A PAPER OF REPLICATION: DOES TEENAGE CHILDBEARING AFFECT LATER LIFE OUTCOMES OF TEEN MOTHERS?

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Abstract

This paper follows the estimation approach used by Schulkind and Sandler (2019) to investigate the life outcomes of adolescent mothers who have their first child around the time of high school graduation. By comparing mothers who give birth before finishing high school with those who give birth after, this study aims to replicate the findings of Schulkind and Sandler regarding the impact of teenage childbearing on mothers' long-term outcomes. Both the original study and this replication reveal that teenage childbearing is associated with a decreased likelihood of completing high school, fewer years of overall education, an increased number of children in the household, a higher risk of living in poverty, and no significant impact on labor market outcomes. However, this study differs in finding no measurable effects on the marital status of teenage mothers, and the impact on later life outcomes is smaller compared to those in the replicated paper.

KEYWORDS: (Teenage childbearing, Education, Labor outcomes, Family Structure)

ON MY HONOR, I HAVE NEITHER GIVEN NOR RECEIVED UNAUTHORIZED AID ON THIS THESIS

Signature

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1. Introduction

The adolescent birth rate in the United States is consistently ranked among the highest in high income countries over the years. UNICEF (2001) reports that the U.S. teenage birth rate of 52.1 is the highest among high income nations, approximately four times higher than the European Union average. Despite a significant decline in the adolescent birth rate over the past decade, the U.S. still maintains the highest rate compared to other high-income nations, except for the former Soviet Bloc, as of 2010 (Guttmacher Institute, 2015). The teenage birth rate in the US not only ranked as the highest but also exceeded the second-highest rate in Russia by 25% as of 2012. This indicates that a teenage girl in the United States is approximately 25 percent more likely to become a mother compared to her counterpart in Russia (Kearney & Levine, 2012).

The staggeringly high adolescent birth rate has concerned researchers, prompting investigations into its implications for the current US society and the potential future impacts on individuals and society at large. One significant area of inquiry is the relationship between teenage childbirth and the later socioeconomic status of the teenage mothers. While many researchers, such as Schulkind and Sandler (2019), believe that teenage childbirth contributes to worsened socioeconomic status, others challenge that causal relationship. Some argue instead that poverty causes teen birth, not the reverse (Geronimus & Korenman, 1992).

Despite a general decline in the adolescent birth rate since the 1990s, reaching a record low in 2020, the CDC expressed concern on the teen birth rate in 2022. This concern arises due to the high costs for families of teenage parents and society at large, coupled with the fact that the absolute U.S. teen birth rate remains one of the highest among all industrialized countries (Tollestrup, 2022). To gain deeper insight into the implications of the high teen birth rate and identify effective policies to enhance social welfare for those impacted, two fundamental questions emerge: Is there a causal link between poverty and teen pregnancy, and if so, which factor serves as the cause and which as the effect?

This paper aims to explore these questions by evaluating the prevailing perspective, which posits that teenage birth leads to adverse life outcomes for teenage mothers, particularly in terms of educational attainment and poverty. To do this, the paper replicates the model utilized in the 2019 paper titled "The Timing of Teenage Births: Estimating the Effect on High School Graduation and Later-Life Outcomes" by Schulkind and Sandler. The paper retrieves data on mothers 20 to 35 years old from the 1980 and 2000 US Census Bureau and the 2005-2014 American Community Survey (ACS). The authors identified teen mothers by calculating the mothers' age during their first birth and categorized them into a comparison and a treatment group by identifying whether the first birth happened within the six months before or after the mothers' high school graduation. In doing so, they aimed to determine if teenage childbearing impacts the education attainment, family structure and labor market outcomes of teen mothers. By replicating the estimation process of the paper by Schulkind and Sandler, this paper assesses whether the findings regarding the impact of teenage childbirth on individual outcomes, including educational attainment, wages, poverty, and family outcomes, remain consistent when replicated using a dataset closely resembling the original one.

This study confirms previous findings that teen mothers are less likely to complete high school, attain fewer years of education, have more children in their households, and are more likely to live in poverty, aligning with the results of Schulkind and Sandler's research. Moreover, this study did not find any significant impact on labor market outcomes like the original paper. However, my estimation discovered no correlation between teenage childbearing and the mother's marital status, and the statistical significance of poverty's effects was notably weaker.

Through scrutinizing issues encountered during the replication process and questioning the interpretation of results in the original paper, this study reassesses the reliability of conclusions drawn in Schulkind and Sandler's 2019 paper. This underscores the importance of caution when interpreting conclusions from existing research and encourages vigilance when considering arguments from different perspectives on the effects of teenage childbearing on the lives of teen mothers.

The following section provides an in-depth overview of prior research on the connection between teenage birth rates and individuals' life outcomes. Then the paper follows with a review of the data selection and estimation strategy. Chapter 4 presents the results of the analysis followed by a discussion on the problems that emerged during the replication process and some questions regarding the methodology of the replicated paper. Finally, the paper concludes with a summary of results and directions for future studies in Chapter 6.

2. Literature Review

This literature review seeks to explore previous studies on adolescent childbearing, providing an overview of existing perspectives regarding the effects of adolescent childbearing on later life outcomes for teen mothers, including lower educational attainment, lower wages and differences in family structure. By emphasizing the ongoing debate on the certainty of these negative consequences, this review underscores the importance of replicating research in this field.

