DEUTSCHE BÖRSE GROUP

Preisbildung und Transfer von Langlebigkeitsrisiken auf Basis von Xpect® Indizes

q_x-Club Köln/Bonn/Düsseldorf

Hilden, 01.12.2009

Agenda

1 **Deutsche Börse MD&A and alternative asset classes. Fundamental background regarding Xpect® Data & Indices**

Mario Michael Schultz, Senior Project Manager, Deutsche Börse AG

2 **Basis risk reduction with sociodemographic parameters. Xpect® Indices as underlying for longevity risk transfer**

Dr. Albert Jürgen Enders, Geschäftsführer, ValueData7 GmbH

3 **Indexbasierter Transfer von Langlebigkeitsrisiken**

Alexis Iglauer, Client Partner Life, Partner Reinsurance Europe Limited

Agenda

1

Deutsche Börse MD&A and alternative asset classes. Fundamental background regarding Xpect® Data & Indices

Mario Michael Schultz, Senior Project Manager, Deutsche Börse AG

Market Data & Analytics: Prices, statistics, analysis & indices directly from the trading venue

DBAG:	Xetra	Eurex	MD&A	Clearstream

Issuer data

- Independent indices
- Customized indices
- Indicative Net Asset Value
- Index components
- Index analytics

Front Office data

- Real-time trading information
- Pre-trade data (bid/ask price, volumes)
- Post-trade data (price, volumes)
- Order book and market analytics
- CEF® direct data feeds

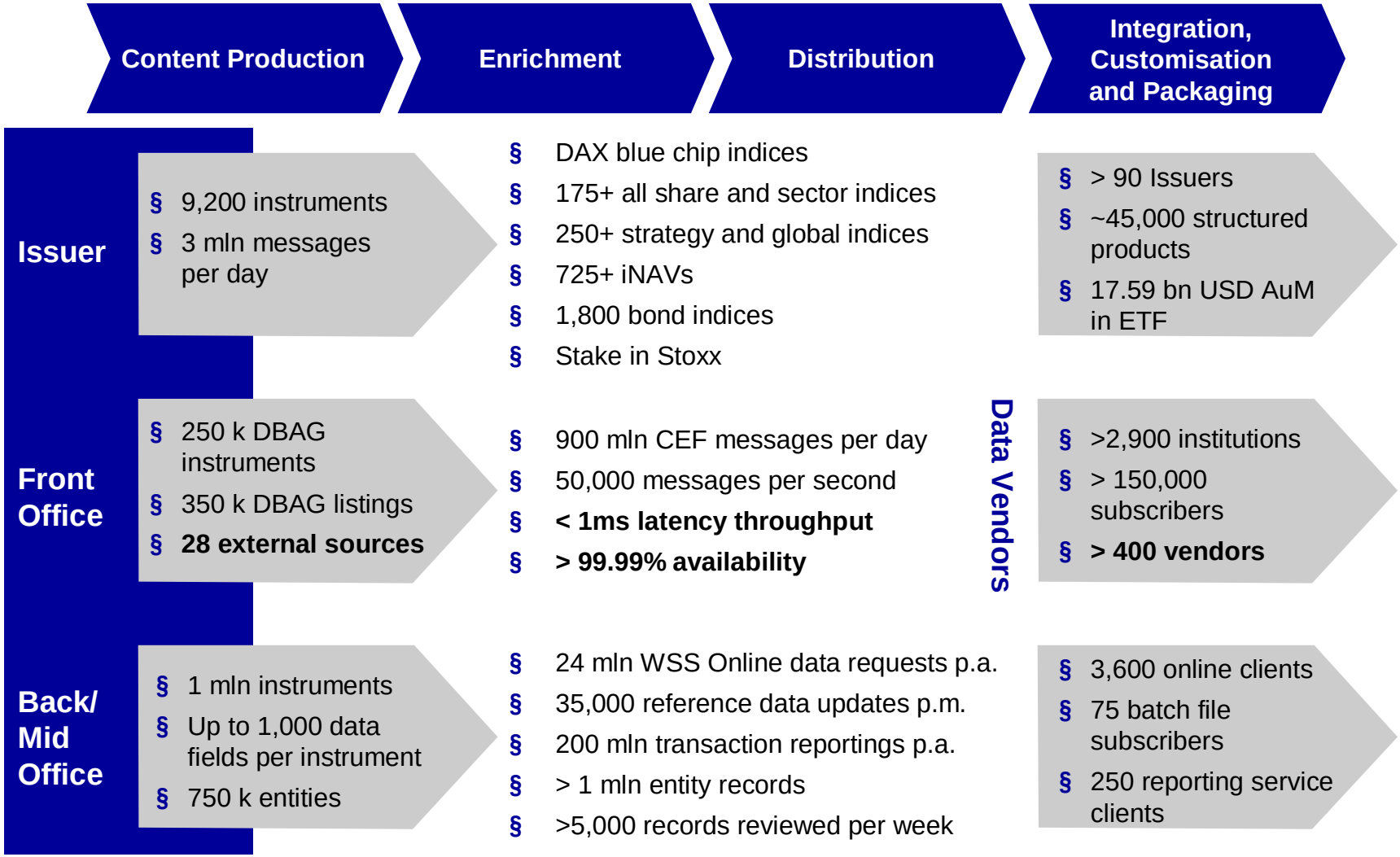
Mid Office data

- Pricing/valuations
- Historical price data
- Risk analytics
- Benchmarks
- Counterparty data
- Company hierarchies

Back Office data

- Instrument data (e.g. identifiers)
- Corporate actions
- Accounting & tax data
- Ratings
- Transactional data
- Evaluation prices

