2020 and Beyond: The Future of Insurance

Stephen J. Mildenhall
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ST. JOHN'S
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The Busy Manager's Guide to Evaluating New Ideas

Does the *shiny new object* address a...

The Busy Manager's Guide to Evaluating New Ideas

Does the *shiny new object* address a. . .

Fundamental business *problem*?

- KYC
- Adverse selection
- Morale hazard

Unique to insurance

The Busy Manager's Guide to Evaluating New Ideas

Does the *shiny new object* address a…

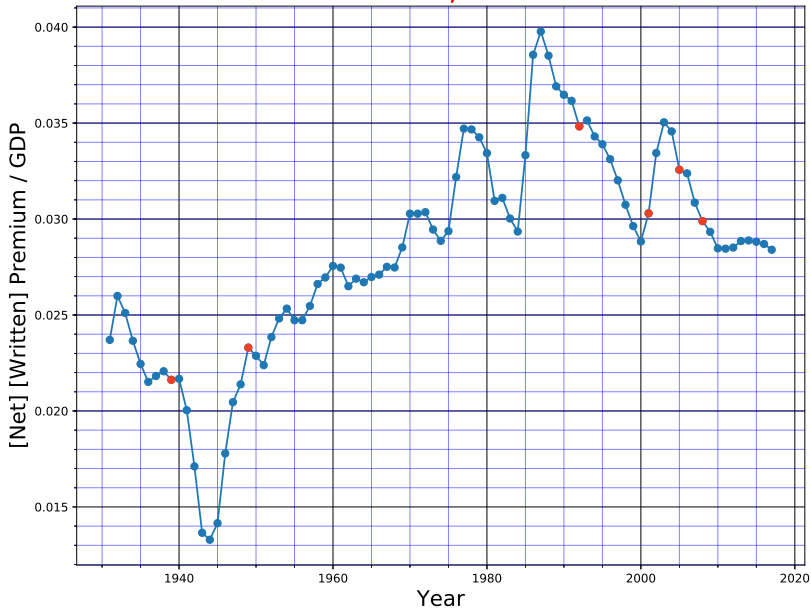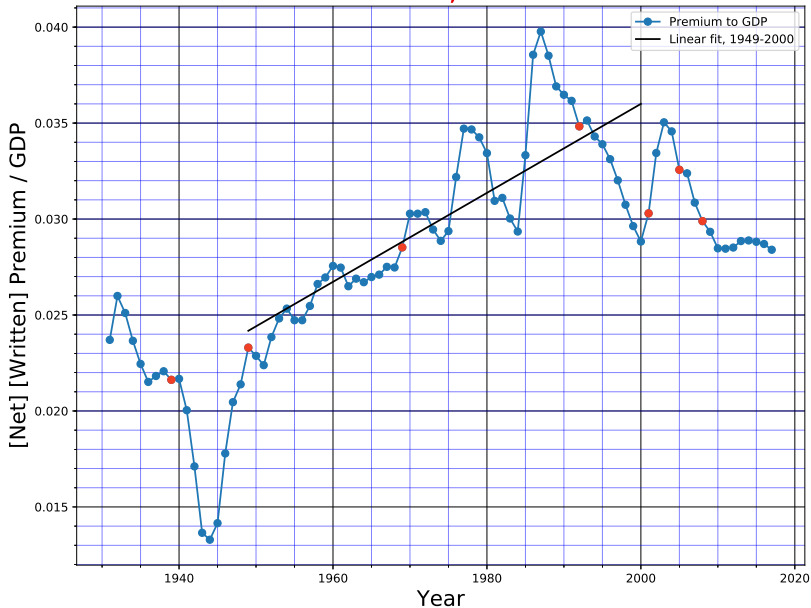| **Fundamental business *problem*?**	**Fundamental business *objective*?**
- KYC - Adverse selection - Morale hazard	- Growth - Profitability - Risk
Unique to insurance	Common to all businesses