The phenomenon of adolescent birth and its impacts on teenage mothers have garnered the attention of American researchers since the late 1970s. Hayes and

Hofferth (1987) conducted a comprehensive analysis of the effects of teen birth on teenage mothers by summarizing and organizing scholarly literature from the late 1970s through the 1980s. Their work synthesized findings from various studies, revealing a consensus that early childbearing, especially among high school teenagers, has adverse implications for the subsequent economic well-being of teenage mothers. These effects persist even after controlling for factors such as prior social background and aptitude, albeit with varying degrees of impact across different racial groups. The negative consequences of early birth stem indirectly from a chain of causation, where early childbearing leads to reduced educational attainment and larger family sizes for teen mothers, ultimately resulting in decreased labor force participation, earnings, and family income.

Numerous studies corroborate these negative outcomes. For instance, a study in 1999 using the National Longitudinal Survey of Youth (NLSY) as its sample analyzed how adolescent birth affects the human capital and wages of teenage mothers (Klepinger et al., 1999). In this case, human capital characteristics included years of schooling, teenage work experience, and young adult work experience. The researchers acknowledged that the costs of teenage childbearing may affect human capital decisions through factors beyond realized fertility. Thus, they included instrumental variables,which clarify the endogenous independent variable of interest without directly explaining the dependent variable. This helps mitigate endogeneity in the Ordinary Least Squares (OLS) model, typically employed to gauge the relationship between one or more independent variables and a dependent variable by estimating the coefficients of linear regression equations.

The results show that teenage childbearing reduces the years of schooling and early work experience as teenagers for the entire sample of teenage mothers, while decreasing young adult work experience for only those who are white. In addition, the study showed that lower human capital investments led to lower wages in different ways for White and Black populations. While fewer years of schooling reduced wages for both groups, less early work experience had a statistically significant negative impact on wages for Black females, and less adult work experience caused lower wages for White females with statistical significance.

A decade later, Fletcher and Wolfe (2009) found similar results indicating that teenage childbearing negatively affected the receipt of a high school diploma, decreased the total number of years of education by 0.8 years, and reduced household income and labor income by over two thousand dollars. In their analysis, the authors controlled for community fixed effects in their Ordinary Least Squares (OLS) model to reduce endogeneity. However, Fletcher and Wolfe noted that the results could potentially be biased because those who gave birth may come from disadvantaged backgrounds while those who did not may be more originally advantaged, even though they lived in the same communities. The results should also be taken cautiously due to the relatively small sample size of their model, which is only around 1000 observations.

Lee (2010) applied a counterfactual approach called the propensity score matching approach with Rosenbaum bounds. The propensity scores in the study were predicted probabilities of teen motherhood calculated using a logit model created from various determinants of teenage childbearing status. Lee further matched the teen mothers with those with similar propensity scores to form the sample and balance the matches on observed covariates, which are characteristics of observations excluding the actual treatment, to reduce absolute biases. However, since the model depended on pre-existing observed variables, there could be biases hidden in the process of creating the sample due to pre-existing unobserved variables. To reduce the hidden biases, Lee introduced Rosenbaum bounds, a measure used to make the extent of such biases explicit so that researchers are able to see how strong the biases are required to alter the causal relationship concluded from observed covariates. Thus, Lee was able to factor out any distortion in the extent of the potentially existing causal inference of interest and achieve a more precise understanding of the relationship.

The results from Lee's analysis showed that teenage childbearing had significant negative effects on the socioeconomic outcomes of adolescent mothers, including a higher dropout rate, lower college attendance, and worse employment status, despite such negative impacts being exaggerated due to the inherent socioeconomic background of such mothers. Since the Rosenbaum bounds suggested that the selection bias caused by unobserved covariates had to be great to alter the propensity score estimates, the results could be taken with rather confidence (Lee, 2010).

Another study published in 2013 employed four different estimation methods to examine the impact of teen birth on educational attainment. These four approaches include non-experimental OLS regression, commonly used in earlier studies; the propensity score matching method, which was the main approach of Lee's research mentioned previously; a treatment effects model, using a dummy variable as an independent variable and assuming the effects on the dependent variable can be shown as an intercept shift; and a discrete factor model, similar to a treatment effects model but with advantages in terms of examining the validity of assumptions and the strength of unobserved variables (Kane et al., 2013). All four approaches led to the conclusion that teen childbearing hinders the educational progress of teenage mothers, with the extent of this hindrance varying from 0.7 to 1.9 years, depending on the specific model employed.

Schulkind and Sandler's research in 2019 further reinforces the narrative that teen childbearing has detrimental effects on the life outcomes of teenage mothers. Their model demonstrates that giving birth as a teenager decreases the likelihood of high school completion, increases the probability of living in poverty, although surprisingly, it does not significantly affect wages. Importantly, these negative impacts cut across racial lines, affecting White, Black, and Hispanic teenage mothers alike.

Interestingly, Gorry's publication, from the same year as Schulkind and Sandler's research, challenges the prevailing belief in the negative impacts of adolescent birth (Gorry, 2019). Gorry's findings validate only a small portion of the purported negative effects, specifically pertaining to education attainment and labor outcomes for White teenagers and those from higher-income counties. In contrast, for teenagers from lower-income counties and minority groups, the relationship between teen birth and education and labor prospects appears to be more complementary than causal. Gorry even suggests that if a causal relationship does exist for minority groups or those from lower-income backgrounds, it tends to encourage them to pursue higher education and achieve better labor market prospects.

