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**Andriana Bellou**
*Université de Montréal and IZA*

**Emanuela Cardia**
*Université de Montréal*

**Joshua Lewis**
*Université de Montréal*

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**IZA – Institute of Labor Economics**

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

# ABSTRACT

## From Bust to Boom: The Great Depression and Women's Fertility*

The United States experienced dramatic swings in fertility over the course of the early- and mid-20th century. This paper presents a novel explanation for these changes, linking the Great Depression to the contemporaneous fertility bust in the early 1930s, the baby boom from the late-1930s through the 1950s, and the subsequent baby bust of the 1960s. Our empirical analysis is based on an event-study approach that links county-level measures of Depression severity to annual fertility rates over an extended 50-year time horizon. We find that the Great Depression can account for roughly half of the bust-boom-bust swings in fertility rates over this period. It can also account for large cross-cohort differences in lifecycle fertility profiles and completed childbearing. We present evidence for a mechanism that accounts for these patterns: the shock incentivized Depression-era women to delay childbearing and to increase lifetime labor force participation. This employment response, in turn, temporarily crowded-out economic opportunities for subsequent generations of women, contributing to their high fertility rates through the 1950s and early 1960s.

**Keywords:** baby boom, baby bust, Great Depression

**Corresponding author:**
Andriana Bellou
Department of Economics
Université de Montréal
C.P. 6128 succursale Centreville
Montréal, QC H3C 3J7
Canada
E-mail: andriana.bellou@umontreal.ca

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# 1 Introduction

The United States experienced pronounced swings in fertility during the early- and mid-20th century. Fertility rates fell sharply during the Great Depression, rose during the baby boom from the late 1930s through the 1950s, and collapsed with the onset of the baby bust in the 1960s (Figure 1). The changes in relative cohort size brought about by these bust-boom-bust fertility cycles have had lasting impacts on the economy through a range of channels including labor markets, housing markets, and government finances (Macunovich, 2002; Mankiw and Weil, 1989). Despite their broad social and economic significance, however, our understanding of the underlying drivers of these massive demographic shifts remains limited.

The bust-boom-bust swings in annual fertility rates were partly the result of changes in completed fertility across cohorts. Figure 1 shows that completed fertility rates were lowest among cohorts whose peak childbearing years overlapped with the Depression, increased for cohorts who entered their childbearing years during the 1940s and 1950s, and declined thereafter. These trends in completed fertility have been well-documented by both economic historians and historical demographers, and research on the causes of the baby boom has largely focused on changes in desired family size across cohorts (see Bailey and Hershbein, 2018, for a discussion).

This paper documents and analyzes a previously unexplored aspect of the baby boom: the bust-boom-bust swings in annual fertility were largely the result of sharp changes in the lifecycle fertility profiles across subsequent cohorts of women. Figure 2 reports the relative age-specific fertility rates across cohorts of women born between 1901 and 1950.[1] The figure reveals striking changes in lifecycle fertility patterns across cohorts. Women who entered their childbearing years during the Great Depression had relatively low fertility when young and relatively high fertility when old. In contrast, women who reached adulthood in the 1950s and early 1960s had high relative fertility rates in early adulthood only to then sharply decrease childbearing as they reached older ages. As an example, consider the cohort of women born between 1936 and 1940. When they were 20-24 years old, these women had the highest age-specific fertility rates of any cohort born in the first half of the 20th century. Nevertheless, their later-life fertility decline was so pronounced

[1] For ease of presentation, we report relative age-specific fertility rates that abstract from the general inverted-U shaped lifecycle pattern of fertility. For each cohort, we report age-specific fertility rates for ages 21 to 40 relative to the corresponding age-specific fertility rate for the 1896-1900 baseline reference cohort.

that this cohort ended up with *fewer* total children than prior generations. These changes in the timing of lifecycle fertility across cohorts were large, accounting for 60 percent of the trough-to-peak increase in annual fertility documented in Figure 1.[2] Thus, an explanation for the aggregate swings in annual fertility rates during this era needs to account for *both* the changes in completed fertility across cohorts as well as their evolving patterns of lifecycle fertility.

In this paper, we study the impact of the Great Depression on these changing patterns in women's fertility. Our main empirical analysis combines a measure of local economic distress – the change in county per capita retail sales from 1929 to 1933 (Fishback, Kantor and Wallis, 2003) – with annual county fertility rates from 1921 to 1975 (Bailey et al., 2018*a*). We estimate difference-in-differences regressions that compare changes in fertility rates before and after the Great Depression across counties within the same state that shared similar pre-1930 trends, but that faced differing levels of economic distress in the early 1930s.[3]

We find that the Great Depression was a major driver of the bust-boom-bust swings in annual fertility rates. Counties more severely affected by the Depression experienced relative fertility declines through the mid-1930s, increases throughout the 1940s and 1950s, and returned to trend by the late 1960s.[4] The results suggest that Depression's influence extended well beyond the early 1930s to impact women's fertility during both the mid-century baby boom and the subsequent baby bust. The estimated effects are large in magnitude. A simple back-of-the-envelope calculation, based on our regression estimates, implies that the Depression accounts for roughly half of the trough-to-peak increase in annual fertility rates observed from the mid-1930s to the late 1950s (Figure 1).

To what extent do these Depression estimates reflect changes in lifecycle fertility profiles versus changes in completed childbearing across cohorts? We explore this question, decomposing the main estimates into two components: changes in completed fertility across cohorts and shifts in the timing of fertility across cohorts. Combining census microdata with state-level variation in Depression exposure, we find that the economic shock led to a significant bust-boom-bust pattern

[2]See Section 2 for the details of this calculation.

