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Index-linked longevity risk transfer

reduced basis risk with sociodemographic parameter

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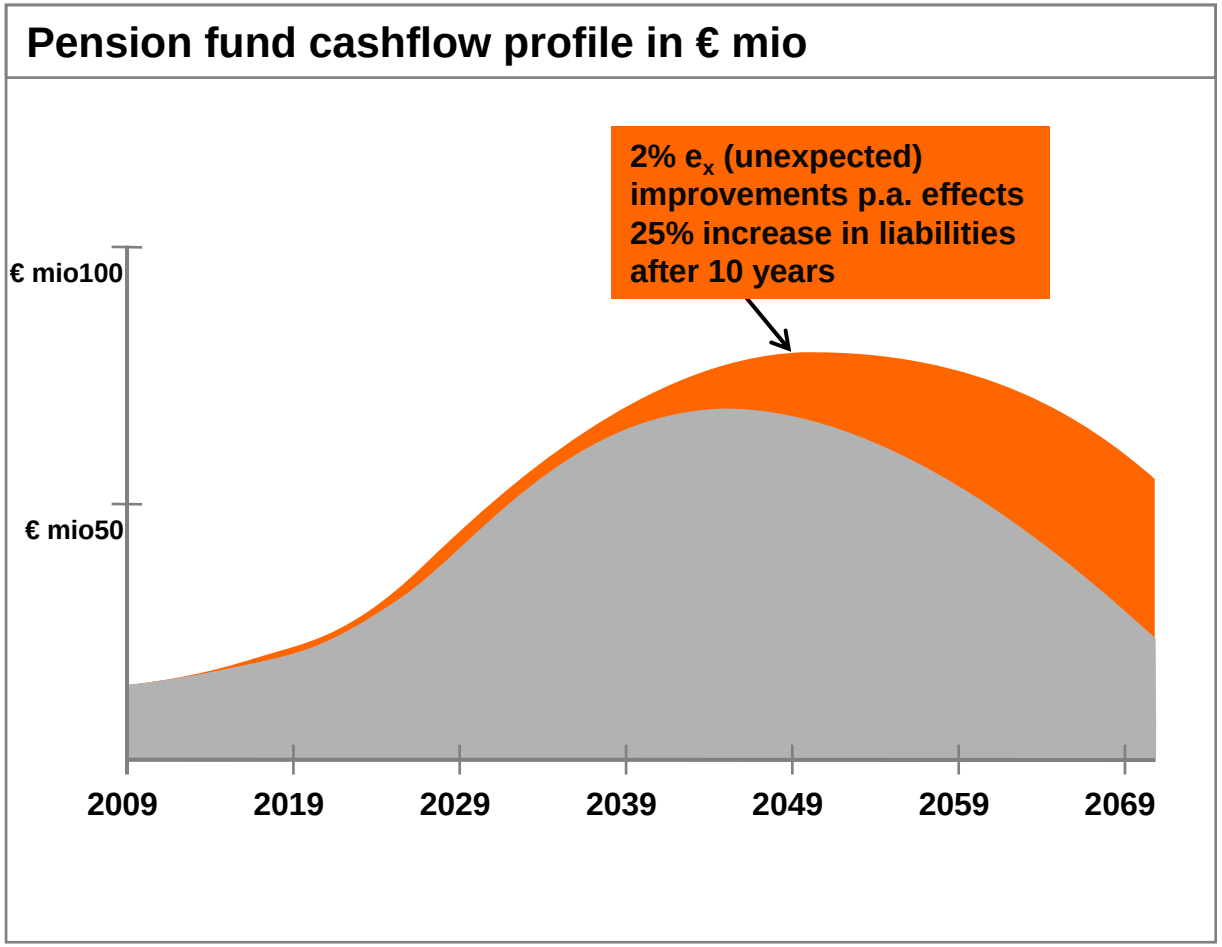
DAV
DEUTSCHE AKTUARVEREINIGUNG e.V.

Model of longevity risk profile of a young pension plan evaluated with actual e_x



- Hedging of Interest risk and Inflation risk is common
- What about longevity risk ?

