Winter 12-3-2023

Is the declining birthrate really an issue for the economy?

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RSCH 202: Introduction to Research Methods

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03 December 2023

Abstract

This study aims to explore the complex implications of declining birth rates on the economy, focusing on GDP per capita as a crucial metric, and aims to uncover both potential opportunities and challenges stemming from this demographic transformation using regression analysis. Using a quantitative methodology and secondary data from OECD.stat, World Population Review, and World Bank, the study explores the relationship between declining birth rates and economic impacts. GDP per capita serves as an essential dependent variable, and it accounts for control variables such as labour force participation, literacy, and education levels, child dependence ratio, and physical capital. Past studies highlight the need to consider several variables, including labour force dynamics and educational attainment, to fully comprehend how birth rate declines impact economic prosperity. The preliminary result of the study identifies fertility as a statistically significant key independent variable for economic growth with a low r-square value. This highlights potential areas for improvements in future studies through the review of the model specification to ensure important variables have not been omitted or using a non-linear model for analysis. Understanding the economic effects of decreasing birth rates is crucial for governments and corporations because it helps guide policy decisions about economic development plans, labour market dynamics, and social security programs.

Keywords: declining birthrates, labour shortages, control variables, demographic shifts, economic impact, and GDP per capita.

Introduction

Research on the relationship between declining birthrates and economic outcomes reveals a nuanced interplay between demographic shifts and economic dynamics. Examining this complex relationship, scholars have explored the potential negative impacts, such as labour shortages, strains on social security systems, reduced consumer demand, and challenges in capital accumulation due to declining birthrates. Previous studies have underscored the delicate balance between economic growth and fertility decisions, emphasising the influence of factors like female wages, economic growth, and demographic ageing on labour markets and societal structures. A recurrent theme in this research is the strain on social security and healthcare systems as the proportion of the elderly grows relative to the working population, potentially limiting resources for other sectors. Additionally, the reduction in consumer demand due to declining populations can have implications for businesses and overall economic growth.

While the prevailing narrative highlights the challenges associated with declining birthrates, it is crucial to recognise that, when coupled with effective policies and societal adaptability, such demographic shifts can also bring about economic advantages. Peterson (2017) suggests that declining birthrates and population shifts can create opportunities for economic growth in low-income countries, fostering the emergence of new markets and avenues for innovation. When exploring the positive impacts of declining birthrates, researchers like Li & Zhao (2022) and Lee & Mason (2009) argue that a decrease in family sizes can lead to increased investment per child in terms of education and human capital. This can result in better educational outcomes, higher skill levels, and a more competitive workforce, positively affecting total factor productivity (TFP) and a country's economic competitiveness. Moreover, the decline in family sizes may empower more women to enter the workforce, potentially increasing the

overall number of workers and stimulating innovation. This perspective aligns with the findings of Bloom et al. (2007) and Mammen and Paxson (2000), who highlight the impact of female workforce participation on economic output, particularly in urbanised and developed economies.

Literature Review

Previous research in this area has shown a complex relationship between declining birth rates and economic outcomes. The interplay between demographic shifts and economic dynamics has been explored in various contexts, from high-income countries grappling with ageing populations to developing nations experiencing urbanisation. Through past research, many articles have suggested that declining birthrates will harm the economy citing potential labour shortages, strains on social security systems, reduced consumer demand, and challenges related to capital accumulation as key contributors.

In Day (2018), the delicate balance between economic growth and fertility decisions was explored by emphasising how shifts in female wages and economic growth can influence fertility rates, potentially leading to labour market imbalances and affecting gender wage dynamics. Similarly, Komine and Kabe (2009) forecast rapid demographic ageing in several Asian countries, characterised by declining birth rates and an ageing populace, which can strain societal structures, including social security systems, and lead to labour shortages. The sentiments are also echoed in Doran (2012) where a reduced labour force due to declining birthrates could potentially hinder economic growth, leading to labour shortages and wage pressures. Lastly, Peterson (2017) highlights the broader implications of these demographic changes, suggesting that slow population growth in high-income countries can exacerbate economic inequalities and pose challenges such as reduced consumer demand.

A recurring theme to the issues arising from declining birthrates is the potential strain on social security and healthcare systems as the proportion of the elderly grows relative to the working population. This demographic shift can lead to increased public expenditure on health and pensions, potentially limiting resources available for other sectors. Additionally, declining populations might result in reduced consumer demand, which can have implications for businesses and economic growth as observed in Doran (2012).

