Longevity risk mitigation from a supervisory perspective

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DeNederlandscheBank

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- Modelling the Best Estimate
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- Longevity indemnity and index transactions
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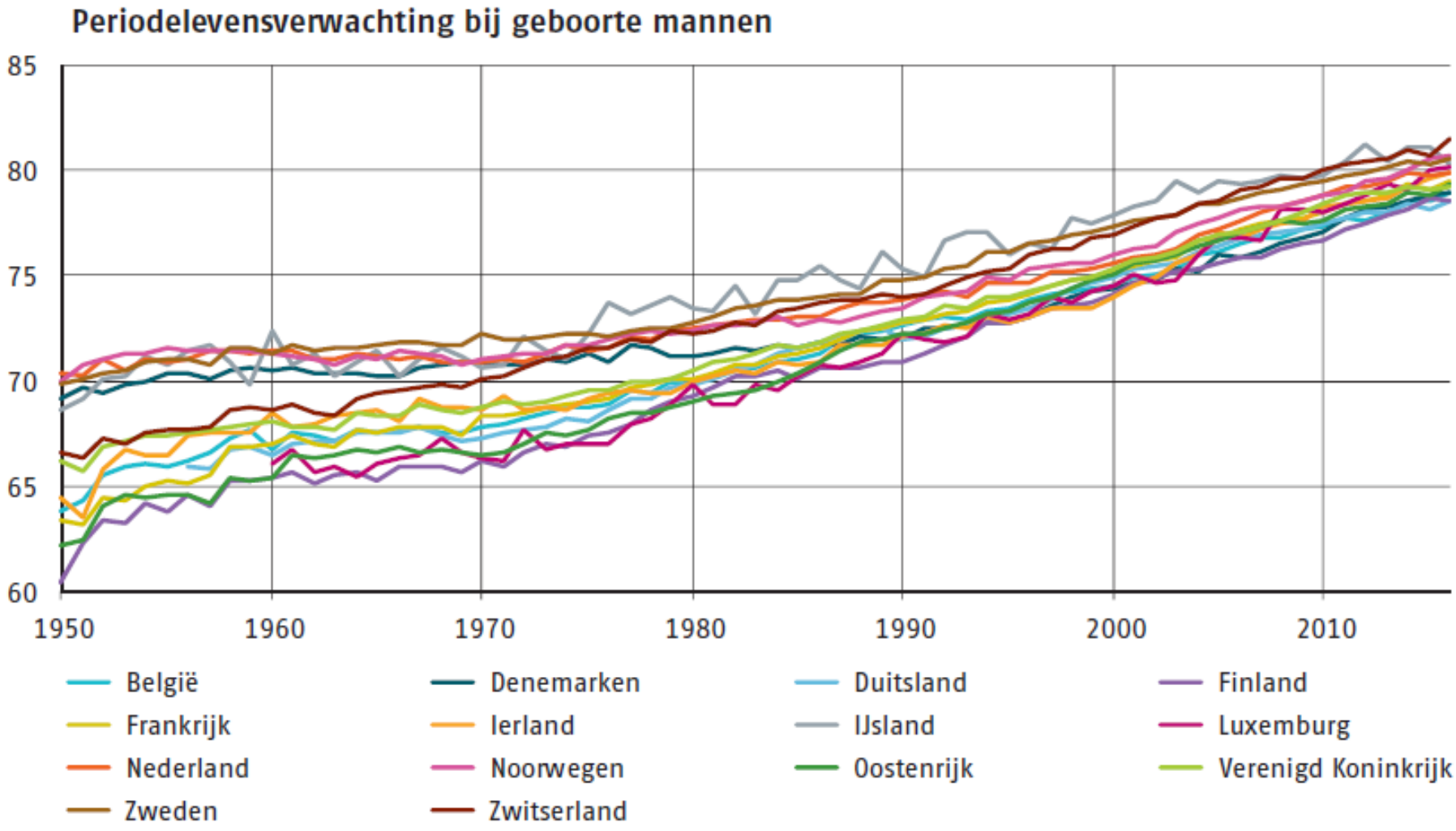
- Regulatory treatment
- Materiality of basis risk
- Conclusion

Who bears the longevity risk?

- Diversification
  - Does not help against trend risk
- Natural hedge
  - Longevity versus mortality risk
  - e.g. funeral business
- Indemnity reinsurance
  - Within insurance market
- Index based solutions
  - Opens up for market investors as risk takers
  - Securitization as next step?

Modeling the Best Estimate

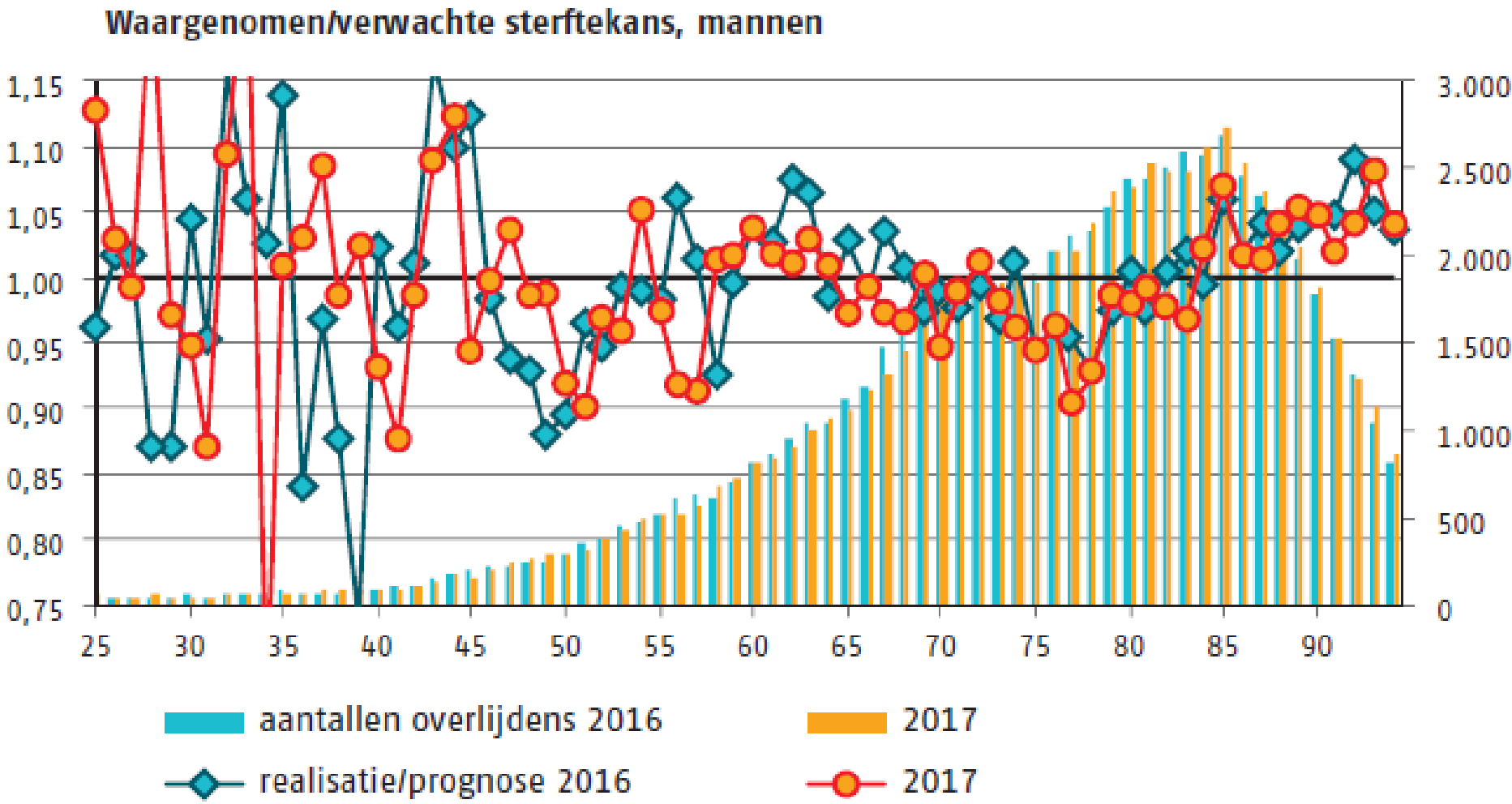
From: Prognosetafel 2018, Actuarieel Genootschap



