An Analysis of the Solvency II Regulatory Framework's Smith-Wilson Model for the Term Structure of Risk-free Interest Rates

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About the speaker

- **Peter Løchte Jørgensen**
- Professor of finance
- Research and teaching interests: Asset and derivatives pricing

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- **Aarhus University, Denmark**
- 40.000 students
- 8.000 employees
- Business School (Aarhus BSS) has 13.000 students, and 600 faculty…

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My paper ☺

Main points of the paper I

- Models for the term structure of interest rates (TSIR) are well developed in financial theory
- The Solvency II regulation points out one particular model for use in pension liability valuation – The Smith-Wilson model
- Many finance academics – even experts in term structure theory – have never heard of this model

Main points of the paper II

- EIOPA has put very tight restrictions on the implementation and calibration of the Smith-Wilson model
- Many of these restrictions seem to contradict a main purpose of the Solvency II regulation – Market consistent valuation
- They all seem biased in the same direction – the regulatory curve lies well above market curve ⇒ the approach leads to underestimation of L&P liabilities – in some cases massively

General Solvency II principles

- An overall goal of Solvency II is *"the economic valuation of the whole balance sheet, where all assets and liabilities are valued according to market consistent principles"* 

- This generates a need for calibrating / estimating a term structure of risk-free interest rates so that typical L&P liabilities / traditional promised benefits and LTGs can be discounted and valued in a market consistent fashion

- This task is handed over to EIOPA

EUROPEAN INSURANCE AND OCCUPATIONAL PENSIONS AUTHORITY

EIOPA-BoS-15/035

31 January 2018

Technical documentation of the methodology to derive EIOPA's risk-free interest rate term structures

ICA CIA BERLIN 2018

EIOPAs 131 page manual

Describes the Smith-Wilson model and its calibration and implementation

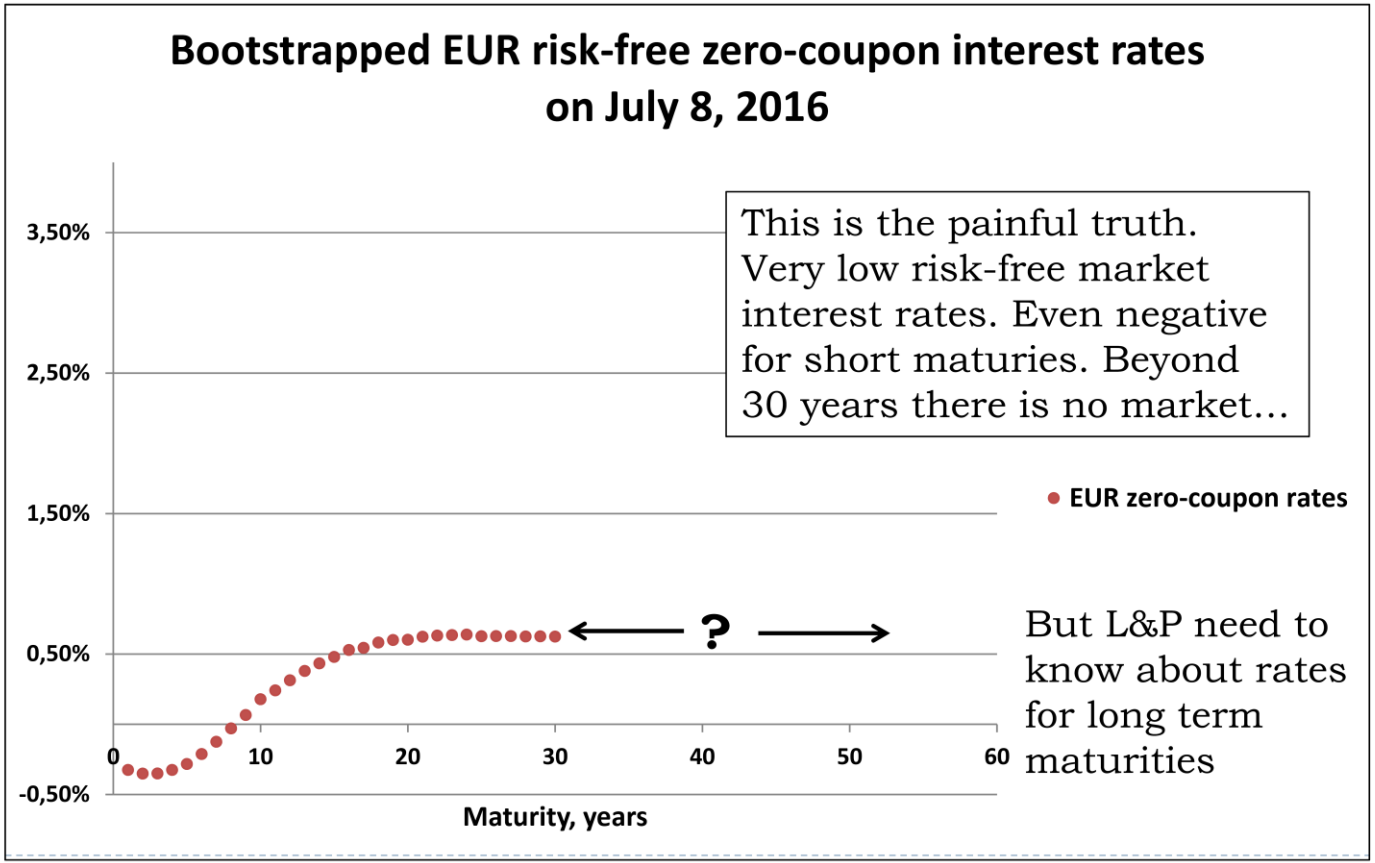
Partial list of peculiarities with EIOPAs methodology for determining the TSIR

