

The Long Run Effects of Recessions on Fertility

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Abstract

Using large repeated cross sections and a cohort-based econometric approach, this paper produces evidence that females who finish their formal education during periods of high unemployment have significantly, and persistently, lower fertility compared to females who graduate during more favorable economic conditions. In terms of magnitude, a female who graduates into a market with a 3 percentage point higher unemployment rate experiences an approximate 14 percent reduction in birth probabilities about a half decade later. The long-recognized negative effects of unemployment on marriage explain, at most, 30 of that reduction in fertility. Rather, graduating into high unemployment appears to exert its own influence on fertility, separate from its effect on marriage.

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1 Introduction

In recent decades, developed nations throughout the world have experienced fertility rates falling below “replacement” levels (IUSSP, 2017). For example, the World Bank reports births per woman in 2020 of 1.64 in the United States, 1.56 in the United Kingdom, and 1.83 in France. All three fall far below the roughly 2.1 births per woman needed to replace one generation to the next. That pattern has set off a large literature that aims to explore the macroeconomic consequences of fertility changes (Bairoliya, Miller, and Saxena, 2019). In the U.S., the overall population continues to expand, but the main driver of that growth is immigration from other countries (U.S. Census report, 2022), and some studies express doubt as to whether immigration offers a long run answer to lower fertility (Lichter and Johnson, 2020).

Those concerns highlight a pressing need to identify possible explanations for changing fertility, both at the micro and macro levels. This paper explores one such micro-level explanation. Specifically, this paper shows that females who finish their formal education during periods of high unemployment have significantly, and persistently, lower fertility compared to females who graduate during more favorable economic conditions. In terms of magnitude, a female who graduates into a market with a 3 percentage point higher unemployment rate experiences an approximate 14 percent reduction in birth

probabilities about a half decade later. Those reduced birth probabilities do not appear to be due to delayed child bearing; rather, fertility appears to have remained permanently depressed for females graduating into higher unemployment.

That finding comes from an econometric “scarring model” that uses large cross-sectional surveys and focuses on state-level cohorts by graduation year. Using a similar econometric approach, this paper also demonstrates that the same is true for marriage, with females graduating during periods of high employment also being significantly, and persistently, less likely to marry. Of course, marriage, itself, is an important determinant of fertility. Thus, an obvious follow-up question is: Does graduating into high unemployment *directly* lower fertility, or does graduating into high unemployment reduce marriage, which then, in turn, hinders fertility? If lawmakers wish to enact policies aimed at boosting fertility, then the answer to that question has important implications for how those policies should be structured and targeted.

In an attempt to untangle those interconnected parts, this paper turns to a mediation analysis (Baron and Kenny, 1986), an approach that has seen growing popularity in the applied statistical literature. Results from that exercise suggest that, following periods of high unemployment, lower marriage rates explain, at most, 30% of lower fertility. Rather, graduating into

high unemployment appears to exert its own influence on fertility, separate from its effect on marriage. The most likely explanation is that adverse economic conditions bring about a negative income effect, which in turn reduces females' opportunities, abilities, or desires to have children.

That conclusion has important implications for policymakers who might wish to encourage fertility. For example, findings of this paper suggest that, following periods of high unemployment, marriage-friendly policies, by themselves, might not yield large boosts to fertility. Rather, graduating into high unemployment appears to bring with it persistent economic scarring, and thus fertility might recover only by offering assistance that directly reduces the costs of bearing children, such as favorable tax treatment or subsidized child care.

The following section offers an abbreviated discussion of fertility as it relates to economic conditions. That is followed by a discussion of the large cross sections, drawn from the American Community Survey, used to form the cohort-based estimation sample. Then, following a formal presentation of the econometric scarring setup, the paper presents its main results. Attention then turns to a mediation exercise, which attempts to offer further insights into the results of the scarring model. The final section offers concluding remarks and policy implications.

2 Background

Dating at least to studies by Galbraith and Thomas (1941) and Silver (1965), social scientists have sought to explore links between economic conditions and fertility. That early generation of studies primarily focused on quantifying historical correlations between business cycles, marital rates, and births. As developed nations continued to become richer, a curious pattern emerged, characterized by an inverse relationship between income and fertility, both at the micro and macro levels. Becker's seminal work (1960) marked a turning point, and ushered in a new generation of studies seeking to explain *why* income relates to lower fertility. Much of that literature settled on rising female labor force participation, and its attendant deleterious effects on fertility, as a central explanation for the inverse link between income and fertility (Hotz, Klerman, and Willis, 1997).

