JOURNAL OF
RISK EDUCATION

Volume 10, Number 1, 2019

Table of Contents

Editor's Report 3

Call for Papers 4

Best Practices Make Progress: When the Talent Gap and Undermatching Crisis Meet 5

Opening the Black Box: Teaching the Mechanics of Monte Carlo Simulation Through Value at Risk 16

Agent/Broker Errors and Omissions In An Illustrative Commercial Property Insurance Case: A Risk Management Perspective 24

Dynamic Analysis of Total Cost of Risk with Simulation Software 35

Editor's Report

I am pleased to bring to you the 2019 issue of *Journal of Risk Education (JRE)*. Admittedly it is being published in 2020, but it is being published!

Thanks to the reviewers and associate editors who worked so hard to achieve our goal of fast turnaround on the submissions we receive. Any delays in turnaround this past year are my fault and mine alone.

There has been some discussion about possibly affiliating this journal with one of our academic associations. I would like your feedback on this idea. I need to hear from the readers of this journal before I make such a drastic change. I hope you will contact me at editor@jofriskeducation.org with your candid and confidential feedback.

Please continue to send us your papers for consideration. If you have questions, don't hesitate to ask them.

Sincerely,

Brenda Wells, Ph.D., CPCU, AAI, CRIS

Editor
Robert F. Bird Distinguished Professor of Risk and Insurance
East Carolina University

Call for Papers

The *Journal of Risk Education* (*JRE*) requests submissions of articles and other materials for its 2020 and 2021 issues.

Submissions may be of most any format, as the journal offers several publication features:

Articles: double-blind peer reviewed articles related to risk management and insurance teaching and education. Both theoretical and pedagogical pieces are encouraged.

Editorials: editorially-reviewed commentary related to risk and insurance education.

Book Reviews: editorially-reviewed summaries of books and periodicals that pertain to risk management and insurance, with preference given to those items that have practical classroom applications.

Doctoral Perspectives: double-blind peer reviewed articles that are by or for doctoral students planning to become risk educators in the future. Any topic of relevance to doctoral candidates may be submitted.

Teaching Cases: cases for use in the risk management classroom. Teaching cases should be founded in the academic and practitioner literature, and will be double-blind peer reviewed.

To submit an article for consideration, please create an account on our website at www.jofriskeducation.org and follow our electronic submission process. If you are willing to serve as a reviewer for future papers, please contact the editor.

For questions and more information, please contact:

Dr. Brenda Wells, CPCU, AAI, CRIS, Editor
East Carolina University
www.jofriskeducation.org
E-mail: editor@jofriskeducation.org

Best Practices Make Progress: When the Talent Gap and Undermatching Crisis Meet

Jamie Parson, JD
Appalachian State University

ABSTRACT

Diversity and inclusion are important to the insurance industry as an evolving business imperative. Insureds come from a variety of backgrounds and demand cultural competency as customers. A diverse and culturally proficient student body is important in meeting the increasingly diverse employment needs of the insurance industry. This article addresses one Risk Management and Insurance program's initiative to recruit a diverse student body and create a more inclusive academic culture. Practice does not make perfect. Practice makes progress. Diversity and inclusion best practices do not make a perfect program, but they can aid in the progress of a program.

INTRODUCTION

Diversity and Inclusion matters. Demographic projections by the U.S. Census suggest by 2044 the U.S. will be majority non-white (U.S. Census, 2015). A number of recent studies document the value a diverse and inclusive workplace culture brings to business (Sherbin & Rashid, 2017).

Diversity and inclusion are of particular importance to the insurance industry. Insureds come from a variety of backgrounds and demand cultural competency as customers. Insurance consumer experiences are no longer shaped by the insurance product alone but rather the experiences had with the online and app-based market. Over $8 billion was raised by InsurTech companies globally between 2014 and 2018 (FinTech Global, 2018). Therefore, diversity of thought often produced by demographic diversity and cultural awareness is a relevant factor to innovation needs brought by new technologies and efficiency models.

A diverse and culturally proficient student body is important in meeting the increasingly diverse employment needs of the insurance industry. RIMS (2019) reports only 16% agree that there will be a sufficient number of risk management graduates to meet market demands in 2025.

In 2016, PwC released a survey on diversity and inclusion of roughly 8,000 millennial women. In this survey, 13% of women said they would not want to work in the insurance industry because of its image, one of the highest ratios for any job sector in the survey (PwC, 2016). A recent study by Marsh (2018) in the Journey of African American Insurance Professionals suggests that while there is general job satisfaction once in the insurance industry, there is little is being done to recruit African-Americans to the industry. Participants in the study stated in addition to nepotism and lack of historically black college and university (HBCU) recruitment, insurance organizations generally look for students with risk management and insurance coursework, which are not taught at most universities (Marsh, 2018).

While the latter is perhaps true in the grander scheme of the number of colleges and universities in the U.S., there are over 60 schools that offer risk management and insurance undergraduate curriculum and over 40 schools with undergraduate majors in various locations across the country (InsurMyPath). These schools are uniquely positioned to already have the attention of insurance recruiters and thus have the ability and the resources to expose students to the insurance industry; which means that these schools are also in a position to expose students of diverse identities to the insurance industry (Pope & Goebel, 2016). This is not to say that HBCUs are not a good place for companies to find diverse talent for insurance careers. In fact, there are perhaps unexplored opportunities for predominately-white institutions who are already delivering insurance content to collaborate with HBCU programs.

Practice does not make perfect. Practice makes progress. Diversity and Inclusion best practices do not make a perfect program, but they do advance in the progress of a program. This paper contributes to the developing literature regarding the challenges and successes of Risk Management & Insurance programs. This article addresses one Risk Management and Insurance program's initiative to recruit a more diverse student body and create a more inclusive academic culture. Part I provides background and a profile of the institution and community where the program is located. Part II gives a framework of implemented programs. Part III identifies early program outcomes followed by Part IV, which addresses challenges and future direction.

PART I: BACKGROUND

The University & College Program

While a long-standing part of academic education-diversity, equity, and inclusion are evolving into strategic initiatives and core values for many colleges and universities including Appalachian State University (hereafter "Appalachian State" or "Appalachian"). Appalachian State is located in the rural mountains of western North Carolina and is home to a campus of roughly 19,000 students in a community of about the same size (Appalachian State, 2019).

90% of students attending Appalachian qualify for in-state tuition, 16% identify as racially and ethnically underrepresented students, 290 (1.5%) students are veterans, and the school maintains a 43:57 male-to-female ratio (Appalachian State, 2018). The city of Boone is 7% racially and ethnically diverse, has 326 (less than 2%) veterans, and roughly 58% of persons in poverty (U.S. Census, 2018). North Carolina is 30% racially and ethnically diverse, has 670, 326 veterans, and about 14% of persons in North Carolina are in poverty (U.S. Census, 2018).

The Walker College of Business (WCOB) is an AACSB accredited business school with fourteen majors, fifteen minors and three masters programs including MBA, Accounting and Data Analytics. There are approximately 3,000 undergraduate students and 150 graduate students as of 2019. The WCOB has roughly 15% racially and ethnically underrepresented students, and a 67:33 male-to-female ratio (IRAP, 2018).

While some suggest defining diverse demographics is counterproductive to inclusivity, Williams (2013) states that an unclear diversity definition muddles the mission and can stall the movement. He also recognizes that the definition of diversity is different based on the context in which it is used. Like much of the business industry, Appalachian and the WCOB define diversity broadly including but not limited to race, color, national origin, gender, gender identity, first-generation, low-income, veteran status, (dis)abilities and those from rural communities (Walker College of Business, 2019).

Risk Management & Insurance Program

Since 1988, the Brantley Risk and Insurance Center has supported the Risk Management & Insurance major. The Brantley Center is a privately funded entity within the Walker College of Business that receives no state funding. The Center is led by a managing director with the support of an advisory board and a small cohort of faculty and staff. It provides resources to prepare students for a wide variety of professions within the insurance field. Three academic programs feed into the Brantley Center: students majoring in Risk Management and Insurance, Actuarial Science and those who are minoring in Employee Benefits. There are on average around 200 students majoring in RMI with about 60% of those students double majoring (usually in Finance or another College of Business major). The Employee Benefits program has around 20-30 students from various majors across campus. At Appalachian, Actuarial Science is located in the Math Department in the College of Arts & Sciences and has around 60 students.

Students receive soft-skill development, career fair experiences, extensive travel opportunities to risk and insurance-related events, guest speakers and a plethora of networking opportunities. While not every school with an RMI or Actuarial Science program has a formal center, many schools provide similar opportunities to their students with the unwavering support of dedicated faculty and specialized staff.

PART II: BUILDING INSURANCE TALENT INITIATIVE

Building Insurance Talent Background

Building Insurance Talent (BIT) was piloted from 2009-2011 through the Risk, Management and Insurance Program after the Associate Director's realized the major had little to no ethnically diverse students in the program to apply for a scholarship serving underrepresented populations in the insurance industry. With the help of the company offering the initial scholarship and a few other supporters, the program successfully increased the percentage of ethnically and racially diverse RMI majors from 1% to 11% in two years; providing these students opportunities in industry travel and preparing them to be competitive in the job market. Additionally, job placement for those students participating in the program was above 95%. After the Associate Director left to serve at the College Level, there was no one to champion the program. Therefore, it dissipated and consequently so did the number of ethnically diverse students. Organizational responsibility where a person or group leads the creation and measurement of goals is critical to providing effective diversity and inclusion programs (Kalev et. al., 2006). Likewise, diversity without inclusion efforts does not foster sustainable growth (Sherbini & Rashid, 2017).

Building Insurance Talent Regeneration

In light of the evolving vision around diversity and inclusion at the university level, the Brantley Center decided to revitalize the Building Insurance Talent program. The Center hoped to develop a robust program to introduce diverse students to the endless potential in Risk Management and Insurance and provide the students with the tools and resources to succeed in the industry. While all of these initiatives run ad hoc, the Center has come to realize one comprehensive program might be more sustainable and successful in building relationships with students earlier on in their academic ventures. This concept has yet to be tested therefore the ad hoc initiatives are separately outlined below.

Recruitment Initiatives

There is extant research on college undermatching however; the idea of career undermatching is new. Career undermatching is a term coined by Jessica Pilksa founder and CEO of The Opportunity Network, a nonprofit guiding low-income youth to college and career success.

> "Career undermatching describes the phenomenon in which talented, college graduates from low-income families wind up in jobs that don't match their abilities or ambitions. Instead, they work in jobs that are less stimulating than they want, below their skill set and qualifications, offer lower pay scales and provide fewer opportunities for advancement." (Pilksa, 2016)

While career undermatching primarily impacts first-generation, low-income students, it often intersects with those from other traditionally underrepresented groups such as race and ethnicity. One of the most significant impacts professors can have on the undermatching dilemma is to provide students with accurate information about the insurance industry. First, there is a talent crisis in the risk management and insurance industry, which means job opportunity (Wells, 2009, Cole & McCullough, 2012). Second, while the agency is a significant contributor to the insurance industry, there are a plethora of opportunities outside of the traditional sales skill set relevant to the insurance industry that are not well known to the average student. For example, the introduction of InsurTech provides an interdisciplinary need for more diverse skill sets including math, computer science, and data analytics.

Third, diversity and inclusion is no longer a philanthropic initiative. It is a business imperative (McKinsey, 2015 & McKinsey, 2018).

The Center hosts an "Inclusive Excellence in Risk Management and Insurance Dinner" every spring to recruit students from diverse identities. The program features diverse industry professionals (alumni & non-alumni) as well as members of Gamma Iota Sigma. The dinner is geared towards freshmen, sophomores, and transfer students of various diverse identities. The Center works with partners across campus to invite students to the dinner. This program aims to recruit diverse undergraduate students with an interest in pursuing a degree in Risk Management & Insurance or Actuarial Science. It also serves to encourage undecided majors from underrepresented backgrounds to consider the Risk Management & Insurance or Actuarial Science major.

There are other ways to reach students if a formal dinner is cost-prohibitive including an Ice Cream Social or Meet the Industry Social where students gather for an intimate networking opportunity to learn more about the Risk Management and Insurance program. No matter what the format of the event, the key is to have a structured intimate gathering for students to interact with peers, faculty and/or industry. Networking events that serve to recruit students receive unwavering support from industry partners as they genuinely enjoy the opportunity to engage with students and speak intentionally about a career that many of them just "fell into".

Students are the best recruiters of other students as they often look to each other for advice on choosing a major (Wells, 2009). Gamma Iota Sigma (GIS) plays a critical role in student recruitment. The Appalachian State GIS added a leadership role called the Inclusive Excellence Liaison in 2018. The purpose of this role is not to "guarantee a spot for a diverse person" on the leadership team but rather to foster inclusiveness strategically and practically in the organization. The Grand Chapter of GIS launched GammaSAID (Solutions for Authenticity, Inclusion and Diversity) a few years ago which has led half of the chapters to create a GammaSAID position within the student leadership.

Retention/Support:

Efforts in recruiting traditionally underrepresented students are useless without strategic retention and support initiatives. Social capital and mentoring relationships directly correlate with student success in college (Crisp, 2010; Stanton-Salazar 2011). Social capital looks at the transition a student makes in their social network between high school and college. Often, the high school and community connections weaken and a student fails to create ties in college, which can be detrimental to academic and professional success (Schwartz et. al., 2016). One of the significant contributors to low graduation rates among racial and ethnic minorities is the failure to develop meaningful on-campus connections (Baker, 2013).

Low-income, first-generation students are about four times more likely than their counterparts to leave after the first year of college (Engle & Tinto, 2008). Faculty support is the most important type of social support in a student's academic success (Baker, 2013). The need for a social connection from peers and faculty is also true for veteran and LGBTQ+ students (Olsen et. al, 2014; Avery et. al., 2016). Imagine a scenario of a first-generation student entering college several hours away from home when none of their friends went to college. Not only may the students struggle with creating social capital in their new environment, they may also struggle with maintaining existing social capital with peers who are not in college environments.

The Brantley Center's board of advisors came together to create an Executive Mentoring Program. Ten students were selected as mentees and matched with mentors from the insurance industry. Mentors were recommended by members of the advisory board and contacted by the sub-committee to gauge interest. Each mentor had one mentee. Crutcher's (2007) suggests that mentoring programs that struggle to find mentors, particularly mentors from underrepresented populations, need to focus on strategies to make cross-cultural mentoring work.

While there was some effort made to match students across identities, most students from non-white backgrounds were willing to be with a mentor outside of their racial identity. Therefore, the only identity considered was gender.[1] Additional factors used for pairing included career interests, hobbies, and personality preferences. The mentors and mentees were introduced via email by a coordinator. Mentors were asked to make the first non-email contact prior to the Kick- off Meeting. The Kick-off Meeting included a networking social, team-building exercises and time for the mentor and mentee to schedule their next interaction. Every month, the sub-committee holds a conference call with the mentors to check in with challenges and provide updates on upcoming events such as the career fair or final exams. No mentoring relationship poses the same challenges but often similar challenges arise and the monthly phone calls enable the mentors to share experiences and ideas.

Like many Risk Management & Insurance programs, students have the opportunity to travel to industry events. Over the last few years, several students attended the National African-American Insurance Association (NAAIA) Conference as well as the Latin American Association of Insurance Agencies (LAAIA) conference.

Over the last two years, the Brantley Center supported 2-4 students to attend the *National African-American Insurance Association Conference (NAAIA)* held in Atlanta, Georgia. This conference gave students the chance to learn about issues affecting the African-American insurance community as well as provide an opportunity for them to network with other students and industry leaders for diversity and inclusion. The assessment of the success of these programs is anecdotal. Students who attended these conferences walked away with mentorship opportunities and industry contacts to help them achieve the next level of success whether that was formal mentorship, internship or a job prospect. Additionally, as these students started to travel to other industry events, they saw familiar faces, which helped them form social capital within the industry very early on in their careers.

The Importance of a Designated Leadership

Having a designated coordinator, whether faculty or staff, is critical to the success of creating a robust and sustainable diversity and inclusion initiative. Without a coordinator, it is difficult to establish credibility and relationship with marginalized campus communities. Without credibility and relationship, it is difficult to assess and meet the needs of underserved populations. Without meeting the needs of students, it is difficult to effectively attract and retain talent.

Consistent delivery and monitoring of diversity and inclusion efforts are important to the viability of the program. The current role of the faculty coordinator includes working with a focus group on the board to develop programming, recruit students from underserved and underrepresented populations, assess and monitor the needs of those students, and serve as a liaison between various constituents when challenges arise. Industry partners also appreciate having a designated person to turn to when they have diversity and inclusion specific information (reports, upcoming events, etc.) to share.

