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LONGEVITY 17
2022 WATERLOO

ESTABLISHING METHODS FOR ANNUAL UPDATES TO COHORT LIFE EXPECTANCIES

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R. Dale Hall, FSA, CERA, MAAA, CFA
Managing Director, SOA Research Institute

Background

- Life expectancy: Estimate of the average number of years of life a person who has attained a given age can expect to live in the future

- Often used in comparisons of mortality trends
  - Within one market over time
  - Subdivisions of a market at a point in time
  - Across markets

- Used often for public education and awareness
  - Life Expectancy from Birth
  - Life Expectancy from Retirement Age

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Background

- Risks
  - Period life expectancies often used, where mortality rates used are all from the same current year
  - Focus on period life expectancies can cause large shocks when sudden changes to mortality levels
    - Pandemic
    - War
    - Natural Catastrophe
  - Overemphasis on period life expectancies may cause undesirable individual or system reactions
    - Personal decisions on life insurance
    - Personal decisions on retirement planning
    - Social systems where benefits or funding tied to life expectancies

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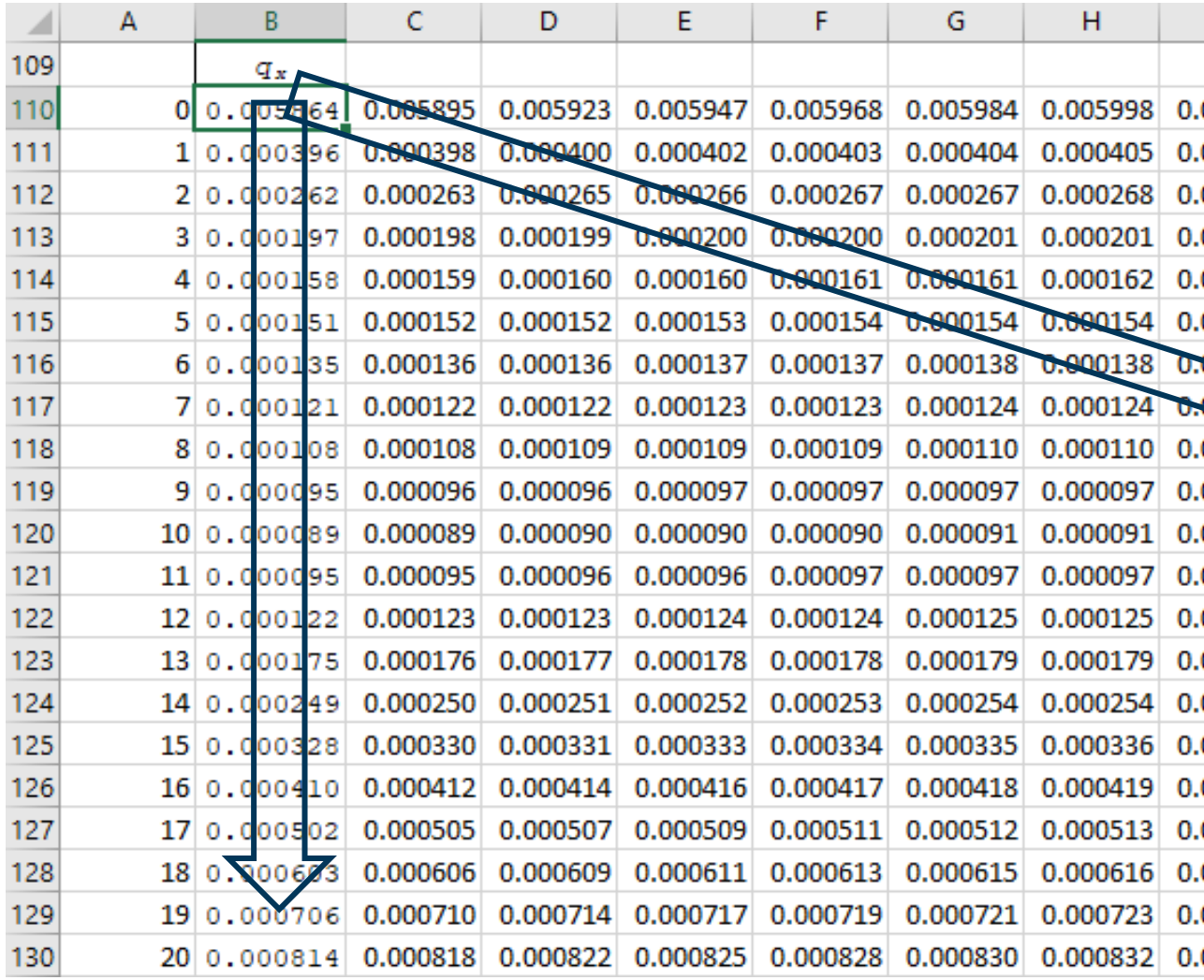
Cohort Life Expectancies

- Cohort life expectancies
  - Calculated using mortality that is expected to arise for a cohort in forward years, instead of focusing on mortality in the current year
  - Are there ways to create trends in objective cohort life expectancies, with consistency over time