- Smith-Wilson model is not in finance theory's standard toolbox
- EIOPAs emphasizes that SW model is in "open domain", but it was never published and actually it cannot be used "*without the prior written consent of Bacon & Woodrow*" (a British actuarial consultancy)
- EIOPA emphasizes SW model's ability to fit market perfectly (market consistency) but a lot of market information is thrown away

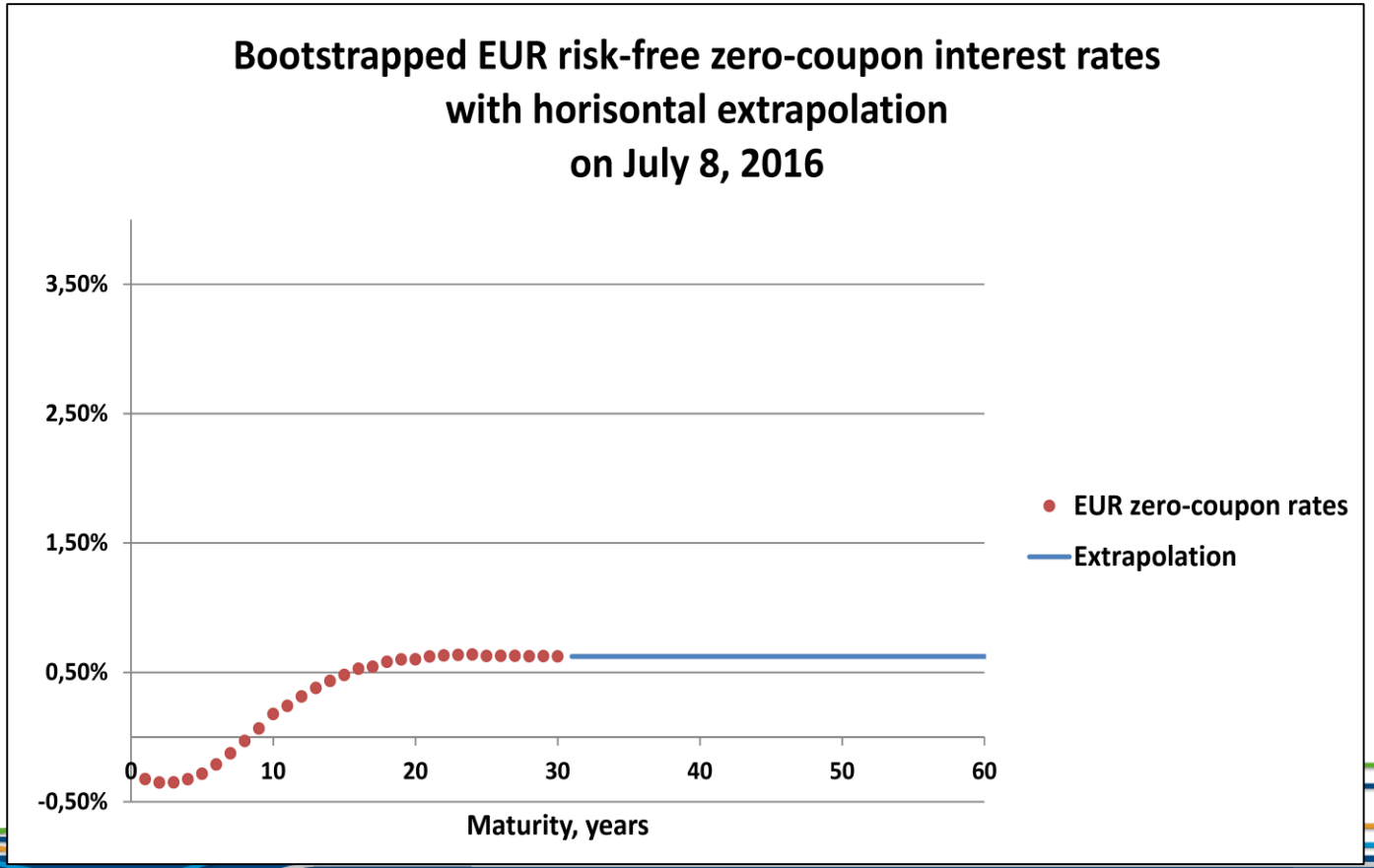
Partial list of peculiarities with EIOPAs methodology for determining the TSIR

- Market rates are fitted only up to a *Last Liquid Point* (LLP) which is 20 years for most currencies
- After LLP market information is completely disregarded and fairly fast convergence of forward rates to *Ultimate Forward Rate* (UFR) is required
- UFR parameter is set by EIOPA. Was 4.2% until 2018. Now 4.05%, but still much higher than longest observed market rates
- A *volatility adjustment* is allowed so that also the liquid part of the curve is lifted. In some cases (e.g. DK) significantly…