Xpect Indices of Deutsche Börse are published monthly

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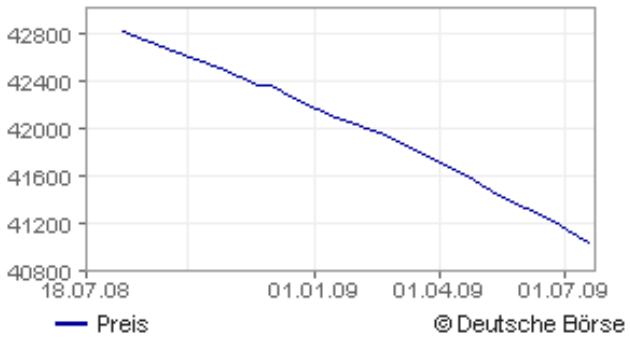
XPECT DE COHORT 1920 - 1939 M

Index, ISIN DE000A0X7P98, WKN A0X7P9

3 M | 6 M | **1 J** | 3 J | 5 J | 10 J

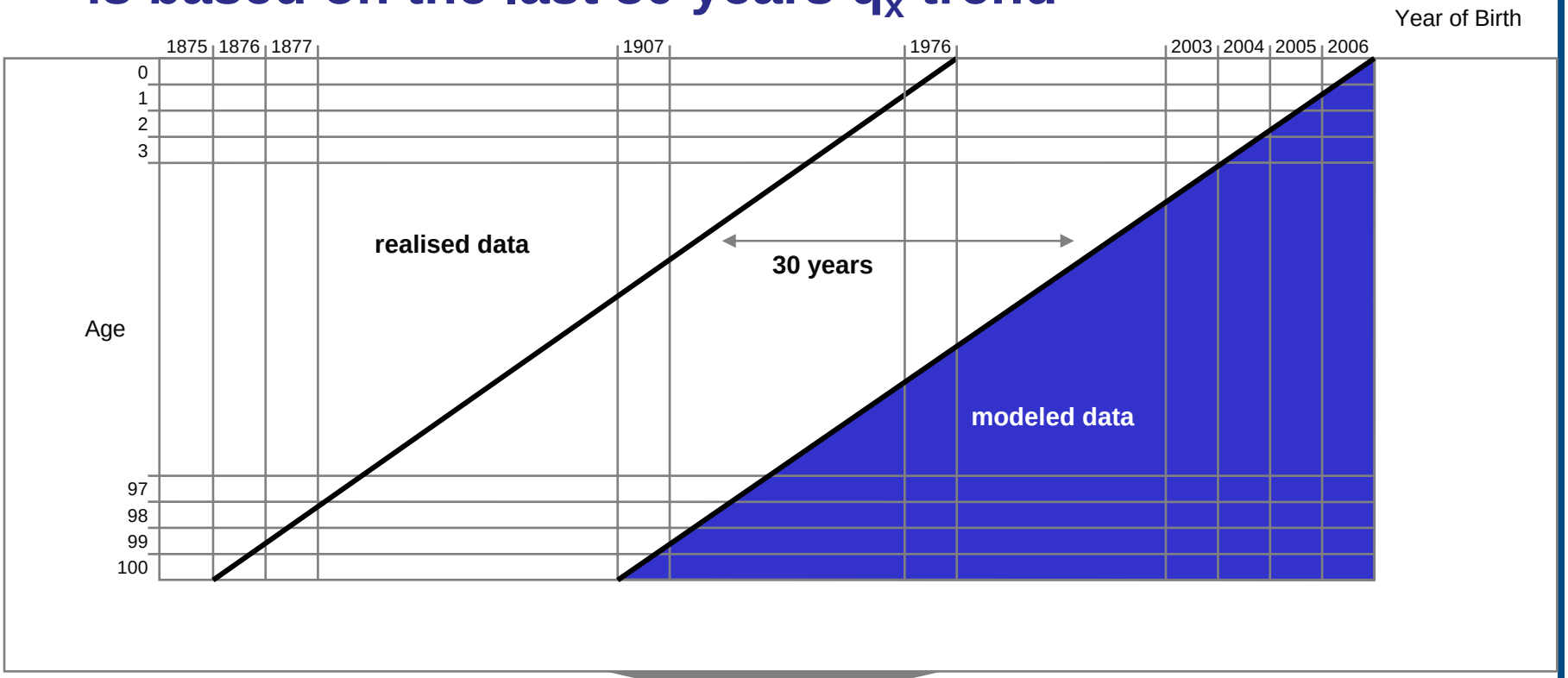


Kursinformationen

Letzter Stand	41.024,00
Datum, Zeit	17.07.2009 15:00

21.07.2009, 11:29. Preise sind 15 Min. zeitverzögert.