Grafiek 6.1 Convergentie van periodelevensverwachting van een aantal Europese

Non-observable probabilities

From: Prognosetafel 2018, Actuarieel Genootschap



Li-Lee model

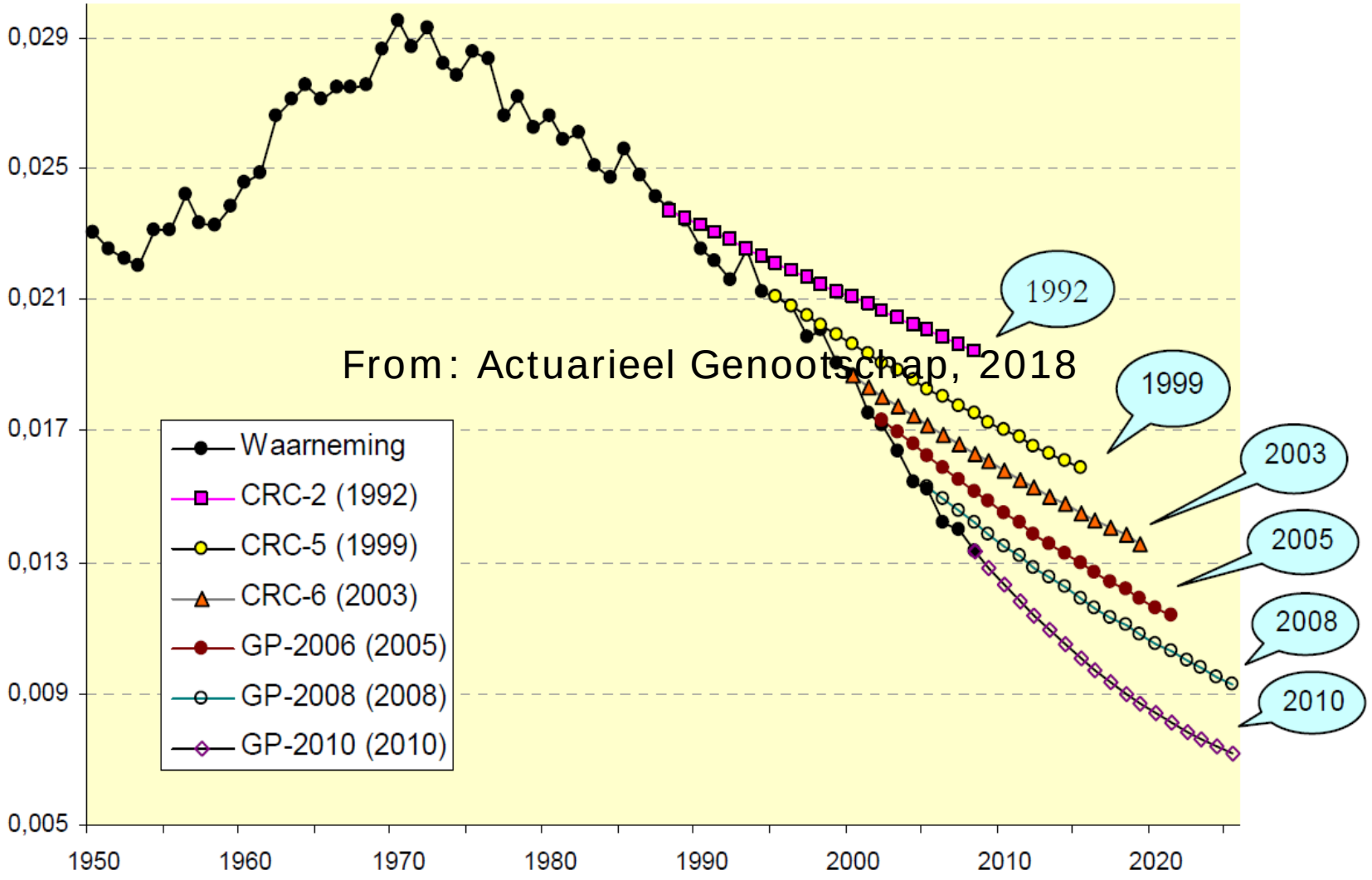
$$K_t^g = K_{t-1}^g + \theta^g + \epsilon_t^g$$

$$\kappa_t^g = a^g \kappa_{t-1}^g + \delta_t^g.$$

- In use by Actuarieel Genootschap, 2014 - 2018
- $a^f = 0.9925$
- $a^m = 0.9752$

Our own tacit assumptions

Grafiek 15 Het verloop van de prognose van de sterftekansen voor een 65-jarige man



From: Generatietafels Pensioen 2010 – Verbond van Verzekeraars

Uncertainty in the Tail

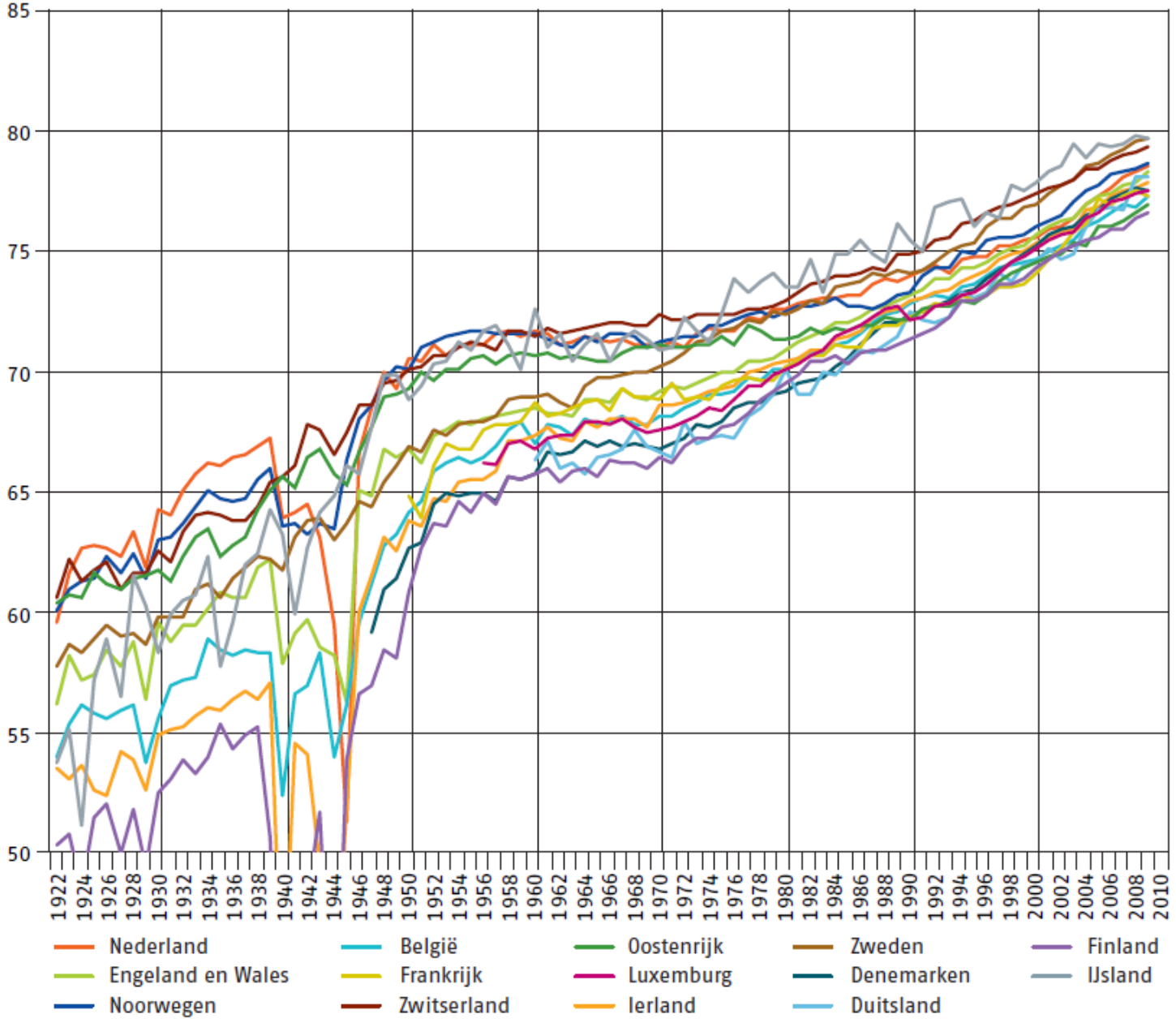
- F. Knight, "*Risk, Uncertainty, and Profit* (1921)"

"A measurable uncertainty, or "risk" proper, as we shall use the term, is so far different from an unmeasurable one that it is not in effect an uncertainty at all. We shall accordingly restrict the term "uncertainty" to cases of the non-quantitative type."

