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Scenarios as if integrated assessment mattered: demographics

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Approach

- Context: risk communication
  - How do we create scenarios that will be admitted into the decision set?
  - Show simple model that addresses major areas where I think progress is necessary: demographics, per capita energy consumption, energy technology
  - Address demographic issues: How to think about difficult structural issues in a probabilistic context

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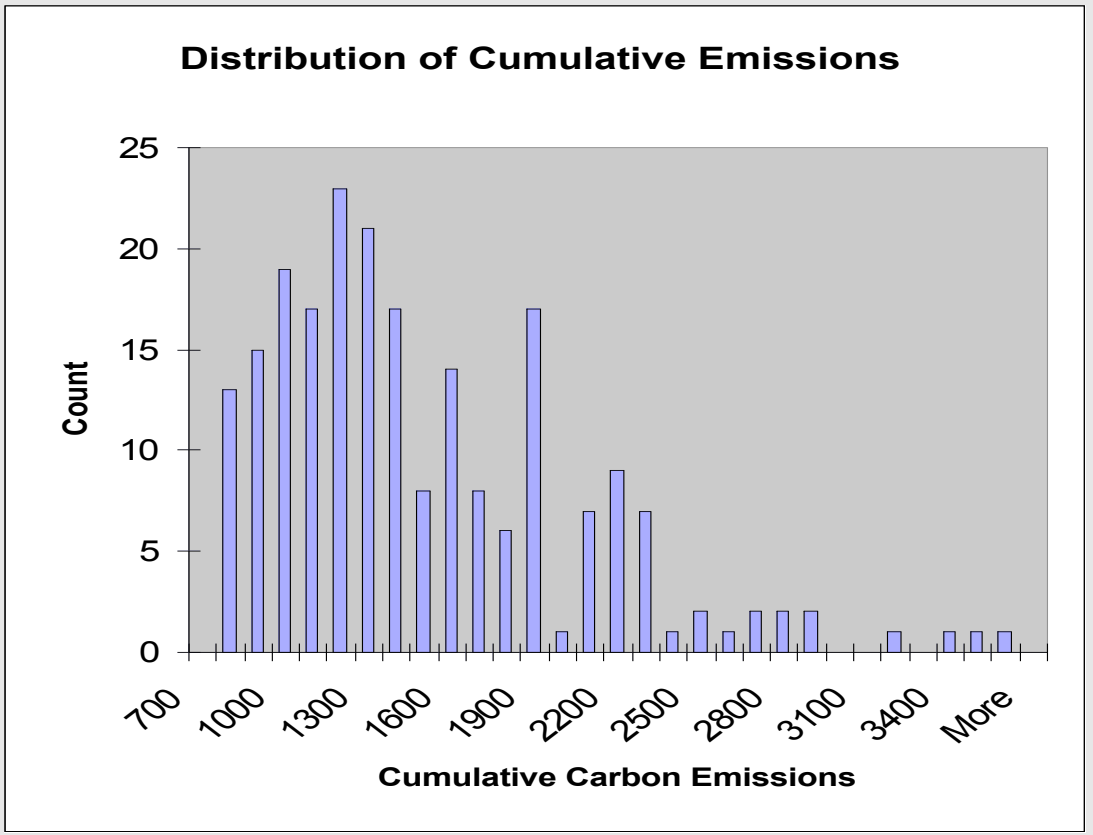
A simple emissions distribution model

- Take 6 total population trajectories
- Do the same for per capita energy consumption
- And the same for carbon per exajoule of energy
- Do a complete set of interactions, yielding perhaps 200 or so emissions trajectories for C.
- Compute cumulative emissions
- Draw a histogram of the results

Cumulative Carbon Emissions derived from the SRES Marker Scenarios (plus a couple)



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If some combinations are more likely than others …

- Adding conditional probabilities to the mix tells you the following:
- The upper bound is somewhat sensitive to changes in conditional probabilities
- The lower bound is not sensitive

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A couple of questions

- Can we make judgmental probability statements about the range?
- Can we make expert judgments about the likelihood of individual realizations?
- Are there possible changes in the components that would qualitatively change the range?

- Examine some demographic issues in detail to see if there is any help to be had in answering these questions.

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The population scenarios

- The SRES components
  - High and Low from IIASA probabilistic scenario process (since revised)
  - Median from 1996 UN median scenario
- Additional series correct for total completed fertility problem