Gorry's conclusions challenge the conventional wisdom regarding the negative impacts of teen birth. Similar challenges were raised as early as the 1990s. In 1997, Holtz, Mullin, and Sanders conducted a study on how teenage childbirth could impact a woman’s educational attainment and labor market performance as an adult, using miscarriages as a contaminated instrumental variable to control for endogeneity and measurement error, and comparing the results with those obtained using ordinary least squares (OLS) estimators. In this study, miscarriages failed to meet the exclusion restriction for a proper instrumental variable since other factors, such as alcohol consumption during pregnancy, can affect both the incidence of miscarriages and "a woman's subsequent human capital accumulation and labor market productivity." Yet, due to the high randomness and uncertainty in the causes of miscarriages, the authors still chose miscarriages as the instrumental variable but recognized the contamination and potential errors in the model. They found nearly opposite results from the mainstream perspective using the instrumental variable model. According to their analysis, teen birth does not significantly influence high school completion, increases hours worked during early adulthood, and surprisingly, raises annual earnings later in life.

Levine and Painter's research in 2003 specifically delved into the relationship between teen childbearing and educational attainment. They concluded that "a substantial portion of the relationship between teen childbearing and high school completion is due to preexisting disadvantages of young women, not due to the childbirth itself" (p. 898). Moreover, they discovered that the remaining causal effect is more significant for advantaged teen mothers than disadvantaged ones, aligning with Gorry's 2019 findings that adolescent childbearing negatively impacts teen mothers from richer and majority race backgrounds to a greater extent.

Beyond questioning the existence and magnitude of a causal relationship, some scholars argue for a reverse causality. They propose that a poor economic background increases the likelihood of teen birth, rather than teen birth leading to poverty.

Kearney and Levine (2012) conducted an empirical analysis supporting this perspective, suggesting that teen birth is more a byproduct of poverty than a cause of it. The increased likelihood of teen mothers living in poverty may stem from their pre-existing economic disadvantages, which persist even after childbirth. Consequently, they recommend policymakers focus on improving economic opportunities rather than directly reducing birth rates through means such as sex education.

In conclusion, this literature review has offered a comprehensive overview of existing research concerning the correlation between teenage childbearing and the subsequent life outcomes of adolescent mothers. Through examining various studies, it has become evident that while most findings suggest negative impacts of teenage childbearing on teen mothers, including aspects such as educational attainment, employment outcomes, and family structure, there remains a debate regarding the formation of a consensus on this relationship, as some researchers have reported neutral or conflicting results. Therefore, the validation of the results of the existing studies and further research are necessary. This section elucidates the underlying motive for and importance of the subsequent sections.

3. Theory and Methodology

3.1 Data

The original paper (Schulkind & Sandler, 2019) used data from the 1980 and 2000 decennial censuses (US Census Bureau, 1980, 2000) as well as the 2005-2014 American Community Survey (ACS) (US Census Bureau, 2005-2014). The decennial censuses are 1-in-6 national random samples of US households, and the ACS is an ongoing survey that collects information about the social, economic, housing, demographic characteristics of the national population (US Census Bureau, 2024). However, as the decennial census data used in the original paper was restricted, this paper used a 5% sample of the state census data instead, which represent 1-in-20 national random samples of the population. Despite a smaller sample size than the original, the treatment group and control groups in the model still contain over 50,000 observations.

The paper focused on mothers between 20 and 35 years old, and the youngest mothers in the treatment group were 17 years old when giving birth to their first child. This means that the child would reach 18 when the mother was 35 years old. The firstborn child must reside in the same household as the mother to be considered, and the eldest child could be no older than 18 to ensure that the mother gave birth during her teenage years, specifically in her senior year, to be part of the sample.

3.2.1 Selection of groups

The paper considers only mothers who gave birth during their final semester before high school graduation, occurring between January and June of their senior year, or soon after expected graduation, between July and December of the year they graduated from high school. To identify these groups within the broader teenage population, the paper first examines mothers aged 17 to 19 years old during their first birth using the age of the eldest child in the household subtracting from the mothers' age. Then the quarter of birth for both the mothers and the eldest child were used to decide whether the mothers were in their senior year when they gave birth.

Moreover, the study ensures that the eldest child in the household is the mother's biological child using the detailed relationship to household head. Adopted children and stepchildren were excluded when locating the quarters of birth of the first child and calculating the age gap between the first and the second child. However, the Census Bureau's inclusion of stepchildren and adopted children in the variable "number of children" could introduce measurement errors. Figure 1 illustrates the assignment of teen mothers to treatment and control groups: those highlighted in the first and second columns are assigned to the treatment group, while those highlighted in the third and fourth columns are assigned to the control group. For instance, a mother born between January and March (indicating birth quarter 1) who gave birth during the first quarter of her 18th year is considered in her senior year and placed in the treatment group. Conversely, if a mother born in the first quarter had her first child at 18 years old between July and September (corresponding to the child's birth quarter being 3), she gave birth during the summer after high school graduation and before college and is assigned to the control group.

