IAA AAI SECTION COLLOQUIUM 2019

THE MODERN ACTUARY - CHALLENGE • INFLUENCE • LEAD

ASTIN • IAAHS • IAALS • IACA • PBSS

2 - 5 April
2019
Cape Town
South Africa
CTICC

www.colloquium2019.org.za

Hosted by
ACTUARIAL SOCIETY OF SOUTH AFRICA

Actuarial ®Evolutions

Pierre Miehe

ASTIN Colloquium 2019 – April 2019 / Cape Town

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SECTION COLLOQUIUM 2019

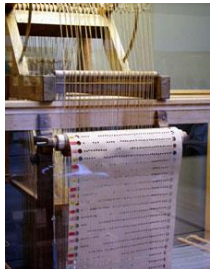
Contents

IT vs Actuarial Evolutions

IT

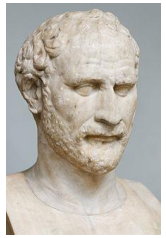
1BC
Antikythera mechanism

17th century
La Pascaline



18th century
Basile Bouchon / Joseph Marie Jacquard

Actuarial



4th century BC
First non life insurance
(Demosthene)

2nd century AD
Ulpian's life table

17th century
Pascal/Pierre de Fermat
Birth of Probability theory
First insurance organisations
First mortality table (John Graunt/Edmond Halley)

18th century
Richard Price /
Equitable
Assurance

IT vs Actuarial Evolutions (2)

IT

1896
Tabulating Company
➔ IBM

1919
Enigma (cf Alan Turing 1942)

1939
Analog computers

1941
Konrad Zuse Z3 : 10Hz / 22 bits

1952
IBM 701 16 Khz / 18 bits

Actuarial

1895
« Comité permanent des congrès d'actuaires » ➔ International Actuarial Association

1920
First Chain Ladder (then Henry 1938)

1939
UK Govt & Lloyds: car insurance

1949
Jackknife method

1951
Copulas (Maurice René Fréchet)

1957
ICA = Electronic data processing congress

IT vs Actuarial Evolutions (3)

IT

1969-1972
Pascal & C (<= Algol)

1976 - 1981
Apple I, IBM PC 8 bits 4,77Mhz

1982
Commodore 64

1982
Internet

Actuarial

1971
GLM (J. Nelder, R. Wedderburn)

1972
Bornhuetter-Ferguson

1973
Black & Scholes

1978
Bootstrap (Efron)

1984
Devylder

1993
Mack

IT vs Actuarial Evolutions (4)

