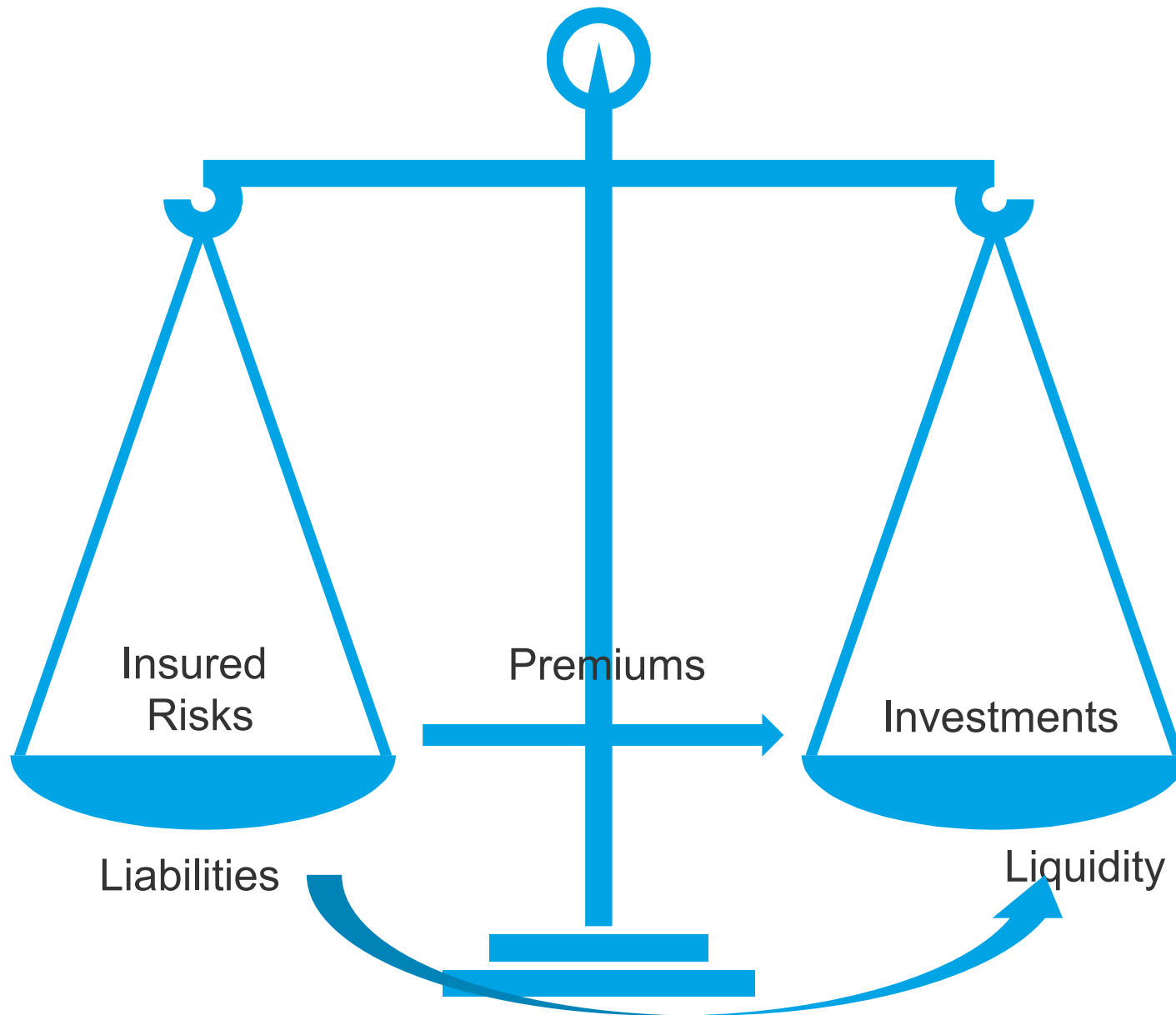# Opportunities for Careers in Insurance for Statisticians and Data Scientists