Figure 1.

Assignment to Treatment and Control Groups

	Child's Quarter of Birth			
	Treat		Control	
Mom's Quarter of Birth	1	2	3	4
1	17: Junior	17: Junior	17: Summer J/S	17: Senior
	18: Senior	18: Senior	18: Summer S/C	18: College1
	19: College1	19: College1	19: Summer C1/C2	19: College2
2	17: Senior	17: Junior	17: Summer J/S	17: Senior
	18: College1	18: Senior	18: Summer S/C1	18: College1
	19: College2	19: College1	19: Summer C1/C2	19: College2
3	17: Senior	17: Senior	17: Summer J/S	17: Senior
	18: College1	18: College1	18: Summer S/C1	18: College1
	19: College2	19: College2	19: Summer C1/C2	19: College2
4	17: Junior	17: Junior	17: Summer J/S	17: Junior
	18: Senior	18: Senior	18: Summer S/C1	18: Senior
	19: College1	19: College1	19: Summer C1/C2	19: College1

Notes: Reproduced from *The Timing of Teenage Births: Estimating the Effect on High School Graduation and Later Life Outcomes* (Schulkind & Sandler, 2019), Figure 2. “The shaded rows in the first two columns represent the treated group, while the shaded rows in the 3rd and 4th columns represent the control group. Each cell displays the school year at ages 17, 18 and 19 for someone who has made normal progress in school. “Junior” is the second to last year of high school. “Senior” is the last year of high school. “College1” denotes the first year of college, and “College2” denotes the second year of college. “J/S” is the summer between Junior and Senior year of high school, “S/C1” is the summer between Senior year and the first year of college, and "C1/C2" is the summer between the first two years of college."

In addition to the treatment and control groups within the teenage population, the sample also includes a group of older mothers who gave birth for the first time between ages of 23 and 25. This inclusion aims to account for any seasonal variations in the demographics of women giving birth throughout the year. A previous study in 2013 observed a correlation between the month of a child's birth and the mother's later outcomes, suggesting the importance of considering seasonal patterns among mothers who give birth at different times of the year (Buckles & Hungerman, 2013).

3.2 Methodology

The original paper estimated the effects of an interruption in high school education on outcomes of interest using the following function:

$$Outcome_{isarc} = \alpha + \beta_1 Treat_{isarc} \times Teen_{isarc} + \beta_2 Treat_{isarc} + \beta_3 Teen_{isarc} + \Phi_s + \Phi_a + \Phi_r + \Phi_c + \varepsilon_{isarc}$$

where $Outcome_{isarc}$ represents different outcome variables of interest, $Treat_{isarc}$ is a dummy variable that is equal to one if the first child was born between January and June, and $Teen_{isarc}$ is an indicator variable that equals one if the mother gave birth as a teen, specifically at ages 17 to 19 in this model. The coefficient of interest is β_1, which shows the difference-in-differences for the outcome variables of interest. It shows the effect of having a child just before high school graduation rather than right after high school graduation after differencing out the seasonality using the sample of older mothers. The function also includes a set of fixed effects, Φ_s for the state where the household the mother belongs to resides, Φ_a for the mother's age during the time of survey, Φ_r for the mother's race and Φ_c for the year of census.

The paper employs the function shown above through Ordinary Least Squares (OLS) regressions to investigate various outcome variables of interest. Half of these regressions are linear probability models because half of the outcome variables are dummy variables, and the number of explanatory variables used to predict them exceeds one. First, it explores whether an interruption in education caused by an anticipated child affects the mothers' years of education or the probability of completing high school, as well as their decision to pursue further education in college later on. Second, it assesses whether the interruption in education has adverse impacts on the mother's individual income, employment status or the likelihood of her family falling below the 100% or 200% Federal Poverty Level. Finally, the paper examines whether there are differences in family structure at the time of the survey for the mothers, including their marital status, the number of children in the household, and the age gap between the first and second child.

4. Results and Analysis

4.1 Education

The most immediate impact of a disruption during the final semester of high school due to teenage pregnancy is expected to manifest in education itself, which is termed the first-order effect. Table 1 presents findings from estimating the effects of teenage childbearing on education across four measures using the estimation function shown above. As anticipated, there are statistically significant differences in the probability of completing high school education and the total years of education completed between the teenage mothers in the treatment group and those in the control group. However, the results for the two outcome variables concerning college education, namely, Some College and College Graduate, are mixed with limited statistical significance.

Table 1.

Effect of Teen Fertility on Education

	All	White	Black	Hispanic
High School Graduate	-0.044*** (0.0028)	-0.053*** (0.0033)	-0.031*** (0.0063)	-0.028*** (0.0075)
Some College	-0.0076** (0.0027)	-0.004 (0.003)	-0.015* (0.0076)	-0.011 (0.0064)
College Graduate	0.0014 (0.0019)	0.0026 (0.0022)	0.00064 (0.0054)	-0.0001 (0.0046)
Years of Education	-0.15*** (0.016)	-0.16*** (0.018)	-0.11** (0.036)	-0.19** (0.059)
N	516,276	410,619	58,312	72,491

Notes: As in Schulkind & Sandler (2019), each cell displays the coefficient β1 from a separate estimation of the following equation: $Outcomeisarc = \alpha + \beta 1Treatisarc \times Teenisarc + \beta 2Treatisarc + \beta 3Teenisarc + \Phi s + \Phi a + \Phi r + \Phi c + \varepsilon isarc$. The first column lists the outcome variables. Standard errors, clustered by state, are displayed within parentheses. * p<0.05, ** p<0.01, *** p<0.001

Row 1 presents findings for the High School Graduate variable, a dummy variable that equals to one if the mother completes her high school education. Teens giving birth before their expected high school graduation date are 4.4 percent less likely to finish high school compared to those giving birth after graduation within the same year. This negative impact is consistent across all subgroups of teen mothers, with the largest effect observed among White mothers (a decrease of around 5.3%) and the smallest among Hispanic mothers (a decrease of around 2.8%).

