An expert-based stochastic population forecast

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What I'll cover

-What is this?

-Why I did this.

-How it works.

-What the data look like.

-How to run it.

-Problems and other strategies.

-Hopes.

-Questions. (And ask questions along the way.)

What is this?

-A framework for an expert-based stochastic population projection.

-Quantifies uncertainty based on a model (rather than empirical uncertainty).

-Uses autoregressive models with random coefficients.

-Experts can plug in coefficients for uncertainty through time series models.

-Has not been used for official projections.

Why I did this

-Did stochastic population projections for Alaska a few years back, and felt a little hemmed in by the historical data.

-Given our very short collection of historical data, and having seen lots of these stochastic projections, I felt that expert knowledge could be used for making the time series models.

-I wanted to make a system to use expert knowledge for real and reasonable stochastic projections.

-Fun to think about what we don't know, and different possibilities.

How it works

-Cohort component model with first order autoregressive (AR1) models for fertility, migration and mortality.

-Instead of estimating coefficients based on historical data, I just choose parameters and ranges based on simple reasoning and other stochastic population projections.
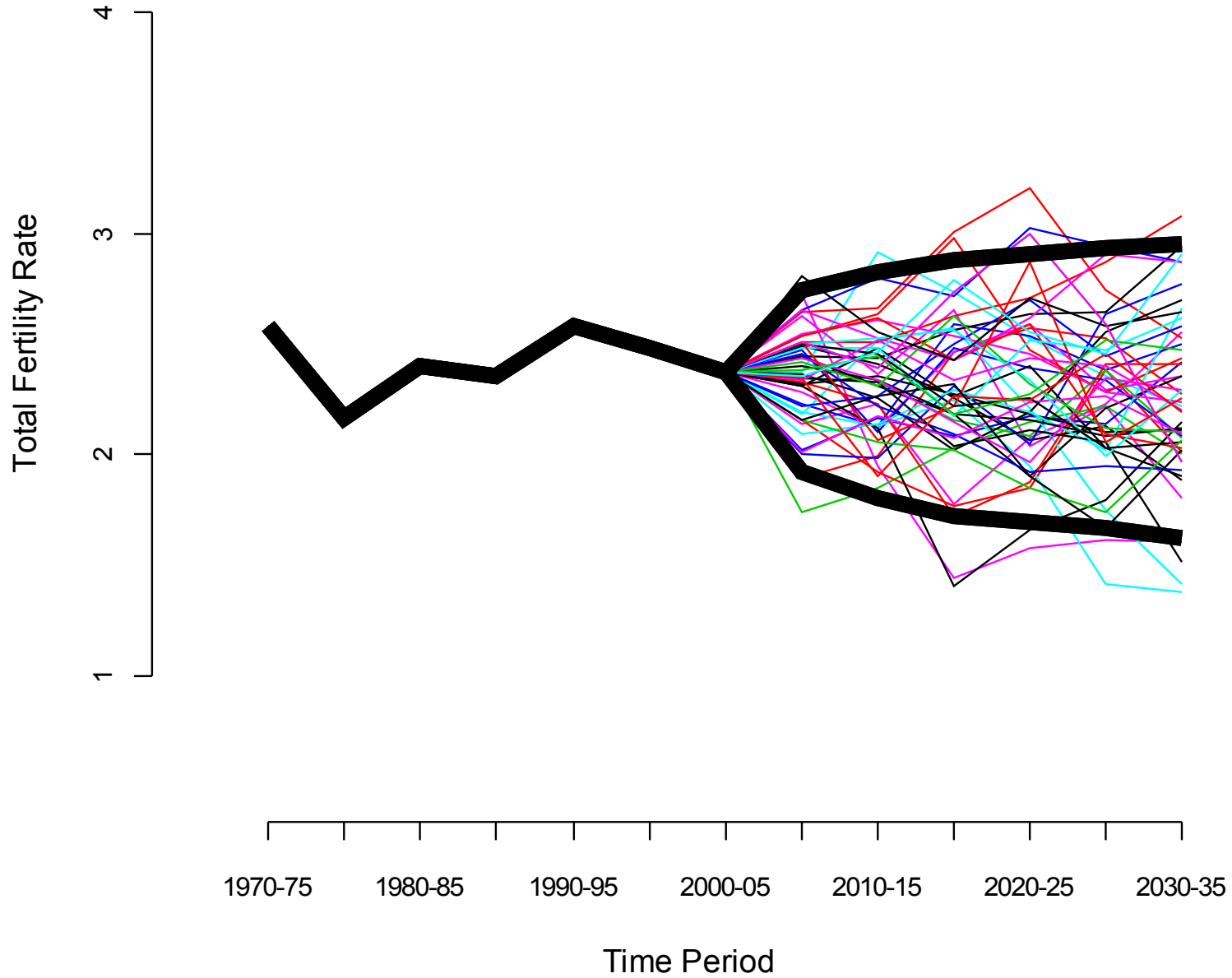
-Could also fit time series models from data.

First order autoregressive (AR1) model

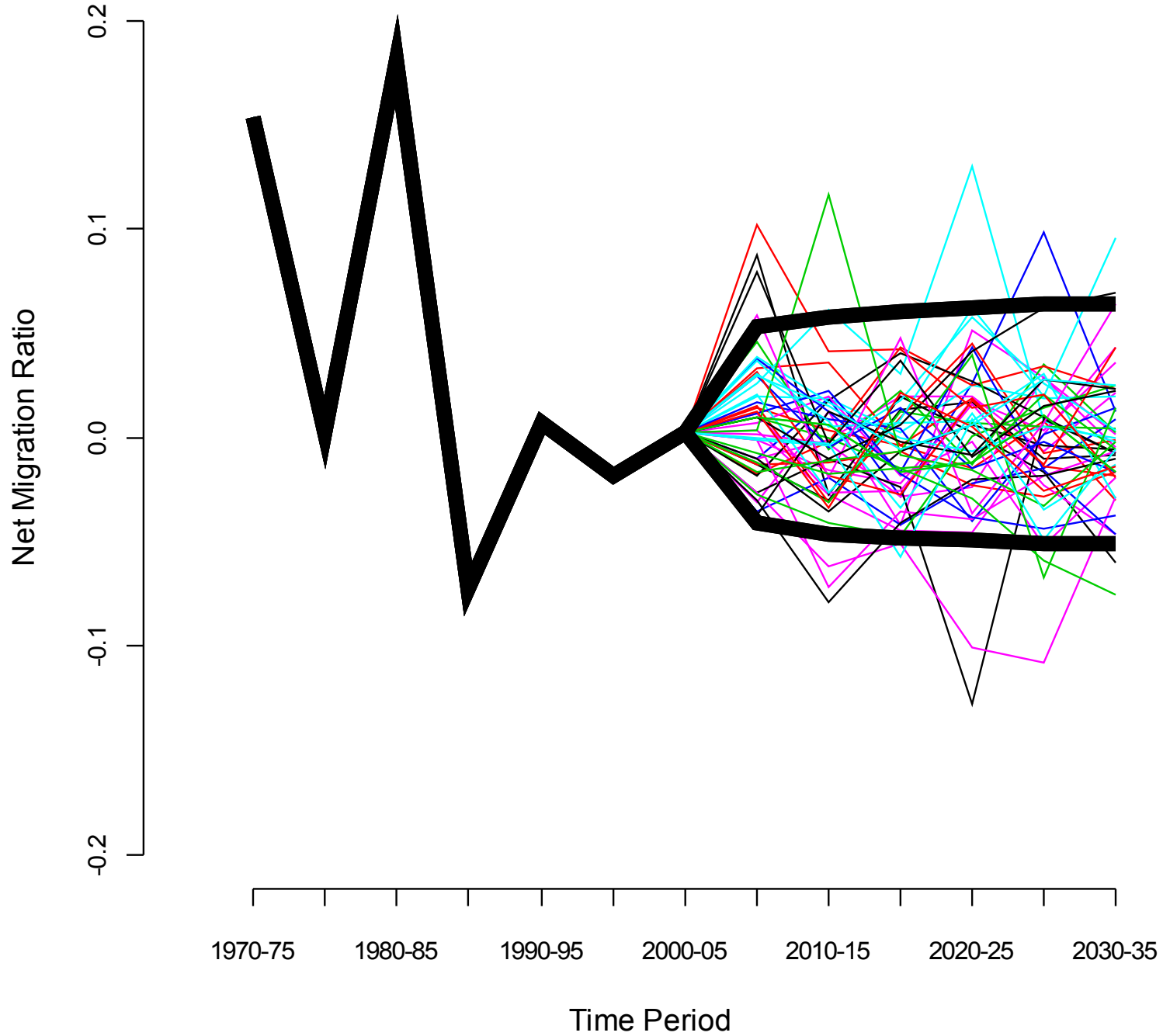$$\chi_t = \varphi \, \chi_{t-1} + c + \varepsilon$$