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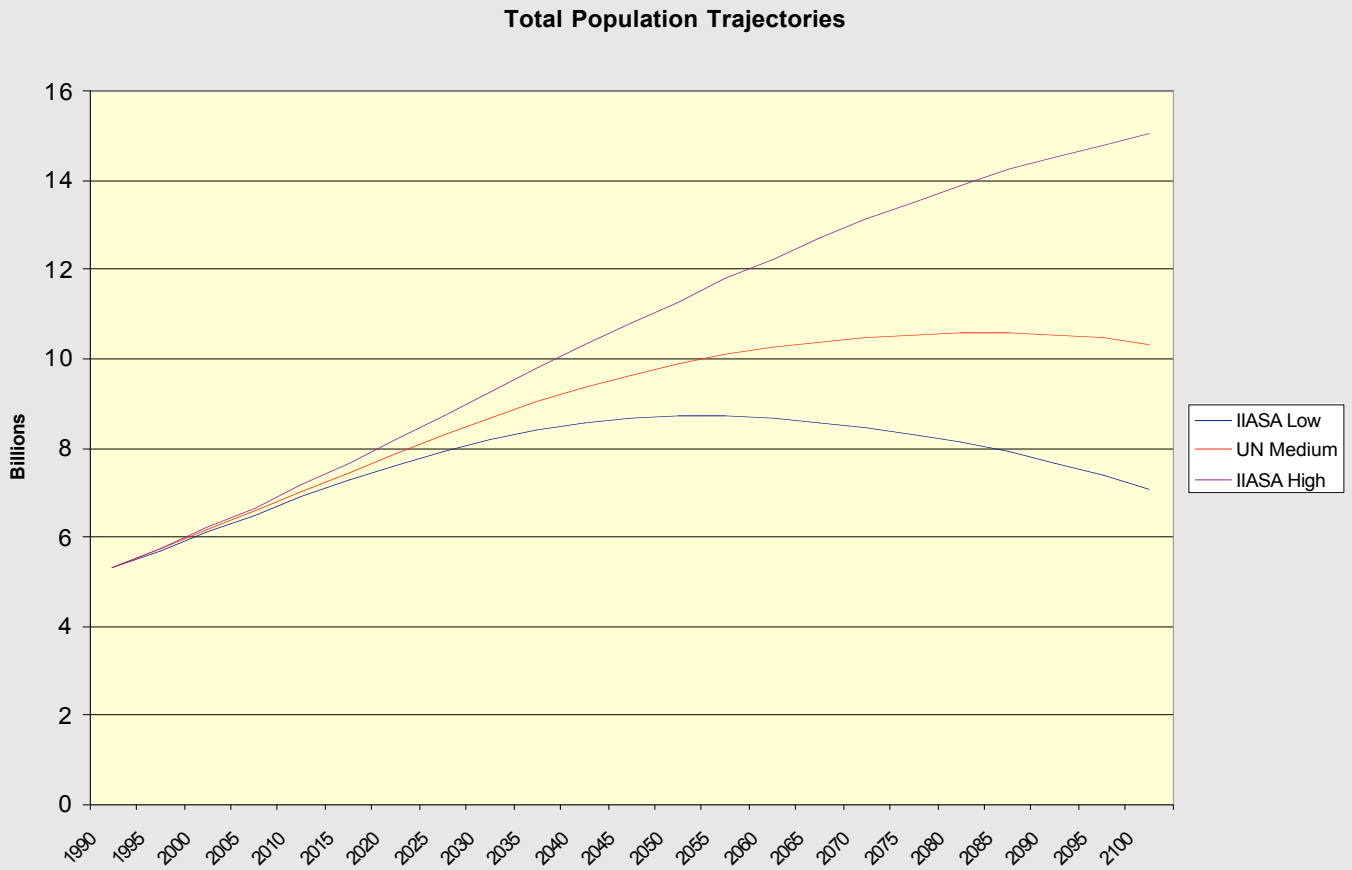
Total population diverges sharply after 2050