Moving to Row 2, the Some College variable indicates whether the mother completed some college education. Teen mothers in the treatment group are approximately 0.8% less likely to attain some college education than those in the control group. While the negative impact is statistically significant for the whole population, this statistical significance does not extend to the White and Hispanic populations, despite negative coefficients being present across all subgroups. This contrasts with the findings of Schulkind and Sandler, who reported negative coefficients with significant statistical weight for the Some College variable.

The third row displays the probability for the mother to complete her college education. Despite positive coefficients observed for the entire population and the subgroups of White and Black teen mothers, no positive impact can be confirmed as the p-values for the estimations are all too high to be considered statistically significant. Similarly, the negative coefficient for the College Graduate variable for Hispanic teen mothers also lacks statistical significance.

The last row displays the estimated effects of teenage childbearing on the number of years of education for adolescent mothers. Treated teenage mothers have 0.15 fewer years of education than the control group, with the magnitude of the negative effect on years of completed education varying across subgroups. Among Hispanic teen mothers, the negative effect is largest, with 0.19 fewer years of education, while among Black teen mothers, it is smallest, with 0.11 fewer years.

4.2 Family and Labor Market Outcomes

In addition to the immediate effects on education, the disruption in high school due to teenage childbearing also has an impact on later life outcomes, as shown in Tables 2 to 4.

4.2.1 Labor Market Outcomes

Table 2.

Effect of Teen Fertility on Labor Market Outcomes

	All	White	Black	Hispanic
Working	-0.0062 (0.0032)	-0.0066 (0.0037)	-0.0007 (0.0079)	-0.012 (0.0079)
Log Wage	-0.033 (0.028)	-0.025 (0.033)	-0.018 (0.068)	-0.0033 (0.073)
Log Total Family Income	-0.0037 (0.0097)	0.0001 (0.01)	-0.018 (0.032)	0.017 (0.025)
N	516,276	410,619	58,312	72,491

Notes: As in Schulkind & Sandler (2019), each cell displays the coefficient β1 from a separate estimation of the following equation: *Outcomeisarc = α + β1Treatisarc × Teenisarc + β2Treatisarc + β3Teenisarc +Φs +Φa +Φr +Φc +εisarc*. The first column lists the outcome variables. Standard errors, clustered by state, are displayed within parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 2 presents results on three labor market outcome measures using the estimation strategy. The first row focuses on the Working variable, a dummy variable indicating whether the teen mother was employed at the time of the survey. The second row estimates the difference in wage income between the treated and control groups of teen mothers, while the third row reflects the difference in total family income.

In Row 1, it's evident that teen childbearing reduces the probability of employment for teen mothers by 0.6% for the entire population, with variations across subgroups. The reduction is most pronounced among Hispanic mothers (1.2%) and least among the Black subgroup (0.07%).

Row 2 indicates that giving birth just before high school graduation decreases the wage income of teen mothers by 3.3% compared to the control group. This negative impact is strongest among White teen mothers and weakest among Hispanic mothers.

The mixed results in Row 3 indicate that the correlation between teen childbearing and the total family income of mothers is generally negative, but positive for specific populations of White and Hispanic mothers.

However, none of the results on labor market outcomes can be confirmed, as the p-values for all estimations are greater than 0.05, with some even exceeding 0.9. Consequently, the results are all statistically insignificant, and I was unable to reject the null hypotheses of no effect at a 95% confidence level.

Furthermore, these findings differ significantly from those in the original paper (Schulkind & Sandler, 2019) in terms of statistical significance and coefficient values. The original authors found statistically significant negative effects on the Working variable for the entire population and the outcome variable measuring total family income. In addition, the effect they observed on total family income was negative for the entire population and across specific groups, unlike the mixed results here demonstrated by different signs of coefficients for each sample group. While neither study found a statistically significant correlation between teen childbearing and mothers' wage income, the signs of the coefficients were mixed in the original paper and consistently negative in my estimation.

4.3 Family Outcomes

Apart from labor market outcomes, the paper also examines the effect of giving birth as a teen on the teen mothers' family structure and the poverty status of their households.

Table 3.

