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## Deep in the Data Mines

By Kerry Pechter     *Fri, Nov 20, 2015*

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*At the Society of Actuaries Equity-Based Insurance Guarantees conference in Chicago this week, the use of 'predictive modeling' to unearth buried or cryptic data was strongly encouraged.*

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Predictions are always dangerous to make, it is said, especially when they're about the future. So the search for better prediction tools goes on. One such tool is "predictive modeling," one of the topics covered at the Society of Actuaries' Equity-Based Insurance Guarantees (EBIG) conference in Chicago this week.

In many industries, predictive modeling is old news. The health care, finance, Internet, law enforcement and other sectors have long used it to draw conclusions about past events and measure the probability of future ones. It's a kind of universal drill bit for mining Big Data. But applications in the annuity industry are apparently only a couple of years old.

One driver of interest in predictive modeling among annuity issuers has been its potential for predicting the behavior of policyholders. The profitability (or toxicity) of blocks of in-force contracts with income riders will depend partly on how policyholders use them and how well insurers can anticipate that behavior. Predictive modeling might give insurers a better handle on that problem.

Most of what I heard about predictive modeling in Chicago, frankly, flew past me—a flurry of major league liners over a Little Leaguer's head. But while the equations and terminology were mysteries, the implications were fairly clear. Predictive modeling has multiple applications in the annuity business, and beats some of the modeling techniques that failed in the financial crisis. It is expensive, hard to do right, and not always successful. But the possibility that it might free up capital has captured life insurers' attention: Some 200 actuaries and consultants from virtually all the major life insurers and several large asset managers attended the meetings, some from overseas.

### **What is predictive modeling?**

In laymen's terms, predictive modeling is a way to extract lessons from the past or to predict the probability of events in the future, based on what has happened in the past. Since the dawn of the Internet Age, its applications have been large, small, and pervasive. When Google auto-completes a search term or URL based on the first few letters you type into your browser's address bar, it uses predictive modeling. It's how your e-mail spam filter

works.

Actuaries and statisticians have been using various methods to calculate risks and probabilities for a long time. But predictive modeling, a child of high-speed computing and big data, is a new twist. At the EBIG conference, it was variously described as a better way to reveal a *distribution* of outcomes, as opposed to an *expected* outcome; or to add context to results; or, generally, to simplify what Nationwide actuary Dan Heyer called problems of “frightening” complexity.

Property and casualty actuaries like Heyer have been using predictive modeling for years to reveal, for instance, the shrinkage of gender differences in collision probabilities as drivers age. But since the Financial Crisis, actuaries at some large annuity issuers have started using predictive models to forecast policyholder behavior. Contract surrender rates and usage rates of income options can determine whether a large block of in-force business will generate a profit or a loss.

“Both for variable annuities and fixed indexed annuities, the more dynamic they become, the harder it is to analyze policyholder behavior with traditional techniques,” said Guillaume Briere-Giroux, a consulting actuary at Oliver Wyman who advises life insurers on predictive modeling.

### **What can PM do for you?**

Predictive modeling can be applied to a wide variety of business problems. In 2015, with variable annuity sales down 20% from the previous year, Lincoln Financial Group wanted to rebalance its wholesaling effort toward indexed annuities, whose sales are flourishing, according to Craig Dealmeida, assistant vice president of Annuity Risk Management at Lincoln.

Through advanced modeling techniques, Dealmeida said, Lincoln was able to distinguish between advisors who would probably be willing to switch from selling VAs to selling FIAs, and advisors who wouldn't be as flexible. As a result, its FIA wholesalers were able to schedule more visits to high-probability advisors.

In another case, predictive modeling was used to challenge existing interpretations of lapse behavior, said Briere-Giroux. During the financial crisis, annuity issuers noticed that more surrenders were coming from owners of variable annuity contracts with “at-the-money” income riders (where the account values and guaranteed benefit values were about the same) rather than owners of “deep-in-the-money” riders (the account values were much

lower than the guaranteed benefit values).

Insurers tended to assume that owners of deep-in-the-money contracts recognized the value of what they owned. But, predictive modeling suggested the alternative possibility that advisors, not owners, were driving the trend. Suitability standards barred advisors from pitching 1035-exchanges to owners of deep-in-the-money contracts, so the advisors limited their exchange transactions—which account for about 85% of annual VA sales—to the owners of less valuable contracts.

Nationwide began examining lapse rates on its fixed deferred annuity contracts in 2013, Heyer said. The number of variables that were involved in predicting lapse behavior was daunting. Variables included the attained age of the contract owner, policy size, crediting rate, guaranteed floor rates, difference between market rate and crediting rate, and whether the contract was qualified or non-qualified. A predictive model that considered the variables one at a time, instead of all at once, produced better lapse estimates, he said.

Another insight into the value of predictive modeling was suggested during Briere-Giroux' presentation. Insurance actuaries are familiar with hedge-able market risks, like interest rate risk, longevity risk, credit risk and volatility, he said. But, to predict the future, they also have to make assumptions about future lapse rates, annuitization rates and withdrawal rates. Predictive modeling can help them do that.

Predictive modeling techniques also help actuaries refine their analyses of policyholder behavior, the Oliver Wyman consultant said. Without predictive modeling, actuaries might look at all owners of Guaranteed Lifetime Withdrawal Benefit riders as a single group. But predictive modeling techniques make it possible to segment owners into four sub-groups—those who take 100% of their guaranteed monthly income benefit, those who take less or more than 100% of their benefit, and those who haven't taken a withdrawal yet—each of which has its own characteristic lapse rate.

### **Freeing up capital**

While Lincoln Financial and Nationwide are clearly employing predictive modeling, the adoption rate by other carriers isn't clear. At the conference, actuaries noted that creating a predictive modeling program can be expensive, partly because it often involves the hiring of Ph.D.-level statisticians to complement the skills of actuaries. But senior executives have difficulty approving an investment in what they don't fully understand. "Sometimes it's harder to persuade people to let you do predictive modeling than to do predictive

modeling,” Dealmeida said. Actuaries can be more persuasive if they remember to tie their cryptic equations to a business “story,” he added, and to emphasize predictive modeling’s potential to free up capital.

In addition, the process of building predictive models isn’t foolproof. Heyer said he likes to create problems with known answers to see if his models will ferret them out. Conversely, he sometimes assigns nonsense problems to his models to see if they produce an answer that isn’t there. Given the difficulty of making predictions, actuaries should “use the models to inform their decision-making,” he said, “but not to rely on them.”

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