IT

1998
Deep Blue vs Kasparov

2001
Full DNA (Apollo)
Cost 2.7MD€

2007
Darpa
(Autonomous car)

2015 / 2017
Alpha Go /
Alpha Chess

2017
Tesla autonomous driving for everybody

2018
Full DNA
cost 750€

Actuarial

2006
Swiss Solvency Test

2015
C-ROSS

2016
Solvency II

2022
IFRS 17

- **What next?**

Contents

Reminder: today's main fields for actuaries

47% Underwriting/pricing

40% Reserving

38% Enterprise Risk Management

30% Modeling/ALM

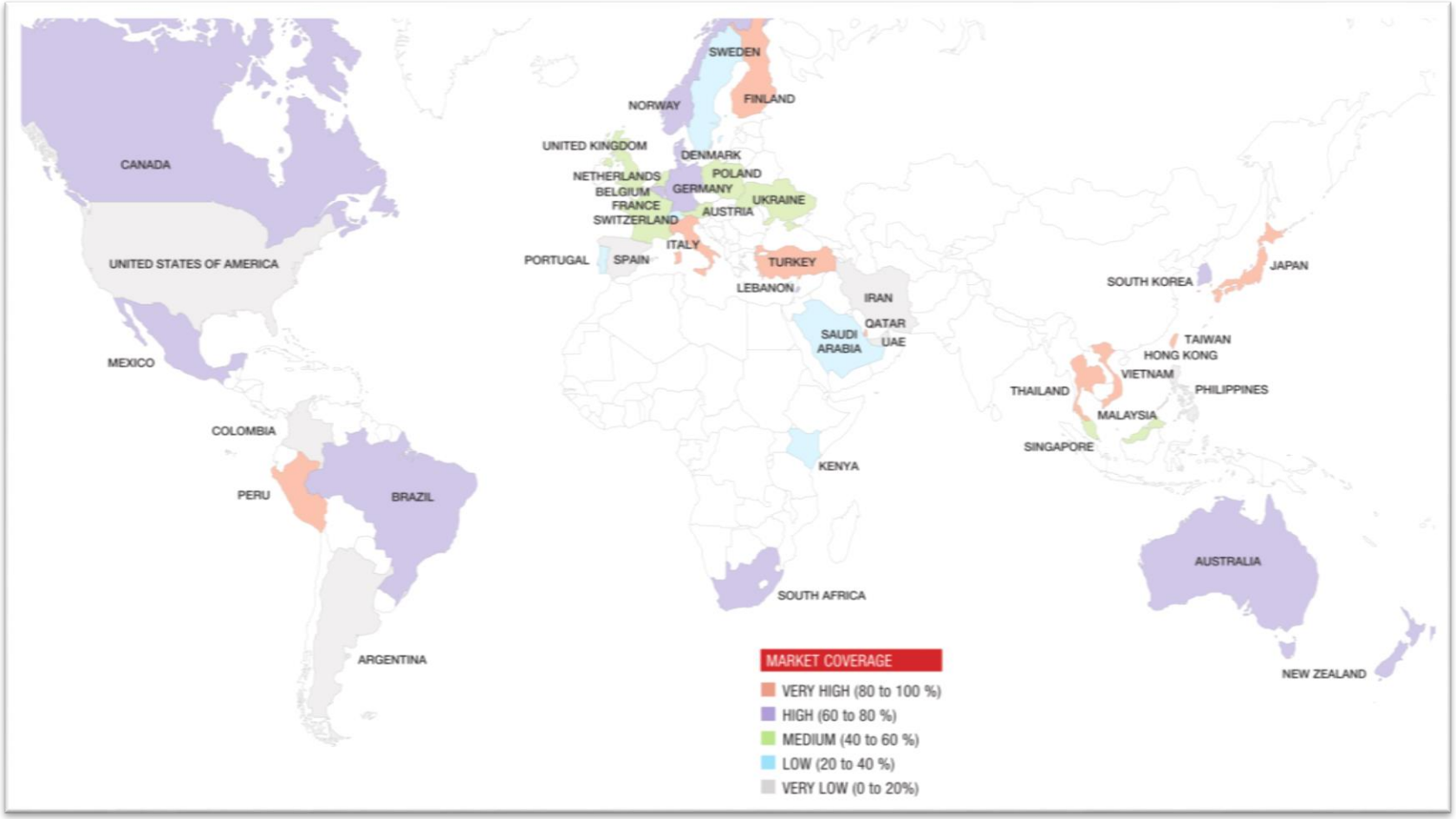
17% Marketing/new offers

14% Asset management

6% HR/Benefits

(source: L'Actuariel n.30)

Non-Life Reserving Practices Report by ASTIN: 42 participating countries, 87% NL Premium Income



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Spotlight on South Africa

AFRICA

SOUTH AFRICA

Full Member Association

Population: 54.5 million

Insurance premiums: MUSD 38,915

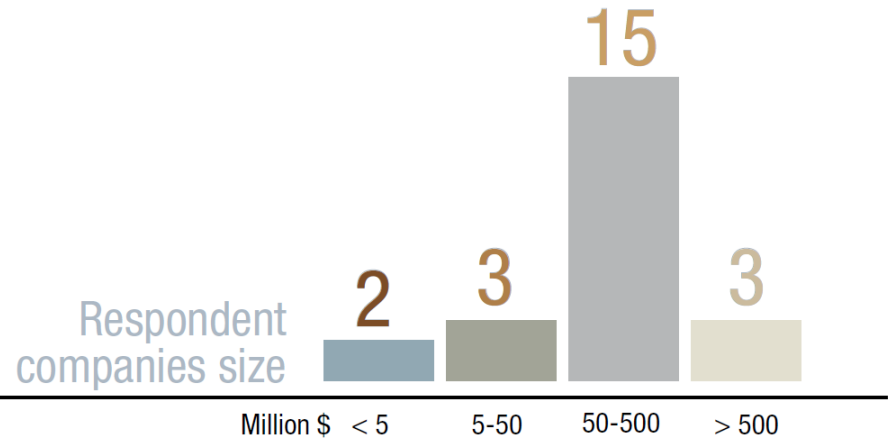
Non Life premiums: MUSD 7,713

NL premium/capita: USD 141.52

Local GAAP: ☐ Discounting ☐ Appointed/signing actuary

Respondents market share:

Country report by
Junaid KHAN
junaid.khan@za.pwc.com



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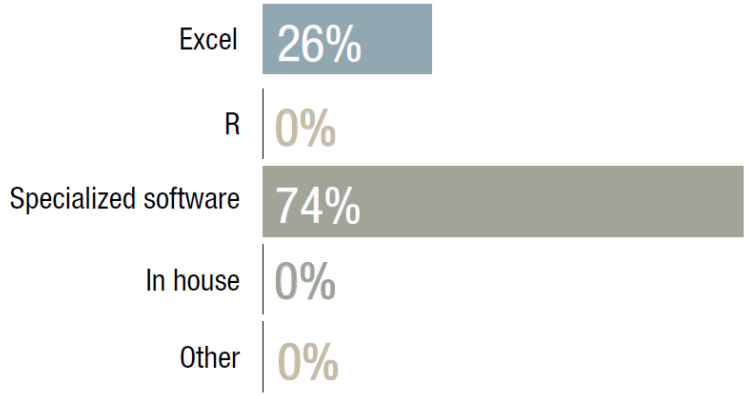
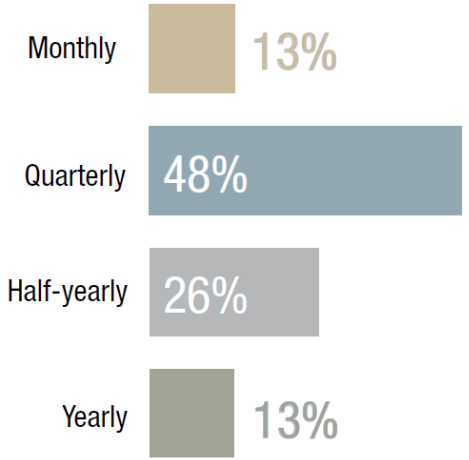
Spotlight on South Africa (2)

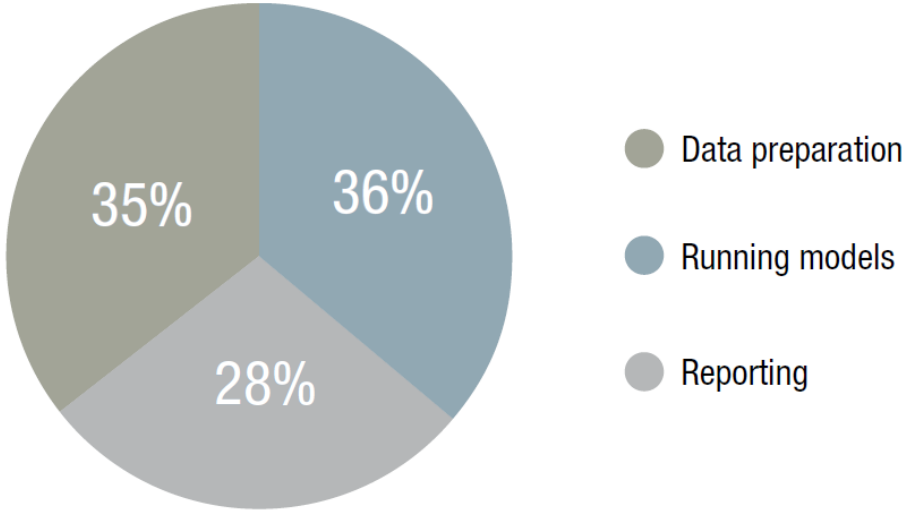
Reserving tool



Reserving exercise periodicity



Resources split



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Spotlight on South Africa (3)