"Business decisions, for example, deal with situations which are far too unique, generally speaking, for any sort of statistical tabulation to have any value for guidance. The conception of an objectively measurable probability or chance is simply inapplicable."

When looking further back

From: Prognosetafel 2014, Actuarieel Genootschap



Like in Fatal discontinuities

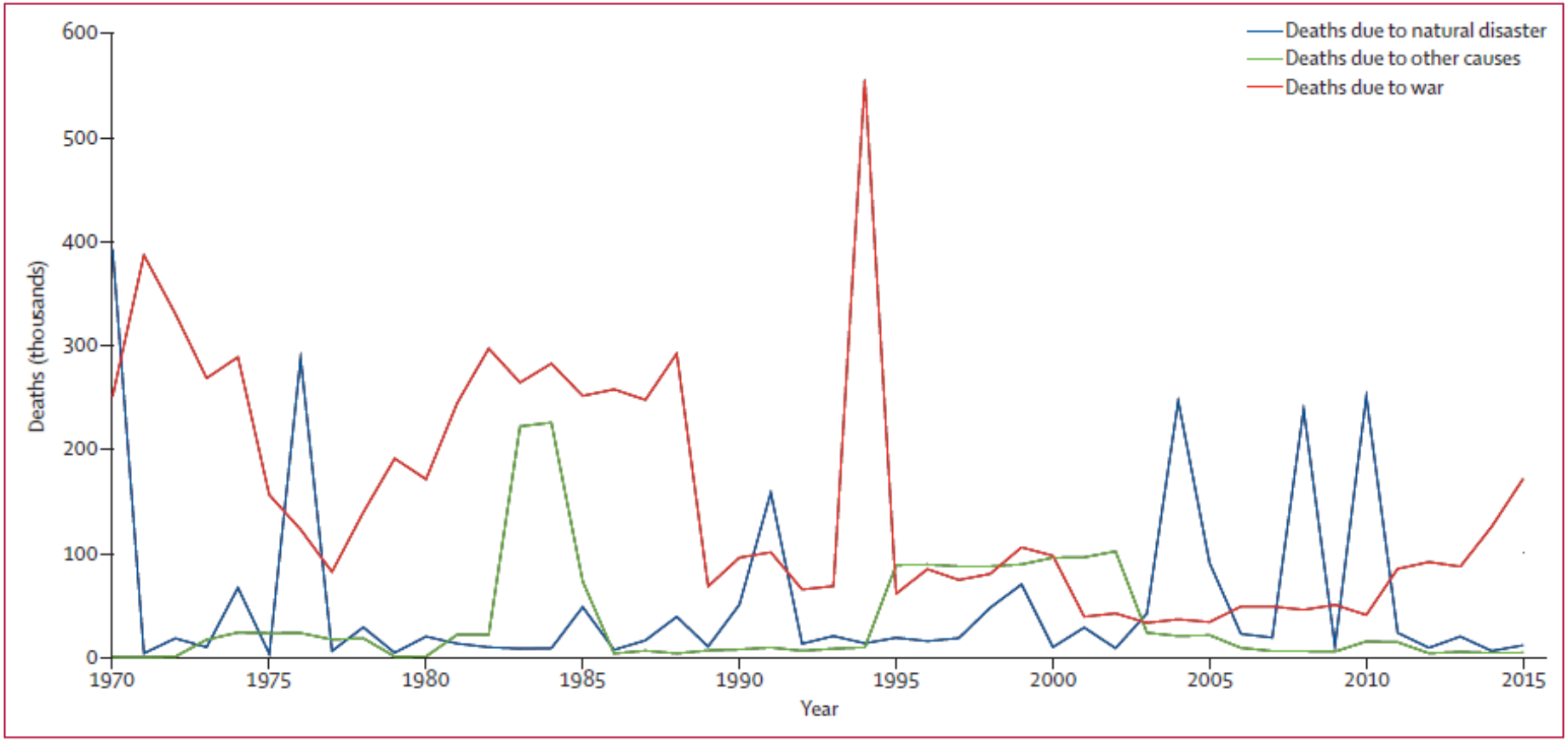


Figure 11: **Global deaths due to fatal discontinuities by cause group for each year, 1980–2015**
Numbers shown are total deaths. Fatal discontinuities are events that lead to abrupt changes in deaths in a geography. The causes for these fatal discontinuities include wars, natural disasters, industrial accidents, large transport accidents, epidemics, famines, or other injuries.