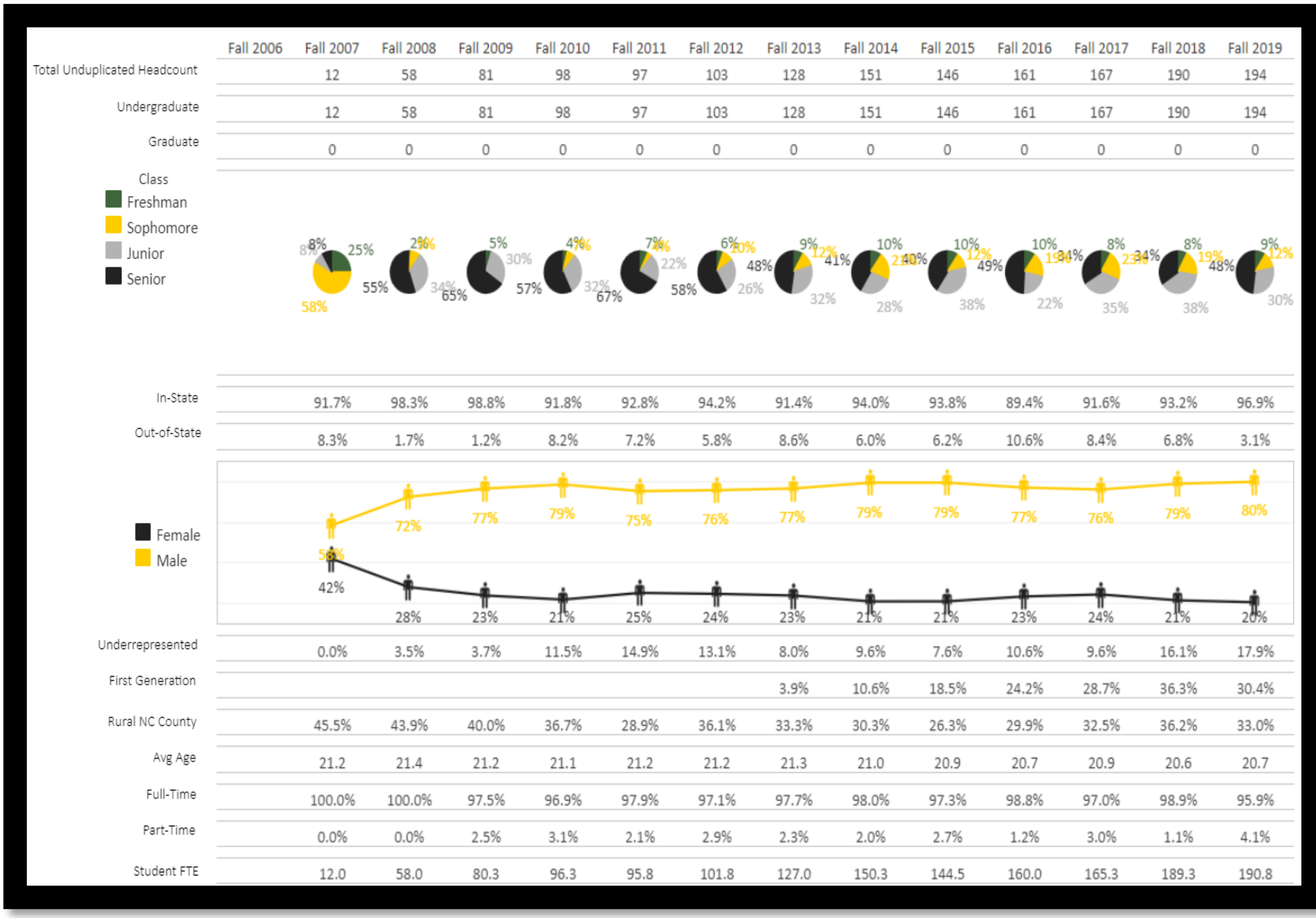
The generation of students coming through college today value secure and stable pathways and have an innate ability to sense authenticity (Williams et. al, 2017). If diversity and inclusion comes with waves of support in the form of one-off programming or inconsistent support in the classroom, students will recognize the imitative efforts and turn to other academic programs where diversity and inclusion are consistently interwoven.

[1] Note: No student in the pilot identified as non-binary.

PART III: EARLY OUTCOMES

It's difficult to attribute increased diversity within the RMI major to one particular initiative. It is likely a unique combination of various programs and support that represents each student's journey through the Risk Management & Insurance program.

The chart below shows several undergraduate underrepresented student population percentages from 2006 through 2019. The Fall 2019 headcount includes students who intend to or have declared Risk Management and Insurance as a major. University Census data was used to measure changes in First Generation, Ethnicity and Rural diversity make up from 2006 through 2019, including the BIT program from 2009-2011 and then relaunch in 2017.



	Fall 2006	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	Fall 2017	Fall 2018	Fall 2019
Total Unduplicated Headcount		12	58	81	98	97	103	128	151	146	161	167	190	194
Undergraduate		12	58	81	98	97	103	128	151	146	161	167	190	194
Graduate		0	0	0	0	0	0	0	0	0	0	0	0	0
In-State		91.7%	98.3%	98.8%	91.8%	92.8%	94.2%	91.4%	94.0%	93.8%	89.4%	91.6%	93.2%	96.9%
Out-of-State		8.3%	1.7%	1.2%	8.2%	7.2%	5.8%	8.6%	6.0%	6.2%	10.6%	8.4%	6.8%	3.1%
Male		58%	72%	77%	79%	75%	76%	77%	79%	79%	77%	76%	79%	80%
Female		42%	28%	23%	21%	25%	24%	23%	21%	21%	23%	24%	21%	20%
Underrepresented		0.0%	3.5%	3.7%	11.5%	14.9%	13.1%	8.0%	9.6%	7.6%	10.6%	9.6%	16.1%	17.9%
First Generation								3.9%	10.6%	18.5%	24.2%	28.7%	36.3%	30.4%
Rural NC County		45.5%	43.9%	40.0%	36.7%	28.9%	36.1%	33.3%	30.3%	26.3%	29.9%	32.5%	36.2%	33.0%
Avg Age		21.2	21.4	21.2	21.1	21.2	21.2	21.3	21.0	20.9	20.7	20.9	20.6	20.7
Full-Time		100.0%	100.0%	97.5%	96.9%	97.9%	97.1%	97.7%	98.0%	97.3%	98.8%	97.0%	98.9%	95.9%
Part-Time		0.0%	0.0%	2.5%	3.1%	2.1%	2.9%	2.3%	2.0%	2.7%	1.2%	3.0%	1.1%	4.1%
Student FTE		12.0	58.0	80.3	96.3	95.8	101.8	127.0	150.3	144.5	160.0	165.3	189.3	190.8

Source: Appalachian State Institutional Research, Assessment and Planning (IRAP), 2019

PART IV: CHALLENGES AND FUTURE DIRECTION

Financial Support

Diversity and Inclusion work is challenging and time-consuming. In an ideal setting, there would be an entire team of faculty, and staff exclusively dedicated to diversity and inclusion work in the Center. Many institutions, including Appalachian, do not provide for such expansive resources. Therefore, the challenges assessed will not focus on this area of need. To quote Arthur Ashe, "Start where you are. Use what you have. Do what you can."

For the most part, the Center covers student travel. However, there are incidental expenses that come up such as providing for a meal while traveling, having proper travel equipment (such as a suitcase), having the proper business and business casual attire which are typically covered by the student. Additionally, student members of Gamma Iota Sigma Fraternity often pay bi-annual dues. While many students work and/or have the funds to cover these costs, some do not. Often, the students who do not have the funds come from low-income backgrounds or are self-supporting due to lack of parent support or loss of parents. These students often choose not to participate vs. draw attention to their inability to acquire the funds.

The Center discovered that providing a non-confrontational mechanism for students to identify themselves as high need for these resources is the easiest way to meet this particular need. The form is located on a main college page and includes identification information as well as a list of options for students to articulate the evidence of financial need (i.e. Pell Grant Recipient, high need FAFSA, and other federally supported programs). There is also a fill-in-the-blank option for students who suffer undue hardship during the semester such as loss of a parent, sick parent or loss of a job as a self-supporting student.

Asking a student to provide evidence of financial need is helpful to deter a rare number of students who may take unfair advantage of the resource. The faculty coordinator receives a notification and coordinates a plan of action with the Center Director on how to best support the student for the present situation but also future funding needs so the student does not have to repeat the request.

As far as funding these supplemental expenses, the simple fix is to pay for these expenses with unrestricted funds or in the case of Gamma dues, absorb the cost as an organization. Another solution is to provide a stipend/scholarship to need-based students to offset the cost of travel and dues. However, it is imperative to know how financial aid works on your campus. Delivering a simple stipend can be complicated by institutional hurdles if a student is participating in a scholarship program that consequently absorbs additional scholarship support. Funding students in need is another opportunity to engage industry support. It is particularly effective in engaging young alumni who are eager to make an immediate impact but do not have the resources to commit to annual giving.

Academic Success Support

Academic support can be a challenge regardless of student identity. The Brantley Center piloted an academic support cohort with minimal success. The program was designed to offer workshops and create a study hall environment at the end of every week. The Center partnered with other campus programs to deliver academic success workshops. The initial pilot invitation included almost 150 students identified as a participant in the BIT program, transfer student, or student under a 3.0 GPA (not all of these students were from traditionally underserved backgrounds). Less than 1% of those invited attended the sessions. While some of the first two groups were performing to academic standards above a 3.0, others were not.

Preliminary assessment of this pilot indicated a vast majority of students didn't think they needed assistance, had club/organization/campus event conflicts, had to work, or were not motivated to attend. Getting students to appreciate campus resources is not a new phenomenon and a frequent challenge. However, of particular concern were working students who are often first-generation, low-income or self-supporting. In the future, we would target younger students (freshman, sophomore, transfer students in their first semester) as building study skills much later almost comes too late to establish a solid GPA for internship placement. Additionally, a monetary incentive for participating in a combination of these programs would help offset the financial burden imposed by attending campus workshops when a student could be working.

Building An Inclusive Community For All

Creating a greater sense of community while shepherding a cohort of diverse students can be challenging. Students tend to gravitate toward familiar identities and if the only identities they see in the program belong to the cohort, then students can find it difficult to interact with other non-cohort students. Before completing the analysis of the third challenge, it is imperative to add the fourth challenge into the mix.

The fourth challenge is deciding which of the above-mentioned events should be open to underrepresented/identity specific students vs. those that should be open to all students. Students of historically marginalized or underserved backgrounds often need the space to have transparent conversations about issues they face in the comfort of individuals and cohorts with shared identities. At the same time, exclusively segmenting students by visible identities can discourage a program from embracing intersectionality and achieving the ultimate goals of inclusion. Beyond the value to the program, there are several key educational benefits to engaging students across identities including exposure to more varied viewpoints, increased cultural competency and development of ethical standards (Clayton-Pedersen & Musil, 2009).

As previously mentioned, diversity without inclusion efforts does not foster sustainable growth (Sherbini & Rashid, 2017). Therefore, it is critical to the sustainability of the program to create space for all RMI students to participate in conversations about diversity and inclusion. Examples include seminars/workshops, professional development days, inviting guest speakers from various identities into the classroom as guest speakers, book clubs that discuss existing emerging issues in insurance through a diversity and inclusion lens such as the future of data analytics in Risk Management and Insurance using Dr. Sifya Noble's *Algorithms of Oppression*.

Supporting students through career exploration and development programming is just one piece of the support students from underrepresented backgrounds need. While numerous efforts are made across the industry to embrace a culture of diversity and inclusion, stories of microaggressions, unconscious and conscious bias still exist (Grzadkowska, 2019). Faculty, mentors and student mentors should be equipped with the tools and prepared to recognize and counsel students through these scenarios.

Mentorship from multiple perspectives is a key component of retention. One way to develop the mentoring model is Cascade Mentoring, which includes industry mentors as well as peer and faculty mentors for students. Cross-identity communication can be difficult. Miscommunication while well-intended can be the result of societal bias and microaggressions. Future development of the mentoring program will include cultural competency, implicit and unconscious bias training. Mentors don't always have to look like their mentees but they do need to be able to engage with appropriate boundaries and understanding when mentees face situations they cannot directly empathize with. Perhaps the most successful cross-cultural mentorships can articulate the language of cultural competency and empathy.

Perhaps the most significant change to consider for the future is the incorporation of data related to this work. Williams (2013) argues that we must use data to ground, sustain, and institutionalize our diversity efforts. He also suggests using a scorecard that assists in assessing the effectiveness, organizing priorities, sharpening focus and driving diversity initiatives (Williams, 2013).

CONCLUDING THOUGHTS

Diversity, Equity and Inclusion initiatives continue to expand as scholarship develops around what diversity, equity and inclusion really mean for both academics and the industry. The transformational demands and needs for future generations will continue to change. As the insurance industry steadily evolves, the business imperatives of today will likely shift to more tenacious enterprise models in the future.

Appalachian State is just one piece of the puzzle when it comes to schools creating diverse and inclusive student initiatives. Professors and support directors are positioned to provide students from all backgrounds the tools to succeed in their future insurance career. Therefore, Risk Management and Insurance programs must stay relevant in the discussion and progression of the talent pool by providing robust programming and curriculum to advance diversity, equity and inclusion for all.

REFERENCES

Appalachian State. (2019). Diversity and Inclusion at Appalachian. Retrieved from https://diversity.appstate.edu/

Avery, Liz., Harwood, Samantha., Jones, Brad., Potter, Sarah B., Boettcher, Michelle. (2016). Modern LGBT Students: Navigating Issues of Wellbeing in Higher Education. NASPA. Retrieved from https://www.naspa.org/images/uploads/main/2016SPRINGNASPAGLBTKCWhitePaper.pdf

Baker, C. N. (2013). Social support and success in higher education: The influence of on-campus support on African American and Latino college students. *The Urban Review*, *45*(5), 632-650.

Clayton-Pedersen, A. R., & Musil, C. M. (2009). Making Excellence Inclusive a Framework for Embedding Diversity and Inclusion Into Colleges and Universities' Academic Excellence Mission.

Cole, C.R., & McCullough, K.A. (2012). The insurance industry's talent gap and where we go from here. *Risk Management and Insurance Review*, 15(1), 107-116.

Crisp, G. (2010). The impact of mentoring on community college students' intent to persist. The Review of Higher Education, 34(1), 39–60. http://dx.doi.org/10.1353/rhe.2010. 0003.

Crutcher, B. N. (2007). Mentoring across cultures. *ACADEME-BULLETIN OF THE AAUP-*, *93*(4), 44.

Engle, J., & Tinto, V. (2008) Moving Beyond Access: College Success for Low-Income, First Generation Students. Washington, DC: The Pell Institute for the Study of Opportunity in Higher Education. Retrieved from https://files.eric.ed.gov/fulltext/ED504448.pdf

FinTech Global. (2019). InsurTech investment doubled between 2017 and 2018. Retrieved from https://fintech.global/global-insurtech-funding-tops-3bn-in-2018/

Grzadkowska, Alicia. (2019). How Unconscious Bias Harms the Diversity in Insurance. Insurance Business Magazine. Retrieved from https://www.insurancebusinessmag.com/us/news/breaking-news/how-unconscious-bias-harms-the-diversity-in-insurance-158245.aspx

InsurMyPath. (2016). Where to Major in Business? Colleges that Offer RMI Degrees. Retrieved from https://www.insuremypath.org/career-planning-tools/college-graduate-timeline/where-major-business-colleges-offer-rmi-degrees

Institutional Research & Planning at Appalachian State University (IRAP). (2018) Student Diversity. Retrieved from https://public.tableau.com/views/StudentDiversity_15689245486370/Whoarethey?:embed=y&:display_count=no&:showVizHome=no

Kalev, A., Dobbin, F., & Kelly, E. (2006). Best practices or best guesses? Assessing the efficacy of corporate affirmative action and diversity policies. *American sociological review*, *71*(4), 589-617.

Marsh & McClennon, (2019). The Journey of African-American Insurance Professionals. Retrived from https://www.marsh.com/us/insights/research/the-journey-of-african-american-insurance-professionals.html

McKinsey & Company. (2015) Why Diversity Matters. Retrieved from https://www.mckinsey.com/business-functions/organization/our-insights/why-diversity-matters

McKinsey & Company. (2018). Delivering through Diversity. Retrived from https://www.mckinsey.com/business-functions/organization/our-insights/delivering-through-diversity

Olsen, Timothy, Badger, Karen & McCuddy, Michael. (2014). Understanding the Student Veterans' College Experience: An Exploratory Study. Retrived from https://www.researchgate.net/profile/Debra_Archuleta/publication/270218258_Raising_the_clinical_standard_of_care_for_suicidal_soldiers_An_army_process_improvement_initiative/links/54e36f7f0cf2b2314f5d1e80.pdf#page=103

Pilksa, Jessica. (2016). Career Undermatching: The Higher Ed Issue You Need to Know About. Diverse Issues in High Education. Retrieved from https://diverseeducation.com/article/82502/

Pope, Nat & Goebel, Dan. (2016). What is the Value of an RMI Degree to the Insurance Industry? Journal of Risk Education. 7, 5-21.

PwC (2016). Breaking Through: How Insurers Can Harness the Diversity Dividend. Retrieved from https://www.pwc.com/gx/en/insurance/publications/breaking-through how%20insurers-can-harness-the-diversity-dividend.pdf

Risk Management Society (RIMS). (2019). RIMS Risk Management Talent 2025 Report. Retrieved from www.rims.org/resources/risk-knowledge.

Schwartz, S. E., Kanchewa, S. S., Rhodes, J. E., Cutler, E., & Cunningham, J. L. (2016). "I didn't know you could just ask:" Empowering underrepresented college-bound students to recruit academic and career mentors. *Children and Youth Services Review*, *64*, 51-59.

Sherbin, L., & Rashid, R. (2017). Diversity doesn't stick without inclusion. *Harvard Business Review*, *1*.

Stanton-Salazar, R. D. (2011). A social capital framework for the study of institutional agents and their role in the empowerment of low-status students and youth. Youth & Society, 43, 1066–1109.