Siddhartha Dalal
Columbia University

NISS Career Fair: March 2022
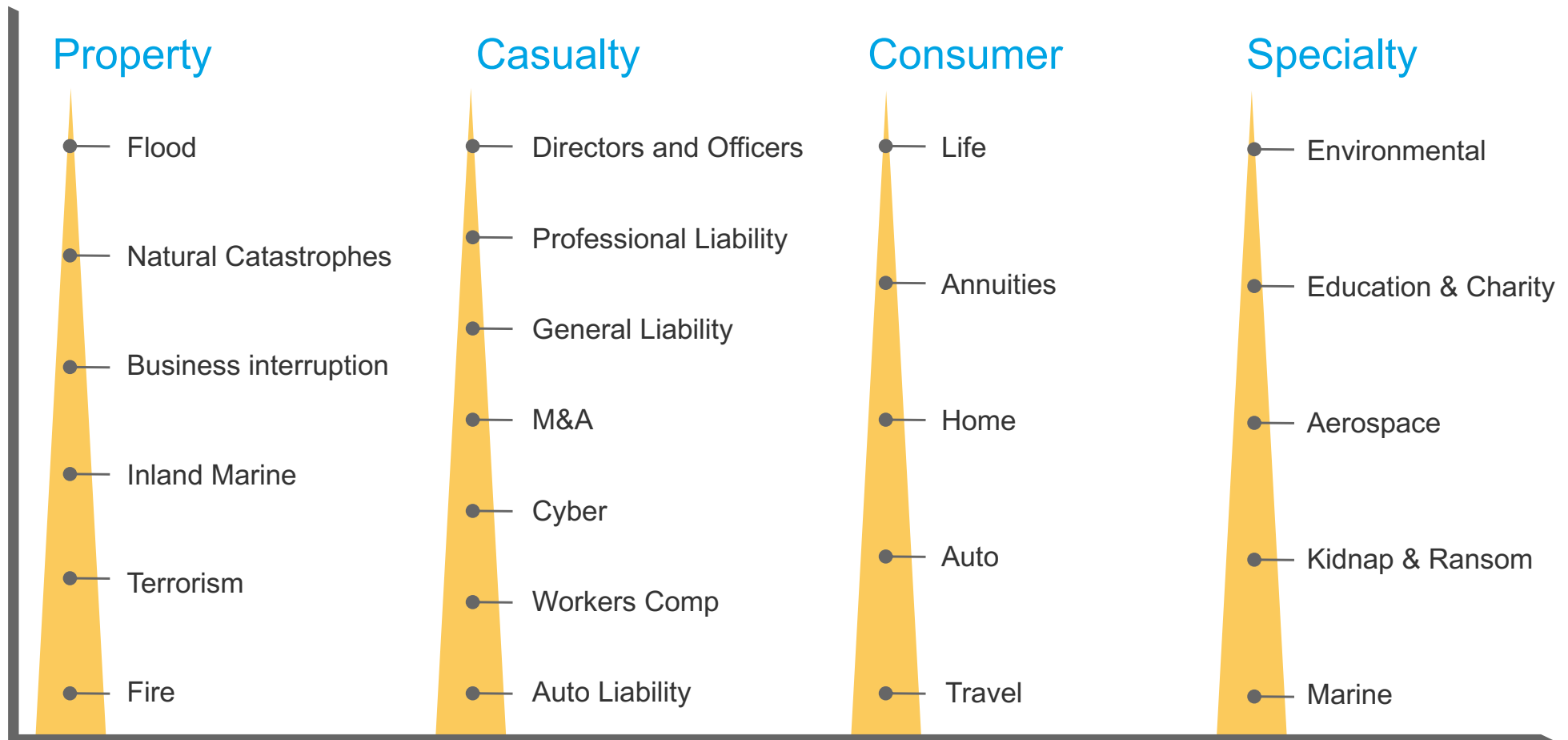
Insurance business balances between insured risks & investments

Insured Risks

Premiums

Investments

Liabilities

Liquidity

Typical lines of insurance business

SAMPLING

Property
- Flood
- Natural Catastrophes
- Business interruption
- Inland Marine
- Terrorism
- Fire

Casualty
- Directors and Officers
- Professional Liability
- General Liability
- M&A
- Cyber
- Workers Comp
- Auto Liability

Consumer
- Life
- Annuities
- Home
- Auto
- Travel

Specialty
- Environmental
- Education & Charity
- Aerospace
- Kidnap & Ransom
- Marine

Why data science?

