

Deciphering the Trends: A Comprehensive Analysis of US Birth Rates and Educational Attainment from 1980 to 2020*

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In an aging population that has reaching its highest numbers in the 21st century, it is ever more important to understand what influences birth rates. This paper examines the trends in birth rates across the United States from 1980 to 2020, analyzing how factors like marital status, education level, and age group influence fertility decisions. Through the examination of comprehensive data, provided by American Economics Association (AEA 2022), we uncovered a significant decline in birth rates post-2007, with marked variations across different demographic groups, indicating a shift towards later-life parenthood and a nuanced relationship between education and fertility. These findings highlight the complex interplay between socioeconomic factors and reproductive choices, shedding light on how societal norms and individual priorities are reshaping family formation patterns.

*Code and data underpinning this paper are available at: https://github.com/AlexanderG123/usa_birthrate. Selected aspects of the original paper that underpins this paper were reproduced and a record of this is available at: DOI : <https://doi.org/10.48152/ssrp-g8j2-3h68>

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Introduction

This paper analyzes the changing landscape of birth rates in the United States over forty years, focusing on its interrelationships among age, education level, and marital status. Using extensive data from the American Economics Association, we employ statistical analysis to uncover the nuances of these trends. Our findings estimated the impact of socioeconomic traits, such as education level and marital status, on fertility decisions to explain the decrease in fertility seen over time. They particularly highlight the shift towards later-life parenthood

and the changing dynamics of family formation when it comes to marriage. The analysis shows how changes in these demographic factors have shaped fertility patterns.

Our analysis, conducted using the R programming language (R Core Team 2022), reveals significant shifts in birth patterns that have far-reaching implications. The larger context of demographic shifts and their implications for societal structures, economic planning, and policy formulation is the driving force behind this study. By breaking down the trends by demographic, we hope to close a critical gap in our understanding of the interactions between socioeconomic factors and fertility decisions.

Analysis of data “The Puzzle of Falling US Birth Rates since the Great Recession” (Kearney, Levine, and Pardue 2022), a paper from the Journal of Economic Perspectives (AEA 2022), was done using the R programming language (R Core Team 2022) in conjunction with the following packages: tidyverse (Wickham et al. 2019) and Knitr (Xie 2014). The figures were created using ggplot2 (Wickham 2016). Data points on birth rates per 1000 women was used to observe overarching birth patterns in the US from women ages 15-44 from 1980-2020. Demographic variables were also obtained from the data providing functionality for further analysis. Birth rates by age group, marital status and education level were available and selected as independent variables from the data. This breakdown facilitated a more nuanced understanding of how birth rates varied within these demographic cohorts for the specified period.

The paper is organized with a data, results and discussion section. In the data Section , we describe the methodological approach including data sourcing and analytical tools. In the results Section we show our analysis with descriptive figures, and finally, in the discussion Section we discuss the significance of the results within the context of the previous research, and areas of future study.

Our research highlights the importance of demographic studies in informing policy and public debate, offering a foundation for addressing the challenges posed by changing birth rates. By exploring the intersections of education, marital status, and age with fertility, we contribute valuable insights into the shifting demographic landscape of the United States.

2 Data

2.1 Description of datasets

The American Economics Association (AEA 2022) has made available a dataset that provides a thorough analysis of birth rates over a long period, broken down by a variety of demographic variables. Among the detailed records of birth rates are those by age group, education level, and marital status. Birth rates by age group and marital status are gathered from CDC Vital Statistics Births Reports. Birth rates by mother’s education is calculated by the National Center for Health Statistics (NCHS) Vital Statistics birth microdata, SEER population data,

and the Current Population Survey. The age group data covers the years 1980 to 2020 and is particularly useful for understanding how birth rates have changed over time across different age brackets. The education level data covers the years 1992 to 2019 and gives insights into how educational attainment influences birth rates. The marital status data, which covers the years 1980 to 2019, provides insight into the variations in birth rates between married and single people, reflecting changes in society and individual preferences. For this paper, there were no suitable alternative data sources.