MD&A builds on high scale processing and distribution



DBAG´s motivation to develop longevity indices

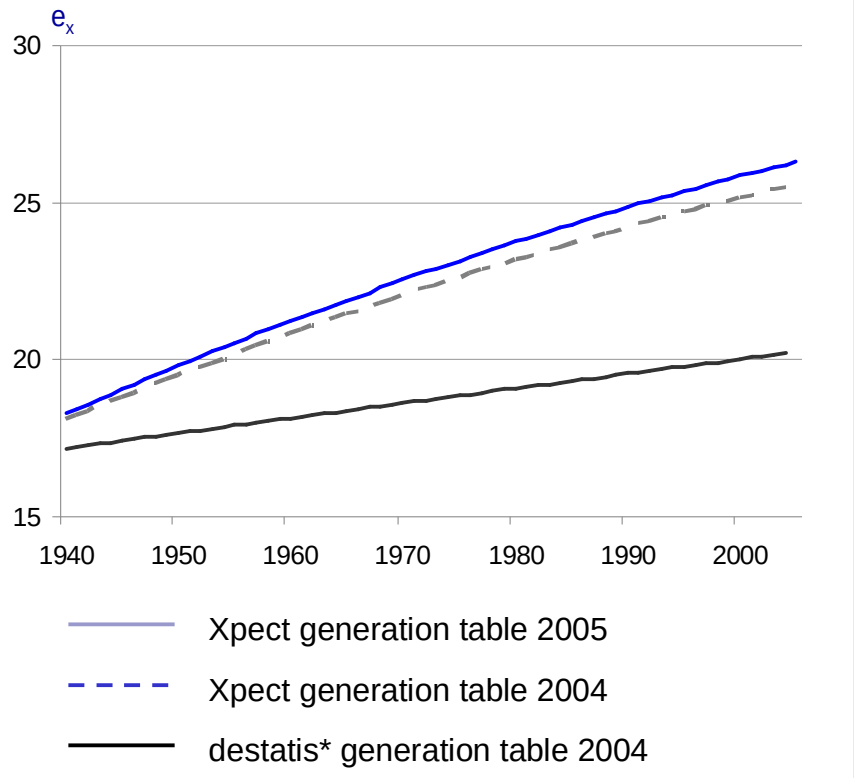
Longevity is a new risk class	§ Hedging of longevity risk is important due to the huge volumes in pension and insurance longevity risk § Longevity risk transfer to fill a gap: for interest and inflation risks the risk transfer tools and the financial markets do exist
Neutrality and expertise	§ DBAG with high expertise in developing indices § DBAG acts as a neutral calculation agent (no moral hazard) § DBAG provides the infrastructure to distribute indices globally to over 400 data vendors
Willingness to invest in a early market phase	§ DBAG wants to provide underlyings for a longevity risk market § Investment in data and infrastructure for Xpect® since 2007 § First product in Germany based on the Xpect Generation Life Table to be launched in Q4/2009

Xpect® Data as Generation Life Tables are calculated monthly since 2008

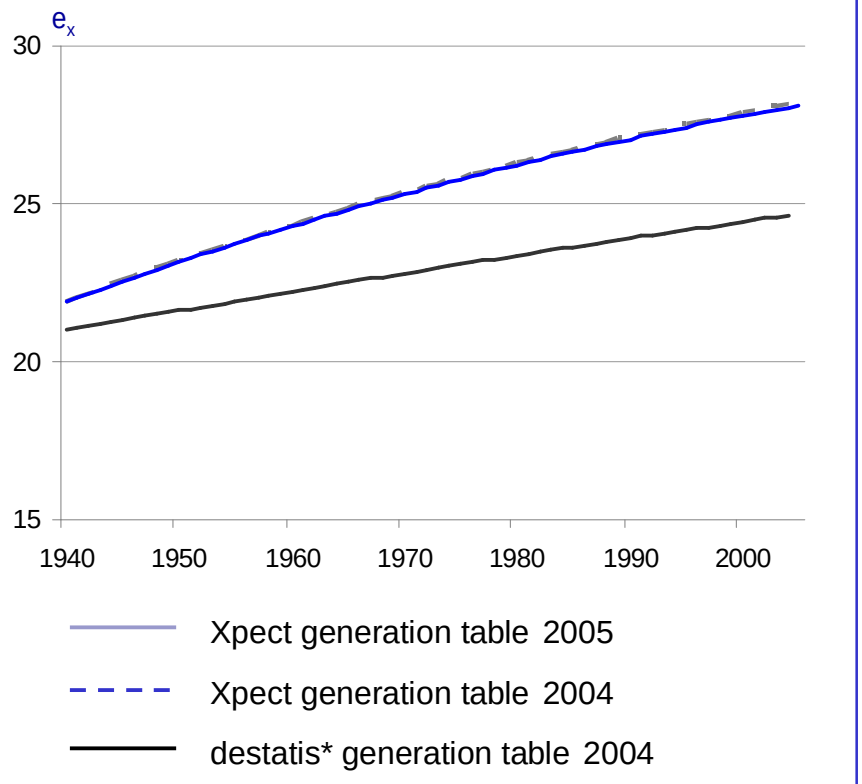
Country: NL	Reporting y: 2004	Reporting m: Dec	Gender: M	Cohort: 1966			
x	qx	px	lx	dx	LLx	exlx	ex
0	0,01638	0,98362	100000	1638	99181	7749436	77,49
1	0,00141	0,99859	98362	139	98293	7650255	77,78
2	0,00110	0,99890	98223	108	98169	7551963	76,89
3	0,00104	0,99896	98115	102	98064	7453793	75,97
4	0,00070	0,99930	98013	69	97979	7355729	75,05
5	0,00065	0,99935	97944	64	97912	7257750	74,10
6	0,00049	0,99951	97880	48	97856	7159838	73,15
7	0,00040	0,99960	97833	39	97813	7061982	72,18
8	0,00038	0,99962	97794	37	97775	6964169	71,21
9	0,00027	0,99973	97757	26	97744	6866393	70,24
10	0,00032	0,99968	97731	31	97715	6768649	69,26
38	0,00104	0,99896	96033	99	95984	4052098	42,19
39	0,00119	0,99881	95934	114	95877	3956115	41,24
40	0,00121	0,99879	95820	116	95762	3860238	40,29
86	0,14245	0,85755	31601	4502	29351	129823	4,11
87	0,16701	0,83299	27100	4526	24837	100473	3,71
88	0,19378	0,80622	22574	4374	20387	75636	3,35
89	0,21782	0,78218	18199	3964	16217	55249	3,04
90	0,25423	0,74577	14235	3619	12426	39032	2,74

Xpect® Data: near real-time calculation of the remaining life expectancy for every age group