Illustration

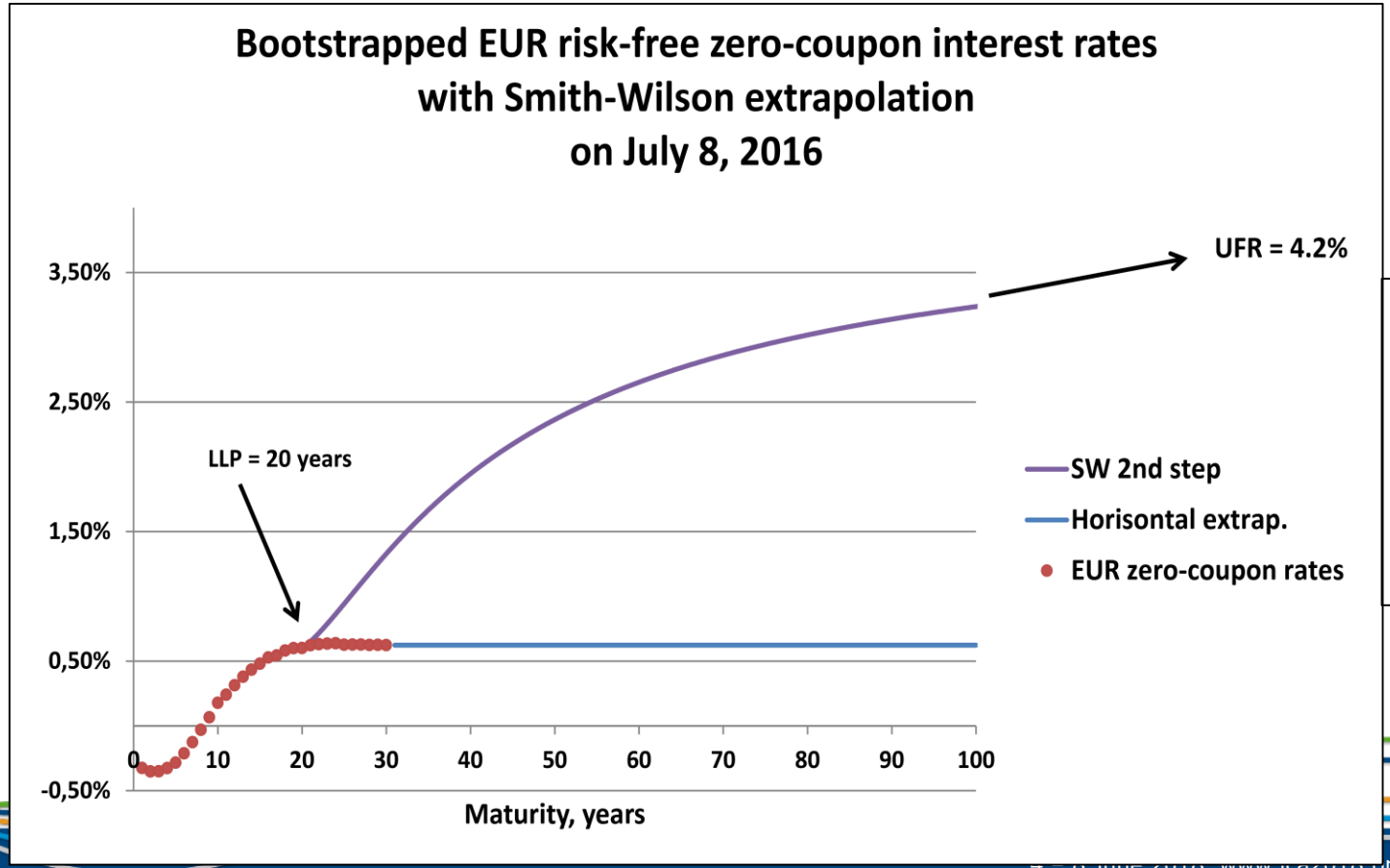


Extrapolating the curve horizontally



This approach would seem not only natural, but also *prudent*

The EIOPA/Smith-Wilson approach



A spectacular difference after the 20 year point…

… but it doesn't end here

… a "VA adjustment" can also be applied →

EIOPAs volatility adjustment

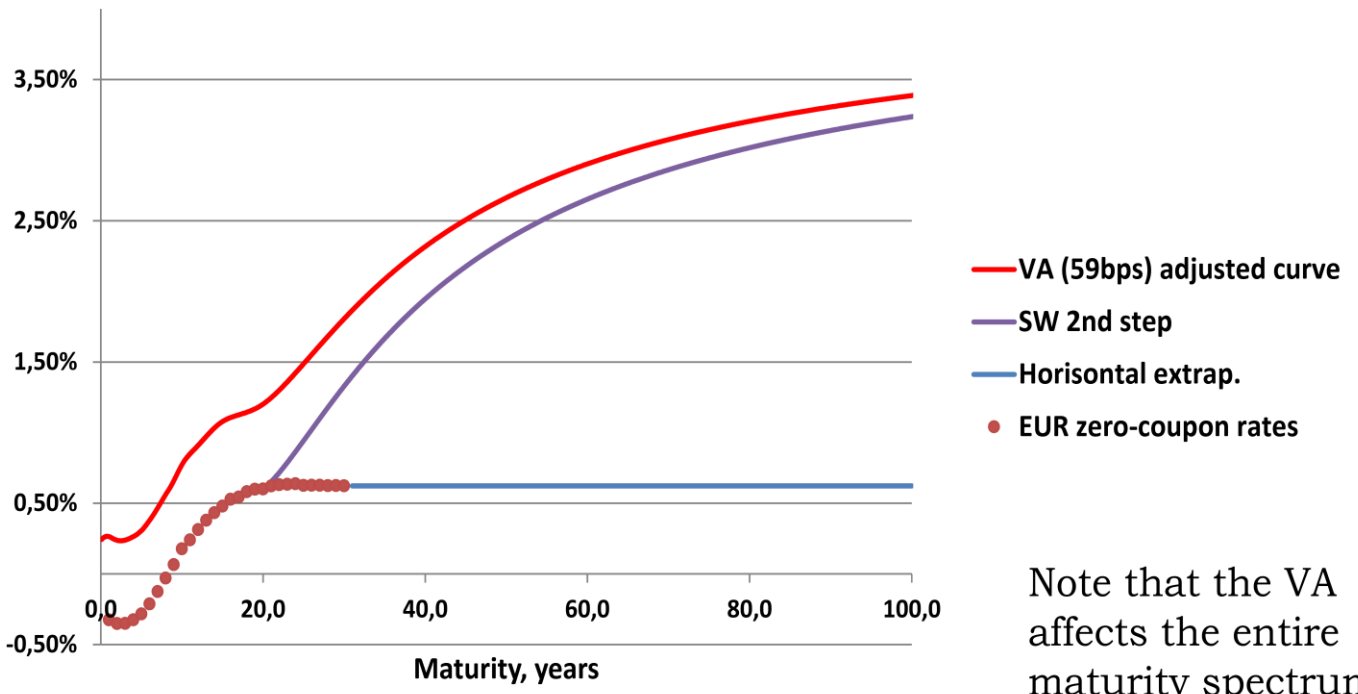
- The volatility adjustment is described in 45-50 incomprehensible pages in the EIOPA manual

- Basically what they are saying is this:
  - *"We don't believe in basic financial theory that says that riskless cashflows should be discounted with risk-free rates to establish their true value. We think that you should use riskless rates PLUS a risk premium to discount riskless cash flows…"*
  - *"We think you should use one curve for valuation on the left hand side of balance sheet, and another – higher – curve for valuation on the right hand side of the balance sheet"*

