A Darwinian View on Internal Models … and beyond!

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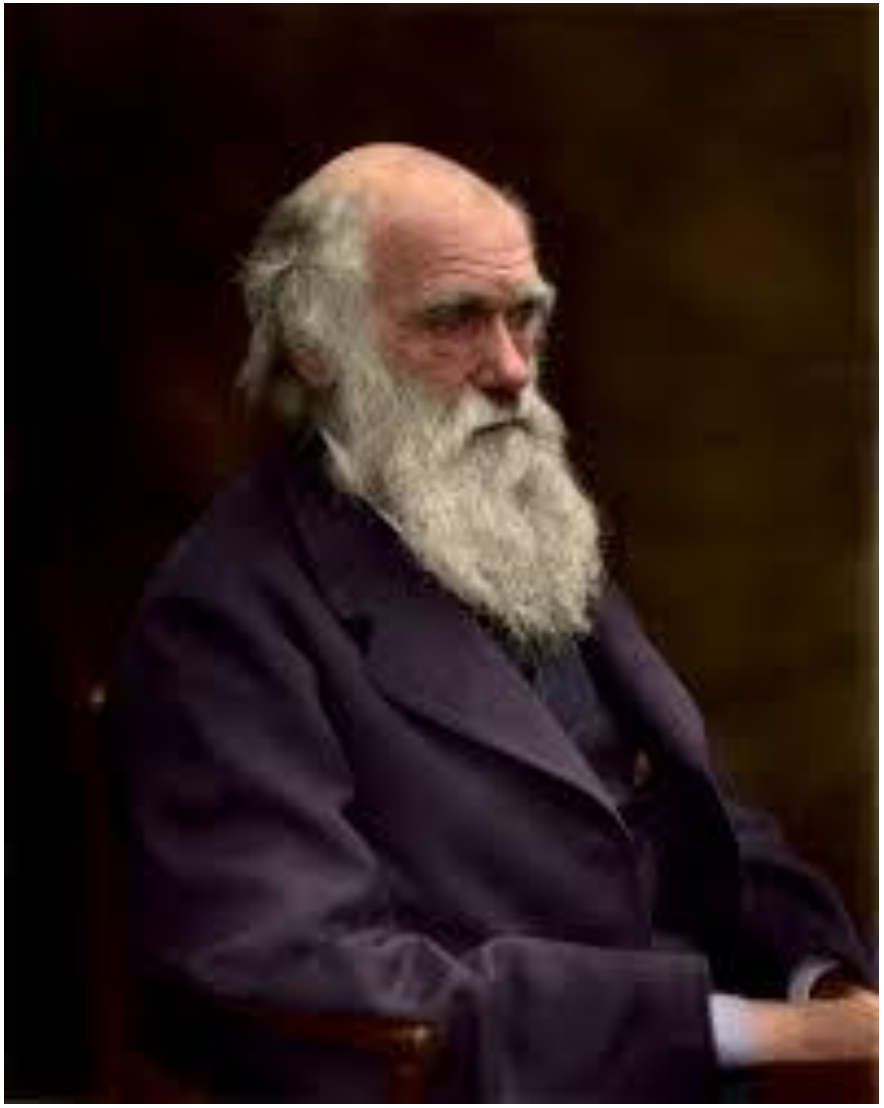
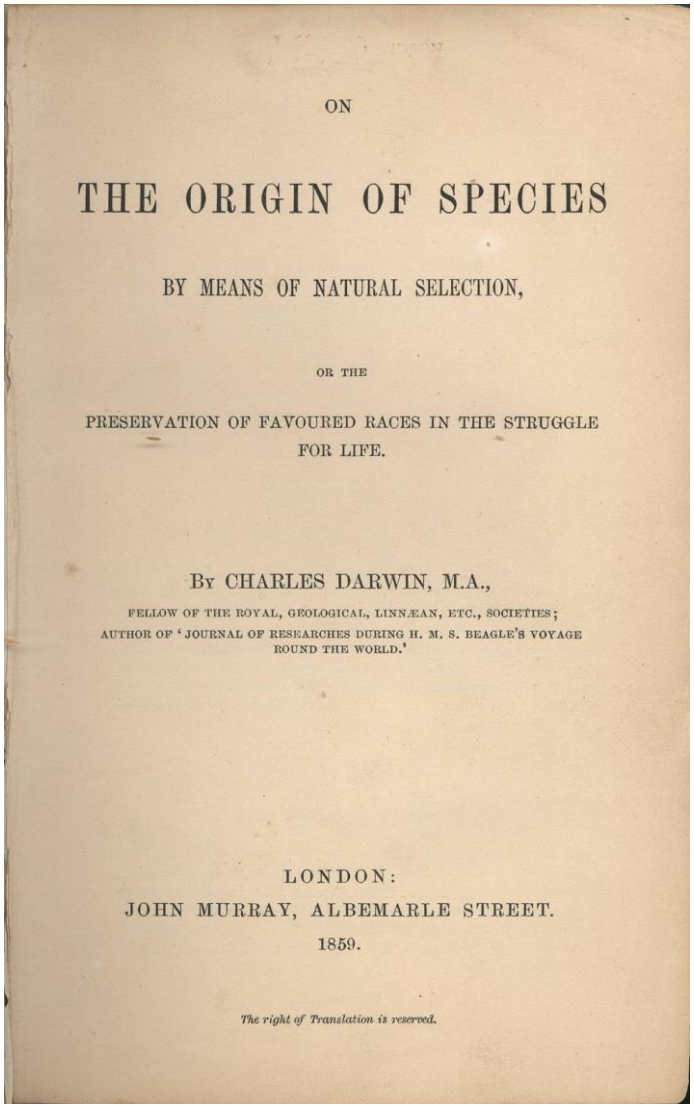
Why this title?