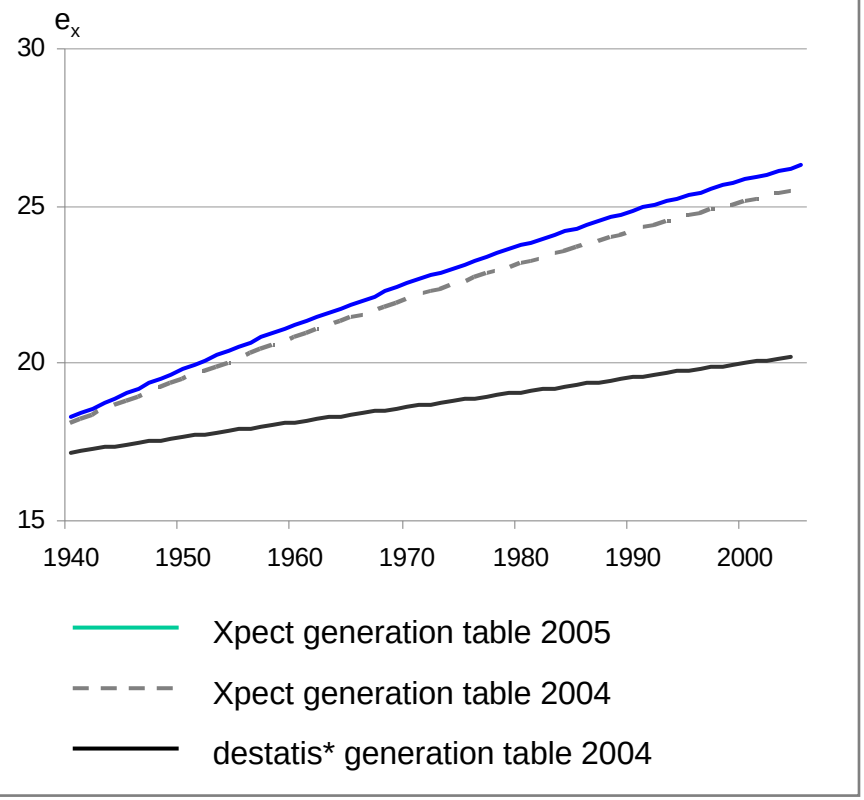
Modeling the Xpect generation life table is based on the last 30 years q_x trend



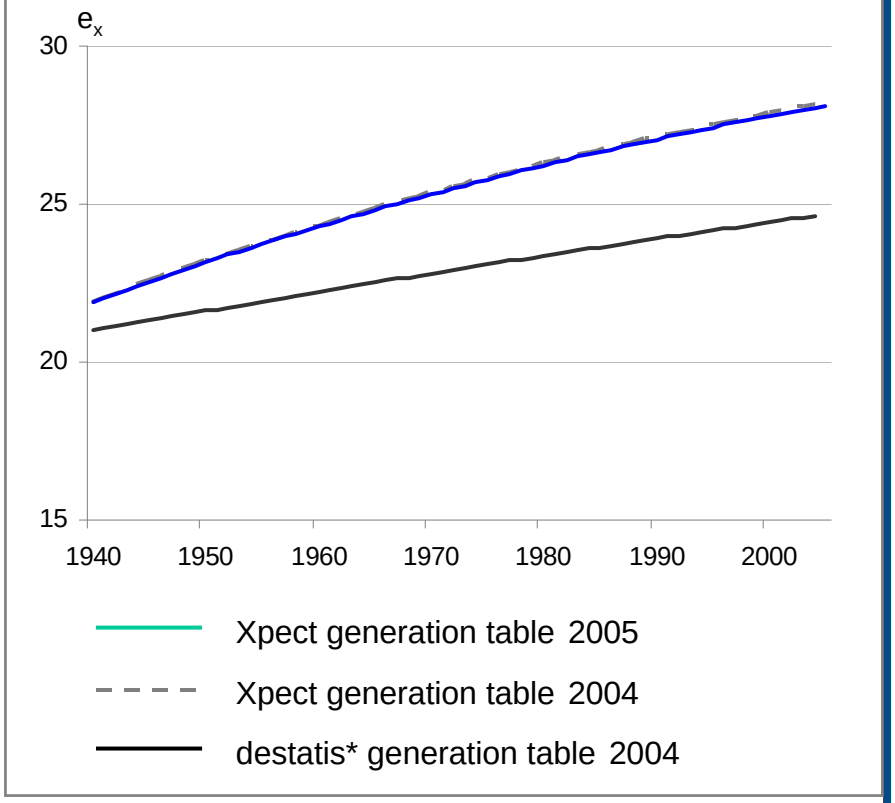
Only realised q_x per age from the last 30 years are considered for modeling the Xpect generation life table