Since around 1980, however, that inverse relationship between income and fertility has vanished, and in some cases slightly reversed, at least among developed countries. Doepke, Hannusch, Kindermann, and Tertilt (2022) provide a survey of the various theories that seek to explain that reversal. Many of the explanations point to policies that have been implemented in developed nations that attempt to ease the ability of females to raise children while simultaneously pursuing careers. Examples include flexible work

arrangements and favorable tax treatment of childcare.

A much smaller strand of research focuses specifically on the link between *unemployment* and fertility. Adsera (2005) argues that economic theory points to ambiguous links between the two. On one hand, a short unemployment spell brings with it a fall in opportunity costs of child bearing, thus possibly increasing fertility. However, she argues that a persistent unemployment spell actuates a potentially large income penalty, which in turn might reduce fertility, especially if parents count children as “normal goods.” Corroborating her prediction of ambiguous effects, some studies find countercyclical effects, characterized by higher unemployment leading to increased fertility (Butz and Ward, 1979; Ermisch, 1980; Ermisch, 1988), but other studies find procyclical patterns (Macunovich, 1996; Adsera, 2004; Sobotka, Skirbekk, and Philipov, 2011; Bono, Weber, and Winter-Ebmer, 2015; Schneider, 2015; Shaller, 2016; Raymo and Shibata, 2017; Orsal and Goldstein, 2018; Bellido and Marcen, 2019). The closest study to this paper is Currie and Schwandt (2014). Their emphasis and data sources differ somewhat from what appear in this paper, but they, too, find procyclical fertility patterns using a cohort-based analysis.

3 Data

Research in labor economics offers several examples of “scarring” models, which seek to investigate the long run damage of experiencing negative economic circumstances (Oreopoulos, von Wachter, and Heisz, 2012; Schwandt and von Wachter, 2019; Rothstein, 2021). The empirical approach employed in this paper offers a version of such a model. Specifically, this paper seeks to explore a relationship characterized by

$$y_{i,t} = \alpha + \beta u_{i,0} + \varepsilon_{i,t}$$

where $y_{i,t}$ is a measure of fertility for female i in year t , and $u_{i,0}$ is the unemployment rate in the state in which she resided when she finished her formal schooling. In an ideal setting, the coefficient β would give the causal effect of unemployment on subsequent fertility. The form of the actual econometric setup attempts to mimic this ideal regression in light of the types of information commonly available in large household surveys. For that reason, the data sources are discussed before turning to details of the estimation approach.

Person-level information comes from repeated annual waves of the American Community Survey (ACS), conducted and published by the U.S. Census Bureau. Containing nationally-representative information usually available only in the long form of the decennial census, the ACS represents the largest

household survey administered by the Census Bureau. Data used in this study come from the annual waves of the survey from the years 2000, 2001, ... , 2019. The estimation sample includes all females who, during their ACS interview, were between the ages 16 and 45, and who reported at least a 9th grade education. The sample considers only females born in one of the 50 U.S. states or the District of Columbia.

An important disadvantage of the ACS is that it does not record when a person finishes her formal education. Following the literature (Schwandt and von Wachter, 2019), this paper sidesteps that data limitation by forming, for every female, a “Mincerian” year of graduation, defined as birth year, plus 6, plus years of reported education. Because of the years of the ACS cross sections, and the ages of the females under consideration, the Mincerian graduation years cover 1985 to 2019. (The Mincerian year of completion is hereafter referred to as the “graduation year.”)

Another disadvantage of the ACS is that it does not record the state in which the person resided during her graduation year, which precludes a perfect match of females to their graduation year unemployment rates. This paper proxies for that information using the unemployment in the female’s graduation year in her current state of residence, but that opens the possibility of bias owing to endogenous migration. If, for example, females seeking

to have children migrate to locations with more favorable economic conditions, then such migration patterns will attenuate the observed link between unemployment and fertility. A frequent concern among cohort-based studies that use census data, this paper explores the extent of endogenous migration by also considering a subsample of females who, during the year of their ACS interview, reported living in the same states in which they were born. Results from that subsample of non-migrators produce estimates that are nearly identical to those obtained from the larger baseline estimation sample.