[3]By focusing on within-state comparisons in Depression severity, the analysis holds constant state-level policy changes and other cross-state shocks, such as the decline in pregnancy-related mortality (Albanesi and Olivetti, 2014), that also affected fertility rates in this era.

[4]The main findings are robust to a wide range of controls and alternative specifications and cannot be explained by cross-county differences in New Deal spending, Dust Bowl exposure, World War II casualties, war-related industrial production, or migration.

in completed fertility across cohorts.[5] Nevertheless, these completed fertility effects are too small and occurred too gradually to account for the large swings in annual fertility rates implied by the main estimates. Instead, we find that roughly 60 percent of the Depression's impacts on annual fertility rates stemmed from shifts in the timing of childbearing across cohorts.[6]

To further assess the impact of the Great Depression on fertility timing, we use full-count census data from 1910 to 1950 to estimate age-specific fertility responses to the economic shock across different cohorts of women. We find that the Depression led to sharp increases in the fertility rates of Depression-era cohorts in the late-1930s and 1940s; evidence that is consistent with "catch-up" fertility following the bust in fertility rates in the early 1930s.[7] The results confirm that the Depression induced a shift in the timing of childbearing among the Depression cohorts, with fertility delayed in early adulthood and then accelerated later in life. We also find that the shock led post-Depression cohorts to have higher fertility rates in early adulthood, consistent with the nationwide patterns documented in Figure 2. Unfortunately, because individual county-level data is not available after 1950, we are unable to track the later-life fertility behavior of these post-Depression cohorts.

What explains the Great Depression's long-lasting impacts on women's fertility patterns? To shed light on the mechanisms, we develop a stylized model of fertility for overlapping cohorts of women and examine how the crisis shaped childbearing incentives.[8] For women entering adulthood during the Depression, the one time negative shock to household income delayed childbearing, as they shifted fertility to later-life and reduced total family size. At the same time, the crisis prompted many of these women to enter – and remain in – the labor market, in an effort to compensate for lost household income. This influx of Depression-era women into the workforce increased labor market competition, and reduced the shadow price of fertility for younger cohorts of women who entered adulthood in the 1940s and 1950s. This led to an increase in desired family size and a shift towards earlier childbearing among these post-Depression cohorts. By contrast, the

[5]To identify these effects, we rely on variation in exposure to the Depression based on state-of-birth, since information on county of residence is unavailable after 1950.

[6]The completed fertility estimates account for the remaining 40 percent.

[7]For ease of exposition, we define Depression-era cohorts as women who were at least 15 years old 1930, and post-Depression cohorts as women under 5 in 1930.

[8]To align with our empirical analysis, which is based on relative effects across counties that were more or less severely impacted by the crisis, the framework abstracts from broader national-level forces affecting women's employment and childbearing incentives.

retirement of Depression-era women in the 1960s, expanded labor market opportunities for younger cohorts, contributing to a decline in their later-life fertility. Thus, this simple framework shows how the Depression can account for both the observed swings in completed fertility and the changing patterns in lifecycle fertility across cohorts.

Consistent with this proposed mechanism, we find that the economic shock contributed to large and persistent *increases* in employment rates among Depression-era women. Regressions based on full-count census data from 1910 to 1950 imply that the Great Depression raised women's employment by 8 percent in 1940 and 12 percent in 1950 among affected cohorts.[9] Combining these estimates with female labor demand elasticities for this period (Acemoglu, Autor and Lyle, 2004), we calculate that the entry of Depression-era women was large enough to meaningfully reduce the relative wages for subsequent cohorts of women through the 1950s. Beyond their large scale labor market entry, we find that Depression-era women worked in a wide range of occupations, including those offering higher wages and better working conditions, potentially limiting their availability to subsequent cohorts.[10]

At the same time, we find that the Great Depression led to large and significant *decreases* in employment among younger generations of women in 1950.[11] Hence, the crisis appears to have temporarily counteracted the national trend of rising labor force participation among younger women driven by increased demand for office and clerical work, gains in education, and the removal of barriers to married women's work (Goldin, 2006). The relative employment decreases spanned a range of occupations, consistent with "crowd-out" forces stemming from the broad-based supply response of Depression-era women.

Further supporting the labor market crowd-out channel, we find that that the effects of the Depression on the bust-boom-bust fertility patterns were especially large in counties with a relatively high share of Depression-era women at the onset of the crisis. In these counties, competitive labor market pressure on younger women was particularly acute, which reinforced the impact of the crisis

[9] These findings align with previous research by Bellou and Cardia (2021), who document how the crisis induced an outward shift in women's labor supply as Depression-era families sought to counteract losses in household income. Further, they show how this shift persisted, contributing to higher participation rates among Depression-era women in 1950 and 1960.

[10] We find large and persistent effects on Depression-era women's employment in clerical work, sales, and professional occupations.

[11] These results are unaffected by controls for exposure to either World War II mobilization or war-related industrial expansion.

on subsequent fertility patterns.

Labor market competition is not the only channel through which the Great Depression may have influenced fertility patterns. Other plausible pathways include its long-term impact on male educational attainment (Janas, 2024; Bellou and Cardia, 2024), earnings (Feigenbaum, 2015), and preferences for childbearing (Easterlin, 1961). While these channels may have contributed, they do not fully account for the observed changes in both completed childbearing and fertility timing across cohorts.