While declining birth rates in many parts of the world have often been associated with potential economic challenges, it's imperative to recognise that they can also bring about several economic advantages. By examining these nuances, it becomes evident that declining birth rates, when complemented with effective policies and societal adaptability, can offer a multitude of economic opportunities. While declining birth rates in many parts of the world have often been associated with potential economic challenges, it's imperative to recognise that they can also bring about several economic advantages. According to Peterson (2017), declining birth rates and population shifts can lead to developments and opportunities for economic growth in low-income countries. The emergence of new markets as a result of demographic trends can offer avenues for economic expansion and innovation.

Total factor productivity (TFP) is defined as an increase in output achieved through technological progress. It is a core driver of economic growth, and it reflects a country’s economic competitiveness. TFP reflects an increase in output achieved through technological progress. Human capital refers to the knowledge, skills, and health that people invest in and accumulate throughout their lives, and Li & Zhao (2022) mentioned that the increase in the birth rate has a significantly negative impact on human capital accumulation, with fewer children to educate, governments and families can invest more per child. This can lead to better educational

outcomes, higher skill levels, and a more competitive workforce. These findings are reinforced by Lee & Mason (2009) whose results suggest that human capital expenditures per child are much higher where fertility is lower, in countries such as Hungary, and Japan with total fertility rates close to 1, and in poorer countries such as Uruguay with a TFR of 2.5 and the Philippines at 3.6. This suggests that the human capital expenditure is much higher, providing a much better environment and education for the lower fertility.

A decline in family sizes may allow more women to choose or have the opportunity to enter the workforce, increasing the number of workers overall. This has the potential to greatly increase economic output and stimulate innovation (Bloom et al., 2007). Mammen and Paxson (2000) developed a U-shaped association between female involvement rates and per capita income where they deduced female participation to be low in underdeveloped economies, in urbanised areas, female participation is the lowest in middle-class nations and the rates of female participation are high amongst leading nations with big service industries and highly educated women.

The current publications emphasise the potential economic advantages of decreasing birth rates, including enhanced human capital, growth potential, and higher Total Factor Productivity (TFP). The long-term sustainability of these benefits, the flexibility of social systems, and gender dynamics in labour force participation are some of the gaps that still exist. By examining the complex relationship between dropping birth rates, successful policies, societal flexibility, and sustained economic growth, this study seeks to close these gaps. This research aims to offer policymakers and stakeholders useful insights by concentrating on gender-specific features of labour participation. This approach contributes to a more nuanced understanding of the intricate relationship between demographic shifts and economic results.

Research Question

Our research question is “Is the declining birthrate an issue for the economy?”.

Theoretical Framework

Dependent variable

When examining the potential economic impacts of declining birthrates on the economy, the measure, GDP per capita, stands out as a dependent variable. GDP per capita, which represents the economic output per person, serves as a comprehensive indicator of a country's standard of living and economic health. As birthrates decline, the potential shifts in labour market dynamics, capital availability, consumer demand, and even innovation could all manifest in changes to GDP per capita. This allows GDP per capita to become the lens through which the economic benefits or challenges of declining birthrates are viewed, providing a quantifiable metric to gauge the impacts of demographics and economic prosperity.

Key independent variables

In a study examining the economic impact of reducing birthrates, the Total Fertility Rate (TFR) emerges as a key independent variable. TFR, which measures the average number of children a woman would have of childbearing age (15 - 49 years old), provides a comprehensive indicator of birthrate trends within a population. Its significance lies in its ability to encapsulate broader demographic shifts, offering insights beyond annual birth statistics. Economically, a lower TFR may initially alleviate the burden on resources such as healthcare and education, potentially increasing per capita investment in each child. However, over time, it can lead to an ageing population, increased dependency ratios, and challenges in sustaining economic productivity and pension systems.

Control Variables

The study on the economic impact of reducing birthrates identifies several control variables such as annual labour force, life expectancy, tertiary industries, female employment rate and literacy rates. The annual labour force is a critical control variable, as it directly impacts economic productivity and output. Life expectancy serves as another vital control variable, influencing the population's age structure and, consequently, economic factors such as healthcare demands and pension systems. The proportion of tertiary industries is included to account for a country's economic structure, with a higher prevalence indicating a shift towards a knowledge-based economy, which may differently influence the economic impact of birthrate changes compared to more industrial or agrarian settings. The female employment rate is also a crucial control variable, considering its significant role in economic growth and the dynamics of changing birthrates, especially in terms of labour supply and gender-centric economic policies. Additionally, literacy rates can be used as a control variable to delineate the study's focus on developed countries (World Population Review, 2023). This threshold ensures that the analysis is centred on nations with a certain level of educational attainment, which typically correlates with advanced economic structures and more complex demographic-economic interactions.