- Autocorrelation

- Long term trend and mean

- Noise (error)
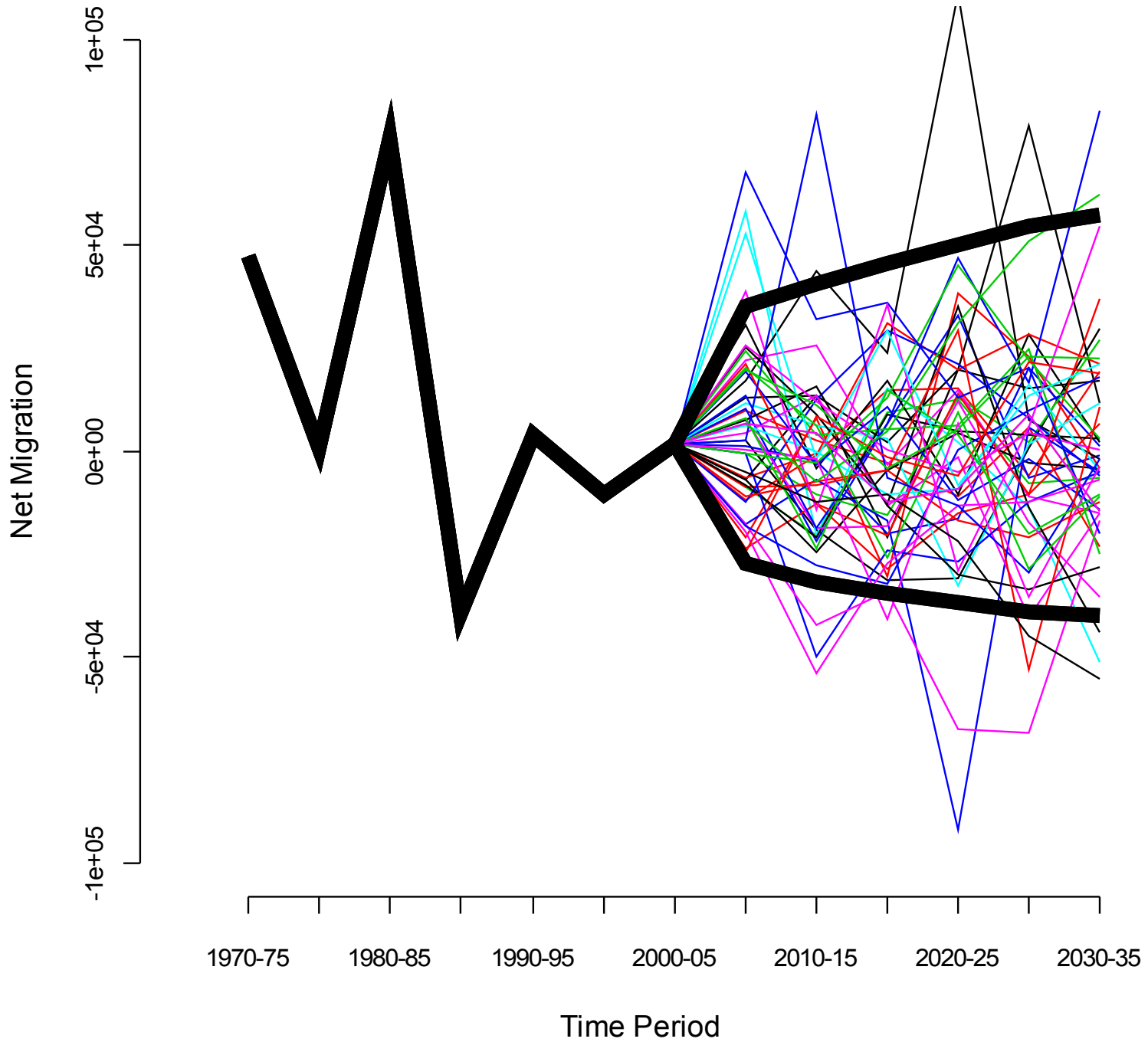
What the data look like...

TOTAL FERTILITY RATE: HISTORICAL AND 50 FORECASTS WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)

