SOCIETY OF ACTUARIES
PREDICTIVE ANALYTICS AND FUTURISM SECTION

PREDICTIVE ANALYTICS AND FUTURISM
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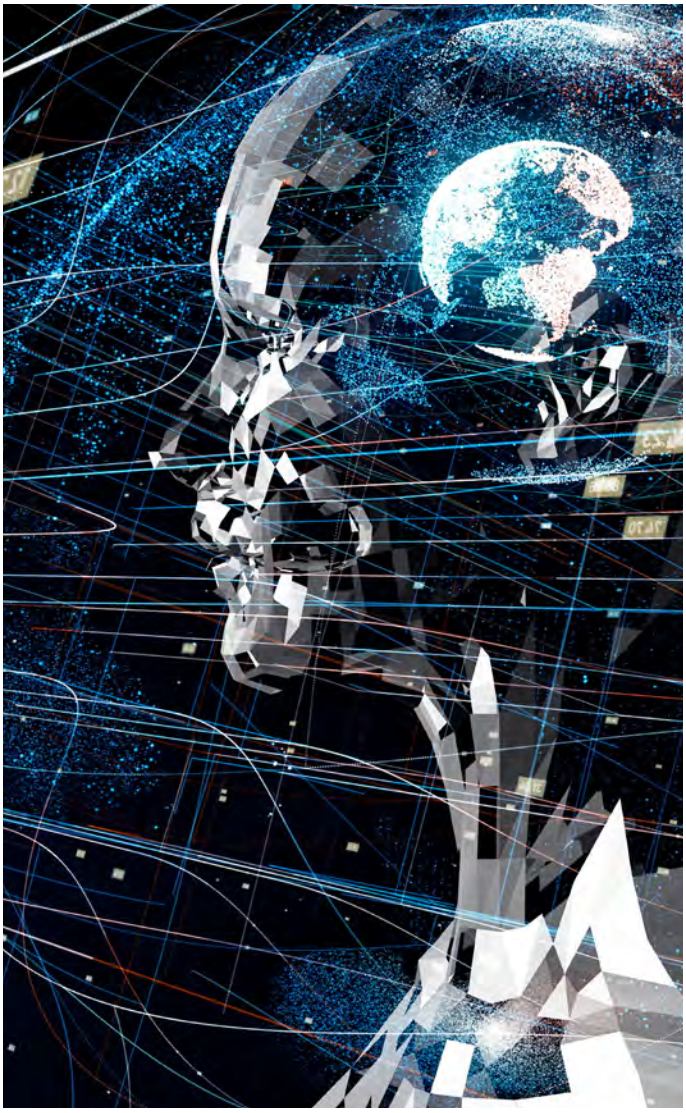
Technology and Skill Trends in the Actuarial Profession

By Julie Curtis



Big data, predictive analytics, machine learning and AI will likely transform the insurance market and the actuarial profession. The actuarial profession is seeing changes in the markets related to personal property and auto insurance. Health care delivery is also starting to show signs of transformation and other types of risks assessed by actuaries are likely to follow suit. Last month, *The Actuary* magazine published the first of a series of articles that provides an overview of some of the changes we are currently seeing and puts them in a historical context. This article describes these trends and provides an introduction into what companies and the Society of Actuaries (SOA) are doing to adapt and capitalize on these trends.

As more data becomes available and as machines become more adept at identifying trends and performing analyses, actuaries are likely to see their roles change. Employers such as insurance companies will probably look to actuaries less often for the more routine computations needed in common product offerings, pricings, and reserving calculations. Instead, future employers will look to actuaries for more strategic analysis and help answering questions such as:

- How can the data be used to create new, meaningful risk groups?
- What is the business case and financial impact of using the data to deliver products in new ways?
- To what extent can an insurer use the new technology to predict and alter future behaviors?
- What societal and financial impact would such ability to alter future behaviors have on the insurer, the insured and other key parties?

In addition to changes in the information available to actuaries and the new tools that permit in-depth analysis of that information, the risk environments faced by actuaries are changing. Actuaries face new risks posed by climate change, uncertain economic markets, and the emergence of sudden disruptors such as what we face now with COVID-19.