1. Standard claims: triangle-based technologies

		Main method	Peer method	Informational	Unused
DETERMINISTIC	Percentage	10%	0%	5%	86%
	Loss ratio	5%	24%	14%	57%
	Chain ladder	74%	0%	17%	9%
	Bornhuetter-Ferguson	32%	23%	18%	27%
	Cape Cod	9%	5%	0%	86%
	Average cost	14%	5%	29%	52%
	De Vylder	0%	0%	0%	100%
	Fisher-Lange	0%	0%	0%	100%
	GLM	0%	0%	0%	100%
	Munich Chain Ladder	0%	0%	0%	100%
STOCHASTIC	Market-based std dev	5%	5%	0%	91%
	Internal calibration	5%	0%	0%	95%
	Mack	24%	19%	0%	57%
	Merz & Wüthrich	5%	0%	5%	90%
	GLM	0%	0%	0%	100%
	Bootstrap / CL	57%	4%	0%	39%
	Bootstrap / BF	5%	0%	5%	90%
	RJMCMC	0%	0%	0%	100%

2. Standard claims: individual claims-based technologies

	Main method	Peer method	Informational	Unused
Percentage	10%	0%	5%	86%
ICR (Antonio-Plat)	0%	0%	0%	100%
ICR (Chalnot-Gremillet)	0%	0%	0%	100%
ICR (other)	5%	0%	0%	95%

Spotlight on South Africa (4)

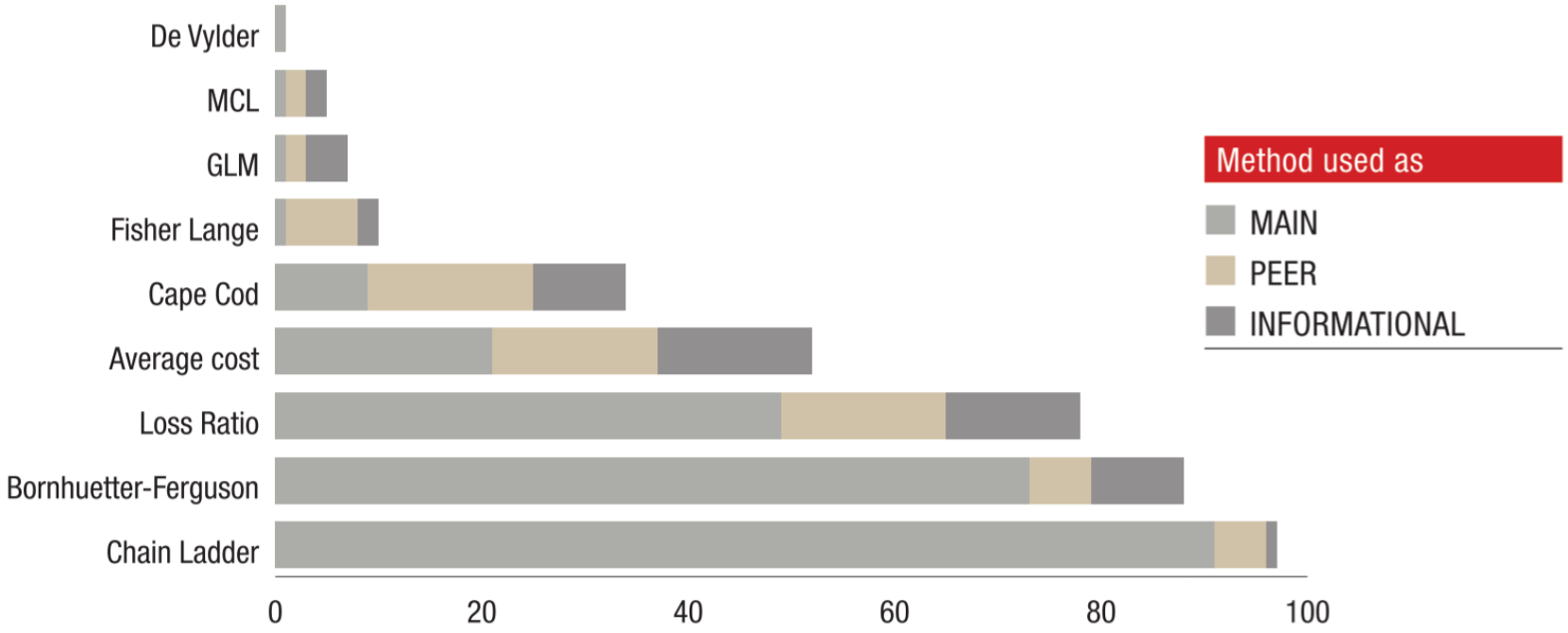
3. Other claims

Annuities	N/A	100%	Deterministic math. reserves	0%	Other modalities	0%
Asbestos	N/A	100%	Survival Ratio	0%	Other modalities	0%
Disability/workers comp.	N/A	90%	Other	10%	Other modalities	0%
Decennal/contruction liab.	N/A	95%	Other	5%	Other modalities	0%
Credit	N/A	85%	Other	15%	Other modalities	0%