- Insurance = measured risk taking by spreading across a pool of risks

- Critical elements:
  - Scenarios
  - Data Collection
  - Probabilities
  - Behaviors
  - Outcomes
  - Insurance & investment portfolios

- Data Science plays a key role in all of these

- Lesson: Incorrect data can have catastrophic consequences

 Data Collection, Cleaning and Wrangling

Risk Pooling Reduces Volatility

St. Deviation

Unique Risk

Market Risk

# of Policies
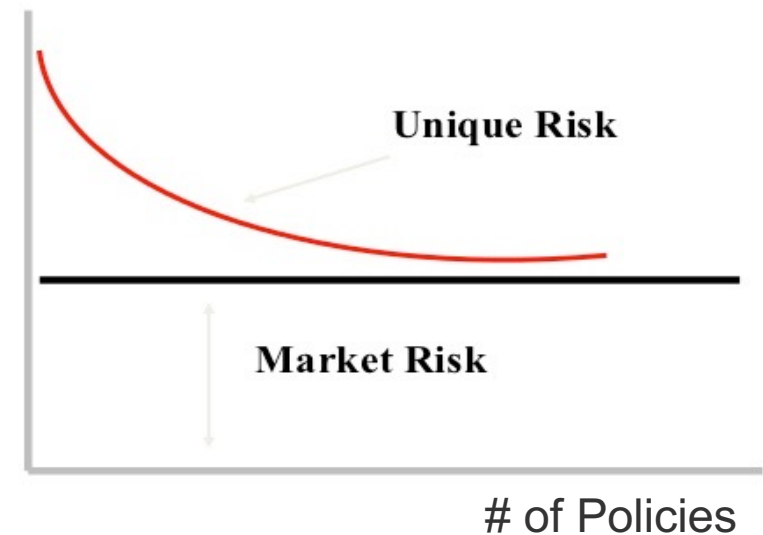
The Opportunity and the Challenge:

Exploitation of unconventional data: information, as well as information sources, types, and capture mechanisms are growing exponentially. *(Unstructured data: text, images, video, audio, sensors)*

VIDEO GROWTH
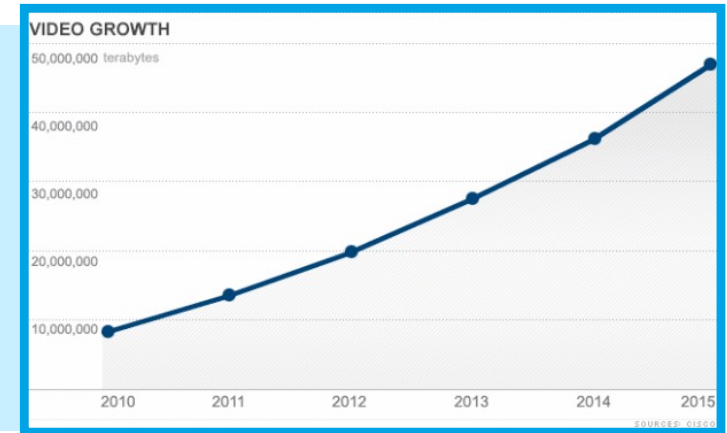
- Text Data
  - Can we predict how soon a worker will be off the disability?
  - Is there any merit in the case which has been filed? What is the probability of winning a lawsuit?

NOTICE OF LOSS OR DAMAGE

An Accident Reconstruction

When the facts of a bicycle crash are unknown or are in dispute, care work often can reveal what actually happened.