Insurance Today: Looking Forwards by Looking Backwards
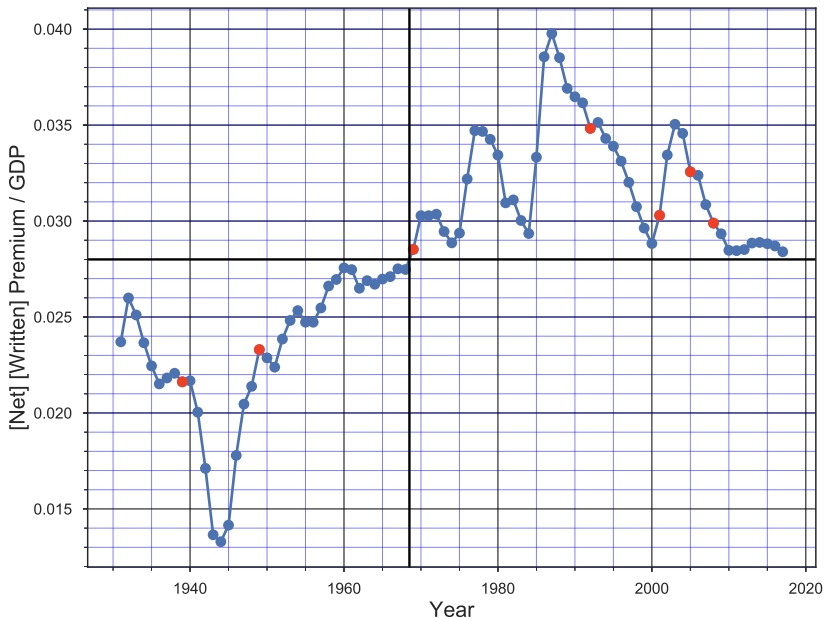
Insurance in the Broader Economy

Premium to GDP Ratio, 1930 to Present
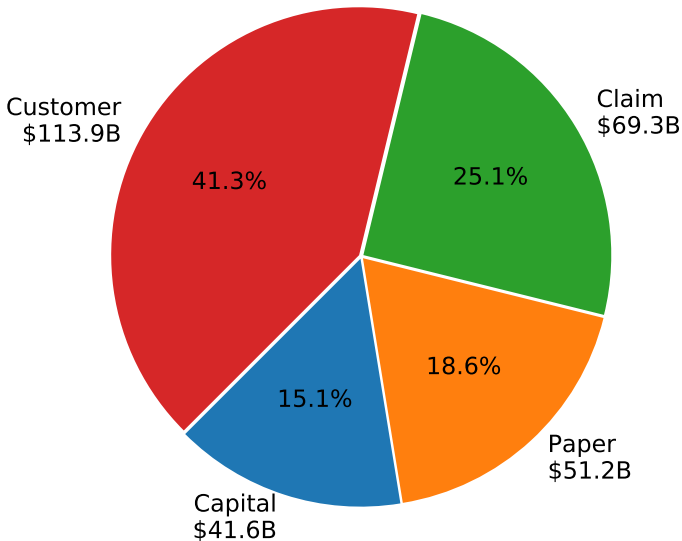
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Premium to GDP Ratio, 1930 to Present

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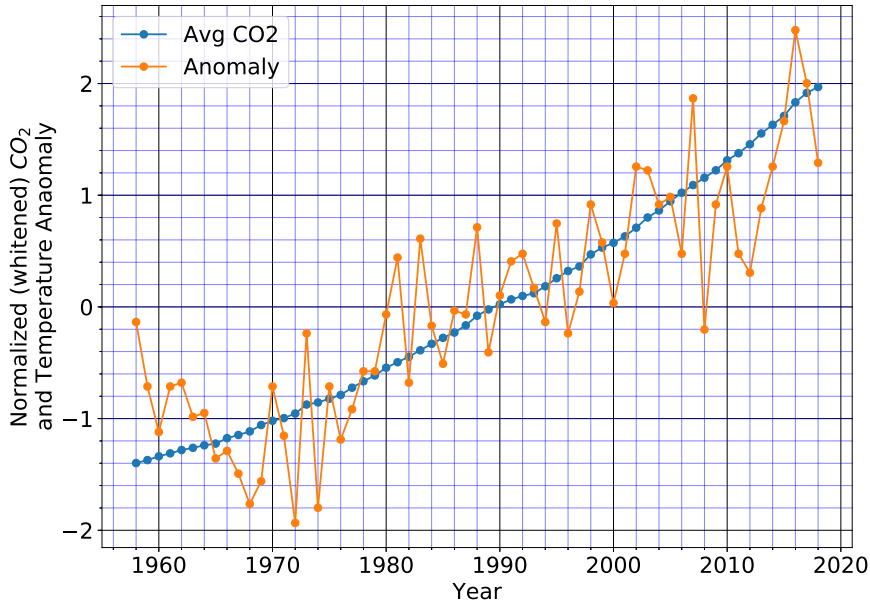
Insurer Expenses By Value Chain Component