These actual e_x represents longevity changes of the population near-time

Remaining life expectancy for all respectively 65 year old men in Germany



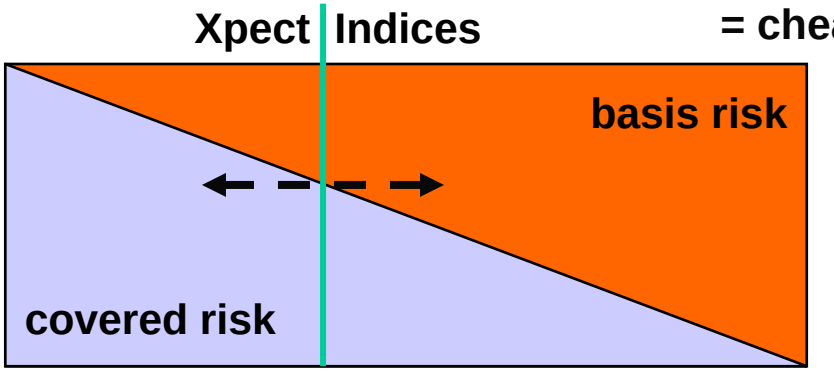
Remaining life expectancy for all respectively 65 year old women in Germany



Parametric Indices as underlying support longevity risk transfer, but basis risk is still an issue

Hedging on a parametric index

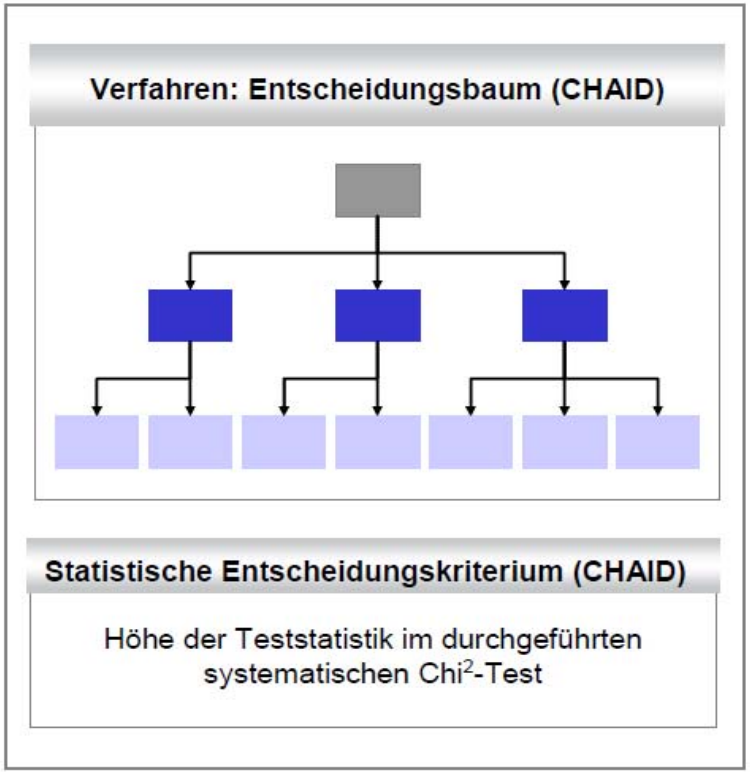
= standardised index hedge
= value hedge
= cheaper, more liquid



Hedging on indemnity risk

= tailored hedge
= cash flow hedge
= expensive (structural costs)

We selected the CHAID approach to get sociodemographic segment q_x indices



- To get the relevant attributes a chi-square independence test is applied
- 400.000 dead records in relation to 70 mio live records – comparison of deads with alives per year of birth
- The parameter with the highest ratio (chi square ratio) is selected
- Result: cohort and gender specific q_x prognosis based on residential quarter parameters

Female born 1943-1947 (61-65 years old)
Relevance of parameter value to q_x prognosis