	A	B	C	D	E	F	G	H
109		q_x						
110	0	0.005664	0.005895	0.005923	0.005947	0.005968	0.005984	0.005998
111	1	0.000396	0.000398	0.000400	0.000402	0.000403	0.000404	0.000405
112	2	0.000262	0.000263	0.000265	0.000266	0.000267	0.000267	0.000268
113	3	0.000197	0.000198	0.000199	0.000200	0.000200	0.000201	0.000201
114	4	0.000158	0.000159	0.000160	0.000160	0.000161	0.000161	0.000162
115	5	0.000151	0.000152	0.000152	0.000153	0.000154	0.000154	0.000154
116	6	0.000135	0.000136	0.000136	0.000137	0.000137	0.000138	0.000138
117	7	0.000121	0.000122	0.000122	0.000123	0.000123	0.000124	0.000124
118	8	0.000108	0.000108	0.000109	0.000109	0.000109	0.000110	0.000110
119	9	0.000095	0.000096	0.000096	0.000097	0.000097	0.000097	0.000097
120	10	0.000089	0.000089	0.000090	0.000090	0.000090	0.000091	0.000091
121	11	0.000095	0.000095	0.000096	0.000096	0.000097	0.000097	0.000097
122	12	0.000122	0.000123	0.000123	0.000124	0.000124	0.000125	0.000125
123	13	0.000175	0.000176	0.000177	0.000178	0.000178	0.000179	0.000179
124	14	0.000249	0.000250	0.000251	0.000252	0.000253	0.000254	0.000254
125	15	0.000328	0.000330	0.000331	0.000333	0.000334	0.000335	0.000336
126	16	0.000410	0.000412	0.000414	0.000416	0.000417	0.000418	0.000419
127	17	0.000502	0.000505	0.000507	0.000509	0.000511	0.000512	0.000513
128	18	0.000603	0.000606	0.000609	0.000611	0.000613	0.000615	0.000616
129	19	0.000706	0.000710	0.000714	0.000717	0.000719	0.000721	0.000723
130	20	0.000814	0.000818	0.000822	0.000825	0.000828	0.000830	0.000832

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Cohort Life Expectancies

- Objective Decisions
  - **How should the CLE consider the starting point for the base mortality rates to be used?**
    - CLE Base Mortality in year t (a% weight from year t-1; b% weight from year t, adjusted/non-adjusted for current year extreme events)
    - PLE Base Mortality in year t = CLE Base Mortality in year t (a=0%; b=100%, non-adjusted)
    - Subset of all potential CLE mortality choices

  - **How should past mortality improvement leading up to the current year be used for a short-term future year mortality improvement rate and transition to a long-term improvement rate?**
  - Use SOA Mortality Improvement Model and set Long-Term Mortality Improvement Target
  - CLE Long-Term Mortality Improvement Target = $\sum_{n=t-19}^{t}\left((MI\ Rate_x)_n\ (MI\ Weight)_n; adjusted\ or\ nonadjusted\ for\ extreme\ events\right)$ where the MI Weights over time add up to 100%
  - Calculations for PLE Long-Term Mortality Improvements are again a subset of the range of possibilities for these CLE targets with $(MI\ Rate)_t$ = 0 for all values of t.

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Cohort Life Expectancy Trend Examples 2016-2020

- U.S. Period Life Expectancies:

Year	2016	2017	2018	2019	2020 (no COVID adjustment, without mortality improvement)
Mortality Rates for PLE					
Age 0	5.86	5.78	5.65	5.57	**4.88**
Age 25	1.11	1.12	1.07	1.06	**1.25**
Age 45	2.62	2.65	2.65	2.68	**3.05**
Age 65	12.71	12.71	12.69	12.62	**14.87**
Age 85	81.19	81.95	81.64	80.53	**97.48**
Age 99	304.08	316.46	317.52	308.77	**355.69**
Period Life Expectancy at Birth (PLE) (Years)	78.7	78.6	78.7	78.8	**77.0**
Change from Previous Year		(0.1)	0.1	0.1	**(1.8)**

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Cohort Life Expectancy Trend Examples 2016-2020

- U.S. Cohort Life Expectancies:

Year	2016	2017	2018	2019	2020 (COVID adjustment, with mortality improvement)
Mortality Rates for CLE					
Age 0	5.86	5.78	5.65	5.57	**4.87**
Age 25	1.27	1.41	1.40	1.38	**1.59**
Age 45	2.14	2.31	2.37	2.40	**2.48**
Age 65	5.31	5.56	5.55	5.51	**5.74**
Age 85	37.77	37.85	36.51	36.01	**38.22**
Age 99	249.21	250.21	243.23	236.53	**240.07**
Cohort Life Expectancy at Birth (CLE) (Years)	84.5	84.1	84.2	84.3	**83.6**
Change from Previous Year		(0.4)	0.1	0.1	**(0.7)**

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Further Research

- CLE calculations allow changes in annual statistics to be able to be decomposed into two distinct components:
  - How much of the change is due to current year mortality levels, and
  - How much of the change is due to the average change in mortality improvement that has been seen in recent years

- Build further past trends
  - What assumption for the long-term mortality improvement target best estimates actual observed life expectancies?
  - CLE calculations at a typical retirement age
  - Doing the similar calculations at attained age 65 would provide a more realistic look forward to what retirees might actually expect in terms of future lifetime

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Questions and Feedback

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@rdalehall
https://www.linkedin.com/in/rdalehall/
dhall@soa.org


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