a valuation cycle. This involves performing the client's IRS Funding and Expense (Financial Accounting Standard (FAS) 87) valuations, preparing FAS 106 and FAS Disclosure reports, learning the basics of benefit calculations and filling government forms for the client's Pension Plan.

Although the student's tasks are very specific, going through them also allows the team to learn and understand the business philosophy of any pension or retirement practice of a benefits consulting firm. It is to help its clients (usually large corporations) identify the right set of solutions for their retirement program from among a growing array of options, including redesigning the pension plan, enabling employees to optimize plan value, rebuilding the plan's funded status, creating greater plan management efficiencies and modifying asset/investment policies. Whether the clients offer a defined benefit pension or a defined contribution plan, actuaries at the retirement practice work with them to determine the right approach to design, funding, investing, governing and employee engagement. They take into account the nature of the clients' business, the composition of their workforce and their goals for benefit adequacy, competitiveness and cost management. They approach clients' pension plan as a financial subsidiary that can significantly affect earnings, cash flow and their balance sheet. Sophisticated tools and research brings a tailored solution that balances clients' retirement program risks and costs with plan objectives and opportunities.

The team has a "senior consultant", a knowledgeable faculty member who will guide students through the process. Each week a new topic is introduced and studied. Weekly homework helps students understand what is discussed.

The project begins with the First Client Meeting, where the team explains to the client what work will be done and what final product will be delivered.

Internally, the students start with the overview of retirement plans. They learn about the vehicles used to obtain financial security at retirement. A common metaphor associated

with components of financial security at retirement is the "three-legged stool"; each leg represents one source of retirement income. For many years the first leg has been referred to as "Government", or simply Social Security and Medicare. The second leg, "Individual", refers to personal savings which includes income from family members, contributions to an IRA account, 401(k) plan, and other financial security programs. The third leg, commonly referred to as "Employer", refers to employer-provided retirement plans. The three most common types are defined benefit, defined contribution, or post-retirement medical plan.

The students then study the rules governing retirement plans. They learn about ERISA, Employee Retirement Income Security Act of 1974, and its key provisions which include Protection of Employee Benefit Rights, Amendments to the Internal Revenue Code relating to retirement plans, Jurisdiction, Administration and Enforcement, Plan termination insurance. They also obtain a quick reference to the Internal Revenue Code, the key manual for enrolled actuaries.

Valuation Overview becomes one of the central topics of the team's studies. This is where the students will get some practical experience in preparing actuarial valuations that are technical reports providing full disclosure of the financial and funding status of a pension plan. Students learn about the three types of valuation reports: funding, expense, and post-retirement benefits. They study different purposes of each report.

In particular, a funding report:

- Details the minimum and maximum deductible contributions for plan year,
- Outlines a schedule of minimum required contribution due dates, including information required by the IRS (Internal Revenue Service), DOL (Department of Labor), and PBGC (Pension Benefit Guarantee Corporation) related to asset performance, and
- Illustrates liability experience: deviation of the actual from the expected liability based on assumptions such as death, retirement and turnover.

On the other hand, an expense (or FAS 87) report:

- Specifies how a company must reflect pension expense on its financial statements,
- Provides the accounting expense for the fiscal year, and the information applicable for financial statement purposes at the end of the fiscal year,
- Provides Net Periodic Pension Cost (NPPC) for pension plans.

There is also a year-end disclosure report associated with the FAS 87 report.

Finally, a post-retirement benefits (FAS 106) report:

- Establishes accounting standards for employers' accounting for postretirement benefits other than pensions,
- Provides Net Periodic Pension Cost (NPPC) for retiree medical and life insurance plans (similar to FAS 87).

Although it applies to all forms of postretirement benefits, this Statement focuses principally on postretirement health care benefits. As with the FAS 87 report, a year-end FAS 106 disclosure report provides the funded status of the plan and sensitivity to changes in the assumption about future health care costs.

Along with the valuation overview, the students also learn about benefit calculations, an important service that a retirement practice provides to their client throughout the year. Every company that has a defined benefit pension plan needs calculation of benefits for retiring, terminating and deceased employees and/or their beneficiaries based on their individual data in accordance with the client's pension plan. Students gain understanding of the information that is used in calculating a benefit, become familiar with benefit calculation vocabulary, and are taught how to calculate various pension benefits.

