

By Robert L. Brown and  
Conrad Ciccotello

# Can Education Substitute for Actuarial Exams?

## EVIDENCE AND POLICY IMPLICATIONS

**R**ELYING ON DATA FROM ACTUARIAL EXAMS over the period from 2000 to 2002, we find that candidates who are currently students in academic institutions pass actuarial exams in Courses 1 through 4 at a higher rate than candidates in the workforce. Consistent with changes in the 2005 Society of Actuaries syllabus, the findings suggest that exam credits could be obtained from suitable academic educational attainment. Unlike recent academic studies of other financial services professions, however, this analysis was not able to control for other candidate attributes, such as experience and aptitude. Additional analysis is needed to inform the ongoing debate about syllabus changes and the protection of actuarial trademarks in the changing financial services marketplace.

### The Actuarial Profession

Long thought of as belonging to one of the most stable and exclusive of professions, actuarial professionals in North America currently number about 20,000. They qualify through the Casualty Actuarial Society (CAS) or the Society of Actuaries (SOA), which set standards of qualification for their membership.


Actuaries evaluate business, economic, and financial implications of future contingent events using economic and statistical techniques. Actuarial candidates can effectively qualify in one of five specialty tracks: finance/investments, group and health benefits, individual life insurance and annuities, pensions, and property/casualty insurance. The actuarial profession has recently experienced some stagnation

in the number of fully qualified members, and has expressed concerns for how to address that issue (although very recently, entry-level candidate numbers have grown significantly). Changes in service provider (life insurance companies, in particular) and employee benefit (defined contribution versus defined benefit) structures have intensified the debate about the profession's future.

The actuarial profession also faces a growing threat from business, where actuarial students' skills are in high demand. Many excellent actuarial students are tempted by Wall Street offers to use their quantitative skill sets immediately for salaries well in excess of what actuarial firms offer entry-level candidates. Faced with a series of professional examinations before attaining professional status, these candidates often choose to exit the exam qualification process.

According to a 2003 article in the *American Business Law Journal*: "The best candidates attract the lucrative business offers, and might be the first to jump ship and avoid the high costs of professional exams. If exams actually improved the candidates' ability to serve clients, the result might be different. Unfortunately, the evidence suggests that the best candidates are increasingly forgoing exams."

Actuaries in the United States achieve professional status by passing a set of examinations prescribed by the CAS or SOA. For example, if candidates pass nine examinations and attend a capstone course on professionalism and ethics, they'll satisfy the membership requirements as a fellow, CAS. For the SOA,



**Actuarial exams  
are notoriously  
difficult.  
Does that  
notoriety keep  
otherwise  
well qualified  
math students  
from the  
actuarial  
profession?**

beginning in 2005, there are nine formal examinations, and a similar capstone course in professionalism and ethics required for fellowship.

There are now about 12,500 fellows in the two societies. Associate membership in the SOA is available after six examinations (seven for the CAS) and an associate professionalism course (in both societies). Exam requirements progress from more technical topics in the early exams toward more applied topics in the latter ones.

The examinations for both associate and fellowship levels are difficult. Generally, well under half the candidates pass a particular exam. Data from the SOA indicate that average age at the attainment of fellowship is now 33, suggesting that a typical candidate could take 10 to 15 years to complete the sequence. This distribution is quite skewed. Some candidates take a very long time to qualify, and there are no limits on how many times any exam may be attempted.

Regarding education, the SOA recommends that in addition to a strong math background, candidates take a variety of college “classes that prepare them to apply a well-rounded business approach to problem-solving and to develop communication skills.” Three years’ experience is also required to be a member of the American Academy of Actuaries (MAAA), which defines a licensed actuary in the United States. All actuaries follow a code of ethics in practice.

In Continental Europe, the qualification process is quite different. There, the process is entirely a matter of university education within an approved program (usually resulting in a master’s degree). In Australia, all but two of the required exams can be waived based on academic education in one of four approved academic programs. The United Kingdom uses a mix of professional examinations and waivers (for approved academic courses).