Hypothesis

H0: Declining birthrates have a negative impact or no impact on the economy.

H1: Declining birthrates have a positive impact on the economy.

Study Design

This in-depth research aims to thoroughly investigate the effects of declining birth rates on a country’s economy. Determining the complex relationship between falling birthrates and a country's overall economic well-being is the main research subject. The study puts forth two

hypotheses; the null hypothesis (H0), which suggests declining birthrates have a negative or no influence on the economy, and the alternative hypothesis (H1), which suggests that declining birthrates have a positive impact on the economy. This study uses a strong quantitative methodology and draws from a wide range of secondary data sources, such as economic reports, demographic surveys, and national statistical databases. The data will then be analysed using statistical methods involving descriptive statistics, ANOVA, and regression analysis.

Population & Sample

For this study on the impact of various demographic and economic factors on economic growth, the population of interest comprises developed nations, as indicated by a minimum adult literacy rate of 96%. This criterion ensures that the study focuses on countries with a relatively high level of educational attainment, which is often associated with advanced economic structures and dynamics. The sample will consist of a selection of developed countries from various regions to ensure a diverse representation of different economic systems, cultural backgrounds, and policy environments.

The sample will be selected using a stratified sampling method and countries will be categorised based on geographical regions. From each stratum, a proportionate number of countries will be randomly selected to ensure that the sample is representative of the global distribution of developed nations. This approach allows for a comprehensive analysis of the relationship between birthrates, labour force characteristics, service sector contribution, life expectancy, gender workforce composition, and economic growth in a variety of developed country contexts.

Variables and Measures

In the proposed study on the impact of declining birth rates on economic growth, several key variables were identified. Economic growth, measured in GDP, is identified as the dependent variable to reflect the total economic output and health of a country.

The key independent variable identified for this study is TFR, measured by the number of children given birth to per woman aged 15 to 49 years old. indicates reproductive behaviour and potential future demographic changes and allows for the understanding of the balance between population growth and economic sustainability, especially in the context of environmental constraints and resource management.

The control variables identified include annual labour force, life expectancy, tertiary industries, female employment rate and literacy rates. The annual labour force, quantified in thousands, helps to account for the direct impact of workforce size and composition on the economy. Life expectancy, recorded in years, is used as a measure of public health and ageing demographics. Tertiary industries, measured as a percentage of GDP, differentiate the economic impacts of declining birthrates in diverse economic structures, recognising that knowledge-based economies may respond differently than industrial or agrarian ones. The female employment rate, measured as a percentage of total employment, acknowledges the role of women in the labour market and helps isolate the effect of birthrates on the economy from the influence of gender dynamics and women's workforce participation.

The relationship between these variables is complex and interlinked. Birthrates can influence the future labour force size and demographic structure, impacting economic growth. The annual labour force size directly affects the potential for economic output. The contribution of the service sector, as a proportion of GDP, reflects the economic structure and development

stage, influencing overall economic growth. Life expectancy can affect labour market dynamics and long-term economic planning, while the gender composition of the workforce can impact productivity and economic diversity. The control variable, literacy rates, ensures that the analysis is focused on developed nations, where higher education levels typically correlate with different economic dynamics compared to developing countries.

Data collection methods

Secondary data will be used and obtained from reliable sources such as the OECD.stat, World Bank and World Population Review for the conduct of this study. The data will utilise panel data from the period of 2010 to 2021 as data was provided in full for this period and it prevents ambiguities. As previously mentioned, 30 countries were selected using cluster sampling and identified to include Australia, Austria, Belgium, Canada, Chile, Costa Rica, Denmark, Estonia, France, Germany, Iceland, Ireland, Israel, Italy, Japan, Korea, Lithuania, Latvia, Luxembourg, Netherlands, New Zealand, Norway, Poland, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and the United States.

2010		*2021*	
Mean	2.605141451	Mean	6.043406124
Standard Deviation	2.465924645	Standard Deviation	2.385468483
Minimum	-4.455558039	Minimum	2.158293921
Maximum	6.804824918	Maximum	13.40760158
Count	30	Count	30

Figure 1.

