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Forecasting International Migration: Dealing with Uncertainty Across a Range of Time Horizons

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The project *QuantMig: Quantifying Migration Scenarios for Better Policy* has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 870299
www.quantmig.eu

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Migration uncertainty

Types of uncertainty in migration forecasting

- ***Epistemic***: related to our limited knowledge of the processes; potentially reducible (*knowable unknowns*)
- ***Aleatory***: intrinsic uncertainty about the processes and the future; irreducible (*unknowable unknowns*)

Migration uncertainty

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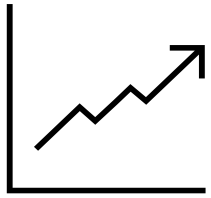
Epistemic	Aleatory
• Concepts and definitions • Migration data and measures • Drivers and their configurations • Models: migration, drivers & decisions	• Systemic shocks to migration & drivers • Step-change in data or modelling • Unpredictable human behaviour • **A fundamentally open future**

Models and methods

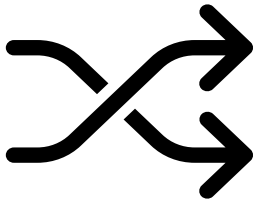
See the talk by Ravenna Sohst this morning

- Expert- and survey-based
  - Expert studies, Delphi
  - Migration intention surveys

- Extrapolations and early warnings
  - Statistical and econometric models
  - With or without covariates



- Scenario-based approaches
  - Narrative scenarios
  - Simulations, micro and macro



Models and methods

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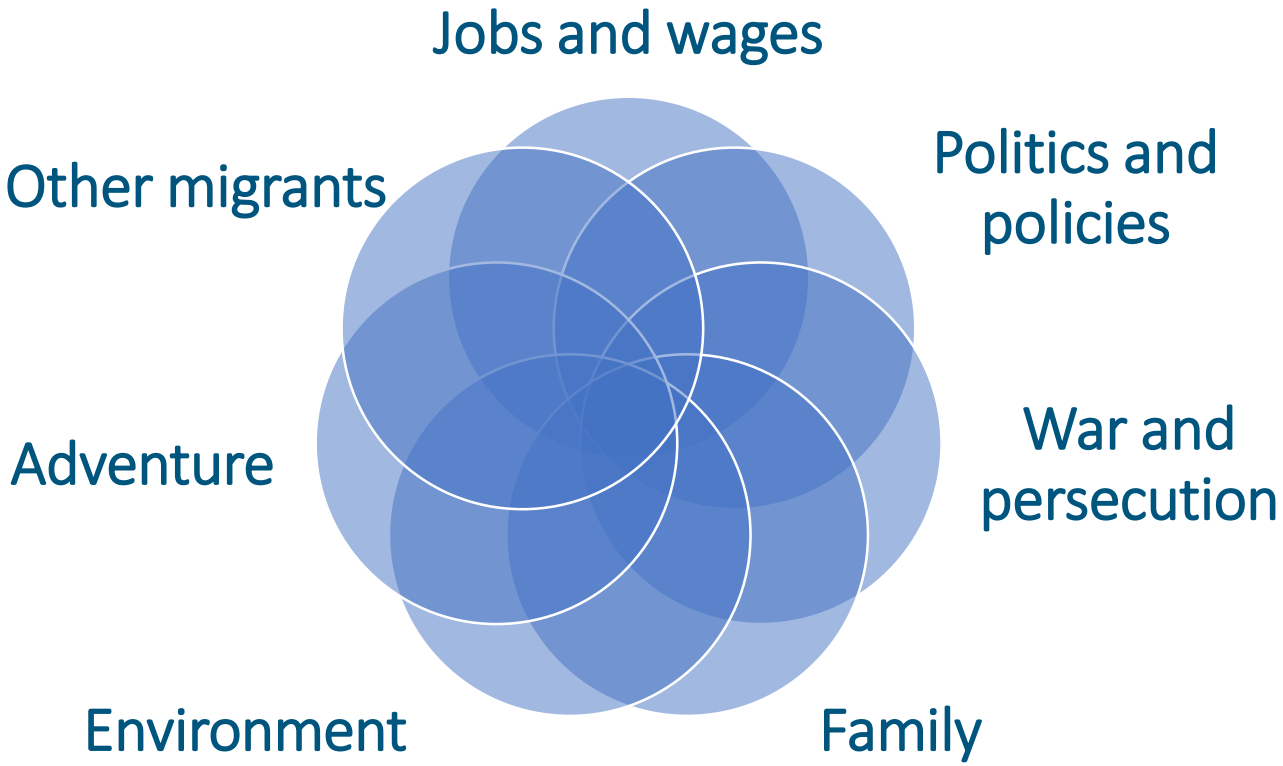
Where is the uncertainty hidden?