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NET MIGRATION RATIO: HISTORICAL AND 50 FORECASTS WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)
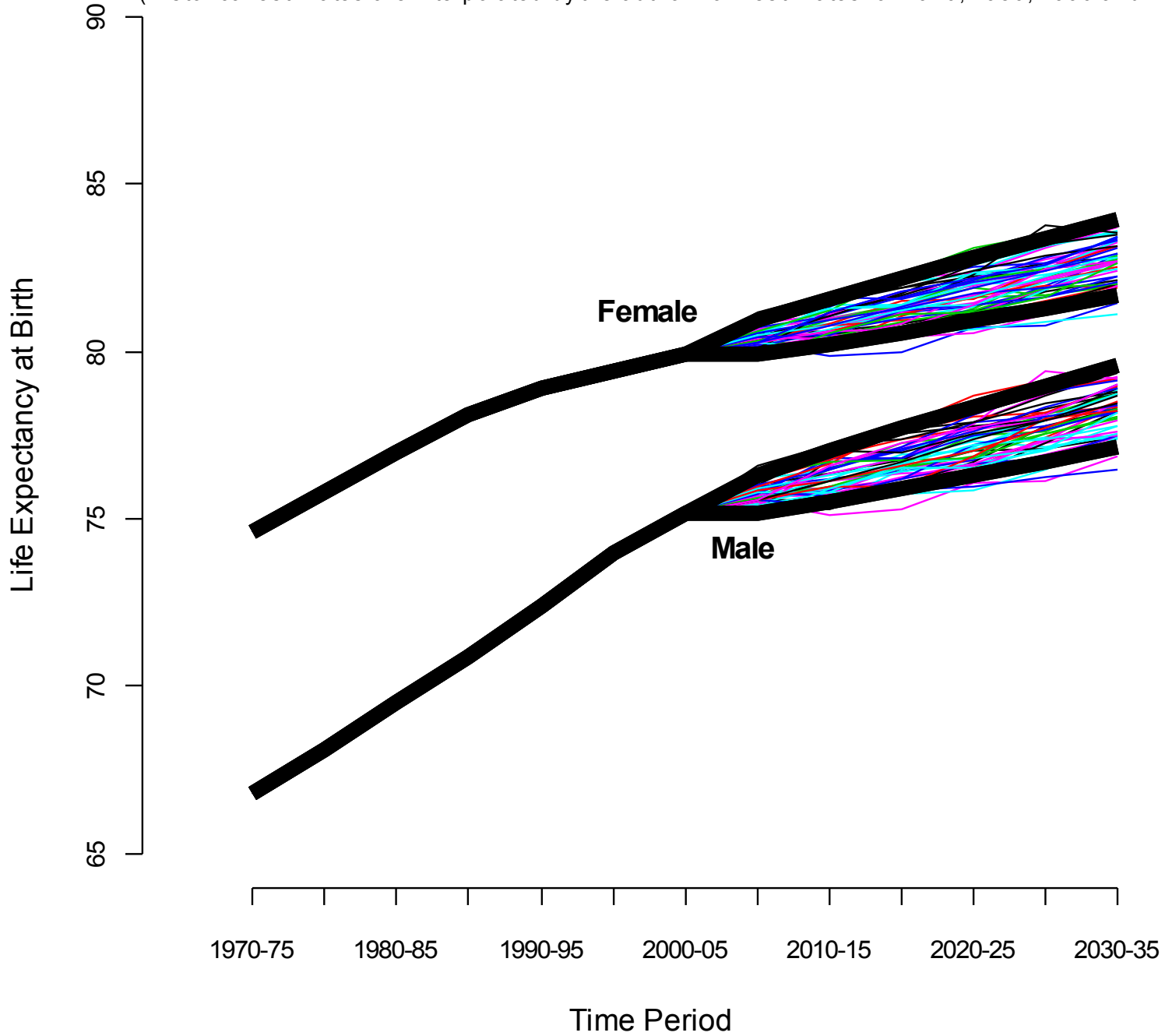
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**NET MIGRATION: HISTORICAL AND 50 FORECASTS