Conclusions

From the police photographs, police report, injury reports and damag was able to establish that the SUV traveled completely across and pas lane of travel, striking her while in that lane. From the final position clear that the collision could not possibly have occurred near the cen intersection, as shown in the police diagram. The SUV was never ther unusually abrupt left turn suggests that he was trying to cut in front o underestimated her speed.

Ms. Daniel has, fortunately, largely recovered from her injuries, but a helmet -- she was knocked unconscious in the crash and does not re witness who had just overtaken her heard the crash behind him and we but he did not see the collision occur. There were no other witnesses nobody who could dispute the SUV driver's statement until the facts l result of the investigation. The investigation made it possible to prese based on the driver's failure to yield right of way to through traffic.

When the results of the investigation were brought forward, the SUV company was willing to settle the case.

Casualty Insurance: Drug & Chemical Tort Cases: Policy Underwriting Is Increasingly Complex

– Pharmaceuticals/Chemicals are entering the marketplace at a faster pace

Many before their adverse effects are known

– Global beneficial impact and risks

– **A.M. Best** report. Net asbestos losses for the U.S. property/casualty (P/C) industry at $85 billion, with net environmental losses estimated at $42 billion.

– Deaths- over 100,000 in USA shipyard workers

– FDA and NIOSH are taking a long time before coming up with actions

– ***Need Early Warning Radar***

– 80,000 chemicals and 100s of harms to consider

– Academic research is an early- warning system

How can we mine 20M+ articles? Capture expert opinions?
Praedicat, Inc.

All could have became identifiable years before regulatory action

N-Propyl Bromide
Salient 2002 Neural

TCE
Salient 1967 Kidney/Liver

Bisphenol A
Salient 1994 Reproductive

Diacetyl
Salient 2001 Lung

MTBE
Salient 1994 Water Pollution

- Reville Dalal, et al. (2014)(Patent)
- Shetty K. and Dalal S. (2011), "Using Information Mining of the Medical Literature to Improve Drug Safety", *J. American Medical Informatics Assoc.,*18(5):668-7

Property Insurance: How much damage can be assessed using satellite images?

Before & after hurricane images- Hurricane Sandy

Property Insurance: Identifying Potential Risks Due to Tornados

- ▪ **Insurance Industry pays Billions of dollars in processing Tornado Claims.**

- ▪ **Can we save costs by automatically identifying "defective structures- roofs"?**