4. Adjustments / misc.

Past inflation	Not treated	86%	Year per year	14%	Other modalities	0%
Future inflation	Not treated	87%	Flat assumption	13%	Other modalities	0%
Discounting	Not treated	57%	Dvt patterns-based	26%	Other modalities	17%
Discount type	Yield curve	75%	Flat rate	25%	Other modalities	0%
Development patterns	Chain ladder/paid	91%	Other	5%	Other modalities	5%
Diversification effect	Not calculated	96%	Correlation matrix	4%	Other modalities	0%
Large claims	Treated separately	48%	Treated jointly	43%	Other modalities	9%
Reinsurance / retrocession	Projection of net triangles	43%	N/A	26%	Other modalities	30%
Subrogations	Projection of net triangles	48%	Not calculated	17%	Other modalities	35%
Ibnr contract allocation	Not allocated	65%	Individual claims reserving	17%	Other modalities	17%
Equalization reserve (local)	No eq. reserve	83%	Calculated	17%	Other modalities	0%
Risk Margin	Projected	64%	Percentage	18%	Other modalities	18%
Ibnyr and Ibner diff.?	No	83%	Yes	17%	Other modalities	0%

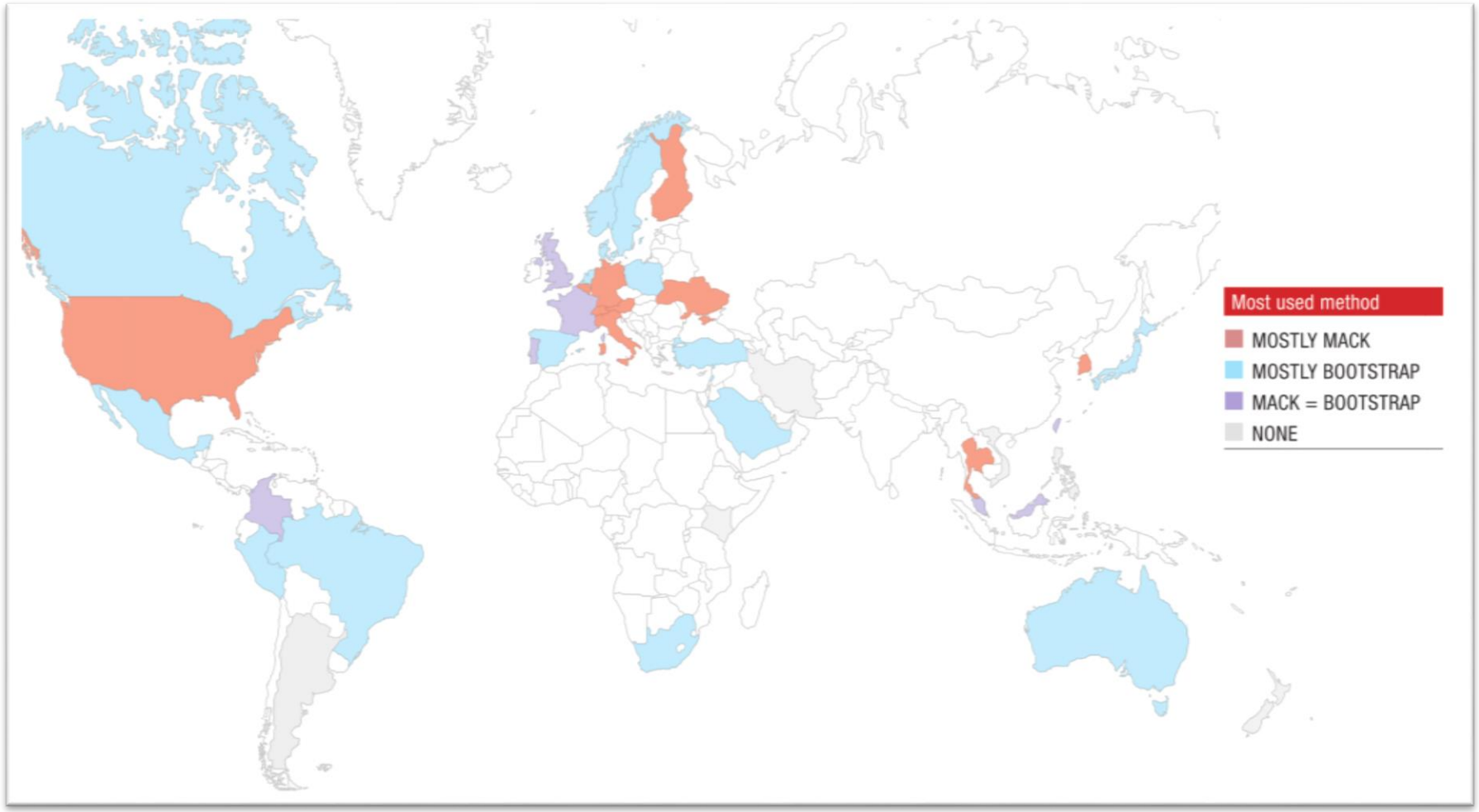
World / Main used deterministic methods



World / Use of stochastic methods

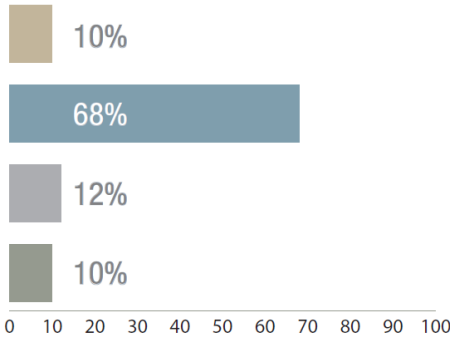
Zone	Country	Stochastic %
World	**N/A**	**54%**
Africa	Kenya	0%
Africa	South Africa	70%
Asia	Hong Kong	50%
Asia	Japan	13%
Asia	Malaysia	92%
Asia	Philippines	0%
Asia	Singapore	63%
Asia	South Korea	50%
Asia	Taiwan	38%
Asia	Thailand	36%
Asia	Vietnam	0%
Europe	Austria	57%
Europe	Belgium	87%
Europe	Denmark	50%
Europe	Finland	92%
Europe	France	70%
Europe	Germany	88%
Europe	Italy	61%
Europe	NL	76%
Europe	Norway	64%
Europe	Poland	33%
Europe	Portugal	75%
Europe	Spain	100%
Europe	Sweeden	50%
Europe	Switzerland	71%
Europe	Turkey	61%
Europe	UK	75%
Europe	Ukraine	50%
Latin America	Argentina	0%
Latin America	Brazil	21%
Latin America	Colombia	100%
Latin America	Mexico	70%
Latin America	Peru	57%
Middle East	Iran	0%
Middle East	Lebanon	44%
Middle East	Qatar	0%
Middle East	Saudi Arabia	33%
Middle East	UAE	0%
North America	Canada	29%
North America	USA	67%
Oceania	Autralia	53%
Oceania	New Zealand	0%