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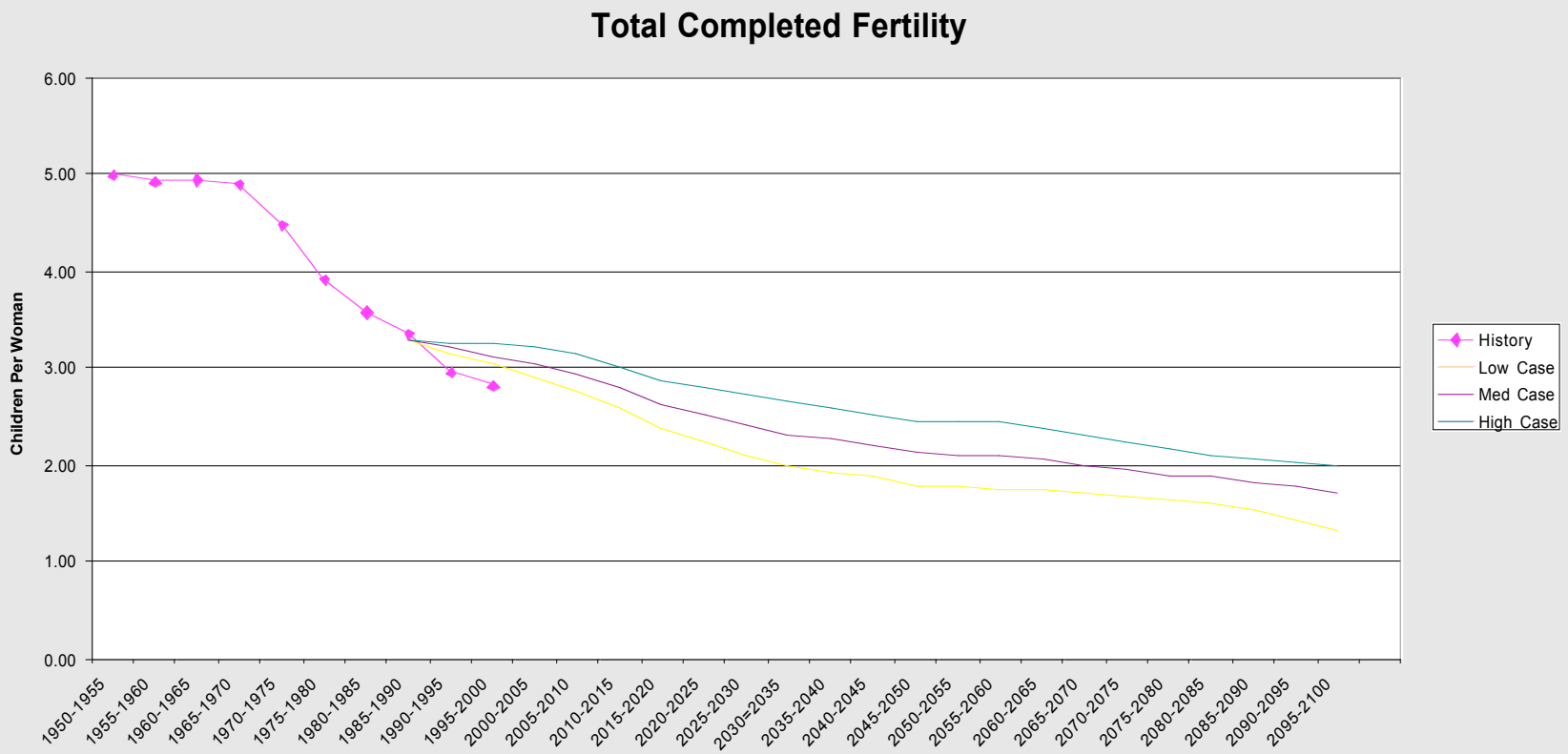
All Three Scenarios badly miss the ongoing decline in Total Completed Fertility



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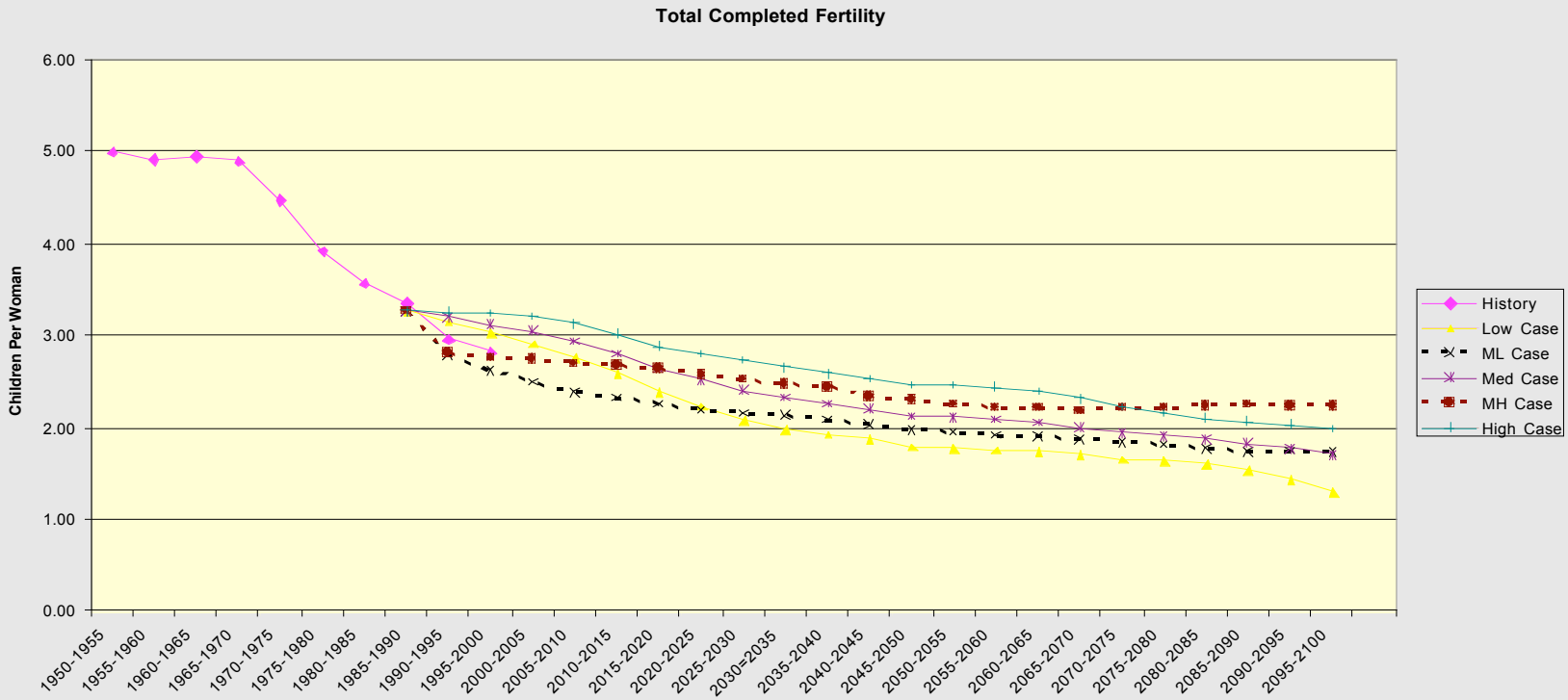
Two New TCF Series