One of many examples of changing risk due to climate change is property insurance risk due to wildfires. Older models are becoming outdated because increasing climate extremes are creating more pronounced wet and dry conditions. The profession has always understood that the past cannot predict the future, but the divergence between future expectations and past experience is also becoming more extreme.

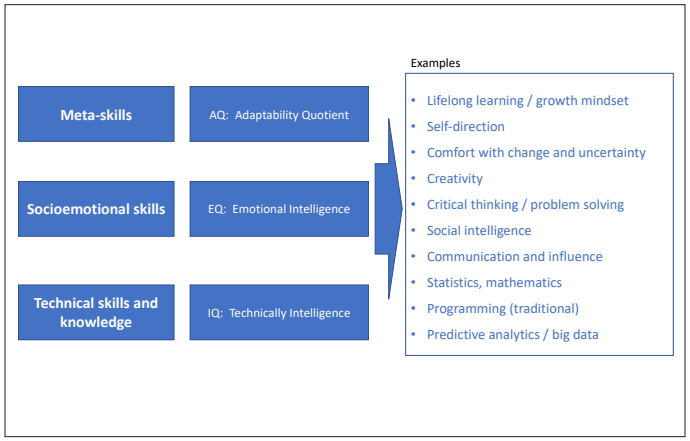
In the future, actuaries may not be called on as often to "predict" because the machines will have already done so. What will become more valuable is what is done with that prediction. . . .

COVID-19 and other possible pandemics create other sets of risks and may create volatility in health, retirement, long-term care, and life insurance markets. To navigate the emerging changes, the actuarial profession will likely need to acquire new skills. While actuaries will need to maintain their expertise in practice areas and regulatory environment, actuaries will also need to understand the underlying data and sort through the new ways of analyzing the data to spot trends, opportunities, and concerns. Then actuaries will need to put the information into a context that enables and empowers them to make informed decisions.

The ability to synthesize the information, develop business-related conclusions and communicate it means that more actuaries will have an opportunity to develop their "Adaptability Quotient" and their "Emotional Intelligence." More than ever, actuaries will need to layer their creative, communicative skills on top of their technical expertise.

In the future, actuaries may not be called on as often to "predict" because the machines will already have done so. What will become more valuable is what is done with that prediction: critical thinking and decision making, information processing and interpretation, and creativity. These create opportunities for actuaries to do new things and add more value to their companies. It will become more critical that actuaries have business judgment so that they can put the analytical results into context.

Figure 1
The SOA's Skills (Intelligence) Taxonomy



Social and emotional skills will be even more important. That is the Emotional Intelligence component. With more information, the key becomes "what to do about it"—and that requires persuading and leading others. That's advanced communication and negotiation skills, interpersonal skills, and leadership. It's also problem solving—not a math problem but making difficult choices based on incomplete data.

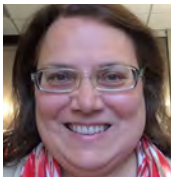
The Adaptability Quotient involves more than learning about new technical intelligence. It requires self-direction and being comfortable with change.

The changes described in this article mean that actuaries' jobs will change. Technical knowledge—the ability to analyze data and make a prediction—will become less important because machines will perform that more efficiently and effectively. What then becomes important is WHAT to do with that information: creativity, problem solving, the ability to design new solutions, communicate them to others and influence them to adopt them.

The SOA is presently looking at ways to ensure a prosperous future for the SOA's members, candidates, and employers and to keep the profession relevant and in high demand in a fast-evolving world. It's still early in a multi-year effort, but the SOA has taken some steps already. Current candidates are required to demonstrate a working knowledge of predictive analytics to earn their ASA. Members who are already credentialed can earn a predictive analytics certificate to acquire the necessary expertise.

The SOA continues to examine the environment in which their members are living and is now thinking through a wide array of possible changes to respond to and get ahead of this environment.