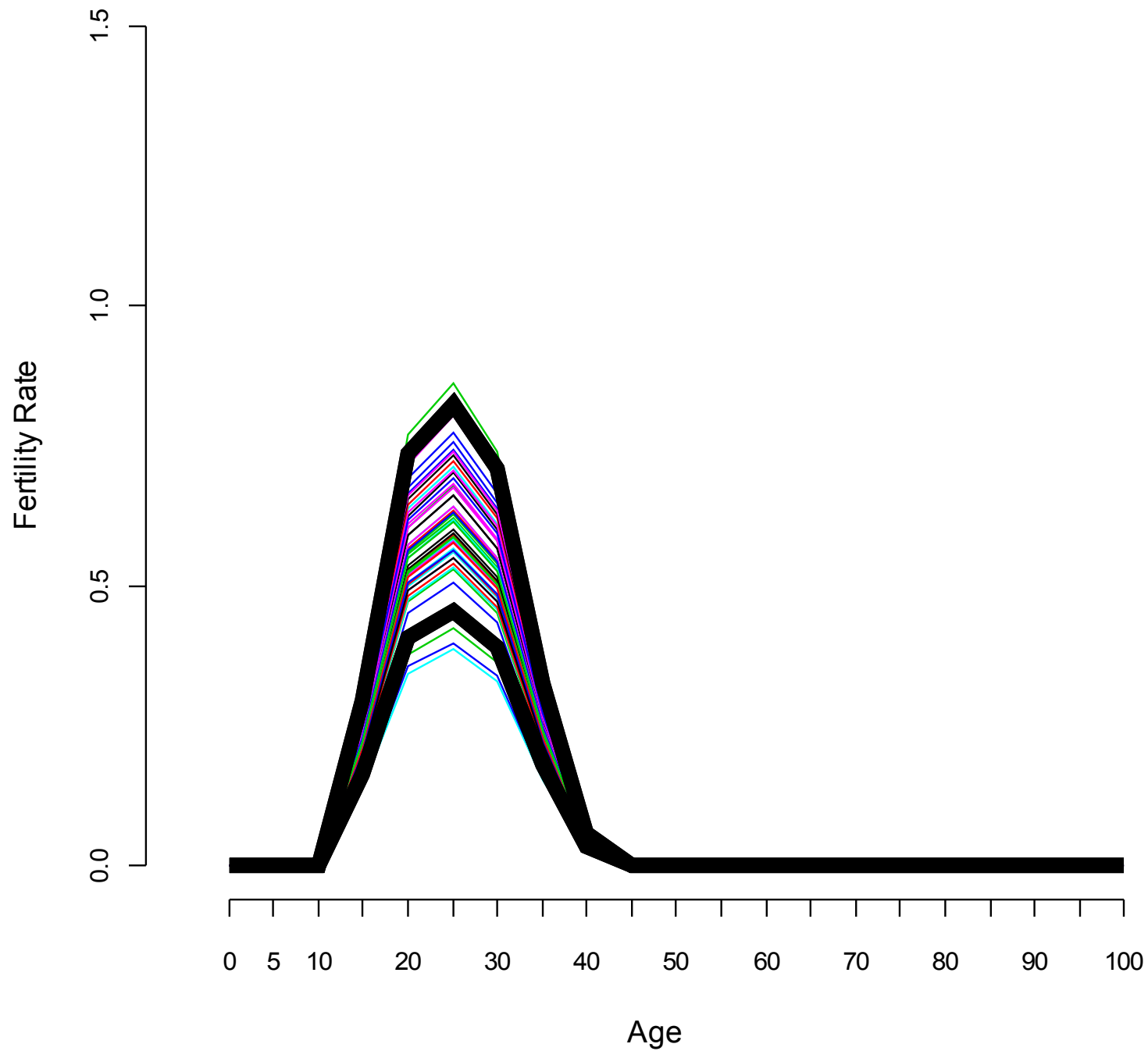WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)**

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LIFE EXPECTANCY AT BIRTH: HISTORICAL AND 50 FORECASTS
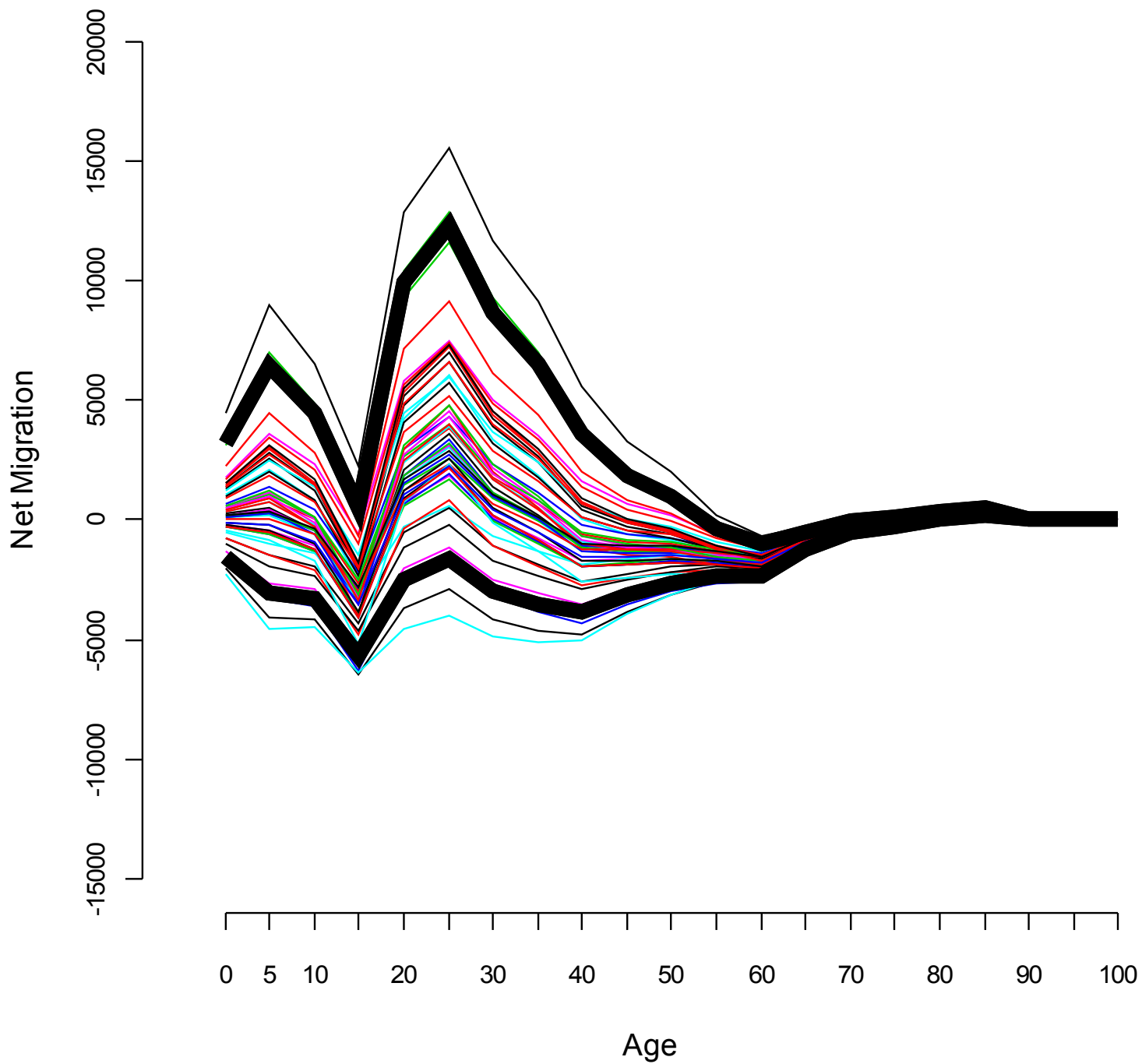## WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)