Another concern is possible endogenous termination of education. That is, although this paper's main concerns are fertility patterns *after* a female completes her education, she *could* end her education *because* of pregnancy or marriage. And while the impacts of pregnancy and marriage on early termination of education represent important policy concerns, they are not the main focus of this paper. Thus, to reduce the possibility of endogenously-terminated education, the estimation sample deletes females who gave birth or became married in their first year after their Mincerian completion year. Finally, the estimation sample focuses on females no more than 15 years removed from their graduation year, as those are likely the most important years for family formation and fertility.

Those sample restrictions yield 5,046,772 unique females, with sample

means reported in Table 1. The top of the table reports the main outcome of interest. Rather than number of children ever born, the ACS records whether the female gave birth during the past year. Meanwhile, marital status is captured by a dichotomous indicator for whether the subject is currently married. The table also reports four education groups, which are constructed from the graduation year. The table also reports race.

Table 1: Person-level data
American Community Survey cross sections (2000-2019)

	Mean	Min	Max
Outcomes			
Gave birth in past year	0.08	0	1
Currently married	0.32	0	1
Timing			
Year	2011	2000	2019
Graduation year	2005	1985	2019
Years since graduation	6.12	0	15
Education groups			
Less than high school	0.15	0	1
High school degree	0.28	0	1
Some college	0.27	0	1
College degree or higher	0.30	0	1
Demographics			
Age	26	16	38
Nonwhite	0.22	0	1
Location			
State of residence	51 dummies		

Following the practice of other cohort-based studies, those more than 5 million data points are aggregated at the level of (1) current state of residence, (2) calendar year, (3) graduation year, and (4) education group. Such a cell-based approach suffices because the empirical analysis does not use individual-level controls, and it reflects that the main source of variation in the treatment variable (unemployment rate) occurs at the state/year level. The final cell-based sample size includes 64,266 observations. That final estimation sample includes the main treatment variable of interest, the state-level unemployment rate during the cell’s year of graduation, available from the U.S. Bureau of Labor Statistics.

4 Econometric Model

The scarring model takes the form of a linear regression

$$\bar{y}_{s,t,g,e} = \alpha + \beta_z u_{s,g} + \gamma_s + \delta_t + \eta_g + \theta_e + \lambda_z + \varepsilon_{s,t,g,e} \quad (1)$$

where $\bar{y}_{s,t,g,e}$ represents mean fertility at the cell level. The four subscripts index current state of residence (s), calendar year (t), graduation year (g), and education group (e). The regression also includes fixed effects for years since graduation (z). The treatment variable of interest, $u_{s,g}$, is the unemployment rate in state s during graduation year g . With the dependent variable measured as means, and with different numbers of observations giving rise

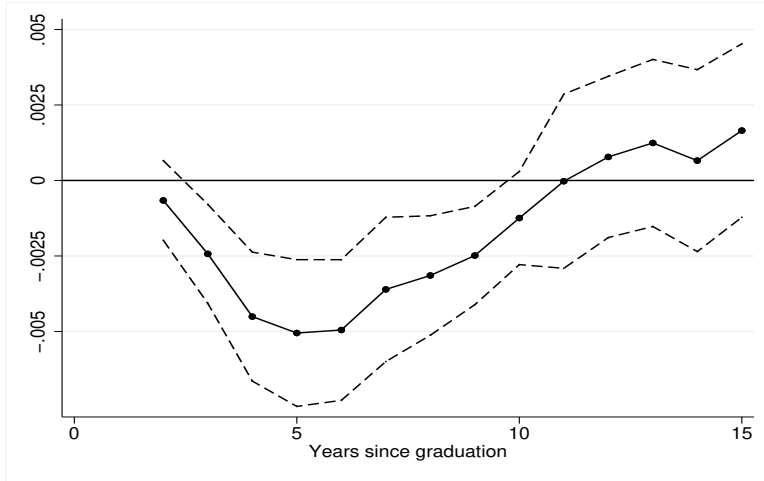
to those means, all estimates reported below analytically weight by cell size. Moreover, all standard errors account for clustering at the state level. (Different clustering levels did not appear to alter the main conclusions.)

