Models and Uncertainty in Insurance Regulation and Decision Making

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Random vector of risk factors

- Claims frequencies, hurricane trajectories, inflation...
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Risk/performance functional applied to outputs

- Value-at-Risk, Return-on-Capital...
- **Disagreements** on what we should be measuring

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Decision making: make strategic and operational choices that optimise some performance measure (e.g. Return-on-Capital)

- Link between model output and decisions is **flexible**

SR 11-7: Guidance on Model Risk Management

*"The use of models invariably presents **model risk**, which is the potential for adverse consequences from decisions based on **incorrect or misused** model outputs and reports."*

[Federal Reserve, 2011]

Solvency II Statistical Quality Standards

"Actuarial and statistical techniques shall only be considered adequate [if...]

- *the outputs of the internal model are **stable** in relation to changes in the input data that do not correspond to a relevant change of the risk profile [...];*
- *the internal model captures **all the relevant characteristics** of the risk profile [...];*
- *the outputs of the internal model **do not include a material model error** or estimation error..."*

[Council of European Union, 2014, Article 229]

Switching perspective

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[Cabantous & Tsanakas, 2020]

- Qualitative study; literatures on social studies of finance / strategy tools
- Interviews with London market insurers, regulators, and consultants; variety of role profiles
- Questions around model use, uncertainty, decision-making

(see also: [Aggarwal et al., 2016])

The model's two facets

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These two facets are **entangled**

- Modellers are **sensitive to implications** of outputs
- Model **parameters are negotiated**
- Model is **not used instrumentally** in decision making

Entanglement

"*So they say 60%, we say, well, the data says 80%, and they say, yeah, but the data in that year is rubbish, get rid of it, and we say, fine, 75. But you've agreed that this data's good, so you need to get... and they say 65,* ***and you gradually meet somewhere in the middle***."

(Capital Modelling Actuary)

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(An aside: given conflicting perspectives, what would happen if there was no uncertainty?)

Uncertainty within the model

"*But for certain key assumptions, we'll have alternate views. We'll sort of say "look, the correct assumption could be anywhere between here and here. We've picked one because* ***we have to pick one****". And when we're doing our capital modeling, we will make sure that we're looking at "well* ***what's the impact*** *if we go at the lower end, what's the impact if we're at the higher end?" "*

(Chief Actuary)

Uncertainty outside the model (I)

"*It's very reasonable to think, "Okay what is the next asbestos? " Or, "Is something going to come out of cell phones that nobody knew about?"* ***There is going to be some disease later****; I think it's very difficult.*"

(CEO)

Uncertainty outside the model (II)

"*Even if your model were perfectly built for the risk, perfectly calibrated, there may be reasons why you'd say . . . so* ***I know that's the right answer, but I'm not going to do that*** *because... well that would mean I'd have to concentrate all my risk with two brokers. But I don't want to do that.*"

(CRO)

The pragmatic regulator

*"There are **processes** within the company, which can validate [the model]... It is a question of management continually **questioning** whether their model is in the right ballpark. And I think that's **all you can hope for is the right ballpark** not the right number."*

(Regulator – Technical Expert)

Some findings [Cabantous & Tsanakas, 2020]

"Stakeholders talk about the things that the model does not accurately 'represent' and about those things that it 'does not capture'... about the extent to which the recommendations it produces should be followed... As they talk about the model's limitations, ***stakeholders become aware of (and by this, expand) their own knowledge boundaries****."*

Some findings [Cabantous & Tsanakas, 2020]

"Stakeholders talk about the things that the model does not accurately 'represent' and about those things that it 'does not capture'... about the extent to which the recommendations it produces should be followed... As they talk about the model's limitations, ***stakeholders become aware of (and by this, expand) their own knowledge boundaries****."*

"Modelers invest a lot of time in ***explaining models*** *to engage other stakeholders...* ***The very fact that models are not indisputable is what makes them acceptable to management*** *and thus allows them to be used to support strategy making... 'black-boxing' can be seen to work against models' legitimacy in an organization."*

Concluding reflections

Insurance risk models are subject to a lot of uncertainty

- Practitioners have found ways of coping (and learning)

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Predictive models (e.g. for pricing) using ML/AI

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What changes? (technical context in: [Richman et al., 2019])

- Types of model uncertainty
- In what sense models represent the world
- Transformation of stakeholder roles

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