U.S. Census Bureau. (2018). QuickFacts Boone, North Carolina. Retrieved from https://www.census.gov/quickfacts/fact/table/US/PST045218

U.S. Census Bureau. (2018). QuickFacts United States. Retrieved from https://www.census.gov/quickfacts/fact/table/US/PST045218

U.S. Census Bureau. (2015). New Census Bureau Report Analyzes U.S. Population Projections.Retrieved from https://www.census.gov/newsroom/press-releases/2015/cb15tps16.html

Walker College of Business (2019). Diversity Initiatives. Retrieved from https://business.appstate.edu/sustain/diversity-initiatives

Wells, Brenda, (2009), The Insurance Industry Talent Crisis: Investing in Risk Management and Insurance Graduates. International Risk Management Institute (Dallas). Retrieved from http://www.irmi.com/insights/articles/2009/insurance-inudstry-talent-recruiting.pdf

Williams, D., Parsons, L., McQuiston, M., Ellis, I., Penner, A., Crusoe, D., Walch, T., Collins, K., and Madriga K. (2017). Voice, Choice, Access, & Passion: Preparing the Centennial Generation for Leadership. Atlanta, GA: Boys & Girls Clubs of America.

Williams, D. A. (2013). *Strategic Diversity Leadership: Activating change and transformation in higher education*. Stylus Publishing, LLC..

Opening the Black Box: Teaching the Mechanics of Monte Carlo Simulation Through Value at Risk

James I. Hilliard
Temple University

Joseph S. Ruhland
Georgia Southern University

ABSTRACT

Monte Carlo simulation is a useful tool for modeling complex scenarios and extracting both potential outcome distributions as well as best- and worst-case scenarios. Hoyt, Powell, and Sommer (2007) propose a Monte Carlo Simulation application to estimate Value at Risk using @Risk. We expand on this application to demonstrate, at a very high level, the types of calculations that @Risk might be performing in this exercise. While the original case study provides important opportunities for increasing comprehension of Value at Risk using simulation, our approach provides insight into mechanics of simulation, enabling students to use the tool more profitably, while limiting errors associated with lack of understanding.

INTRODUCTION

There are numerous applications of Monte Carlo Simulation in Risk Management, Finance, and Operations Management. Many of these applications are built around proprietary software or costly software add-ons, such as @Risk or Crystal Ball. However, teaching simulation with these add-ons as a *starting point* treats the simulation as a "black box" and may fail to provide students with a sufficient understanding of the mechanics of Monte Carlo Simulation.

In this exercise, we use the basic problem proposed by Hoyt, Powell, and Sommer (2007). Their Value at Risk simulation exercise (as published) includes the following learning objectives:

1. Students will be able to define Value at Risk, and determine Value at Risk (VaR) for a specified set of loss exposures.
2. Students will apply Monte Carlo Simulation to a VaR problem, and use simulation to estimate VaR for a complex loss distribution.
3. Students will correctly consider correlation among loss exposures in the simulation.
4. Students will demonstrate the effects of the Central Limit Theorem. In particular, they will show that variation decreases as the number of iterations of the simulation increases.
5. Students will show how interactions among the loss exposures influence the overall risk profile of the firm.
6. Students will describe the impact of negative correlation on enterprise-level risk.
7. Students will accurately describe the difference between point estimates, variation, and tails.

We retain these learning objectives, but add additional insight regarding the mechanics of the process. While our assignment requires a higher level of spreadsheet competence, and will likely take longer to complete, we believe that students employing our method will leave with a higher level of competence in statistical analysis, and will also have a deeper understanding of both the opportunities and limitations of Monte Carlo simulation. In our view, the key advantage to this version of the assignment is to reinforce for students the importance of distributional assumptions, and to open the "black box", allowing them more control over the process. In addition, this version of the assignment can be completed with any modern spreadsheet software (including Microsoft Excel and Google Sheets) and does not impose potential technical support issues[1], nor the additional cost of proprietary software.

Our version of the assignment could stand alone, helping to develop modeling skills. It could also be used before introducing @Risk, giving students a decent background in simulation principles before giving them access to a more powerful tool. Finally, students could complete this module after learning @Risk, giving them new insight into how the tool works after seeing the results from both approaches.

STARTING POINTS

Hoyt, Powell, and Sommer (2007) begin with a cursory review of Monte Carlo simulation. Our plan expands on this explanation by demonstrating a very simple simulation project. We begin teaching Monte Carlo Simulation with a simple, manual exercise to illustrate the concept. Providing students with an excerpt of a random number table and a discrete (preferably triangular) distribution, we show how to find the average of a series of observations. The process is simple. Let's assume, for example, that the proposed triangular distribution is given in Table 1.

Table 1. Sample Triangular Distribution

Probability	Observation
0.3	10,000
0.4	15,000
0.3	20,000

We ask the students to calculate the expected value and population standard deviation of this distribution, which are 15,000 and 3,871.98, respectively.

We then provide them with a random number table (which can be duplicated from a textbook or created using a pseudo-random number generator; an example is provided in the second column of Table 2) and ask the students to find the observed values for each random number draw. We tell the students that any random number less than or equal to 0.3 will result in an observed value of 10,000. Any random number greater than 0.3 but less than or equal to 0.7 will result in an observed value of 15,000. Any random number greater than 0.7 will result in an observed value of 20,000. The results are illustrated in the third column of Table 2.

Table 2. Random Numbers and Values Derived for Monte Carlo Simulation

Draw	Random Number	Observed Value
1	0.18587401	10,000
2	0.255184	10,000
3	0.64619778	15,000
4	0.15962684	10,000
5	0.17181847	10,000
6	0.41905881	15,000

[1] For example, the trial version of @Risk cannot be used in a Remote Desktop environment, and is not compatible with Mac versions of Excel. Some students may require additional assistance activating the @Risk modules. We realize, however, that the level of technical proficiency required to complete the modified assignment that we present may be higher than that required to successfully install the trial version of @Risk.

7	0.49356207	15,000
8	0.27863263	10,000
9	0.75681234	20,000
10	0.81493712	20,000

The average of this series is 13,500 and the population (sample) standard deviation is 3,905.12 (4,116.36). Students can calculate these moments manually, using a financial or graphing calculator, or using a spreadsheet. Note that this series gives us the opportunity to remind students of the difference between the sample and population standard deviations, and how to know which is appropriate for the present application. We also ask students what they think will happen to the average and standard deviation if they were provided with ten more random numbers, with 90 more random numbers, and with 990 more random numbers. We discuss how the process would quickly become tedious, and invoke a spreadsheet as a potential solution to the problem.

USING A SPREADSHEET

Discrete Distributions

We can now show students how to use the **=VLOOKUP** and **=RAND** function in a spreadsheet to solve this problem with an arbitrarily large number of pseudo-random numbers. First, we will show students how to set up the lookup table, as illustrated in Figure 1.

Figure 1. Example Lookup Table Based on Triangular Distribution

	A	B	C
1	Probability	Cumulative Probability	Observation
2	0.3	0.3	10,000
3	0.4	0.7	15,000
4	0.3	1.0	20,000

Then, we demonstrate how to use **=VLOOKUP**. If the first random number is in cell E1, for example, the **=VLOOKUP** function would be **=VLOOKUP(E1,$B$2:$C$4,2,TRUE)**. This formula looks for the value in cell E1 (the random number), compares it to the cumulative probabilities in column B, and returns the corresponding value in the second column. The "TRUE" argument will search for nearest value less than or equal to the contents of E1 (in other words, if the value in E1 is less than or equal to 0.3, the formula will return 10,000 and if the value in E1 is greater than 0.3 but less than or equal to 0.7, the formula will return 15,000). The absolute references (indicated by **$** in the formula) in the range allow the student to copy and paste the **=VLOOKUP** formula while retaining the reference to the modified probability table.

Once students have mastered the process for finding random values based on a discrete distribution, we can move to a continuous distribution. The easiest distribution to explain is the normal distribution. Now, instead of creating a distribution table as above, we can simply declare the moments of the distribution. Using the normal distribution, the only moments that matter are the mean and standard deviation. In a section of the spreadsheet used for assumptions, we can declare those moments. Let's assume now that we have a distribution with mean of 15,000 and standard deviation of 3,871.98, but instead of being distribution discretely, the distribution follows the normal distribution, with an example shown in Figure 2.

Figure 2. Sample Mean and Standard Deviation for Continuous Distribution.

	A	B
1	**Moment**	**Assumption**
2	Mean	15,000
3	Standard Deviation	3,871.98

With the first random number in cell E1, we will use the formula **=NORM.INV(E1,$B$2,$B$3)**. Copying this formula to all of the random numbers we provided in the first example, we would end up with the array illustrated in Table 3.

Table 3. Random Number Draws from the Normal Distribution

Draw	Random Number	Observed Value
1	0.18587401	11541.5326
2	0.255184	12451.2119
3	0.64619778	16452.2842
4	0.15962684	11143.5361
5	0.17181847	11333.221
6	0.41905881	14208.9473
7	0.49356207	14937.5132
8	0.27863263	12727.5026
9	0.75681234	17695.2289
10	0.81493712	18470.2149

The mean of this series of observations is 14,096.12 and the sample standard deviation is 2,704.21. It's worth noting that it would not be appropriate to use the population standard deviation here, since outliers are almost certainly omitted. We can again ask the students to consider what would happen if the list of random numbers were expanded to 100 or 1,000 or 10,000. Once the series is in a spreadsheet, testing those predictions is a trivial task[2].

At the conclusion of this step, students should have a fairly solid idea of the mechanics of Monte Carlo simulation. We could also explore other distributional assumptions, including the binary (for use in flipping coins, for example) and the lognormal (for use in predicting possible stock prices), directly. Students with advanced statistical skills might wish to explore available transformations from the normal and the binary for derivative distributions. The following distributions are available directly in Excel:

1. Normal
2. Standard normal
3. T-distribution
4. F-distribution
5. Chi-square
6. Lognormal
7. Binomial
8. Beta
9. Gamma

[2] For these examples, we assign a series of previously-selected pseudo-random numbers so that students can match their answers to our in-class examples. In future steps, we allow students to generate their own random numbers.

A student can also generate a random number table directly from a series of distributions using the Random Number Generator included in the Data Analysis ToolPak in Excel, but this technique is less useful for modelling, which is our next step.

MODELING

It can be a huge step from learning the fundamentals of Monte Carlo simulation to employing the technique in a modeling setting. The assignment suggested by Hoyt, Sommer, and Powell (2007) provides an ideal model for exploring Value at Risk (VaR) using Monte Carlo simulation. To ease the implementation of simulation, we first ask students to create a basic, static model using expected values. The file provided along with the Hoyt, Sommer, and Powell article is not set up to permit static estimation as is. We provide a similar file with a static model following their example.

We can now build toward the Hoyt, Sommer, and Powell (2007) example by simulating one of the inputs of interest. To do so, we will create a new sheet and simulate only the Workers Compensation Losses. The Hoyt, Sommer, and Powell (2007) case suggests that Workers Compensation losses are lognormally distributed with mean 3.25 and standard deviation 3. To make things easier, we will now embed the random number generation in the formula as follows: **=LOGNORM.INV(RAND(),3.25,3)**. Note that it is preferable to declare the moment assumptions outside the formula, but we include them in the formula here for ease of explanation. We can conduct 100 iterations of this analysis ten times to replicate the process used in Hoyt, Sommer, and Powell (2007).

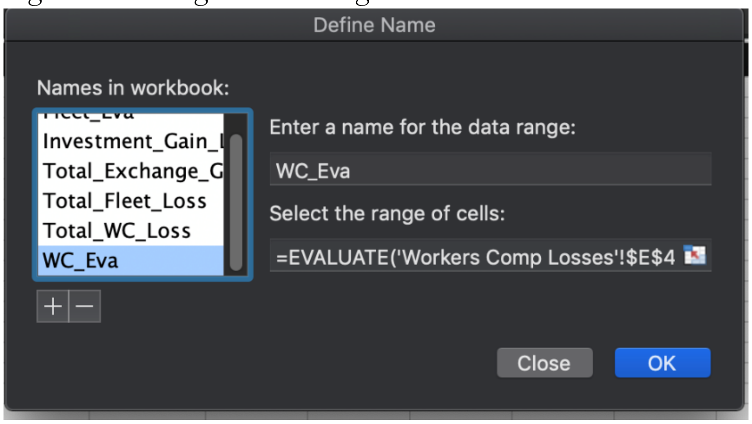
The trick to complete a Monte Carlo Simulation without specialized software is the use of the Data Tables function. It may be useful to alert students that simulation is an undocumented use of Data Tables, which is typically designed for one- or two-variable sensitivity analysis. However, the process can also be used to record the results from a large number of random observations (which is the point of Monte Carlo simulation). Thus, we can create a Data Table from a random observation resulting from that observation as follows:

To keep things clean, we prefer to accumulate our results in a separate sheet. We label our columns in row 1. In column A, we will simply list the number of iterations in our simulation (in our example, from 1 to 50). In cell B2, we create our formula, **=(LOGNORM.INV(RAND(),3.25,3)).** This formula creates a random number drawn from the lognormal distribution with mean 3.25 and standard deviation 3. We can invoke the Data Tables mechanism by selecting the populated cells in column A (starting with A2) and the corresponding cells in column B. Then, we choose the "Table" option from the "Data" menu. When the dialog box appears, click in the "Column input cell" field and select a random blank cell on the sheet. The result should be 50 randomly generated values drawn from the lognormal distribution with mean 3.25 and standard deviation 3.

The Hoyt, Sommer, and Powell (2007) case also invokes randomness in accident frequency. They specify that accident frequency is normally distributed with mean 20 and standard deviation 10 (truncated at 1 and 50). While it may be technically preferable to randomly determine the accident frequency and then randomly draw accidents from the list of randomly generated accidents from the prior step, this process adds complexity without adding substantially to the learning experience. Therefore, in this case, we will determine a random (***x***) number of accidents and then choose the first ***x*** accidents from the randomly generated list. Thus, we will use the randomly drawn frequency (**=NORM.INV(RAND(),'Assumptions and Report'!$A$2,'Assumptions and Report'!$C$2)** in cell D2, then **=IF(D2<1,1,IF(D2>50,50,ROUND(D2,0)))** in cell D3) to determine how many accidents to include in our sum of losses for the given simulation. It is not simple to incorporate a randomly drawn number in a formula, so we will need to generate the formula using a text string: **="SUM(B2:B"&E2+1&")"** where **E2** is the randomly generated number of accidents in the period of interest. We can name this function (using the "Name" function from the Insert Menu, and the special "**EVALUATE**" formula to connect this text string to a formula) and use it to generate the total Workers Compensation losses for the period of interest; see Figure 3 for an example[3]. The Workers Compensation losses for the period is simply the sum of the losses over the number of losses that we randomly determined.

We have now modeled Workers Compensation Losses for a single period. If the student presses **F9** (or **Fn-F9** on a Mac), they will see that every time the spreadsheet recalculates, a new estimate for Workers Compensation Losses is generated.

Figure 3. Naming a Text String for Use in a Formula



The student can now create a new sheet and repeat the process for Fleet losses. The process is similar, except that the number of losses in the period is drawn from the Poisson distribution rather than the truncated Normal distribution. Note that Excel does not have a native inverse Poisson function, while some software add-ons might have that distribution. However, this is a good time to note that the Poisson distribution is the limiting case of the binomial distribution, and Excel does have the inverse Binomial distribution. Thus, we can very closely approximate the Poisson distribution using an arbitrarily large number of trials in a Binomal distribution. We accomplish this with the formula **=BINOM.INV(10000000,*LAMBDA*/10000000, RAND())**. In this case, Lambda=25. Once the number of accidents is determined in a given scenario, the expected loss calculation process is very similar to the Workers Compensation case above.

We could stop here and allow the expected loss to simply be the sum of the uncorrelated expected losses from Workers Compensation and Fleet. Given this sum, a student can replicate a large number of scenarios using the Data Table method. If the assignment stopped here, a very good introduction to the mechanics of Monte Carlo simulation will be gained. We will return to the specifics of the Hoyt, Sommer, and Powell (2007) case in the next section.

INCORPORATING CORRELATION

The Hoyt, Sommer, and Powell (2007) case adds one additional wrinkle to the simulation process by suggesting that market returns and exchange rates both affect total losses and are correlated. This innovation provides an additional opportunity to open the "black box" and illustrate the impact of correlation by allowing

[3] This process is one of the more challenging portions of the manual Monte Carlo simulation process. However, it remain accessible to students with intermediate spreadsheet skills without invoking VBA or proprietary software. Indeed, learning some of these less-used features of spreadsheets can greatly increase a student's capabilities with this software.

students to generate random variables that are correlated with one another. The mechanics of generating random variables that are correlated is beyond the scope of this exercise. Instead, we suggest showing students that once a series of random numbers is drawn from the uniform distribution, a correlated set of random numbers can be generated quickly. In the referenced case, 63 days of market returns and exchange rates are suggested. Market returns are drawn from a normal distribution with mean 0.001034 and standard deviation 0.00965 while exchange rates are drawn from a normal distribution with mean -0.00054 and standard deviation 0.005396. Obviously, having different means and standard deviations, market returns and exchange rates will not likely have a correlation coefficient (ρ) of either -1 or 1, but observations can be generated from random numbers that do bear perfect positive or negative correlation. To operationalize this, we will create two series of random numbers drawn from the uniform distribution. The first series of random numbers x_1 will be used to generate the market returns. The second series of random numbers y_1 will be used to generate a correlated series of random numbers x_2 that will be used to generate the exchange rates.

The formula for the correlated series of random numbers is:

$$x_2 = \rho x_1 + y_1\sqrt{1-\rho^2}$$

Once a correlated series of uniformly-distributed random numbers has been generated, it can be used to generate random exchange rates. In our example, we create random numbers for both investment returns and exchange rate on the same worksheet for simplicity.

TYING IT TOGETHER

We have now replicated everything in the Hoyt, Sommer, and Powell (2007) case without using external software, macros, or VBA code. The only two functions outside of ordinary spreadsheet operations used here are the function naming device (Insert->Name), which we use to sum the randomly-determined number of accidents and Data Tables (Data->Tables). Everything else is some permutation of a standard spreadsheet function.