Over the coming months, the SOA plans to reach out to members to discuss the environmental changes we see and the need for the profession to respond. The SOA needs the thoughts and input of all its members. And the members of the Predictive Analytics and Futurism Section are especially well positioned to provide suggestions and guidance. Please share your thoughts and observations on how the profession has already changed for you, or suggestions for future training by emailing membercomms@soa.org. If reader response is strong, it may form the basis for a series of follow up articles on how we can move the profession forward. ■



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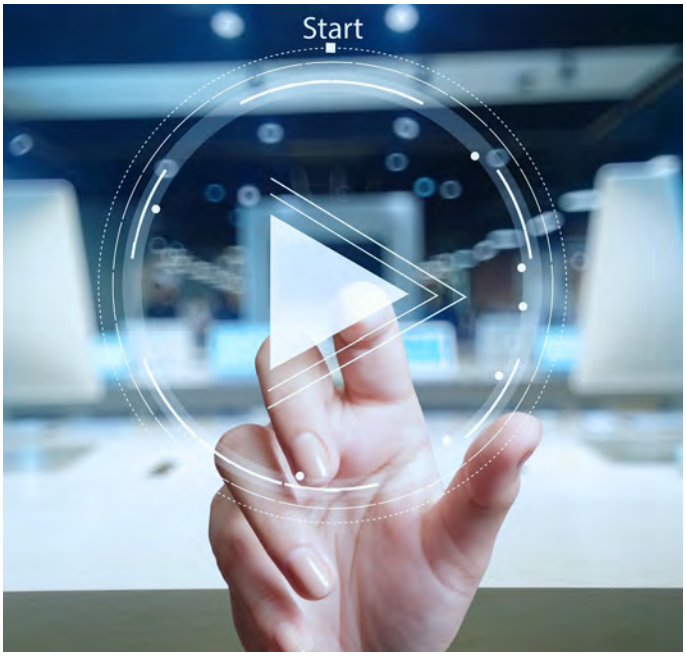
Seven Trends That Will Change Your Future—Part One

By Taylor Patterson, Xiaoxu Liu and Pei Wang



What do data, technology, offices, skills, and cultural perspectives all have in common? Significant transformation.

Technology, robotics, cognitive computing, and AI exponentially advance every year. Data constantly expands with an influx of new numbers and figures converging into a higher resolution picture of the world. Cultural perspectives are shifting alongside priorities and preferences of the population. Lastly, offices are no longer simply clusters of cubicles dotted with cabinets and desktops.

The Exponential Professional team analyzed seven trends to foresee the financial professional of the future, particularly the actuary, and how to make the most of it. These trends are Technology is Everywhere; Tsunami of Data; Artificial Intelligence (AI), Cognitive Computing, and Robotics; Jobs Vulnerable to Automation; Diversity/Generational Change; Careers 100-Year Life; and Explosion in Contingent Work. Part one of this two-part feature focuses on the first three trends.

SECTION 1: TECHNOLOGY IS EVERYWHERE

What's Trending

Technology makes up the canvas of the world. It operates day and night in all facets of daily life. In our current world of about 7.8 billion people, about 3.5 billion own a smartphone, and the number is projected to grow to 3.8 billion by 2021.[1] On average, Americans spend 11 hours per day watching, reading, listening to, or simply interacting with media.[2] Between 2017 and 2022 globally, virtual reality (VR) and augmented reality traffic will increase 12 times, and traffic from internet videos viewed through TV will increase three times.[3] For example, in 2018, the "League of Legends" World Championship drew the eyes of 100 million online viewers, compared to the 2018 Super Bowl's 98 million viewers.[4]

With the rise in technological advances and in the expectation to do more work in less time, professionals, especially actuaries, are experiencing shifts in how they work. For example, we have already been seeing an increase in the number of remote professionals, and given the current COVID-19 health crisis, this number has grown significantly, adding surmounting pressure for professionals to perform efficiently as well as raising the question of the future of physical workplaces.