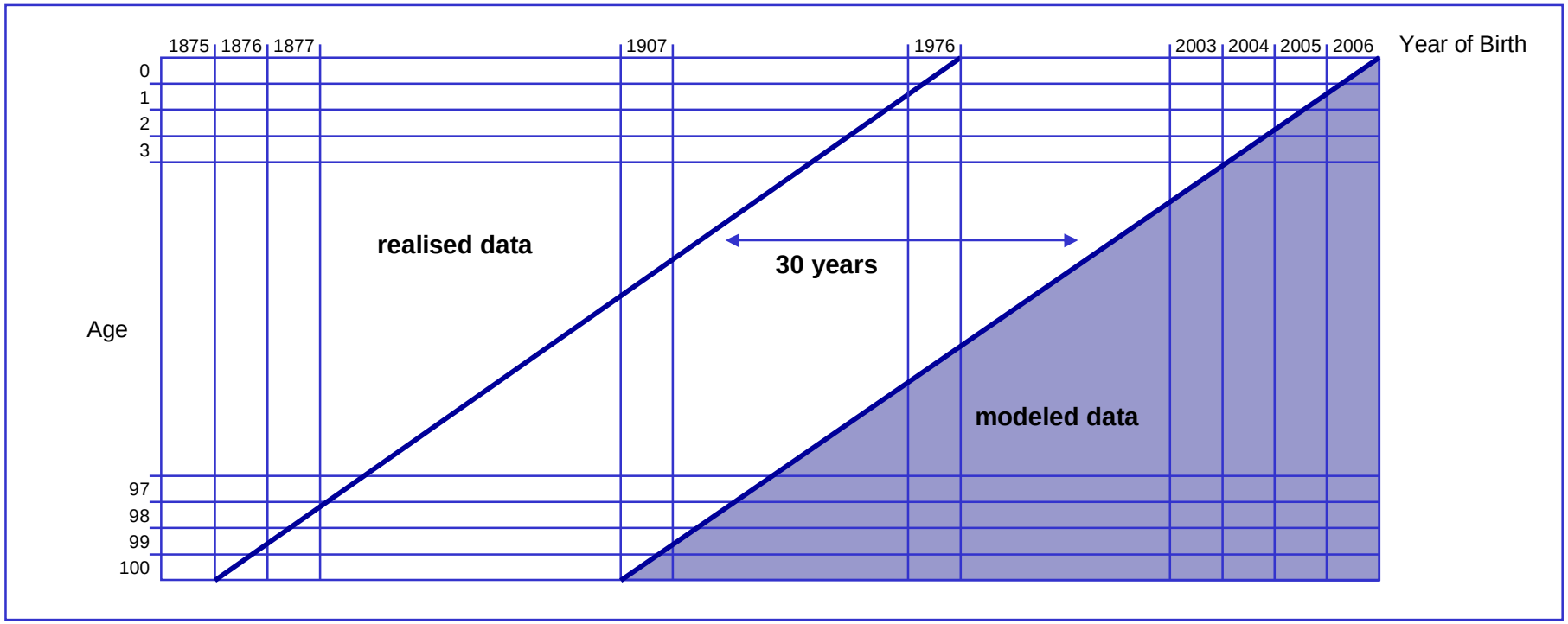
Remaining life expectancy for all respectively 65 year old men in Germany



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



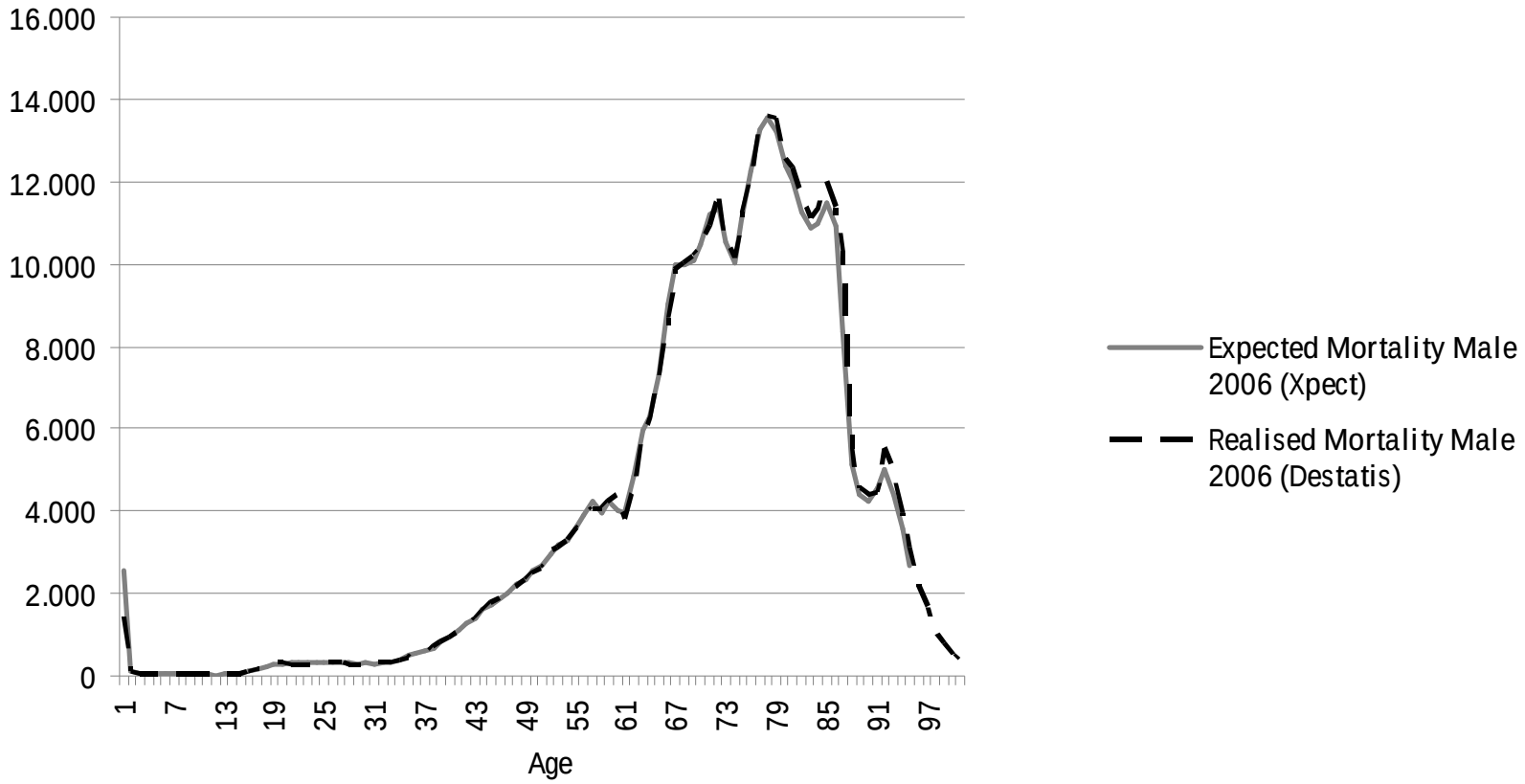
Xpect® Generation Life Tables incorporate the last 30 year's q_x trend



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

Xpect® Generation Life Table shows high quality grade

Expected versus actual mortality 2006, number of death



Xpect® Indices are developed for longevity risk evaluation and transfer

Xpect Age Indices

- Weighted average life of a age groups e.g. 65-90
- Multiplies population per cohort (groups) with its e_x + x and divides by total population of age groups
- Represents “open” population: adding monthly additional population at the tail sides of the age groups
- Customising possible but concrete portfolio population data required

