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Versicherungen. Finanzen.

Kritische Aspekte des Klimarisikos – wo stehen wir, wo sollten wir hin?

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The risk landscape

- high lights from Risk Baedeker
  - P. Drucker: *If you can't measure it - you can't manage it* – **Does (can) Math makes the world go round?**
  - J. Sanio: *Die Bürokratie ist der Terrorismus des 21-zigsten Jahrhunderts* – **Autopoiesis at work**, complexity and reg
  - L. Wittgenstein: *Satz 7, Tractus* Whereof one cannot speak, thereof one must be silent. – Borderline to terra incognita of knowledge
- top three **P**'s – the risk landscape
  1. $\mathfrak{P}$ business processes incl. ERM
  2. $\mathbb{P}$ prob. models
  3. $\mathcal{P}$ principle based regulation (Basel III, Solvency II, IDW 340ps, ...)

  $\Rightarrow$ RM is **interdisciplinary**, challenge: balancing the **P**s

Climate risks and insurers

Impact on income statement

Group P&L	Physical Risks	Transition Risks	Litigation Risks	Example / Outlook
Gross written premium		↓	↓	• Economic downturn/ recession, lower income of customers • Reputational impact if acused of climate-related misconduct
Claims & claim expenses	↑		↑	• More claims due to increase in extrem weather events • Claims in liability / D&O due to climate-related lawsuits
Reserves			↑	• Recalculation of technical reserves due to higher litigation risk
Administrative/ Operating expenses		↑	↑	• Continuos rise in carbon price increases offsetting costs • Costs of non-compliance with substainability regulation, fees
Net investment income	↓	↓		• Stranded and stressed assets • Macro-financial effects by sector and region
Operating profit/loss (EBIT)	↓	↓	↓	

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Toolbox

space: Taylor' theorem – **sensis**

principle: Theorem of Pythagoras – **diversification**

knowledge: Bayes' theorem – **communication**

$$\mathbb{P}(Theory \mid Data) = \frac{\mathbb{P}(\mathbf{D} \mid \mathbf{T})\mathbb{P}(\mathbf{T})}{\mathbb{P}(\mathbf{D} \mid \mathbf{T})\mathbb{P}(\mathbf{T}) + \sum_{Alter} \mathbb{P}(\mathbf{D} \mid Alter)\mathbb{P}(Alter)}$$

Targets of the Talk

- Regulation and managing of Climate Risk (for corporates) is INDISPENSABLE
- so-called stranded assets motivate **National Banks** to introduce a capital charge for climate change – in analogy to market risk, **BaFin** has a different approach
- Blueprints taken from financial regulation are **NOT** the right choice (over-confidence, lack of knowledge...)
- we propose a shift from $\mathbb{P}$ to $\mathfrak{P}$
- stochastic models are under regulatory discussion (Basel III) due to **complexity** issues and **predictability** (see work of Metrick, Yale)

Targets of the Talk cont.

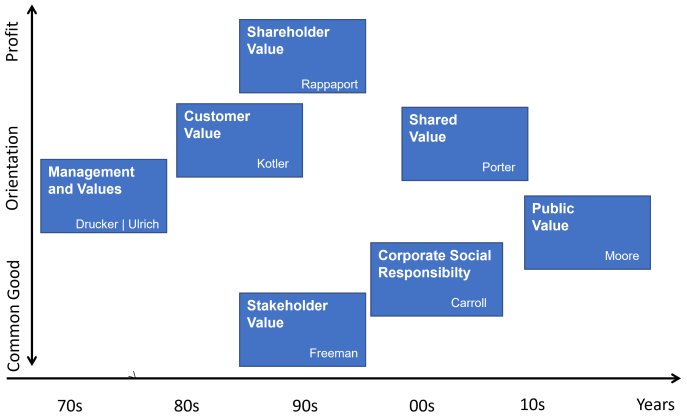
- The regulation of climate risks should focus changing BEHAVIOR of market participants including corporates
- Utility function adequate for climate change (Epstein-Zin) are not used in financial risk management
- climate change should be regulated for corporates and the stylized facts of climate risk should be captured by the regulatory framework

financial risk management & some axioms

- Pricing is the starting point of financial risk management $\Rightarrow$ Value-at-Risk, J.P. Morgan, 1994
- Mondiliani-Miller Theorem, RAROC, Bankers Trust, 80ies, shareholder value
- capital & homeostasis (system stability), HEAD-paper
- (1) to (4) implies linear (!) utility function

$$\begin{aligned}
\text{Preferences CEO} &: X \prec Y \Rightarrow \varrho(X) \leq \varrho(Y) && (1)\\
\text{Invariance CFO} &: \varrho(X + A) = \varrho(X) - a && (2)\\
\text{Sublinearity CRO} &: \varrho(X + Y) \leq \varrho(X) + \varrho(Y) && (3)\\
\text{Homogenuity COO} &: \varrho(\lambda X) = \lambda \varrho(X) && (4)
\end{aligned}$$

Key Performance Indicators – Changes of the Normative Frame



Source: adapted from Gomez,P. et al. (2019): „Verantwortungsvoll führen in einer komplexen Welt", Haupt Verlag.