10 Years From Now

We expect to see a growing number of professionals working remotely, especially on production-related projects such as financial reporting. Nearly 4 million employees worked remotely at least half of the time in 2015; this represents about 3 percent of the U.S. workforce, a 115 percent increase since 2005.[5] However, while the benefits of working remotely provide flexibility, increasingly empty offices and dwindling office culture absorb the costs. Corporations can emphasize developing culture and sense of belonging through regular social events,[6] and continually tailor and design the office space to suit traditional office workers and remote workers alike.[7] Just as importantly, organizations should improve employees' digital experiences with their laptops and technology pieces. Such actions can maintain or even improve the employee engagement and enhance productivity.

Alongside the workplace evolution is the technology transformation. All actuarial vendor platforms will be run from the cloud with very little instances of desktop versions of the software. Actuaries and finance professionals will utilize other vendor applications as part of business as usual (e.g., Workiva, SaS, Alteryx). Experience studies will be performed using neural network technologies developed by data scientists and analytics individuals. Users will be able to complete actuarial-related tasks using their mobile devices and tablets; reports showing results of production runs will be available on mobile devices with the ability to accept or decline production, and users will easily run scenarios at the swipe of a few key strokes. Quantum computing will be utilized for several actuarial activities. Additionally, blockchain will help improve security in transactions, be used as data storage, and enable automation of complex transactions. These will allow actuaries to better predict and manage risk by collecting more data points more quickly, improving reserve setting and pricing assumptions. Consequently, actuaries will be expected to shift their roles to collaborate with coders and guide the development process with their actuarial and financial expertise. This shift will allow actuaries to increase their capacity to deliver more impact and have a bigger say in key business decisions, i.e., when financial results deviate from forecasted results; augmented reality and data visualization will allow for actuaries to quickly drill down into the driving components.

SECTION 2: TSUNAMI OF DATA

What's Trending

Anything can be decomposed into data nowadays—demographics, behavior, and characteristics never thought of a decade ago. With proliferating mobile devices, expanding cloud computing traffic, and burgeoning new technologies such as the Internet of Things (IoT), the collecting of large and complex data is easier and more accessible. In the last two years alone, nine times more data has been collected than was collected in all of human history.[8] However, companies are struggling to capture, clean, and use the data. Of all the data in the world, only 0.5 percent of it is ever used.[9] It will be important to find ways to use this data as the global big data market is forecasted to grow to 103 billion U.S. dollars by 2027, more than double its expected market size in 2018.[10] When used correctly, this tsunami of data can enable advanced analytics tools, such as predictive modeling and data mining, to generate business insights.

10 Years From Now

Reflecting this trend, professionals will collect and analyze data from not only traditional sources, but also wearables, mobile apps, social media, and IoT devices.[11] Data is no longer just collected within the function, but with outside vendors such as Google, AWS, and Microsoft. Data will need to be cleansed and validated, and actuaries will play a key role in simplifying data analysis and creating predictive models at a faster rate. Actuaries will also be responsible for data integrity, as data will need to be continuously monitored and validated to ensure compliance to regulations and enterprise risk profiles. Hybrid jobs will emerge as professionals partner with vendors to develop the data ecosystem from motion-tracking devices such as Fitbit and Citibike. The fascinating new categories of data will transform experience studies and help better price and measure risk: research shows that physical activity, currently defined steps per day, is one of the biggest indicators of mortality risk and is 10 times more indicative than smoking status.[12]

With big data and greater computational power, actuaries will price "pay-as-you-go" life insurance that dynamically adjusts the premium pricing based on real-time life choices and other behavioral patterns collected through connected devices. Actuaries also envision a dynamic marketing model that sells insurance products like Amazon—providing indicative quotes for all suitable life insurance products within the same internet window without the need for customers to key-in much additional information.[13] In the future, actuaries could evolve into roles where they combine psychology, data analysis, and behavioral science to design customer influencing strategies to drive healthy living habits for policyholders and increase profitability for insurers. Yet risks associated with the use of data include data privacy, unauthorized sharing, regulatory compliance, and third-party data credibility.[14]

SECTION 3: AI, COGNITIVE COMPUTING, ROBOTICS

What's Trending

In Deloitte's 2019 Global Human Capital Trends survey, the majority of the respondents predicted growth in automation, robotics, cognitive technologies, and AI.[15] Even nowadays, Deloitte uses VR to allow new hires to visit Deloitte University virtually to attend virtual classrooms and perform hands-on simulations of real-life job scenarios. International Data Corp. forecasts that annual corporate spending on AI will grow to about $52 billion by 2021.[16] AI is beating humans in more than just poker and chess games, it is better and faster than doctors in interpreting medical exam results and paralegals in conducting due diligence.[17] Will actuaries and financial professionals, at some point, be displaced by technologies and are there any other implications to the actuarial workforce?