Index points represent weighted total life in years

Xpect Cohort Indices

- Survivors of cohort based on generation life table 100.000 population e.g for 20 cohorts e.g. 1920-1939 M
- Starting at a defined date and count the cohort population down by deads (dx)
- Represents closed portfolios
- Customising possible with portfolio-specific parameter

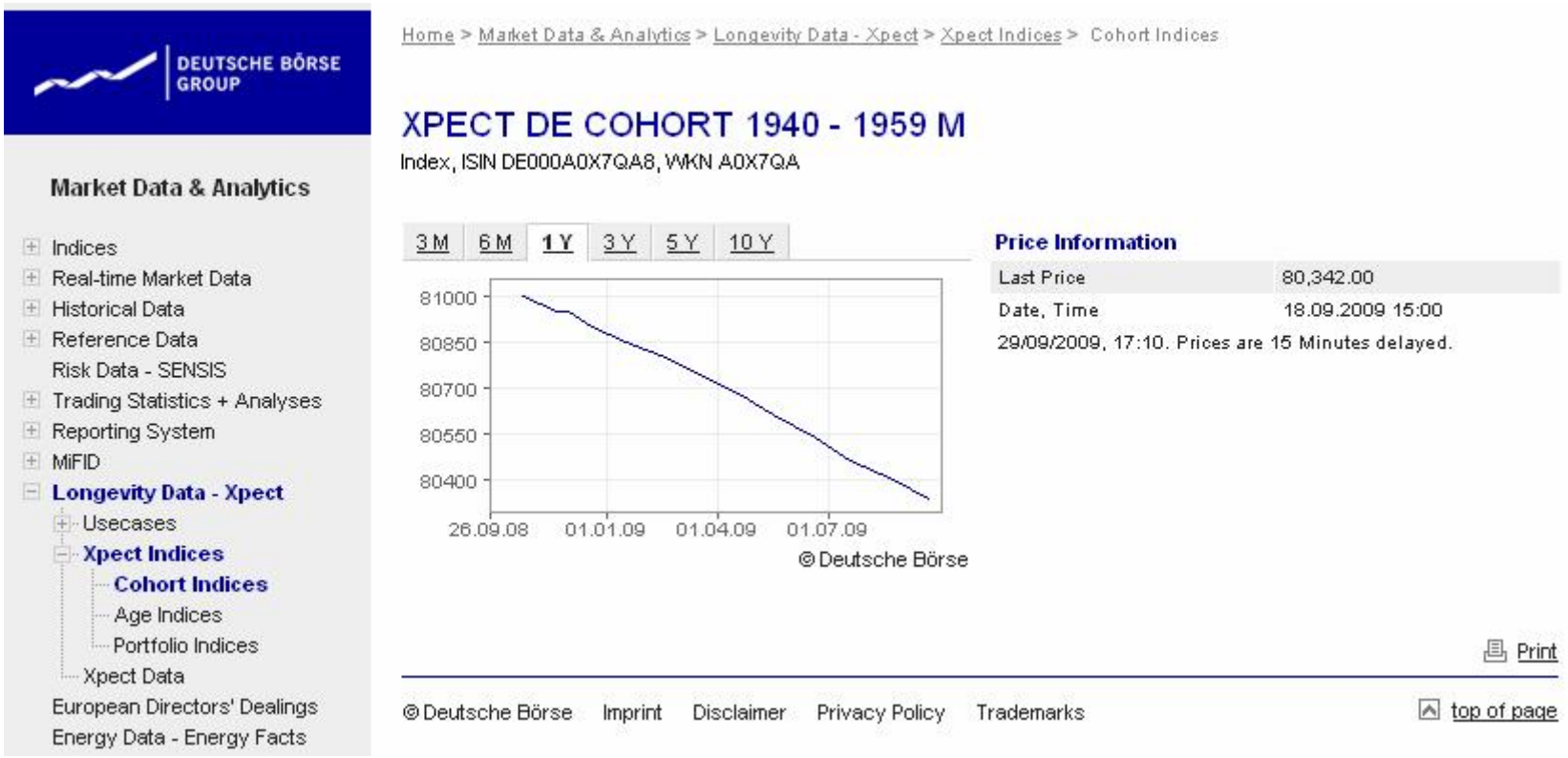
Index points represent cohort survivors

Xpect Portfolio Indices

- Based on effective portfolio cohorts and contract details
- Cashflows and widow-annuities could be implemented
- Represents closed portfolio
- Each contract is evaluated monthly with its specific Xpect q_x
- Sociodemographic profiles could be integrated
- Is reducing basis risk

Index points represent portfolio structure

Xpect® Cohort and Age Indices are available on the Deutsche Börse website or via Data Vendors



Agenda

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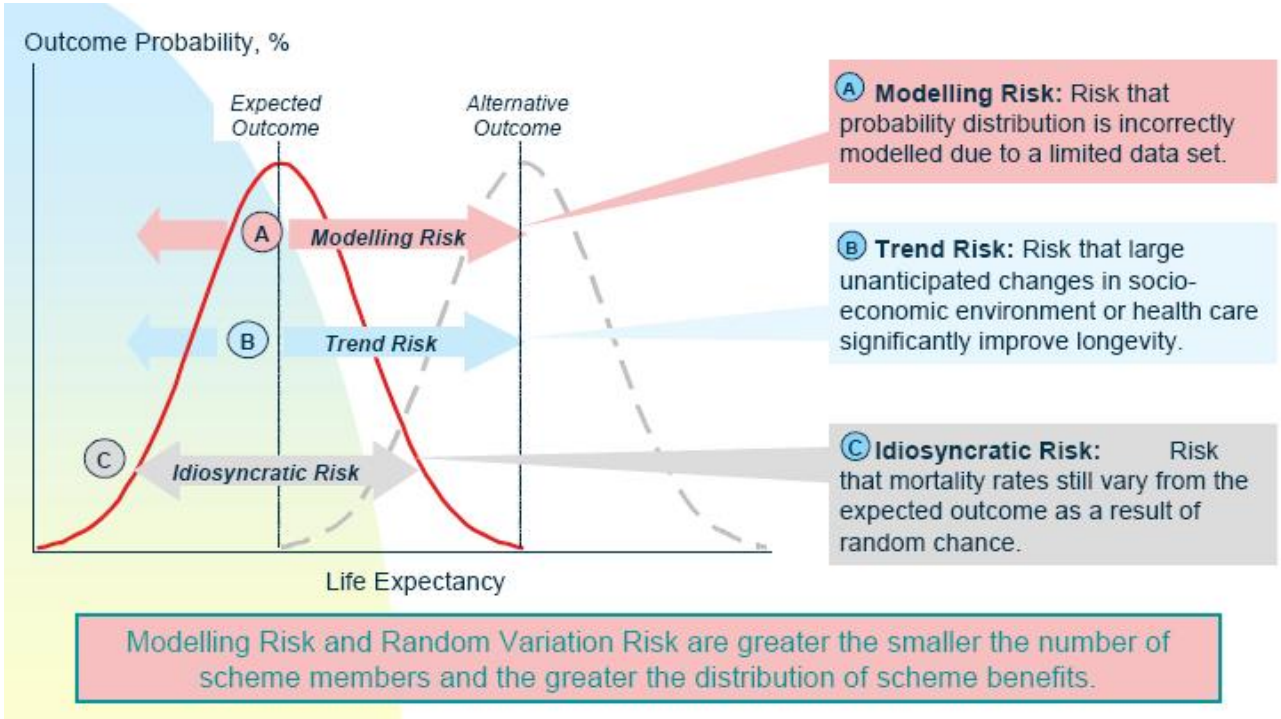
Basis risk reduction with sociodemographic parameters. Xpect® Indices as underlying for longevity risk transfer