Stochastic: Mack vs Bootstrap battle



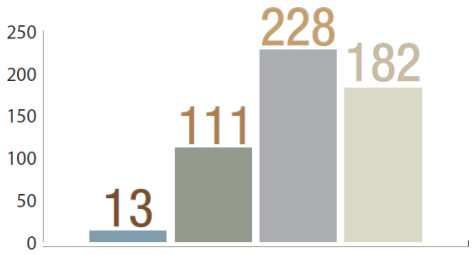
Non-Life Reserving Process

Reserving exercise periodicity



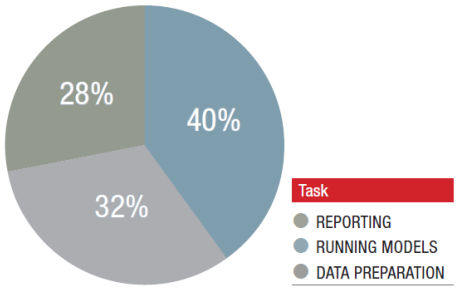
Over 2/3 of insurance companies calculate their reserves quarterly.

Respondent companies size



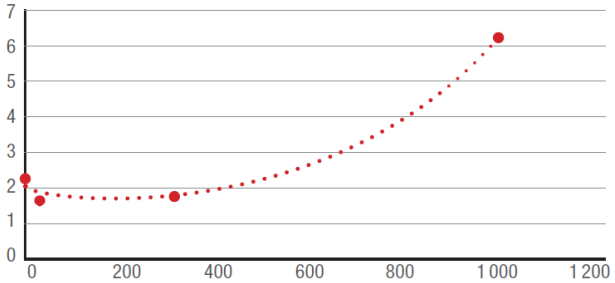
Most repondents are medium-big size companies, with premiums over 50MUSD.

Resources split



Running model is the main task for actuaries for most insurers (40%). Then comes data preparation (32%), and reporting (28%).

Average number of actuaries vs companies size



The number of actuaries required to make a reserving exercise seems to be constant around 2, until the company size exceeds USD 500M.

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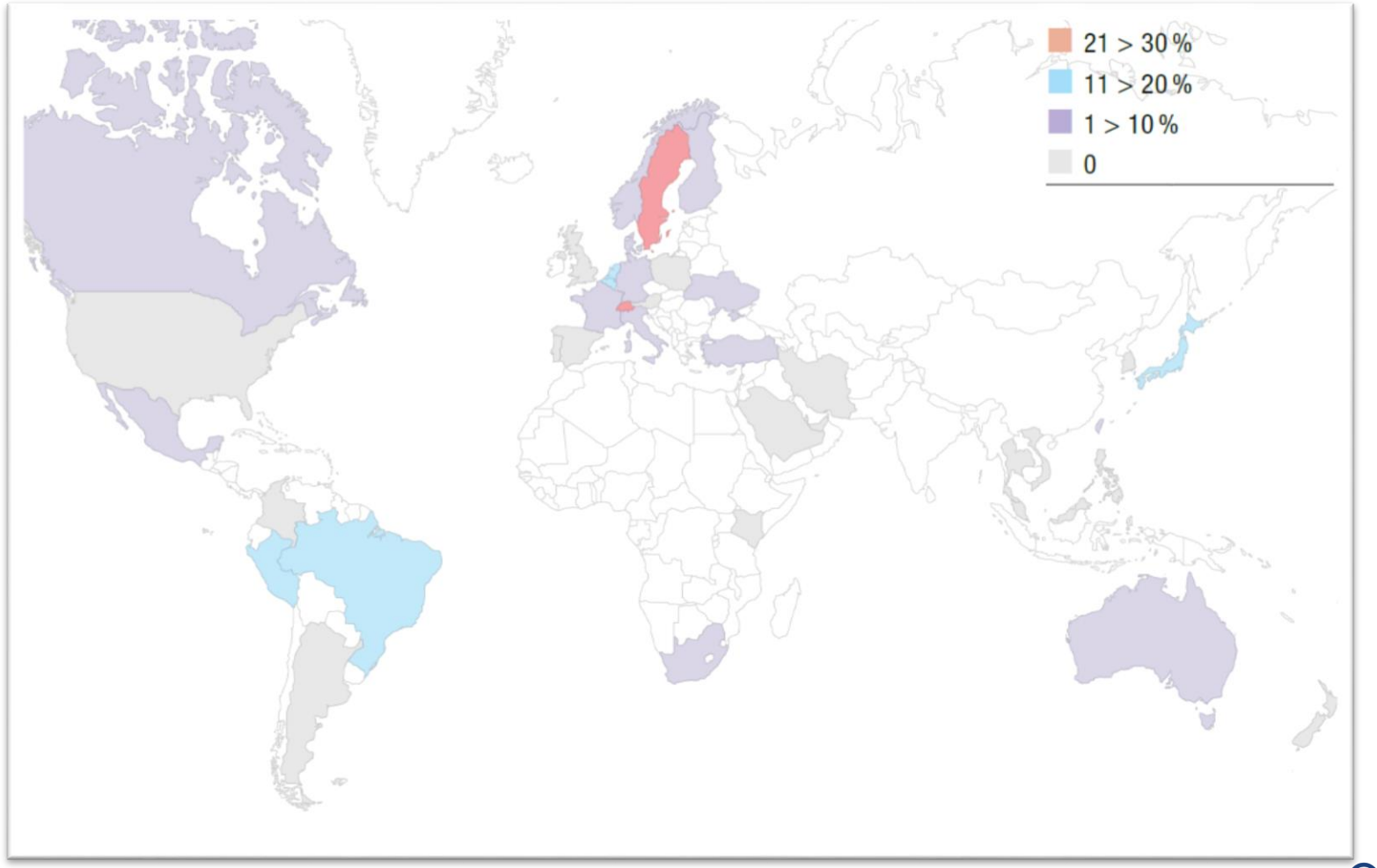
Use of individual claims reserving methods