ON

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION,

OR THE

PRESERVATION OF FAVOURED RACES IN THE STRUGGLE FOR LIFE.

BY CHARLES DARWIN, M.A.,

FELLOW OF THE ROYAL, GEOLOGICAL, LINNÆAN, ETC., SOCIETIES;
AUTHOR OF 'JOURNAL OF RESEARCHES DURING H. M. S. BEAGLE'S VOYAGE ROUND THE WORLD.'

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1859.

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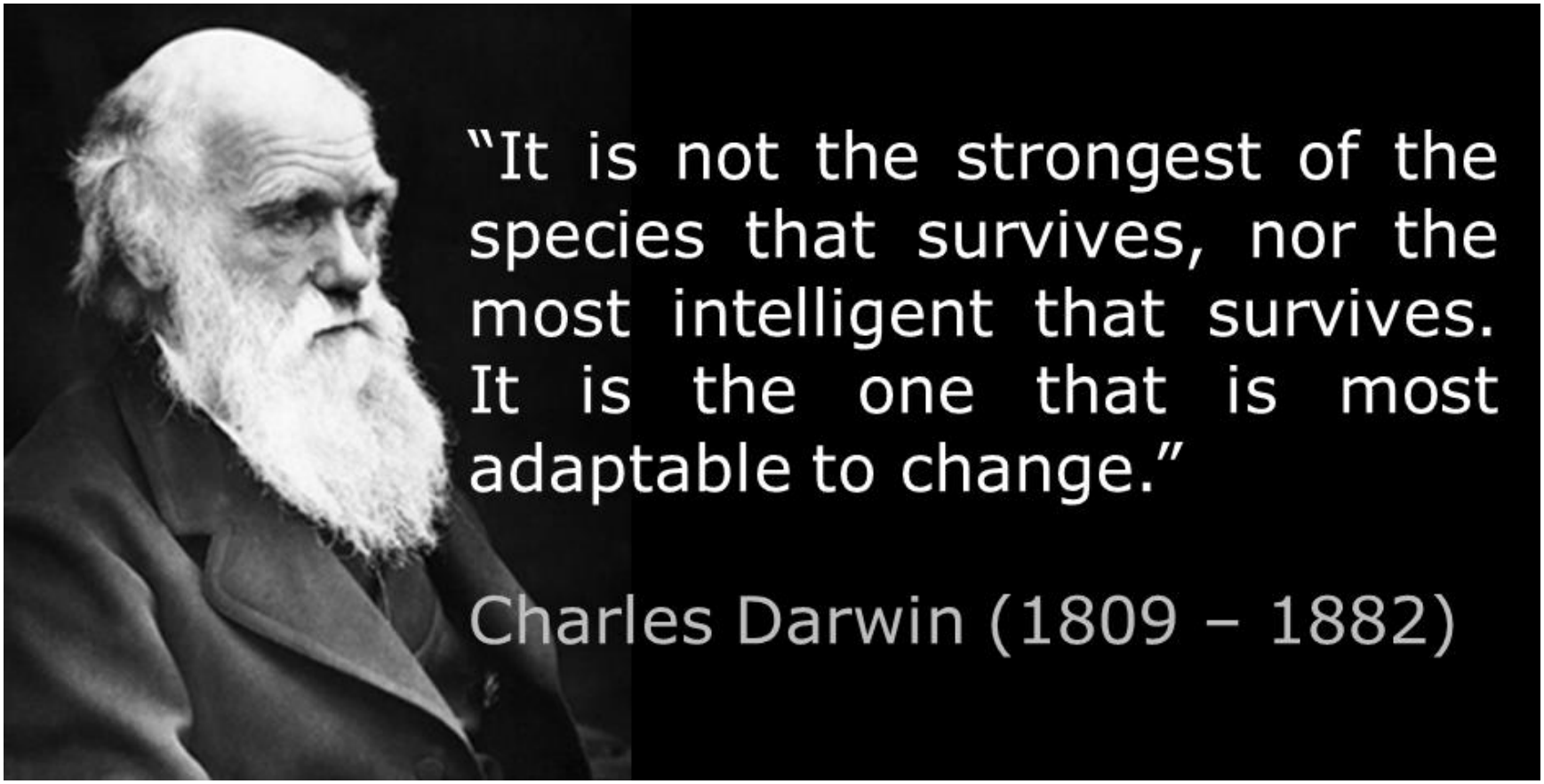
A famous quote:



This got translated as:

- The survival of the fittest (Herbert Spencer)!
- Let the best “man” win!