Effect of Teen Fertility on Family Structure

	All	White	Black	Hispanic
Married	-0.0011 (0.0026)	0.0033 (0.0028)	-0.012 (0.0078)	-0.0054 (0.0065)
Number of Children	0.067*** (0.0064)	0.0596*** (0.0073)	0.096*** (0.017)	0.063*** (0.016)
N	516,276	410,619	58,312	72,491

Notes: As in Schulkind & Sandler (2019), each cell displays the coefficient β1 from a separate estimation of the following equation: $Outcome_{isarc} = \alpha + \beta_1 Treat_{isarc} \times Teen_{isarc} + \beta_2 Treat_{isarc} + \beta_3 Teen_{isarc} + \Phi_s + \Phi_a + \Phi_r + \Phi_c + \varepsilon_{isarc}$. The first column lists the outcome variables. Standard errors, clustered by state, are displayed within parentheses. * p<0.05, ** p<0.01, *** p<0.001

Table 3 assesses the family structure of teen mothers by examining their marital status and the number of children they have. Row 1 shows that giving birth before high school graduation reduces the probability of the mother being married by 0.1% for the entire population, 1.2% for Black mothers, and 0.5% for Hispanic mothers, but increases this probability for White mothers. However, all these results have large p-values, rendering them statistically insignificant. Furthermore, the coefficients are so small that their practical significance is questionable. These findings sharply contrast with the statistically significant negative relationships found in the original paper, raising questions about the disparities in results.

On the contrary, Row 2 reveals a statistically significant positive relationship, consistent with the original paper. Teen mothers who give birth before high school graduation tend to have more children later on than those who give birth after high school, with an increase of 0.07 for the entire population, 0.06 for White mothers, 0.10 for Black mothers, and 0.06 for Hispanic mothers. While the magnitude of the positive effect on the entire population is similar between the original study and my results, the strength of the effect on subgroups differs. In my results, Black mothers experience the largest effect, whereas in the original study, Hispanic mothers are most affected.

Table 4.

Effect of Teen Fertility on Poverty

	All	White	Black	Hispanic
Below 100 % of Federal Poverty Line	0.006* (0.0027)	0.0016 (0.003)	0.015 (0.0078)	-0.0048 (0.0073)
Below 200 % of Federal Poverty Line	0.0079** (0.003)	0.004 (0.0036)	0.019* (0.0076)	0.0032 (0.0074)
N	516,276	410,619	58,312	72,491

Notes: As in Schulkind & Sandler (2019), each cell displays the coefficient β1 from a separate estimation of the following equation: $Outcome_{isarc} = \alpha + \beta_1 Treat_{isarc} \times Teen_{isarc} + \beta_2 Treat_{isarc} + \beta_3 Teen_{isarc} + \Phi_s + \Phi_a + \Phi_r + \Phi_c + \varepsilon_{isarc}$. The first column lists the outcome variables. Standard errors, clustered by state, are displayed within parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 4 discusses the effect on the poverty status of the households the teen mothers are in. Given the lack of statistically significant results on the individual wage income of the mothers and total family income, it's unsurprising that there is little statistical significance in the measured effect of teen childbearing on whether the family's total income falls below 100% of the Federal Poverty Line (FPL). As displayed in the first row in Table 4, I can only conclude that teen mothers in the treated group are more likely to fall below the 100% Federal Poverty Line by 0.6% at a 95% confidence level. All the other results are statistically insignificant, suggesting that there may be no correlation between them.

Moreover, the measured effects on whether the teen mothers fall below 200% of FPL have a larger statistical significance, as shown in Row 2. Teen mothers in the treated group are 0.8% more likely to fall below 200% of FPL than the control group. A similar effect applies to the Black subgroup, as Black teens who give birth before graduation are 1.9% more likely to fall below 200% of FPL than those who give birth after high school graduation. No significant results are found for the White and Hispanic population.

Similar to the differences in results on total family income, the original paper had different and much more statistically significant results on the poverty status variables compared to my results. The authors were able to state with confidence that giving birth before high school graduation increases the likelihood of teen mothers falling below 100% and 200% of FPL for the entire population.

5. Discussion

The previous section highlights numerous discrepancies in the results between the original paper (Schulkind & Sandler, 2019) and my estimation. Despite using 5% state census data instead of decennial census data due to access issues, the results should not have varied so substantially. This suggests two potential scenarios: either I made errors in my replication process, indicating disparities in how I prepared my data and ran my regressions compared to Schulkind and Sandler, or the results in the original paper may not be reliable. The latter implies that the conclusions drawn from the original study should be questioned and warrant further investigation. In this section, I will discuss the potential causes of these differences and express doubts regarding the methodology and conclusions presented in the original paper.

5.1 Problems in the attempts to replicate

5.1.1 Data

First, the original paper used survey dates and exact birth dates of teen mothers and their children to accurately determine the mothers' age at first birth. However, I couldn't obtain specific birth dates from IPUMS USA for either the mothers or their first child. This could introduce errors when assigning treatment and control groups, as well as values for variables like age at birth. For instance, if a mother was born on April 15, 1950, and her child on May 1, 1965, the mother's age would be recorded as 29 and the child's as 14 by the survey date of April 1. But if the mother's birthdate is March 31, 1950, the mother's age on the survey date would be documented as 30, while the child's age remains 14. In the original paper, the age at birth of the teen mother is consistently 15 for both cases, whereas in my calculation, it's 15 for the first scenario and 16 for the second. This discrepancy can lead to errors in group assignment since it partially relies on the age of the teen mothers.

Second, for the outcome variable "College Graduate," I derived values based on education attainment as the original paper didn't explain how these values were generated. Since some individuals spent more than four years in college, it's unclear if those who completed more than four years actually graduated.