Economic growth, measured in terms of total GDP output and represented in Figure 1 shows recorded mean economic growth in 2010 is 2.61% while the mean recorded economic growth in 2021 is 6.04% showing an overall improvement. Additionally, the standard deviation decreased slightly from 2.47% in 2010 to 2.39% in 2021. The minimum and maximum values

also increased from –4.46% and 6.80% respectively in 2010 to 2.16% and 13.41% in 2021. These results imply a strong economic growth over this period.

2010		*2021*	
Mean	1.751666667	Mean	1.572333333
Standard Deviation	0.366465723	Standard Deviation	0.338838618
Minimum	1.23	Minimum	0.81
Maximum	3.03	Maximum	3
Count	30	Count	30

Figure 2.

TFR, measured by the average number of children per woman of childbearing age of ages 15 to 49 years old and represented in Figure 2, observed the mean dropping from 1.75 in 2010 to 1.57 in 2021. Additionally, the standard deviation was reduced from 0.37 in 2010 to 0.34 in 2021. These suggest a trend towards smaller family sizes and lower fertility rates. Such a decline is commonly observed as countries undergo economic development and societal changes (Nargund, 2009).

2010		*2021*	
Mean	16680.6827	Mean	17657.36397
Standard Deviation	29935.22155	Standard Deviation	31361.27611
Minimum	178.55	Minimum	209.675
Maximum	153616.7	Maximum	161203.9
Count	30	Count	30

Figure 3.

The annual labour force, quantified in thousands and represented in Figure 2, saw an increase in the average labour force from 16,680 in 2010 to 17,657 in 2021 across the countries of study. The increase in the number of labour force available for employment contributes to an overall higher productivity and output to the economy, influenced by factors such as population growth and working-age population.

2010		*2021*	
Mean	64.36821943	Mean	65.15538329
Standard Deviation	6.223449275	Standard Deviation	6.752363798
Minimum	52.2863522	Minimum	51.81011107
Maximum	78.90693084	Maximum	79.32443708
Count	30	Count	30

Figure 4.

Tertiary industry or, services value added as represented in the World Bank, represents the part of a country's economy concerned with the provision of services. Measured as a percentage of GDP and represented in Figure 4, tertiary industries accounted for 64.4% of the global GDP in 2010, before increasing to 65.2% in 2021 with standard deviation also increasing from 6.22% to 6.75%. The shift toward Tertiary industries typically involves a greater focus on knowledge-based and service-related occupations and may influence employment trends (Li, 2022). This shift is in line with the increasing labour force.

2010		*2021*	
Mean	79.90333333	Mean	80.89
Standard Deviation	2.589565712	Standard Deviation	3.125131721
Minimum	73.1	Minimum	73.1
Maximum	82.9	Maximum	84.5
Count	30	Count	30

Figure 5.

Life expectancy, measured in years and represented in Figure 5, for these selected countries increased from a mean of 79.9 years old in 2010 to 80.9 years old in 2021 with a standard deviation increasing from 2.59 to 3.13 years. Suggesting an overall improvement in the average lifespan of the population possibly due to advancements in healthcare and medical technologies. This in turn, increases the ageing population and an ageing population often means

a higher proportion of individuals transitioning into retirement leading to a shrinking working-age population, impacting the overall size and productivity of the labour force and the economy.

2010		*2021*	
Mean	45.77936167	Mean	46.33543767
Standard Deviation	3.478639074	Standard Deviation	2.560318569
Minimum	36.3	Minimum	37.59132
Maximum	52.67288	Maximum	50.09057
Count	30	Count	30

Figure 6.

The female working population, measured as a percentage of total employment, and shown in Figure 6, increased from an average of 45.78% in 2010 to 46.34% in 2021. The standard deviation also decreased from 3.48% in 2010 to 2.56% in 2021 indicating that more women are pursuing career opportunities, which could explain the tendency to delay childbirth to focus on professional development.

This methodological approach ensures a comprehensive and nuanced understanding of the factors influencing economic growth in developed nations.

Data analysis methods

The data analysis technique we will be using to analyse is Regression. The use of regression analysis in this study helps quantify and interpret the complex relationships between multiple variables (Gallo, 2022). This allows for a nuanced understanding of how changes in birthrates influence economic growth, measured in terms of GDP while controlling for other relevant factors such as labour force characteristics, service sector contributions, life expectancy, and gender workforce composition. This method provides clarity in understanding causal relationships and offers predictive insights, which are invaluable for policymakers and economists looking to address the challenges and opportunities presented by demographic shifts.