2.2 Data cleaning and construction

The study's data preparation process was significantly streamlined, primarily because of the thorough preliminary work conducted by the American Economics Association (AEA 2022), which organized and cleaned the data for Figure 1, Figure 3, and Figure 4. This meant that for these datasets, no additional data cleaning was required, enabling us to move straight into analysis. The fourth dataset, which was used to create Figure 2, required a minimal amount of additional cleaning because it contained information that was not necessary for our analysis and was therefore refined to just the necessary information by using the select function from Tidyverse (Wickham et al. 2019). No new variables were constructed. These steps represented the extent of data cleaning needed for our study.

2.3 Variable explanation

One of the most important variables in this dataset is the age group data, which breaks down birth rates into age brackets like 15–19, 20–24, and so on up to the 40–44 age group. This level of granularity allows for a detailed analysis of fertility patterns among various age groups, highlighting trends like the growing trend of having children later in life or the decrease in teenage pregnancies. The education level dataset provides a nuanced view of how educational background correlates with reproductive choices and fertility rates by breaking down birth rates into categories based on the highest level of education attained, such as less than high school, high school graduate, some college graduate, and college graduate. Finally, by distinguishing between married and single women, the marital status dataset offers a window into the relationship between fertility and marital status. These variables are essential to comprehending societal patterns and demographic dynamics because they provide a platform to explore how fertility decisions and behaviours are influenced by marital status.

2.4 Measurement

The birth rate measures the number of live births per 1,000 people in a population annually. Measuring births that take place in hospital settings is simple, but recording births that

happen outside of hospitals can be more difficult. It is possible that non-hospital births do not always get registered right away, especially in underserved or rural areas, which could result in underreporting in official datasets. This discrepancy can affect how we interpret birth rates, especially in areas where home births or births outside of medical facilities are more prevalent.

Age is one reliable variable in this study because age group measurement is less ambiguous and more direct. It is determined using official documentation, such as birth certificates, passports, or ID cards. This process ensures high accuracy in categorizing individuals into their respective age groups. However, the accuracy and availability of official records can vary, which can affect the precision of age group data. Fortunately, any such inaccuracy is heavily mitigated by the grouping of age groups rather than performing the analysis on individual ages.

Marital status is another variable that is well documented. In the United States, each state collects data on marriages, divorces, and annulments. Since this data is based on official documents like marriage certificates and legal records of separation or divorce, it is usually dependable. However, the documentation and reporting of marital status can vary depending on cultural and regional differences in the recognition of certain marital statuses. Common-law marriages or partnerships that are not formally registered with the state will not be captured by the binary variable used here.

The Mother's Education item on the U.S. Standard Certificate of Live Birth is used to determine the mother's educational attainment. This information is provided by the mother or a surrogate and asks for the highest degree or level of education completed at the time of delivery. While this method allows for a direct report of educational attainment, it suffers from some information biases, such as social desirability bias (Althubaiti 2016) which may skew the results towards higher education levels. Further self-reported answers may be influenced by the individual's understanding and interpretation of the question.

3 Results:

We begin by looking at the overall trend in birth rate from 1980 - 2020. Figure 1 is a line chart with a linear regression overlapped on it. A linear regression is a statistical model that aims to illustrate a linear relationship between two variables to be able to forecast how a change in one of the variables will affect a change in the other. In this situation, it indicates that the birth rate is trending downward over time. Breaking down the data into different demographics will provide a clearer picture of what is causing this decline.