Or with respect to applications in the financial and insurance industry:

The survival of the fittest/best model!

Let the best model win!

This point of view got somewhat engraved in the early Basel and Solvency proposals.

Darwinian examples include

- The broader class of **Black-Scholes-Merton** models for market data
- The **Black** model for pricing options on futures
- The **KMV** model for Credit Risk
- The various **triangle models** for non-life insurance loss reserving
- The **risk measure** Ansatz (P&L, VaR, ES, ...)
- The Gaussian copula **almost** made it
- ...

It is fair to say that regulatory Darwinism worked:

- To a **considerable degree** for Market Risk (with possible early warnings like the 1987 crash in part due to Portfolio Insurance)
- To a somewhat **lesser degree** for Credit Risk (keeping the 2007-2009 financial crisis in mind)
- But **did not work at all** for Operational Risk (here there is a big difference between insurance and finance) → **more in detail!**

Operational Risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. Including legal risk but excluding strategic and reputational risk.

Operational Risk losses can be/are considerable:

From The Economist, 13/8/2016, OpRisk losses since 2009 as % of market capitalisation (+/-):

(1) Bank of America: 50% (70 billion USD)
(2) Deutsche Bank: 30% (not taken recent problems into account)
(3) JP Morgan: 18%
(4) Credit Suisse: 16%
(5) Morgan Stanley: 15%
(6) BNP Paribas: 13%
(7) Citigroup: 12%
(8) Barclays: (11%)
(9) UBS: 10%
(10) Goldman Sachs: 10%, ...

So far (August 2016) 188 settlements for a total of 219 Bi USD, about 278 possible cases more in the pipeline ...

From the Basel Committee's March 2016 Consultative Document on OpRisk:

Quote: A recent review of the measures related to banks' operational risk modelling practices and capital outcomes revealed that the Committee's expectations failed to materialize. Supervisory experience with the AMA has been mixed. The inherent complexity of the AMA and the lack of comparability arising from a wide range of internal modelling practices have exacerbated **variability in risk-weighted asset calculations**, and have eroded confidence in risk-weighted capital ratios. **The Committee has therefore determined that the withdrawal of internal modelling approaches for operational risk regulatory capital from the Basel Framework is warranted. (Eoq)**

AMA is replaced by a standardized BI-based approach!

So surely, for Operational Risk, Model-Darwinism did **not** work!

Whereas I do agree with the overall assessment by the Basel Committee on the AMA for Operational Risk, and indeed in the past (already in 2001 (*)) have voiced my concerns about the (im)possibility of the AMA/LDA on the basis of available and quality of statistical OpRisk data **(*)**, **I strongly believe that, at least for industry-internal purposes, more detailed statistical modeling is very useful.** This is very much akin to Total Quality Control in manufacturing industry!

(*) Swiss Solvency Test

(*) P. Embrechts et al. "An academic response to Basel II"

An Interludium:

An influential regulatory paper:

A. G. Haldane & V. Madouros (BoE): **The dog and the frisbee** (Jackson Hole Speech, 31/8/2012)

So what is the **secret** of the dog's success? The **answer**, as in many other areas of complex decision-making, **is simple**. Or rather, it is to keep it simple. For studies have shown that the frisbee-catching dog follows the simplest of rules of thumb: run at a speed so that the angle of gaze to the frisbee remains roughly constant. Humans follow an identical rule of thumb.

Catching a crisis, like catching a frisbee, is difficult. Doing so requires the regulator to weigh a complex array of financial and psychological factors, among them innovation and risk appetite. Were an economist to write down **crisis-catching** as an optimal control problem, they would probably have to ask a physicist for help. (Quote HM)

Some further quotes from this paper:

- … why the type of complex regulation developed over recent decades might not just be costly and cumbersome but **sub-optimal for crisis control**. Less is more!
- Complex environments often instead call for **simple decision rules**. That is because **these rules are more robust to ignorance**.
- **(Conclusion) Because complexity generates uncertainty, not risk, it requires a regulatory response grounded in simplicity, not complexity.** A point of view echoed by regulators worldwide in an after-financial-crisis aera. (Quotes HM)

Simplify and streamline the control framework: five rules!