To complete the process laid out in the referenced case, we will need to generate modeled total losses for the hypothetical firm, and provide the appropriate number of trials to match the original assignment. The first question instructs students to run ten simulations of 100 iterations. The Data Tables mechanism is more appropriately applied here by creating a 1,000 entry data table and reporting descripting statistics for consecutive sets of 100 iterations (mean, median, 5th percentile, and min) where the 5th percentile provides the 95th percentile of Value at Risk and the min reflects maximum possible loss. The second question asks the students to run five simulations of 5,000 iterations. Here, we will create a data table with 25,000 iterations and report descriptive statistics for consecutive sets of 5,000 iterations. Finally, the students are asked to run one simulation of 10,000 iterations. This can be accomplished with a set of 10,000 iterations and descriptive statistics taken over the entire data table. Finally, the process can be repeated with different assumed correlation coefficients to answer the fifth question in the case.

CONCLUSION

In this note, we have proposed an alternative method to complete the assignment suggested by Hoyt, Powell, and Sommer (2007) without using any proprietary software. While the techniques suggested here do not take advantage of the efficiency of proprietary software such as @Risk, they help reinforce understanding of the Monte Carlo simulation process. Students using our techniques will be equipped to solve simulation problems even when proprietary software is not available, and will have a deeper understanding of the potential opportunities and challenges of Monte Carlo simulation for problem-solving. Future research associated with this note will include testing among students and classes to determine the appropriate time allocation for this exercise, and validation of assessment metrics associated with Assurance of Learning requirements.

REFERENCES

Hoyt, Robert E., Lawrence S. Powell, and David W. Sommer. 2007. Computing Value at Risk: A Simulation Assignment to Illustrate the Value of Enterprise Risk Management. *Risk Management and Insurance Review* 10 (2):299-307.

Agent/Broker Errors and Omissions In An Illustrative Commercial Property Insurance Case: A Risk Management Perspective

William Warfel
Indiana State University

ABSTRACT

The author was first exposed to the expert witness field while on a campus visit as a prospective doctoral student during which he first met his mentor and doctoral dissertation chairperson. While his mentor primarily served as a consulting/testifying expert witness in large long-tail liability insurance coverage cases (e.g., asbestos, environmental), the author embarked on a career as a testifying expert witness in insurance agent/broker errors and omissions cases, as well as breach of contract/bad faith cases, about ten years after completing his terminal degree and commencing a professional career as an Insurance and Risk Management (IRM) Professor.

The author is in a very small minority of IRM professors who have embarked on a career as a testifying expert witness in the sort of insurance cases referenced above. This fact is confirmed based largely on personal observations of the author over about thirty years – the author completed his terminal degree in 1990. Memberships in the American Risk and Insurance Association (ARIA), as well as the Western and Southern Risk and Insurance Associations (WRIA and SRIA), in which most IRM academics are a member, are very small in comparison to other academic associations tied to other business disciplines such as finance, marketing, management, and accounting. For this reason, the author knows, or is acquainted with, a large percentage of IRM academics over many years.

The purpose of this article is to encourage more IRM academics to serve as expert witnesses in insurance agent/broker errors and omissions cases. The vehicle for achieving this purpose is to present an illustrative commercial property insurance case in which the author (1) applied a textbook, fundamental, IRM concept to a set of facts so as to make an argument that the insurance agent committed an error or omission, (2) utilized knowledge concerning the operation of property insurance contract provisions, combined with an analysis of insurance requirements set forth in a governing contract (in this case, the by-laws of a condominium association plan document), so as to make inferences concerning whether an error or omission was committed by the insurance agent, and (3) applied basic legal concepts such as detrimental reliance in evaluating whether the insurance agent committed an error or omission in providing risk management services to a client. Most importantly, this illustrative case can be shared with IRM students in a variety of IRM courses for the purpose of demonstrating the application of textbook IRM concepts and basic legal concepts to a real world legal case.

INTRODUCTION

As referenced above in the abstract, few IRM faculty members have served as expert witnesses in insurance agent/broker errors and omissions cases over the years. A purpose of this article is to encourage IRM faculty to take on expert witness assignments of the sort presented in this article, and thereby address the deficiency referenced above. Most importantly, broadly speaking, serving as an expert witness furthers the university's goal of creating and sharing knowledge with society. See Warfel, William J., "Guest Editorial: Expert Witness Consulting and Its Relationship to Research, Service, and Teaching," CPCU eJournal, April 2008, pp. 1-3. The expert witness assignment presented in this article illustrates how such an assignment can enhance the learning process in the IRM classroom; IRM students observe first- hand the application of a textbook IRM concept and a basic legal concept to a real world legal case.

As referenced above, this article presents an illustrative agent/broker errors and omissions case in which the author served as a testifying expert witness. Generally, there are three kinds of agent/broker errors and omissions cases: (1) Failure to procure insurance coverage on a timely basis/failure to maintain insurance coverage on an ongoing basis; (2) Failure to procure and maintain a sufficient policy limit; and (3) Failure to procure and maintain insurance coverage for a known exposure to loss. See Warfel, William J., "Agent/Broker Liability: A Tutorial for Commercial Policyholders," The John Liner Review, Winter 2010, pp. 26-37. The illustrative case study presented in this article concerns a legal case in which the insurance agent (1) failed to consult the governing contract that set forth insurance requirements for the policyholder (i.e., the by-laws in a condominium association plan document) pursuant to custom and practice, and, therefore, (2) failed to request that the underwriter perform an insurance – to – value computation, which would have confirmed that the policyholder was severely underinsured (i.e., the insurance agent failed to procure and maintain a sufficient policy limit). Of course, a large loss occurred subsequent to this breach of professional responsibility by the insurance agent, and a substantial coinsurance penalty was imposed on the policyholder, which prompted the filing of an errors and omissions lawsuit by the policyholder against the insurance agent claiming damages that were equal to the coinsurance penalty referenced above.

ILLUSTRATIVE COMMERCIAL PROPERTY INSURANCE CASE/THE UNIT OWNERS OF TIMBERLANE VILLAGE GARDENS CONDOMINIUM (PLAINTIFF) V. INSURANCE DESIGNERS (DEFENDANT AND THIRD PARTY PLAINTIFF) V. THE MOORE AGENCY (THIRD PARTY DEFENDANT)/ HISTORICAL PERSPECTIVE AND DESCRIPTION OF LOSS

Timberlane Village Gardens Condominium (hereinafter referred to as Timberlane) was originally an apartment complex consisting of twelve buildings scattered on a premises located in Fairfax, Virginia, but it was converted into a condominium in 1978. At this time, it procured a Commercial Property Condominium Association Coverage Form through John Mann, an exclusive Nationwide agent. A blanket limit applicable to all twelve of the buildings was specified in the Declarations. Whether this blanket limit, which was based on a statement of values per building, was supported by (1) a real estate appraisal obtained by the Board of Directors at Timberlane, or (2) an insurance-to-value calculation performed by an underwriter using a replacement-cost estimator formula (i.e., data including, for example, square footage and construction are plugged into the replacement-cost estimator formula to calculate the approximate replacement cost of a building) is unknown. John Mann, who departed Nationwide in late December 1996, was not available for a discovery deposition.

Based on the record, however, it is known that the policy issued by Seneca Insurance Company that was applicable on the July 2, 2005 date of loss did not include an Agreed Amount Endorsement, contrary to an insurance requirement contained in the condominium association plan document that required inclusion of such an endorsement. Most likely, the policy originally issued by Nationwide in 1978 at John Mann's request also did not include an Agreed Amount Endorsement, and such an endorsement was never added to the policy in subsequent years. Assuming the lack of such an endorsement when the policy was originally issued in 1978, the effect of which is to suspend the operation of the coinsurance clause in the event that the blanket limit is insufficient, the logical inference is that the underwriter did not perform an insurance – to – value calculation so as to make sure that the policy limit was sufficient. More likely than not, a real estate appraisal obtained by the Board of Directors of Timberlane was submitted by John Mann to the underwriter; more likely than not, the underwriter relied on this real estate appraisal, and concluded that the blanket limit was sufficient at the time that the policy was initially underwritten in 1978. Of course, over the years since 1978, property values at Timberlane escalated, an updated real estate appraisal probably was never obtained, and the blanket limit clearly was grossly insufficient on the July 2, 2005 date of loss.

Upon John Mann's departure from Nationwide in late December 1996, the Timberlane account was assigned to Charles Moore of The Moore Agency. The Moore Agency also was an exclusive agent with Nationwide. According to the discovery deposition of Charles Moore, he relied on the statement of values supplied by John Mann, his former colleague at Nationwide. Eleven months after Nationwide assigned the

Timberlane account to Charles Moore, it non-renewed the policy effective November 20, 1997 based on the adverse loss history of Timberlane. At this juncture, The Moore Agency was the agent-of-record, meaning that this agency owned the Timberlane account. For this reason, The Moore Agency had an incentive to find another market for the Timberlane account. Because The Moore Agency was not contracted with other admitted insurance carriers, they sought to broker the policy through an unrelated agency. In this way, they could retain a portion of the commission on the Timberlane account. In this particular case, the owner of the Timberlane account, in this case The Moore Agency, and the unrelated agency to which the Timberlane account was brokered, in this case Insurance Designers, agreed to share the Timberlane account commission equally (i.e., both parties received fifty percent of the commission). The agreement concerning the split of the commission that was reached by the parties in this particular case may or may not be consistent with the custom and practice.

Concerning the relationship between The Moore Agency and Insurance Designers, Charles Moore testified in his discovery deposition that, "I don't think [I ever worked with Insurance Designers previously]...I might have had one case before that....Right [another Nationwide agent referred me to Insurance Designers]." Mary Jo Curtis, the Insurance Designers agent who handled the Timberlane account, confirmed this lack of a substantial relationship with The Moore Agency in her discovery deposition; "I don't recall. [whether I ever had to deal with Nationwide]."

Notwithstanding this lack of a substantial relationship with The Moore Agency, in requesting a quote from Seneca Insurance Company for a policy effective November 20, 1997 for the Timberlane account, Mary Jo Curtis testified in her discovery deposition that, "I never completed the quote applications that were submitted to Seneca. Those applications are Charlie Moore's application, which I believe his employee completed.... I received a statement of values per building [from Charles Moore or The Moore Agency]....I thought that was his [Charles Moore's] account [Timberlane] for a long time. But all the information was on the ACORD applications. That was enough for me to obtain a quote.... I looked at the ACORD application. It looked in order to me, enough to send to the company [Seneca]. I wasn't aware of this account [Timberlane]. I had to go by what was given to me...Seneca...was willing to quote it [based on the statement of values per building provided by Charles Moore or The Moore Agency]."

Unfortunately, the result of this reliance by Insurance Designers and Mary Jo Curtis on the statement of values per building supplied by The Moore Agency and Charles Moore was the specification of a grossly insufficient blanket limit in the Seneca policy that was issued to Timberlane effective November 20, 1997. The blanket limit referenced above was increased by four percent at each renewal to guard against inflation but, of course, the blanket limit remained grossly insufficient each time the policy was renewed. The policy with Seneca was non-renewed on November 20, 2003, and it was replaced with a policy that was issued by Firstline National Insurance Company, a member of the Harford Insurance Group, effective on November 20, 2003. The issue concerning why Seneca elected to non-renew the Timberlane account on November 20, 2003 is not clear from the record. In the author's opinion, this decision to non-renew probably was based on adverse loss history, or a perception by the Seneca underwriter that the Timberlane account was not a quality piece of business. In reviewing the minutes of the Timberlane Board of Directors meetings over a period of time, there were references in these minutes to a variety of vandalism incidents such as the tires of a vehicle being slashed while the vehicle was parked in the Timberlane parking lot. Certainly, in the author's opinion, this reference to a series of ongoing vandalism incidents of this sort speaks volumes in terms of the quality of the Timberlane account.

The policy that was issued by Firstline National Insurance Company on November 20, 2003 was renewed on November 20, 2004; this policy was in effect on July 2, 2005, the date of the loss. A structural fire originating in a furnace significantly damaged two of the twelve buildings that comprise Timberlane, resulting in a direct damage property loss with a total replacement cost of $2,274,364.

On the July 2, 2005 date of loss, the blanket limit in the policy was $19,951,000, and the applicable coinsurance percentage identified in the Declarations was 100 percent. At the time of loss, the replacement cost value of all twelve buildings was $34,035,566, meaning that the Timberlane account was substantially underinsured. Pursuant to the loss settlement provision contained in the policy, Firstline was obligated to pay the higher of (1) the formula amount of $1,331,723 (i.e., $19,951,000 divided by $34,035,566 X ($2,274,364 minus the $2,500 deductible)), or (2) the actual cash value of the loss minus the deductible ($1,674,464 minus the $2,500 deductible = $1,671,964). Thus, assuming that Timberlane had not been severely underinsured at the time of the loss, the claim settlement amount would have been $2,271,864 (i.e., $2,274,364 minus the $2,500 deductible) as opposed to $1,671,964 (i.e., a difference of $599,900). In other words, there was a shortfall of $599,900 with respect to the insurance recovery that can be directly attributed to the insufficient blanket limit of $19,951, 000.

COMMENCEMENT OF LEGAL ACTION

When a policyholder learns of a major coverage deficiency following a large loss (i.e., there was a shortfall of $599,900 with respect to the insurance recovery for the large fire loss on account of the insufficient blanket limit that was applicable on the July 2, 2005 date of loss), in many cases, if not all cases, the policyholder will consult with legal counsel to determine if legal recourse is viable. Timberlane consulted with Attorney Sheyna Burt, with whom it had an ongoing attorney-client relationship that had been in place for some period of time that is not clear from the record. Subsequent to this consultation, Sheyna Burt, an attorney with Chadwick, Washington, Moriarty, Elmore, and Bunn P.C. (based in Fairfax, Virginia), notified the Clerk of Court for Prince William County in Virginia on November 20, 2006 that contract and general tort liability actions were being filed against Insurance Designers. Based on an investigation that had been conducted by Attorney Burt, a Formal Complaint was filed with the court alleging the following counts: (1) Count I – Breach of Contract; (2) Count II – Professional Negligence; (3) Count III – Breach of Fiduciary Duty; and (4) Count IV – Negligent Misrepresentation. In this Formal Complaint, Timberlane (the plaintiff) requested that the court enter a judgment against Insurance Designers in the sum of $599,900 (the shortfall referenced above).

At some point after this Formal Complaint was filed by Attorney Burt on behalf of Timberlane on November 20, 2006, Insurance Designers (the defendant) filed a Third Party Formal Complaint against The Moore Agency essentially making the following assertion; while Insurance Designers did not believe that it bore responsibility for the shortfall referenced above, if, in fact, Insurance Designers was wrong, and it did bear such responsibility, then The Moore Agency also bore responsibility for this shortfall. Of course, the purpose of a Third Party Complaint of this sort is to shift at least a portion of the damages (i.e., the shortfall of $599,900 referenced above) to another culpable party (in this case, The Moore Agency, upon which Insurance Designers had relied in terms of the statement of values that supported the grossly insufficient blanket limit that resulted in the imposition of the $599,900 coinsurance penalty).

In October 2008, the author was retained as a testifying expert witness for Timberlane; an expert report setting forth the author's opinions, the documents reviewed by the author, and the basis for the author's opinions, was submitted by the author to Attorney Burt in November 2008. In this expert report, the author expressed the opinions that (1) Insurance Designers did bear responsibility for the shortfall referenced above because it failed to comply with the insurance requirements specified in the by-laws of the condominium association plan document, and (2) The Moore Agency did not bear responsibility for the shortfall referenced above because it was entitled to rely on the statement of values prepared by John Mann because both agencies were exclusive Nationwide agents(i.e., they were inextricably tied to each other because of their relationship to Nationwide Insurance Company). An expert witness disclosure was made by Attorney Burt, and the author was deposed by Attorney Kelly Lippincott, who represented Insurance Designers, on April 27, 2009. Daniel Lynch, who represented The Moore Agency, appeared at this deposition via telephone. At the conclusion of the author's discovery deposition, Attorney Lynch stated his intention to retain the author to serve as a testifying expert witness on behalf of his client, The Moore Agency. In expressing this intention, Attorney Lynch asserted his opinion that there was no conflict of interest that prevented him from retaining the author. The author agreed to serve as a testifying expert witness for The Moore Agency shortly after the discovery deposition referenced above.

RELIANCE: WAS INSURANCE DESIGNERS ENTITLED TO RELY ON THE MOORE AGENCY?

As referenced above, Insurance Designers and Mary Jo Curtis relied on the statement of values per building supplied by The Moore Agency. The question arose concerning whether this reliance was reasonable. The author testified on behalf of Timberlane that this reliance was unreasonable; Robert J. Graziosi, a National Business Consultant, was retained as a testifying expert witness for Insurance Designers, and he testified that this reliance was reasonable.

As referenced above, discovery deposition testimony of both Charles Moore and Mary Jo Curtis clearly establishes that a substantial previous business relationship between the two parties' did not exist at the time Charles Moore referred the Timberlane account to Mary Jo Curtis in 1997. Given this lack of a substantial previous business relationship, it was the author's testimony that Mary Jo Curtis was not entitled to rely on Charles Moore in terms of the accuracy of the statement of values per building.