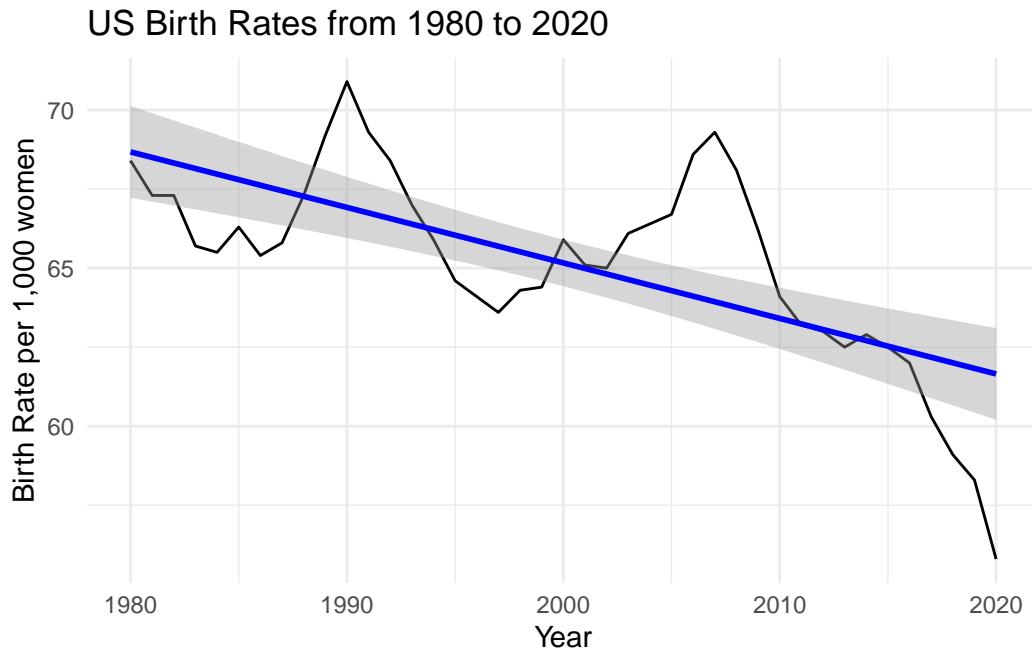


Figure 1: Birth rate for women aged 15-44 regressed on a declining linear model

3.1 Age Group vs Birth Rate

Figure 2 depicts the fluctuations in birth rates for 6 different age groups between 1980 – 2020. Age groups 15-19, 20-24 and 25-29 saw a sharp decline in birth rate over the four decades with 15-19 experiencing the steepest decline. The birth rate for this age group went from 53 births per 1000 women in 1980 to 15.3 births in 2020. Birth rates for women in their 20s also saw noticeable declines, though the decrease was less sharp compared to the teenaged group. Specifically, the birth rate for women aged 20-24 fell from 115.1 per 1,000 in 1980 to 62.8 per 1,000 in 2020, while for women aged 25-29, it declined from 112.9 per 1,000 to 90.0 per 1,000 over the same period.

On the other hand, older age groups, including women aged 30-34, 35-39, and 40-44 saw a rise in birth rates over time. However, the rise in birth rates for these age groups was significantly less pronounced when compared to the decline in birth rates for the younger age groups which contributed to an overall decrease in birth rates, highlighting a widespread trend of reduced fertility rates (Figure 1) across different stages of adulthood.