Environmental Trends

What if global warming isn't a Chinese hoax?

Avg Annual CO_2 and Temperature Anomaly

COAL CONSUMPTION AFFECT-ING CLIMATE.

The furnaces of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanket for the earth and to raise its temperature. The effect may be considerable in a few centuries.

10

Economic and Insured Catastrophe Losses
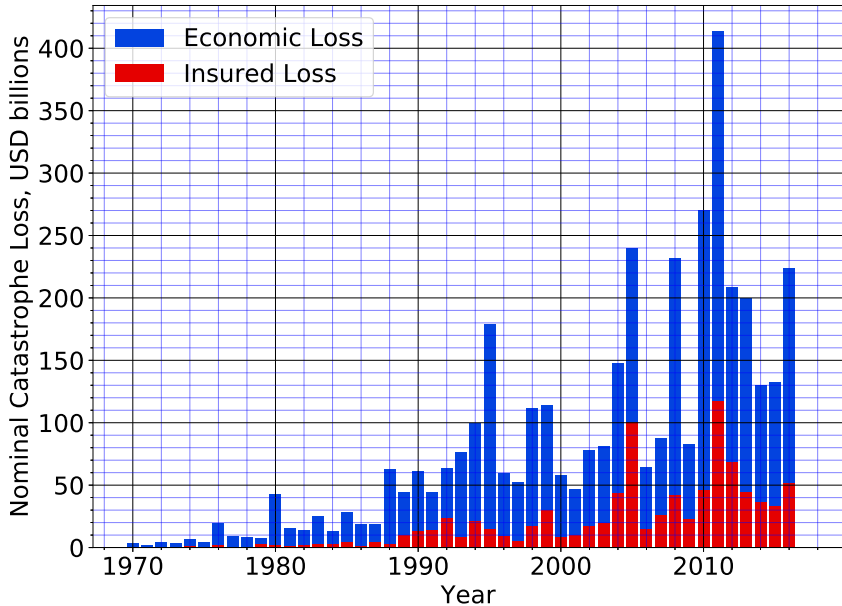
Demographic Trends

Everyday 180,000 people leave the countryside
and move to a city

Major Cities are in Disaster Prone Areas

City Population

- ∘ 300-500 thousand
- ∘ 500-1000 thousand
- ○ 1-5 million
- ○ 5-10 million
- □ 10 million or more

