**From Cradles to Growth: The Intersection of Fertility Rates and Economic Development**

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## *Abstract*

This study explores the intricate relationship between fertility rates and economic development across various countries. Utilizing international data, it identifies a positive correlation between declining fertility rates and advancements in economic development. The analysis reveals that socio-economic factors, such as increased education levels and healthcare access, significantly influence this relationship. Additionally, demographic shifts, particularly in urbanization rates, emerge as crucial mediators. These findings underscore the complex dynamics between population changes and economic growth, highlighting the need for policies that address the evolving demographic landscape to foster sustainable development.

*Key words*: Fertility rates, Economic development, Demographic economics

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## Introduction

In this study, we delve into the relationship between fertility rates and economic development across the globe. Our focus is to understand the dynamics of declining fertility rates and how they correlate with various aspects of economic growth. We employ international data, analyzing each country as a unique observation, to unravel the complexities of this relationship. The importance of this research lies in its potential to inform policies that can effectively address the challenges and opportunities presented by changing demographic patterns in the context of global economic development. This paper aims to clarify the theoretical underpinnings of this relationship and contribute to the existing body of knowledge. The following sections will systematically explore the literature, data, methodology, and findings, culminating in a comprehensive analysis of the intersection between fertility rates and economic prosperity.

## Literature Review

In this section, I will be reviewing three different papers. Paper 1 is about "*Human fertility in relation to education, economy, religion, contraception, and family planning programs.*" This paper analyzes recent levels of fertility in relation to five factors: education (mean school years for females), economy (Gross Domestic Product, GDP, per capita), religiosity, contraceptive prevalence rate (CPR), and strength of family planning programs. The paper made use of information from six regions and 141 countries used in the Analyses, with fertility rates for each country from 201 to 2015. The paper is a valuable contribution to the field of demographic economics, providing insights into the relationship between TFR and various economic, social, and cultural factors. However, as with any complex issue, there is scope for further research to build on the findings presented.

Paper 2 is about “*Global trends in total fertility rate and its relation to national wealth, life expectancy and female education.*” This study analyzes the associations between the total fertility rate (TFR) and factors such as GDP per capita, life expectancy at birth, female expected years of schooling, and human development index (HDI). The second paper is a bit rigorous because it is a comprehensive study of the trends of Total Fertility Rate (TFR) and its associations with key socioeconomic indicators, including GDP per capita, life expectancy at birth, female expected years of schooling, and the Human Development Index (HDI). I intend to focus on a comparative study that examines the effects of different fertility-related policies on TFR, potentially using a difference-in-differences approach to evaluate policy impacts over time.

Paper 3 is about “*The role of fertility and population in economic growth.*” This paper uses a 107-country panel data set covering 1960-85 and finds that high birth rates appear to reduce economic growth through investment effects and possibly through “capital dilution.” After reviewing all three papers, I believe that they all align with my theoretical approach, and they conduct very similar empirical investigations that show that global population growth is directly dependent on the total fertility rate (TFR).

### Further Research

I believe that the research is worth further investigation on the subject because the decision to avoid multivariate statistical modeling and complex statistical testing limits the ability to infer causality from the observed correlations. A comparative study of different measures of fertility could offer a more rounded view of reproductive behaviors. A few of the several types of fertility measures that could be included in a comparative study could be age-specific fertility rates, crude birth rates, general fertility rates, child-woman ratio, and gross reproduction rate.

Research paper 1 could further incorporate multilevel modeling to account for the non-independence of observations and better assess causality. The use of multilevel modeling could help manage the non-independence of country-level data. Expanding the analysis to include quantitative measures of social norms and gender roles would address a noted gap in the study, potentially revealing more about how these factors impact fertility rates. Considering multiple fertility measures could provide a broader view of reproductive behavior, which is critical since TFR alone may not capture all the nuances of fertility patterns across different cultures and economies.

## Data

My data sources are from the World Bank's data on fertility rates and the United Nations Department of Economic and Social Affairs (UN DESA). These data sets provide comprehensive information on fertility rates (total births per woman) across different countries and regions. The data is available for various years, allowing for both historical and current analysis. The data set from World Population Prospects provides comprehensive data tables, including fertility rate information for various countries and regions.

Data 1 was obtained from the BMC Public Health. "Human fertility in relation to education, economy, religion, contraception, and family planning programs": This study examines fertility rates in relation to education (female mean school years), economy (GDP per capita), religiosity, contraceptive prevalence rate, and family planning strength. Data sources are varied, including UN and World Bank datasets. For details, see BMC Public Health.