Our findings contribute to the literature on the baby boom, where there remains considerable debate over the main drivers of the large swings in fertility over the early- and mid-20th century. Previous macroeconomic research has emphasized the role of household technological change (Greenwood, Seshadri and Vandenbroucke, 2005), however, several studies based on disaggregated state- and county-level data have found little empirical support for this hypothesis (Bailey and Collins, 2011; Lewis, 2018; Vidart, 2024). Other research has emphasized the contribution of World War II for the increase in fertility among subsequent cohorts (Doepke, Hazan and Maoz, 2015), although recent research has demonstrated the sensitivity of these relationships to covariates and county-level analyses (Brodeur and Kattan, 2022). Albanesi and Olivetti (2014) demonstrate that advances in maternal healthcare was an important determinant of cross-state boom-bust patterns in completed fertility across cohorts. This mechanism, however does not account for important changes in lifecycle fertility that were also major drivers of the baby boom and baby bust (Figure 2).[12] Finally, recent research by Dettling and Kearney (2025) shows that expansion in access to home mortgages under the Federal Housing Administration and the Veteran's Administration contributed to the rise in fertility beginning in the mid-1930s. Our paper complements this research, establishing that the Great Depression was a quantitatively important driver of the bust-boom-bust swings in annual fertility rates from the 1930s to the 1960s. Moreover, we show that the Great Depression was an important contributor to both the changes in completed childbearing and the changing patterns of lifecycle fertility throughout this era.

Our paper also builds on previous macroeconomic research that has linked the Great Depression

[12]In their framework, improvements in maternal health are hypothesized to increase investment in daughters' human capital, which ultimately causes a decrease in the total fertility of younger cohorts. While this mechanism accounts for the observed changes in completed fertility across cohorts (Figure 1), it does not capture the fact that cohorts entering adulthood in the 1950s and early 1960s had initially high fertility when young only to drastically decrease their fertility in later-life (Figure 2).

to the baby boom. Most well known, is the Easterlin (1961) "relative income" hypothesis, which posits that the improvements in material well-being of cohorts who grew up during the Depression led to an increase in their demand for children in adulthood.[13] This hypothesis, however, runs counter to the longer-run secular trends of rising household income and declining fertility over the past two centuries (Jones, Schoonbroodt and Tertilt, 2008; Guinnane, 2011).[14] Whereas previous evidence for this relationship has been either descriptive or based on aggregate national-level trends, we establish the causal impact of the Great Depression on fertility patterns based on a quasi-experimental research design and granular county-level data.

More broadly the paper is related to the large literature describing the evolving patterns of fertility and women's work over the course of 20th century (Goldin, 2006; Bailey and Hershbein, 2018). Previous research has documented the role of technological change (Lewis, 2018; Vidart, 2024), World War II (Acemoglu, Autor and Lyle, 2004; Fernández, Fogli and Olivetti, 2004), and the Pill (Goldin and Katz, 2002; Bailey, 2006, 2010) in affecting these longer-run demographic shifts.

Finally, this paper contributes to the literature on the socioeconomic consequences of the Great Depression. Previous work has documented that the economic crisis led to large contemporaneous decreases in fertility and marriage rates, and increases in infant mortality rates (Fishback, Haines and Kantor, 2007; Hill, 2015). Other research has found lasting effects of the Depression on education income, disability, and women's labor supply (Thomasson and Fishback, 2014; Feigenbaum, 2015; Moulton, 2017; Janas, 2024; Bellou and Cardia, 2021).

[13]In related work, Easterlin (1968) argues that the Depression caused the baby boom through its impact on relative cohort size. He argues that the relatively smaller birth cohorts of the early 1930s enjoyed favorable economic conditions when they entered the labor market, which contributed to the high fertility rates in the mid-1950s and 1960s. However, this explanation cannot account for the timing of the baby baby's onset in the late 1930s, and why different cohorts of women experienced sharp changes in their lifecycle fertility trajectories.

[14]Jones and Schoonbroodt (2016) also argue that the negative income shock led to a contemporaneous decrease in cohort fertility followed by a second-generation fertility boom that resulted from this cohort having benefited from larger in vivo wealth transfers. A challenge for this mechanism is the limited scale of intergeneration wealth transfers in this era.

# 2 Background

## 2.1 Trends in Completed Childbearing and Lifecycle Fertility in the Early and Mid-20th Century

The U.S. fertility rate time series shows striking variation throughout the first two-thirds of the 20th century (Figure 1). After nearly a century of secular decline, fertility rates fell sharply during the Depression years, reaching a low point in 1934. Fertility rates rose dramatically over the subsequent decades of the baby boom, peaking in 1957, only to decline again during the baby bust of the 1960s and 1970s.

These swings in annual fertility rates have largely been attributed to changes in completed childbearing (Bailey and Hershbein, 2018), and existing explanations for the baby boom have focused almost exclusively on changes in completed fertility across cohorts (Easterlin, 1961; Becker and Barro, 1988; Albanesi and Olivetti, 2014). This period did witness large swings in completed childbearing. For cohorts born between 1906 and 1910, whose peak childbearing years overlapped with the Great Depression, completed fertility fell below 2.3. For cohorts born between 1931 and 1935, who entered their childbearing years in the 1950s, completed fertility was 3.2. These changes in average family size were reinforced by evolving patterns of childlessness, which fell from nearly one quarter among Depression-era women to less than 10 percent among post-Depression cohorts (Baudin, de La Croix and Gobbi, 2015).