Economic Vulnerability

- No economic vulnerability
- Low/medium economic vulnerability
- High economic vulnerability to 1 type of disaster
- High economic vulnerability to 2 types of disaster
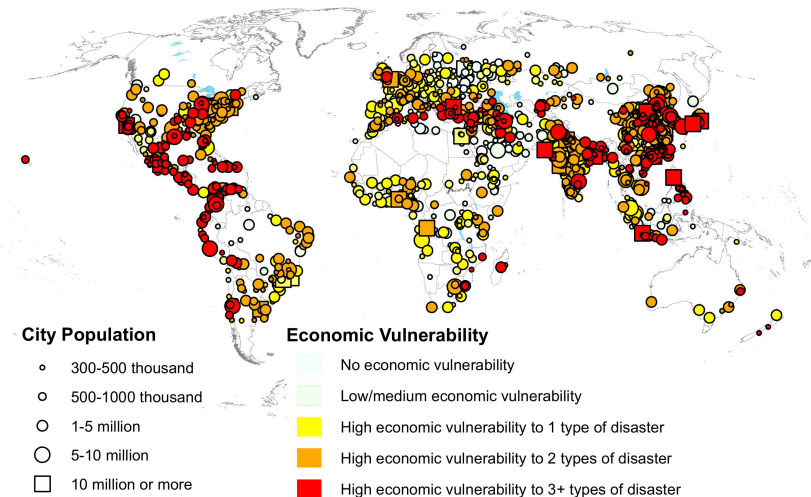- High economic vulnerability to 3+ types of disaster
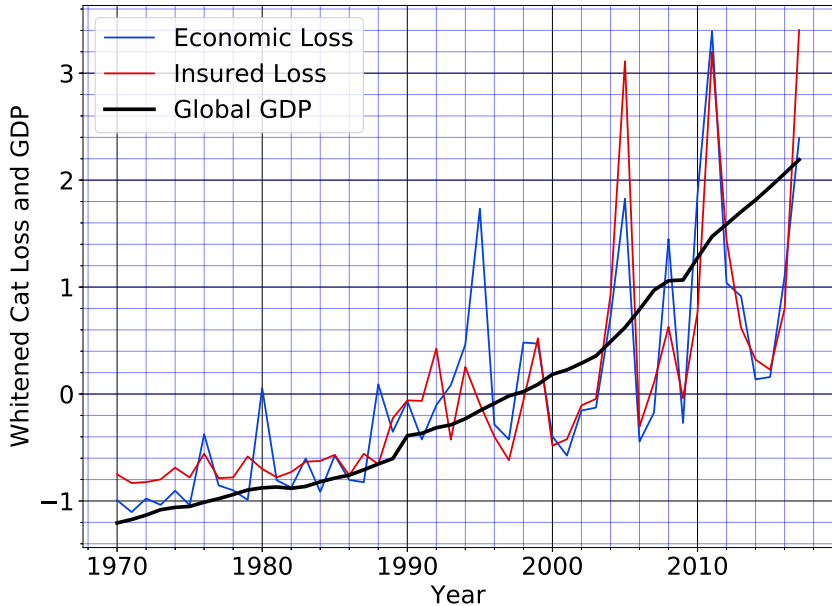
Figure 1: From "The World's Cities", United Nations, 2016

Global Eco and Insd Cat Loss and GDP Trends

Technology and Analytics

Get **tech** to work...get the **product** right...**liftoff**
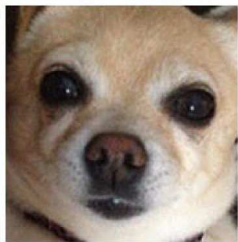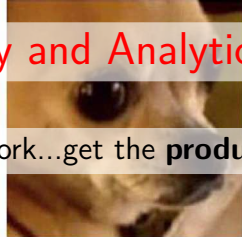
AI Will Be More Important Than Fire & Electricity

Statistical models
- Low marginal value of data
- Few experts provide. . .
- Complex inputs

Machine learning AI
- Increasing returns to data
- Many users provide. . .
- Simple inputs

Statistical Value of Data
Decreasing Marginal Value

AI/ML Value of Data
Increasing Marginal Value

Symbiotic Tetrahedron of InsureTech Capabilities
...in Search of Problems

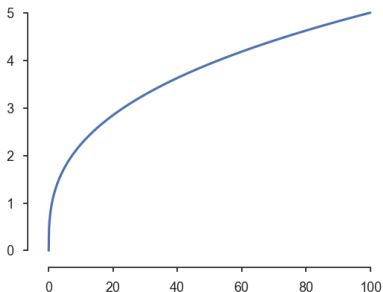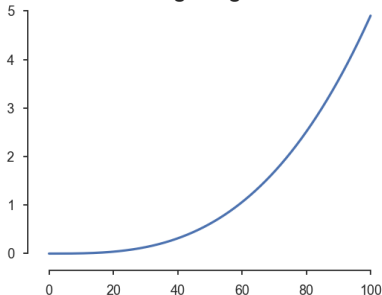| Hardware |
| --- |
| - Mobile |
| - **Cloud** |
| - ASIC, GPUs |
| - Internet of Things (IoT) |
| - Home sensors |
| - Auto telematics |
| - Drones, micro satellites |
| - Quantum computing |