- de-layering the Basel structure;
- placing leverage on a stronger regulatory footing;
- strengthening supervisory discretion and market discipline;
- regulating complexity explicitly;
- and structurally re-configuring the financial system. (Quotes HM)

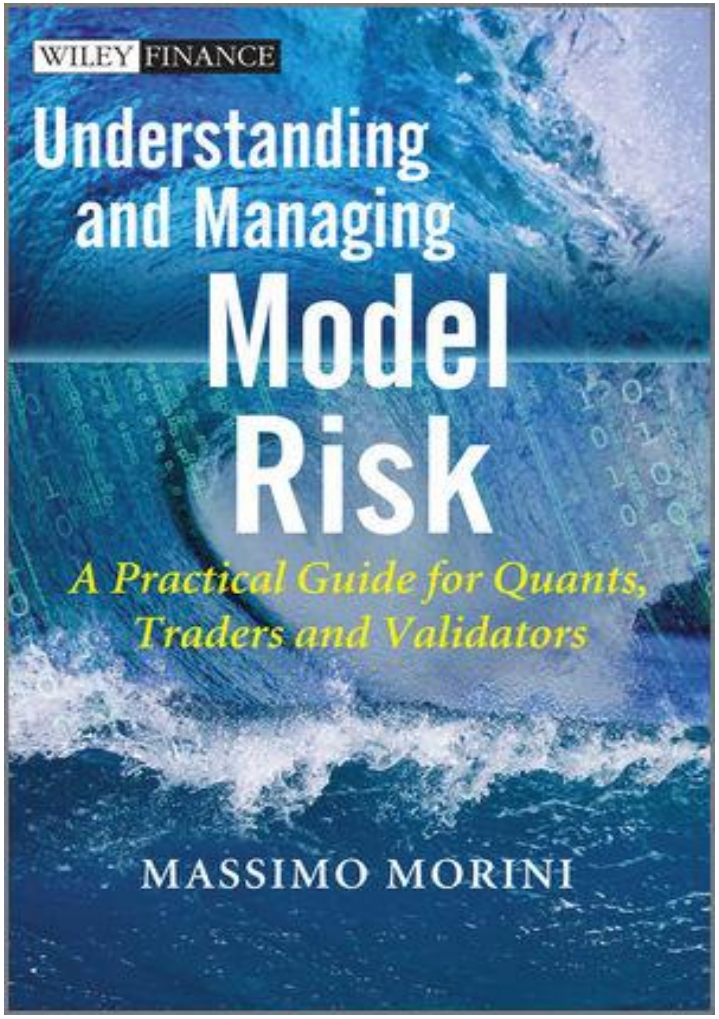
On risk-sensitivity:

The quest for risk-sensitivity in the Basel framework, while sensible in principle, has generated problems in practice. It has spawned startling degrees of complexity and an over-reliance on probably unreliable models. The Tower of Basel (sic) is at risk of over-fitting – and over-balancing. It may be time to rethink its architecture. A useful starting point might be to take a more sceptical view of the role and **robustness** of internal risk models in the regulatory framework. **These are the main source of opacity and complexity.** (Quote HM)

Akin to the following research topics (**PE**):

- Robustness properties of regulatory risk measures
- Robust risk allocation
- Robust Finance
- .... see **www.math.ethz.ch/~embrechts**
- But always «**robustness**» is defined in function of some distance measure (i.e. **topology**)
- Relevant terminology: **Model Uncertainty/Risk**

On Model Risk:



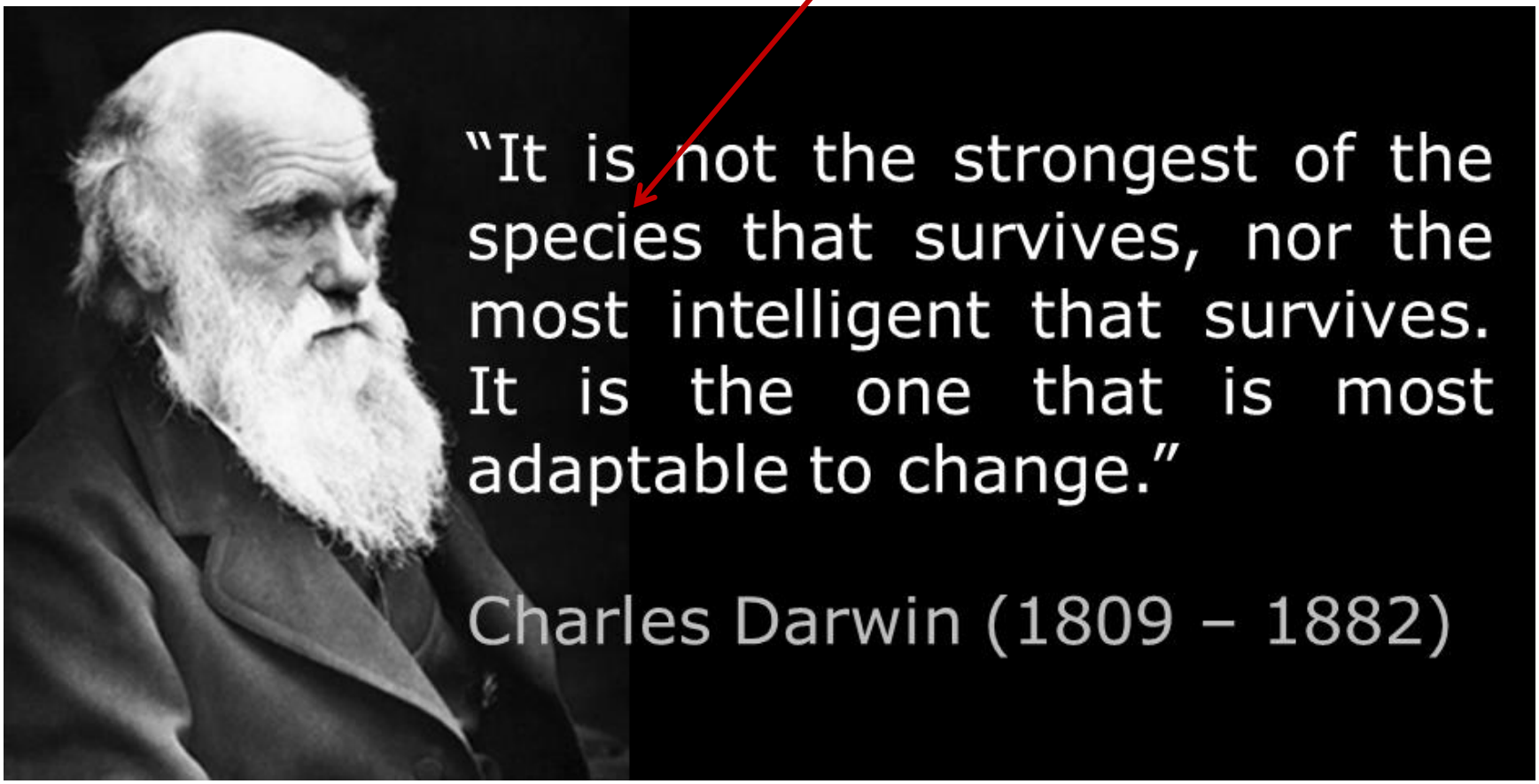
We currently find ourselves at several **crossroads**:

- A **crossroad** between standardised and internal models
- A **crossroad** between complexity and heuristics
- A **crossroad** between quantitative and qualitative
- A **crossroad** between rational and behavioural
- And (e.g. **USA**) a **crossroad** between more versus **less** regulation

But much more importantly

- As an industry we are at a **crossroad** when it comes to **products, data, economic environment, political and demographic shifts, ...**
- Most of these changes demand for **a strong quantitative actuarial function** being able to capture emerging risks via well-chosen and wisely-guided internal models; in the words of Charles Darwin again:

models/companies



And changes do present themselves, here are **four**:

1 The Allianz Risk Barometer 2016:

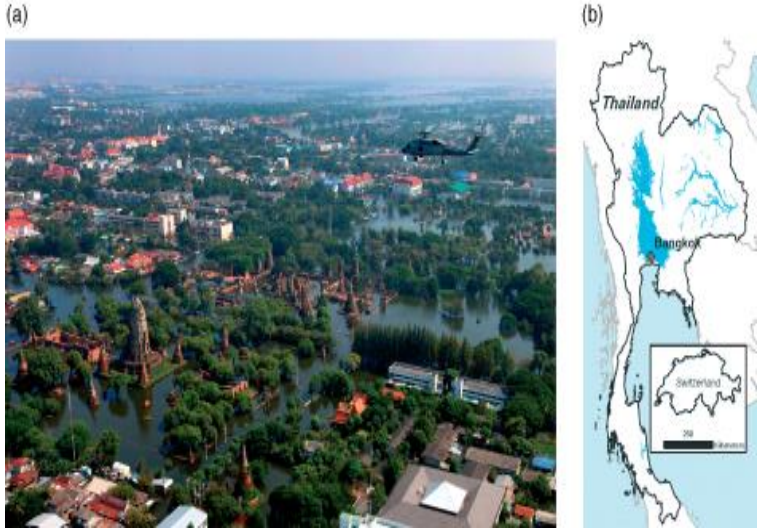
"The fifth annual Allianz Risk Barometer identifies the top **corporate perils** for 2016 and beyond, based on the responses of more than 800 risk experts from 40+ countries around the globe.
(1) Business interruption (incl. supply chain disruption), **(2)** market developments (volatility, intensified competition and market stagnation) and **(3)** cyber incidents are the top three global business risks. Business interruption (BI) is top for the fourth year in succession.

(*) 2011 Thailand flooding

- due to rainfall
- EL 30 bi USD (4th)
- EIL 12 biUSD (record)
- Chao Phraya Riverbasin
- 20 mio people (30%)
- Manufacturing industry
- Topography

Historical records (1985-2012):

- Flood magnitude (7.9): 5th
- Flood duration (158 days): 1st
- 10-20 years return period
- If → What If ...