Previous research has largely overlooked the dramatic changes in lifecycle fertility profiles during this era (Figure 2).[15] Women who entered their childbearing years in the 1930s had substantially lower fertility in early adulthood, only to increase fertility in later-life. This pattern is reversed for post-Depression cohorts, who entered their childbearing years in the 1950s and early 1960s. Throughout their 20s, these women had the highest age-specific fertility rates of any cohort born in the first half of 20th century; by their mid-30s, they had the lowest.

To what extent do the swings in aggregate fertility rates reflect changes in completed childbearing versus changes in the timing of lifecycle fertility? To explore this question, we decompose the observed change in the annual fertility rate time series (relative to its value in 1929), $\Delta GFR_t$, into

[15] One notable exception is Ryder (1980), who emphasizes the importance of shifts in tempo (fertility timing) for aggregate fertility trends, although he does not distinguish how these various cohorts contributed to the aggregate changes in tempo.

the sum of two independent components: 1) the observed change in completed childbearing across cohorts (holding constant their lifecycle fertility profile), $\Delta GFR_t^{completed}$, and 2) the unobserved (residual) change in lifecycle fertility patterns across cohorts (holding constant their completed childbearing), $\Delta GFR_t^{timing}$. Appendix A.2 presents the methodology for this decomposition.

Figure 3 reports the results of this decomposition. The figure shows that the bust-boom-bust swings in observed annual fertility rates were only partially the result of changes in completed childbearing. The $\Delta GFR_t^{completed}$ series remains below zero during the baby bust of the 1930s, peaks in the late-1950s, and falls below zero by the end of the 1960s. Nevertheless, the bust-boom-bust swings in observed annual fertility are much larger than the time series trend predicted by cross-cohort changes in completed childbearing alone. Indeed, roughly 60 percent of the trough-to-peak-to-trough changes in annual fertility were the result of changes in fertility *timing* across cohorts.[16] Moreover, the bust-boom-bust swings in observed annual fertility rate occur more rapidly than is predicted by the completed fertility series, which adjusts more smoothly as overlapping cohorts gradually age out of their childbearing years.[17]

The trends in Figure 3 highlight the central role of lifecycle fertility patterns in driving the bust-boom-bust patterns in aggregate fertility rates during this era. A complete account of these swings must explain not just changes in completed fertility across cohorts, but also the wide differences in fertility timing across distinct cohorts.

## 2.2 The Great Depression and its Impacts on Families

The Great Depression was a catastrophic economic event in U.S. history, with real GNP contracting by more than one-third between 1929 and 1933 (Bordo, Goldin and White, 1998). At its peak, one quarter of the nation's workforce was unemployed, and even those who remained employed saw wage incomes fall by more than 40 percent.

The Depression had significant short-term sociodemographic effects on American families. Because families faced significant borrowing constraints, they were unable to smooth consumption, and the Depression coincided with sharp declines in aggregate consumption and household durable

[16]The lifecycle component accounts for 72 percent of the decline in annual fertility rates between 1929 and 1933, 59 percent of the increase between 1933 and 1957, and 56 percent of the decline between 1957 and 1975.

[17]Interestingly, Figure 3 also highlights how the sharp changes in fertility rates during and immediately after World War II were solely the result of fertility timing.

goods purchases (Temin, 1976; Mishkin, 1978).[18] Marriage rates also decreased sharply in the early 1930s, as poor labor market conditions led to delayed family formation (Hill, 2015). At the same time, the economic shock induced large-scale entry of women into the labor market, as families sought to offset the losses in household incomes (Bellou and Cardia, 2021). The Depression led to significant decreases in contemporaneous fertility rates (Fishback et al., 2005), a pattern that aligns with the procyclicality of U.S. fertility rates throughout much of the 20th century (Fishback et al., 2015). The "baby bust" of the early 1930s appears to have been driven both by delayed marriage formation (Hill, 2015), as well as by declines in marital fertility rates. Indeed, nearly half of Depression-era women reported using some form of birth control during this period (Ridley, 2007).[19]

The Great Depression may have had longer-term consequences for U.S. fertility rates. High rates of family formation in the late-1930s may have contributed to the catch-up fertility among Depression-era cohorts that we document in Figure 2 (Hill, 2015). The economic shock also had lasting effects on women's labor market behavior; Depression-era women maintained higher employment rates through the 1940s and 1950s (Bellou and Cardia, 2021). This supply shift may have impacted local labor market opportunities for subsequent cohorts of women and reduced their opportunity cost of childrearing in early adulthood (Figure 2). Finally, the economic crisis may also have affected long-run fertility through its lasting impacts on education, income, and disability (Thomasson and Fishback, 2014; Feigenbaum, 2015; Moulton, 2017; Janas, 2024; Bellou and Cardia, 2024).

# 3 Data

## 3.1 Data sources, variable construction, and sample selection

Our empirical analysis draws on several different data sources including county-level measures of Great Depression severity, annual fertility rates, and individual-level socioeconomic outcomes in decennial years.

[18]This contemporaneous decline in household consumption is also consistent with the positive impact of the Great Depression on infant mortality (Fishback et al., 2006).

[19]These results are based on a 1978 national survey of 1,049 white ever-married women born between 1900 and 1910 in which respondents were asked a range of retrospective questions related to contraceptive practices during their childbearing years.

To construct a local measure of Great Depression severity, we rely on the change in county-level retail sales per capita between 1929 and 1933. These data were originally digitized by (Fishback, Horrace and Kantor, 2005) from the biennial Censuses of Retail Sales. They show that per capita retail sales are highly correlated with personal income at the state-level. Because data on personal income or unemployment do not exist at the county-level during this period, retail sales offers one of the only measures of local economic conditions in the early 1930s. This measure has been widely used to capture local differences in Depression severity (Fishback, Haines and Kantor, 2007; Hill, 2015; Janas, 2024).