- Expert- and survey-based
  - Expert judgement also uncertain
  - Intentions do not translate into reality
- Extrapolations and early warnings
  - Assume stability of some trends
  - Drivers uncertain and difficult to predict
- Scenario-based approaches
  - Are the narratives imaginative and coherent?
  - Simulations data-hungry and assumption-driven

Migration drivers



See the talks by Susanne Melde and Mathias Czaika (later)

Prediction horizons

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- **Non-stationarity:** migration shocks bring about new equilibria, all the time
- Uncertainty increases with the time horizon
- Different implications for decision makers:
  - Very short term: Operations
  - Short- and mid-term: Planning
  - Long-term: Strategic and policy
- Different methods for different horizons

Horizons vs uncertainty

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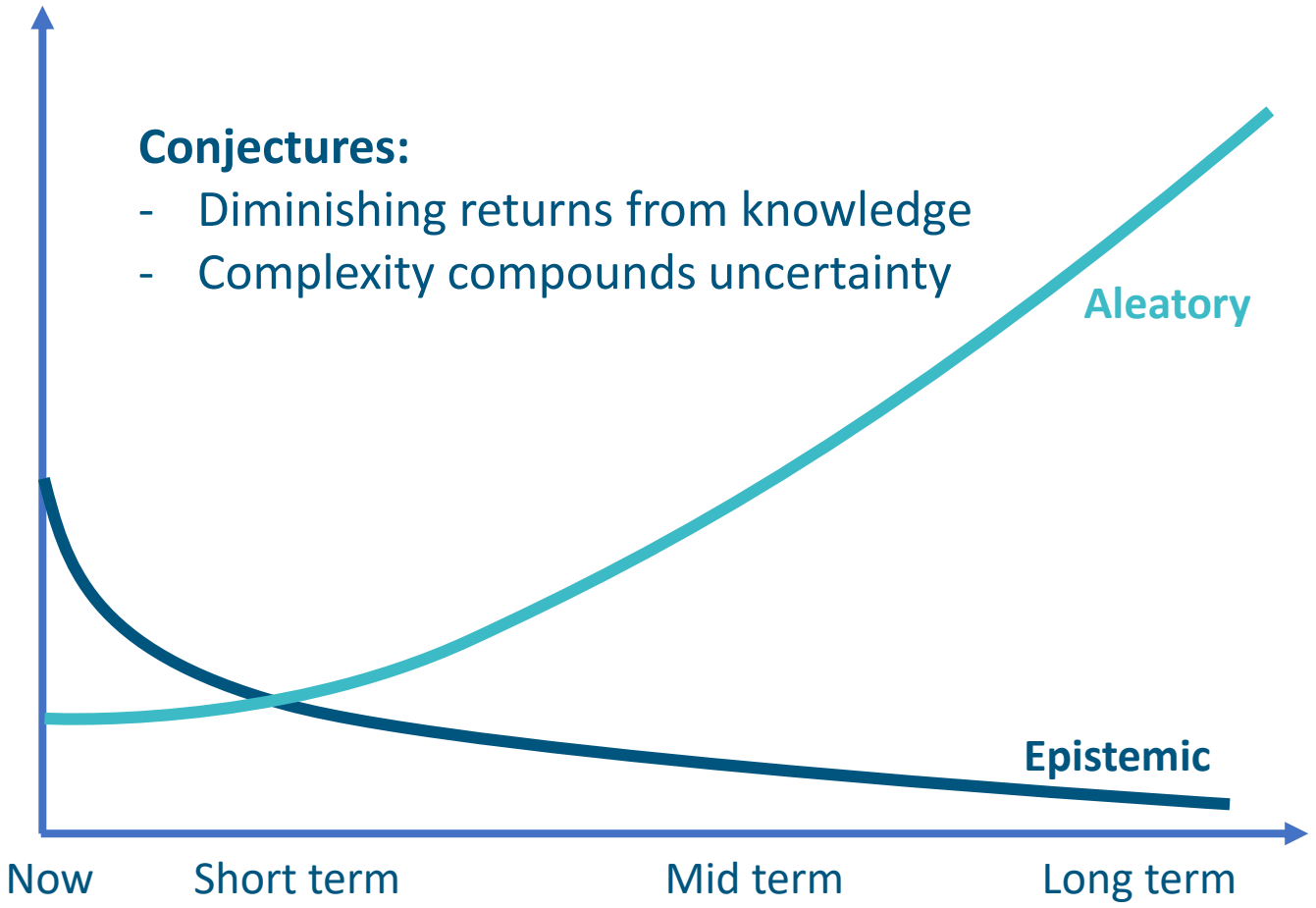
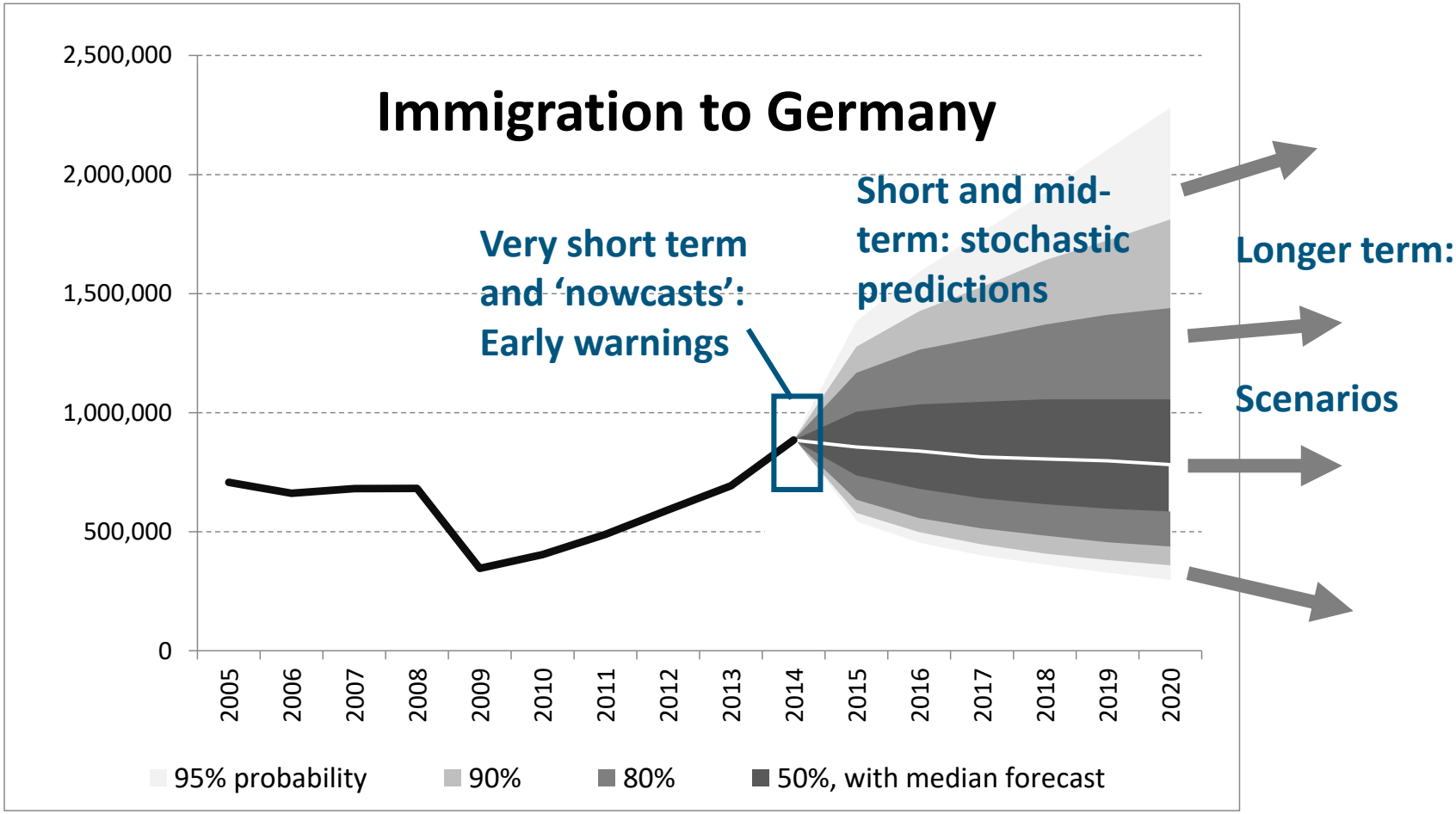