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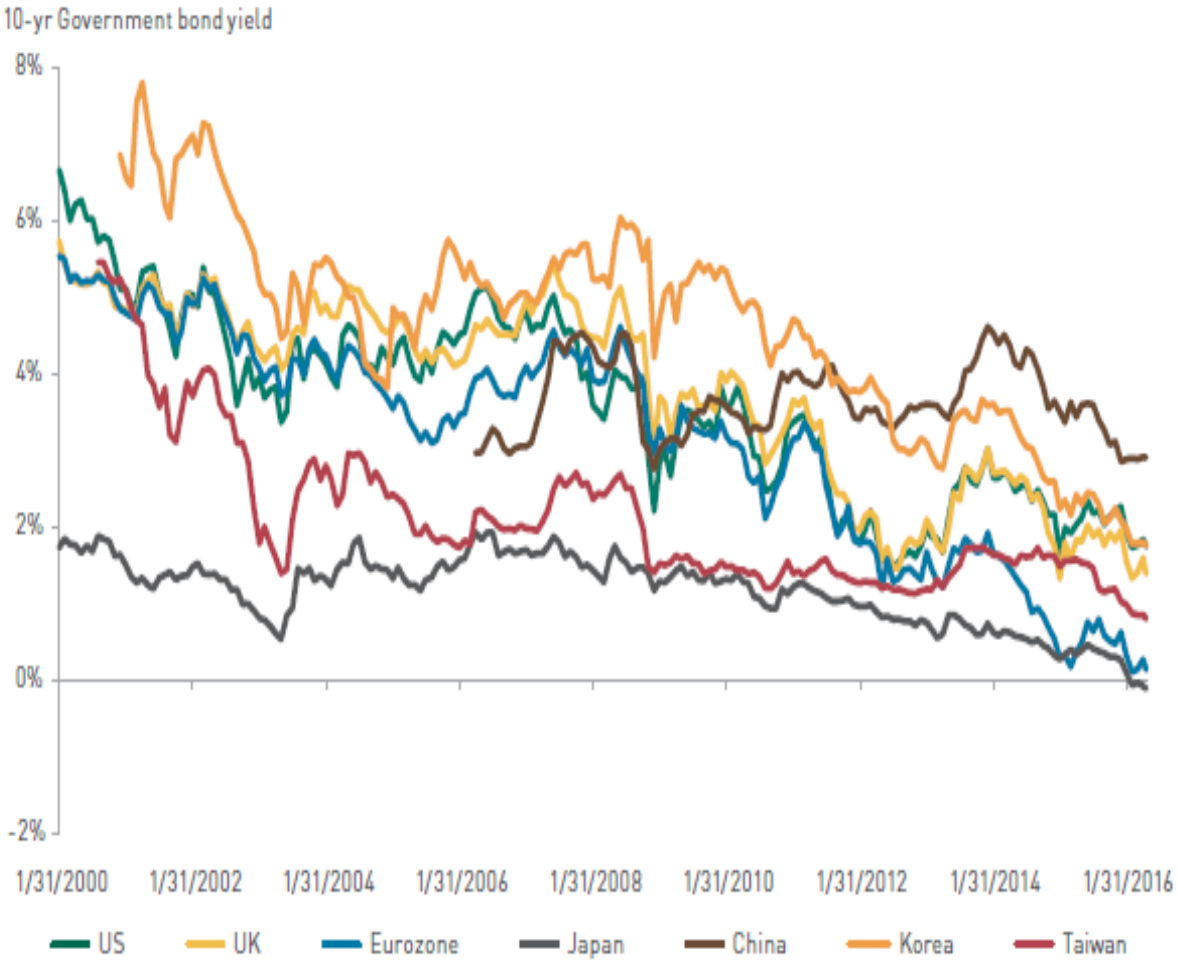
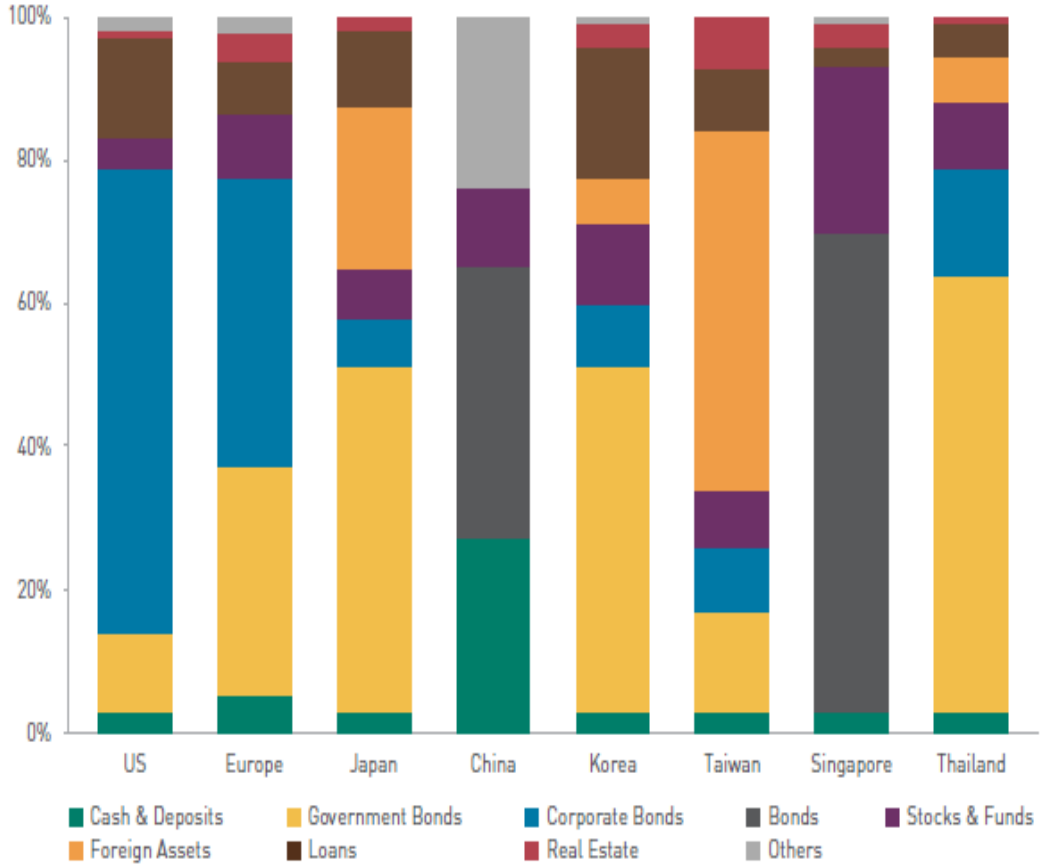