As referenced above, The Moore Agency retained ownership of the Timberlane account when Nationwide elected to non-renew the policy based on Timberlane's adverse loss history. Because The Moore Agency was an exclusive agency with Nationwide, it did not have access to insurance markets apart from Nationwide and, thus, it contacted Insurance Designers to request assistance in finding a market for the Timberlane account. Insurance Designers was unable to find coverage with its contracted insurance carriers in the admitted market. For this reason, Insurance Designers turned to a wholesaler, Horan Goldman of Maryland, who had access to the surplus lines, or non-admitted, insurance market. Horan Goldman of Maryland found coverage for the Timberlane account with Seneca Insurance Company. In this respect, Insurance Designers acted consistent with applicable insurance regulation. It checked with its contracted carriers in the admitted market (i.e., rates and coverage forms are subject to regulatory oversight, the guaranty fund applies if a carrier becomes insolvent), and then it went through a wholesaler to place coverage in the non-admitted, or surplus lines market (i.e., rates and coverage forms are not subject to regulatory oversight, the guaranty fund does not apply if a carrier becomes insolvent) upon confirming that coverage simply was not available in the admitted market (i.e., most, if not all, states require three declinations in the admitted market before coverage is placed in the non-admitted, or surplus lines, market).

Robert J. Graziosi testified on behalf of Insurance Designers that the producing agency was The Moore Agency, and Insurance Designers functioned purely as a broker for the purpose of finding a market willing to underwrite commercial property insurance for Timberlane. It was his testimony that a broker (Insurance Designers) customarily relies on the producing agency (The Moore Agency), which owns the account (Timberlane), to supply underwriting data (the statement of values per building) for the insurance carrier (Seneca Insurance Company). In this way, there is (1) a direct chain of command, and the chance for a miscommunication is reduced, and (2) the business relationship between the producing agency and the insured is protected, which is important because the producing agency owns the account and retains a portion of the commission.

Most importantly, whether the author or Mr. Graziosi was correct in terms of whether Insurance Designers reliance on the statement of values prepared by The Moore Agency was either unreasonable or reasonable is an inherently factual issue for the jury; it cannot be determined by a judge as a matter of law. A factual inquiry must be conducted concerning (1) the historical nature of the relationship between The Moore Agency and Insurance Designers, and (2) the custom and practice concerning the interaction between the agency that owns an account, and the agency that finds a market willing to underwrite coverage for the account. For this reason, neither the plaintiff nor the defendant filed a Motion for Summary Judgment with the court asserting that either the reliance by Insurance Designers on The Moore Agency was either unreasonable or reasonable.

IDENTIFYING & MEASURING EXPOSURES, COVERAGE SPECIFICATIONS, AGENCY WEB SITES, CHECKLIST METHOD, DOCUMENTATION

Assuming that Insurance Designers and Mary Jo Curtis was not reasonable in its reliance on the statement of values per building prepared by The Moore Agency and Charles Moore, Mary Jo Curtis arguably had a duty to undertake a comprehensive identification and measurement of the property exposure to loss faced by Timberlane. In the author's opinion, this duty encompassed learning of the property insurance coverage specifications of Timberlane. In her capacity as the new retail insurance agent for Timberlane, Timberlane reasonably relied on Mary Jo Curtis to fulfill this duty, consistent with (1) her vast experience in the insurance industry (i.e., over twenty-four years of experience as an agent- she was a vice-president at Insurance Designers and responsible for the entire commercial insurance operation), and (2) the manner in which Insurance Designers and Mary Jo Curtis held itself out to the insuring public on its web site- it promised to serve as the risk manager for its clients, matching the coverage procured to the exposure to loss.

In performing this task, in the author's opinion, the custom and practice in the insurance industry is to utilize the checklist method, and request from the client a copy of all relevant contracts. This custom and practice is confirmed in countless introductory insurance and risk management textbooks utilized in universities across the country. This concept is presented in the chapter in which the risk management process is discussed in terms of the identification and measurement of exposures to loss. See e.g., Rejda, George E. and McNamara, Michael J., Principles of Risk Management and Insurance, 13th Edition, Chapter 3-Introduction to Risk Management, Pearson, 2017. When Timberlane was converted from an apartment complex into a condominium association in 1978, a plan document was drafted establishing a plan for condominium ownership. In this plan document, the Board of Directors of the Condominium Association was authorized to purchase a single master property insurance policy, and, most importantly, the coverage specifications to be included in a request for a quote were identified in this plan document, as well as in article X of the by-laws, which were attached to the plan document. Clearly, in order to (1) properly measure the property exposure to be insured, and (2) include in the policy the appropriate coverage specifications, Mary Jo Curtis needed to review the documents referenced above. The record confirms that Mary Jo Curtis failed to do so, and the result was that the blanket limit was grossly insufficient on the date of loss, and a substantial coinsurance penalty was imposed on Timberlane.

On the one hand, George Hedrick, who was the property manager for Timberlane at the time Nationwide notified Timberlane on September 22, 1997 of its decision to non-renew the policy (i.e., the property manager had a broad range of responsibilities typically associated with the management of a condominium complex including, for example, maintenance of the premises, supervision of personnel employed by the condominium association, and financial management including procurement of insurance coverage), testified in his deposition that (1) the Nationwide agent, Charles Moore, referred him to Mary Jo Curtis, and (2) documents that he provided to Insurance Designers included "the section [pertaining to Insurance Provisions], if not the entire document [Declaration Establishing A Plan For Condominium Ownership Of Premises Located In Fairfax County, Virginia], the declaration of covenants, conditions, and restrictions, the by-laws [including article X of the by-laws attached to the plan document]…." On the other hand, Mary Jo Curtis testified in her deposition that, "No, I was not [ever provided with a copy of the association's by-laws]." The record confirms that Mary Jo Curtis both (1) failed to document her request to George Hedrick for a copy of the documents referenced above, and (2) failed to document George Hedrick's lack of compliance with her request referenced above.

The author has served as a testifying expert witness in numerous agent/broker errors and omissions cases since 1997. While this sample size is very small in comparison to the universe of agent/broker errors and omissions cases that have been litigated since 1997, the author's experience in the sort of case referenced above is that there commonly are conflicting accounts from the policyholder and the agent/broker in terms of whether or not the policyholder made an important document available to the agent/broker (e.g., a lease, the purchase/sale agreement connected to the disposal of a property, a plan document establishing a condominium association and the by-laws related thereto). This huge potential for conflicting accounts of the sort referenced above underscores the vital importance of documentation (i.e., use by the agent/broker of logs, letters, e-mails, text messages, and dated notes of each interaction that the agent had with the client). If an important document is not made available to the agent/broker, then the agent/broker needs to document this fact. In the author's opinion, a failure on the part of an agent/broker to properly document constitutes a breach of professional responsibility. A failure to properly document is at odds with the custom and practice in the insurance industry. Even if an important document contains sensitive data that has no relevance to the insurance transaction (e.g., the purchase price referenced in a purchase/sale agreement connected to the disposal of property), the sensitive data can be easily redacted, and the document can be made available to the agent/broker.

EVALUATING THE SUFFICIENCY OF THE BLANKET LIMIT: DID INSURANCE DESIGNERS AND MARY JO CURTIS BREACH ITS PROFESSIONAL RESPONSIBILITY TO TIMBERLANE?

As referenced above, the blanket limit was $19,951,000 on the July 2, 2005 date of loss; it should have been $34,035,566. Had Insurance Designers and Mary Jo Curtis ask the underwriter at Seneca Insurance Company to perform replacement cost calculations on each of the twelve buildings, the underinsurance problem could have been detected, and it could have been rectified. Indeed, Sherry Fantaci, a customer service representative with Insurance Designers, confirmed in her discovery deposition that "usually the insurance companies [the underwriters] will do them [perform a replacement cost calculation] when we [Insurance Designers, the agent, or the customer service representative] send in the request." The underinsurance problem could have been detected and rectified, assuming Timberlane supplied the input data such as square footage and construction that was needed by the underwriter to perform the replacement cost calculation. In failing to ask the underwriter to perform these replacement cost calculations, did Insurance Designers and Mary Jo Curtis breach its professional responsibility to Timberlane? In the author's opinion, the answer is the affirmative for the following reasons:

(1) Insurance Designers and Mary Jo Curtis failed to obtain from George Hedrick a copy of the plan document and the by-laws. These documents define the property interest to be insured under the policy. The policy itself references these documents in terms of exactly what property interest is covered under the policy. Whether the blanket limit is sufficient cannot be determined unless the current real estate appraisal that supports the blanket limit is examined in relation to the property interest that is covered under the policy. Most importantly, considerable variation exists among condominium associations in terms of who (i.e., the condominium association itself, or the individual unit owners) assumes the responsibility to insure such items as glass windows, sliding glass doors, and non-weight bearing walls that are contained in the individual units. If the condominium association assumes the responsibility to insure these items, the blanket limit must be higher than otherwise would be the case. If the condominium association assumes the responsibility to insure these items, the agent must procure a condominium association master property insurance policy that takes an insuring approach that is referenced as a "single entity" approach (under which items such as sinks, built-in cabinets, appliances, flooring, and wallpaper owned and used by individual unit owners, but which are permanently attached to the building, are insured under the condominium association master property insurance policy). The "single entity" approach is in contrast to the "bare walls" approach, under which items of the sort referenced above are not insured under the condominium association master property insurance policy, but rather are insured under a property insurance policy purchased by an individual unit owner. In this particular case, the property interest specified to be insured under the Timberlane condominium association master property insurance policy included not only the structure, fixtures, and furnishings of the collectively owned areas, and the collectively owned personal property of the Timberlane condominium association, but also the interior shell of an individual unit defined to include bathroom and kitchen fixtures, air-conditioning equipment, and other service machinery contained in the individual unit. The plan document and by-laws pertaining to Timberlane required this specified property interest to be insured under the master property insurance policy procured by the Board of Directors of Timberlane. Insurance Designers and Mary Jo Curtis requested that a 2001 Insurance Services Office Commercial Property Form (CP 00 17 04 02) - Condominium Association Coverage Form- be utilized,

which is the correct coverage form. Under this coverage form, identified items within individual units, regardless of ownership, are covered (i.e., "(a) Fixtures, improvements and alterations that are a part of the building or structure; and (b) Appliances, such as those used for refrigerating, ventilating, cooking, dishwashing, laundering, security or housekeeping."), assuming the plan document or by-laws requires the condominium association to insure such property; such was the case, as referenced above. While Insurance Designers and Mary Jo Curtis requested that the correct property insurance coverage form be utilized for the Timberlane account, they failed to make an inquiry concerning whether a current real estate appraisal obtained by the Timberlane Board of Directors reflected fully the property interest as defined in the plan document and the by-laws and, most importantly, whether or not the current real estate appraisal number matched the blanket limit contained in the property insurance policy that had been issued by the insurance carrier, in this case Seneca Insurance Company. Had such an inquiry been made, Insurance Designers and Mary Jo Curtis could have learned of the non-existence of a current real estate appraisal, in which case a recommendation could have been made to the Board of Directors to obtain a current real estate appraisal to support the specified blanket limit. Presumably, the Board of Directors could have followed this recommendation, and a current real estate appraisal could have been obtained. This current real estate appraisal could have revealed the gross insufficiency of the blanket limit, which could have prompted the Board of Directors to request a substantial increase in the blanket limit contained in its property insurance policy, thereby avoiding a substantial coinsurance penalty.

(2) Insurance Designers and Mary Jo Curtis failed to obtain from George Hedrick a copy of the plan document and the by-laws, which contained a coverage specification in article X of the by-laws which required that the "Condominium Replacement Cost Endorsement" be attached to the master property insurance policy. This endorsement stipulates that coverage is to be provided on a replacement cost basis without deduction for depreciation as opposed to on an actual cash value (ACV) basis. Clearly, in the event a request for a quote includes an insufficient blanket limit, the inclusion of the insufficient blanket limit is functionally equivalent to a failure on the part of the insurance agent/broker to obtain replacement cost coverage without deduction for depreciation. The one hundred percent coinsurance clause prevents a policyholder from realizing the benefit of replacement cost coverage in the event that the blanket limit is insufficient (i.e., the policyholder must insure- to-value in order to reap the benefit of replacement cost coverage). In other words, assuming the blanket limit is grossly insufficient, provision of coverage on a replacement cost basis as opposed to on an actual cash value basis is an illusory enhancement in coverage. Assuming that the blanket limit is grossly insufficient (i.e., in the Timberlane case, $19,951,000 as opposed to $34,035,566), the coinsurance penalty will exceed the depreciation, in which case the claim settlement amount will be the actual cash value of the loss, notwithstanding the fact that coverage ostensibly was provided on a replacement cost basis. In requesting a quote from the underwriter based on a grossly insufficient blanket limit, Insurance Designers and Mary Jo Curtis, in effect, failed to follow the Board of Directors instruction with respect to the procurement of a property insurance policy that provided coverage on a replacement cost basis, even though a "Replacement Cost Endorsement" was attached to the property insurance policy. Failure to follow this policyholder instruction constituted a breach of professional responsibility. This breach could have been avoided had Insurance Designers and Mary Jo Curtis requested that the underwriter at Seneca Insurance Company perform a replacement cost calculation for each building. Upon learning that the specified blanket limit was grossly insufficient, the underwriter could have made a recommendation to the Board of Directors that the blanket limit be increased substantially. Assuming that the Board of Directors followed this recommendation, replacement cost coverage would have been available with respect to the July 2, 2005 fire loss.

(3) For whatever reason, Insurance Designers and Mary Jo Curtis failed to obtain from George Hedrick a copy of the plan document and the by-laws, which contained a coverage specification in article X of the by-laws that required the "Agreed Amount Endorsement" to be attached to the master property insurance policy. The "Agreed Amount Endorsement" stipulates that the insurer agrees to suspend the coinsurance provision, and not impose a coinsurance penalty in the event of a loss, even if the blanket limit is grossly insufficient. Because the request for

a quote did not include a coverage specification requiring that an "Agreed Amount Endorsement" be attached to the master property insurance policy, the insurer did not verify the accuracy of the values insured. Inclusion of the "Agreed Amount Endorsement" in a request for a quote essentially forces the underwriter to perform a replacement cost calculation. In the absence of an "Agreed Amount Endorsement," a need arguably does not exist for the underwriter to verify the accuracy of the values insured. Such is the case because the underwriter knows that the potential application of a coinsurance penalty encourages the policyholder to insure-to-value. Given the tendency for policyholders to underinsure in order to save premium dollars (i.e., most losses are partial losses as opposed to total losses), however, the underwriter knows that he/she must check the accuracy of the values insured, assuming that the insurer has agreed to suspend the operation of the coinsurance provision, pursuant to the "Agreed Amount Endorsement," and not impose a coinsurance penalty in the event of a loss. Indeed, Mary Jo Curtis confirms that such is the case in her discovery deposition (i.e., "Most carriers… will not give you the agreed amount endorsement unless they 'see' it insured to 90 or 100 percent…Normally 100 percent [by performing a replacement cost calculation for each building, and comparing these calculations to the statement of values per building, the carrier is able to 'see' if it is insured to 100 percent]." Of course, had (1) Insurance Designers and Mary Jo Curtis not failed to include in the request for a quote a coverage specification requiring that an "Agreed Amount Endorsement" be attached to the master property insurance policy, and (2) Seneca Insurance Company checked the accuracy of the values insured by performing a replacement cost calculation for each building, and comparing these calculations to the statement of values per building, Timberlane could have been alerted by the underwriter that the blanket limit identified in the application for property insurance was grossly insufficient. The Board of Directors could have requested that the blanket limit be substantially increased, in which case the July 2, 2005 fire loss would have been paid on a replacement cost basis without deduction for depreciation as opposed to on an actual cash value (ACV) basis.

DOES THE BOARD OF DIRECTORS BEAR RESPONSIBILITY FOR THE INSUFFICIENT BLANKET LIMIT?

A question arises concerning whether the Board of Directors bears any responsibility for the grossly insufficient blanket limit. The Timberlane condominium association plan document contains a provision specifying that "prior to obtaining … insurance …, the Board of Directors shall obtain an appraisal from an insurance company, or such other source as the Board of Directors may determine, of the full replacement value … of the property, without deduction for depreciation, for the purpose of determining the amount of … insurance to be effected …." While this provision may be at odds with established protocol – normally, with the exception of issues relating to a reported claim or a premium invoice, the policyholder interfaces with the agent as opposed to the insurance carrier -, the intent of this provision is unmistakable. Either the Board of Directors should (1) get a current real estate appraisal from a real estate appraisal firm that supports the proposed blanket limit, or (2) submit input data such as square footage and construction to the agent, and ask the agent to relay this data to the underwriter, along with a request to perform a replacement cost calculation. In this particular case, the Board of Directors clearly failed to do so, and it bears responsibility for this failure to comply with an important provision contained in its condominium association plan document. In the absence of this failure on the part of the Board of Directors, the underinsurance problem could have been detected, and it could have been rectified by increasing substantially the proposed blanket limit, which would have been approved by the underwriter. In this way, the substantial coinsurance penalty could have been avoided.

WAS THE BOARD OF DIRECTORS FAILURE TO OBTAIN A CURRENT REAL ESTATE APPRAISAL ATTRIBUTABLE TO OVERT CONDUCT ON THE PART OF INSURANCE DESIGNERS?