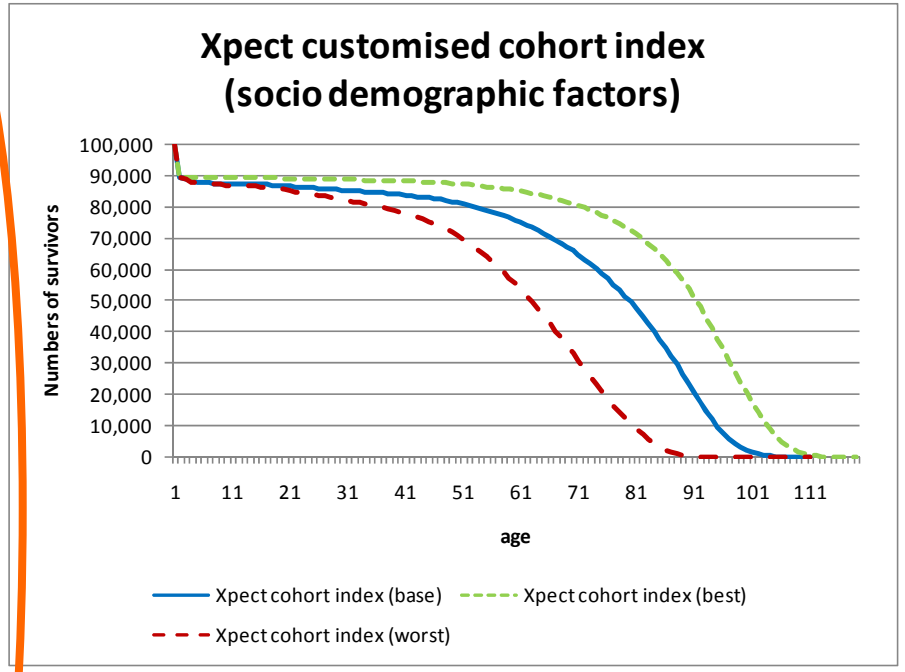
Priority 1	▪ Geldanleger ↓
Priority 2	▪ AC Nielsen Freizeitmilieus_Wahrscheinlichkeit Traditionelle ↑ ▪ Anzahl Gewerbehaushalte ↓
Priority 3	▪ Technik ↑ ▪ Wohnadresse ist Senioren- oder Pflegeeinrichtung ↑ ▪ Distanz zur nächsten Autobahn ↓ ▪ Distanz zum nächsten Kernkraftwerk ↓ ▪ Direktversicherte ↓
Priority 4	▪ TV Lotto ↑ ▪ TV-Magazin ↑ ▪ Lifestyle ↑ ▪ Anzahl Haushalte ↑ ▪ Distanz zum nächsten Park ↑
Priority 5	▪ Yellowpress ↑ ▪ Distanz zum nächsten ICE-Bahnhof ↓ ▪ AC Nielsen LOHAS Typologie_Reife LOHAS ↓ ▪ Familienanteil ↓ ▪ Arbeitslosenquote (Gemeindeebene) ↑ ▪ Einwohnerdichte ↓ ▪ Finanzinteressierte ↓ ▪ AC Nielsen Freizeitmilieus_Wahrscheinlichkeit Intellektuelle ↓