https://www.pinebridge.com/images/insights/thought-papers/charts/insurance-historical-10-year-government-bond-yields.gif

Asset Allocation of Life Insurers

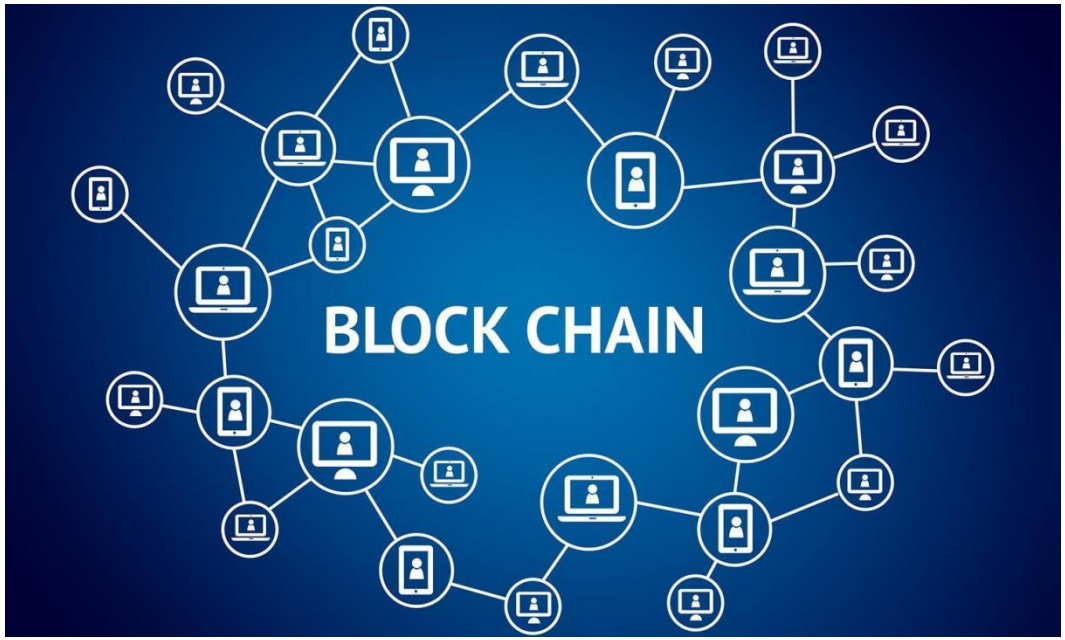


https://www.pinebridge.com/images/insights/thought-papers/charts/insurance-asset-allocation-of-life-insurers.gif

ALM challenges under (r < 0) - constraints

- Always: solvency , political, market, policyholder constraints
- Classical ALM does not work (there (r > 0) as a pre-condition)
- Relevant (r < 0)-models from finance? **(More research needed!)**
- Need for intellectual and regulatory flexibility
- Important to compare and contrast internationally («laboratory»)
- Industry and regulation are in need of **strong risk management functions**; the current move «away from internal models» may destroy potential RM skills just when we need them more than ever

3



- For **Blockchain based technology**: no doubt there exists considerable **upside potential** but with non-neglidgeable **downside risk**
- **Beware of over-enthusiasm** (see also recent Wharton study)
- The market went well beyond Bitcoin, e.g. Ethereum, Lykke,...
- Number of cryptocurrencies as of July 2016: more than 700! (**CRIX**)
- Emerging cryptocurrency derivatives markets, e.g. BitMEX, OKCoin, Bitfinex, ... Regulation?
- Beware of potential for cyber-risk and fraud: e.g. Bitcoinica (2012, 28Mi.$), Mt Gox (28/2/14, 350), 2016: Cryptsy (10), DAO (50), Bitfinex (65), ...
- Theory in early stages: e.g. 50%, 33%, 25% Theorems
- Who and where are currently the main market players?
- Brainstorm on potential influence of blockchain based technology to current market structures, products and participants. Winners? Losers? Are we facing an example of Disruptive Technology (Bower-Christensen) also referred as Digital Disruption (Fujitsu, in The Actuary, March 1, 2017)?

A Bitcoin-bubble?