In 1998, Insurance Designers and Mary Jo Curtis recommended to the Board of Directors that the policy limit for Ordinance and Law Coverage be increased from $125,000 to $1,000,000. Most importantly, this recommendation was not prompted by an inquiry from the Board directed to Insurance Designers and Mary Jo

Curtis. Indeed, the minutes of the November 17, 1998 Board meeting at which Mary Jo Curtis was present confirm that she unilaterally recommended to the Board that the Ordinance and Law Coverage policy limit be increased from $125,000 to $1,000,000. A lengthy discussion among Board members and Mary Jo Curtis ensued following this unilateral recommendation, and after much deliberation the Board agreed to increase the Ordinance and Law Coverage by $250,000 increments each policy year until the policy limit for Ordinance and Law Coverage finally had reached $1,000,000, consistent with the unilateral recommendation of Insurance Designers and Mary Jo Curtis. Notwithstanding this undisputed fact referenced above that documents the relationship between Insurance Designers and the Board, Mary Jo Curtis testified in her discovery deposition that "its up to the insured [George Hedrick and the Board of Directors] to recognize the limits on the policy, and its up to them [George Hedrick and the Board of Directors] to let us [the agent and the insurance carrier] know if its insured-to-value [if the blanket limit is grossly insufficient, it is incumbent upon George Hedrick and the Board of Directors to put the agent and insurance carrier on notice concerning the need to increase substantially the blanket limit]." In fact, when the overt conduct of an entity causes another entity to act to its detriment, then the entity that engaged in the overt conduct bears legal responsibility for the detriment suffered by the entity that had reasonably relied upon the overt conduct. Such is the essence of the legal concept referenced as detrimental reliance.

Furthermore, the record confirms that Insurance Designers and Mary Jo Curtis knew, or should have known, that the Board was relying on her to tell them if an increase in a policy limit was warranted. First, Mary Jo Curtis knew that George Hedrick had a broad range of responsibilities as property manager of Timberlane whose primary focus was on the amount of the insurance premium that needed to be included in the budget for the purpose of calculating assessments to be levied on individual unit owners as opposed to the sufficiency of the proposed blanket limit. Second, Mary Jo Curtis knew that the Board of Directors was composed of ordinary residents of the condominium complex whose primary focus was on issues that impacted their daily lives as opposed to the sufficiency of the proposed blanket limit. Deposition testimony of George Hedrick confirms that, between the fall of 1997 when Insurance Designers and Mary Jo Curtis first contacted him, there was neither (1) a discussion between himself and Mary Jo Curtis concerning "property valuations, appraisals or cost estimates for [property] insurance purposes … [or] amounts of coverage," nor (2) "a specific conversation with the Timberlane board of directors with regard to amounts of coverage." Mary Jo Curtis was clearly on notice concerning the reliance referenced above.

Certainly, an opposing viewpoint exists concerning the applicability of detrimental reliance to the Timberlane case. There was considerable discussion in the author's discovery deposition relating to this opposing viewpoint. Attorney Kelly Lippincott, who represented Insurance Designers, suggested in her line of questions posed to the author that detrimental reliance should be restricted to those errors and omissions cases where the overt conduct of the defendant upon which the plaintiff relied to its detriment is inextricably tied specifically to the error or omission that resulted in the filing of the lawsuit. In other words, Attorney Lippincott conceded that detrimental reliance would apply in the Timberlane case had Insurance Designers and Mary Jo Curtis made a recommendation in the past concerning a proposed increase in the blanket limit as opposed to a proposed increase in the Ordinance and Law Coverage policy limit. In the author's opinion, this opposing viewpoint is very narrow in application, and it does not comport with the way in which policyholders usually interact with their insurance agents or brokers.

The opposing expert did not address the detrimental reliance issue in his expert report, and he was not deposed in this case by opposing counsel. He did not testify at trial because the case was dismissed by the judge before the defense presented its case to the jury.

CONCLUSION

In September 2009, the author fully anticipated that the Timberlane case would settle; clearly, there was fault that could be assigned to both the plaintiff and the defendant. While the author's experience in errors and omissions cases is based on a very small sample size in comparison to the universe of errors and omissions cases, the Timberlane case, in the author's view, was just an ordinary errors and omissions case. This viewpoint was confirmed in a telephone conversation with Attorney Dan Lynch, who represented The Moore Agency (the third party defendant in this case). Moreover, as the scheduled November 2009 trial date quickly approached, Attorney Sheyna Burt mentioned in a telephone conversation with the author that her experience was that legal cases oftentimes settle on the "courthouse steps" (i.e., immediately before a scheduled jury trial). On the exact day that jury selection was to commence, the author received a telephone call at the airport while waiting on a flight to Virginia for the trial to the effect that a scheduling error had occurred, and the scheduled jury trial would be postponed to a date to be determined sometime in Spring 2010. In announcing the scheduling error, the judge strongly encouraged the parties to engage in settlement discussions with his assistance to no avail.

For whatever reason, Attorney Kelly Lippincott, who represented Insurance Designers, neither (1) filed a Motion for Summary Judgment requesting that the judge dismiss the Timberlane case as a matter of law based on Timberlane's failure to obtain a real estate appraisal consistent with the provision contained in the condominium association plan document requiring it to do so, nor (2) made a serious settlement offer to Timberlane – confirmed by Attorney Sheyna Burt to the author. For this reason, the Timberlane case went to a jury trial in April 2010. Most importantly, the author does not have a basis for speculating concerning why defense counsel Kelly Lippincott made this strategic decision. Indeed, in the absence of a serious settlement offer on the part of defense counsel, usually a Motion for Summary Judgment is filed by defense counsel in an effort to win the case outright at minimal cost. From a defense perspective, proceeding to a jury trial is costly and fraught with uncertainty-juries oftentimes react to these sort of errors and omissions cases unfavorably from a defense perspective. Also, there is some risk concerning potential adverse rulings from the judge.

Timberlane faced an uphill battle when the jury trial commenced in April 2010. Unlike the vast majority of jurisdictions, Virginia, the state in which the Timberlane case was tried, is a contributory negligence state as opposed to a comparative negligence state. In a contributory negligence state, if the plaintiff (in this case, Timberlane) is even one percent at fault, it completely loses the case, a very harsh result in the opinion of the author. In a comparative negligence state (Indiana and Missouri, for example), the damages proved by the plaintiff are reduced proportionate to its negligence, assuming the jury assigns responsibility to the plaintiff for some percentage less than fifty percent, an equitable result in the opinion of the author. For this reason, when a Motion to Dismiss was filed by the defense after the plaintiff had completed its presentation to the jury, it was granted by the judge.

Finally, once the judge granted the defense's Motion to Dismiss, the Third Party Complaint that had been filed by Insurance Designer's against The Moore Agency became moot. Insurance Designer's bore no responsibility to Timberlane, and the sole purpose of a Third Party Action is to shift some financial responsibility to the Third Party Defendant (The Moore Agency), assuming that the Third Party Plaintiff (Insurance Designers) in fact bears some financial responsibility to the plaintiff (Timberlane). Of course, Insurance Designers did not bear any responsibility to Timberlane once its Motion to Dismiss was granted by the judge and, therefore, there was no responsibility that could be shifted by Insurance Designers to The Moore Agency.

Dynamic Analysis of Total Cost of Risk with Simulation Software

Yu-Luen Ma
University of North Texas

Yu Lei
University of Hartford

ABSTRACT

Total cost of risk (TCOR) is a commonly used measure to assess the cost efficiency of risks that companies undertake. This paper presents a class project that utilizes a simulation software, @Risk, to help students learn how to calculate TCOR that involves time value of money and uncertainties with probability distributions. We present step-by-step process for setting up TCOR models and illustrate how to run simulations to generate loss distributions and make risk management decisions. We also present several variations of class exercises and projects that can be derived from the presented platform for use in different levels of risk management and insurance courses.

INTRODUCTION

All businesses face risks as they endeavor to achieve their objectives such as maximizing stakeholders' value. Corporate valuation depends on a company's future cash flow. Any unexpected increases on cash outflow or reduction in cash inflow could result in reduced business value. Thus, it is critical that companies conduct thorough risk assessment prior to taking on capital investment projects. Total cost of risk (TCOR) is a commonly used measure to gauge the cost efficiency of risks that companies undertake. As Aon's global chief executive officer of analytics, Paul Mang, pointed out in its 2017 Global Insurance Opportunities report, TCOR is instrumental in identifying the most cost-effective ways to manage and reduce risk.

This paper presents a class project that educators may use in their insurance and risk management courses to help students understand the concept of TCOR and learn how to calculate TCOR under uncertainty and with consideration for time value of money. Using a powerful simulation-based program @RISK, students are able to assume the roles of risk managers and make decisions with regard to risk control and risk financing alternatives. Numerous variations of class exercises and projects can be derived from the presented platform. The opportunity to imitate real life decision-making turns risk management from theory to reality which not only enhances the learning experience but also stimulates student interest in the risk management and insurance subject.

TOTAL COST OF RISK (TCOR)

The Risk and Insurance Management Society (RIMS), Inc. has been partnering with Advisen Ltd. and conducting an annual survey of TCOR since 1979. Their annual surveys provide benchmark statistics with industry data for thousands of risk management programs from hundreds of organizations, many of which are Fortune 500 companies.[1] The annual RIMS survey defines TCOR as the sum of insurance

[1] https://www.rims.org/resources/BenchmarkSurvey/Pages/default.aspx

premiums, self-funded losses, risk control expenditures, and internal and external administrative costs.[2] The Institutes similarly defines TCOR as "the total cost incurred by an organization because of the possibility of accidental loss" (Elliott, 2016).

Self-funded losses may include deductibles, coinsurance payments, and any other uninsured losses. Investment in risk control and any applicable maintenance costs are examples of risk control expenditures. Internal and external administrative costs may include salaries and benefits paid to risk management staff, commissions paid to insurance brokers, and claims adjusting expenses paid to third-party administrators.

Different components of TCOR may potentially interact with one another. For instance, while insurance purchase will require premium payments, it may reduce retained loss amounts. Expenses on mechanisms that reduce either loss frequency or loss severity may result in reduction in cost of risk financing. Whether risk mitigation strategies are in place may also affect one's desire to purchase insurance. Bajtelsmit *et at.* (2015) investigated the decision between risk control and insurance and found that ambiguity in loss probability induces people to increase insurance uptake. Given the interactive relationships between different components of TCOR, it's important for one to keep in mind that a cost-efficient risk management program should aim for the lowest TCOR among available risk management options, not any component of it.

The 2018 annual RIMS Benchmark Survey showed that the average TCOR dropped from $10.07 per $1,000 revenue in 2016 to $9.75 in 2017, continuing a four-year trend. A significant driver of lower TCOR was a decline in liability, property and worker's compensation costs. Four sectors - healthcare, government & nonprofit, information technology, and consumer staples, however, experienced rising TCOR in 2017. Despite the rising cost of cyber insurance, Ryan (2018) noted significant increase in the number of companies buying cyber insurance in recent years as many companies consider their business to be at "extremely high risk" of a cyber security breach.

It is important to recognize that different components of TCOR may not always happen at the same time point. For instance, insurance premiums may be payable every year while a capital spending on a new security system is a one-time investment. As such, it is essential to consider the time value of money in TCOR calculations. According to Arrow and Lind (1970), private capital market investors choose to maximize the present value of risk-adjusted returns. Additionally, while insurance premium and capital investment for risk control can be known with certainty, loss amounts in TCOR calculation are often unknown at the time when businesses weigh cost and benefit of risk management alternatives, which creates challenges when comparing TCOR among options. Simulation provides rapid feedback on hypothetical scenarios which can be a powerful tool when making financial decisions.

SIMULATION

To account for uncertainties in the TCOR calculation, we use @RISK, a simulation-based program developed by Palisade Corporation.[3] A full-featured trial version of the program is free to

---

[2] This definition was developed by RIMS' former president and risk management pioneer Douglas Barlow (https://www.businessinsurance.com/article/20180626/NEWS06/912322243/Total-cost-of-risk-declines-for-fourth-year-straight-Risk-and-Insurance-Manageme).

[3] Descriptions of @RISK and simulation are based on the Users' Guide provided by Palisade Corporation.

download from the publisher's website at http://palisade.com/trials.asp. We use the package named "@RISK Version 7.6 Industrial Edition" for this project. This program is an Excel add-in and does not require any coding. Once users set up their risk analysis models, with inputs and outputs clearly specified, @RISK will use simulation to generate results with a wide range of possible outcomes.

Simulation is a method where a computer recalculates an Excel model repeatedly by using randomly sampled sets of input values with specified probability distributions. This is just like running hundreds or thousands of "what-if" analyses, but all in one sitting. Each recalculation of the model is called an iteration.

For instance, a model is defined as Y = A*B, where both A and B follow Normal distributions but with different parameters. A's mean and standard deviations are 10 and 5, respectively, while B's parameters are 20 and 12. If we set the iteration number at 1,000, then @RISK will recalculate Y 1,000 times, with each time drawing a value from N (10, 5) and another value from N (20, 12). We will have 1,000 data points of Y to form a simulated distribution of Y, whose summary statistics will be automatically calculated by @RISK. A step-by-step instruction for using @Risk software as an Excel add-in can be found in Winston (2001).

There have been a few articles that discuss how to use @RISK in risk management and insurance courses. Hoyt *et al.* (2007) shows how to use @RISK to calculate the Value at Risk. Joaquin (2007) relies on the same program to simulate the present value of payments for losses occurring within a one-year policy period. Lei (2009) uses @RISK and RISKOptimizer (an optimization program developed by the same company) to examine the optimal risk management investment to minimize TCOR. This project is similar to Lei (2009) in that it also focuses on TCOR. The main difference is that we assume that inputs to risk management alternatives, such as investment required to purchase sprinkler systems, are known, whereas Lei (2009) tries to find the optimal level of investment in risk management. Additionally, this project takes one step further to incorporate the concept of time value of money and considers the fact that different components of TCOR may occur at different time points.

OVERVIEW OF THE PROJECT

The learning objectives of the project include:

- Understand the concept and calculation of TCOR;
- Learn how to use @RISK to model uncertainties with probability distributions;
- Practice how to set up TCOR models in Excel and how to run simulations to generate simulated distributions of output variables;
- Interpret simulation results to aid in selection of best risk management alternatives.

The project involves doing a TCOR analysis for a company that has the following four options available to manage its fire risk:

- Option 1: Do not implement any risk management strategies and simply pay for fire losses when they happen;
- Option 2: Install a sprinkler system, but do not purchase fire insurance;
- Option 3: Purchase fire insurance, but do not install a sprinkler system;

- Option 4: Install a sprinkler system and purchase fire insurance at the same time.

Students are instructed to choose the best option that returns the lowest TCOR for the company. There are some assumptions that need to be made when designing the project. We describe these assumptions below. Instructors can easily change the assumptions and make several variations of the same example.

EXPLANATIONS OF ASSUMPTIONS USED IN THE PROJECT

1) Assumptions about fire loss

We assume that the fire loss frequency follows a Poisson distribution and the loss severity follows a lognormal distribution. Poisson distribution is a discrete probability distribution that describes the probability of the number of times an event occurs in an interval. It has one parameter, which is the average number of times an event occurs. For this project, we assume the company incurs 10 fires on average under all four possible risk management options.

Lognormal distribution is a continuous probability distribution of a variable whose logarithm is normally distributed. It has two parameters, which are the mean and standard deviation of the natural logarithm of the loss severity. Without a sprinkler system in place (options 1 and 3), the two parameters are assumed to be 4000 and 2500. The sprinkler system is considered a risk reduction technique which mitigates loss severity. When a sprinkler system is installed, the two parameters are assumed to reduce to 3000 and 2000, respectively.

Intuitively, the total amount of fire loss would be the average frequency multiplies by the average severity. We will discuss how to use @RISK to simulate total amount of fire loss later.

2) Assumptions about risk management

If the company chooses to purchase a sprinkler system, the one-time investment is assumed to be $200,000 with an annual maintenance cost of $1,500. The system is expected to last 10 years, after which time no value is left. Each year, the company can take depreciation to reduce its taxable income.

3) Assumptions about insurance policy

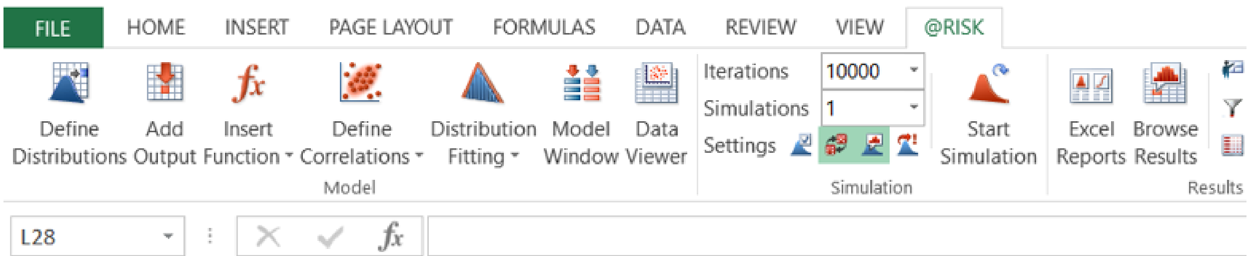
If the company decides to purchase insurance, we assume it purchases a stop-loss coverage, which means it retains its fire loss up to a deductible amount (or retention limit) before insurance kicks in and pays up to an aggregate policy limit. For simplicity, we also assume that the company chooses the same deductible level of $8,000 and the same aggregate policy limit of 32,000 regardless of whether it has a sprinkler system or not. Insurance premiums are assumed to be $3,300 without sprinkler and $2,600 with sprinkler.

4) Assumptions about tax rate and discount rate

Annual premium and loss payments as well as maintenance costs are tax deductible. We assume a tax rate of 25.7% for this project reflecting the Tax Cuts and Jobs Act (TCJA)[4]. We also assume an 8% of discount rate in our calculation of discounted cost of risk.

Figure 1 shows the assumptions as entered into the Excel spreadsheet. The decision tree and the corresponding impacts on TCOR for each of the four options are presented in Figure 2.