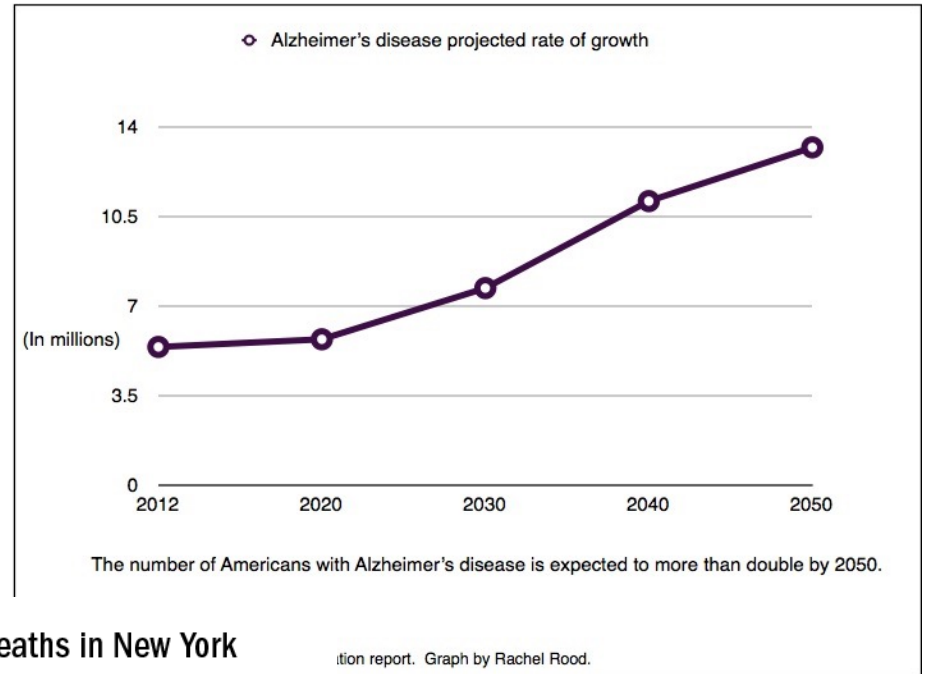- ▪ **Instead of Field Engineers can we use satellites or drones?**
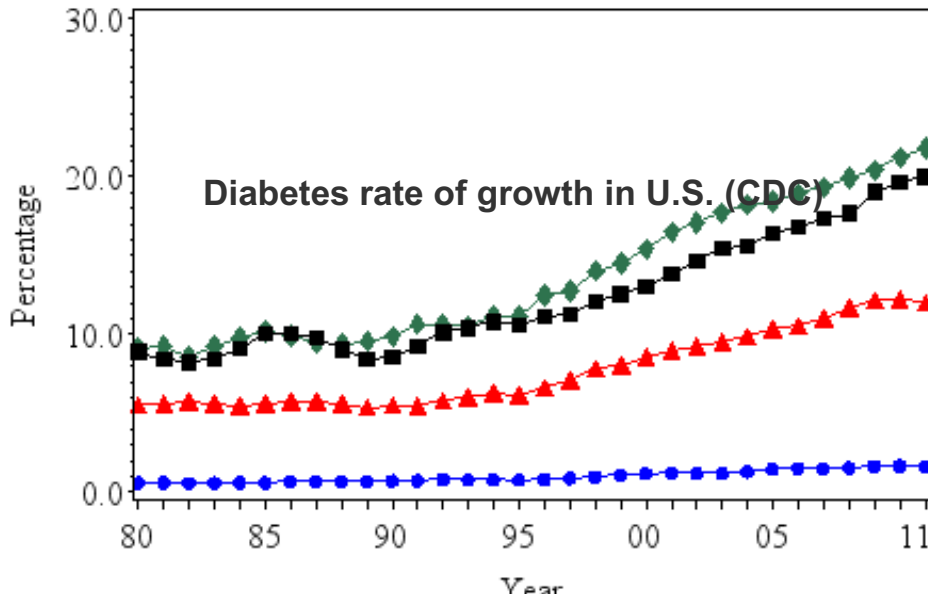

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- • Dalal, S., Bassu, D. (2020) Deep Analytics for Workplace Risk and Disaster Management, IEEE-*IBM J. Research and Development,* Volume 64, 14:1
- • Dalal et al (2021) Patent

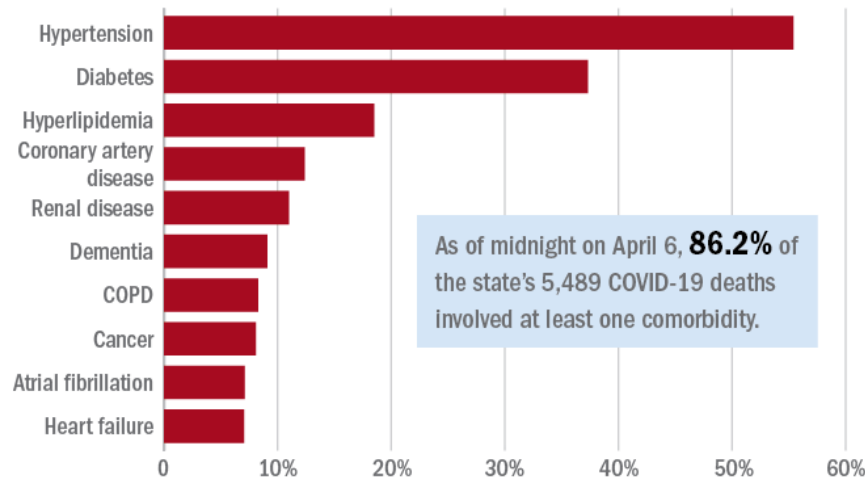# Property Insurance: Improving efficiency & customer experience in claims

- Insurance Industry pays Billions of dollars in processing Auto-claims.