Third, for the outcome variable measuring years of education, I capped the maximum at 18 despite the possibility of more than 18 years of education. This limitation arises from the coding of the education attainment variable, which I utilized to derive the variable for years of education. Unfortunately, without details on how this variable was generated in the original paper, it's unclear whether this discrepancy could lead to different results from those presented in the original study.

Fourth, I determined the age of the oldest child born to the mother by considering the age of the oldest child in the household, excluding adopted and stepchildren. This contrasts with the original paper's method, which directly used "the age of a mother’s oldest 'own child' living with her at survey date" when calculating the mother’s age at first birth for her first child (Schulkind & Sandler, 2019, pp.7). The original method's inclusion of stepchildren and adopted children in determining the age of the oldest child in the household can introduce errors in estimating the age at first birth of the teen mothers. I made this adjustment to reduce potential errors, which could contribute to differences in results.

Last, I generated poverty variables, "Below 100% of Federal Poverty Level (FPL)" and "Below 200% of FPL," based on the dataset's poverty variable, reflecting the percentage of poverty thresholds the total family income of teen mothers falls below after adjusting for inflation. However, the process for structuring these variables may differ from that in the original paper, which wasn't explained.

5.1.2 Omitted analyses

In the results section, I did not conduct regression analysis on the outcome variable Age Gap. Despite the original paper reporting the same number of observations for this variable as for other outcome variables, I encountered difficulties replicating this estimation. Consequently, I omitted it from my paper due to insufficient information.

I also chose not to include mean values for the outcome variables in the tables, unlike the original paper. This decision was made due to inconsistency in the authors' selection of means. Specifically, in the original paper, means of outcome variables for education were presented without specifying any particular group, while means for family and labor market outcomes were specifically for the treated group. The rationale behind this switch was not explained in the paper. To prevent confusion, I decided to exclude mean values altogether.

5.2 Questions regarding interpretation

Besides the issues in the replication process, I also had some questions regarding the interpretation of results in the original paper.

In their study, Schulkind and Sandler categorized the effects of teenage childbearing on education outcomes as the first-order effect, while labeling the effects on family and labor market outcomes as the second-order effect—consequences of the consequences stemming from an action. They claimed that the effects on family and labor market outcomes are caused by the effects on education. Consequently, they were able to attribute statistically significant results on later life outcome variables to the statistically significant results on education-related variables.

However, it's important to note that the estimation strategy employed in the original paper was the same across all outcome variables. This suggests that the estimated effects were directly attributed to teen childbearing on those outcomes, rather than through the intermediary of education. As a result, the reliability of the understanding that the effects on later life outcomes are second-order effects may be questioned.

Despite the differences in results observed during the replication, this paper implies that the findings from Schulkind and Sandler's 2019 study should be approached with caution. It underscores the necessity for further research into the effects of teen childbearing to gain a more comprehensive understanding of its implications.

6. Conclusion

The United States has long grappled with a high teenage birth rate, sparking heated debates among researchers regarding its implications and impact on the lives of teen mothers. While many studies suggest a negative correlation between teenage childbirth and later life outcomes such as education attainment, socioeconomic status, and family structure, others have found no causal relationship or even observed reverse causation. Thus, it's crucial to replicate existing literature to better understand the correlation between teenage childbearing and its potential effects on teen mothers' lives.

This paper replicates key aspects of Schulkind and Sandler's 2019 study, specifically employing their proposed strategy to examine the effects of adolescent childbearing on later life outcomes of teen mothers. The focus is on comparing teenage females who give birth within six months before their expected high school graduation with those who give birth within six months after graduation, assuming no differences between the two groups prior to childbirth.

Consistent with the original paper, I found that giving birth within six months prior to high school graduation decreases the probability of completing high school by 5.4% and reduces years of education obtained by 0.14 years compared to giving birth within six months after high school. It also increases the number of children the mother has later in life and the probability of living in poverty, especially below 200% of the Federal Poverty Level. In addition, there were no measurable effects on employment status and earnings of teen mothers. Unlike the original paper, this replication does not find significant effects on marital status, and the significance of the effects on poverty status is much smaller in my estimation. Overall, my findings reveal fewer effects of teen childbearing on later life outcomes of teen mothers with smaller statistical significance.

These results call for further scrutiny of existing research findings and underscore the need for a more careful evaluation of arguments on both sides of the debate regarding the effects of teen childbearing. Moreover, the insignificance of the results in this replication raises doubts about the cost efficiency of current policies aimed at addressing the teenage birth rate.