- There is also not a single academic reference in EIOPAs manual…

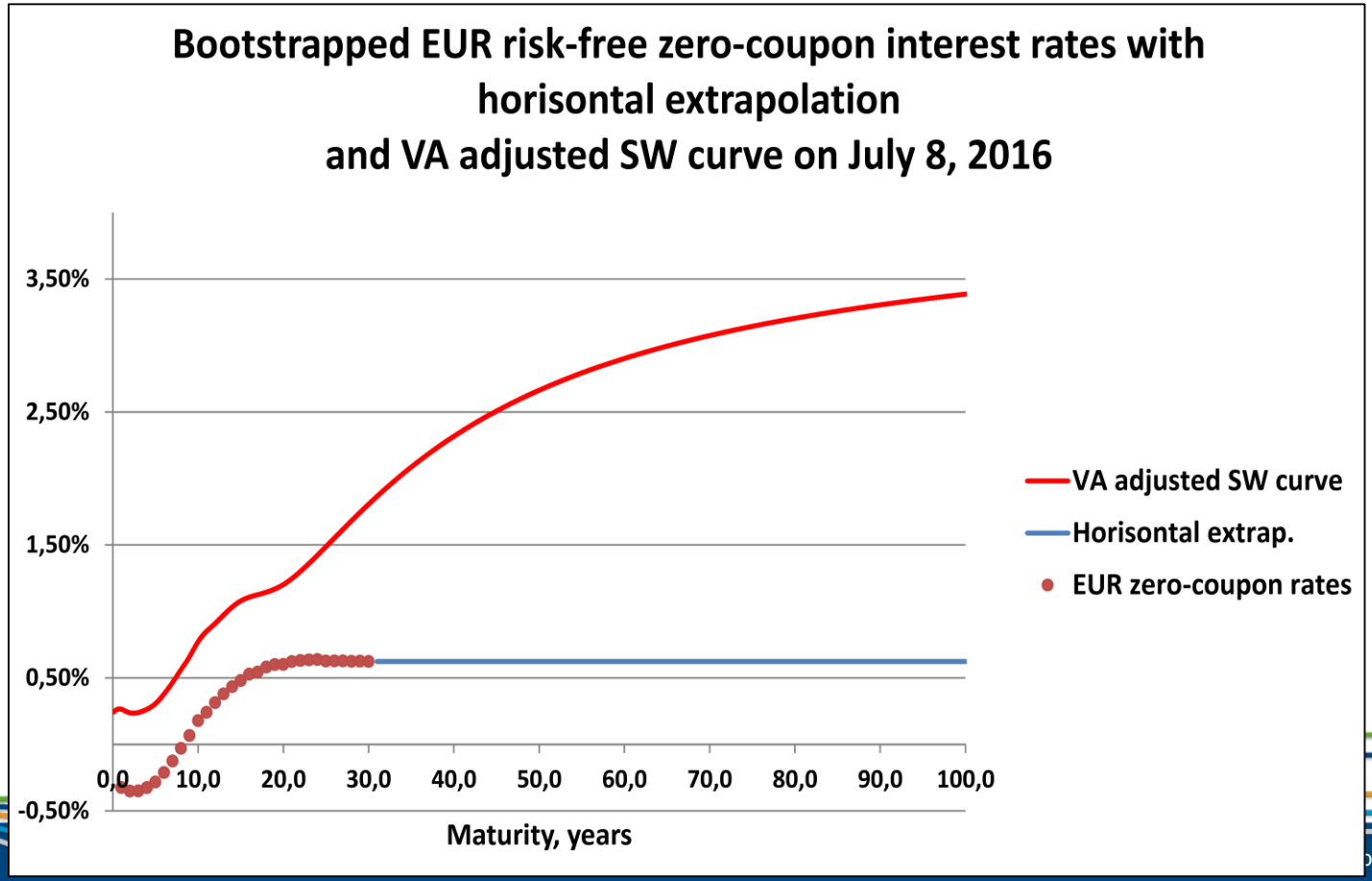
Here is the result →

Volatility adjusted curve for DKK (VA=59bps)