Figure A.2 presents a map of Depression severity across counties, based on the change in per capita retail sales between 1929 and 1933 (Fishback, Horrace and Kantor, 2005). There was wide geographic variation in the severity of the economic downturn. The Depression was generally more severe in the West and Midwest, while it was milder in the upper South. Even within states, there were wide differences in the magnitude of the downturn. In Pennsylvania, for example, Lackawanna county (home to Scranton) experienced a decline of 21 percent in per capita retail sales, while nearby Lehigh county (home to Allentown) experienced a decline of 42 percent. Researchers have identified several contributing factors to the regional disparities in the magnitude of the downturn, including industry structure, population growth during the 1920s, and financial regulatory policy during the crisis (Wallis, 1989; Garrett and Wheelock, 2006; Richard and Troost, 2009; Feigenbaum, 2015). In our empirical analysis, we control directly for both industry composition and population trends. Moreover, our within-state research design allows for broader regional differences in financial regulatory policy.

Our main outcome variable is the county-level fertility rate, measured as the number of annual live births per 1,000 women aged 15 to 44. These data were originally compiled in annual volumes of the *Vital Statistics* and *Natality Statistics* compiled by Bailey et al. (2018*b*). The data were first reported in 1915 when the Birth Registration Areas were established, although initially births were reported in just 10 states. The sample of reporting counties expands dramatically over the first decade, as more states entered the registry, and by 1933 all continental states and the District of Columbia reported births.

We supplement these data with individual-level outcomes from the full count censuses for decennial years 1910 to 1950 (Ruggles et al., 2024). The individual-level data allow us to assess the fertility behavior for different age groups of women over time. We construct two measures of fertility: an indicator for the presence of a child aged less than one, and the number of children less than five years old in the household. We also use the census data to construct several labor market outcomes including employment status and employment in different occupations.[20]

We also assemble a range of county-level covariates from different sources. These include a host of pre-1930 county-level socioeconomic variables (Haines and ICPSR, 2010), information on New Deal relief spending (Fishback, Haines and Kantor, 2007), and World War II casualties (Brodeur and Kattan, 2022).

Our primary sample is a balanced panel of 1,470 counties from 27 states reporting information on fertility from 1921 to 1975 (Figure A.3). This sampling choice was motivated by an effort to obtain an extended pre-Depression time horizon, which allows us to assess the common trends assumption underlying our empirical strategy. Because the sample excludes states that were slower to enter the Birth Registry, however, southern states are underrepresented in the main analysis. We also report results based on several expanded balanced samples of counties that had joined the Birth Registry by 1926 and by 1930 (Figure A.4).[21]

### 3.2 Trends in fertility by Great Depression Severity

Figure 4 reports within-state comparisons of long-run fertility trends across counties that experience above- versus below-median decreases in per capita retail sales during the Depression. The figure plots the difference in annual fertility rates across the two groups relative to the baseline in difference in 1927.

The figure reveals notable differences in annual fertility rates across high- and low-exposure counties in the post-1930 period, consistent with the Great Depression having influenced these swings in fertility. Fertility rates trended similarly across the two groups throughout the decade prior to the Depression. In the early 1930s, high-exposure counties experienced a relative decline in fertility rates; this was followed by a relative fertility boom throughout the 1940s and 1950s. Although fertility rates remained higher in high-exposure counties throughout the 1960s, both groups experienced parallel downward trends over the decade. These differential fertility swings

[20] Unfortunately, employment status is not reported in the 1920 census.

[21] Of course, a drawback of these expanded samples is that both provide a shorter pre-Depression time horizon.

motivate the empirical analysis described in the next section.

## 4 Empirical Framework

Our primary empirical approach is based on a difference-in-differences framework that compares average changes in annual fertility rates across counties in the same state that experienced more or less severe declines in per capital retail sales during the early 1930s. Formally, we estimate the following regression specification:

$$y_{ct} = \alpha + \sum_{k=1921}^{1975} \beta_k GD_c \times \mathbb{1}(t = k) + \gamma_{st} + \lambda_c + \phi FemPop_{c,1930} \times t + X_c t + \epsilon_{ct} \quad (1)$$

where $y_{ct}$ denotes the fertility rate in county $c$ in year $t$. The variable $GD_c$ measures the change in county per capita retail sales from 1929 to 1933. The model includes a vector of state-by-year fixed effects, $\gamma_{st}$. We include a vector of county fixed effects, $\lambda$, to control for time invariant differences in average county fertility rates. The term $FemPop_{c,1930}$ captures the baseline age structure of the potential childbearing population. It includes a vector of four variables: the share of women age 0 to 44 in 1930 who were aged 10-19, 20-29, 30-39, and 40-44. We interact each variable with a linear time trend to allow for differences in county fertility trends depending on the baseline age structure of the female population.[22] We also allow for a linear county-specific trend according to baseline county socioeconomic characteristics (percent employment in agricultural, manufacturing, share nonwhite, and share foreign born). $\epsilon_{ct}$ denotes the error term. We report standard errors clustered at the county level to allow for arbitrary within-county dependence of the error term over time.[23]

The coefficients of interest, $\beta_k$, measure the effect of the Great Depression on annual fertility rates in every year $k$ from 1921 to 1975. Specifically, each coefficient captures the year $k$ within-state difference in fertility rates across counties that experienced larger- versus smaller decreases in per capita retail sales, relative to the difference in fertility rates in the reference year (which we designate as 1927).