Next, the students learn about government forms. Every company that has a defined benefit pension plan needs to fill out several tax forms related to that plan and file them with the an appropriate government agency. There is a multitude of forms that needs to be filed, but the most typical are 5500 packages and the Pension Benefit Guaranty Corporation (PBGC) forms.

The students get familiar with the Form 5500 Series that is part of ERISA's overall reporting and disclosure framework intended to assure that employee benefit plans are operated and managed in accordance with certain prescribed standards and that participants and beneficiaries, as well as regulators, are provided or have access to sufficient information to protect the rights and benefits of participants and beneficiaries under employee benefit plans.

They learn about PBGC that is an independent agency of the United States government created by the ERISA to encourage the continuation and maintenance of voluntary private defined benefit pension plans, provide timely and uninterrupted payment of pension benefits, and keep pension insurance premiums at the lowest level necessary to carry out its operations.

The result of the project is the Final Client Meeting where the "consultants" deliver the valuation reports and explain to the client their significance.

Project 2. Reserve Test.

The second project teaches students essential technical skills used in the Valuation and Forecasting area of an insurance company. The purpose of the project is to further develop students' knowledge of Excel, Access, and Visual Basic for Applications (VBA) computer language. The project can be performed by a team of students or individually and is guided by an experienced faculty member.

The project leader defines the task: Given a year-end reserve on a product as of 12/31, for starting active in-force, estimate the month-end reserve for subsequent months and the redundancy or deficiency of the original reserve as the difference between the estimated ending reserve and the actual ending reserve. The reserve is redundant if the difference is positive and deficient if it is negative.

The students need to track the reserve on the active in-force that was present at the end of the year through subsequent months and see if the current reserve is adequate relative to the reserve set at the end of the year. The students are provided with the basic chart of developing estimated ending reserve:

	Original Reserve as of 12/31
+	Net Earned Premium for starting Policies In Force (PIF)
+	Estimated Net Investment Income (NII)
-	Paid Benefits on starting in-force
-	Current reserves on starting in-force that are no longer active but have not been paid a benefit yet
=	Estimated Ending Reserve

There are several challenges in this project.

On one hand, because the starting active in-force is changing as new insureds enter the in-force and others terminate, there is a need to compare the original in-force with the new one, excluding the newcomers and tracking the reserves and benefits for terminating insureds. In addition, the data set is large. So, students should be able to create the right queries in Access against an existing table of benefits paid, premiums earned and reserves held. Query results are to be exported into Excel where more macros summarizing the information are run with sums linked into a Summary Excel spreadsheet.

On the other hand, since the students repeat the analysis every month for multiple cohorts of the insureds (for example, insureds in separate companies), they need to write macros in Visual Basic.

The project leader provides an algorithm that describes the process in the Access Database. Suppose the year we are looking at is 2012. Our comparison is to 12/31/2011 reserve.

1. Enter the date of the analysis (e.g. 201203).

2. Import the current month (CM) Active and Terminated files that contain basic data information including Net Premium, Reserve with Claim Offset and Cash Surrender Value.
3. Append Terminated table for the CM to the existing Terminated Table (this table grows as months go on).
4. Load Claims for the current month.
5. Attach them to the Benefits table (this table grows as months go on as well).
6. Create and run a query that identifies actives in both 201112 and Current Month table.
7. Create and run a query that picks up the reserves in both 201112 and Current Month and export them to an Excel file.
8. Create and run a query that picks Net Premiums in both 201112 and Current Month and export them to Excel file.
9. Create and run a query that identifies actives in 201112 but not in both months. This group could be called "unrecognized". Insureds in this group may have terminated and already received the benefit or terminated and their benefits have not been paid, which means the company will still be holding the reserve for them.
10. Create and run a query that determines which insureds are no longer active and have received benefits and export the results into Benefits files.
11. Create and run a query that picks up Current Month Terminated Reserve for the subset of "unrecognized" that have not been paid the benefit yet and export them to an Excel file.

The final product of this project will be redundancy/deficiency reserve calculation for the given data over the course of the testing period.

Project 3. Monte Carlo Simulation.