Dr. Albert Jürgen Enders, Geschäftsführer, ValueData7 GmbH

Longevity risk is driven by three underlying risks



Source: Prof. Dave Blake, Pension Institute: The New Life Market – from Survivor Bonds to Life Settlement Securitisation; AFIR/LIFE Munich September 2009

Longevity risks and required tasks

- § Modelling risk -> use public models
- § Trend risk -> providing long and detailed data history
- § Idiosyncratic risk -> sociodemographic sub-indices

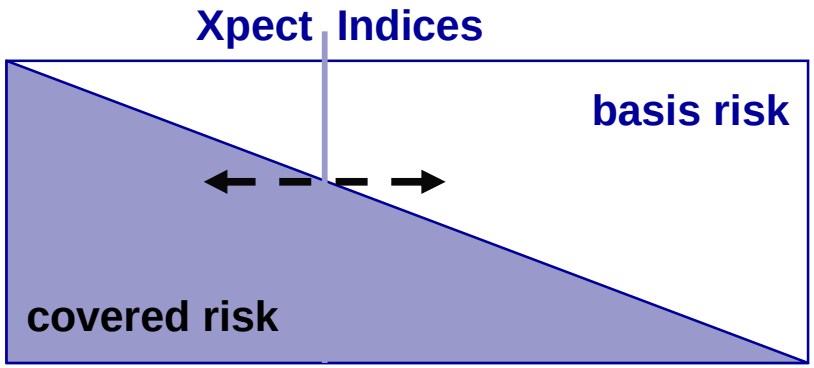
- > last but not least: let the market make own expectations

Xpect® Indices as underlyings support longevity risk transfer, but basis risk is still an issue

Hedging on indemnity risk

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

= Xpect Custom Indices



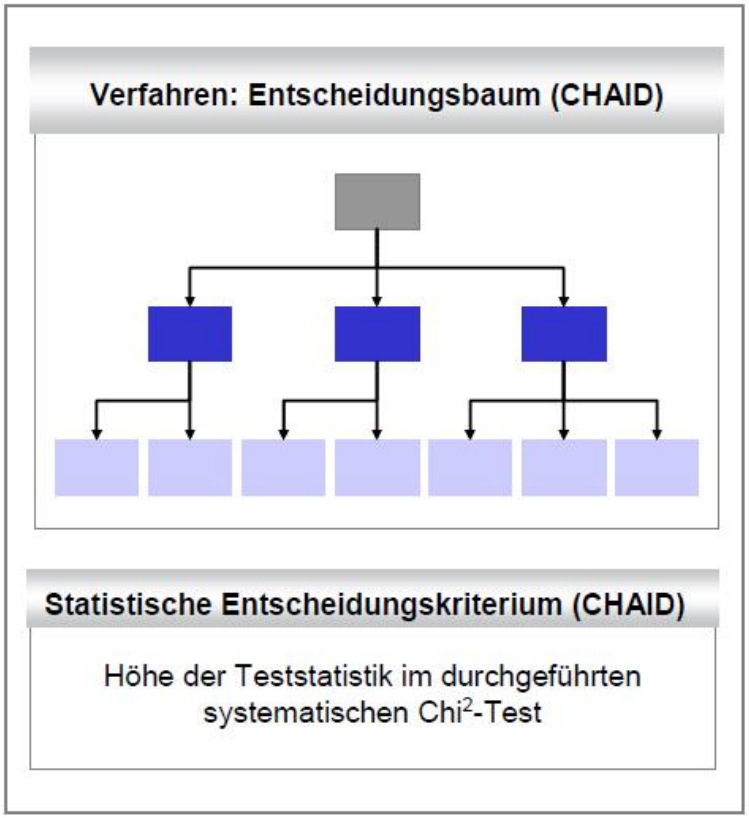
Hedging on a parametric index

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

= Xpect Public Indices

- Xpect Index to be used as a base to hedge longevity and (extreme) mortality risks
- The basis risk is defined by both parties and will be covered in the contract e.g. premium to Xpect Index values
- The near-time (monthly) Xpect index calculation covers the expected and unexpected e_x and q_x changes
- Parametric indices enable easier standardisation of contracts and products but keep basis risk

We selected the CHAID approach to get sociodemographic segment q_x indices per cohort



- 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 living environment parameters