(Historical estimates are interpolated by the author from estimates for 1970, 1980, 1990 and 2000.)
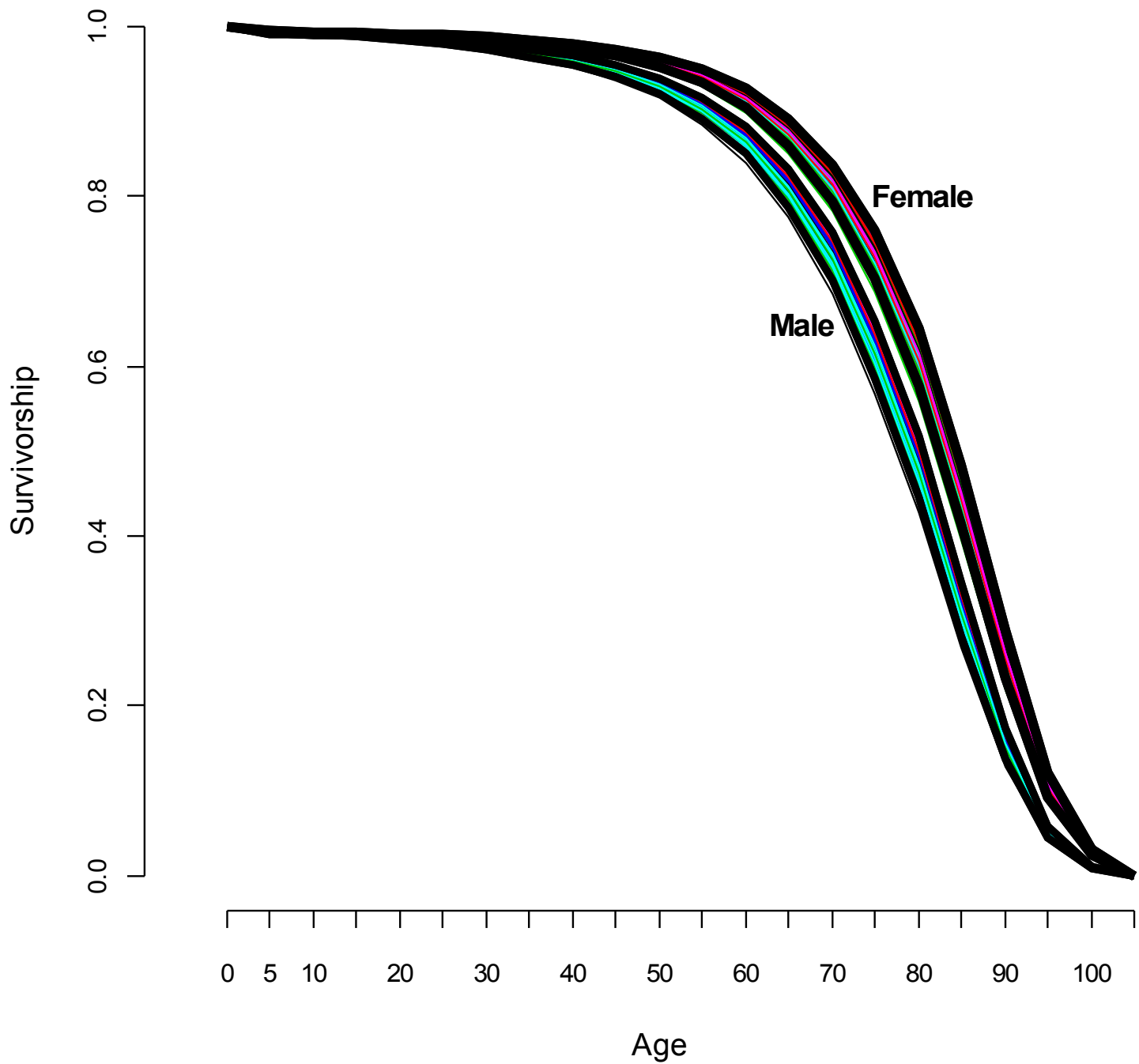

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50 AGE SPECIFIC FERTILITY RATE FORECASTS FOR 2030-2035 WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)
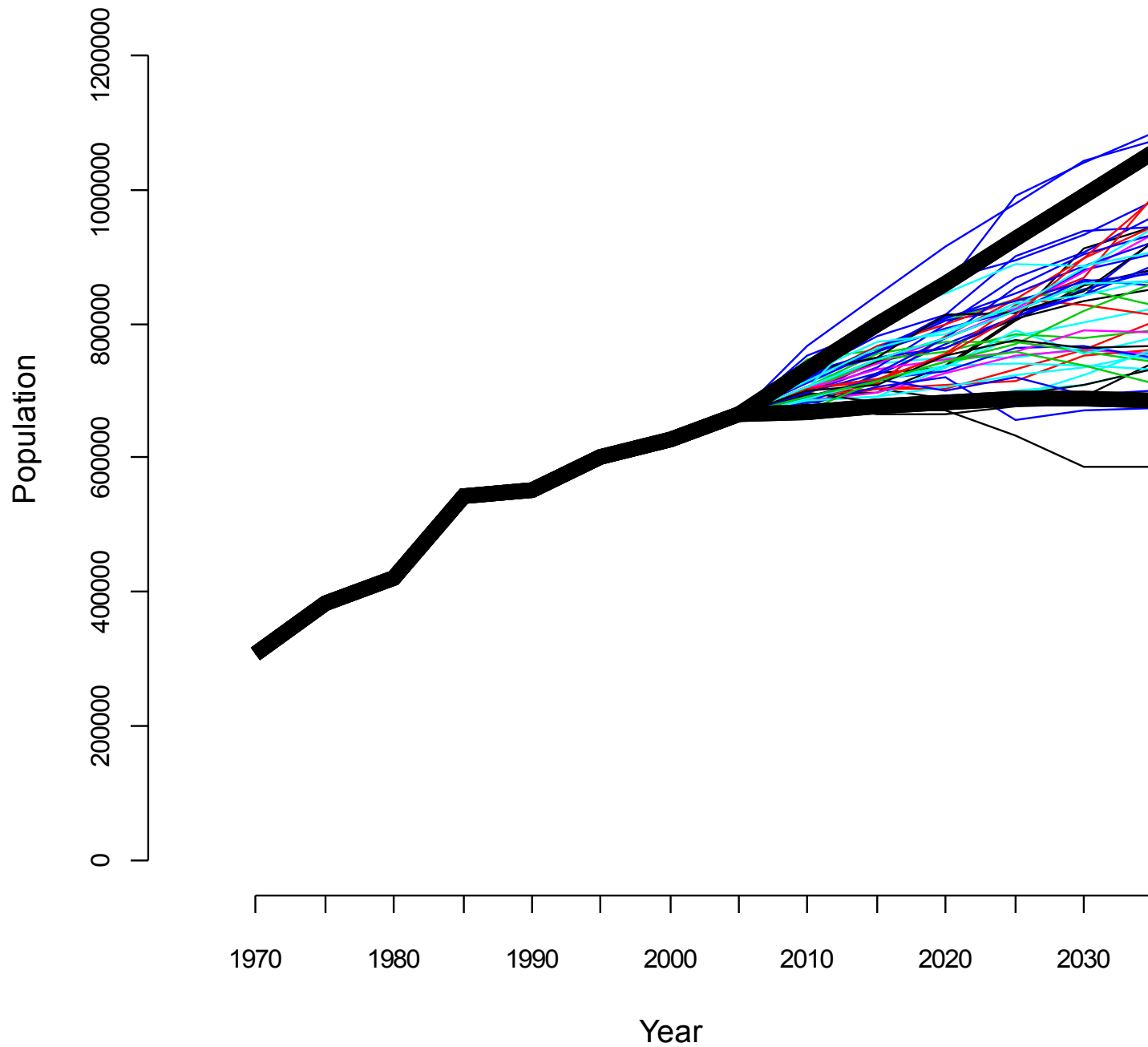
12