10 Years From Now

Labor intensive functions may be eliminated—companies will use cognitive computing and gamification to understand the impact of events on financial planning and analysis; experience studies will be developed based on neural networks and quantum computing; actuarial reserving will be based on regression analysis and predictive models; document reviewing of reinsurance agreements will be ingested and standardized using natural language processing; natural language generation will produce tailored actuarial reports for financial reporting and asset liability management; chat bots will help actuaries complete root cause analysis in real time using visualization.

However, actuaries should not narrowly define themselves based on function, whether it be reserving or pricing; rather, they could take a broader role from a business perspective, for the benefit of the policyholders and shareholders.[18] Technology is more than automation of the current practice, it can be a combination of the strength of humans and machines. Actuaries will develop risk profiles based on data and cognitive computing to price life insurance within minutes, so they can build more enhanced products while also developing technical tools to acquire, underwrite, cross-sell, and retain business. Actuaries will develop products using data and technology that will be the main driver of competitive advantage; this innovation will mute the competition purely on price, which may no longer be the central driving force in consumer decision making given the changing generational buyer landscape.

TAKEAWAYS

It is important to note that with these ever-evolving practices in the workplace, it is vital for companies and professionals to be adaptable and add human touches to steer the technologies used at work. With the vast amount of data available and disruptive technological forces at work, actuaries face an increasing pressure to finish more work quicker and effectively. However, with this increase in change comes an increase in possibilities if we are willing to adapt, evolve, and learn. Specifically, actuaries have a great opportunity to redefine their role to one that is more value added and strategic, with a new focus on productivity, business insights, and performance.

Part Two of this two-part series will delve further into how automation and current cultural pieces are impacting and transforming the workforce. ■

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Know Your Policyholders First, Model Their Behavior Second

By David Wang

This article first appeared in the June 2020 issue of Milliman's Variable Annuity Market Update. *It is reprinted here with permission.*

Author's note: This article applies to all kinds of policyholder behavior, including, but not limited to, lapses/surrenders, premium persistency, partial withdrawals, policy loan take-ups, and buy-back take-ups. However, for the ease of presentation, lapse from a contract with cash surrender value is the focus of the discussion.

Actuaries have traditionally determined the lapse assumption by studying how many policies have lapsed out of the entire product portfolio over time. This analysis is then split over dimensions such as policy duration, distribution channel, etc., which then drives a typical lapse assumption.

Some products offer significant guaranteed benefits, such as the living benefit riders on variable annuities (VA). The lapse assumption for these products typically involves a dynamic function in the sense that lapse rates can be affected by external market conditions such as equity market movements or interest rate changes. The formulation of the dynamic function revolves around our view as actuaries of the perceived value of the insurance benefits (including the guarantees) to the policyholders. A typical example in the case of VA is where we expect, when the equity markets experience low returns or losses, that the underlying guarantee becomes more valuable and therefore the policyholders will hold on to the contract. We sometimes would claim that policyholders behave irrationally if the actual experience deviates from that expectation.

We can defend our lapse assumption using a traditional "A over E" analysis, which compares actual experience with the expected assumption. It serves as a useful check on our assumption being consistent with the actual experience.

That said, there are still challenges when we try to formulate a lapse assumption in some unprecedented environments. For example, what would happen with the fixed annuity lapse if interest rates go up a lot, and very quickly, or more generally how would policyholders behave in extreme tail event scenarios? It is hard to answer questions like these when there is very little or no historical data that mimic such unprecedented environments. In situations like these, we fall back to what we do best: apply actuarial judgment.