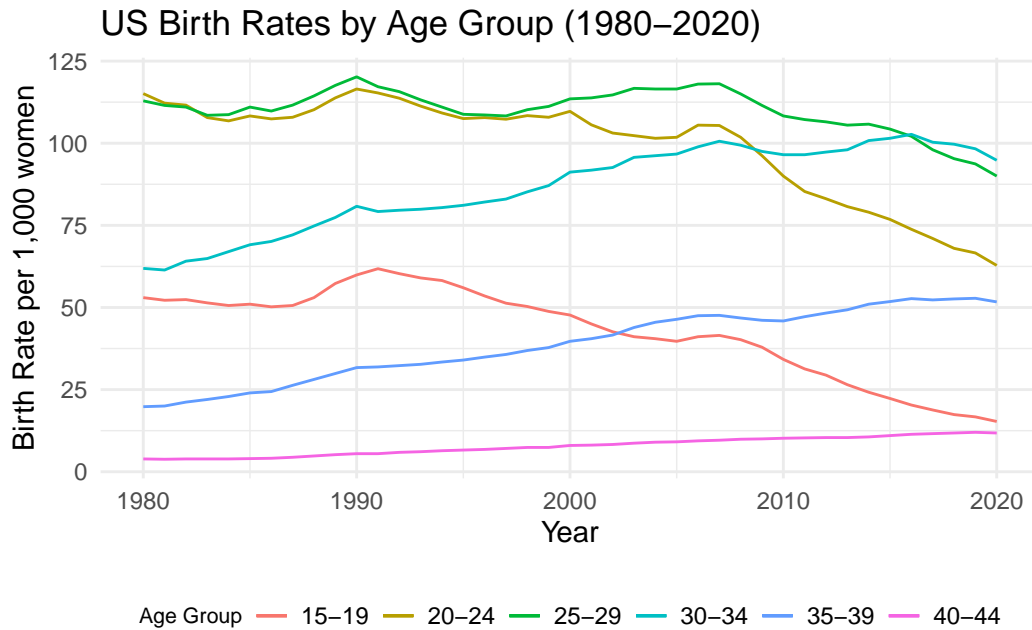


Figure 2: Birth rate of different age groups, showing decline in younger age group while an increase in older groups (30+)

3.2 Education Level vs Birth Rate

The analysis of birth rates by education level from 1980 to the 2010s reveals that both the most and least educated women experienced the largest drops in birth rates. As seen in Figure 3, women with college degrees and those without high school diplomas saw the most significant declines, suggesting a complex interaction between education and fertility rates. Despite these overall trends, birth rates for women without a high school degree remained generally higher when compared to those with higher education levels throughout the period studied. This observation points to an enduring disparity in birth rates along educational lines.

Over the years, birth rates fluctuated across all education levels, indicating that various factors, beyond education alone, influence fertility decisions. There were instances of notable increases or decreases in birth rates among different educational groups, hinting at the impact of societal or economic factors on reproductive choices. Towards the later years in the dataset, particularly in the 2010s, a stabilization or slight decline in birth rates was evident across all education levels. This trend suggests a convergence in fertility patterns irrespective of educational attainment, with the birth rates appearing to level off or reduce slightly for women across the spectrum of education.