50 NET MIGRATION BY AGE FORECASTS FOR 2030-2035 WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)
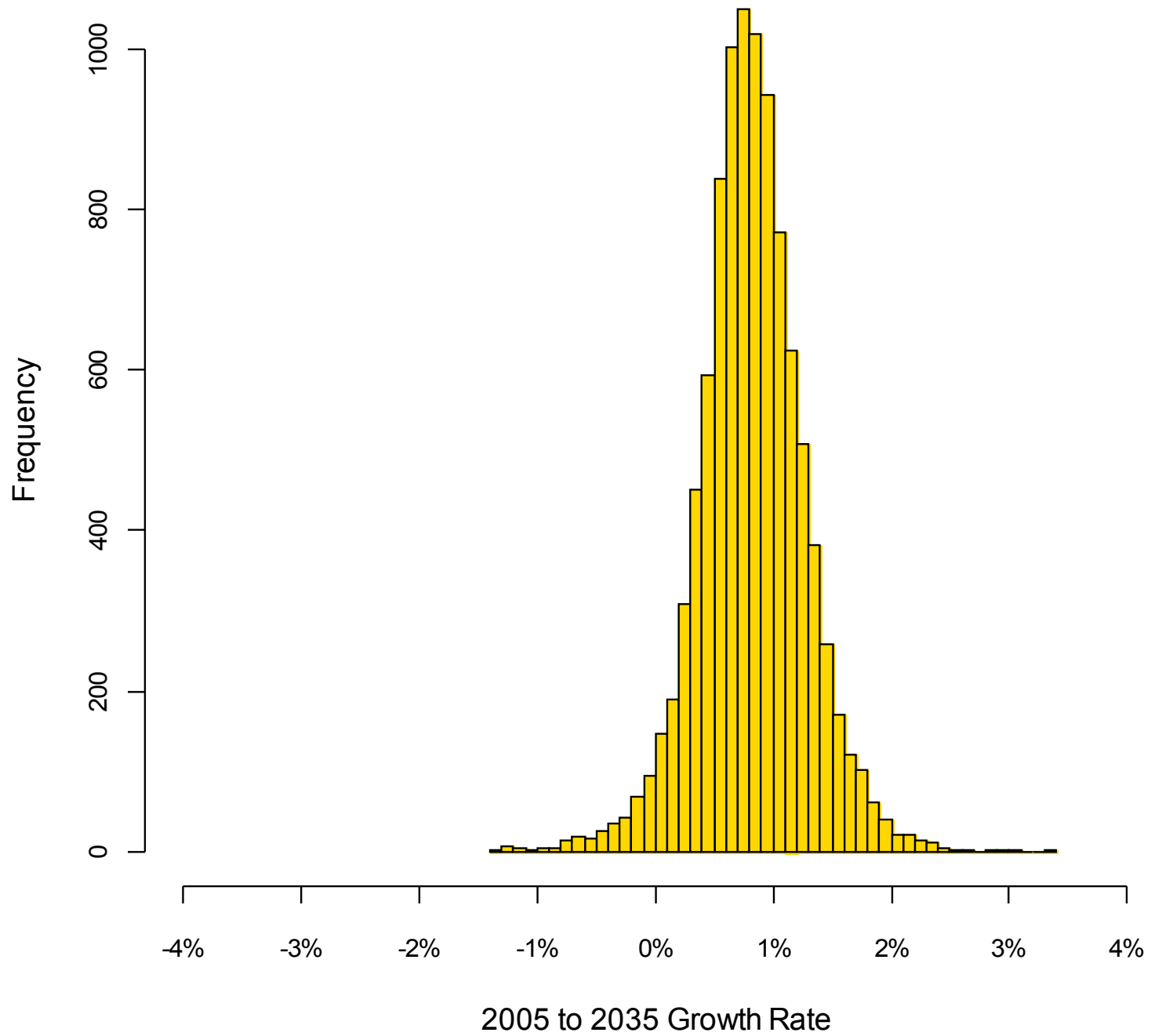
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50 PERIOD LIFE TABLE SURVIVORSHIP FORECASTS FOR 2030-2035 WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)
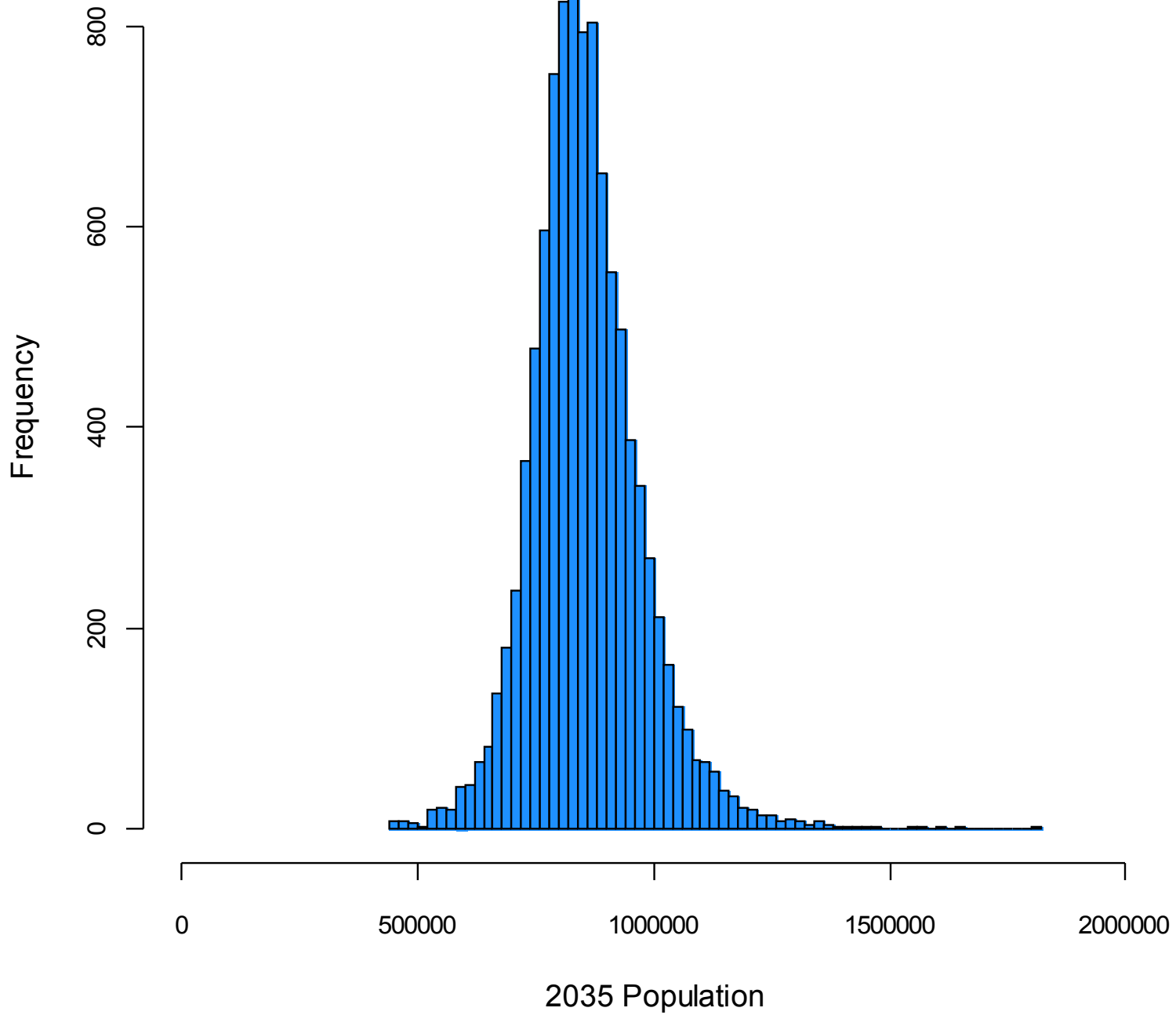
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**TOTAL POPULATION: HISTORICAL AND 50 FORECASTS
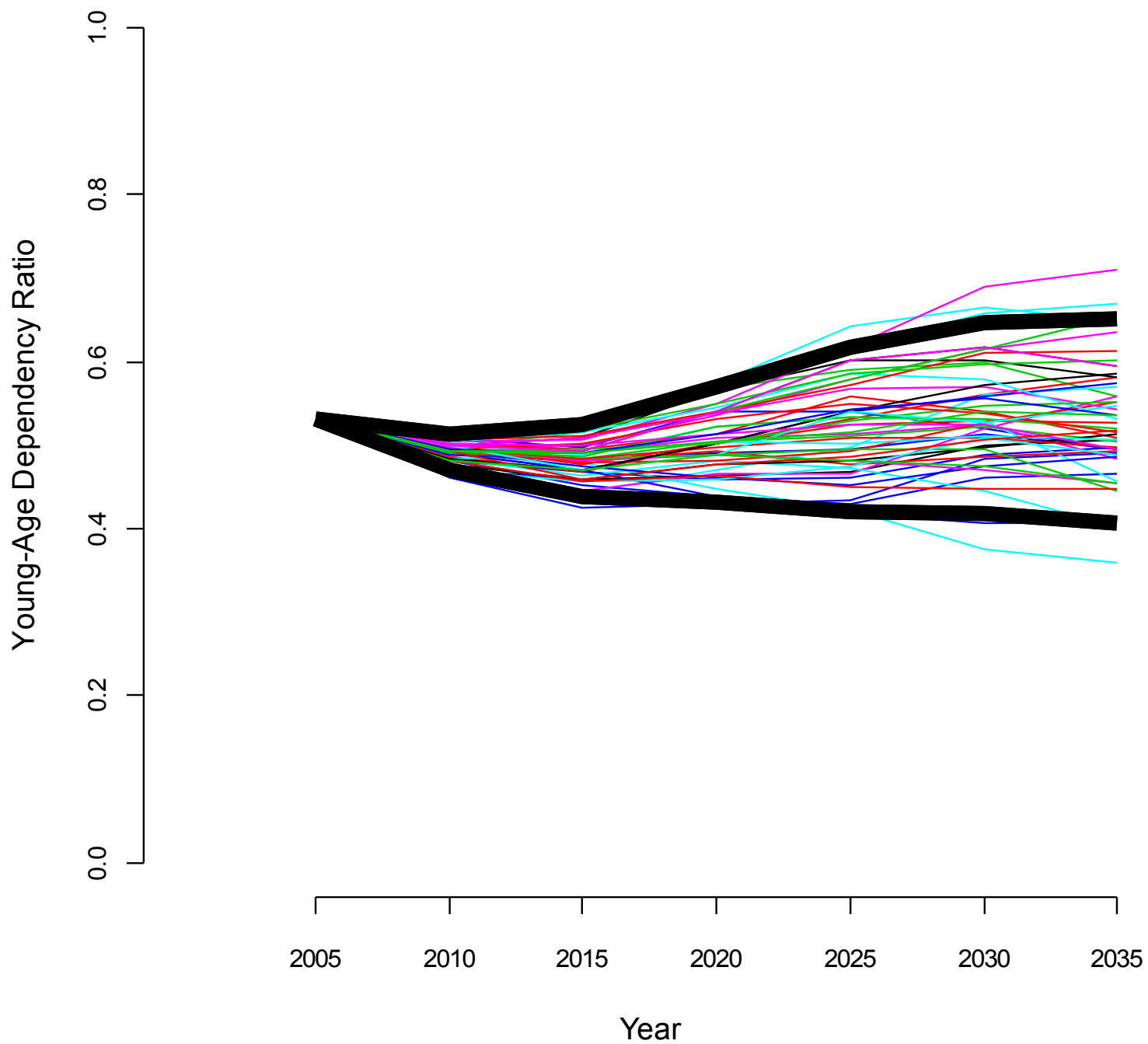WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)**