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

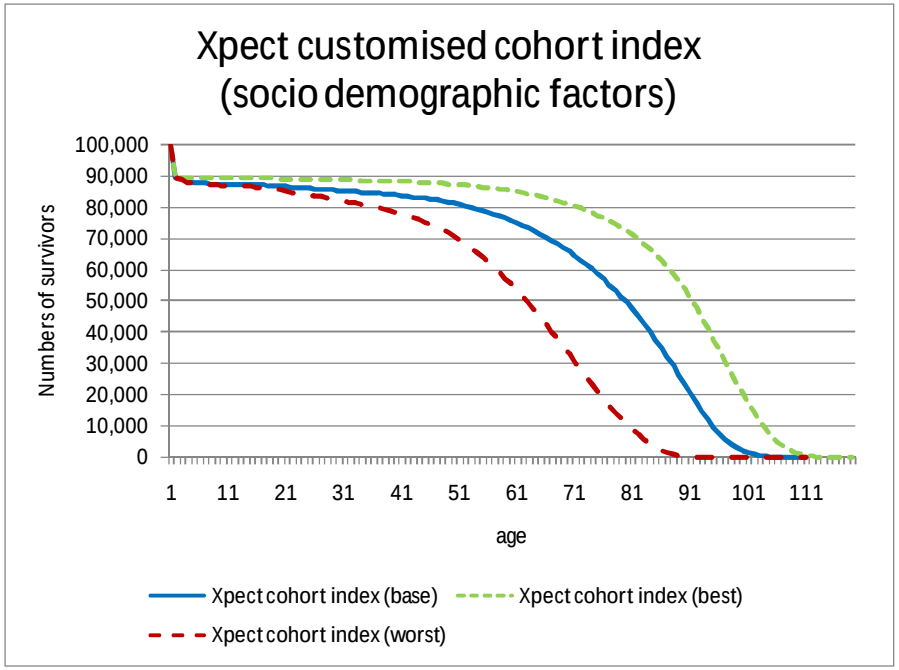
Priority 1	§ Geldanleger ê
Priority 2	§ AC Nielsen Freizeitmilieus_Wahrscheinlichkeit Traditionelle é § Anzahl Gewerbehaushalte ê
Priority 3	§ Technik é § Wohnadresse ist Senioren- oder Pflegeeinrichtung é § Distanz zur nächsten Autobahn ê § Distanz zum nächsten Kernkraftwerk ê § Direktversicherte ê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

é the higher the parameter value, the **higher q_x**

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

Xpect® sociodemographic index results: Male, 64 years old, born 1944

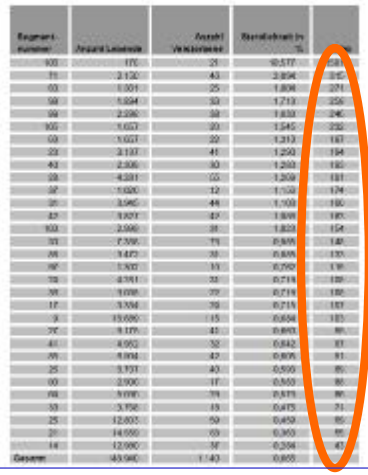
Segment-nummer	Anzahl Lebende	Anzahl Verstorbene	Sterblichkeit in %	Index
106	178	21	10,577	1591
71	2.150	46	2,094	315
60	1.361	25	1,804	271
98	1.894	33	1,713	258
89	2.288	38	1,633	246
105	1.657	26	1,545	232
63	1.657	22	1,310	197
23	3.137	41	1,290	194
40	2.308	30	1,283	193
28	4.281	55	1,269	191
37	1.026	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	



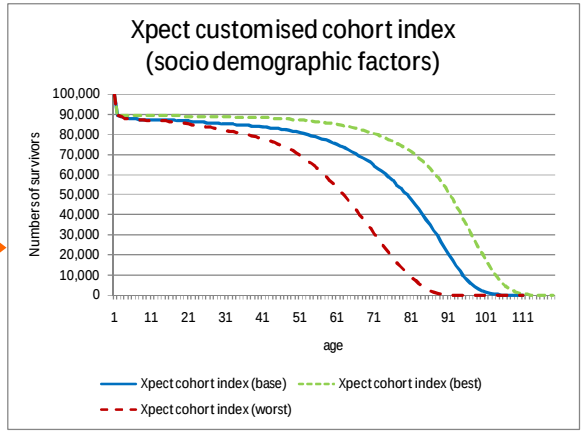
Adjustments were based on the assumption that the effects are weaker before the point of measurement and stronger afterwards.

As a result Xpect® sociodemographic sub-indices support basis risk reduction in portfolio transactions

Based on sociodemographic sub-indices the basis and the trend risks of a portfolio of annuities are assessable



Assesssment



Xpect Custom Indices

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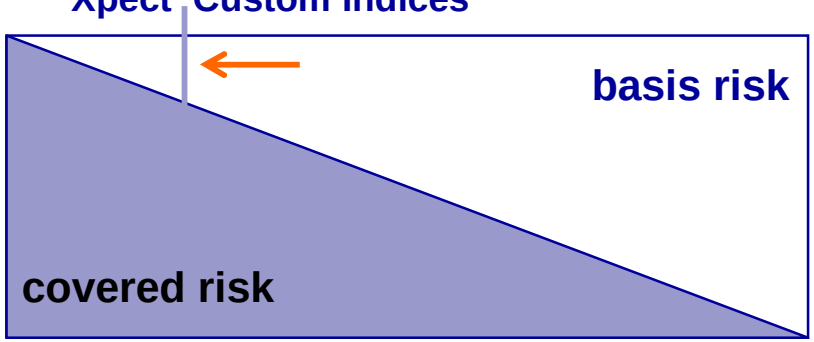

Hedging on a parametric index

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Customer portfolio assessement process based on Xpect® sociodemographic parameter

Step 1

Generate anonymous Portfolio File

client contract database

Data enrichment

No	Sex	Year of Birth	Payment in €	Payment frequency	street	Number	city	postcode
1	M	1945			Baderstr	12	Astadt	61462
2	F	1937			Schlossallee	16	Bdorf	65464
3	F	1963			Poststr	678	Cweiler	23456
4	M	1970			Schulstr	34	Dburg	34256
5	M	1963			Parkstr	67	Ehausen	73542
6	M	1955			Hauptstr	88	Fgraben	91324
7	F	1957			Nebenstr	32	Gberg	45637
8	M	1961			Finkenweg	18	Hroden	24356
9	F	1962			Aachenerstr	12	Iland	12345

Step 2

Portfolio Assessment

No	street	city	postcode
1	Baderstr	Astadt	61462
2	Schlossallee	Bdorf	65464
3	Poststr	Cweiler	23456
4	Schulstr	Dburg	
5	Parkstr	Ehausen	
6	Hauptstr	Fgraben	
7	Nebenstr	Gberg	
8	Finkenweg	Hroden	
9	Aachenerstr	Iland	