Only in North America do candidates have to pass all the professional examinations, regardless of parallel education. But changes in the SOA 2005 syllabus begin to permit educational attainment to substitute for examination. Beginning in 2005, the SOA will no longer test macroeconomics, microeconomics, corporate finance, and applied statistical methods. Students can get credit for these modules with a “validation of education experience,” obtained by completing approved coursework.

## The Data

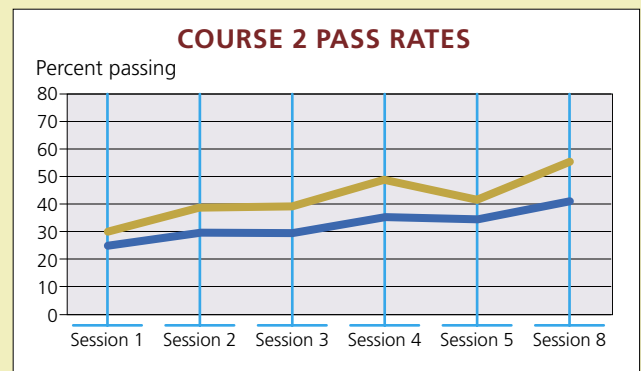
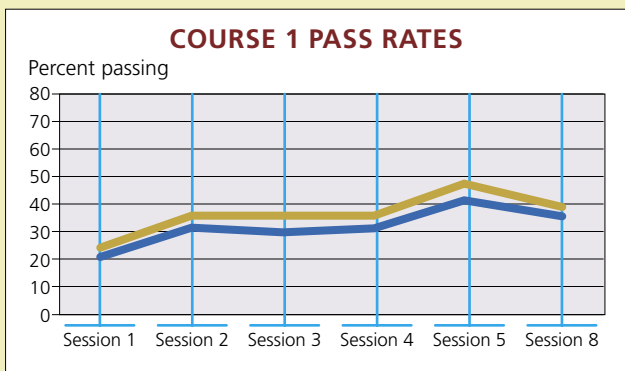
We obtained data from the SOA to analyze pass ratios for recent candidates in Courses 1 to 4. We have two sittings for each exam from 2000 through 2002, or six data sets in total per course. The data contain a flag that allows the identification of those candidates currently in an academic program. To obtain a student discount, academic students must identify themselves as students. The presence of a discount thus provides the incentive to report truthfully.

The raw data contain the following inputs: candidates who are at school full time and applying for a student discount; candidates in the workforce who have identified with the CAS; candidates in the workforce who have identified with the SOA; and candidates in the workforce who have not indicated a societal identity.

At this stage, we have no access to data regarding: (1) aptitude, measured by the candidate’s Scholastic Aptitude Test (SAT) or American College Test (ACT) math and verbal percentile ranking (potentially ranging from one to 99); (2) total number of college credit hours; (3) math or quantitative hours; (4) whether the candidate has a graduate degree; (5) whether the academic program the candidate took would be labeled as an actuarial program; (6) whether the candidate took any review courses for the four exams; (7) whether the candidate has worked with an actuarial firm and for how long; (8) performance on or time taken to pass previous exams; (9) the types of dedicated exam review courses taken; and (10) time from completion of academic program or review course until exam sitting.

The results can be seen in Exhibit I. The data clearly show that candidates who are currently students pass exams at a higher rate than candidates who are not students. This is the case in all four courses, although the differences in pass ratios in Courses 3 and 4 tend to be wider than those in Courses 1 and 2. In sum, the results seem to suggest that education can substitute for exams. Without additional data analysis, however, it’s impossible to discern to what extent these differences derive from education or from other candidate attributes. Education might be a proxy for other candidate characteristics, such as aptitude. Recent research in the *Journal of Accounting and Public Policy* finds that a candidate’s math aptitude is the strongest contributor to success on the CPA exam.