But is actuarial judgment really useful in these situations? Undeniably, with our training, actuaries are better positioned than most others to understand the mechanics of insurance products. However, perhaps the very fact that we know so much about the mechanics of insurance products makes us ill-positioned to speculate on how less knowledgeable policyholders would behave. Our assumptions may be more geared towards how we would behave, as a fully informed individual. This "self-selection" offers little guidance about how an individual with lesser technical knowledge that owns the same insurance products would behave.

As a simple example, my wife is not an actuary, and she owns a whole life insurance policy that offers a cash surrender value that is linked to the insurance company's investment performance. When I asked her when she might surrender and cash in, her response was either when kids go to college or when we retire. In either case, there is a need for some big lump sum cash that will cover more than our daily expenditure. When I asked her about how the insurance product works and how she expects the company will credit return on the policy, she has no idea. My wife has no actuarial training, but she studied finance and used to work at a reputable investment bank. Nevertheless, it is clear that her thinking about when to lapse has little to do with how the underlying value of the contract works, and instead is driven almost exclusively by the family needs for money. It is very likely that such needs may change over time as the financial condition and/or spending needs of our household changes, but fundamentally the time when she thinks about surrendering the policy is when she or the family needs the money.

Now if we look at this issue from a broader perspective, an insurance company has many policyholders of the same age and gender that have purchased the same insurance product from the same distribution channel around the same time. Today, we typically assume that they behave the same way in terms of lapsing the policy. In reality, however, two female policyholders both at age 45 can live a very different life: one married and the other single; one owns the house and the other rents; their jobs and income level can differ significantly; or their health condition may differ. Therefore, their need to access the insurance policy for additional cash is likely to differ significantly too.

Traditionally, an actuarial projection only requires us to have a reasonably good estimate of the overall lapse from any particular product. There is, therefore, no need for actuaries to know more about individual policyholders. An overall estimate averages out the different behavior patterns from different policyholders. However, when unprecedented conditions arise, whether individual, household, or economic, individuals respond differently, and our overall estimates start to be less accurate, possibly to the point of failing.

During the financial crisis of 2008–2009, account values of most VA contracts reduced significantly, resulting in the underlying living benefit guarantees becoming much more valuable. This would predict a reduced lapse rate under a typical actuarial lapse assumption for VA. However, the Milliman VALUES study, an industry-level experience study on VA products, shows that during the financial crisis the actual observed lapses far exceeded the expected from such a lapse assumption, as shown in Figure 1.