Software
- Text analysis, semantics
- Voice recognition
- Chat bots, Siri, Alexa
- Image recognition
- Virtual reality
- **Tensor Flow**
- Hadoop, MongoDo, Redis
- Python, R, Julia, Go

Algorithms
- **Artificial intelligence (AI)**
- **Machine learning (ML)**
- Neural networks
- Deep learning
- Hash functions
- Cryptography
- Compressed sensing

Data
- **Big data (BD)**
- Text, speech, image, video
- Behavioral data
- Social media
- Spending
- Credit
- Trading, financial data

Get **tech** to work...get **product** right...**liftoff**

Insurance Opportunities

More granular pricing

- You can't afford to be the company with the **coarsest rating plan**—adverse selection is a real and is an arms race
  - Race to the bottom, CBA or ROI rationale least-bad choice
  - First mover advantage largely gone

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New products and services

- Better KYC and more **effective** underwriting & marketing
- Become the trusted risk partner: 24x7 risk monitoring
- Improved claims adjusting process
- Learn from near misses—more underwriting information

Potential of Technology Varies with Problem Domain

Stunning Results

- Static, rules based environment
- Clean, direct observations
- Essentially limitless data
- Definitive right answer
- Classification problems
- Simple dynamic control

Building Capability

- Autonomy

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Characteristics of Insurance

- Behavioral feedbacks
- Dynamic: reacts as we learn
- Proxy data, not direct
- Granularity drives small classes
- Uncertain information: claim development, trend
- Latency: asbestos and environmental
- Need to protect social function

Dangers of AI/ML: We Don't Understand Why It Works

$+ .007 \times$

$=$

$\boldsymbol{x}$

"panda"
57.7% confidence

$\text{sign}(\nabla_{\boldsymbol{x}} J(\boldsymbol{\theta}, \boldsymbol{x}, y))$

"nematode"
8.2% confidence
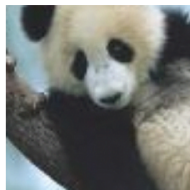
$\boldsymbol{x} +$
$\epsilon \text{sign}(\nabla_{\boldsymbol{x}} J(\boldsymbol{\theta}, \boldsymbol{x}, y))$

"gibbon"
99.3 % confidence

- Machine learning is like training your dog: it generally does what you want but you don't know why

- Insurance issues: regulatory compliance, unwitting discrimination

Insurance: Strong, but Stealth, Record of Innovation

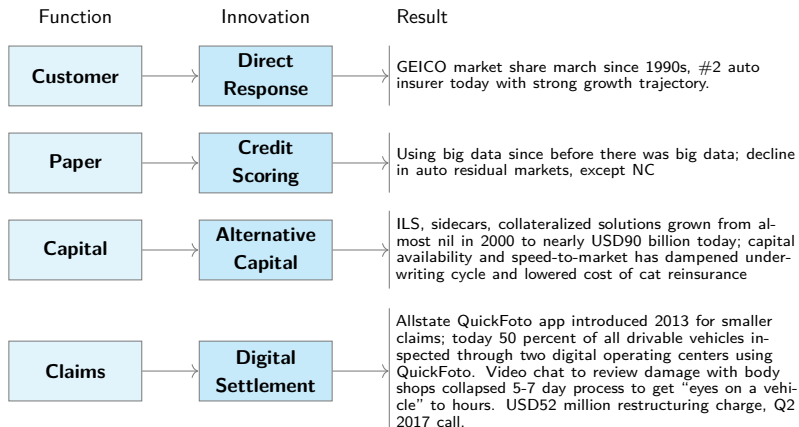| Function	Innovation	Result
Customer	**Direct Response**	GEICO market share march since 1990s, #2 auto insurer today with strong growth trajectory.
Paper	**Credit Scoring**	Using big data since before there was big data; decline in auto residual markets, except NC
Capital	**Alternative Capital**	ILS, sidecars, collateralized solutions grown from almost nil in 2000 to nearly USD90 billion today; capital availability and speed-to-market has dampened underwriting cycle and lowered cost of cat reinsurance
Claims	**Digital Settlement**	Allstate QuickFoto app introduced 2013 for smaller claims; today 50 percent of all drivable vehicles inspected through two digital operating centers using QuickFoto. Video chat to review damage with body shops collapsed 5-7 day process to get "eyes on a vehicle" to hours. USD52 million restructuring charge, Q2 2017 call.