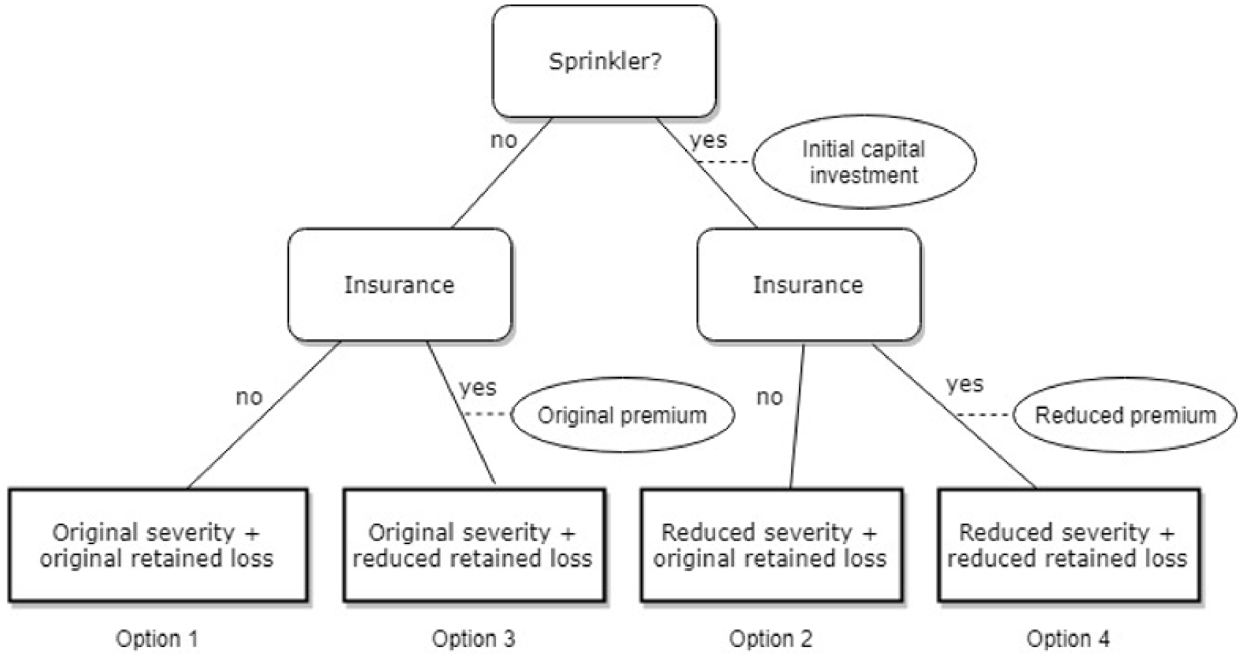
Figure 1: Assumptions



	A	B	C	D	E
1					
2	**Assumptions**	**Option 1 No Risk Management**	**Option 2 Sprinkler Only**	**Option 3 Insurance Only**	**Option 4 Sprinkler + Insurance**
3	Loss Frequency Parameter	10	10	10	10
4	Loss Severity Mean Parameter	4000	3000	4000	3000
5	Loss Severity StdDev Parameter	2500	2000	2500	2000
6	One-time RM Investment	0	20000	0	20000
7	Annual Maintainence Cost	0	1500	0	1500
8	Sprinkler Life Expectancy	10	10	10	10
9	Corporate Tax Rate	0.257	0.257	0.257	0.257
10	Discount Rate	0.08	0.08	0.08	0.08
11	Aggregate Deductible	-	-	8000	8000
12	Aggregate Policy Limit	-	-	32000	32000
13	Annual Insurance Premium	0	0	3300	2600

[4] With the new Tax Cuts and Jobs Act (TCJA), the U.S. federal corporate income tax rate has been reduced from 35% to 21%. In addition to federate tax, corporations operating in the United States also face an average of 4.7% of state corporate income taxes. More information on the new tax rate can be found at https://taxfoundation.org/us-corporate-income-tax-more-competitive/

Figure 2: Decision Tree and Impacts on TCOR



CALCULATION OF TOTAL COST OF RISK

Recall that TCOR is defined as the sum of insurance premiums, self-funded losses, risk control expenditures, internal and external administrative costs. In this project, we assume the company incurs no internal or external administrative costs.

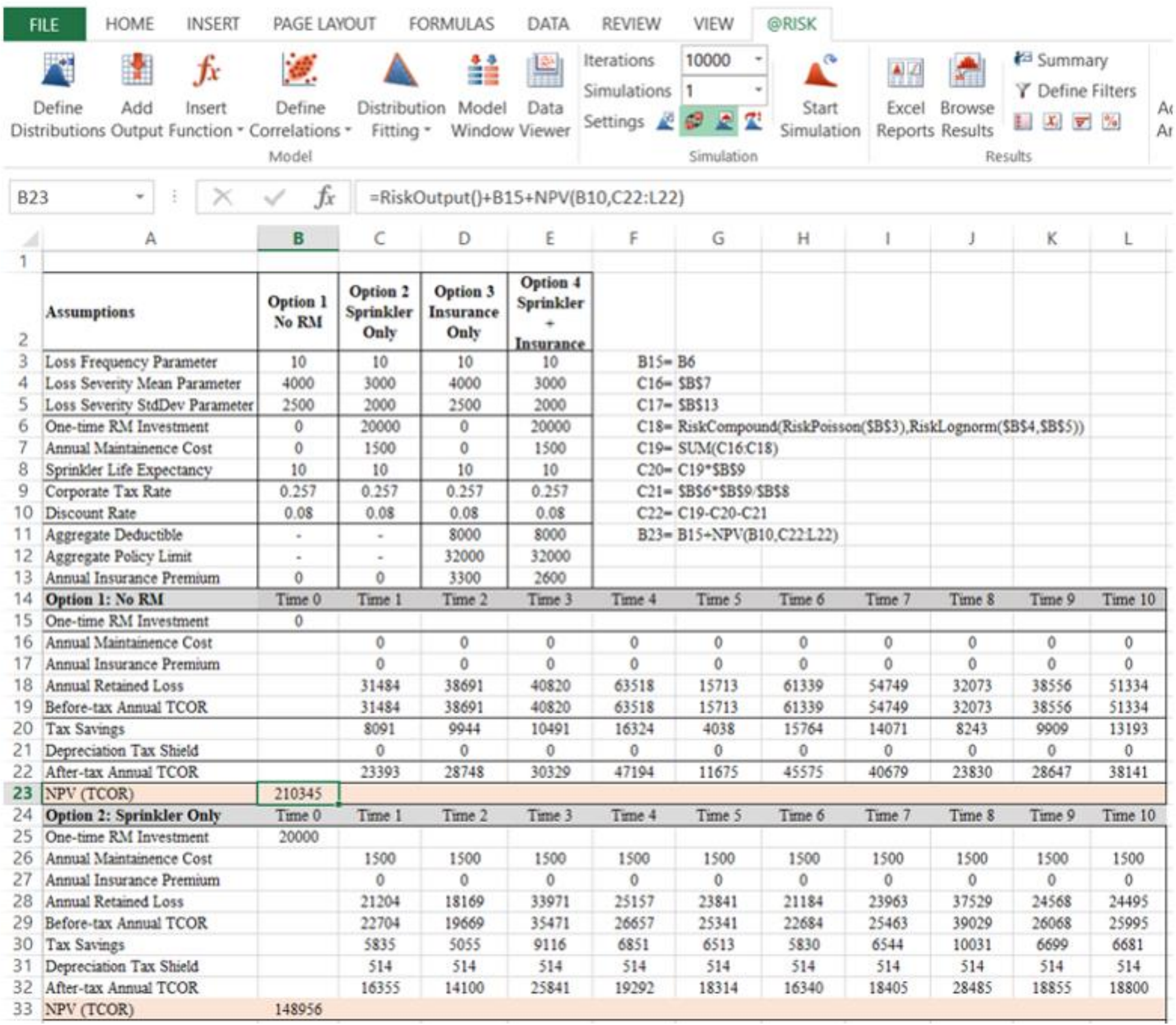
Given the options available to the company, risk control expenditures include one-time capital investment in the sprinkler system and annual upkeep costs, if the company chooses to purchase a sprinkler system. Risk financing expenditures includes insurance premiums. Therefore, TCOR is the sum of investment in sprinkler and upkeep cost of sprinkler, insurance premiums, and retained losses, which occur at different time points.

As the sprinkler system is assumed to last 10 years, Figure 3 shows a 10-year timeline setup for TCOR calculations.[5] The one-time investment is paid at time 0 (beginning of the first year) and insurance premiums and sprinkler upkeep costs (if applicable) are paid at the end of each year for 10 years.

As the company weighs available risk management alternatives, it should use the net present value of TCOR as the basis for comparison.

[5] Figure 3 contains the assumptions presented in Figure 1, as well as TCOR calculation for options 1 an 2. Due to space constraint, we show a snapshot of TCOR calculations for options 3 and 4 in Figure 4.

Figure 3: TCOR Setup for Options 1 and 2



	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	**Assumptions**	**Option 1 No RM**	**Option 2 Sprinkler Only**	**Option 3 Insurance Only**	**Option 4 Sprinkler + Insurance**							
3	Loss Frequency Parameter	10	10	10	10	B15= B6						
4	Loss Severity Mean Parameter	4000	3000	4000	3000	C16= $B$7						
5	Loss Severity StdDev Parameter	2500	2000	2500	2000	C17= $B$13						
6	One-time RM Investment	0	20000	0	20000	C18= RiskCompound(RiskPoisson($B$3),RiskLognorm($B$4,$B$5))						
7	Annual Maintainence Cost	0	1500	0	1500	C19= SUM(C16:C18)						
8	Sprinkler Life Expectancy	10	10	10	10	C20= C19*$B$9						
9	Corporate Tax Rate	0.257	0.257	0.257	0.257	C21= $B$6*$B$9/$B$8						
10	Discount Rate	0.08	0.08	0.08	0.08	C22= C19-C20-C21						
11	Aggregate Deductible	-	-	8000	8000	B23= B15+NPV(B10,C22:L22)						
12	Aggregate Policy Limit	-	-	32000	32000							
13	Annual Insurance Premium	0	0	3300	2600							
14	**Option 1: No RM**	Time 0	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8	Time 9	Time 10
15	One-time RM Investment	0										
16	Annual Maintainence Cost		0	0	0	0	0	0	0	0	0	0
17	Annual Insurance Premium		0	0	0	0	0	0	0	0	0	0
18	Annual Retained Loss		31484	38691	40820	63518	15713	61339	54749	32073	38556	51334
19	Before-tax Annual TCOR		31484	38691	40820	63518	15713	61339	54749	32073	38556	51334
20	Tax Savings		8091	9944	10491	16324	4038	15764	14071	8243	9909	13193
21	Depreciation Tax Shield		0	0	0	0	0	0	0	0	0	0
22	After-tax Annual TCOR		23393	28748	30329	47194	11675	45575	40679	23830	28647	38141
23	NPV (TCOR)	210345										
24	**Option 2: Sprinkler Only**	Time 0	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8	Time 9	Time 10
25	One-time RM Investment	20000										
26	Annual Maintainence Cost		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
27	Annual Insurance Premium		0	0	0	0	0	0	0	0	0	0
28	Annual Retained Loss		21204	18169	33971	25157	23841	21184	23963	37529	24568	24495
29	Before-tax Annual TCOR		22704	19669	35471	26657	25341	22684	25463	39029	26068	25995
30	Tax Savings		5835	5055	9116	6851	6513	5830	6544	10031	6699	6681
31	Depreciation Tax Shield		514	514	514	514	514	514	514	514	514	514
32	After-tax Annual TCOR		16355	14100	25841	19292	18314	16340	18405	28485	18855	18800
33	NPV (TCOR)	148956										

Let $TCOR_i$ (i=0, 1, ..., 10) denote cost of risk for each time point. Assuming a discount rate of d, the net present value of these eleven cash flows can be calculated as follows:

$$\text{Net Present Value (NPV)} = TCOR_0 + \frac{TCOR_1}{(1+d)^1} + \frac{TCOR_2}{(1+d)^2} + \cdots + \frac{TCOR_{10}}{(1+d)^{10}} = \sum_{t=0}^{10} \frac{TCOR_t}{(1+d)^t}$$

Figure 3 shows how to set up $TCOR_i$, with the top-right section of the image showing the formulas used in the calculation. We will use option 1 (no risk management) to demonstrate the setup details.

The one-time risk management investment (in cell B15) is set equal to cell B6 for option 1 with no risk management. It is $TCOR_0$.

For the rest of $TCOR_i$ (i=1, ..., 10), they are calculated in a similar manner. We will use time 1 as an example for demonstration.

Before-tax annual $TCOR_1$ (cell C19)
= annual maintenance cost (C16) + annual insurance premium (C17) + annual retained loss (C18),

where C16 = $B$7= 0, C17 = $B$13= 0, and C18 contains simulated results, which we will discuss later.

After-tax annual $TCOR_1$ (C22)
= Before-tax annual $TCOR_1$ (C19) - Tax saving (C20) - Depreciation tax shield (C21),

where

Tax savings (C20) = tax rate ($B$9) * before-tax $TCOR_1$ (C19)

and

Depreciation[6] tax shield (C21)
= tax rate ($B$9) * one-time investment ($B$6) / sprinkler life expectancy ($B$8).

Once we have above big-picture calculation, we now turn our attention to discussion of retained losses (C18).

In option 1 without risk management, the loss frequency of annual retained loss follows a Poisson distribution with a parameter of 10, and loss severity follows a lognormal distribution with parameters of 4000 and 2500.

Note that both loss frequency and severity are uncertain variables. @RISK has a built-in function *RiskCompound* that simulates the distribution of the total loss amount. The function *RiskCompound* (dist #1, dist #2) takes two distributions to form a new input distribution. It uses two arguments with each normally a @RISK probability distribution function. In a given iteration, the number generated from the first distribution specifies the number of samples to be drawn from the second distribution. Those samples from the second distribution are then summed to give the value returned by the *RiskCompound* function.

So cell C18 = *Riskcompound* (*RiskPoisson*($B$3), *Risklognorm*($B$4, $B$5)).

For instance, during each iteration, if a value of 3 (meaning three fires occur in a certain year) is drawn from *RiskPoisson*($B$3), *Risklognorm*($B$4, $B$5) would then be sampled three times and return three values of severity. If the three values of severity are 0, 500, and 700, respectively, *Riskcompound* would return a sum of 1200 (=0+500+700). In other words, that single iteration simulates a total loss amount of $1,200. If we run 1,000 iterations, we would obtain 1,000 possible values of total loss amounts to aid in our decision-making.

For option 2 with a sprinkler system in place, the formula for the annual retained loss is the same as that of option 1, except that the parameters in the loss severity distribution indicates lower loss

[6] We simply use straight-line depreciation here and assume the sprinkler's value depreciates evenly over time.

potential. So Cell 28 is set to equal to *Riskcompound*(*RiskPoisson*($C$3), *Risklognorm*($C$4, $C$5)), where C3 (=10), C4 (=3000), and C5 (=4000) correspond to loss distribution parameters assumed for option 2.

We are now ready to calculate the net present value of TCOR. Using option 1 as an example, the NPV of TCOR is as follows:

NPV (TCOR) (Cell B23[7])
= one-time investment $TCOR_0$ (B15) + NPV (annual TCOR)
= B15 + NPV ($B$10, C22:L22),
where cell B10 holds the discount rate and C22 through L22 are the annual after-tax TCOR.

The other two options with insurance purchase are set up in a similar manner.

SETUP OF TCOR CALCULATION FOR OPTIONS WITH INSURANCE

The TCOR calculation for options 3 and 4 with insurance purchase is similar to that for options 1 and 2 without insurance purchase. The main difference is that retained losses for the company will now follow a different formula and that insurance premiums will be different.

If the company does purchase insurance, we have an annual deductible of D and an annual limit of L. Assuming the total amount of loss is X, Table 1 shows how the loss will be settled between the company and its insurer given an annual deductible of D and an aggregate policy limit of L.

Table 1: Insurance Payout vs. Retained Losses

If	Company Pays	Insurer Pays
$X < D$	X	0
$D < X < D+L$	D	X – D
$X > D + L$	X – L	L

We now demonstrate with Figure 4 how to set up retained losses and calculate insurance premiums based on Table 1.

[7] Its formula is also shown in the task bar of Figure 3 Excel spreadsheet.