Report / Special sections

- **USGAAP/RBC vs IFRS/Solvency II**

"On an overall basis, the RBC framework is more uniform and easier to implement in a consistent manner across all companies. On the other hand, Solvency II framework is more nuanced but allows a Company to estimate its own risk margins. Hence I believe the Solvency II regime leads to more individual regulatory scrutiny." - Chandu Patel

- **Future of reserving**

"Are the actuarial teams sufficiently trained in computer science to handle the latest technology, and for example switch to individual claims reserving?" - Suzanne Patten & the WPNLReserving team

Contents

European Solvency II & SST direct impacts: the actuary is now responsible!

LSA – Article 24	Article 48 – Solvency 2 directive
The appointed actuary carries the following responsibilities:	1. Insurance and reinsurance undertakings shall provide for an effective actuarial function to undertake the following:
a. the solvency margin is calculated correctly and tied assets are in accordance with supervisory legislation ;	i) To contribute to the effective implementation of the risk management system referred to in Article 43, in particular with respect to the risk modelling underlying the calculation of the capital requirements set out in Chapter VI, Sections 4 and 5 and the assessment referred to in Article 44.2.
b. the utilized technical bases are adequate ;	g) To express an opinion on the overall underwriting policy ; h) To express an opinion on the adequacy of reinsurance arrangements ;
c. the technical provisions are sufficient.	a) To coordinate the calculation of technical provisions; b) To ensure the appropriateness of the methodologies and underlying models used as well as the assumptions made in the calculation of technical provisions; c) To assess the sufficiency and quality of the data used in the calculation of technical provisions; d) To compare best estimates against experience; e) To inform the administrative or management body of the reliability and adequacy of the calculation of technical provisions; f) To oversee the calculation of technical provisions in the cases set out in Article 81.

Source: Is the current legal scheme adapted for the exercise of an independent & efficient function of appointed actuary / actuarial function holder?
Eric Dal Moro, Pierre MIEHE, SSRN 2011

European Solvency II & SST direct impacts: the actuary is now responsible! (2)

- "The actuary is most of the time an employee of the company, without specific insurance liability and potentially under conflict of interest with his direct management."

- The regulator should "clarify the exact responsibility of the actuarial function / role of responsible actuary (civil, penal, what limit?) in coordination with the responsibility of the management bodies"

Source: Is the current legal scheme adapted for the exercise of an independent & efficient function of appointed actuary / actuarial function holder?
Eric Dal Moro, Pierre MIEHE, SSRN 2011

Emergence of actuarial standards

- In response to the growing responsibilities of actuaries (especially IFRS17 and SII), the National, European and International actuarial associations have worked on the implementation of actuarial standards since 2010

- IAA Target for the ISAPs (International Standards of Actuarial Practice):
  - “Widely accepted as a basis for convergence by local standard-setters”
  - “Recognised by the parties who rely on actuarial work such as IASB, IAIS, IOSCO, European authorities, local regulators and audit firms”
  - “Widely seen as contributing to the public good”
  - “Promoting high quality actuarial practice “

International actuarial standards

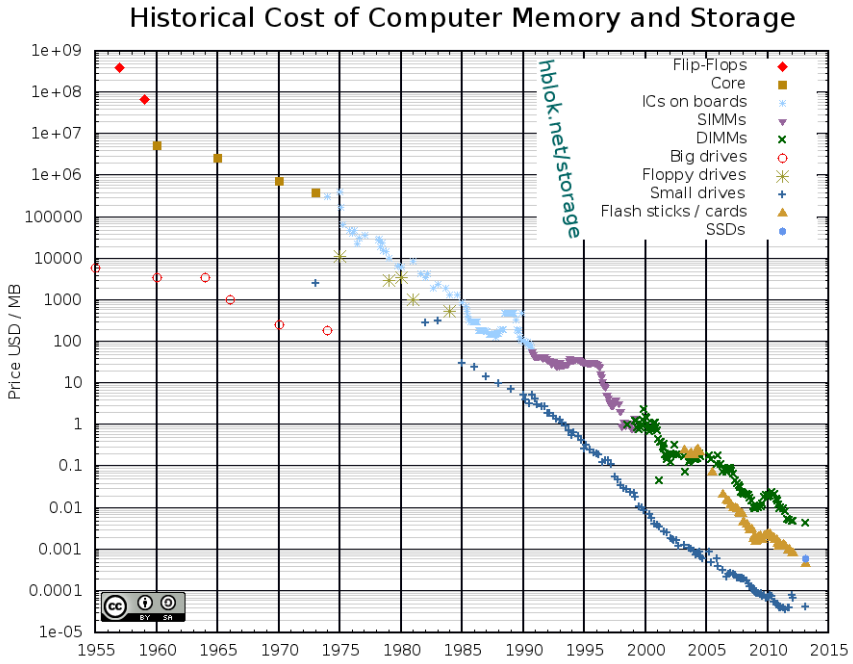
- **European (edited by EAA/SPT)**
  - ESAP 1: General Actuarial Practice (2014)
  - ESAP 2: Actuarial Function Report under Solvency II (2016)
  - ESAP 3: ORSA (2017)
- **International (edited by IAA/ASC)**
  - ISAP 1: General Actuarial Practice (2012)
  - ISAP 1A: Governance of Models (2016)
  - ISAP 2: Social Security Programs (2013)
  - ISAP 3: IAS 19 (2015)
  - ISAP 4: IFRS 17 (draft 2017, expected 2019)
  - ISAP 5: Insurer Enterprise Risk Models (2016)