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Risk and intention

firm specific interpretation of **risk**; **To Do for C-Suite**, role as an observer of the system (= board member) important (**C-risk**= manage disappointment of stakeholders).

Definition (Risk according to ISO norm)

Risk is defined as an effect of uncertainty on objectives, where an effect is a deviation from the expected - positive or negative. Objectives can have different aspects and can apply at different levels (strategic, organization-wide, project, product, process).

Definition (Rosa's definition of risk)

Risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain.

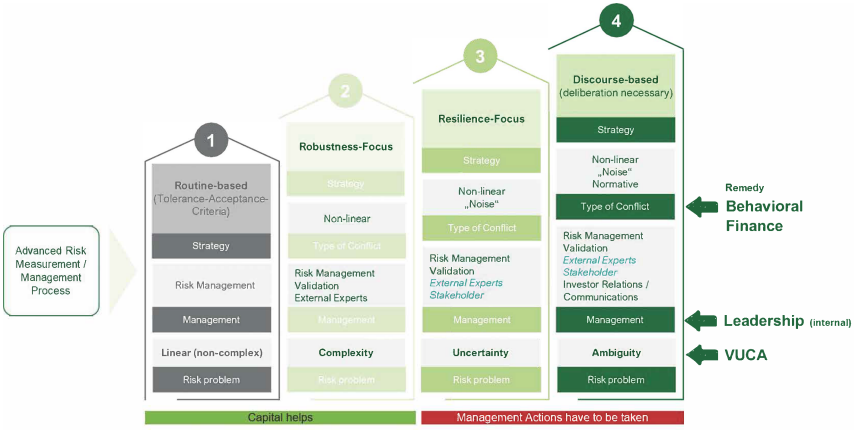
Regulation in a cybernetic perspective

- Theory: Laffont & Tirole
- Practice: Hood et al, 2001, applied a cybernetic approach
- regulatory system which (1) sets standards, (2) gathers information and (3) modifies behavior
- past regulation often buffer based; Solvency II: feedback and feedforward components (prices, valuations [balance sheets])
- NEW CHALLENGE: SYSTEMIC RISKS IN A VUCA WORLD
  - How to measure? How to regulate?
  - How to modify behavior?

Systemic aspects of financial regulation

- TIPPING POINTS IN FINANCIAL REGULATION: Default of a Financial Institution
  - measurement problem
  - attribution problem - who is guilty? e.g. correlation is symmetric
  - what is under the corporate's control?
- current approach to tipping points in regulation is very ad hoc, no clear general strategy, possible conflicts of interests

Risk management framework for systemic risks



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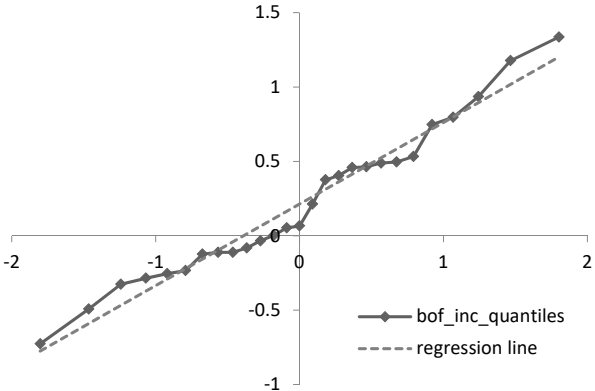
IDW-PS340 – postnormal?