The identifying assumption for the empirical analysis is that annual fertility rates would have

[22] We find very similar results in models that include the baseline female age structure in 1920.

[23] We also report results based on state-by-year clustering to allow for correlation in errors across counties within the same state.

trended similarly across counties that experienced larger versus smaller decreases in retail sales in the early 1930s absent the economic crash of the Great Depression.[24] Several features of the research design bolster the credibility of this assumption. First, the inclusion of state-by-year fixed effects in equation (1) ensures that identification is based solely on within-state comparisons of fertility trajectories. The inclusion of these covariates allows us to control for broader cross-state changes that may have impacted fertility patterns over this period, such as the sharp decline in pregnancy-related mortality in the late-1930s (Albanesi and Olivetti, 2014) and the introduction of the Pill in the 1960s (Goldin and Katz, 2002; Bailey, 2006), as well as broader regional trends in fertility over this time period. Second, the inclusion of a linear county-specific trend in the models allows us to capture the link between the Great Depression and the large swings in fertility rates over this period, while controlling for differential longer-run secular trends in fertility across counties. Notably, these controls allow for different rates of the fertility transition across counties that may be spuriously correlated with the severity of the economic crash of the 1930s.

Finally, the empirical approach allows us to directly assess the parallel trends assumption through the pre-1930 regression estimates. In particular, in the next section, we demonstrate that fertility rates across counties with higher versus lower decreases in retail sales trended similarly in the pre-1930 period.

# 5 Results

## 5.1 The Great Depression and County Fertility Rates

Figure 5 reports the estimates and 95% confidence intervals for the coefficients $\beta_k$ from equation (1). The estimates are reported for a balanced panel of 1470 counties over the period 1921 to 1975, with the 1927 as the omitted reference year.

There is no evidence of differential pre-trends in fertility prior to the onset of the Great Depression. The coefficient estimates prior to 1929 are uniformly small and statistically insignificant and display no evidence of any differential trend. The absence of pre-trends supports the identifying assumption that relative county fertility would have continued to trend similarly in post-1930 era,

[24] Although we estimate difference-in-difference regressions, because the analysis is based on a one-time shock in the 1930s, the results are not subject to the recent concerns raised about staggered differences-in-differences research design.

absent the shock of the Great Depression.

Figure 5 shows that the Great Depression impacted the bust-boom-bust pattern in women's fertility over the early- and mid-20th century. The estimates for the early and mid-1930s are large, negative, and statistically significant, implying that counties with larger declines in per capita sales from 1929 to 1933 experienced a large relative bust in fertility through the mid-1930s. The Great Depression also contributed to the subsequent baby boom in the 1940s and 1950s. The initial negative relationship reverses by the late-1930s, and in subsequent decades, the coefficient estimates are large, positive, and statistically significant. The empirical relationship weakens throughout the 1960s, and by the early 1970s the coefficient estimates are small and statistically insignificant.

To explore the quantitative impact of the Great Depression on national fertility patterns, we construct the counterfactual fertility trend that would have emerged absent the economic shock of the 1930s. Specifically, we calculate the counterfactual fertility rate in any year $t$, $CGFR_t$, as follows:

$$CGFR_t = GFR_t - \beta_t \times \overline{\Delta\text{Retail Sales}}_{'29\text{-}'33},$$

where $GFR_t$ denotes the observed general fertility rate in year $t$, $\beta_t$ is the coefficient estimate for year $t$ and $\overline{\Delta\text{Retail Sales}}_{'29\text{-}'33} = 0.202$ denotes the average nationwide decline in per capita retail sales from 1929 to 1933. Intuitively, the $CGFR_t$ series captures the trend in annual fertility rates after eliminating the portion attributable to the Great Depression.

Figure 6 reports the observed and counterfactual national fertility rates for the period 1921 to 1975.[25] Prior to the 1930s, these two trends overlap, reflecting common pre-trends reported in Figure 5. Throughout the 1930s, observed fertility rates were lower than the counterfactual series, reflecting the fact that part of the initial baby bust was caused by the Great Depression. During the 1940s and 1950s, the annual fertility rates exceed the counterfactual series, highlighting the contribution of the Depression to the mid-20th century boom. By the mid-1960s, the two series realign, as the effects of the Depression abated.

Figure 6 demonstrates the substantial impact of the Great Depression on both the bust in fertility during the early 1930s and the subsequent boom. From 1930 to the trough in 1936, the general fertility rate fell by 13.4 points. Our estimates imply that 30 percent of this decline was

[25]Figure A.5 reports the corresponding results with 95% confidence intervals.

caused by the Great Depression.[26] These effects align with previous work by Fishback, Haines and Kantor (2007) who find large contemporaneous impacts of the Great Depression on fertility rates. The Great Depression was also an important driver of the post-1930s fertility boom. The general fertility rates increased by 47 points from its trough in 1936 to its peak in 1957. Our estimates imply that 49 percent of this overall increase can be attributed to the Depression. These effect sizes are substantial, exceeding even the initial relative declines of the mid-1930s.[27]

Notwithstanding these large estimated impacts, a substantial share of the swings in annual fertility rates from 1930 through the 1960s cannot be attributed to the Great Depression. Other mechanisms, including the rise in homeownership (Dettling and Kearney, 2025) and the decline in maternal mortality (Albanesi and Olivetti, 2014), also contributed to the mid-century baby boom.[28] It is also reassuring that both the observed and counterfactual fertility series exhibit similarly large short-term shifts during and immediately following World War II, as there is little reason to expect the economic shock of the previous decade to drive wartime-related changes in fertility timing. Additional contributors to the baby boom may have included the postwar economic expansion, while the fertility decline – particularly in the mid-to-late 1960s – was also shaped by factors such as the introduction of the Pill and evolving attitudes toward women's role in the labor market (Bailey, 2006; Fernández, Fogli and Olivetti, 2004).