As indicated by the subscript attached to the main coefficient of interest, β_z , the effect of unemployment on fertility is permitted to evolve as the female becomes further removed from her year of graduation. In light of the included fixed effects, those coefficients capture cohort/state specific deviations from the “typical” evolution of how fertility responds to variation in graduation-year unemployment.

5 Main Findings

Figure 1 plots the effects of the state unemployment rate during the year of graduation on the probability of having given birth in the past year. The dots in the figure represent the coefficients β_z in equation (1), and the dashed lines provide a 95 percent confidence band based on the estimated standard errors, which adjust for clustering at the state level. (Recall that, in order to reduce the possibility of endogenously-terminated education, the estimation sample does not include females to who gave birth or married during the first year after their graduation year. For that reason, the effects reported in the figure start two years after graduation.)

Figure 1: The effect of unemployment on fertility.
Dots represent the coefficients β_z in equation (1).
Dashed lines provide 95 percent confidence band.



The figure shows that a higher unemployment rate during the year of graduation associates with an immediate reduction in fertility that persists for about 9-10 years. After that, the effect of graduation year unemployment becomes statistically insignificant, but note that it never turns positive. Thus, because each point in the figure shows the effect on *one-year* fertility, the overall implication is that a female's lifetime fertility shrinks as a consequence of higher graduation year unemployment.

Table 2 shows regression estimates from equation (1) where, to keep the table from becoming unwieldy, the years-since-graduation measure is aggregated into groups. Focusing on the full sample, graduation year unemploy-

ment appears to exert a nearly immediate impact on fertility, with that effect growing in magnitude over time. Approximately 4-6 years after graduation, a 3 percentage point increase in unemployment – the approximate increase peak-to-trough during a recession – reduces the probability of having given birth in the past year by about 1.4 percentage points (3×0.0048). Compared to the mean of the dependent variable (0.10), that 1.4 percentage point decrease represents an approximate 14 percentage decrease in fertility. That decrease in fertility remains 7-9 years after graduation, after which it becomes insignificant, but never turns positive.

Table 2: Effects of unemployment on fertility.
 Dependent variable: Cell-level mean of birth in past year.
 Cluster-robust standard errors in parentheses.

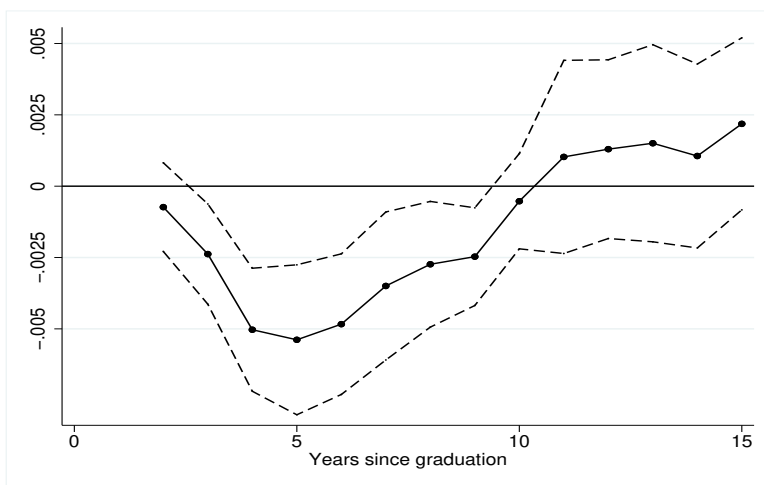
Years since graduation	Full sample	Nonwhite	No high school	High school	Some college	College
2-3	-.0014 (.0007)	-.0028 (.0012)	-.0047 (.0011)	-.0017 (.0009)	.0006 (.0006)	-.0009 (.0011)
4-6	-.0048 (.0011)	-.0046 (.0014)	-.0065 (.0022)	-.0037 (.0011)	-.0032 (.0010)	-.0042 (.0014)
7-9	-.0031 (.0010)	-.0016 (.0009)	-.0019 (.0015)	-.0010 (.0007)	-.0028 (.0011)	-.0038 (.0013)
10-12	-.0004 (.0009)	.0008 (.0014)	.0005 (.0020)	.0002 (.0011)	-.0003 (.0008)	.0010 (.0010)
13-15	.0011 (.0014)	.0028 (.0020)	.0002 (.0017)	.0005 (.0017)	.0013 (.0012)	.0035 (.0017)