Driverless Cars

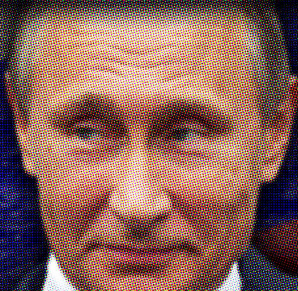Human-driven cars kill $\approx$ 37000 people per year in the US

Auto drives **45 percent** of global property casualty premium

Auto lowers industry volatility by **30 percent**…

…and creates over **USD100 billion** capital capacity for other lines

Social Trends

RUSSIA
HACKING
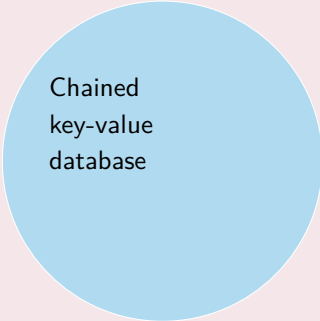THE ELECTION

CIPHER AUTH

PSK
PSK

PSK

EQUIFAX

What if We Could Engineer a Trust-Machine. . .

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The Blockchain: enabling trust between strangers

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The Blockchain: enabling trust between strangers
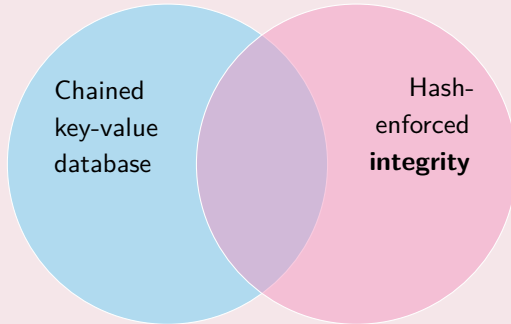
Chained
key-value
database

What if We Could Engineer a Trust-Machine...

The Blockchain: enabling trust between strangers

Chained key-value database

Hash-enforced **integrity**

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Double-spend mechanism

What if We Could Engineer a Trust-Machine. . .

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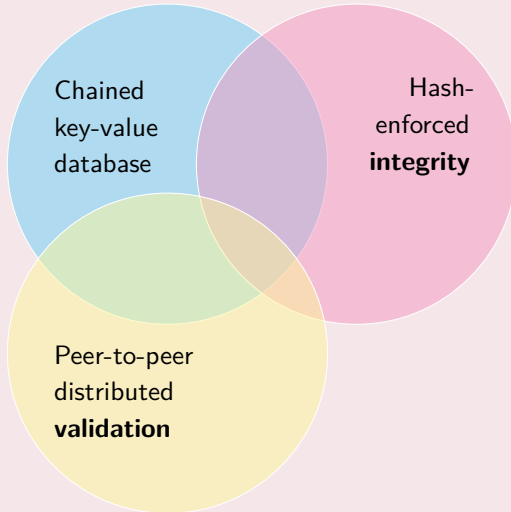Hash-enforced **integrity**

Bitcoin!