Figure 1
Lapse During Financial Crisis

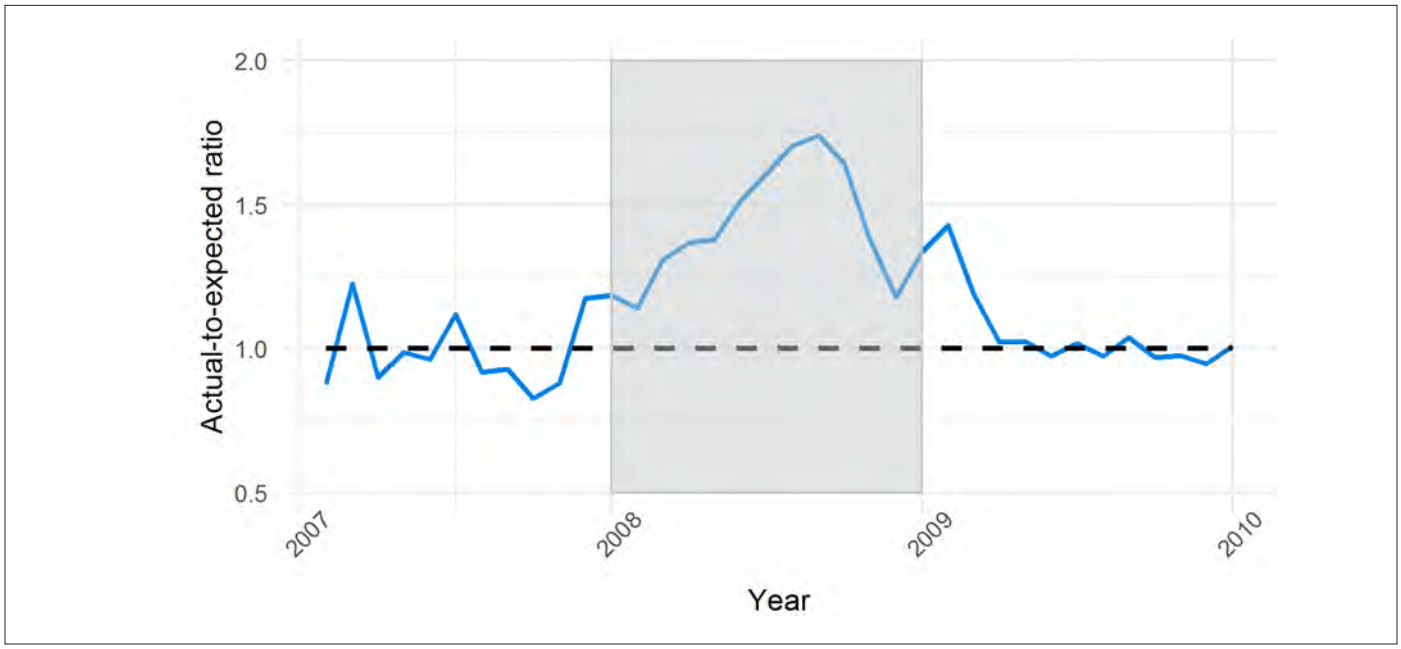
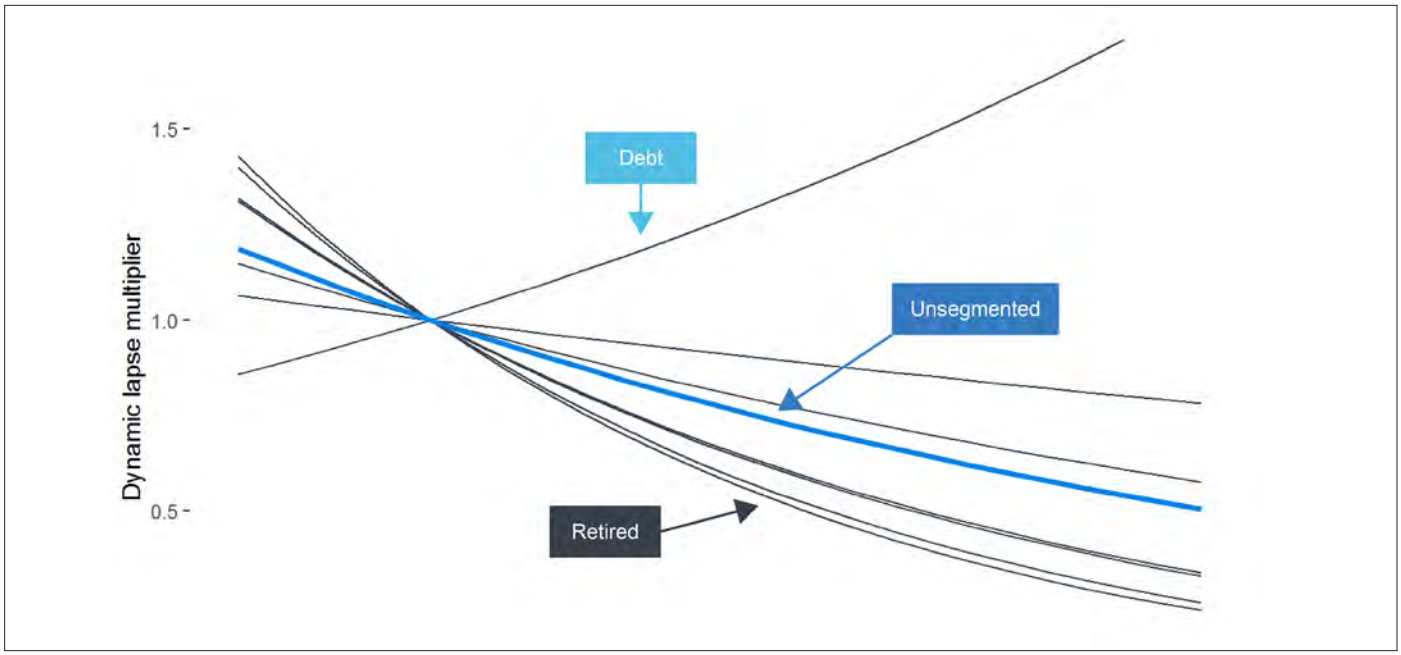