## 5.2 Robustness checks

### 5.2.1 New Deal spending, the Dust Bowl, World War II mobilization, and additional sample restrictions

In this section, we explore the sensitivity of the main estimates to a range of competing factors including New Deal relief spending, the Dustbowl, and World War II, as well as various additional empirical specifications and sampling restrictions.

A first concern is that the main estimates may be biased by relief spending under various

[26] To obtain this value, we multiply the difference in point estimates between 1930 and 1936 by the average nationwide decline in retail sales and divide by the change in fertility rates over the time period: $30\% = -19.6 \times -0.202/13.4$.

[27] In Section 6.1, we discuss the mechanisms for these patterns, and how labor market crowd-out forces may account the large fertility response in the 1940s and 1950s.

[28] For example, Dettling and Kearney (2025) find that the expansion of mortgages under the FHA and VA accounted for 10 percent excess births during the baby boom, while Albanesi and Olivetti (2014) find that the majority of cross-cohort increases in completed fertility can be attributed to improvements in maternal health during this era.

New Deal programs, which potentially mitigated the direct demographic impacts of the Great Depression (Fishback, Haines and Kantor, 2007). To assess this possibility, we construct a county-level measure of total per capita New Deal spending, and interact this variable with a full vector of year fixed effects. Figure A.6, Panel (a) reports the results from these augmented regressions. The inclusion of the New Deal spending controls has very little impact on the main estimates, consistent with previous research showing a limited impact of New Deal relief spending on contemporaneous fertility.

A related concern is that the contemporaneous shocks of the Dust Bowl may bias the main estimates. In particular, the large declines in per capita retail sales from 1929 to 1933 may partly be driven by droughts of the early 1930s, which themselves contributed to the dust storms later in the decade. If so, the main estimates may reflect the long-term demographic and economic impacts of the Dust Bowl. To address this concern, Figure A.6, Panel (b) reports the results from a regression that excludes Dust Bowl counties. The results are similar in sign, significance, and magnitude.

Next, we assess the sensitivity of the main estimates to both World War II mobilization and war-related government spending. Wartime mobilization had large contemporaneous impacts on women's employment patterns and also shifted gender norms over the longer run (Acemoglu, Autor and Lyle, 2004; Fernández, Fogli and Olivetti, 2004); the influence on subsequent fertility patterns has also been the subject of recent debate (Doepke, Hazan and Maoz, 2015; Brodeur and Kattan, 2022). To measure county exposure to WWII, we rely on data on WWII casualty rates from Brodeur and Kattan (2022), and interact this variable with a full vector of year fixed effects. The inclusion of these controls has little impact on the main estimates (Panel (c)).

We also explore the sensitivity of the main findings to controlling for war-related expenditures. In each year from 1943 to 1945, the federal government spent roughly 40 percent of GDP on war-related production. The majority of this spending was allocated through war contracts, which were unevenly distributed throughout the country. Although previous research has generally found modest effects of this spending on local development outcomes (Fishback and Cullen, 2013; Jaworski, 2017), it is possible that this spending may have differentially impacted subsequent labor market opportunities of women. To address this concern, we compute county-level per capita war contract spending and interact this variable with a full vector of year fixed effects.[29] The main findings are not affected by the inclusion of these controls (Panel (d)).

### 5.2.2 Additional specification checks

We explore several additional sample restrictions and alternate specifications in Figure A.7. First, we exclude Southern states from the sample. Panel (a) shows that these results are similar to the baseline estimates. In Panel (b), we exclude counties in the top quartile share of agricultural employment. This restriction has little impact on the coefficient estimates. Finally, in Panel (c), we exclude counties with a large share of African Americans. This sample restriction addresses concerns regarding the undercounting of live births for African American families in the early years of the birth registry (Eriksson, Niemesh and Thomasson, 2018), as well as the distinct changes in labor market conditions of African American women mid-century. This restriction does not quantitatively or qualitatively affect the main estimates.

In Figure A.8, we explore the sensitivity of the main findings to several additional specification checks. In Panel (a), we report estimates from models that exclude the baseline 1920 socioeconomic covariates. The estimates are similar in sign, significance, and magnitude to those from our preferred specification. In Panel (b), we estimate the equation (1) for a balanced panel of 1,885 counties reporting fertility from 1926 to 1975. Because states progressively entered the birth registry through the 1920s and early 1930s, this alternate sample period allows us to include an additional 447 counties in the analysis, although the shorter time horizon limits our ability to assess the common pre-trends assumption. The estimates are similar to the baseline results. In Panel (c) we report estimates based on a balanced panel of 2,715 counties that reported fertility by 1930. The results are similar in sign, significance and magnitude.

Finally, we address recent concerns raised about the event-study regression model with continuous treatment effects. In particular, recent research has shown that even in the non-staggered framework, heterogeneity in treatment effects can bias the estimates of average treatment effects in difference-in-differences models (Callaway et al., 2024, 2025). These issues can arise when treatment effects are related to the treatment dose, as can often be the case when treatment units

[29] Data on war-related expenditures are available from the 1947 County Data Book and compiled by Haines and ICPSR (2010).