Peer-to-peer distributed **validation**

Double-spend mechanism

Blockchain Fills the Trust Vacuum

Reclaim personal ownership of personal information

- It is possible to **verify** information without **revealing** it: a **zero knowledge proof**

- Distributed database of all private credit, health, behavioral data

    - One-time **read/verify-only** access
    - Read, **act** and **forget**, rather than read, act and **store**
    - User **cannot pass along** what they've learned
    - Transferable, international credit history, Bloom Credit
    - No possibility of Equifax hack: data encrypted, you hold keys
    - Smart contracts, DAO = decentralized autonomous organization

- Theoretic potential is huge but commercial model less clear

New Economic Reality Generates New Opportunities

Major opportunities

- **Cyber risk**: front-runners see on-going risk advisory service bundled with meaningful indemnity back-up
- **Gig economy** coverage gaps, e.g. Uber driver coverage, AirBnB

Minor opportunities

- Peer to Peer
- Pay-as-you-Go/Use/Need
- Toy and trinket coverages
- Purchasing groups, Bought by Many

Prognosis

Prognosis: Challenges, but Net Opportunity

Trend	Problems			Objectives			Net
	KYC	**AS**	**MH**	**Grow**	**Pft**	**Risk**	**Net**
Environmental	⚪	🔴	🔴	🟢	🟢	🔴	Opportunity
Demographic	🔴	⚪	⚪	🟢	⚪	⚪	Opportunity
Tech, Analytics	🟢	🟢	🟢	🟢	🟢	🔴	Opportunity
Driverless Cars	🟢	⚪	⚪	🔴	🔴	🔴	Threat
Social	🔴	🔴	🔴	🟢	⚪	🟢	Opportunity
Economic	🔴	🔴	🔴	🟢	⚪	⚪	Opportunity

KYC: know your customer 🟢 positive

AS: adverse selection ⚪ neutral

MH: morale hazard 🔴 negative

Pft: Profitability

Predictions:
The Insurer of the Future Will...

- Update systems to unleash full power of data an analytics
- Scale risk bearing capacity for mega-cats
- Be a 24/7 risk advisor
- Profit from the trust vacuum

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- Muffins and dogs, https://goo.gl/eAp9ia
- Heading quote Sundar Pichai, CEO Google at the World Economic Forum 2018; AlphaZero paper *Mastering Chess and Shogi by Self-Play with a General Reinforcement Learning Algorithm*, Silver, David; Hubert, Thomas; Schrittwieser, Julian; et al. 2017; "AI is bursting" quote from Benedict Evans, https://www.ben-evans.com/benedictevans/2016/3/14/to58mvtuxcs47ndvw0gmdqnh7d1tab
- Get tech to work: Benedict Evans, op. cit.
- Explaining and Harnessing Adversarial Examples Ian J. Goodfellow, Jonathon Shlens, Christian Szegedy. https://arxiv.org/abs/1412.6572
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- Tokyo at night image http://sf.co.ua/id104123; impact of Auto on global P&C insurance from Aon Benfield Insurance Risk Study, 9th Edition, page 17 (2014)
- Russian Hacking Image, author
- Japanese temple to economics image, author, https://flic.kr/p/7SD1BC
- Prognosis image http://www.humresconstruction.co.uk/outlook-uk-construction-industry-next-year/
- Light bulb image, author, https://flic.kr/p/DbxWsf
- Stacked rocks image, author, https://flic.kr/p/YR7rTW

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About the Speaker: Stephen Mildenhall is an Assistant Professor in the School of Risk Management, Insurance and Actuarial Science at St. John's University in New York. He was previously Global CEO of Analytics for Aon plc, based in Singapore, and head of Aon Benfield Analytics. Prior to joining Aon, he worked at Kemper Insurance and CNA Insurance. Stephen has an undergraduate degree in Mathematics from the University of Warwick, England, and a Masters and Doctorate in Mathematics from the University of Chicago. He is a Fellow of the Casualty Actuarial Society, an Associate of the Society of Actuaries, a Chartered Enterprise Risk Analyst (CERA) and a Certified Specialist in Predictive Analytics (CSPA). His research interests include risk theory, capital determination, allocation and optimization, and applications of statistics to reserving and ratemaking. He is a two-time winner of the CAS Woodward-Fondiller prize for the best research paper by a new fellow of the CAS.