### EXHIBIT I PASS RATES - BY SESSION



## Policy Issues Surrounding Entry Barriers

Despite their preliminary nature, the Exhibit 1 results raise a question for the actuarial profession: "If education can substitute for performance on the professional exam, why have separate exams at every level of requirement?" More particularly, would it be possible to design a set of criteria (similar to current policy in the United Kingdom and Australia) so that a mark of "x" from academic program "y" in course "z" would indicate an extremely high probability that the student would pass the parallel professional examination?

Is the actuarial exam sequence a barrier to entry that contributes to unfavorable implications (e.g., monopoly pricing)? The requirement could allow those who have already "scaled the wall" to "pull up the rope." Over the past several years, the CPA educational requirement was raised from between 120 and 128 academic credit hours (the normal bachelor's degree requirement) to 150 hours in most states. Surprisingly, researchers found evidence that the rule will reduce overall audit quality. Some pre-rule CPA candidates, who would not otherwise enter the market, will do so to reap higher fees. Some post-rule CPA candidates will not enter the market due to higher entry costs.

What impact does the actuarial exam sequence have on the actuarial profession? Is it a necessary barrier to entry, or is it chasing away the best and brightest candidates?

## Exam Sequence Redesign

A narrow set of coursework in the early actuarial exams creates an "eye of the needle" problem for the actuarial profession. Other professions, such as medicine, begin with a broad base of knowledge, followed by more specialized training. Conversely, actuaries first require candidates to pass a challenging yet narrow set of exams (one through four) based on applied probability, statistical modeling, and evaluation of contingent events. Later exams are broader in scope and more applied.

If the technical exams at the beginning of the sequence can be satisfied by approved education, as is done in countries outside of the United States, this eye-of-the-needle problem may disappear. The larger issue for the actuarial profession is that issues about design of the exam sequence are confounded by issues about the evolving nature of the profession. Do actuaries

want to be generalists who need broad knowledge and considerable interpersonal skills? Or are they specialists to whom only narrow problems are referred?

The CPA experience is instructive for the actuary. Professional success in accounting is increasingly linked to breadth of knowledge and skills, but CPA exam requirements are narrow and technical. Planned changes to the CPA examination structure emphasize a broader set of competencies and adaptability.

Professional accounting is in a period of unprecedented restructuring that is forcing CPAs to become more adaptive. That profession is undergoing a paradigm shift to skills-based learning rather than knowledge-based requirements because the accounting body of knowledge is changing so rapidly.

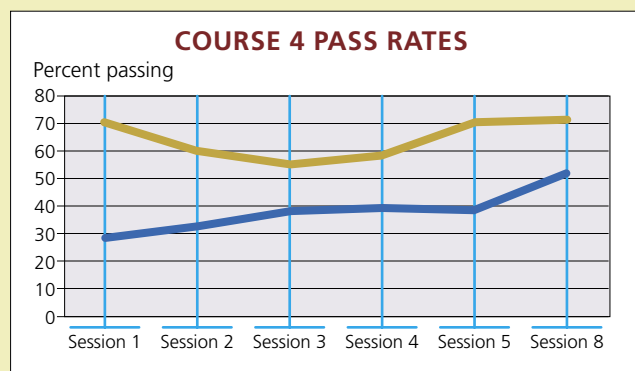
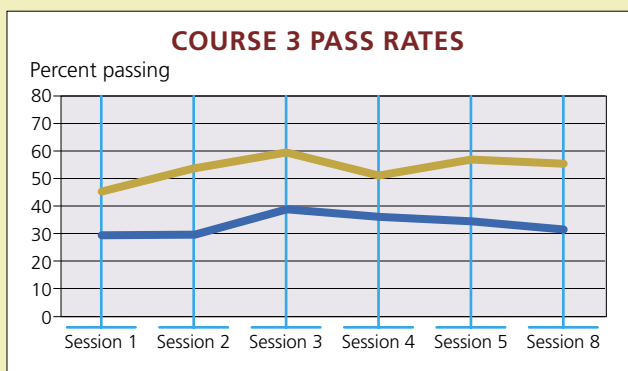
If the actuarial profession is to follow the accounting profession, then actuaries will need to be more broadly trained, and the actuarial exam sequence will have to assess a broader skill set. Recent surveys of actuarial employers done by the SOA show that actuaries rank very high in four attribute areas: ethics, quantitative modeling, solving complex problems, and financial assessment and reporting. On the other hand, deficiencies are found in the following areas: "takes informed risks, business communications skills, proactive, focus on the big picture, and business acumen."