The remainder of Table 2 considers various subsamples of potential policy interest. Nonwhites who graduate into higher unemployment appear to experience larger initial reductions in fertility. By 4-6 years after graduation, magnitudes appear similar to those obtained from the full sample, after which they become statistically insignificant. A somewhat similar pattern emerges amongst females with no high school degree, with the effects being quite pronounced up to 6 years after finishing school, but insignificantly distinguishable from zero after that. At the far extreme, college-educated females show little immediate impact, but unemployment does appear to hinder their fertility 4-9 years after graduating. Curiously, college-educated females show a *positive* effect of graduation-year unemployment on fertility 13-15 years after graduating. (Though, in a table with 30 reported coefficients, the presence of a Type I error would not be surprising.)

As mentioned in the Data section, if females who seek to have children move to locales with more favorable economic conditions, then that sort of endogenous migration might introduce attenuation bias. As a check, equation (1) was reestimated on a subsample of females who, during the year of their ACS interview, report living in the same state in which they were born. Although focusing on non-migrators might push the bias in the opposite direction, the estimates reported in Figure 2 look nearly identical to those

reported in Figure 1.

Figure 2: The effect of unemployment on fertility.
Subsample of non-migrators.
Dots represents the coefficients β_z in equation (1).
Dashed lines provide 95 percent confidence band.



That finding appears to align with other cohort-based studies that fail to detect evidence of endogenous migration (Schwandt and Von Wachter, 2019). Consequently, the remainder of this paper focuses on the full sample of females.

6 The Mediating Role of Marriage

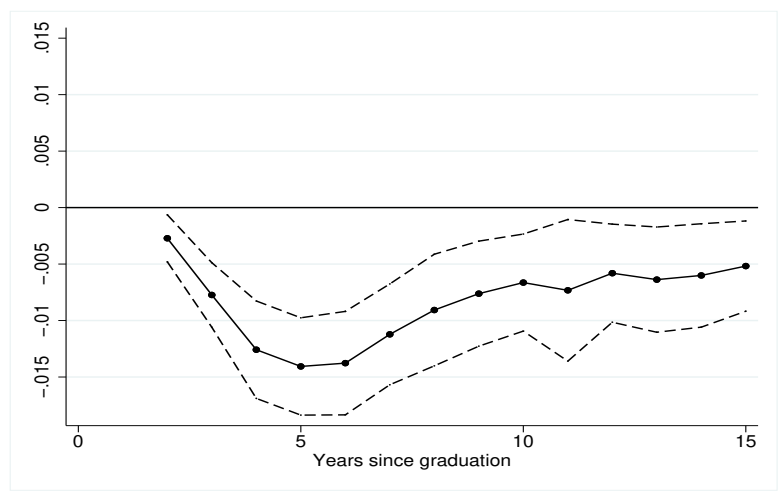
Figure 1 shows the *total effect* of graduation year unemployment on subsequent fertility, represented in the following schematic drawing.



But does there exist a confounding factor that contributes to that total effect? Perhaps high unemployment during a person’s year of graduation hinders her subsequent marital prospects, which, in turn, lowers future fertility.

Taking the regression model in equation (1) and replacing the dependent variable with the cell-level mean for being currently married, one arrives at the following figure.

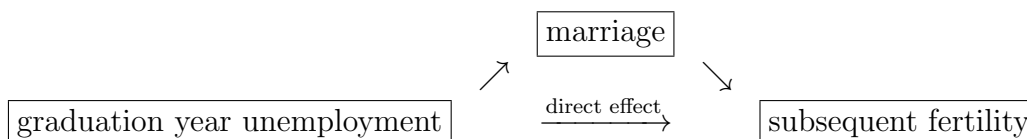
Figure 3: The effect of unemployment on marriage. Dots represents the coefficients β_z in equation (1). Dashed lines provide 95 percent confidence band.



