# Exploring Maternal Age Cohorts in the Decline of US Birthrates*

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Since the early 21st century, birthrates in the United States have been steadily declining. This paper uses data from the American Economic Association to investigate the decline in birthrates in the US and to explore potential factors behind this phenomenon. Based on the exploration of the data, there is strong evidence that the differences in women's social values between generational groups are key players behind the decline of US birthrates since 2007. The results of this study are significant, as a country's birthrate is indicative its economic development, social dynamics and policy development.

## 1 Introduction

The birthrate is the average annual number of live births during a year per 1,000 individuals in the population at midyear (The World Factbook 2021). The National Center for Health Statistics (NCHS) gathers data on birthrates for women by different demographic factors such as age group, ethnic identity and education level. These information are compiled and made available through the National Vital Statistics System (National Center for Health Statistics 2024). Researchers are interested in a country's birthrate as it is a indicative of an economy's health and it is useful for population predictions. A declining birthrate tends to result in a smaller workforce and an aging population, which puts economic pressure on younger generations and on government spending (Pettinger 2021). Hence, in order to predict and reduce these consequences, many previous literature explore factors behind declining birthrates in the US such as cost of living, access to contraceptives and environmental concerns (Nargund 2009).

In this paper I am interested in the generational gaps behind the declining birthrates in the US. Using data from the the article "The Puzzle of Falling US Birthrates since the Great Recession"

*Code and data supporting this analysis are available at: https://github.com/DeniseChang9/US_declining_birth_rates.git

(Kearney, Levine, and Pardue 2022), I explore the differences in birthrates between different age cohorts for women from 1980 to 2019 for more insights on the influence of generational value gaps. I find that, although all age cohorts witness a decline in birthrates, younger age cohorts of mothers present a sharper decrease in birthrates than older age cohort.

The remainder of this paper is structured into 3 distinct sections. Section 2 discusses the data collection and the studied variables. Section 3 presents the results and finding of the exploration of the dataset with the help of visualized data. Section 4 explores further insights from the results and discusses a few weaknesses of this paper. This section also briefly mention potential next steps following this paper.

# 2 Data

## 2.1 Data Collection

The dataset used in this paper is obtained from the replication package of "The Puzzle of Falling US Birthrates since the Great Recession" (Kearney, Levine, and Pardue 2022) published in the Journal of Economic Perspectives (AEA 2022). The replication package contains dataset compiled from a variety of sources including, but not limited to, the National Center for Health Statistics (NCHS), the Current Population Survey Annual Social and Economic Supplement, the Integrated Public Use Microdata Series (IPUMS) and the New York Federal Reserve/EQUIFAX and the Pew Research Center.

For this study, I am interested in the aggregated data on birthrates by age cohorts of mothers. The dataset was built by Kearney, Levine and Pardue (2022), the authors of the replication package, using data from the SEER program at NCHS and data from Vital Statistics. The built dataset captures birthrates by maternal age cohorts and organizes the mothers into 6 cohorts of 5 years from 1968 to 1997 inclusively.

The dataset used for this paper was retrieved on February 5 2024.

## 2.2 Variable of Interest

The data was cleaned and processed using the statistical programming language R (R Core Team 2022). Statistical libraries such as `tidyverse` (Wickham et al. 2019), `janitor` (Firke 2023), `knitr` (Xie 2021) and `here` (Müller 2020) are leveraged in the data processing as well.

### 2.2.1 National Birthrates

Birthrate in the US is calculated as the annual average number of live births per 1,000 individuals in the country at midyear. Births resulting in a child showing evidence of life, such as beating of the heart, pulsation of the umbilical cord and breathing, are considered live births. Live births can originate from any delivery method and from any duration of pregnancy, such that premature babies and babies delivered through Cesarean. The number of live births is measured by the number of birth certificates, which are issued shortly after delivery. Individuals who are considered in the calculation of the birthrate include US citizens and US residents. The national population is measured through a government-funded survey, which is mandatory for all citizens and residents of the US.

Table 1: First Ten Rows of the National Birthrate Data

| Year | National Birthrate |
|---|---|
| 1980 | 68.4 |
| 1981 | 67.3 |
| 1982 | 67.3 |
| 1983 | 65.7 |
| 1984 | 65.5 |
| 1985 | 66.3 |
| 1986 | 65.4 |
| 1987 | 65.8 |
| 1988 | 67.3 |
| 1989 | 69.2 |

Table 1 is a sample of the ten first rows of the national birthrate data in the US. Each column in this dataset represents a different year in chronological order from 1980 to 2019 inclusively. The "Year" column adds a sense of succession to the data, which allows readers to get more insights on the evolution of birthrates throughout time. The "National Birthrate" column is the calculated national birthrate for its respective year.