The examination process as currently structured tends to reinforce the strengths and ignore the weaknesses. De-emphasizing the technical course exams by allowing education to substitute for them would be a step in the right direction. Adding case-based exams that rely on information synthesis, business acumen, and creativity would move the exam sequence more toward actuarial practice. The educational programs for actuaries can also take a role by emphasizing coursework that builds business communication skills, creativity, and broader business knowledge. Stated succinctly, similar to all financial services professionals in the information age, actuaries must become more entrepreneurial.

## Need for Additional Research

Do dedicated exam review seminars substitute for education on actuarial exams? How important is aptitude to success? Can  
*(Continued on Page 44)*

— = Student — = Non-Student



# ACTUARIAL BOOT CAMP

By Debbie Shapiro

"I did yard work right after my exam, and it was awesome."  
Rocky LaTronica, actuary, NCCI Holdings, Inc.

You're having that nightmare again—the one where you're back in college, rushing frantically to get to an important final—but you're hopelessly unprepared! You wake up—what a relief—it was only a dream, and you don't have to deal with tests anymore. But if you're an actuary, you probably wake up many mornings to the reality of a huge exam looming on the horizon.

Most of us know that actuaries take exams—and that they're difficult—but we don't know the full story. While lawyers and doctors take the bar exam and medical boards, the actuarial profession may be the only livelihood that requires its members to pass a series of tests over a period of years in order to advance in their field.

To attain fellowship in the Casualty Actuary Society (CAS), a candidate must pass nine long exams. Fellows in the Society of Actuaries (SOA) pass seven exams and complete 50 hours of professional development activities. Testing takes place twice a

year, and the exams are so rigorous that up to 400 hours of study are recommended in order to pass each one.

Says NCCI's Scott Sobel, "You might spend the equivalent of 20 work weeks a year studying for two exams—you absolutely cannot cram for these tests." Candidates must be able to solve complex problems as well as memorize vast amounts of information on all aspects of the insurance industry. (See opposite for a sample question.)

The exams are graded on a curve, and only 30 percent to 40 percent of all candidates make the cut each time.

## The Secret Life of Actuaries—Revealed

Although some companies allow their actuaries up to 120 hours of study time at work, the remaining 280 hours per test must be accomplished while the rest of us are enjoying our evenings and weekends—hanging out with friends, watching *American Idol*, doing Disney World with the kids, folding laundry, and sleeping. The key to the secret life of actuaries is that for several months each year, they have no life.

The average "travel time" (industry lingo for the time it takes to complete all the exams) is 10 to 12 years. It's very common to fail an exam on the first or even second attempt. Being single seems to be an advantage when setting aside time to prepare without guilt. But even with no immediate family to alienate, the single actuary still runs the risk of being all but forgotten by friends who tire of getting turned down for socializing two or three months running.

Dennis Mealy solved that problem during his early years at Wausau. He did his studying and socializing with a "fraternity" of coworkers who all had the same goal—getting through the exams quickly. "We'd meet for early weekend breakfasts," he says, "and then hit the books."

Several married actuaries reported that although their spouses were extremely supportive, the time away from the family during "study season" could take its toll. While spouses do all of the household chores, attend social functions alone or not at all, and tend to children and in-laws, exam takers may be found at any hour of the day or night curled up in a cocoon of study materials, either revved up on caffeine or asleep and drooling on a pile of books.