Higher graduation-year unemployment appears to associate with immediate and persistent reductions in probabilities of being married during subsequent

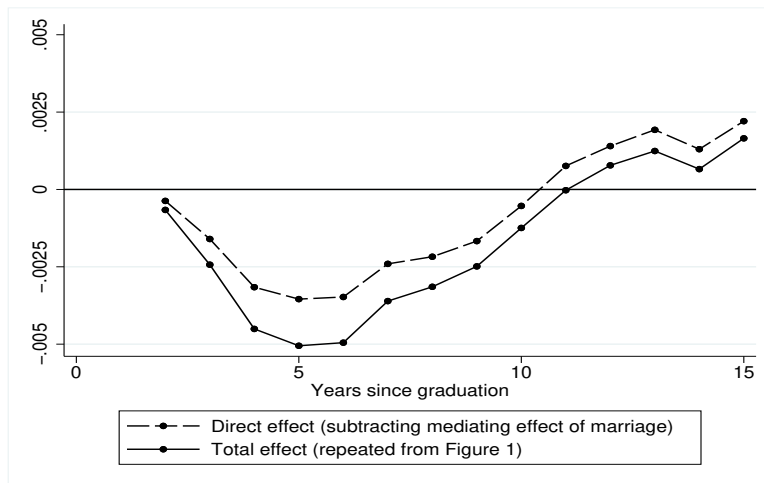
years. The largest effects appear to occur 4-6 years after graduation, when a 3 percentage point increase in graduation-year unemployment reduces marriage probabilities by about 4 percentage points (3×0.0133). Relative to the mean of the dependent variable (0.37), that reduction translates to an approximate 11 percent decrease in marital probabilities. That effect starts to shrink about 5 years after graduation, but remains statistically significant more than a decade after graduation. (Full tables of regression results are not reported, but are available upon request.)

The finding that unemployment hinders marital prospects aligns with earlier research (Schaller, 2013). But in terms of this paper, that finding raises the question of mediating effects. That is, is the negative influence of graduation year unemployment on *fertility* really a true direct effect? Or does that reduction in fertility actually reflect the deleterious effects of graduation year unemployment on *marriage*. And if one filters out those effects on marriage, would any effects on fertility remain? Mediation analysis (Baron and Kenny, 1986) offers an ideal channel through which to address those questions.



Mediation analysis seeks to isolate the bottom arrow, labeled the “direct effect,” after filtering the mediating influence of unemployment on marriage. The algorithm, which is essentially a series of cross-regression hypotheses tests, is implemented using Stata’s `gsem` suite of estimators. (That suite also allows for analytical weights and clustered standard errors, as in the baseline scarring model presented above.) Figure 4 presents mediation results.

Figure 4: The effect of unemployment on fertility.
Mediation analysis.



The solid line repeats Figure 1, but without the confidence band in order to avoid clutter. The dashed line provides the “direct effect” after filtering out the role of marriage. The differences between those two lines are highly statistically significant at every “year since graduation.” But statisti-

cal significance notwithstanding, the mediating role of marriage appears to be quantitatively small.

As an example, focusing on 5 years since graduation, a point at which all effects appear to be near their peaks, the total effect of unemployment on fertility is approximately -0.0051 . Removing the mediating influence of marriage shrinks that effect to approximately -0.0035 . That is, the mediating influence of marriage, at its peak, accounts for only about 30 percent of the total observed effect. The remaining 70 percent represents a direct effect of unemployment on fertility.

7 Conclusion

This paper provides evidence that females who graduate into higher unemployment show large and persistent reductions in fertility. In terms of magnitude, a 3 percentage point higher unemployment rate during a female's year of graduation leads to an approximate 14 percent reduction in birth probabilities about a half decade later. Those probabilities never turn positive, implying a permanent drop in fertility.

Researchers have long been aware that negative economic conditions also tend to hinder marriage rates. Yet, a mediation exercise suggests that, of the aforementioned drop in fertility, at most 30 percent of that drop is explained

by lower rates of marriage. The remaining 70 percent of the drop in fertility appears to be a direct effect of graduating into higher unemployment.

Thus, if lawmakers wish to implement policies aimed at encouraging fertility, then these results suggest that policies targeting marriage would be only partially effective. Instead, lawmakers should directly target the negative income effects brought about by graduating into higher unemployment. Such policies might include financial assistance for neonatal medical services and subsidized daycare.

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