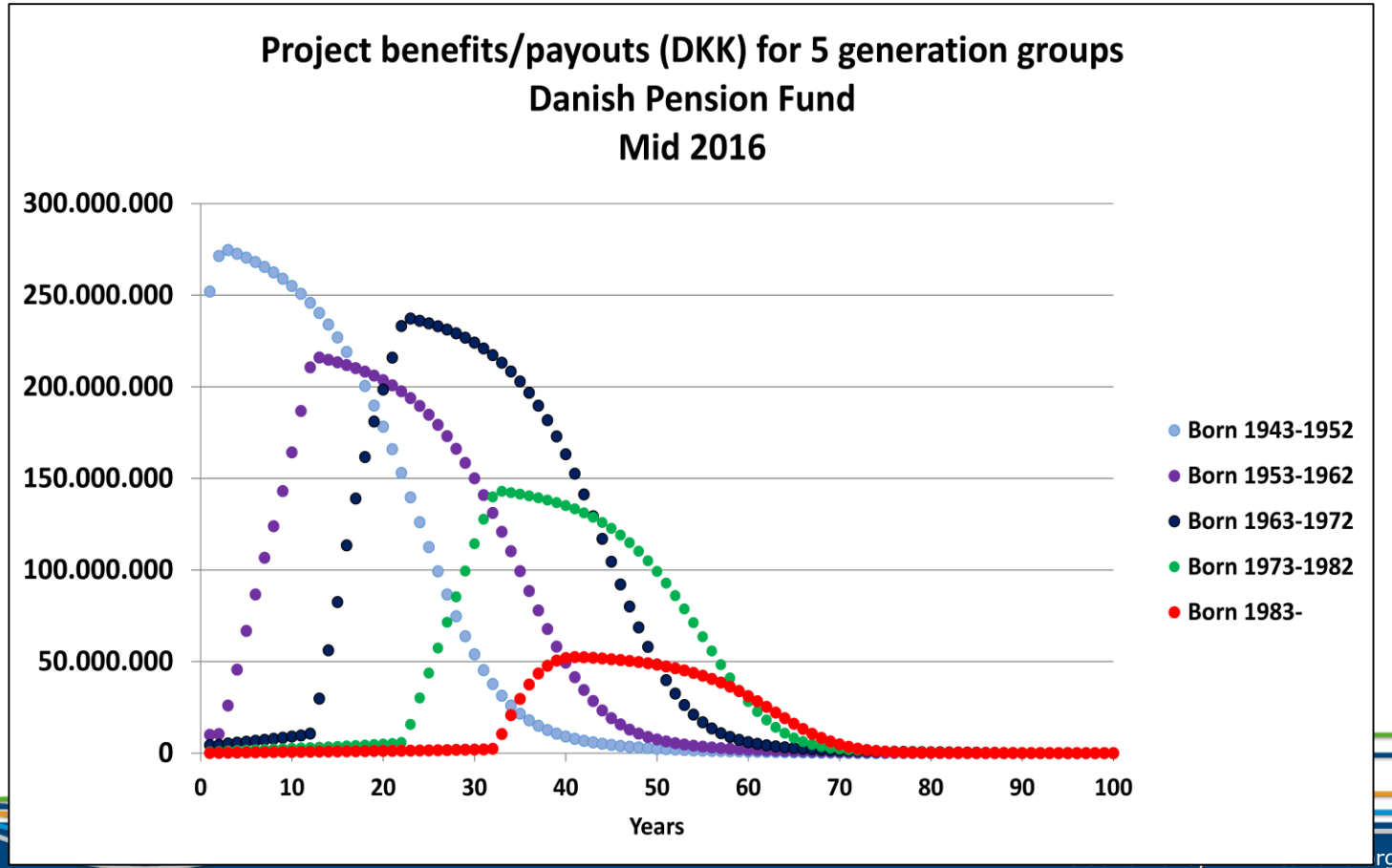


Note that the VA affects the entire maturity spectrum, not just 0-20 years.

Beginning and end…



Does it matter in practical valuations?



Present value of liabilities for different curves

	Age group by year of birth					
	1943-1952	1953-1962	1963-1972	1973-1982	1983-	Total
Bootstrap + horiz. extrap.	100.0	100.0	100.0	100.0	100.0	100.0
Extended Nelson-Siegel	99.9	99.2	97.5	94.4	92.1	97.9
Standard Smith-Wilson	97.6	91.4	79.0	60.4	47.4	83.1
Smith-Wilson + VA-adj.	91.0	82.4	69.3	52.3	40.9	74.9

Conclusions

- The overall Solvency II valuation principles are in general OK – it is the EIOPA TSIR model and its implementation that are questionable
- The current implementation of the SW model provides unjustified financial relief for pension companies with hard, long term guarantees / promised benefits
- Undervaluation implies a risk of intergenerational transfers – and it is likely to get worse over time as reality starts to bite
- EIOPAs term structure model needs to be reconsidered…

Thank you very much for your attention!

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