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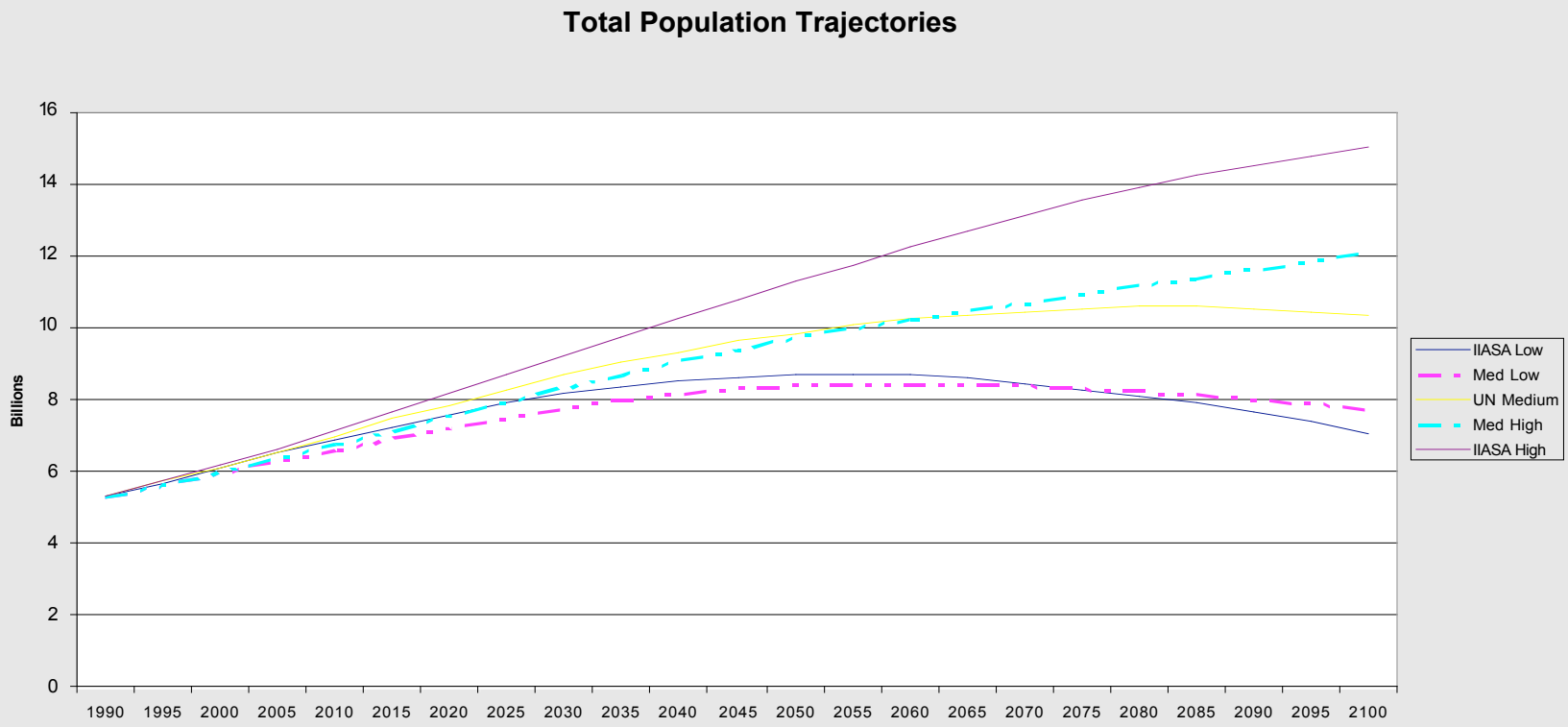
Two New Population Trajectories