- IDW Standard fokussiert auf **bestandsgefährdende Risiken**
- Begriffsanalogie zum Nachweis der Resilienz bei **Sanierungsplan**
- damit steht $\varrho(X + A) = \varrho(X) - a$ **nicht** im Mittelpunkt der Steuerung
- Kapital ermöglicht Resilienz von $\mathfrak{P}_{\mathbf{T}}$ über **Zeit**
- Bsp.: **Sanierungsplan** bei Lebensversicherungen $\Rightarrow$ Eigenzeit $\equiv$ **AGILITAET**
- $\mathcal{A}_T = \left\{ X : \mathbb{E}(u(X)) \geq 0 \right\}$

Overshooting SCR



Zeit und Volatilität

- Sei $B = (B_t)_{t \geq 0}$ ein standard Brown'sche Bewegung und T ein unabhängiger Zeitprozess, dann entsteht die Verteilung $Y_s = B_{T_s}$ aus Mischungen $Y_s \mid T_s \sim N(0, T_s)$ von Normalverteilungen
- Interpretation der Volatilität als Zeitwechsel (Systemzeiten); fraktale Dimension
- $$\frac{\varrho(X+Y)}{\varrho(X)} = \frac{\int_0^\infty F_n^\star \left(\frac{z-\mu_n}{\sigma_n+s}\right) \mathrm{d}\Gamma(s)}{\varrho(X)}. \tag{5}$$
- Interpretation von Y als Feedback, Theorem von Kesten, Power Laws, Taleb

Geodätische Toolbox cont.

- Up-date von neuen Informationen, Formulierung von Szenarien..... (falls $\mathbf{N} \perp \mathbf{D}$)

$$\mathbb{P}(\mathbf{T} \mid News \wedge \mathbf{D}) = \frac{\mathbb{P}(\mathbf{N} \mid \mathbf{T} \wedge \mathbf{D})\mathbb{P}(\mathbf{T} \mid \mathbf{D})}{\mathbb{P}(\mathbf{N} \mid \mathbf{D})}$$

$$= \frac{\mathbb{P}(\mathbf{N} \mid \mathbf{T})\mathbb{P}(\mathbf{T} \mid \mathbf{D})}{\mathbb{P}(\mathbf{N} \mid \mathbf{T})\mathbb{P}(\mathbf{T} \mid \mathbf{D}) + \sum_{\mathbf{A} \neq \mathbf{T}} \mathbb{P}(\mathbf{N} \mid Alter)\mathbb{P}(Alter \mid \mathbf{D})}$$

Empirical results from Bank of England stress tests

Scenario	Zins	Spread	Equity	Property
Soft Transition	30.8% (3J)	11.9% (8J)	34.6% (3J)	6.6% (15J)
Steep Transition	19.0% (5J)	2.3% (44J)	25.8% (4J)	0%
Business as usual	15.9% (6J)	0.8% (125J)	22.9% (4J)	0.2% (588J)

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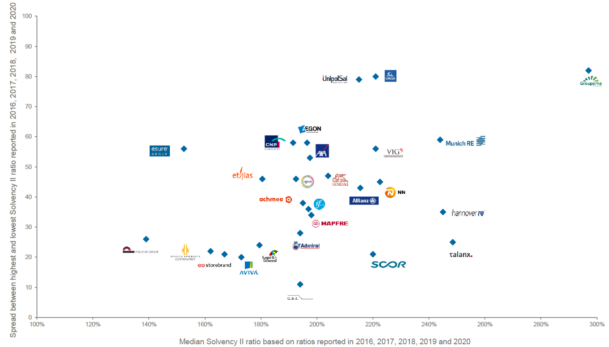
Empirical results from Bank of England stress tests

	Soft Transition	Steep Transition	Business as usaul
BOF	-4%	-10%	-15%
SCR	+2%	+3%	+4%
CAR	-5%	-8%	-20%
	-13%-pts.	-22%-pts.	-48%-pts.

Empirical results from Bank of England stress tests

Correlation between Solvency II ratio volatility and median Solvency II ratio
By median Solvency II ratio

Correlation between Solvency II ratio move and median Solvency II ratio for selected European insurers



J.P.Morgan

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Can capital requirements change behavour?

Silent features of financial risk management

- financial exposures are considered at least as tolerable – many climate risk are not tolerable
- all risks may be replicated by assets – many climate risks can not be replicated
- risk informed decisions – political decisions are to a certain degree opaque, no clear incentive structure
- strong commitment of decision makers – no analogue for politicians, no lessons from financial crisis
- calendar time dominates – climate risks show deep and different intrinsic times, which show different volatilities and reaction times

Can capital requirements change behavour?

Silent features of financial risk management

- most systemic risks are not insurable, i.e. hedgeable – many climate risks are not insurable, e.g. Ahr Valley
- risks are adequately priced, else arbitrage is possible – climate risks are not adequately priced yet
- stranded assets exist also beyond climate risks (e.g. digtlalization) – issues related to stranded assets are typical credit risk
- tipping points of socio-financial systems are weakly regulated – the CS case shows that the rules (resolution plan) are not applied
- mathematical models are dominating, i.e. theorems mirror the real world