- Can we save costs by automatically identifying "total losses" and "small claims" from images?

- Can we help customers get their vehicles repaired cheaper, better, and faster?

Life and Retirement Products:
How do we predict mortality with a collection of morbidities?

Diabetes rate of growth in U.S. (CDC)

Legend: 0-44, 4

Alzheimer's disease projected rate of growth

(In millions)

The number of Americans with Alzheimer's disease is expected to more than double by 2050.

...tion report. Graph by Rachel Rood.

Leading comorbidities among COVID-19 deaths in New York

As of midnight on April 6, **86.2%** of the state's 5,489 COVID-19 deaths involved at least one comorbidity.
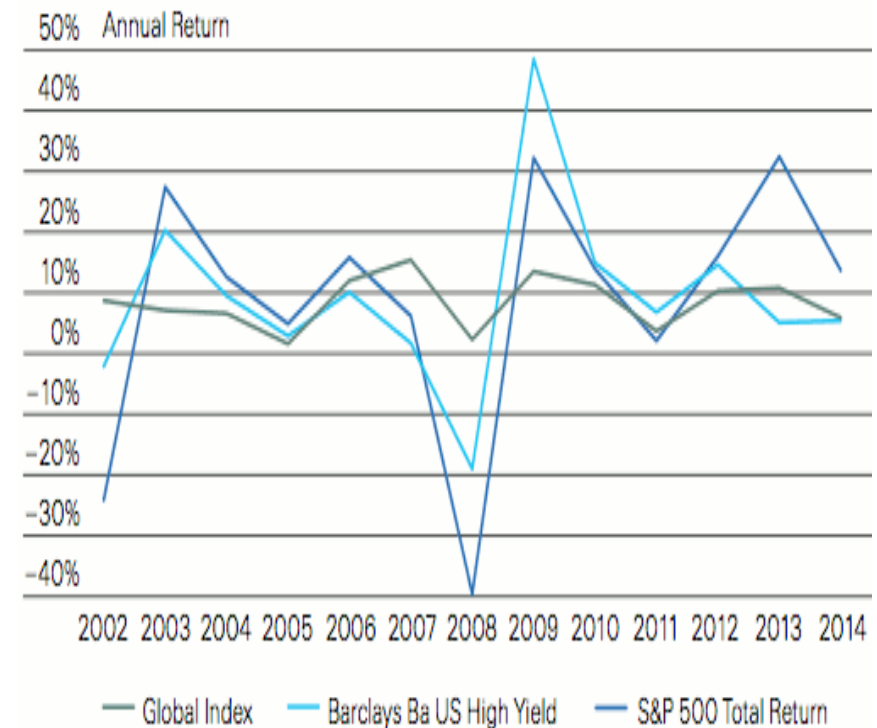
MDedge News

Note: Data reported on a daily basis by hospitals, nursing homes, and other health care facilities.
Source: New York State Department of Health

Reinsurance: Cat Bonds and other Insurance Linked Securities

- Cat Bonds are natural peril based bonds- uncorrelated with market

- Yield=f(risk free rate, peril risk, expected Loss, portfolio risk, risk premium)

- Challenge is to come up with expected loss and its variability

- Large amount of claims and geographical data, peril models, property characteristics at very granular level needed to estimate the distribution of expected loss

- What about other ILS? Casualty based ILS? How will we price it?

50%   Annual Return
40%
30%
20%
10%
0%
−10%
−20%
−30%
−40%

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014

— Global Index   — Barclays Ba US High Yield   — S&P 500 Total Return

Source: Swiss Re Capital Markets; as of December 31 2014

1. Swiss Re Capital Markets pricing indications only

Conclusions

- Insurance industry contributes greatly towards world resilience

- With new data sources, analytics and computing power; we can transform the insurance industry for increased resilience