Formula

$$Y= \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Legend:

Y = Economic Growth (GDP)

β = Constant

ε = Error term from residuals

X_1 = Annual labour force (Thousands)

X_2 = Birthrates (Average number of children per woman between the ages of 15 to 49 years old)

X_3 = Tertiary industries (% of GDP)

X_4 = Life expectancy (Years)

X_5 = Male working population (% of total employment)

Regression Analysis

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.157957714
R Square	0.024950639
Adjusted R Squ	0.022227038
Standard Error	3.037397937
Observations	360

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	84.51649783	84.5165	9.160899218	0.002651412
Residual	358	3302.831469	9.225786		
Total	359	3387.347967			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.103279263	0.805113326	-0.128279	0.898000085	-1.686625209	1.480066683	-1.686625209	1.480066683
Fertility	1.44051767	0.475937075	3.026698	0.002651412	0.50453386	2.37650148	0.50453386	2.37650148

Figure 7.

The initial regression analysis between TFR and economic growth identifies that TFR is statistically significant with a p-value of <0.05. It also has a positive coefficient that indicates a

1.44% increase in economic growth for every increase of 1 unit in fertility. Although there is a statistically significant relationship between TFR and economic growth, the model only explains 2% of the variation in economic growth, indicating a very weak predictive power. as observed in the R-squared.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.290247639
R Square	0.084243692
Adjusted R Squ	0.071309281
Standard Error	2.96018078
Observations	360

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	285.3626984	57.07254	6.513144745	8.22997E-06
Residual	354	3101.985268	8.76267		
Total	359	3387.347967			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	19.80460049	6.692514673	2.959217	0.003291828	6.642512883	32.96668809	6.642512883	32.96668809
Annual labour f	-1.55936E-06	5.74183E-06	-0.271579	0.786103742	-1.28518E-05	9.73303E-06	-1.28518E-05	9.73303E-06
Fertility	1.993799226	0.490228755	4.067079	5.87172E-05	1.029672266	2.957926185	1.029672266	2.957926185
Life expectancy	-0.134082702	0.070968097	-1.889338	0.059663603	-0.2736548	0.005489396	-0.2736548	0.005489396
Tertiary industr	-0.090417468	0.029965117	-3.017424	0.002733888	-0.1493495	-0.031485436	-0.1493495	-0.031485436
Female workin	-0.089016892	0.061583092	-1.445476	0.149208843	-0.210131614	0.032097829	-0.210131614	0.032097829

Figure 8.

When the regression analysis is conducted with all the other independent variables, fertility, and tertiary industries are identified to be statistically significant with a p-value of < 0.05 while life expectancy is identified to be statistically significant with a p-value of < 0.1. The model saw an increase in the coefficient for fertility when compared to the previous model by 0.5% and an overall increase in the R-squared value to explain 8% of the results. While this result is not in line with our initial research question, 92% of the variation is still unexplained and highlights areas for improvements in future studies through the review of the model specification to ensure important variables have not been omitted or using a non-linear model for analysis.

Conclusion

Overall, the study has provided an extensive exploration into the intricate nexus between declining birth rates and their far-reaching economic implications, with a specific emphasis on

GDP per capita as a pivotal metric. Employing a rigorous quantitative methodology and scrutinising secondary data derived from authoritative sources including OECD.stat, World Bank, and World Population Review, the research has delved into the multifaceted dynamics of this demographic shift.

The regression analysis's initial results have highlighted the importance of fertility as a statistically significant independent variable influencing economic growth. It is imperative to recognise the comparatively limited explanatory capacity of the model. A more comprehensive understanding is required, as this nuanced revelation suggests a complex and multifaceted relationship between lowering birth rates and economic repercussions.

The significance of fertility as a statistically significant independent variable influencing economic growth has been highlighted by the preliminary results of the regression analysis. It is imperative to recognise the model's very low explanatory power, nevertheless. This result suggests a complex and multifaceted relationship between economic success and dropping birth rates, calling for a more comprehensive understanding.

The results underscore the need for future research to refine models, consider additional variables, and explore non-linear relationships to unravel the full scope of implications associated with declining birth rates on economic prosperity. This approach is essential for policymakers, businesses, and scholars alike to make informed decisions and develop strategies that acknowledge the intricate dynamics of demographic transformations in the pursuit of sustainable economic development.

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