Jump-start Analytics Research with Illinois Actuarial Program

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The actuary who is only an actuary … is not an actuary.

The actuary’s danger may lie in too close preoccupation with his particular techniques … It is not the tools he uses which make a great craftsman. It is the way he feels and thinks.

-- Frank Redington
Nested stochastic modeling
Nested stochastic modeling is theoretically required in a stochastic calculation where certain financial components are themselves stochastically determined.
Nested Stochastic Modeling

- Nested stochastic modeling - Do we really need it?
  - More regulatory requirements move towards dependence on stochastic modeling
  - Computational burden grows exponentially with nested modeling
  - Run time can be too long to get results and take actions in a timely manner
  - Stronger desire for efficient techniques
Brute-force Monte Carlo

- Computational burden of a typical stochastic model based on 30-year project of variable annuity products. (Reynold and Man, 2008)

\[(30 \text{ years}) \times (4 \text{ quarters}) \times (1 \text{ millions cells}) \times (100 \text{ paths}) \times (1+2 \times 10 \text{ shocks}) \times (1,000 \text{ scenarios}) = 252 \text{ trillion cell-path projects}\]

252 trillion cell-paths/10,000 cell paths per second = 25.2 billion seconds \(\approx 799\) years.
Traditional Monte Carlo Methods
Most common method

- **Pros**
  - Easy to understand and implement
  - Accurate in low dimension

- **Cons**
  - May be difficult to determine boundary points for interpolation
  - Requires large grid in high dimensions
  - Path-dependence (can be addressed by adding dimensions)
Least square Monte Carlo

• Pros
  – Accurate in low dimension
  – Can be used for extrapolation

• Cons
  – Little guidance for basis functions (can be addressed by basis selection techniques)
New approach – sample recycling
Illinois Retirement System

- Illinois retirement systems are only 40% funded with over 130 billions of unfunded liabilities.
- The Illinois Supreme Court overturns state’s 2013 pension reform law.
- State legislators turn to debt management.
Illinois Retirement Systems

The Edgar Ramp
Set artificially low in the '90s, required payments to the state pension funds accelerated dramatically in 2012 and will stay high for the next three decades.

Pension Costs as a Percentage of Total General Funds

Source: Commission on Government Forecasting and Accountability
Illinois’ Statutory Funding Plan

• Pension Funding Act was enacted in 1994 to create a 50-year schedule of State contributions designed to achieve a 90% funded ratio by the end of FY 2045.

• Part I: A ramp-up period of increasing State contributions as a percentage of payroll in each of FY 1996 to 2010.

• Part II: A period of contributions equal to the constant percent of payroll necessary to allow retirement systems to reach 90% funded ratio.
Static assumption: during the ramp-up period, the SFP required that the percentage of payroll contributed by the State increase by an equal amount in each year such that by FY 2010 the contribution percentage of payroll was equal to the same percentage of payroll required to be contributed for FY 2011 through 2045.
• Reality check: the constant percent of payroll is revised and adjusted each year due to modifications to the actuarial assumptions and changes in asset values.
State annual contributions cannot exceed 9 billions.

Reach funded ratio of 90% by 2045.

Other constraints of the current statutory funding plan.
Senate Bill 661

Although the bill itself did not pass, the same idea was extended to introduce bonding for a buyout option in House Bill 3342, which passed both houses and approved by the governor in May 2018.
Other collaborations

• Managing Investment Risk with Contractual Design

• Actuarial Study of Hospital Insurance

• Recovery rate of third party claims
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