Statistical Aspects of the Possible Convergence of Female and Male Mortality

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Background

* female life expectancy has nearly universally been higher than male life expectancy.

* Sven Wicksell (1926): mortality decreased faster in young ages, but in the oldest hardly at all. Survival curve becomes rectangular, with max life expectancy 70.

* rectangularization has NOT happened (actual 81).

* hypothesis: women and men share a similar environment; education; labor force participation more similar; family roles; and life style factors such as leisure activities, nutrition, smoking, or alcohol abuse. So, mortalities should also converge.

* BUT, Pascal Whelpton thought this already in the 1940s.

* AGING: concentrate on survival to 65 and expected years in ages 65+

Life Expectancies at 65 Generally Increase



Figure 1: Average Life Expectancies at 65 for Females and Males, in 1959-2009, in European Regions.

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Mortality Data (HMD) from 23 Countries of Europe

1. Nordic Countries \checkmark

Denmark (1835-2012), Finland (1878-2014), Norway (1846-2009), Sweden (1751-2012)

2. Atlantic Countries

Belgium (1841-2009), Ireland (1950-2010), the Netherlands (1850-2010), United Kingdom (1841-2011)

3. Mediterranean Countries \checkmark

France (1816-2010), Italy (1872-2010), Portugal (1940-2010), Spain (1908-2010)

4. Central Europe

Austria (1947-2010), East and West Germany (1956-2012), Switzerland (1876-2012)

5. Baltic Countries √

Estonia (1959-2012), Latvia (1959-2012), Lithuania (1959-2012), Poland (1958-2010)

6. Eastern Europe

Czech Republic (1950-2012), Slovakia (1950-2010), Hungary (1950-2010)

Survival from Birth to Age 65 Nordic



Figure 2: Ratio of Male Survival Probability to Female Survival Probability, from Birth to Age 65, in Nordic Countries.

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Survival from Birth to Age 65 Mediterranean



Figure 3: Ratio of Male Survival Probability to Female Survival Probability, from Birth to Age 65, in Mediterranean Countries.

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Survival from Birth to Age 65 Baltic



Figure 4: Ratio of Male Survival Probability to Female Survival Probability, from Birth to Age 65, in Baltic Countries.

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Expected Years in Ages 65-99 Nordic



Figure 5: Ratio of Expected Years of Life in Ages 65-99, Given Survival to Age 65, in Nordic Countries.

Expected Years in Ages 65-99 Mediterranean



Figure 6: Ratio of Expected Years of Life in Ages 65-99, Given Survival to Age 65, in Mediterranean Countries.

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Expected Years in Ages 65-99 Baltic



Figure 7: Ratio of Expected Years of Life in Ages 65-99, Given Survival to Age 65, in Baltic Countries.

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Countries Are Divided, Around 2010



Figure 8: Ratio of Expected Years of Life in Ages 65-99, as a Function of the Ratio of Probabilities of Surviving to 65.

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Possible Connection to Political Divisions

From history of male-female divergence, we have three groups:

(1) **Former Socialist**: Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary;

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(2) **Egalitarian**: Denmark, Norway, Sweden, Ireland, the Netherlands;

(3) **Traditional**: Finland, Belgium, the U.K., France, Italy, Portugal, Spain, Austria, East-Germany, West-Germany, Switzerland, Czech Republic.

Esping-Andersen,G (1990): (2) = 'Social Democratic', (3) = 'Corporatist'

Average Group Paths



Figure 9: Ratio of Expected Years of Life in Ages 65-99, and Ratio of the Probability of Surviving to 65, in 2009, and the Path to This Observation Since 1959, Average Values For Three Groups of Countries

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Bilinear Modeling of Normal Scores: Age-Effects



Figure 10: Separately Estimated Age Effects, and Jointly Estimated Common Effect, Finland 1951-2014.

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Bilinear Modeling of Normal Scores: Period Effects



Figure 11: Period Effects of Females and Males, and Their Average, Finland 1951-2014.

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Is Difference in Period Effects Stationary?



Figure 12: Half-Difference in Period Effects of Females and Males, Finland 1951-2014.

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Estimating Probability of Convergence

(1) A priori stationarity ($\phi \in [0, 1)$) and on-stationarity ($\phi = 1$) equally likely.

(2) Uniform or Triangular prior for first autocorrelation $\phi \in [0, 1)$.

Then, Bayes Factors are $BF_U = 0.427$, and $BF_{Tri} = 0.782$, Probabilities of convergence are $P_U = 0.30$ and $P_{Tri} = 0.44$. Sweden: $P_U = 0.32$, $P_{Tri} = 0.47$.

All posterior probabilities < 0.5!

Interpretation: data from 1951-2014 provide only **weak evidence of convergence** for Finland.

Other arguments or data are needed for stronger support of the hypothesis of convergence.