### 2.2.2 Maternal Age Cohort

Maternal age is documented in the US through a voluntary survey issued by each state. Since this variable is self-reported on a voluntary basis, certain mothers choose to opt out or to not disclose their age at childbirth. These cases are marked as "NA" in the dataset, and was removed from the compilation of the data. The data is organized in 6 age cohorts of 5 years.

Table 2: First Ten Rows of Birthrate by Maternal Age

| Year | 15-19 Years Old | 20-24 Years Old | 25-29 Years Old | 30-34 Years Old | 35-39 Years Old | 40-44 Years Old |
|---|---|---|---|---|---|---|
| 1980 | 53.0 | 115.1 | 112.9 | 61.9 | 19.8 | 3.9 |
| 1981 | 52.2 | 112.2 | 111.5 | 61.4 | 20.0 | 3.8 |
| 1982 | 52.4 | 111.6 | 111.0 | 64.1 | 21.2 | 3.9 |
| 1983 | 51.4 | 107.8 | 108.5 | 64.9 | 22.0 | 3.9 |
| 1984 | 50.6 | 106.8 | 108.7 | 67.0 | 22.9 | 3.9 |
| 1985 | 51.0 | 108.3 | 111.0 | 69.1 | 24.0 | 4.0 |
| 1986 | 50.2 | 107.4 | 109.8 | 70.1 | 24.4 | 4.1 |
| 1987 | 50.6 | 107.9 | 111.6 | 72.1 | 26.3 | 4.4 |
| 1988 | 53.0 | 110.2 | 114.4 | 74.8 | 28.1 | 4.8 |
| 1989 | 57.3 | 113.8 | 117.6 | 77.4 | 29.9 | 5.2 |

Table 2 shows a sample of the first 10 rows of the birthrates by maternal age cohorts. Each row in this table represents a year from 1980 to 2019 in chronological order. Similarly to Table 1, the "Year" column allows better estimations of the evolution of birthrates for each of the age cohorts. The remaining 6 columns represent the birthrates of the different age cohorts relative to the year of childbirth. A mother who gives birth twice in two different age groups is considered an additional live birth for each cohort. For this study, only the mothers aged 15 to 44 were considered.

# 3 Results

## 3.1 National Trends

Figure 1 illustrates the evolution of birthrates in the US from 1980 to 2020. From 1980 to 2020, the birthrates in the US consistently fluctuated around 65 to 70 births per 1,000 women aged between 15 to 44 years old. During this period, increases in birthrates were followed by similar decreases in the following years. Starting from 2007, birthrates have steadily declined, falling from 69.3 births in 2007 to 55.8 births in 2020, which is a 19.4% decrease. In 2011, the birthrate in the US fell to 63.4 births, which went below the previous minimum of 63.6 births in 1997 by 0.2 births. The lowest birthrate recorded was in 2020, which is the most recent year.

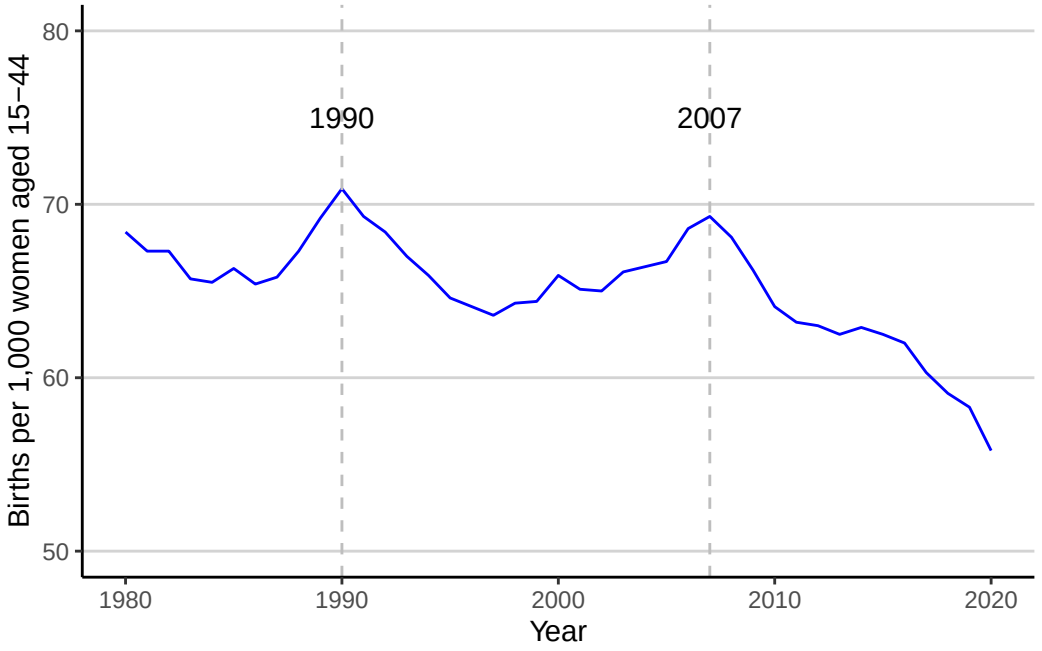


Figure 1: Birthrates in the US from 1980 to 2020

## 3.2 Trends by Age Cohorts

Figure 2 illustrates the trend in birthrates from 1980 to 2019 by maternal age groups. Every age groups present different trends and intensity of change, which are marked by significant change in the years 1990 and 2007.