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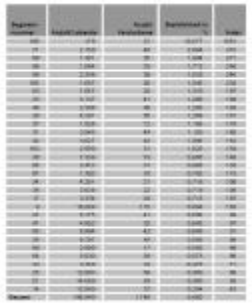
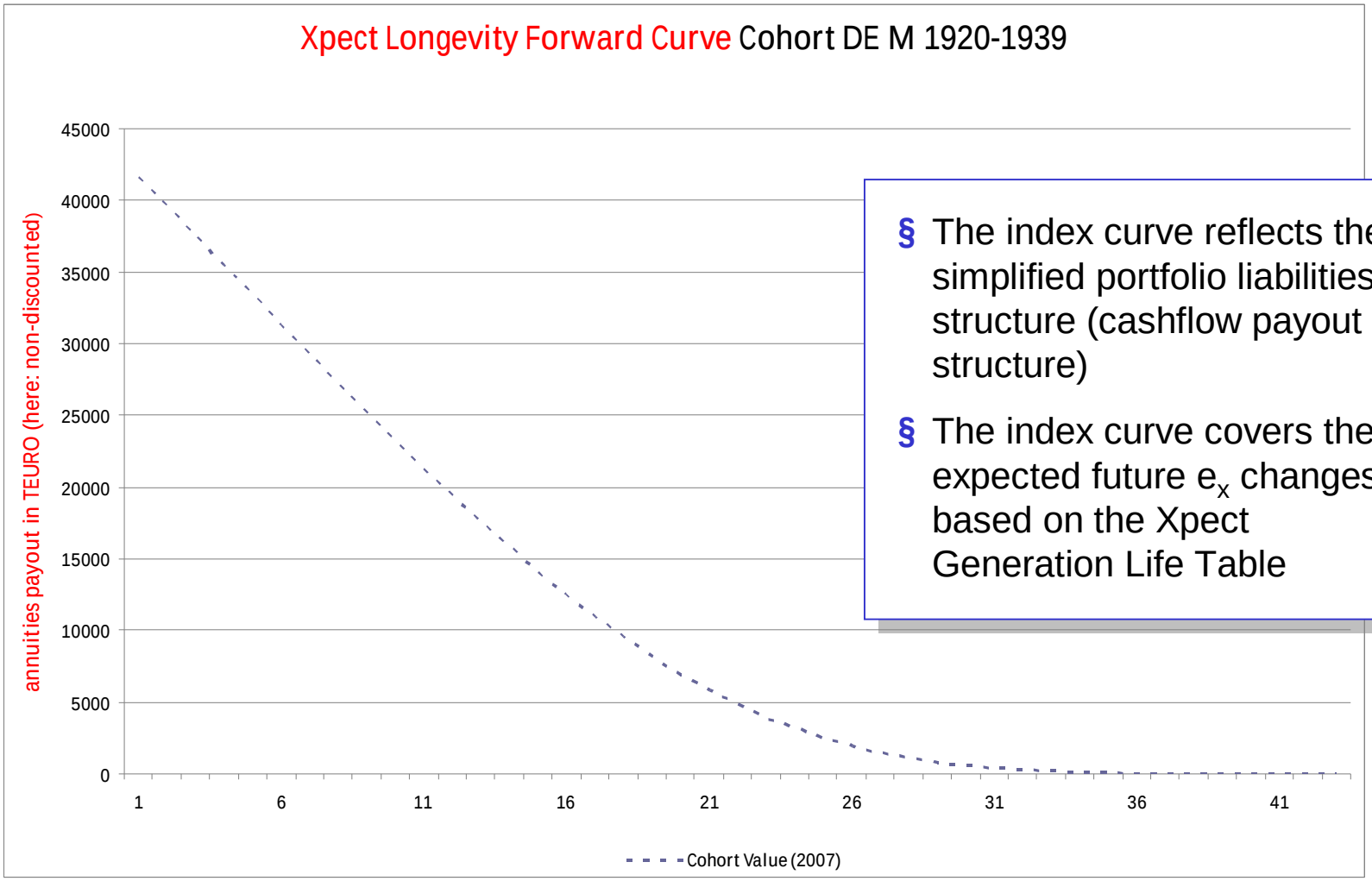


Matching

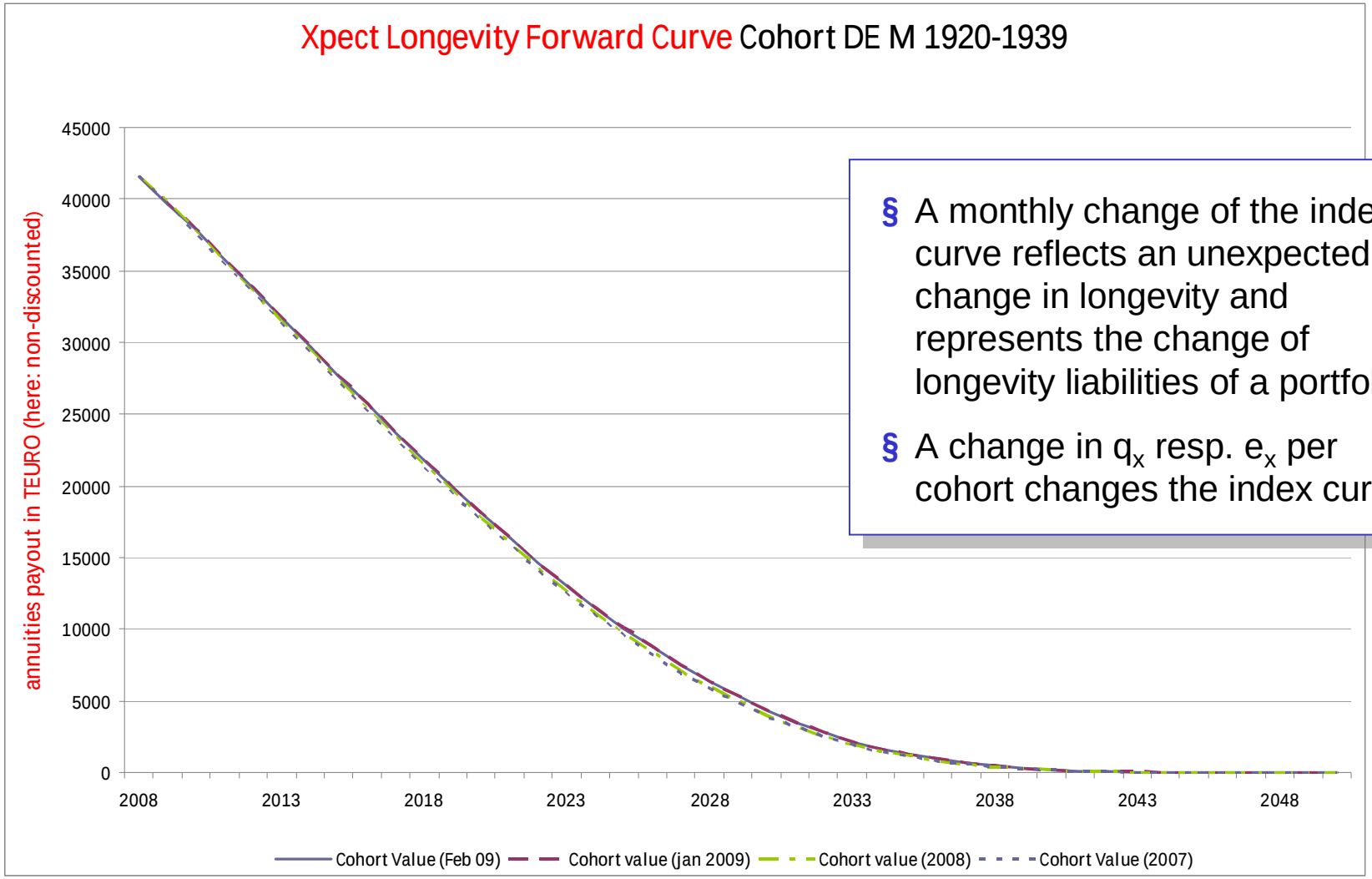
No	Segment	qx segment index	Xpect Segment ex	delta ex contract
1	33	265%	23.6	-11.8
2	54	34%	31.5	9.9
3	11	103%	22.9	-3.1
4	78	23%	20.5	12.4
5	45	187%	13.3	-6.4
6	98	123%	12.5	-6.9
7	37	87%	19.9	8.5
8	28	74%	18.7	9.3
9	4	159%	20.2	-5.7