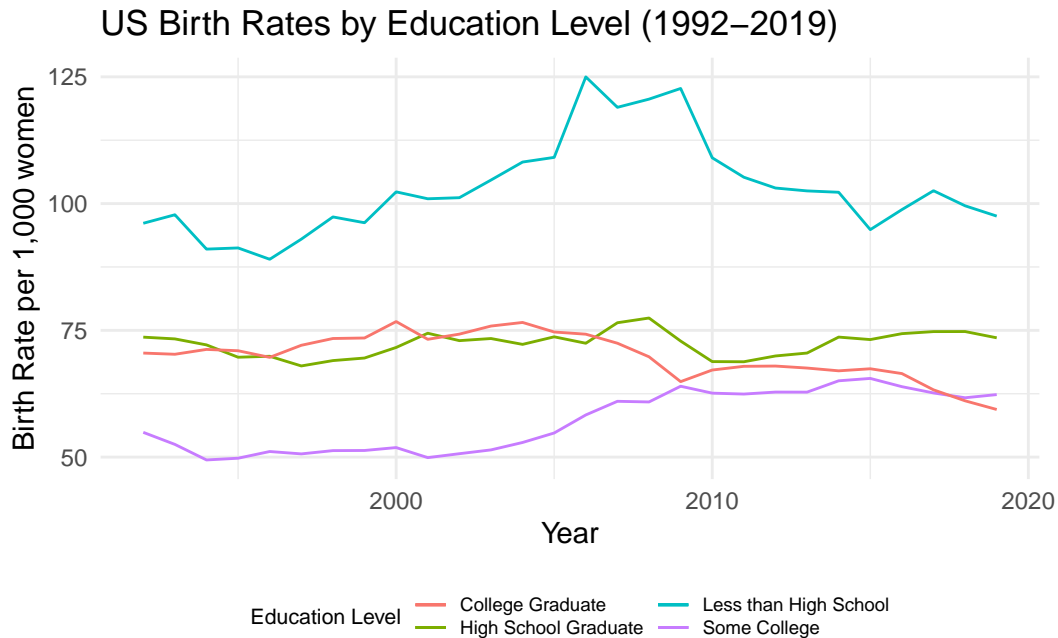


Figure 3: Birth rate by different education level. Most volatility seen in the lowest educated group, and increasing rate observed in highest educated group

3.3 Marital Status vs Birth Rate

Figure 4 shows that the birth rate among unmarried women has been gradually increasing from approximately 29.4 births per 1,000 unmarried women in 1980 to about 43.4 births per 1,000 unmarried women in 2015. In contrast, the birth rate among married women has shown less variation over the same period, maintaining a range of about 84 to 89 births per 1,000 married women from 1980 to 2019. These trends indicate a distinct pattern of change in fertility rates that differs markedly between married and unmarried women over the decades.

Since 2007, birth rates among both married and unmarried women have started to converge, with both groups experiencing declines, though the rate of decline has been somewhat more pronounced among unmarried women. This period has also seen more variability in the birth rate among unmarried women. In the most recent years observed, there has been a slight decline in birth rates for both groups, suggesting a potential shift in fertility patterns.

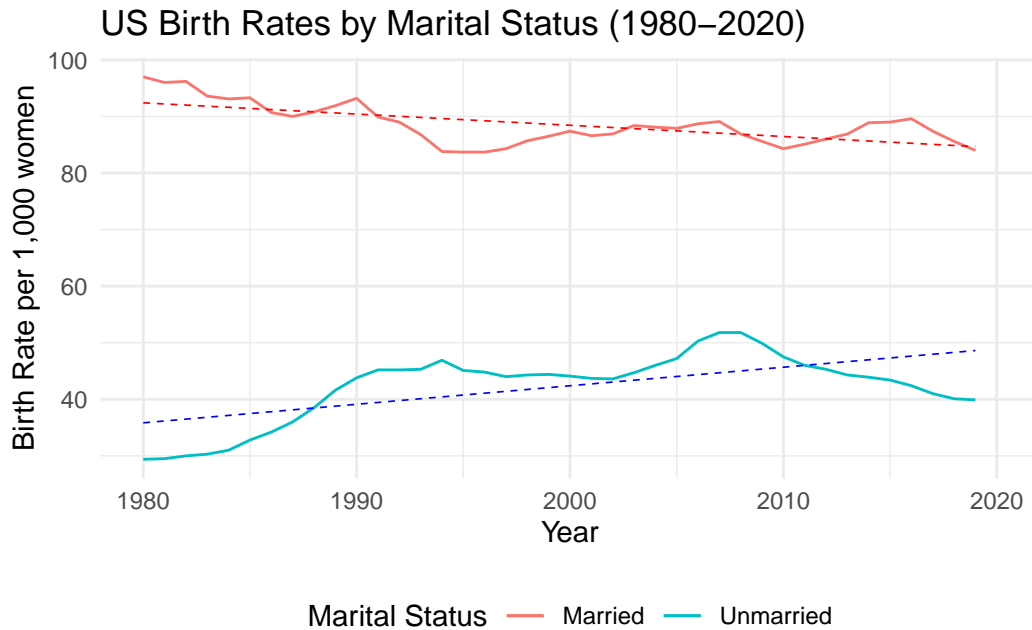


Figure 4: Birth rate of married vs unmarried women, rates trending towards each other over time

4 Discussion:

4.1 Summary of the Study

This paper set out to investigate the dynamics of birth rates over forty years, from 1980 to 2020, by looking at the influence of education, marital status, and societal norms on fertility decisions. By using data on birth rates from various age groups, educational backgrounds, and marital statuses, the study sought to provide a thorough picture of the evolution of birth rates.