Contents

Moore’s law and its consequences

Gordon Moore (Intel co-founder):

“The number of transistors in a dense integrated circuit doubles approximately every two years”



	Mop/sec.	Processor
1971	0,09	INTEL 4004
1974	0,29	INTEL 8080
1977	0,50	INTEL 8085
1979	**1,00**	INTEL 8088
1985	5,00	INTEL 80386
1989	20,00	INTEL 80486
1993	48,20	PENTIUM
1995	161,00	PENTIUM PRO
1997	368,00	PENTIUM II
1999	816,00	PENTIUM III
2003	1 538,00	PENTIUM M
2013	**10 000,00**	IVY BRIDGE

A US survey on the use of predictive analytics: Is it used now/will it be used in 2 years?

Personal lines	Now	Two years
Report ordering	34%	**74%**
Fraud potential	28%	**70%**
Claim triage	18%	**59%**
Litigation potential	23%	**54%**
Case reserving	9%	**41%**
Marketing and advertising	21%	**39%**

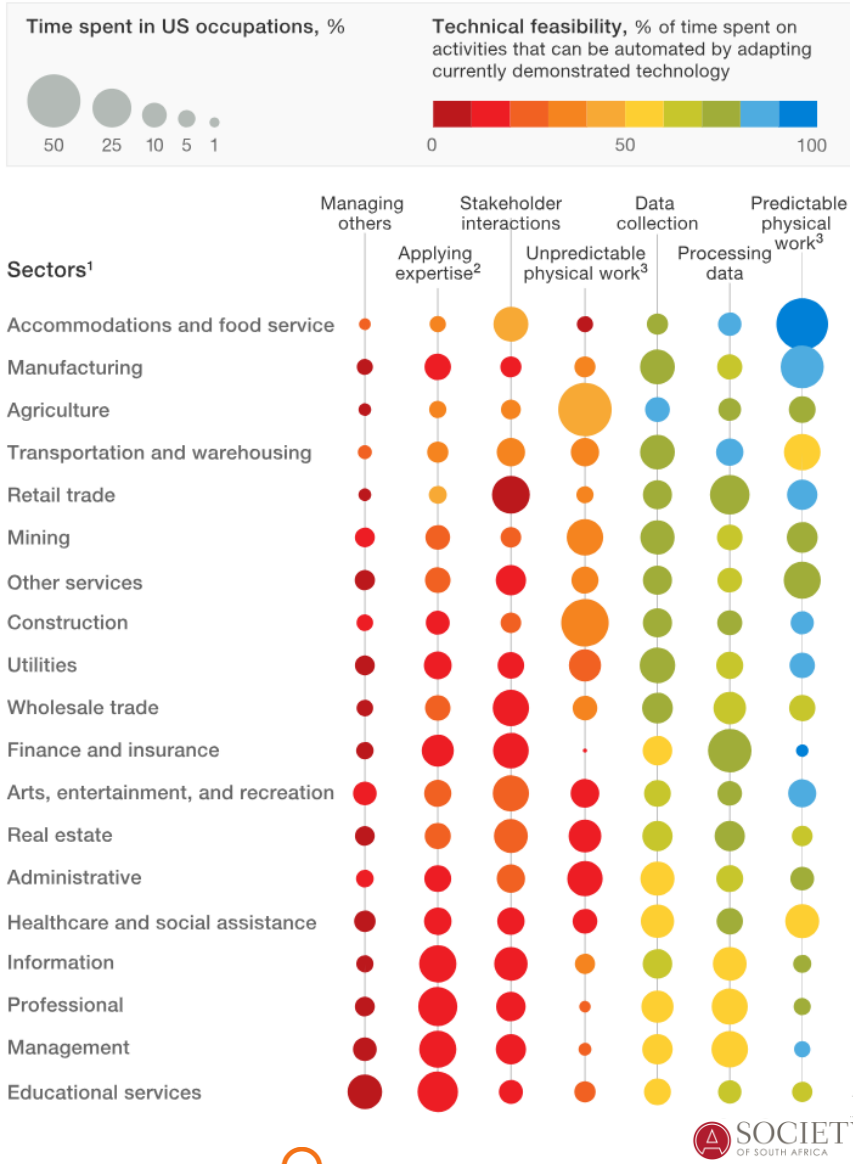
Commercial lines	Now	Two years
Claim triage	15%	**66%**
Fraud potential	14%	**55%**
Litigation potential	10%	**50%**
Report ordering	17%	**48%**
Case reserving	8%	**48%**
Loss control	2%	**39%**

Source: US Predictive Modeling Benchmark Survey, Willis Towers Watson 2016

Actuaries vs Data Scientists or Data Scientist Actuaries?

- Is it easier for an actuary to pick up machine learning than it is for a data scientist to understand insurance?
- 2016: Casualty Actuarial Society rolled out Certified Specialist in Predictive Analytics (CSPA) credential