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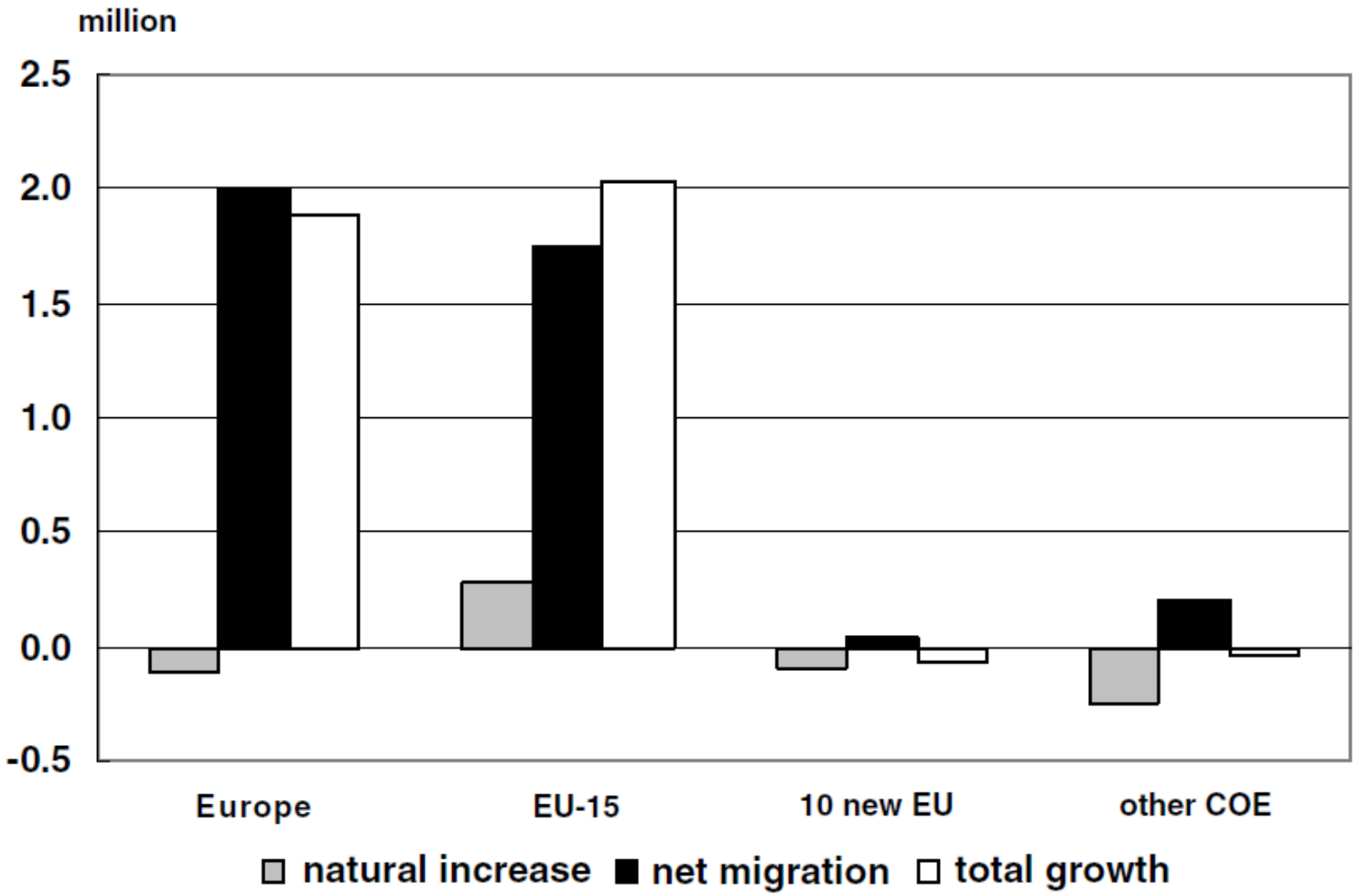
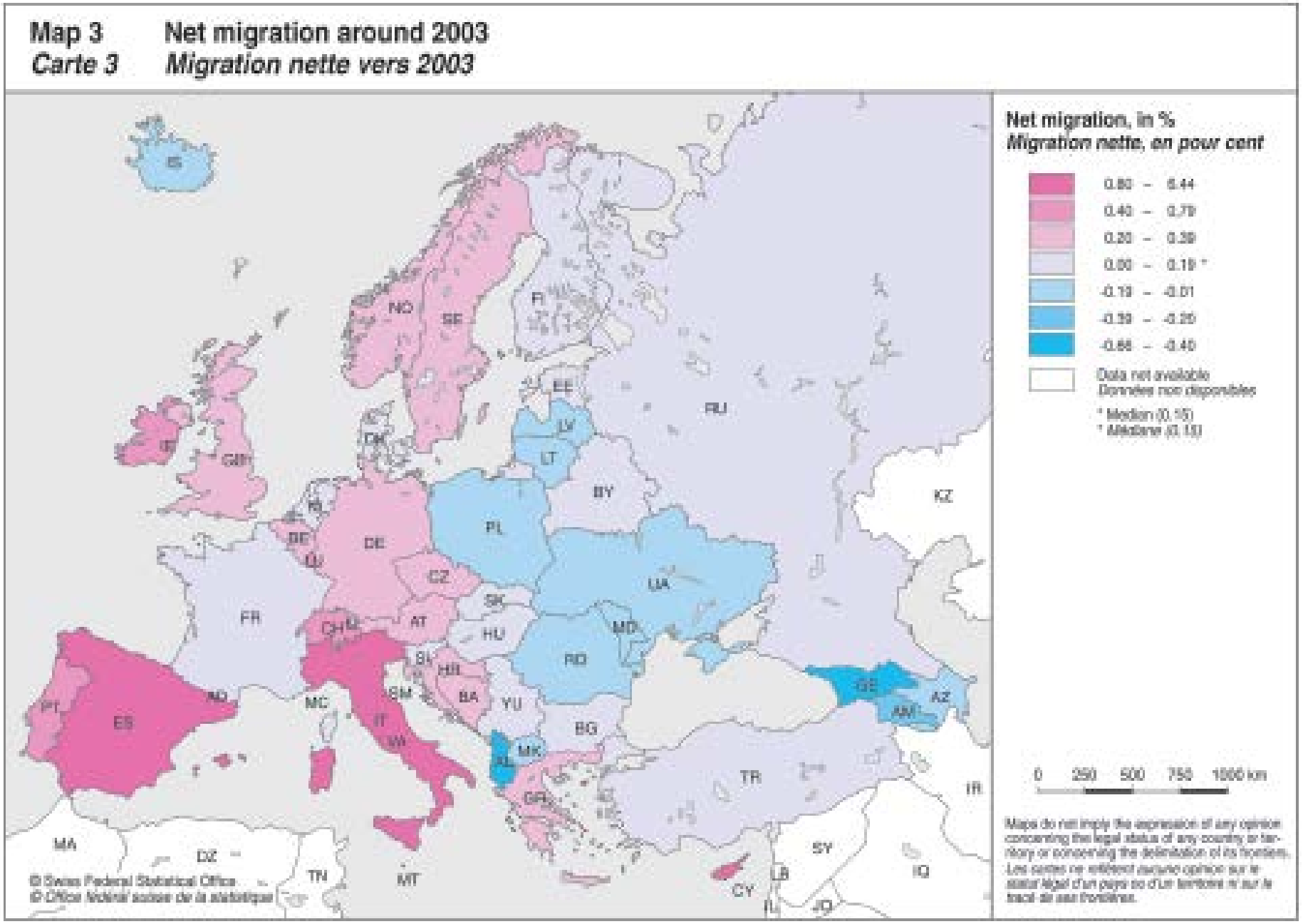
From: Global, regional, and national life expectancy, …, Lancet 2016; 388: 1459–544

Or like in Migration effects

Figure 1 Population growth in Europe in 2003



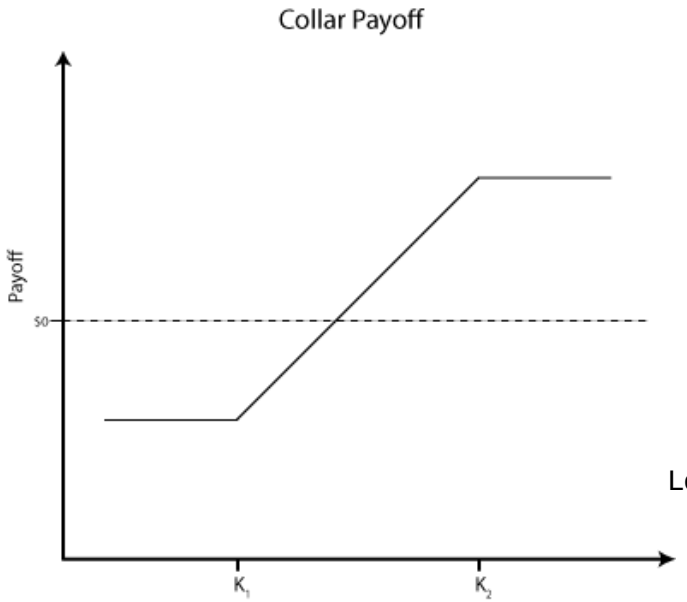
From: Recent demographic developments in Europe 2004. Strasbourg: Council of Europe Publishing



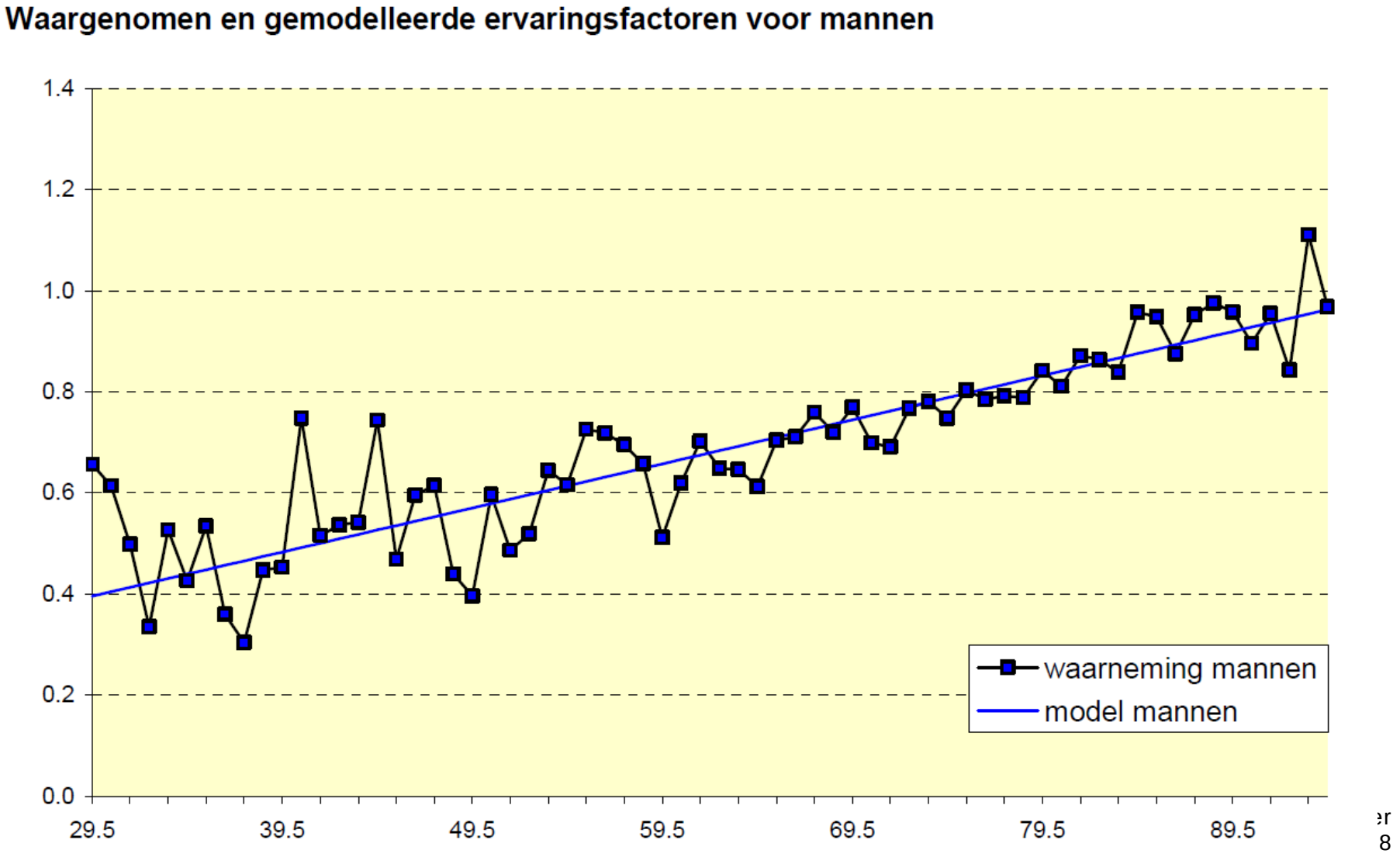
From: Recent demographic developments in Europe 2004. Strasbourg: Council of Europe Publishing