17 Aug 2016 00:00 UTC - 17 Aug 2017 11:09 UTC

XBT/USD close:4447.28425 low:569.65175 high:4453.08526 (one year)

The future: "In (computer) code we trust"?

And then there is of course the Data Science (**Big Data**) (r)evolution

What are the consequences for the **actuarial profession**?

The Actuary of the nth kind

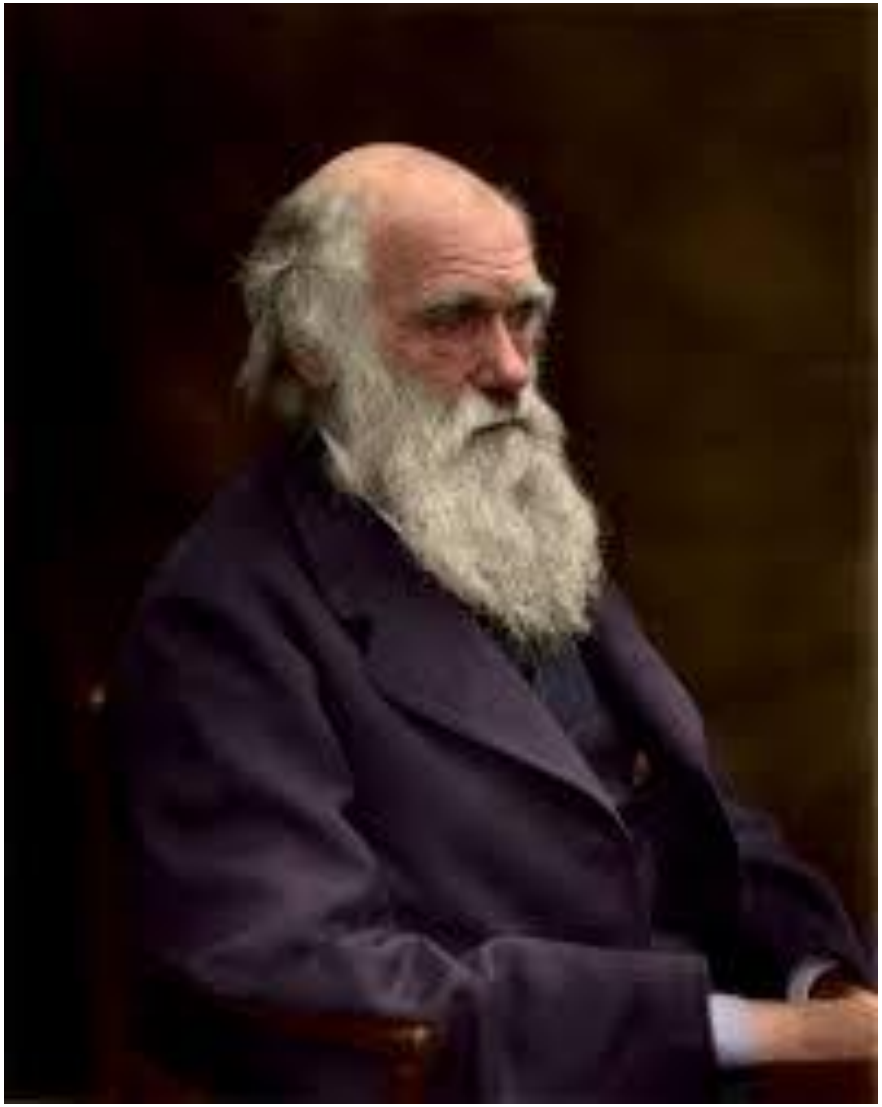
- Actuary of the **first** kind: the **life actuary** (since 17th Century)
- Actuary of the **second** kind: the **non-life actuary** (in 20th Century)
- Actuary of the **third** kind (Hans Buehlmann, ASTIN Bulletin, 1989) for actuaries with skills on the **investment** side of the balance sheet
- Actuary of the **fourth** kind: the ERM actuary (S.P. D'Arcy, Presidential address, November 14, 2005) ← Paul Embrechts presentation
- Actuary of the **fifth** kind: F. Chan & F. Devlin, "B.A.U. for actuaries: **Big data**, Analytics & Unstructured data", Singapore Actuarial Society Big Data Working Party, 3 March, 2016

Because of **kind 5** we definitely have to rethink the actuarial education and research agenda: Data Science and its various intersections with Computer Technology, AI and Social Networks are having a considerable impact on society at large and hence as a consequence on insurance products needed in this changing landscape.

In many ways, going from **1** to **5**, we are coming back home: the word actuary comes from the Latin actuarius (+/- 1550s) meaning copyist, account-keeper … hence surely someone strongly linked and helpful in reaching business decisions based on data.

Through the **kinds 1-5**, we actuaries have also **evolved in a Darwinian way**, recall: **"… most adaptable to change …"**, being well aware that:

Modern society will no doubt need **tomorrow's actuary** (whether life or non-life) to go back to this early cradle of our profession, that is as a **data driven** and **model guided financial decision maker** in a world governed by **uncertainty**.



Thank You