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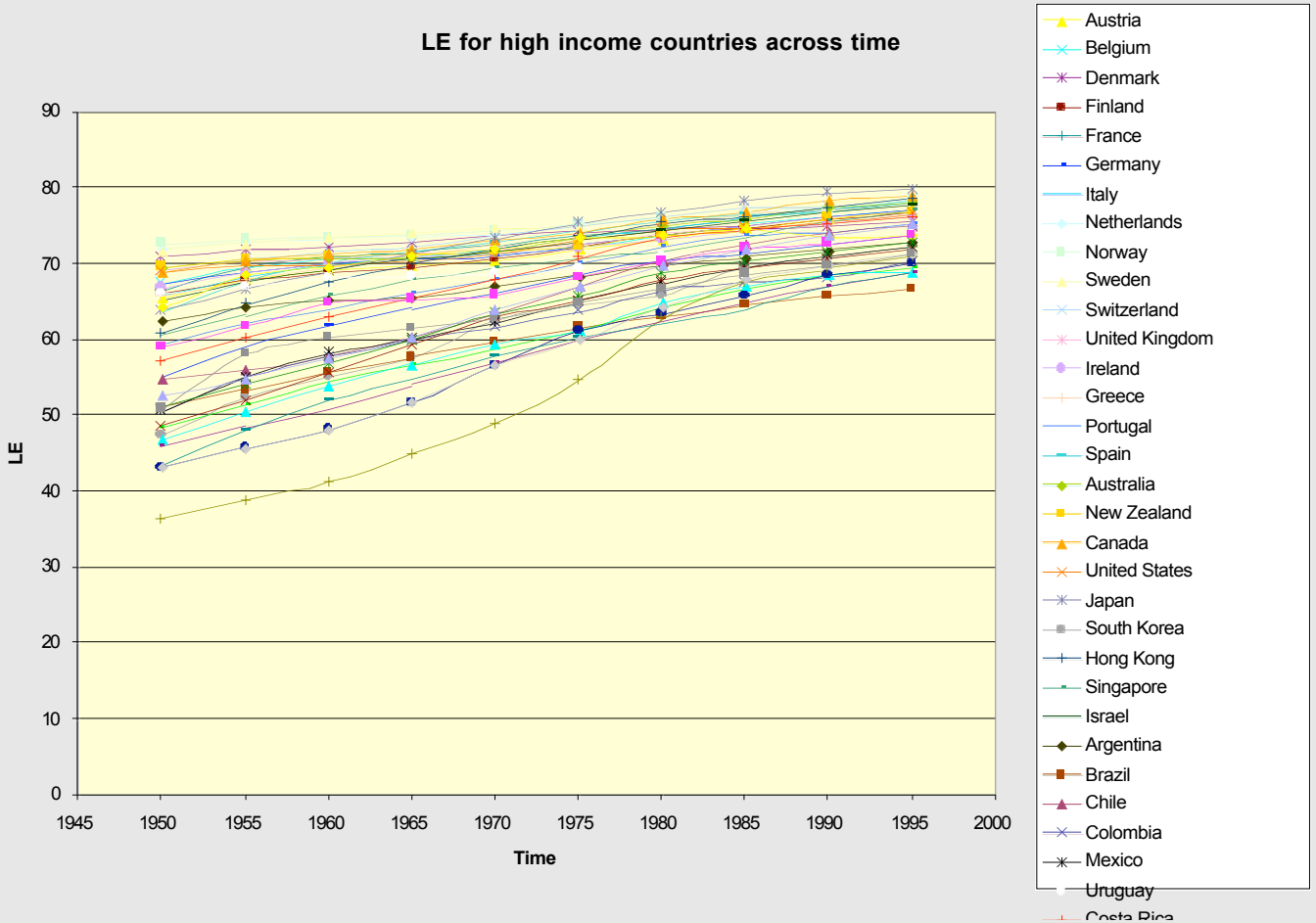
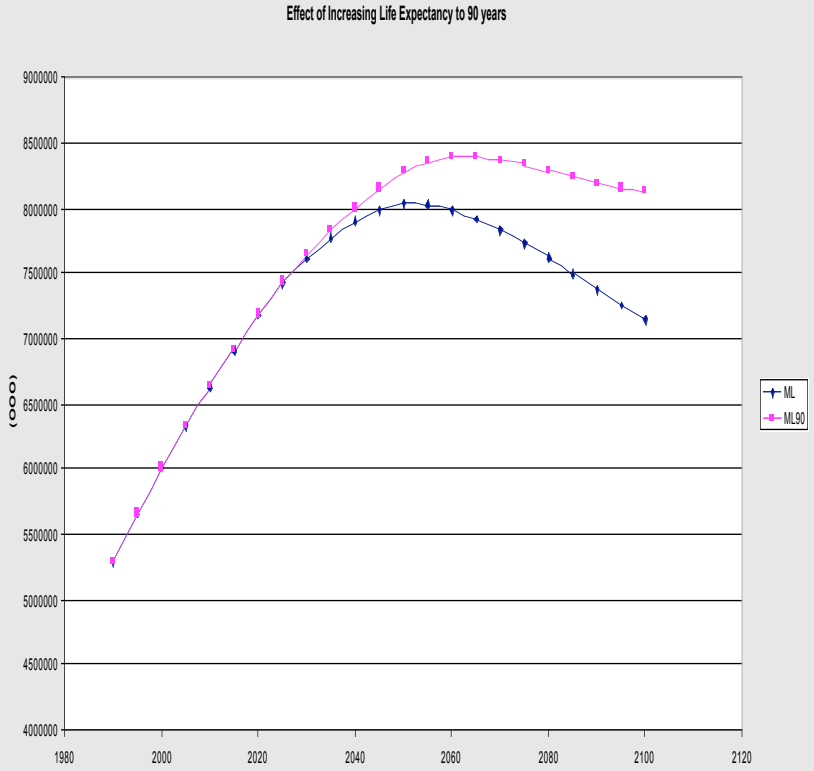
All five cases assume an asymptotic upper bound to life expectancy of 85