Figure 2
Segmented Lapse Model



Another Milliman research project collected a more granular set of data to help understand policyholders better, including data related to mortgage, household income, credit, family demographics, etc. The policyholders were divided into different profiles according to these underlying characteristics as well as how they have behaved differently with their insurance policies. Figure 2 shows a handful of profiles highlighting how different policyholder characteristics can mean a different response to changes in the underlying value of the guarantees in their propensity to lapse prediction. The X-axis shows the moneyness of the guarantees, which is the ratio of the guarantee over the account value. The larger the ratio, the more valuable the guarantees. The y-axis shows the multiplier to the base lapse rates corresponding to the different moneynesses. Each line represents behavior from a different profile, with the blue line representing the average behavior across all policyholders.

In particular, those in what is characterized as the "Debt" profile, defined by individuals with relatively lower credit scores and larger debts and possibly recent delinquencies, would in fact be more likely to lapse when the guarantee is worth more relative to the account value. During the financial crisis of 2008–2009, those in the Debt profile would likely have experienced rapidly increasing liquidity needs and therefore would have sought access to cash within all their available resources. Thus, the lapse propensity of this group increased significantly relative to a typical lapse assumption's expectations, and relative to other policyholder profiles. Conversely, those in what is characterized as the "Retired" profile, defined by individuals that tend to be older, retired, and live in neighborhoods with people of similar age and characteristics, would be least likely to lapse when the guarantee is worth more.

Had we been able to obtain similar big data during the financial crisis, we would have been able to identify those that had increased needs for liquidity and were thus more likely to lapse, regardless of the value of the underlying guarantee. That would then have allowed us to have a better assumption that would be more consistent with the actual observation during the financial crisis.

This approach enables actuaries to know and understand the policyholders first, and then model their behavior. Actuaries can start to embrace the power of big data to understand and monitor the changing liquidity needs of the policyholders. As market conditions change, or even start to slide into uncharted waters such as the financial crisis in 2008 or the pandemic we are experiencing right now, big data can serve as leading indicators to tell us whether policyholders' needs to access liquidity from their insurance policies would increase.

This approach of big-data-driven analytics into individual-level policyholder behavior also enables us to more accurately determine the profitability from each policyholder. With profitability mapped at the individual policyholder level, life insurance companies will be able to deploy business strategies based on policy-level information instead of product-level information. This offers a new lever for insurers to manage their risk, unlock profitability, and ultimately better protect the wellbeing of their customers in the long term.

Retention strategy, buy-back (typically in the annuity space), and asset-liability management (ALM) are some examples of the in-force management strategies insurance companies have employed. With the policy-level information, a retention strategy can be better designed with trade-off analysis between the long-term profitability of each policy and its short-term propensity to lapse. A buy-back strategy can be optimized by understanding how people will respond differently to the offer. An ALM strategy may be modified to group policyholders with similar propensity to lapse, which may serve as a guide to invest in illiquid assets with extra yields.

On the new business side, understanding how policyholders may behave differently could suggest a need to change the product design to better suit certain policyholders. Of course, policyholder behavior is also a function of the distributors and advisors. By mapping the profitability of new business to the individual level, it allows insurers to monitor the performance of distributors not only by the top line (their sales volume) but also by the bottom line (the profitability of business).

Big-data-driven analytics are now being used by life insurance companies in marketing and underwriting, but they have not been employed by actuaries to nearly the same extent to understand our policyholders. Let us not forget that each insurance contract we work with every day is not simply a record or a model point. Behind every insurance contract is a real individual, and each has a different story that motivated their purchase of the insurance contract. We will never have the luxury of listening to every story they would tell, but we can attempt to understand the general narratives a bit better using the data. Know your customer, and then model their behavior. ■

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