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Appendix: Tables of Results by Schulkind and Sandler

Table 5

Effect of Teen Fertility on Education

	All	White	Black	Hispanic
High School Graduate	-0.0536*** (0.00236) .734	-0.0631*** (0.00328) .744	-0.0404*** (0.00335) .787	-0.0362*** (0.00344) .629
Some College	-0.00919*** (0.00148) .194	-0.00723*** (0.00169) .18	-0.0191*** (0.00496) .264	-0.0129** (0.00458) .168
College Graduate	0.00122 (0.000913) .0274	0.00242* (0.00107) .0261	0.000721 (0.00242) .0341	-0.00698*** (0.00197) .0218
Years of Education	-0.136*** (0.00824) 11.75	-0.130*** (0.00977) 11.85	-0.126*** (0.0216) 12.17	-0.199*** (0.0226) 10.83
Obs	1480300	1108800	142200	167000

Note. Retrieved from "The Timing of Teenage Births: Estimating the Effect on High School Graduation and Later Life Outcomes" by Schulkind & Sandler, 2019, *Demography* 56, 345–365 (2019). "Each cell contains the coefficient β_1 from a separate estimation of the following equation: $Outcome_{isarc} = \alpha + \beta_1 Treat_{isarc} \times Teen_{isarc} + \beta_2 Treat_{isarc} + \beta_3 Teen_{isarc} + \Phi_s + \Phi_a + \Phi_r + \Phi_c + \varepsilon_{isarc}$. The variable listed in the first column is the outcome variable. Mean values of each outcome variable for the treated group are listed below the coefficient and standard errors. Standard errors are shown in parentheses and are clustered by state. * $p<0.05$, ** $p<0.01$, *** $p<0.001$"

Table 6

Effect of Teen Fertility on Family Structure

	All	White	Black	Hispanic
Married	-0.0105***	-0.00705***	-0.0174**	-0.0118***
	(0.00170)	(0.00196)	(0.00542)	(0.00238)
	.644	.734	.325	.625
Number of Children	0.0624***	0.0449***	0.0788***	0.0914***
	(0.00383)	(0.00427)	(0.0101)	(0.00972)
	2.398	2.302	2.517	2.617
Age Gap	0.0949***	0.128***	0.00273	0.0270
	(0.0101)	(0.0121)	(0.0283)	(0.0206)
	3.361	3.362	3.334	3.388
Obs	1670700	1233000	163500	201000

Note. Retrieved from "The Timing of Teenage Births: Estimating the Effect on High School Graduation and Later Life Outcomes" by Schulkind & Sandler, 2019, *Demography* 56, 345–365 (2019). "Each cell contains the coefficient β_1 from a separate estimation of the following equation: $Outcome_{isarc} = \alpha + \beta_1 Treat_{isarc} \times Teen_{isarc} + \beta_2 Treat_{isarc} + \beta_3 Teen_{isarc} + \Phi_s + \Phi_a + \Phi_r + \Phi_c + \varepsilon_{isarc}$. The variable listed in the first column is the outcome variable. Mean values of each outcome variable for the treated group are listed below the coefficient and standard errors. Standard errors are shown in parentheses and are clustered by state. * p<0.05, ** p<0.01, *** p<0.001"

Table 7

Effect of Teen Fertility on Labor Market Outcomes

	All	White	Black	Hispanic
Working	-0.00676***	-0.00479*	-0.00481	-0.00747
	(0.00178)	(0.00217)	(0.00506)	(0.00411)
	.545	.548	.588	.489
Log Wage	-0.000526	0.00173	-0.00468	0.00178
	(0.00400)	(0.00497)	(0.0102)	(0.0134)
	9.2	9.16	9.31	9.26
Log Total Family Income	-0.0158***	-0.00622	-0.0492***	-0.0212**
	(0.00284)	(0.00325)	(0.0108)	(0.00779)
	10.27	10.4	9.872	10.15
Obs	1651700	1224000	159400	196300

Note. Retrieved from "The Timing of Teenage Births: Estimating the Effect on High School Graduation and Later Life Outcomes" by Schulkind & Sandler, 2019, *Demography* 56, 345–365 (2019). "Each cell contains the coefficient β_1 from a separate estimation of the following equation: $Outcome_{isarc} = \alpha + \beta_1 Treat_{isarc} \times Teen_{isarc} + \beta_2 Treat_{isarc} + \beta_3 Teen_{isarc} + \Phi_s + \Phi_a + \Phi_r + \Phi_c + \varepsilon_{isarc}$. The variable listed in the first column is the outcome variable. Mean values of each outcome variable for the treated group are listed below the coefficient and standard errors. Standard errors are shown in parentheses and are clustered by state. * p<0.05, ** p<0.01, *** p<0.001"

Table 8

Effect of Teen Fertility on Poverty

	All	White	Black	Hispanic
Below 100% of FPL	0.00989***	0.00508**	0.0203***	0.0130***
	(0.00119)	(0.00162)	(0.00337)	(0.00283)
	.236	.173	.397	.316
Below 200% of FPL	0.0151***	0.0125***	0.0253***	0.0144**
	(0.00151)	(0.00196)	(0.00487)	(0.00469)
	.5246	.4533	.6877	.6374
Obs	1668400	1232500	163300	199900

Note. Retrieved from "The Timing of Teenage Births: Estimating the Effect on High School Graduation and Later Life Outcomes" by Schulkind & Sandler, 2019, *Demography* 56, 345–365 (2019). "Each cell contains the coefficient β_1 from a separate estimation of the following equation: $Outcome_{isarc} = \alpha + \beta_1 Treat_{isarc} \times Teen_{isarc} + \beta_2 Treat_{isarc} + \beta_3 Teen_{isarc} + \Phi_s + \Phi_a + \Phi_r + \Phi_c + \varepsilon_{isarc}$. The variable listed in the first column is the outcome variable. Mean values of each outcome variable for the treated group are listed below the coefficient and standard errors. Standard errors are shown in parentheses and are clustered by state. * $p<0.05$, ** $p<0.01$, *** $p<0.001$"