↑ **the higher the parameter value, the higher q_x**

↓ **the higher the parameter value, the lower q_x**

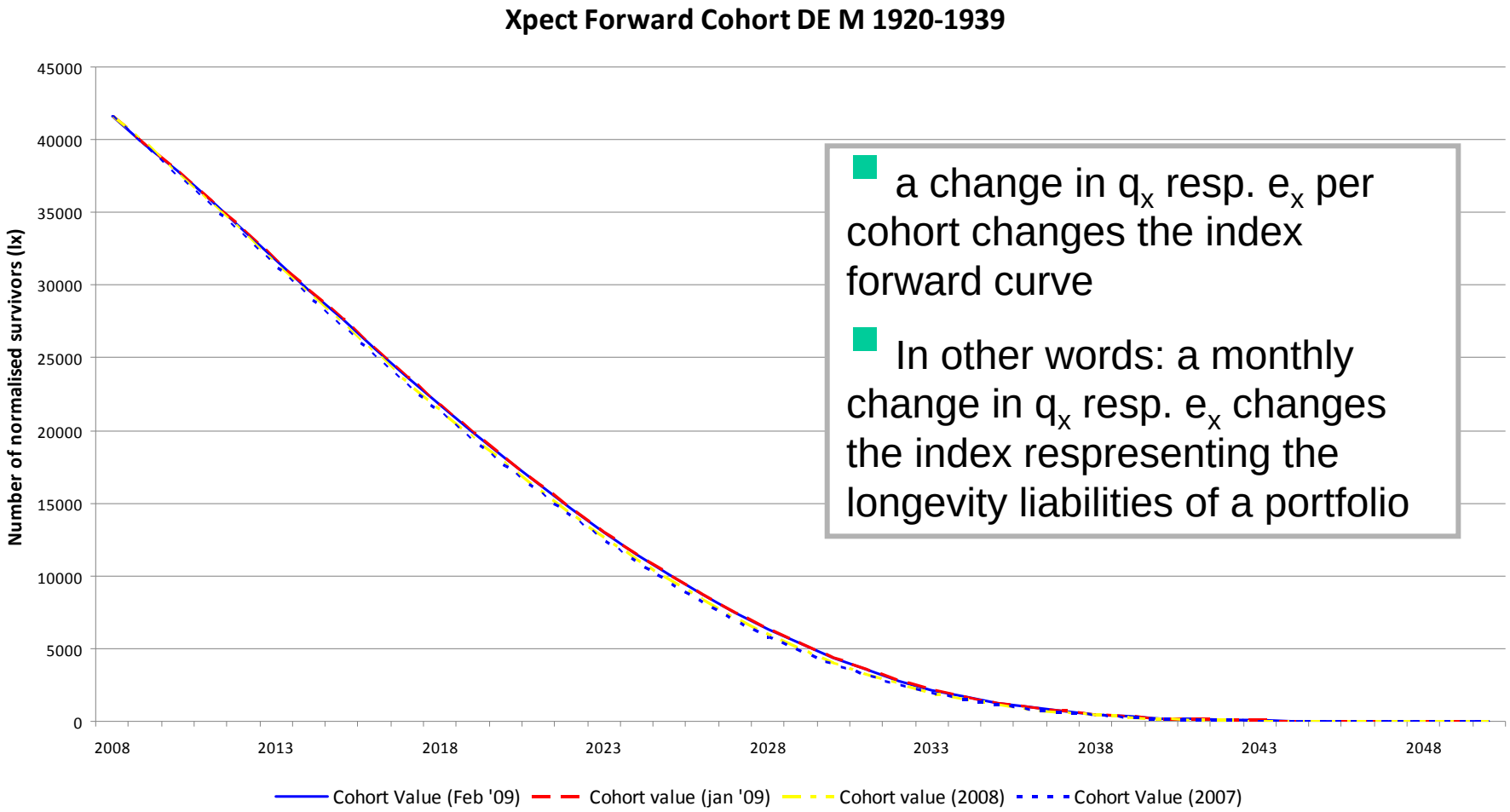
Index results: Male, 64 years old, born 1944

Segment-nummer	Anzahl Lebende	Anzahl Verstorbene	Sterblichkeit in %	Index
106	178	21	10,577	1591
71	2.150	46	2,094	315
60	1.361	25	1,804	271
98	1.894	33	1,713	258
89	2.288	38	1,633	246
105	1.657	26	1,545	232
63	1.657	22	1,310	197
23	3.137	41	1,290	194
40	2.308	30	1,283	193
28	4.281	55	1,269	191
37	1.026	12	1,156	174
31	3.945	44	1,103	166
42	3.827	42	1,086	163
103	2.999	31	1,023	154
30	7.338	73	0,985	148
86	3.472	31	0,885	133
97	1.302	10	0,762	115
24	4.281	31	0,719	108
36	3.038	22	0,719	108
17	3.334	24	0,715	107
9	16.689	115	0,684	103
27	6.175	41	0,660	99
41	4.952	32	0,642	97
85	6.904	42	0,605	91
26	6.707	40	0,593	89
90	2.900	17	0,583	88
64	5.030	29	0,573	86
33	3.768	18	0,475	71
25	12.803	59	0,459	69
21	14.559	53	0,363	55
14	12.980	37	0,284	43
Gesamt	148.940	1.140	0,665	



Adjustments were based on the assumption that the effects are weaker before the point of measurement and stronger afterwards.

Index Forward Curves (with or without sociodemographic parameter) are the underlyings for Longevity Index Products e.g Forwards, zerobonds



- a change in q_x resp. e_x per cohort changes the index forward curve
- In other words: a monthly change in q_x resp. e_x changes the index respresenting the longevity liabilities of a portfolio

Thank you for your attention

Questions ?

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