Longevity Indemnity and Index transactions

	Duration	Structure	Issues
Indemnity	bv 20 yrs	Premium + Collateral	administration
Collar Option based on population index	~ 20	Premium + Collateral	Change of reserve; Retake risk after maturity
Collar Option based on population index (incl commutation)	~ 10	Premium + Collateral	Retake risk after maturity
Collar Option based on population index (long duration)	~ 50	Periodic premium + Collateral + intermediate settlements	Onnatuurlijk verval Halve eeuw?

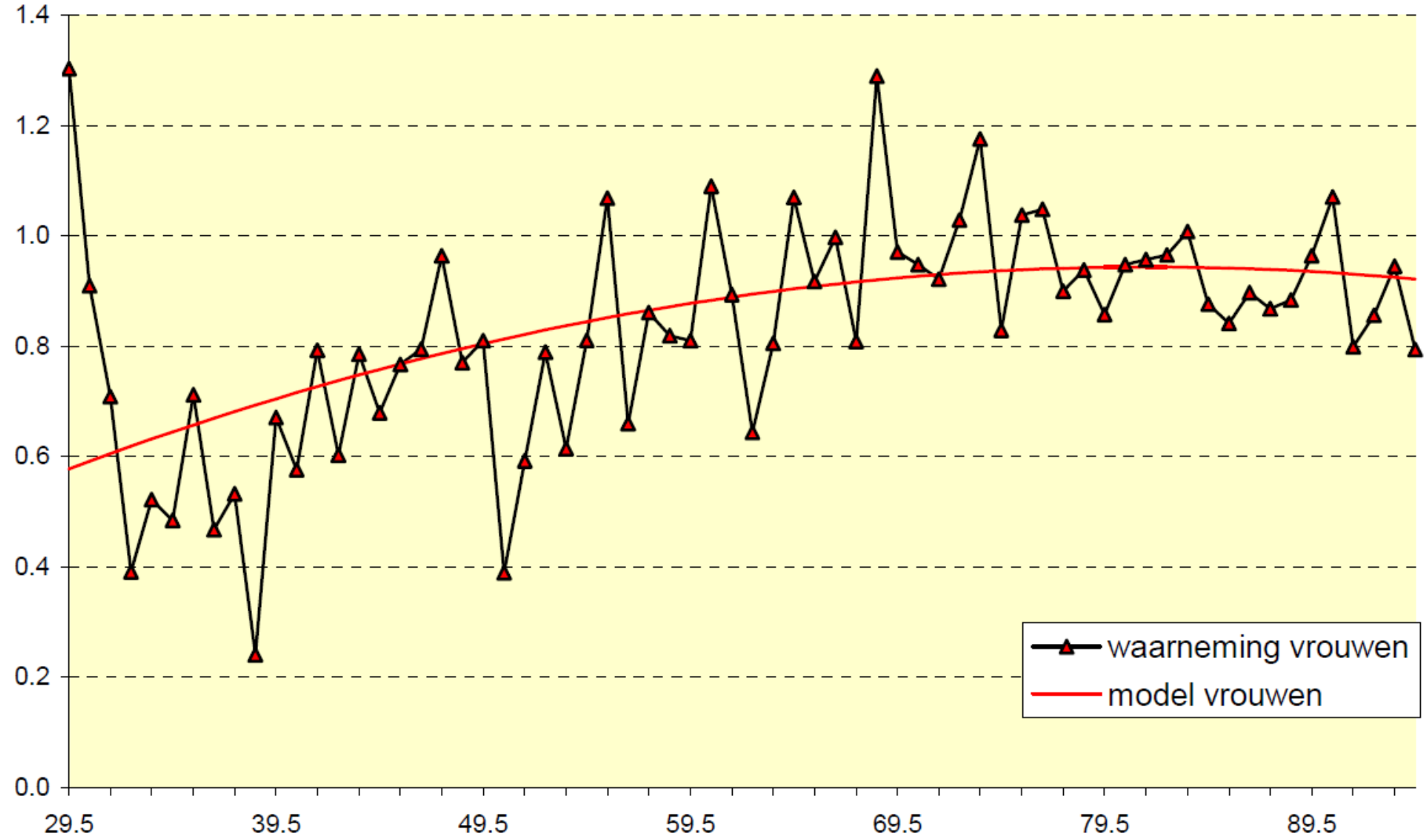


Basis Risk - Experience mortality

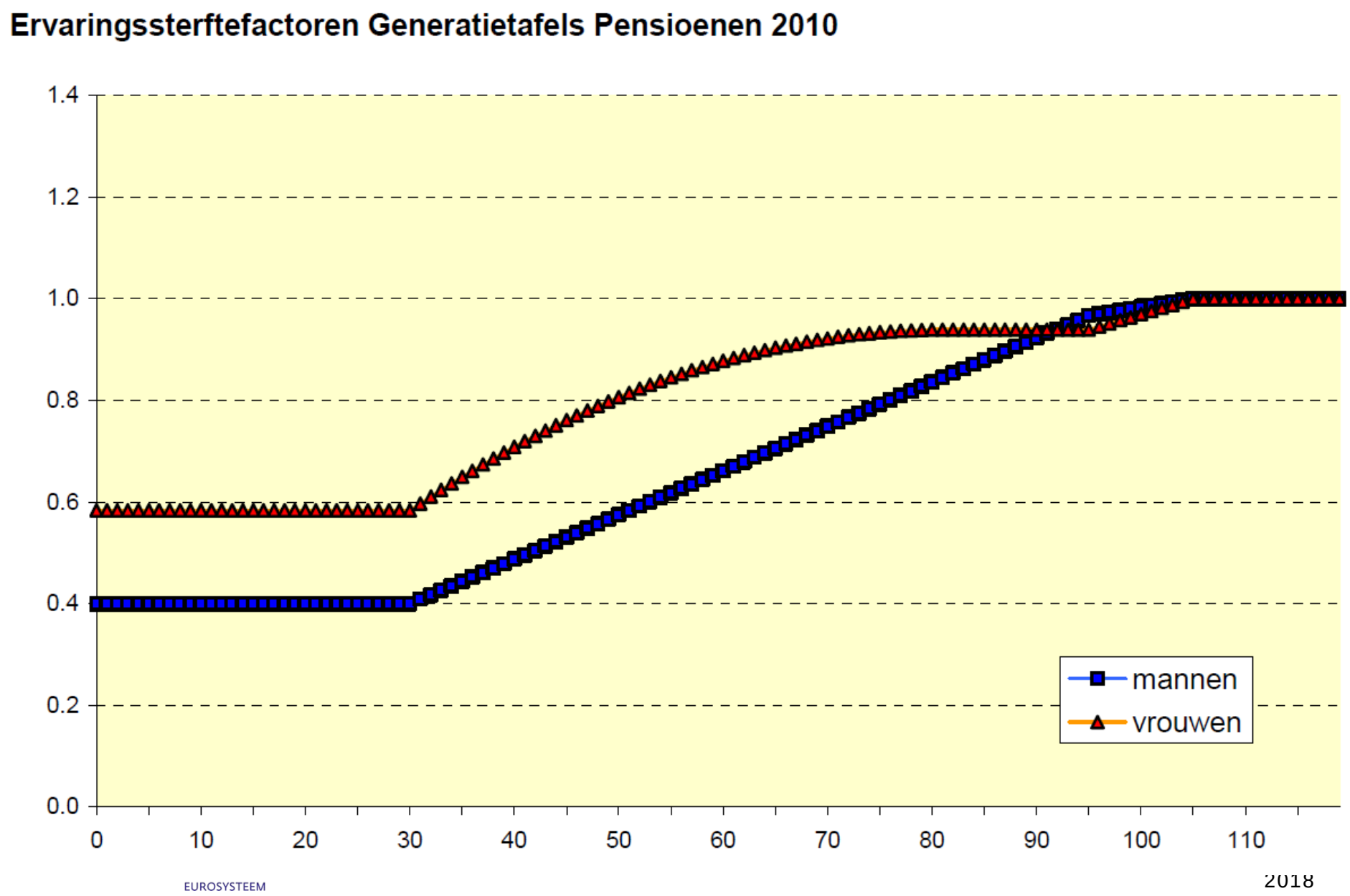