The 15-19 years old groups of mothers shows the most dramatic decline in birthrate in the studied years. Since its peak birthrate in 1991 at 61.8 births per 1,000 women, this age group's

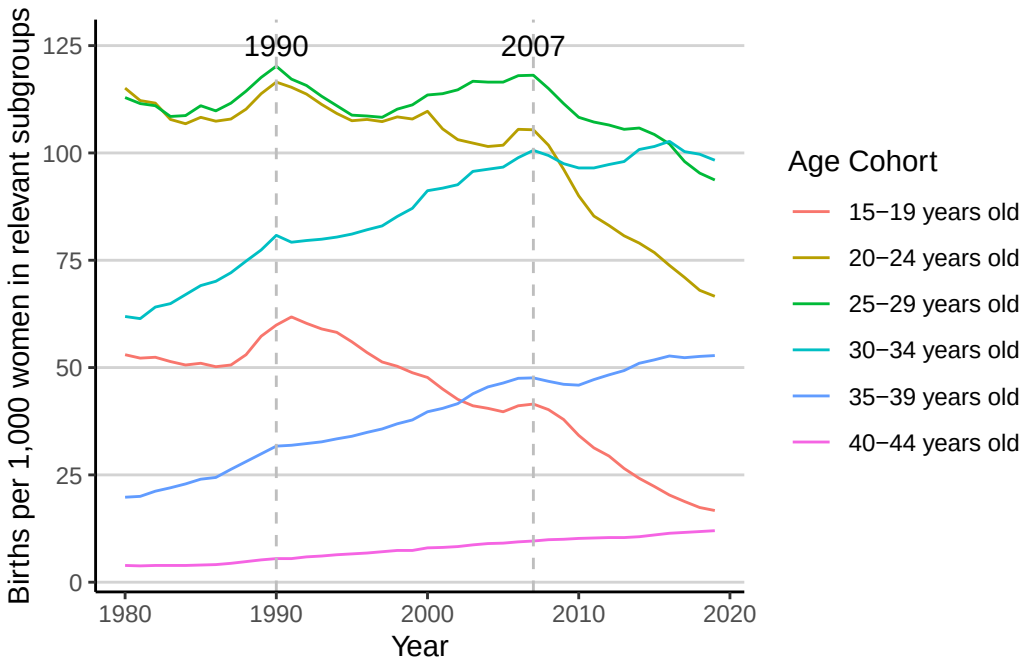


Figure 2: Birthrates in the US from 1980 to 2019 by Maternal Age Cohorts

birthrate fell to 41.5 births in 2007 and to 16.7 births in 2019. The birthrates decreased by 32.8% between the years 1991 and 2007, and then decreased by 59.8% between 2007 and 2019. Both of the checkpoint years resulted in a drastic decline in birthrates in subsequent years, more so after 2007, for mothers in the 15-19 age cohorts.

The 20-24 years old group of mothers shows similar trend as the 15-19 years old group, but at a higher general birthrate. In 1990, this age cohort peaked at 116.5 births per 1,000 women, and fell to 101.5 births in 2004 before dropping even lower to 66.6 births in 2019. From 1990 to 2007, birthrates for this age group decreased by 12.9%, and then decreased by another 34.4% between 2007 and 2019. The birthrate for the 20-24 years old group was already in slight decline since 1990, and experienced a more pronounced decline in 2004 tto 2019.

The 25-29 years old group of mothers presents a decrease in birthrate mainly after 2007. In 1990, the birthrate of the age group was at 120.2 births per 1,000 women. The birthrate decreased by 1.7% in 2007 to a birthrate of 118.1 births. Finally, the birthrate decreased by another 20.7% in 2019 to 93.7 births.

While the three younger age groups each present different decreasing evolution trends marked by the years 1990 and 2007, the three older maternal age cohorts (30-34 years old, 35-39 years old and 40-44 years old) shows steady increasing birthrate trends. The data from 1980 to 2020, though at distinct general birthrates, shows that the older age groups has consistent increases in numbers of birth per 1,000 women per year.