Xpect® Index longevity forward curves serve as term structures



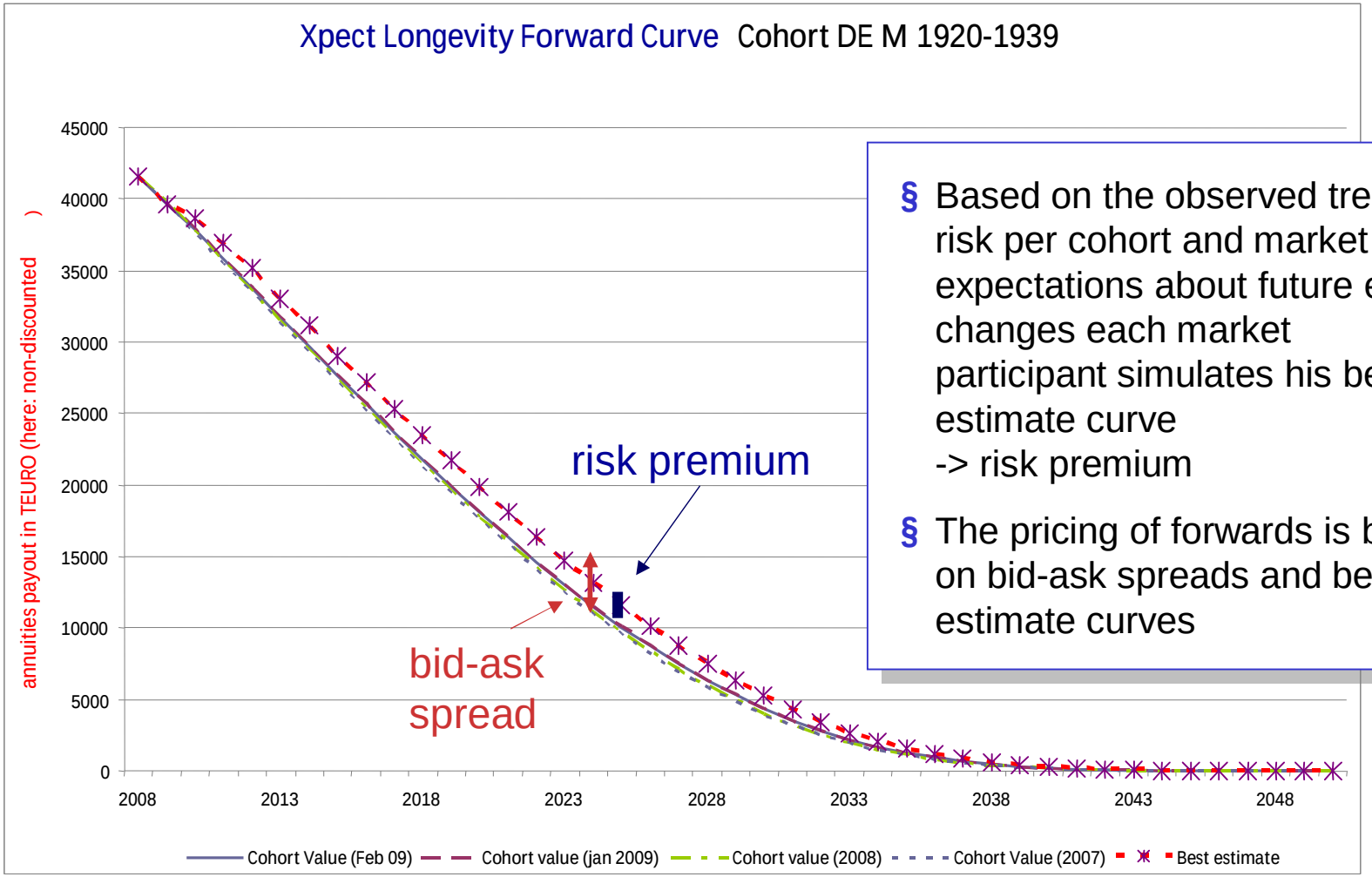
- The index curve reflects the simplified portfolio liabilities structure (cashflow payout structure)
- The index curve covers the expected future e_x changes based on the Xpect Generation Life Table

Xpect® Index longevity forward curves are calculated monthly and represents the actual portfolio liabilities



- A monthly change of the index curve reflects an unexpected change in longevity and represents the change of longevity liabilities of a portfolio
- A change in q_x resp. e_x per cohort changes the index curve

Xpect® Index longevity forward curves are reasonable underlyings for any longevity risk transfer products



- Based on the observed trend risk per cohort and market expectations about future e_x changes each market participant simulates his best estimate curve
  -> risk premium
- The pricing of forwards is based on bid-ask spreads and best estimate curves

Who is interested in longevity data and longevity risk transfer products ?

Interest in longevity risk transfer products:

The Investors: **Funds, Banks, Reinsurer**	§ go **short** longevity § pays: $\text{Longevity}_{\text{realised20xy}}$ – $\text{Longevity}_{\text{forwardprice\_2009}}$
The Hedgers: **Pension Funds, Insurers**	§ go **long** longevity § pay: $\text{Longevity}_{\text{forwardprice\_2009}}$ – $\text{Longevity}_{\text{realised20xy}}$

Interest in up-to-date longevity data e.g. Xpect® Data:

Product Manager	§ to develop new financial products for retirement provision § to assess trend risk and for risk management

Agenda

3

Indexbasierter Transfer von Langlebigkeitsrisiken

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