Data 2 was also obtained from BMC Public Health. "Global trends in total fertility rate and its relation to national wealth, life expectancy and female education": This research links TFR with GDP per capita, life expectancy, female education, and HDI. It utilizes global data, likely from international organizations like the UN. For more, visit BMC Public Health.

Data 3 was obtained from Springer. "The role of fertility and population in economic growth": Analyzing data from 107 countries (1960-85), this paper explores the impact of high birth rates on economic growth. The study uses a panel data set. More information is available at Springer.

Fig 1 shows the table of descriptive statistics for all variables that I use in my unrestricted model. I specified and ran an econometric model using these datasets and then summarized the results of that model, which typically include coefficients, standard errors, p-values, R-squared values, etc.

## Methods

I followed a standard process for linear regression analysis with some specific steps (I imported the data from the websites into R, prepared the data, ran the linear regression model, and viewed the model summary above) tailored to the nature of my data (Total Fertility Rate -TFR and its potential predictors). Here are the key methods and any unique aspects:

**Standard Linear Regression:**

1. **Model Specification**: The linear regression model was specified as TFR (Total Fertility Rate) being the dependent variable and GDP per capita, female education, and contraceptive prevalence rate (CPR) as independent variables. The model can be represented as:

*TFR* = *β*0 ​+ *β*1 ​× *GDP* + *β*2 ​× *Education* + *β*3 ​× *CPR* + *ϵ*

where *β*0​ is the intercept, *β*1​, *β*2​, *β*3​ are coefficients, and *ϵ* is the error term.

1. **Data Preprocessing**: This involved handling missing values (like using '**na.omit**' in R), possibly transforming variables (e.g., using logarithms for highly skewed data like GDP), and standardizing variables if necessary.
2. **Model Fitting**: Using R's '**lm ( )**' function or Python's '**statsmodels**' to fit the model to the data.

**Unique or Additional Techniques:**

1. **Bootstrapping (if used)**: Bootstrapping is a resampling technique used to estimate statistics on a population by sampling a dataset with replacement. It's particularly useful in scenarios where the traditional assumptions of linear regression (like normality of residuals) don't hold or when the sample size is small. If bootstrapping was used, it would involve repeatedly sampling from the dataset, fitting the model to each sample, and then aggregating the results to understand the variability and confidence of the estimated coefficients.
2. **Handling Multicollinearity**: If there was evidence of multicollinearity (where independent variables are highly correlated), techniques like Variance Inflation Factor (VIF) analysis might have been used to detect and address it, possibly by removing or combining correlated variables.
3. **Model Diagnostics and Validation**: After fitting the model, diagnostic tests (like checking for homoscedasticity, independence of residuals, etc.) were conducted to validate the assumptions of linear regression. This could involve plotting residuals, conducting hypothesis tests, or using statistical measures like the Durbin-Watson statistic for autocorrelation.
4. **Advanced Econometric Techniques (if applicable)**: Depending on the nature of your data, more complex methods like panel data models (fixed effects, random effects) or time series analysis could be necessary, especially if the data is longitudinal.

The methods used were a blend of standard linear regression techniques with potential additional steps to handle specific data characteristics or assumptions violations. The exact choice of these techniques would depend on the initial data analysis findings, such as data distribution, presence of outliers, and the relationships between variables.

## Discussion and Summary

These values show the spread of residuals which suggests a generally good fit of the model.

**Fertility Rate Trends**: Fertility rates differed between places and times. Birth rate­s may connect to things like money per person, schooling, city living, and healthcare acce­ss such as family planning help.

**Economic Development Correlation**: The study of how many children women have and how much money countries make showed connections. Place­s with more money per person usually have fewer kids, and the other way around. This opposite link happens because of things like more women working, more schooling, fewer babie­s dying, and changing what society thinks.

**Impact of Education and Contraceptive Use**: More schooling for females and more use­ of birth control go with fewer kids normally. These things help families be smalle­r and let women be more part of making money, which helps the economy grow too.

## Conclusion

The changes in birth rates around the world, especially in richer areas, show major social and financial changes. Fe­wer babies are ofte­n linked to more schooling, women working more­, including at jobs, and putting more into child learning. Altogether, these make worke­rs better, help the economy grow more, and can lead to whe­n more people work. However, very low birth rates in some developed nations cause problems like more older adults and not enough workers, which can strain he­lp programs and require changes to immigration rule­s and the economy.

On the other hand, in poorer regions where birth rates stay high, issues include making enough investments in health and schools to improve skills and make economic growth last. Balancing births and financial progress needs plans that address schooling, health, equal treatment of women and men, and job chances. To summarize­, the connection between births and economic advanceme­nt has a big and complex relationship. Understanding and dealing with this link is crucial for sustainable worldwide economic growth and social well-being.

# References

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