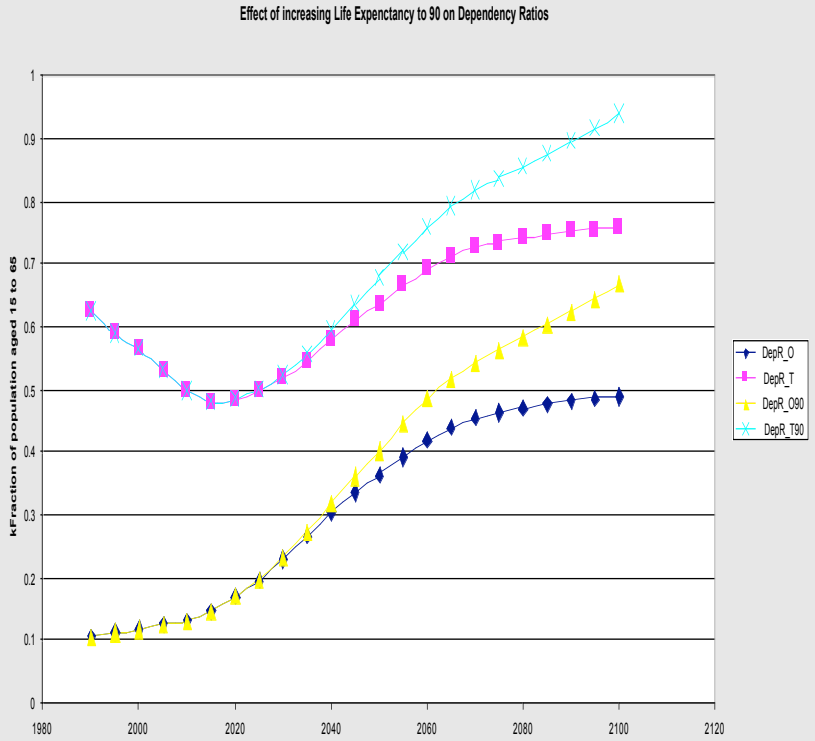
- Is this reasonable?
  - Trend in countries with Per capita income greater than $7500 in 1990 (PPP) is .18 yrs increase per year.
  - This would put Life Expectancy in Japan midway between 95 and 100 by 2100 and the US just under 95
  - Even an increase of LE to just 90 adds one billion people to the A1 scenarios by 2100.
  - Trends are not structural models so what happens if we unpack this number a bit

Life Expectancy has grown at approximately 1 year every five years for high income countries



Impact of increase in LE to 90





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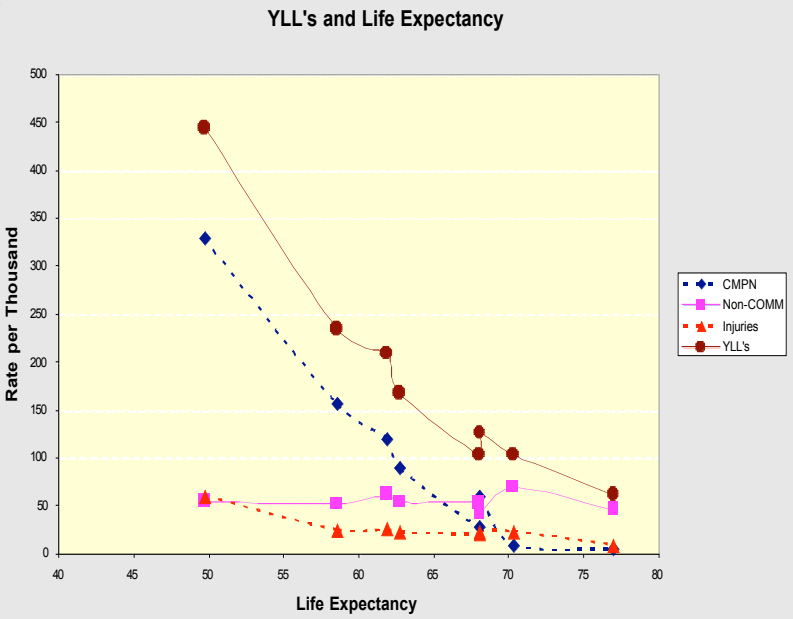
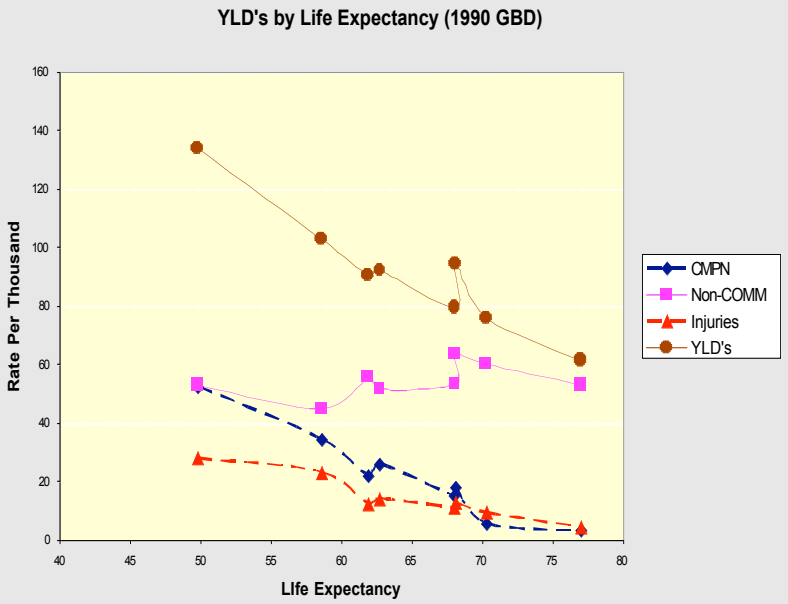
Sources of Mortality and Life Expectancy