Figure 4: TCOR Setup for Options 3 and 4

C45 | =RiskOutput()+IF(C39<C34,C39,IF(C39<(C35+C34),C34,C39-C35))

	A	B	C	D	E	F	G	H	I	J	K	L
34	Aggregate Deductible		8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
35	Aggregate Limit		32000	32000	32000	32000	32000	32000	32000	32000	32000	32000
36	Loss Frequency Parameter		10	10	10	10	10	10	10	10	10	10
37	Loss Severity Mean Parameter		4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
38	Loss Severity StdDev Parameter		2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
39	total X		32416	55845	30202	51626	28488	35102	67680	18418	44154	27726
40	insurance payout		24416	32000	22202	32000	20488	27102	32000	10418	32000	19726
41	**Option 3: Insurance Only**	Time 0	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8	Time 9	Time 10
42	One-time RM Investment	0										
43	Annual Maintainence Cost		0	0	0	0	0	0	0	0	0	0
44	Annual Insurance Premium		3300	3300	3300	3300	3300	3300	3300	3300	3300	3300
45	Annual Retained Loss		8000	23845	8000	19626	8000	8000	35680	8000	12154	8000
46	Before-tax Annual TCOR		11300	27145	11300	22926	11300	11300	38980	11300	15454	11300
47	Tax Savings		2904	6976	2904	5892	2904	2904	10018	2904	3972	2904
48	Depreciation Tax Shield		0	0	0	0	0	0	0	0	0	0
49	After-tax Annual TCOR		8396	20169	8396	17034	8396	8396	28962	8396	11483	8396
50	NPV (TCOR)	86324										
51	Aggregate Deductible		8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
52	Aggregate Limit		32000	32000	32000	32000	32000	32000	32000	32000	32000	32000
53	Loss Frequency Parameter		10	10	10	10	10	10	10	10	10	10
54	Loss Severity Mean Parameter		3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
55	Loss Severity StdDev Parameter		2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
56	total X		20321	41037	36878	11050	11501	21748	53157	17424	32045	24006
57	insurance payout		12321	32000	28878	3050	3501	13748	32000	9424	24045	16006
58	**Option 4: Sprinklers + Insurance**	Time 0	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8	Time 9	Time 10
59	One-time RM Investment	20000										
60	Annual Maintainence Cost		1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
61	Annual Insurance Premium		2600	2600	2600	2600	2600	2600	2600	2600	2600	2600
62	Annual Retained Loss		8000	9037	8000	8000	8000	8000	21157	8000	8000	8000
63	Before-tax Annual TCOR		12100	13137	12100	12100	12100	12100	25257	12100	12100	12100
64	Tax Savings		3110	3376	3110	3110	3110	3110	6491	3110	3110	3110
65	Depreciation Tax Shield		514	514	514	514	514	514	514	514	514	514
66	After-tax Annual TCOR		8476	9246	8476	8476	8476	8476	18252	8476	8476	8476
67	NPV (TCOR)	83241										

Cell C45 holds the value for retained loss for insurance only option at time 1. Its formula (also shown in the task bar of Figure 4) is:

C45= IF(C39<C34,C39,IF(C39<(C35+C34),C34,C39-C35)),

where

C39 = total loss X = *RiskCompound*(*RiskPoisson*(C36),*RiskLognorm*(C37,C38)),
C34 = aggregate deductible (D),
C35 = aggregate limit (L),
C36 = loss frequency parameter,
C37 = loss severity mean parameter,
C38 = loss severity standard deviation parameter.

The retained losses for time points 2 through 10 (cells D45-L45) are similarly defined. In order for @RISK to sample each year's data independently, we must write out formulas for each year, which is why for options 3 and 4 we have a panel in Figure 4 detailing each year's assumptions even though they are the same for every year. For instance, D= IF(D39<D34,D39,IF(D39<(D35+C34),D34,D39-D35)). If instead we simply set cells D45-L45 equal to cell C45, @RISK will return the same value of retained losses for all ten years with each iteration, when in fact retained losses should vary from year to year.

The retained losses for option 4 with both insurance and sprinkler purchase are set up similarly. For instance, cell C62 = IF(C56<C51,C56,IF(C56<(C52+C51),C51,C56-C52)).

SIMULATION RESULTS OF TCOR

Figure 3 and Figure 4 are contained in the same Excel worksheet that is used for the project. They show @RISK as an add-in to Excel. Under the tab "@RISK" are various buttons that can be used to define probability distributions and to run simulations.

Once everything is setup, we can select an iteration number (=10,000) and start simulation. @RISK generates a simulated distribution for each of the four risk management options' net present values of TCOR (cells B23 and B33 in Figure 3 and B50 and B67 in Figure 4).[8] Table 2 shows the summary statistics of the simulated distribution for each option.[9]

Table 2: Summary Statistics of Simulated Distributions of TCOR

	Option 1: No RM	Option 2: Sprinkler only	Option 3: Insurance only	Option 4: Insurance + Sprinkler
Minimum	117330	109174	56337	71258
Maximum	295990	254135	168695	138807
Mean	199455	173752	85809	83906
Standard Deviation	23973	18332	15460	6858
50% Percentile	198743	173167	83977	82243
90% Percentile	230544	197507	106613	93275
95% Percentile	258099	219395	129810	105692
Coefficient of Variation	0.120	0.106	0.180	0.082

Given our assumptions in Figure 1, option 4 with both sprinkler and insurance purchase is shown to be the optimal option, as it has the lowest mean, median (50th percentile), 90th and 95th percentile, standard deviation and coefficient of variation (COV) of the total cost of risk. Of course, if the company chooses to use the minimum TCOR as a selection criterion, option 3 with insurance only would be better as it offers the lowest possible TCOR. If for some reasons sprinkler purchase is not an option (say, due to supply shortage), then option 1 with no risk management is better than option 3 with insurance only if the company uses the coefficient of variation as a selection criterion. Otherwise option 3 is viewed as a better strategy than option 1.

[8] There are two options for the values shown in @RISK models when simulation is not running: one is to show random values and the other is to display expected values of variables. In Figures 3 and 4, random values are shown.
[9] We have run multiple simulations, each with 10,000 iterations. The simulation results are very similar to those reported in Table 2.

Table 2 also indicates that both options with insurance purchase (i.e. options 3 and 4) are better than options without insurance (i.e. options 1 and 2). If insurance is not available, the company is better off with the sprinkler option as the mean, standard deviation, COV and other statistics of option 2 are consistently lower than those of option 1, the option with no risk management.

In a nutshell, businesses may use different summary statistics of TCOR as their selection criteria when deciding on the best risk management option.

Other Uses of Simulation in the Project

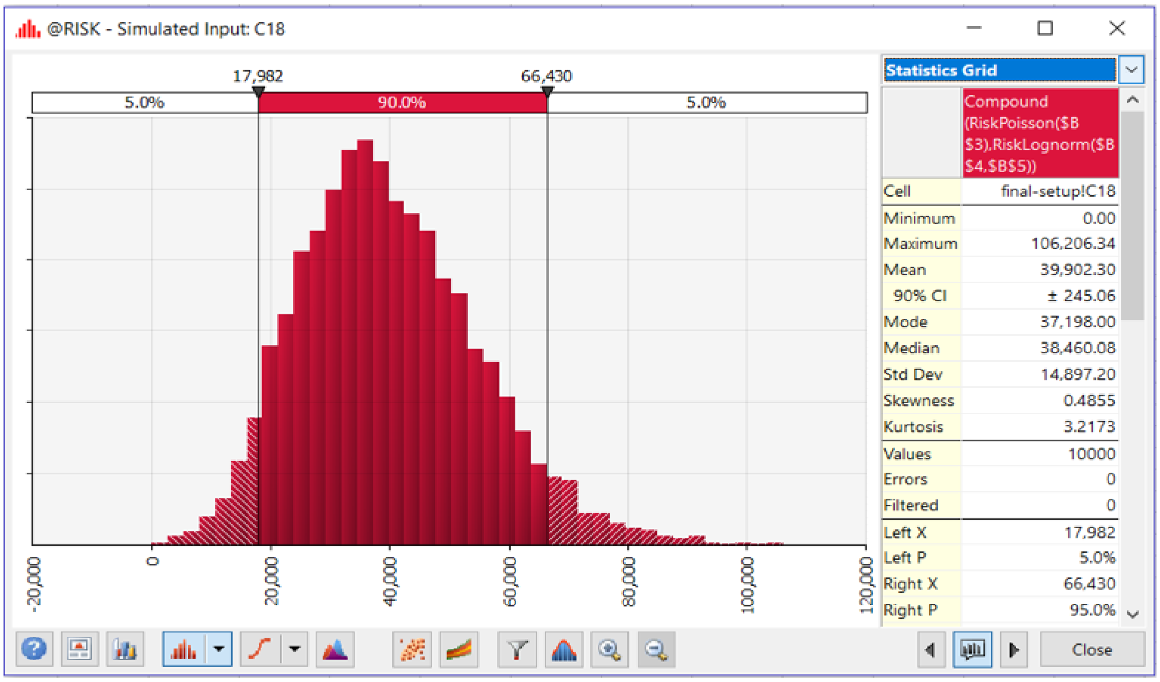
In the above discussion we assume that when insurance is purchased, the company selects a policy limit of $32,000 and the insurance premiums are $3,300 without sprinkler and $2,600 with sprinkler. In an advanced undergraduate course or a MBA level course, instructors may require students to generate an appropriate level of policy limit or calculate actuarially fair premiums given loss distributions and policy terms. In fact, the numbers used in our project were not arbitrarily chosen; we used simulations to help arrive at the values. In this section we demonstrate how @RISK simulation can be used to help a company select appropriate policy limits and help insurers set insurance premiums.

1) Selecting Policy Limit

When we run simulation (with an iteration number of 10,000) of annual total loss without sprinkler (cell C18 in Figure 3), we get 10,000 possible values to form a simulated distribution of annual total loss (see Figure 5). @RISK also returns various summary statistics including mean, minimum, maximum, median, standard deviation, skewness, and percentiles. Depending on a company's risk tolerance, it may choose different policy limits based on these statistics.

For example, an extremely risk averse company may choose a policy limit that equals to the maximum possible simulated loss while another company may use the 90^{th} percentile or 80^{th} percentile as a reference point. In our example, we use the mean value of $39,902 as a reference point and round it up to $40,000 as an estimate of possible loss amount for the company. Since our insurance policy has a deductible of $8,000, we choose a policy limit of $32,000.

Figure 5: Annual Retained Losses



2) Estimating Insurance Premiums

While insurance pricing is very complicated and involves many considerations, if we ignore premium loading and profit margin factors, an actuarially fair premium should be just enough to cover expected payouts to policyholders. Based on this principle, we demonstrate how one can obtain a rough estimate of insurance premiums by simulating insurance payouts to a company.

Based on rules outlined in Table 1, we can calculate insurance payout for each simulated loss amount. The formula for insurance payout as seen in Figure 4 is as follows:

Insurance payout (C40) = IF(C39<C34,0,IF(C39<(C35+C34),C39-C34,C35)).

When we run a simulation with 10,000 iterations, @RISK produces the simulated distribution of insurance payout, as seen in Figure 6.

Figure 6: Option 3 Insurance Payout

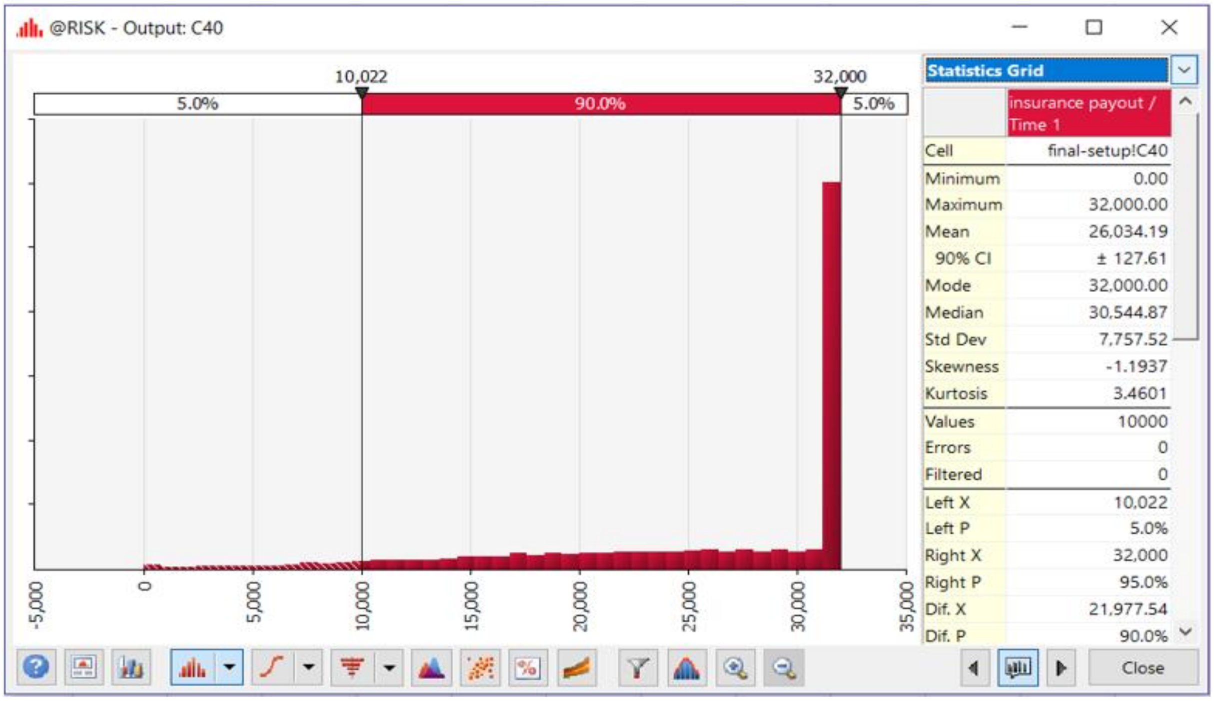


Figure 6 indicates that the average total insurance payout in a year is about $26,035 assuming there are 10 fire losses on average per year.[10] Given that the likelihood of 10 losses per year is 12.5%[11], a pure premium is expected to be $26,035*12.5% = $3,254. In our project we round it up to set the premium at $3,300.[12]

Insurance premium for option 4 can also be estimated using simulation. In Figure 4, Insurance payout (cell C57) = IF(C56<C51,0,IF(C56<(C52+C51),C56-C51,C52)). When we run 10,000 iterations of cell C57, @Risk shows that the average annual insurance payout for option 4 is $20,621. So a pure premium without loading and profit margin would be $20,621*12.5% = $2,577. We round it up to set the premium at $2,600.

For teaching purpose, an instructor can simply give students fixed policy limits and insurance premiums to use or have students go through the simulation exercises discussed in this section to set policy limits and insurance premiums as the first step before calculating TCOR.

[10] To help readers understand how @Risk derives $26,035, let's use 3 iterations to demonstrate the calculation. Note that with each iteration the simulation program will randomly draw the number of fires and the value of insurance payout for each fire before returning the total amount of insurance payout. Assume that the first iteration results in 14 fires for a total insurance payout of $31,000, the second iteration draws 6 fires for a total insurance payout of $22,105, and the third iteration has 10 fires for a total insurance payout of $25,000. The mean value of annual total insurance payout is (31000+22105+25000)/3=26035, and the average number of fires in a year is (14+6+10)/3=10.

[11] The probability of k events occurring is $\exp(-\lambda)*(\lambda^k)/(k!)$, where λ is the Poisson distribution parameter. With a λ of 10, the probability of 10 events is about 12.5%.

[12] We understand that this is by no means accurate insurance pricing, but it gives students an idea of how insurers may set premiums by estimating possible payouts owed to policyholders.

CONCLUSION

This paper presents a simulation-based project that demonstrates how @RISK can be used to help companies select the best combination of risk management strategies based on net present value of TCOR. We also demonstrate how one can use @RISK to choose insurance policy limits and estimate insurance premiums based on loss distributions.

It is important to recognize that simulation results are sensitive to the assumptions used. Any changes to the assumptions indicated in Figure 1 would change the simulated distributions of TCOR and subsequently influence the final choices of risk management options. Simulation, however, is a practical and powerful tool that allows one to visualize and assess potential outcomes with different risk management alternatives without actually possessing data from hundreds of years or thousands of companies.

There are numerous potentials to generate different versions of the project depending on the intended audience and course levels. While only four risk management options are assumed in our project, many more alternatives can be incorporated into the exercise to increase the complexity of the scenario. For example, instead of having just one risk mitigation strategy (in our case, sprinkler), other techniques such as a fire training program or the use of fire-resistance materials may be added to the list of available risk control options. To make it more challenging for advanced undergraduate or MBA courses, a project could also involve multiple risk control alternatives that vary in terms of cost and effectiveness on cutting down loss severities. Similarly, insurance contracts with different policy structure and premiums may be incorporated as well. There are also a variety of ways to assign the project to students. An instructor may simply modify the assumptions and ask the class to replicate the simulation process presented in the paper. Alternatively, in a smaller class setting or a class that contains different student groups, each student or each group may be given a different set of assumptions and comparisons may be made between different scenarios.

REFERENCES

Arrow, Kenneth and R.C. Lind, 1970, "Uncertainty and the Evaluation of Public Investment Decisions", *American Economic Review*, 60 (3): 364-378.

Bajtelsmit, V., Coats, J. C., & Thistle, P., 2015, "The effect of ambiguity on risk management choices: An experimental study", *Journal of Risk and Uncertainty*, *50*(3), 249-280.

Elliott, Michael W., 2016, *Risk Management Principles and Practices*. Malvern, Pennsylvania: The Institutes.

Hoyt, R.E., L.S. Powell, and D.W. Sommer, 2007, "Computing Value at Risk: A Simulation Assignment to Illustrate the Value of Enterprise Risk Management", *Risk Management and Insurance Review*, 10 (2): 299-307.

Joaquin, D.C., 2007, "Loss Modeling Using Spreadsheet-Based Simulation", *Risk Management and Insurance Review*, 10 (2): 283-297.

Lei, Yu, 2011, "Minimizing the Cost of Risk with Simulation Optimization Technique", *Risk Management and Insurance Review*, 14 (1): 121-144.

O'Rourke, M., 2018, Total Cost of Risk Declines Again, *Risk Management, 65*(7), 36.

Ryan, V., 2018, July 3, Cyber-risk costs resist overall trend. Retrieved from http://ww2.cfo.com/risk-management/2018/07/cyber-risk-costs-resist-overall-trend/

Winston, W.L., 2001, *Simulation Modeling Using @Risk*, Pacific Grove, CA: Duxbury Thompson Learning.

2017 Global Insurance Market Opportunities Report: Re-Imagining Risk Management. Retrieved from http://thoughtleadership.aonbenfield.com/Documents/20170910-ab-analytics-gimo-2017.pdf