From: Generatietafels Pensioen 2010 – Verbond van Verzekeraars

Waargenomen en gemodelleerde ervaringsfactoren voor vrouwen



From: Generatietafels Pensioen 2010 – Verbond van Verzekeraars

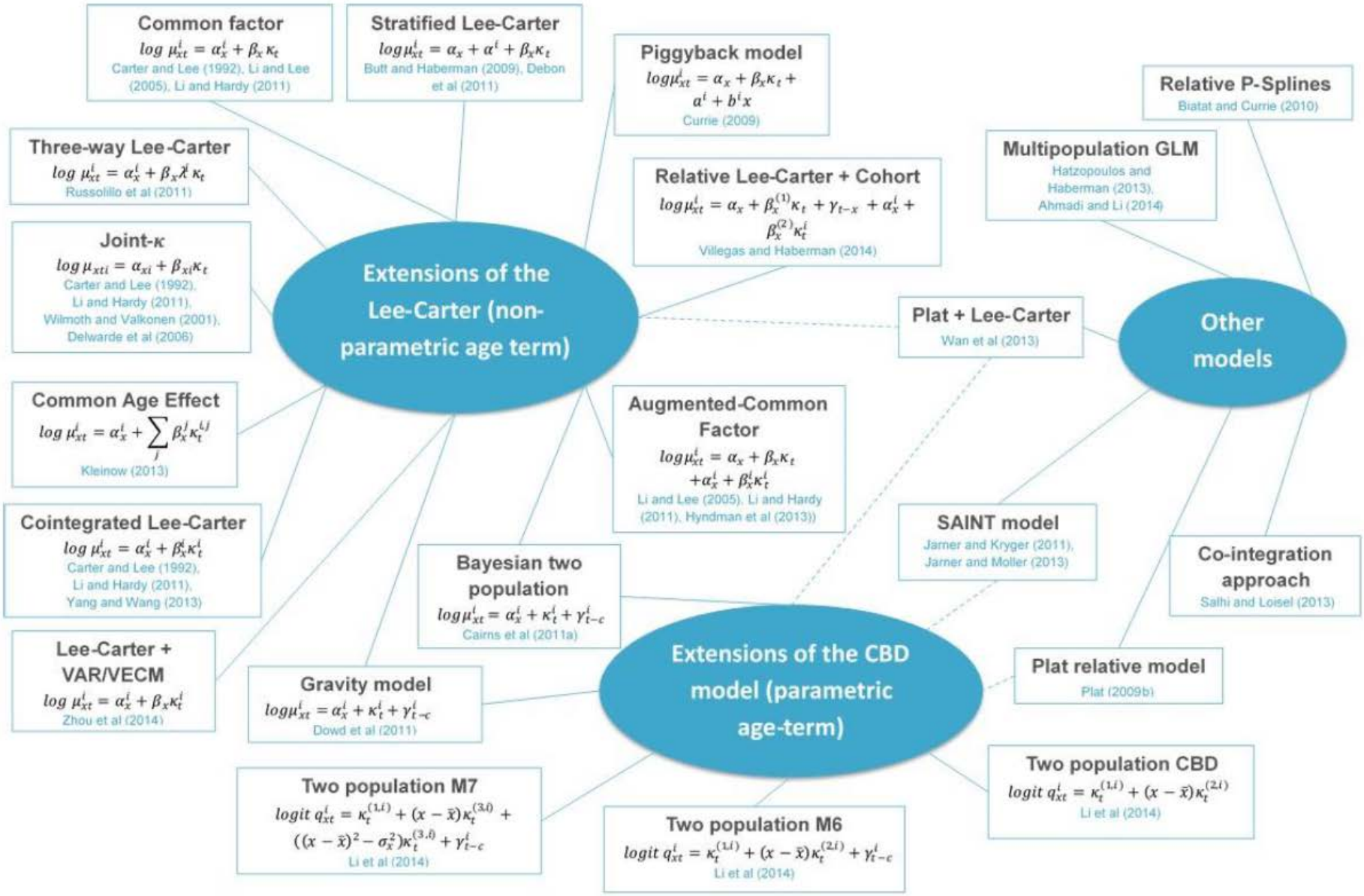


From: Generatietafels Pensioen 2010 – Verbond van Verzekeraars

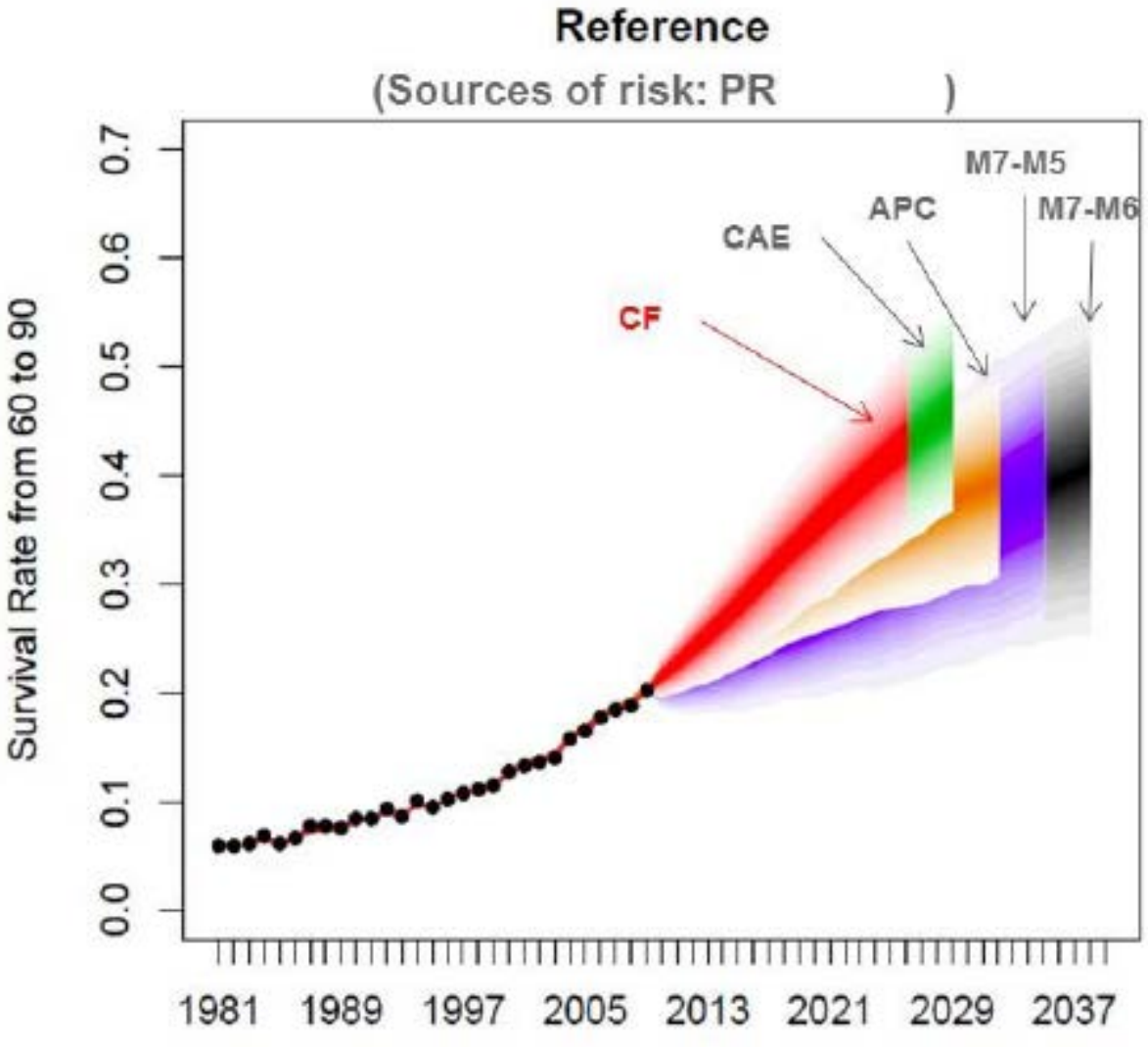
Modeling Landscape

From: Longevity Basis Risk, A methodology for assessing basis risk,

Haberman, Kaishev, Millossovich, Villegas, 2014



Model Risk



From: Longevity Basis Risk, A methodology for assessing basis risk, Haberman, Kaishev, Millossovich, Villegas, 2014