Horizons vs methods



What about the data?

- **Quality of data** (bias, variance) is yet another source of uncertainty – but can be measured
- **Probabilistic estimates** of flows: IMEM project (Raymer et al. 2013); Azose & Raftery (2019)
- **'Big data'** (eg. digital traces): volatility means that they may be useful in the short horizons
- Ideally, **coupling** of 'Big data' with traditional sources, which are better understood

See also the talk by André Gröger

Levels of predictability

- **Risk management approach:** classification based on uncertainty and potential impact

Impact \ Uncertainty (risk)	Low	Medium	High
Low		Long-term migration of UK nationals*	Short-term non-EU migration
Medium		Long-term migration of other EU nationals: old EU (Western Europe)* Long-term migration of non-EU nationals	Long-term migration of other EU nationals: Central & Eastern Europe* Short-term EU migration* Student migration
High		Visas issued, by type	Refugees and asylum seekers

Bijak J et al. (2019) Assessing time series models for forecasting international migration: Lessons from the United Kingdom. *Journal of Forecasting*, 38(5), 470–487.

Predictability: How to measure

- **Ex ante errors:** How large we expect the errors to be, given the predictive model?
- **Ex post errors:** How large are the differences between the predictions and observations?
- **Calibration:** How well are the ex ante and ex post error distributions aligned?
- **Scoring rules:** Combining errors & calibration e.g. minimising well-calibrated errors
- **Additional considerations:** *Loss functions* – impact of errors on actual decisions

Policy options

- **Short horizons**, better predictable flows: Epistemic uncertainty dominates
  - Risk-benefit assessment of possibilities
  - Scope for a formal decision analysis
- **Longer horizons**, worse predictable flows: Aleatory uncertainty dominates
  - ‘What-if’ stress-testing and contingency plans
  - Building capacity and resilience

More in the afternoon talk by Mathias Czaika

Reducing the uncertainty?

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- Possible by better data, knowledge, and new research, but **only** for epistemic uncertainty
- Training in better judgement (Philip Tetlock's and Dan Gardner's *superforecasters*)
- **But:** Aleatory uncertainty always remains – needs to be acknowledged and managed
- Challenge to know which is which

"It is better to be vaguely right than exactly wrong." – Carveth Read

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Thank you!

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With thanks to Mathias Czaika

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Some reading

Bijak J (2010) *Forecasting International Migration in Europe: A Bayesian View.* Dordrecht: Springer.

Bijak J (2016) Migration forecasting: Beyond the limits of uncertainty. Data Briefing 6, Berlin: IOM GMDAC.

Bijak J et al. (2019) Assessing time series models for forecasting international migration: Lessons from the UK. *Journal of Forecasting* 38: 470–487.

Bijak J & Czaika M (2020) How Can Europe Better Prepare for Future Migration Movements? Population & Policy Brief 26. Berlin: Population Europe.

Bijak J & Czaika M (2020) Assessing Uncertain Migration Futures: A Typology of the Unknown. QuantMig project D.1.1, via www.quantmig.eu