- Use Global burden of disease data on Disability Adjusted Life Years for
  - Infectious disease, Maternal and Infant related
  - Injuries
  - Stroke, Heart, Diabetes (diseases of aging)
- Relate to life expectancy for the WHO regions (defined by differing levels of child and adult mortality

Infectious disease and Injuries are distinctly lower for high life expectancy regions





- Diseases of Aging are nearly constant as life expectancy increases. The small remaining potential for the other two argues that we are near an upper limit

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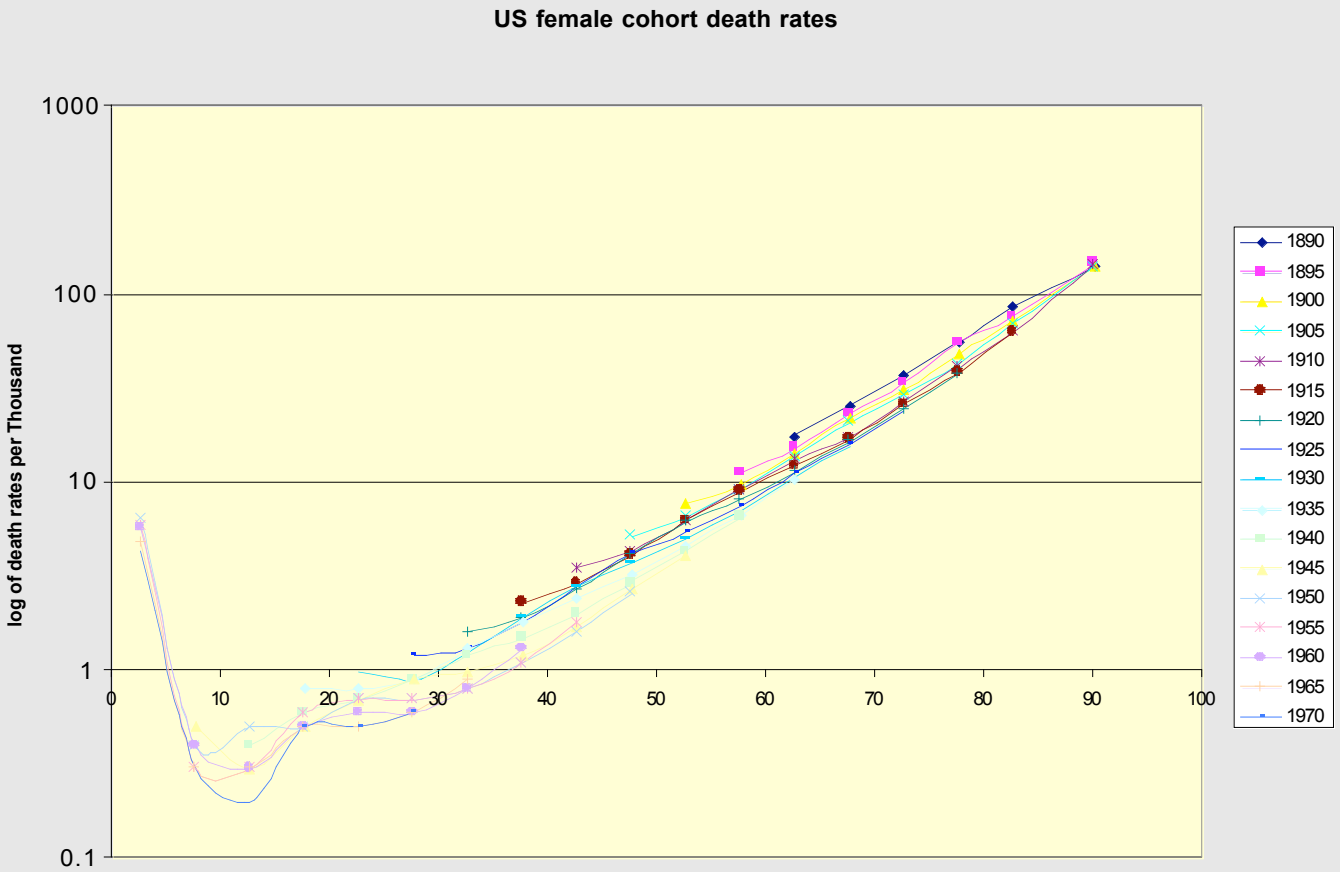
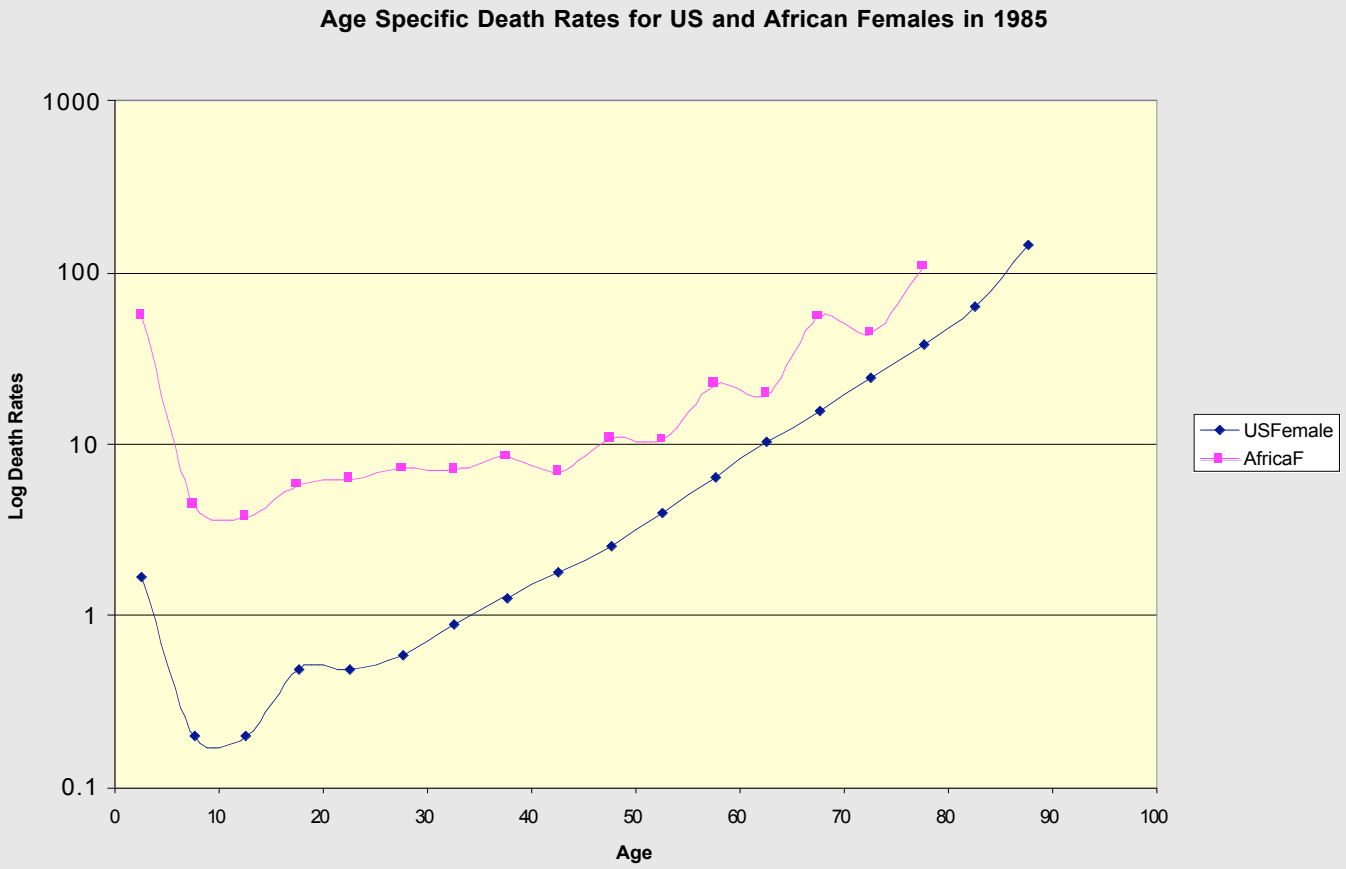
The Force of Mortality



A cross section view of the Force of Mortality



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Will medical sciences suceed in substantially reducing the force of mortality

- A positive answer implies a substantial reduction in underlying death rates across all age groups
- It implies a qualitative change in the ability of medical treatment to manage accumulated risks.
- Such a change would imply a qualitative difference in population, population age structure, the composition of economic activity, energy use, etc.
- Can reducing the force of mortality be characterized as a bifurcation

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How do we deal with bifurcations?

- Achieving the ability to fundamentally reduce the force of mortality results in a qualitatively different world.
- Does it make sense to combine this with a world in which life expectancy saturates around 85?
- Does it make sense to consider this in a conditional probability context?