Uncertainty again

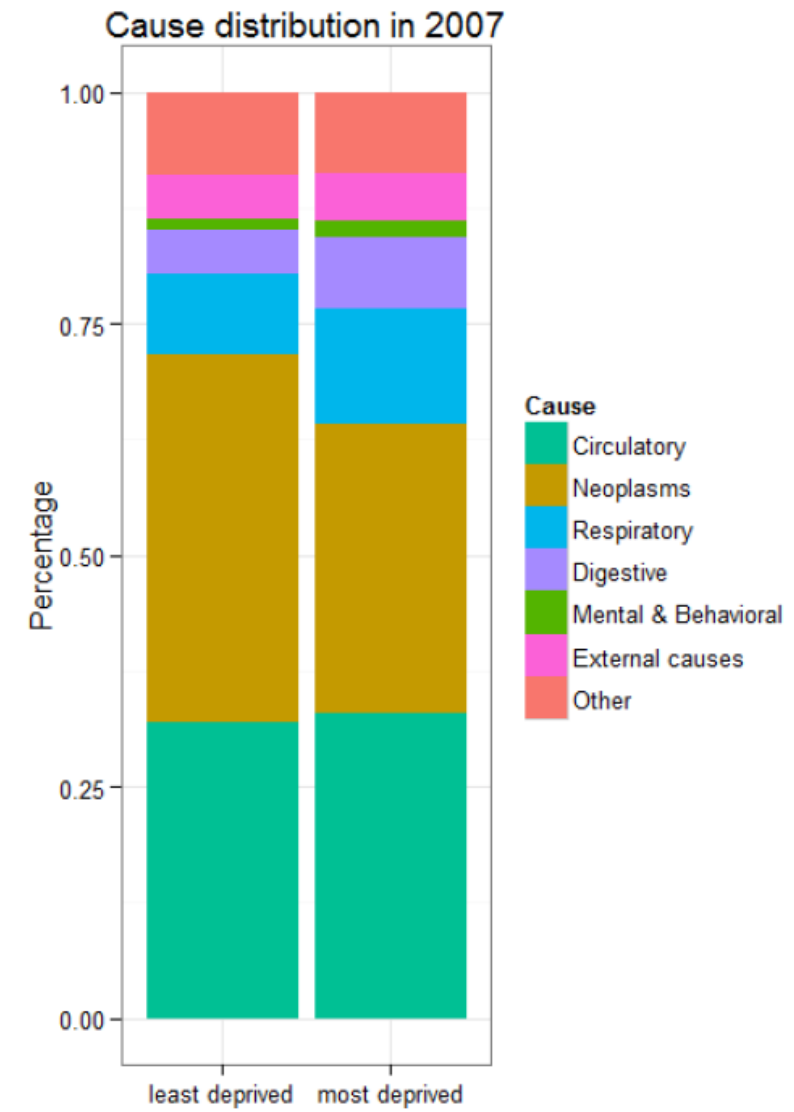
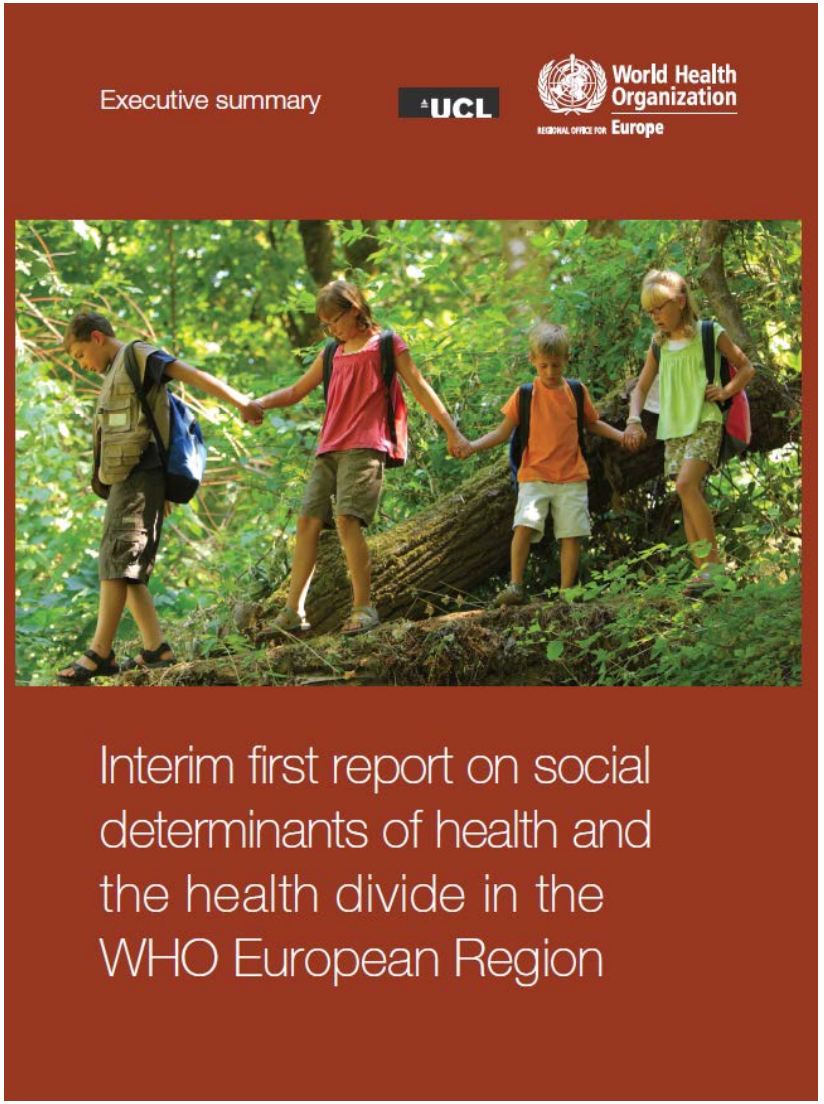


Figure 3.4: Split of mortality by cause of death for the most and least deprived quintiles of England, ages 25-84 (Villegas et al (2014))



Issues

- Data availability
- Observability
- Calibration
- Time series choice for own book vs population
- The past as a guide to the future