Population

Year

15

TOTAL POPULATION GROWTH RATE: HISTOGRAM
OF THE FORECASTS FOR 2005 THROUGH 2035

2005 to 2035 Growth Rate

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TOTAL POPULATION: HISTOGRAM OF THE FORECASTS FOR 2035
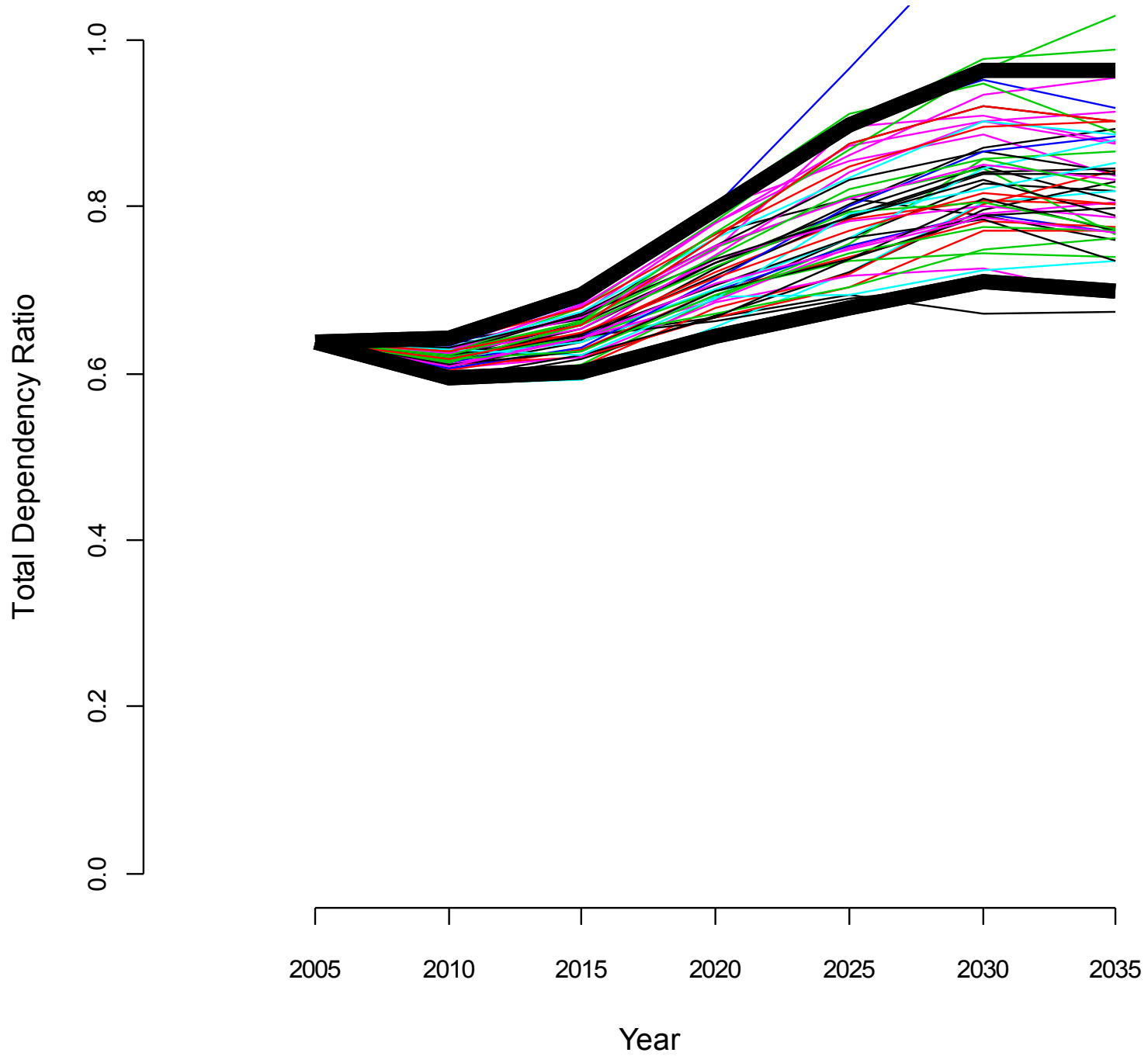
Frequency

2035 Population

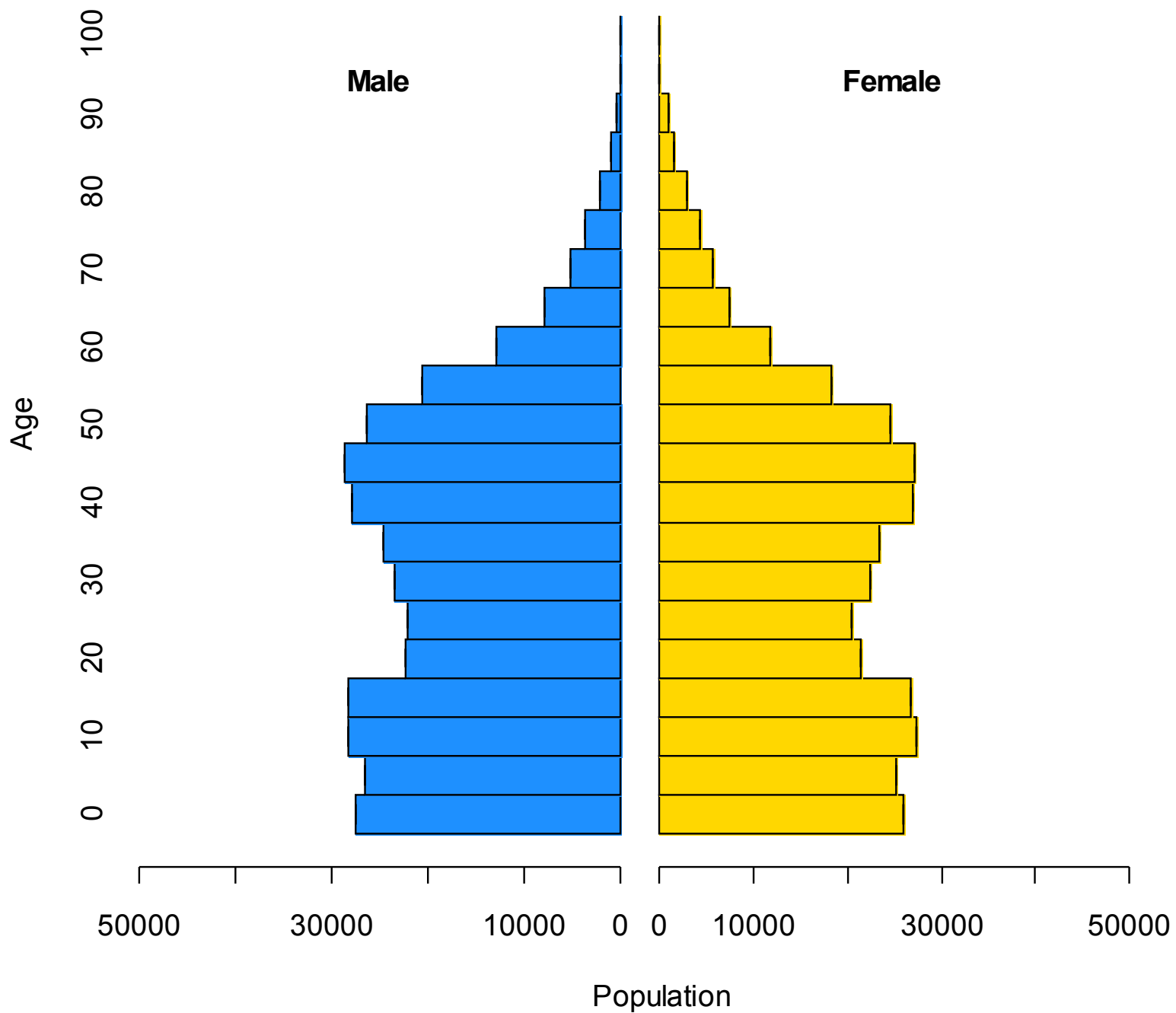**YOUNG-AGE DEPENDENCY RATIO: 50 FORECASTS WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)**