- **Big impact expected on actuarial modeling systems**



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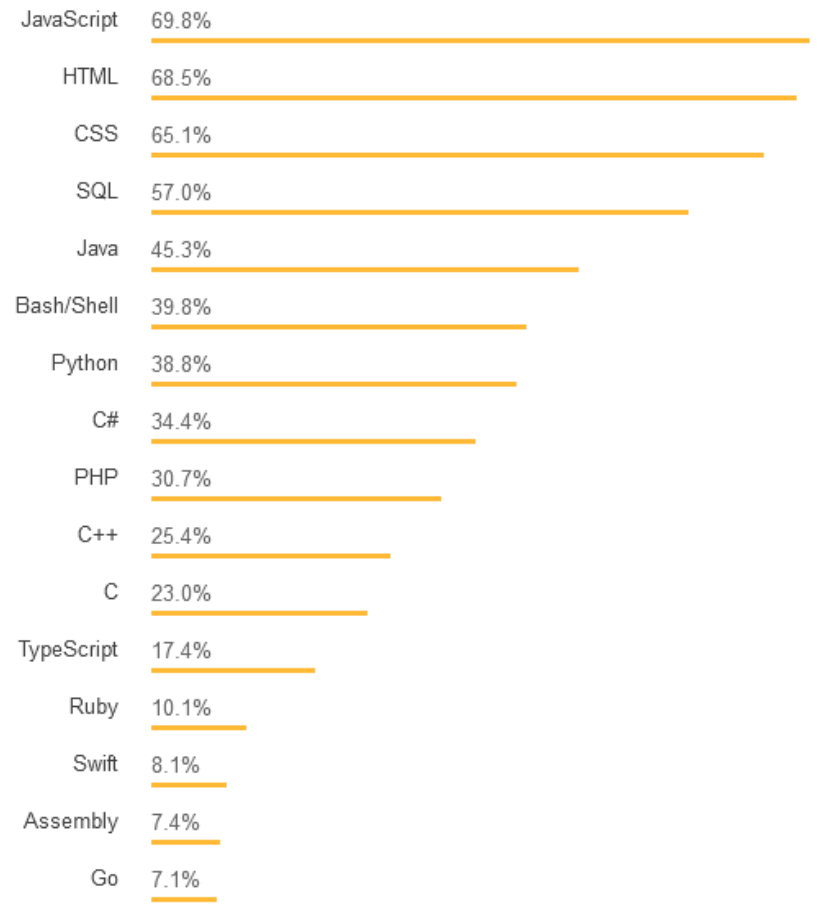
The modeling challenge: current situation

Source: Most popular Technologies Stack Overflow 2018

- Many used different tools;
  - Excel
  - Specialized modelling
  - Data science: R, SAS
  - Switch to direct programming languages (Python, C#)
- Most IT systems are not built for large/big data
- Controls / ensuring audit trail is not easy
- Runtime issues:
  - Different granularity, lots of runs are required
  - Sometimes use of the stochastic dimension
- RGPD issue in Europe



Why not only use Excel?

Excel Pros

- Excel is the common language spoken by all actuaries
- Fast model set up
- Easy to understand and maintain models / no black box (if no VBA)
- Almost all models are developed first in Excel anyway

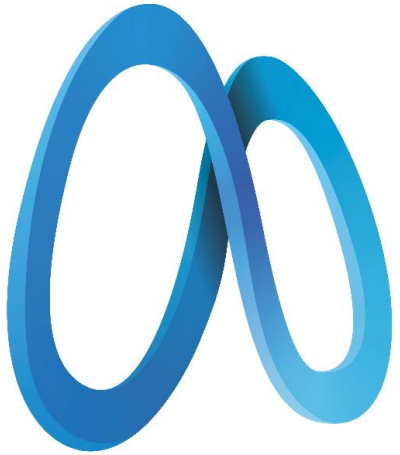
Excel Cons

- Not enough dimensions
- VBA required for complex models
- Slow runtimes, and VBA leads to heavy code / black boxes
- No audit trail, limited team-work capabilities
- Bad reliability with hundreds of spreadsheets interlinked

The Big Four in the US just stated Excel is not SOX compliant!!

Possible solutions for actuaries

- Keep many tools but design automated interfaces between them
- Design all models in C# or Python (as is today the case for some big multinational insurers)
- Apply Scrum framework
- Define & apply “Best Practices” to keep using Excel
- Purchase huge servers with hundreds of cores
- Subcontract data analytics to consulting firms
- …



The new actuary

"An insurance company business is always profitable…

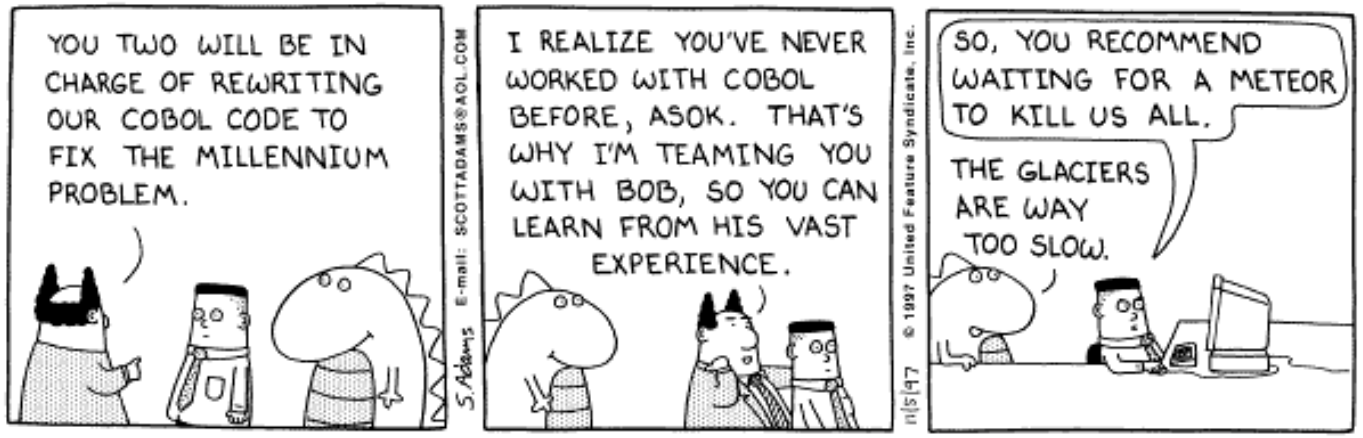
… then comes the actuary."

➔This quote/joke from insurance CEOS in the 90's is not so popular any more...

- Today European insurance startups realize the importance of actuaries at all steps. Actuaries are often part of the project right from the design phase, including predictive analytics.

➔Full recognition of the importance of actuaries

- **But beware of getting "Cobolized"!**



Thank you

More info?

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