Poor eating habits and lack of sleep and exercise can lead to health problems, fatigue, and weight loss or gain. After weeks of sitting inside in solitude, Rocky LaTronica couldn't wait to get out in the sun: "I did yard work right after my exam, and it was awesome."

## Companies Offer Encouragement

Experienced actuaries are highly valued, and most companies provide theirs with a great deal of support throughout the exam process. Benefits include study time at work, paid attendance



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at review seminars, and reimbursement for study materials and exam registration fees. When candidates pass exams, they're often given salary increases and/or bonuses.

### Neither Rain nor Sleet ...

After months of preparation, the actuary's drive to take the exam, no matter what, is comparable to a sea turtle's compulsion to lay her eggs in the sand. Brett King left for his honeymoon two weeks before Exam 2 and didn't lift a book for the duration. Still, he sat for the test. Another actuary checked herself out of the hospital following an appendectomy and had to be carried into the exam room. She passed.

But Angela McGhee wins the award for pure dedication. She took an exam at home after giving birth just two days before. Her next child was born only two days *after* she took an exam.

### Exam Day: Actuaries on Edge

In the exam room, distractions like a ringing phone or noisy candy wrapper can drive the test taker to madness. Panic may set in. Robert Moss said, "I went through the first 10 questions and didn't know a single answer. I felt my heart sink." Eventually he relaxed, regained his memory, and passed the test.

Decisions must be made—drinking lots of coffee to stay sharp increases the chance of having to visit the restroom, which can waste precious time. (See opposite.)

Some actuaries rely on rituals or superstition to give them a psychological advantage. Dennis Mealy wore green to every exam and sat in the exact same spot. Another candidate carried a "lucky" pencil from a friend who'd passed all the exams—it worked for one test but not the next, so he threw it away.

Then there are times when all the planning and studying imaginable won't help if your luck has run out. Imagine how Scott Sobel felt when told that his exam was lost en route to CAS headquarters. He had no option but to take the same exam all over again.

About two months after exam day, results are posted online. It's awkward to get the news at work—if you haven't passed, you want to be alone, and if you have, you don't want to show too much excitement in front of others who have nothing to celebrate. Rocky Latronica's ritual works for him. He prints and folds the list

without looking at it and runs outside to the parking lot. He opens the list. "Then," he says, "I'll either cheer or cry."

### Is It Worth It?

If they were able to do it all over, would they choose to be actuaries? Of those polled for this article:

- 70 percent said "most definitely," "absolutely," or "I like to keep learning, so it's a good fit"
- 10 percent responded "probably" or "it's too early to know"
- 20 percent said either "no" or "I don't think I would"

So what keeps actuaries going as they travel the grueling path to CAS or SOA fellowship? "Dreaming of how good life will be after these exams are behind me" is a typical response. Rocky Latronica thought for a minute about what motivates him. "Pride," he said. "Passing these exams is one of the things I did that very few people have done."

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### SAMPLE EXAM QUESTION

A survey of a group's viewing habits over the last year revealed the following information:

- 28% watched gymnastics
- 29% watched baseball
- 19% watched soccer
- 14% watched gymnastics and baseball
- 12% watched baseball and soccer
- 10% watched gymnastics and soccer
- 8% watched all three sports

Calculate the percentage of the group that watched none of the three sports during the past year.

- 24%
- 36%
- 41%
- 52%
- 60%

### COFFEE/RESTROOM PROBABILITY FORMULA

The goal is to drink the optimal amount of coffee that maximizes test performance and minimizes trips to the bathroom:

$$\text{Max} \left[ \left( \frac{\text{caffeine} / \text{flr}}{\text{coffee}} \right) (\text{pt elasticity of caffeine} - \text{CB}^2) - \left( \frac{\text{pts lost}}{\text{min}} \right) \left( \frac{\text{min}}{\text{bathroom visit}} \right) \left( \frac{\text{bathroom visit}}{\text{bf}_{\text{beg}} + \left( \frac{\text{water}}{\text{coffee}} + \text{sf}(1-dt) \right) (1 - \text{bmsf} + \text{dbf}^2)} \right) \right]$$

where: **flr** = food leverage ratio; **CB2** = caffeine buzz ratio; **bf<sub>beg</sub>** = bladder fullness prior to coffee intake; **sf** = stomach fullness; **dt** = digestion rate (d) x time (t); **bmsf** = bladder/mental sharpness ratio; **dbf2** = dam breakage factor

