SHAPING THE FUTURE: HOW EDUCATION, ECONOMY, AND POLICY INFLUENCE LIFE EXPECTANCY AND FERTILITY

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The Shifting Demographics

Fertility rates have declined significantly over the past fifty years, dropping from 3.5 children per woman in 1959 to approximately 1.8 by 2020.

Life expectancy has steadily risen from 69.9 years in 1959 to 78.9 years in 2020.

Key Questions for the Next 50 Years:

How will age demographics shift in 25–50 years?

With fertility already below replacement, how low will it go, and when?

Can immigration or policy changes reverse declining fertility?

Is life expectancy nearing a plateau?

How will shifting norms redefine "youth" and "adulthood"?

Are we prepared to support a rapidly aging population?

These questions drive the future of our economy, healthcare, and society.

Key Research Priorities:

Drivers of Demographic Change: Identify variables most strongly linked to fertility rates and life expectancy.

Reliable Forecasting (25–50 years): Build models using the best predictors to project future trends and test how adjusting key factors could change outcomes.

Testing Variables and Linear Models

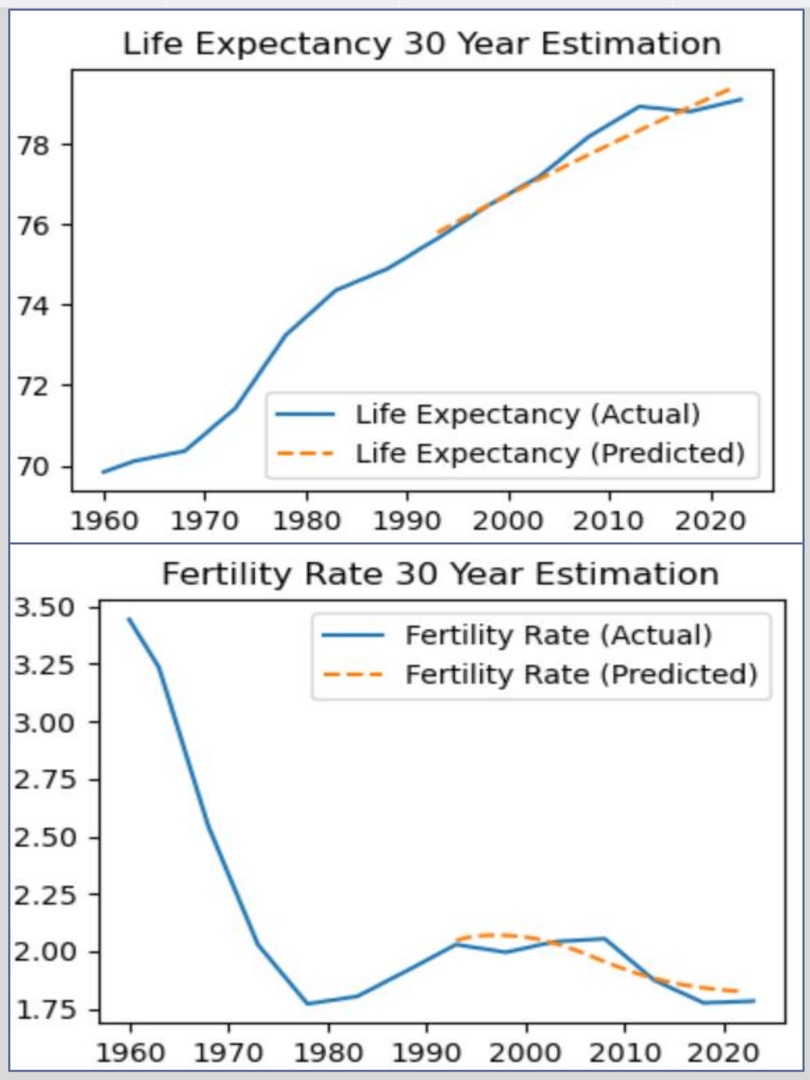
Predictor	Variables	Adj R-Squared	Optimal BIC	Ljung-box	Heteroscedasticity
Fertility Rate	Bachelors for both genders, Education rate per pupil, Marriage age of women, transformed Women in Labor Force, and Contraceptive rate Transformed	0.999	-128.722	1.012 e-8	0.000019
Life Expectancy	Bachelor's degree for both genders, Gross Domestic Product per capita, and transformed Women in the Labor Force	0.999	190.964	2.611 e-12	0.000013

Vector autoregression model

- Tracks fertility rates & life expectancy over time
- Trained on 1960-1992, tested on 1993-2022 to measure error
- Used to forecast 2023-2072 (next 50 years)

Error in Predicting Known 30 years

Predictor	Max Relative Error	Max Percentage Error	Max Absolute Error
Fertility	0.040	4.019%	0.082
Life Expectancy	0.009	0.904%	0.714



Predicting The next 50 Years

Fertility Rate:
1.75 by 2047
~1.6 by 2060s (Penn Wharton)
1.65 by 2065 (our model)

Life Expectancy:
+1.6 years (2023–2035, IHME)
+1.7 years (our model)

What this Means

VAR modeling effectively forecasts fertility & life expectancy

Residual tests: normal distribution, low autocorrelation

Some heteroscedasticity detected, but models remain robust

Provides reliable insights for public health & demographic planning

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