**OLD-AGE DEPENDENCY RATIO: 50 FORECASTS
WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)**
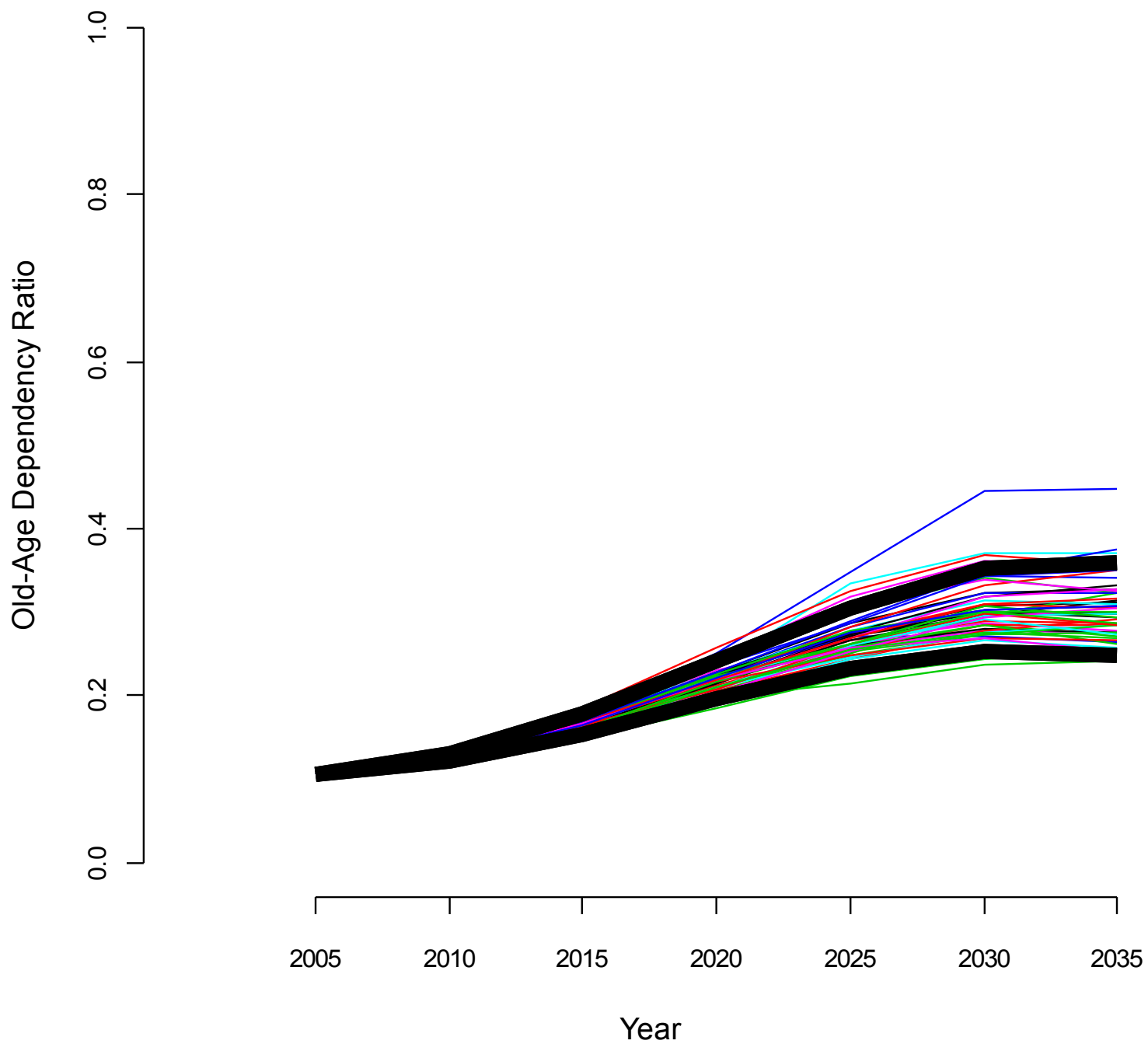
19

**TOTAL DEPENDENCY RATIO: 50 FORECASTS
WITH 90% CONFIDENCE INTERVALS (BOLD BLACK)**
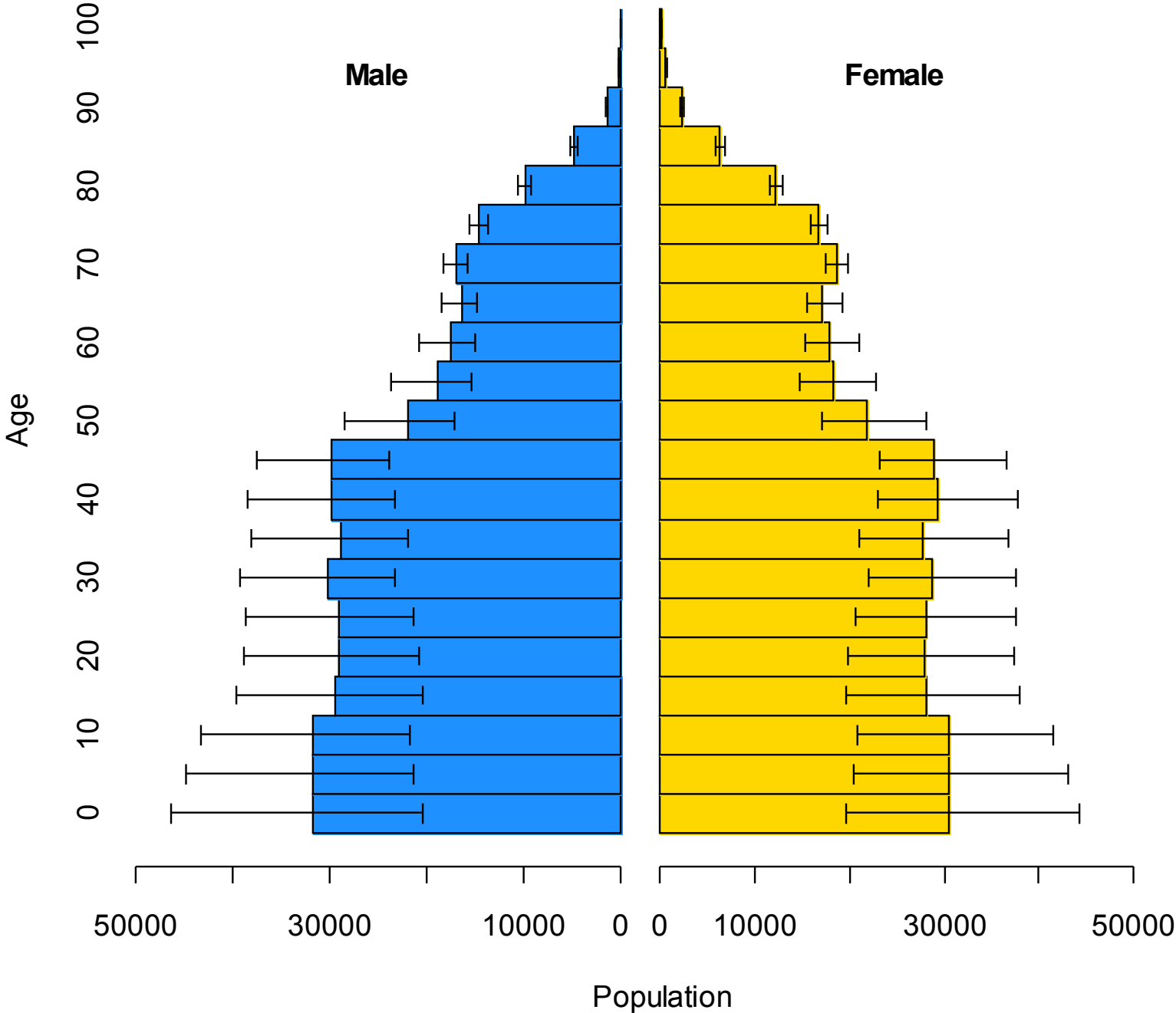
Total Dependency Ratio

Year

20

ALASKA 2005 POPULATION ESTIMATES BY AGE AND SEX

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ALASKA 2035 POPULATION FORECAST BY AGE AND SEX:
MEDIANS WITH 90% CONFIDENCE INTERVALS

How to run it...

http://www.demog.berkeley.edu/~eddieh/toolbox.html

Problems and other strategies

-Has its place, but...

-Only tells part of the uncertainty.

-Just one man's opinion.

-Hard to explain (scenarios are much easier to explain).

-I think empirical uncertainty can be more useful, particularly for sub-national projections.

Hopes

-I'll be glad if this project is instructive, and if anyone can make use of it, but...

-I think what we need most is a simple and accepted system to reliably answer the question "How good are these?" This would likely be through more comparison of projections to censuses.

-One of my big hopes is that our field will talk about projection error and uncertainty more and more; that it will get a strong sense of the size of projection uncertainty and then focus on shrinking it.

Questions?

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