4.2 Learning about the World: Evolution of Birth Rates and Societal Norms

The most notable decrease was seen among teenagers, where birth rates fell from 53 per 1,000 in 1980 to 15.3 in 2020. This dramatic decline not only reflects the success of public health initiatives aimed at reducing teenage pregnancies but also suggests a shift in the social

fabric, with young individuals increasingly prioritizing education and career over early family formation (Manlove et al. 2000). The decline in birth rates across all age groups from 1980 to 2020 signifies a profound transformation in societal norms and individual life choices.

The decline in birth rates among women in their 20s, while not as sharp as that of teenagers, nevertheless indicates a substantial shift in the way younger women view motherhood. The change in birth rates from 115.1 births per 1,000 women in the 20–24 age group in 1980 to 62.8 in 2020, and from 112.9 to 90.0 in the 25–29 age group in the same period, reflects broader trends in society that prioritize the pursuit of higher education, career advancement, and personal development over having children at a young age (Manlove et al. 2000).

A further indication of the trend toward later-life parenthood is the rise in birth rates among the older age groups (30–34, 35–39, and 40–44). This trend may be attributed to the growing accessibility and social acceptance of reproductive technologies as well as the growing belief that achieving financial and professional stability should come before starting a family.

4.3 Learning about the World: The Interplay Between Education and Fertility

The analysis shows a complex relationship between education levels and birth rates, highlighting how fertility decisions are influenced by educational attainment. The sharp decline in birth rates among the most and least educated women indicates that family size preferences are strongly influenced by education. For women with higher levels of education, the tendency towards lower birth rates further reflects the importance placed on career and financial stability, with education offering both the means and the justification for delaying or limiting childbearing (Brand and Davis 2011).

On the other hand, the higher birth rates among women who did not complete high school, even though these rates have declined significantly from their peak, suggest that education, economic opportunities, and family planning resources interact in a complex way. This dynamic begs the question of how much education influences fertility decisions versus the social pressures and economic circumstances that are associated with educational attainment.

The variations in birth rates over time across all educational levels further suggest that education is only one of many factors influencing fertility; these variations also point to the importance of societal, economic, and potentially technological influences in influencing individual decisions regarding the size of their family.

4.4 Weaknesses and Limitations

While the study offers valuable insights, it is not without limitations. Firstly, the data collection process is complicated by the use of self-reported information, which can introduce

biases, especially when measuring education levels. As mentioned in Section 2.4, bias could skew education levels higher. Secondly, there is a possibility of underreporting births among undocumented immigrants, and the requirement for documentation to verify age poses additional challenges. Lastly, a critical gap in the research is the absence of analysis regarding the reasons for choosing to have fewer children, which leaves unexplored the myriad of social, economic, and personal factors that influence fertility patterns. Fertility patterns also have external factors causing impact unavailable in this data. Abortion rates have a direct relationship with birth rates. Not only the availability but the social attitudes of intervention when it comes to pregnancy have changed over recent years. The impact of changing social dynamics on determinants discussed in this paper also apply when talking about abortion, and thus could negatively skew some findings.

4.5 Future Research Directions

Future research should aim to investigate the relationship between financial stability and fertility decisions by correlating trends in birth rates with economic data. Questions like whether having a higher income causes one to have more children or if people are delaying having children because of financial concerns should be thoroughly examined. Other possibly influences on fertility decisions should also be examined at a more social level, not just economic. Changing policy and attitudes will constantly be a force in the number of children being born. Looking into how shock changes in societies structure would be an interesting topic of analysis. Recent repeals of *Roe v. Wade* is an example of such shock changes that will greatly impact fertility levels in the US (Ekerin et al. (2023)). Medical advancements are another changing field, examining the implications of an aging population and the social and economic costs of altering fertility patterns could offer insightful information to policymakers and society at large.

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