# 4 Discussion

## 4.1 Economic Health and Unemployment Rate

On a national level, the two notable drops in birthrate in 1990 and in 2007 illustrated in Figure 1 can be explained by a combination of economic factors. In both 1990 and 2007, the US experienced a recession, characterized by a persistent decline in economic activity and usually followed by increasing unemployment rate in the population (The Investopedia Team 2023). Decreasing employment causes financial stress for households, which discourage women from having children. Raising a child includes rising costs relating to higher housing costs and higher living costs such as food and education.

In Figure 2, the youngest age group of 15 to 19 years old mothers had the greatest decline at both recessions, while the oldest age group of 40 to 44 years old mothers were the least impacted. A study conducted in 1994 highlighted that teenage workers had the largest share of the employment reductions in the 1990 as well as in the previous economic contractions (Gardner 1994). Assuming that this trend can be applied to the recession in 2007, this could suggest that the unemployment rate plays a major role in the declining birthrate by age groups. During recessionary periods, the teen groups have the least amount of education, hence have the least amount of marketable skills. The younger groups end up being the first group influenced by the increasing unemployment rate. Unemployed individuals have unstable income and lower amount of dispensable income, making motherhood less attractive. The unemployment rate playing a role in the birthrates by age group is also consistent with the older age groups' birthrate evolution. For example, the age cohort of 40 to 44 years old had unnoticeable change in births per 1,000 women in 1990 and in 2007. This makes sense since older women in the workforce are associated with higher positions in workplaces than younger women. Older women have more experience and more marketable skills in the labor market, hence making them one of the last age groups affected by the rising unemployment rate.

## 4.2 Social Values and Views on Homosexuality

Another pertinent phenomenon is the change in social values in cohorts of women. An analysis of the data from the General Social Survey (GSS) finds that each cohort is more liberal than the one that came before it (Devitt 2021), suggesting that older age cohorts is more conservative. Older women tend to have more conservative values, influencing their views about love and relationships. A conservative view supports heterosexual relationships, and condemns homosexuality. In fact, a study in 2011 concluded that around 66% of Boomers opposed gay marriages (Pew Research Center 2011). The data from this survey was collected through a voluntary survey in the US. This would explain the higher ratio of heterosexual relationships in older age cohorts, which can result in higher childbirth. On the other side, the younger cohorts, each more liberal than its previous cohort, is more accepting and supports

homosexuality. The same study concluded that around 60% of Millenials and 50% of Gen Xers favour gay marriages (Pew Research Center 2011). This freedom of sexuality in younger cohorts of women causes a higher ratio of homosexual couples, which are unable to naturally conceive. This reduces the portion of the US population that is able to participate in birthrates.

### 4.3 Role of Women and Shifting of Priorities

Between younger and older generations of women, the change in views of a woman's role in society can contribute to the difference in trends in birthrates. Older generations of women, having lived through most of their lives in a patriarchal society, believe in the woman's role as a caregiver and as a household position. Catering to their husband's needs and taking care of children are household responsibilities associates to women. As a housewife, women do not need to worry about providing financially for the households other than giving birth to more children who will gain income for the family in the future. In later years, the rising access to education for women gives women opportunity to join the labour force, and to shift their priorities away from the traditional housewife role to a more independent self-sustainable lifestyle. In fact, a study in 2012 concluded that higher education was related to lower probabilities of teenage childbirths (Martinez, Daniels, and Chandra 2012). Women getting access to higher education also contributed to the shifting of their priorities towards a career-driven lifestyle. This new priority delays motherhood as women tend to settle down in a households at a later age in life, thus giving birth at a later stage. A national census in the US estimates that the median age at marriage for women has risen from a low of 20 years in the 1950's to 27 years in 2016 (US Census Bureau 2016).

### 4.4 Weakness

In the gathering of the data, the NCHS randomly sampled each states for their birth certificate count to determine the birthrate per state. In other words, certain states have as much as 100 percent of their population sampled, while other states only have about 50 percent of their population sampled. Having a few states over-represented than others can bias the results since women from different home states can adopt different social, cultural and religious values. This sampling method of random portions of birth certificates do not accurately represent women in the US, which is a weakness in the collected data used for this paper.

Another weakness that affects the dataset is the measurement of the birthrates. As described in Section 2 of the paper, the number of live births is measured through the number of birth certificates issued in that year. These birth certificates are only issues in hospitals and clinics where the child was born. Hence, this measurement method does not capture the non-hospitable births such as home births and births in retreated societies like cults.

### 4.5 Future Directions

Another aspect that could be interesting to explore would be the birthrates by geographical location in the US. Each state in the US have their own political background and different religious presence, both factors that could influence population values and affect birthrates. For example, the replicated paper did an analysis of this data and found that Southwest states in the US seems to present sharper decline in birthrates relative to other states (Kearney, Levine, and Pardue 2022). That geographical section is also known to have a higher concentration of baptists. It could be interesting to explore the values associated with the religion, and to evaluate the religious commitment of the population.

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