The third project teaches a student necessary techniques to solve different problems using Monte Carlo simulation. Besides being widely used in actuarial science, these techniques can be applied in any business: for example, a grocery store, a department store, or a car dealership. The purpose of this project is to further develop students' modeling and Excel skills while introducing them to this important technique and refreshing their knowledge of basic probability. Note that the Monte Carlo simulation is taught in preparation for exams MLC/3L, MFE/3F and C/4, but this project is designed to show this technique from yet another angle.

At the end of the project the students will understand how to simulate values of discrete and continuous random variables, learn how Monte Carlo simulation could be used to maximize profit, and perceive advantages of the Monte Carlo simulation over *deterministic*, or "single-point estimate", analysis.

The project can be performed by a team of students or individually and is guided by an experienced faculty member. Weekly meetings and a variety of assigned tasks will help the students understand what is discussed.

The students will learn that Monte Carlo simulation lets one see all the possible outcomes of their decisions and assess the impact of risk, allowing for better decision making under uncertainty. It helps answer such questions as:

- How should a greeting card company determine the number of cards to produce?
- How should a car dealership determine the number of cars to order?
- What is the probability that a new product's cash flows will have a positive net present value (NPV)?
- What is the riskiness of an investment portfolio?

Students will study different areas where the Monte Carlo simulation is used and come up with examples of its use. Besides actuarial science, these areas include physical sciences, engineering, computational biology, applied statistics, games, design, finance and business, telecommunications, and mathematics.

To simulate values of discrete and continuous random variables, the students will be given the basic knowledge of Excel RAND() function and taught how to apply it in simulating random variables with a variety of discrete and continuous distributions.

The students will then be ready to approach different problems involving maximizing profit. As an example, they will learn about how to use Monte Carlo simulation to determine the number of magazines a publishing company should produce to make the maximum profit.

The leader sets up the problem: Suppose the demand for a magazine is governed by the following discrete random variable:

Demand	Probability
15,000	0.15
25,000	0.30
45,000	0.45
65,000	0.10

The magazine sells for \$3.50. The variable cost of producing each magazine is \$1.75. Leftover magazines will be disposed at \$0.40 per magazine. How many magazines should be printed to get the highest profit?

The leader then asks the students to first simulate each possible production quantity (15,000, 25,000, 45,000 or 65,000) many times (e.g. 2,000 iterations). Then determine which order quantity yields the maximum average profit over the 2,000 iterations.

Given the unit production cost, unit price and unit disposing cost, students enter a trial production quantity in one cell and create a random number in another. This allows them to simulate demand. They then calculate the number of units sold as a minimum between the production quantity and the demand, revenue as the product of the unit price and the minimum between the number of units produced and demand, the total production cost as the product of units produced and the unit production cost and, finally, the total disposing cost as the product of the unit disposal cost and maximum between zero and the difference of produced and demand. The profit is then generated as the difference between the revenue and the total production and disposing cost.

The students learn how to calculate profit for each production quantity efficiently. The result is a table of profits for each production quantity. They can then perform the risk analysis by calculating the distribution in each case and setting confidence intervals for mean profits.

Finally the students learn about the advantages of Monte Carlo simulation over *deterministic*, or “single-point estimate” analysis. They learn that Monte Carlo simulation results are probabilistic, i.e. the results show not only what could happen, but also how likely each outcome is. The results are also graphical, since the data a Monte Carlo simulation generates lets the analyst easily create graphs of different outcomes and their chances of occurrence. This is important for communicating findings to other stakeholders. Monte Carlo simulation allows researchers to conduct sensitivity analysis making it easy to see which inputs had the biggest effect on bottom-line results. In addition, Monte Carlo simulation allows more convenient performance of the scenario analysis when the analyst can see exactly which inputs had which values together when certain outcomes occurred. This is invaluable for pursuing further analysis. Finally, Monte Carlo simulation allows for correlation of inputs when it is possible to model interdependent relationships between input variables to represent how, when some factors go up, others go up or down accordingly.

The final product of this project will be the profit analysis and understanding of the impact of risk in the student’s decision.

Conclusion

In a current economic environment for all college graduates experience is becoming more and more important. For actuarial students the additional challenges of having high GPA and several passed actuarial exams are still present. But the students have control over these two. What they don’t necessarily have control over is the practical experience and technical skills.

We believe that the university research and internship programs are helping to level the playing field. Through these programs universities help their students gain the

experience they need to be competitive in a job search and enter actuarial profession more confidently and quickly.

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