(Continued from Page 41)

education offset a disadvantage in aptitude? What impact does actuarial practice have on exam success? Currently, lack of data makes these questions difficult to answer.

Additional data could also permit an analysis of endogenous relationships. Perhaps stronger students take exams earlier. Or education might allow students to assess their strengths, thereby timing the taking of exams more effectively. In either case, the causal link between education and exam success could be undermined.

This analysis is particularly important given the changes in the 2005 SOA syllabus. If education isn't a strong input to success in the presence of other candidate attributes, then allowing educational attainment to substitute for exams might not be appropriate.

Removing exams if they're a proper barrier to entry also removes a credible indicator of success to both recruiter and candidate. With fewer exams, employers will have to rely on grade-point averages and other measures of quality to distinguish students. If education isn't strongly related to exam success, then relying on these indicators might be a faulty signal.

Research that addresses marginal explanatory power of candidate attributes and endogenous relationships is critical to inform the future of the actuarial profession. Similar to the accounting profession, it may be that changes in actuarial entry are only in the beginning stages.

### Credential Competition

The protection of professional actuarial credentials from competitive erosion is more important than ever before. Professional certification primarily connotes trust, a function of both client recognition and provider reputation. What role does the actuarial exam sequence play, and what is the role of actuarial education in the support of actuarial credentials?

The strategy for a particular profession in choosing its barriers to entry often depends on its existing trademark position. Such position is a function of size (impact), distinction (strength of mark and competition), and exclusivity (measured by entrance difficulty).

As we've seen, actuaries probably have the greatest entry barriers of all financial services professions. Their situation is complicated by the profession's relatively small size and historically narrow institutional focus in the insurance industry and on defined benefit pension plans. The trend is toward integrated large financial service providers and defined contribution plans. In general, the threat of disintermediation in the cyber-economy is pushing all financial service professions closer to their customers for fear of being "cut out" of the primary adviser role by another provider. This is clearly a business threat to actuaries if the profession remains "experts to whom narrow, technical problems are referred."

While the policy implications of our results suggest substitution of educational attainment for exams would align well with the evolving marketplace for actuaries, such a change necessarily means that two individuals will hold the same designation with the senior of the two having gone through the more costly exam entry sequence. Existing professional members might not

appreciate what they consider to be the resulting "brand dilution." This could lead to a clash of incentives between leadership of the profession and the membership.

Leadership of the profession articulates concerns for the profession's long-run viability, but members tend to be concerned with short-term pricing power. Some members, who are well established, really may not "need" the credential anymore, absent a legal requirement to have one. Standards dilution might concern the members who are building practices more than well-established professionals.

Leaders are also prone to *ad hominem* attacks that their efforts to increase the size of the profession coincide with increased prestige for the leadership of the profession.

### Conclusions

Candidates who are currently full-time students in academic programs tend to pass actuarial Exams 1 through 4 at a higher rate than those candidates who are not currently academic students. The differences are stronger just after the exam change (in May 2000) and stronger in later exams (2 through 4) compared to Exam 1.

The results suggest that technical exams early in the sequence could be replaced by an educational requirement, which is done virtually everywhere else in the world. But the results are certainly preliminary in that a number of candidate inputs to exam success (and thus entry into the actuarial profession) remain unknown.

Continued research into the factors linked to success on actuarial exams has implications for both the design of the exam sequence and for the competitive positioning of the actuarial profession in the increasingly competitive financial services marketplace. ●

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