State of the art – Comfort of supervisor

- Best Estimate
- Variance
- Value At Risk 99.5%
- Hedge

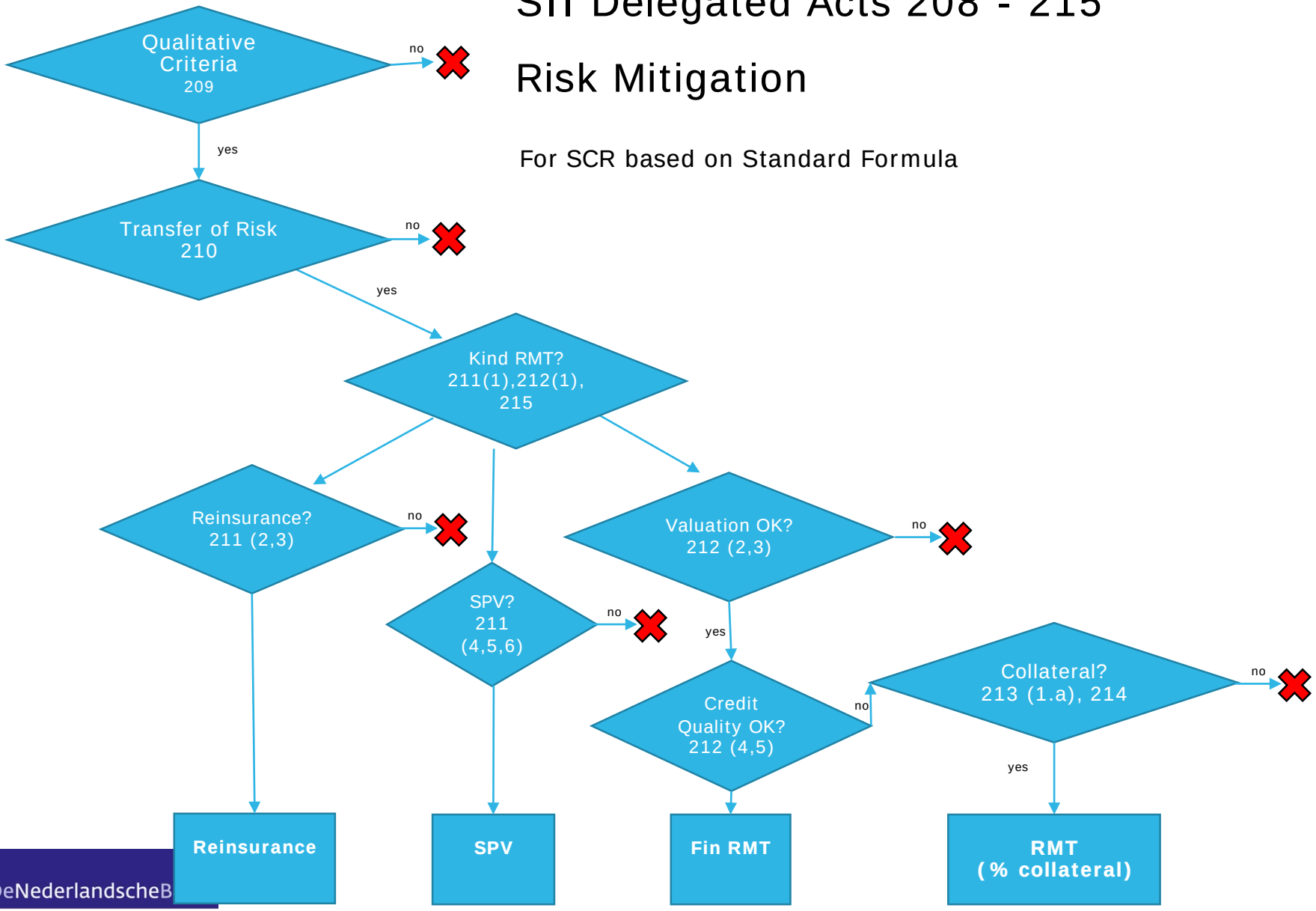
Regulatory treatment of Longevity Risk Mitigation

- Recognition of Mitigation
- Solvency Capital Requirement (SCR) reduction
- Risk Margin reduction
  - Combine with valuation of contract
- Collateral criteria
- Solvency Capital Requirement based on
  - SII Standard Formula
  - Internal Model (approved by supervisor)

SII Delegated Acts 208 - 215

Risk Mitigation

For SCR based on Standard Formula



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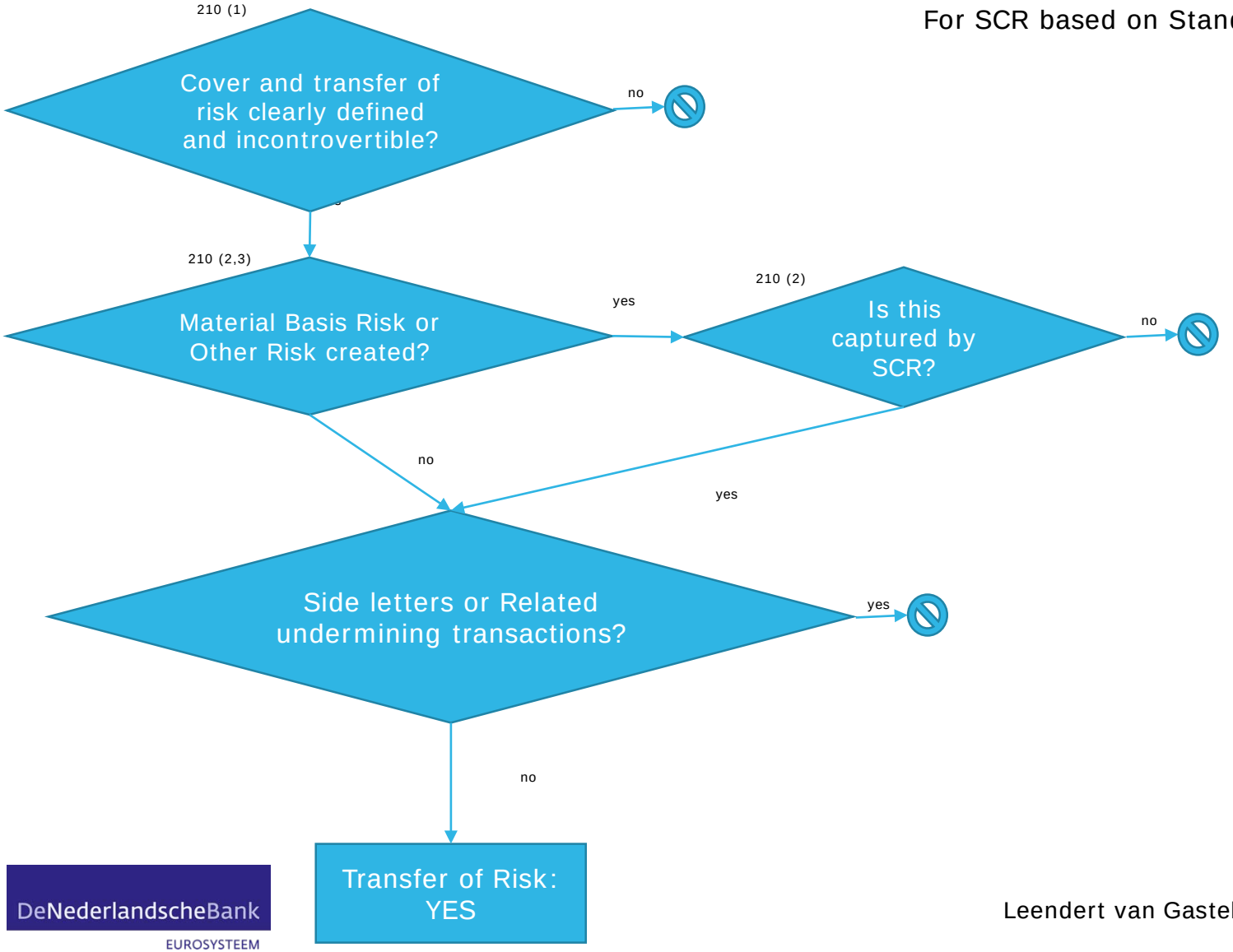
Article 209 on Qualitative Criteria RMT

- Legally effective and enforceable
- All appropriate steps taken to ensure the effectiveness and to address the risks
- Monitoring of effectiveness and related risks
- A direct claim in case of default of counterparty
- No double counting
- If duration < 12 months, then proportional treatment

Article 210 on Effective Transfer of Risk

For SCR based on Standard Formula



Material Basis Risk

Basis Risk = is the risk resulting from the situation in which the exposure covered by the risk-mitigation technique does not correspond to the risk exposure of the insurance or reinsurance undertaking;

Basis risk is **material** if it leads to a misstatement of the risk-mitigating effect on the insurance or reinsurance undertaking's Basic Solvency Capital Requirement that could influence the decision-making or judgement of the intended user of that information, including the supervisory authorities.

No Material Basis Risk if (a.o.):

(a) the exposure covered by the risk-mitigation technique is sufficiently similar in nature to the risk exposure of the undertaking;

(b) the changes in value of the exposure covered by the risk-mitigation technique closely mirror the changes in value of the risk exposure of the undertaking under a comprehensive set of risk scenarios, [...]

Conclusion: a challenge!

- Welcoming a broadening of investors
- Current state of the art of modeling well suited for Best Estimate
- Risk in the tail impacted by
  - Model risk
  - Parameter risk
  - Knightian Uncertainty
- Nevertheless, for capital requirements without hedge acceptable if also other requirements are met
- Solvency II regulation is strict regarding a.o.
  - Transfer of risk
  - Basis risk