"opt-in" to their treatment dose. These issues have little salience in our context, since counties had little direct control over their exposure to the shock of the early 1930s, and certainly were not voluntarily choosing the magnitude of their economic decline on the basis of future potential fertility trajectories.

To further allay concerns, we follow the suggestions of Callaway et al. (2024) and estimate various versions of a discretized treatment. Figure A.9, Panel (a) reports the regression results for a binary treatment comparing counties with above- versus below-median declines in per capita retail sales from 1929 to 1933. The estimates follow the same pattern as those from the continuous treatment effect. In Panel (b), we report the point estimates from two separate regressions: 1) comparisons between the bottom and middle tercile of Great Depression severity and 2) comparisons between the bottom and top terciles of Great Depression severity. The results demonstrate monotonicity in the relationship between the Great Depression and women's fertility. Counties with larger declines in per capita retail sales had systematically lower fertility rates in the 1930s, and higher fertility rates in the 1940s and 1950s.

### 5.2.3 Migration

In this section, we explore the role of selective migration in driving the fertility boom in the post-Depression era. Out-migration is a well-documented response to negative local shocks (Fishback, Horrace and Kantor, 2006; Arthi, Beach and Hanlon, 2022). To the extent that Depression-induced migrants and non-migrants differ in underlying fertility behavior, the relative estimates reported in Figure 5 may partly capture compositional changes across counties. Depending on the selection process into migration, we might overstate or understate the impacts of Depression severity on fertility patterns. For example, if low-fertility families were more likely to migrate in response to a negative economic shock, we would observe an increase in average fertility rates in harder hit counties, even if the Great Depression itself had no impact on actual fertility decisions.

To assess the role of selective migration for the main findings, we draw on an individual-level panel dataset based on the 1930 and 1940 complete count waves of the censuses. To link individual records, we rely on the crosswalks proposed in the Census Tree Project developed by Price et al. (2021) and Buckles et al. (2023). Their methodology leverages information on family relationships on the genealogical website FamilySearch.org to link women across censuses, overcoming previous challenges of name changes at marriage for census linking of women. We focus on women aged 15 to 44 in 1930, for whom the match rate is roughly 60 percent.[30] Table A.1 reports the 1930 socioeconomic characteristics of women in both the full sample and the matched sample. The samples are broadly similar in terms of urban/rural and employment status, although the matched sample tends to be higher educated and includes fewer minorities, reflecting the selection of families into the genealogical website.

We use this dataset to explore the migration patterns of women during the 1930s. Specifically, we create a dummy variable equal to one for women who change their county of residence over the decade. We then assess the extent to which migration patterns were impacted by the Great Depression, and which demographic groups were more likely to move.

Table A.2 reports the results from these analyses. We find that counties more exposed to the Great Depression experienced relative outmigration of young women. The point estimates in column (1) imply that in the average county the Great Depression increased the probability of migration by 18 percent, relative to a county that experienced no economic downturn. In the remaining columns, we explore the extent of *selective* migration, examining how these overall patterns in migration differed across women's underlying demographic characteristics. With the exception of the youngest age group, we find little evidence of differential migration by age (col. 2), or by race or urban status (cols 3,4). We do find systematic differences in the probability of migration by education levels, with higher educated women having been more likely to move (cols. 5,6).

In principle, the differential patterns in migration by education could partly account for the positive fertility estimates in the 1940s and 1950s, given the negative relationship between women's education and fertility. Nevertheless, the effect sizes are too small in magnitude to meaningfully account for the Depression's impact on county fertility rates. To see why, we combine the differential estimates for high school graduates from Table A.2 with average nationwide differences in fertility across women with and without a high school diploma to calculate the change in county fertility rates attributable to selective migration. The resulting estimates imply that selective migration across women with and without a high school diploma accounts for just 8 percent of the trough-to-peak change implied by the main regression estimates.[31]

[30]The additional genealogical information used in the matching process leads to a considerably higher match rate than other conventional methods.

[31]Combining the differential estimates for high school diploma in Table A.2 (col. 6) with the nationwide share

Given the large estimated impacts of the Great Depression on county fertility rates, it is unsurprising that selective migration has limited impact on the main findings. Intuitively, the main estimates are simply too large to be explained by the relatively small differences in average fertility rates across educational groups.

### 5.3 The Great Depression and Changes in Completed Fertility and Lifecycle Fertility across Cohorts

The Great Depression was an important driver of the shifts in annual fertility rates from the mid-1930s through the 1960s. In this section, we assess the extent to which these patterns stemmed from changes in completed fertility across cohorts (Figure 1) and changes in the timing of lifecycle fertility patterns across cohorts (Figure 2).

#### 5.3.1 Effects of the Great Depression on Completed Fertility

First, we explore the impact of the Great Depression on completed fertility rates. Since there are no county-level data on completed fertility that span this time period, the analysis is based on state-level information across cohorts reported in the 1940, 1950, 1960, 1970, 1980, and 1990 censuses.[32] To measure exposure to Great Depression, we rely on the average state decline in retail sales per capital between 1929 and 1933, assigning individuals based on their state-of-birth.[33] We then interact this measure with the year-of-birth to capture the differential impact of the shock across cohorts.

Figure 7 reports the estimates and the 95% confidence intervals. The estimates for completed fertility are negative and significant for the 1901 to 1905 birth cohorts, suggesting that the Great Depression contributed to the relatively lower completed fertility rates among these cohorts documented in Figure 1. For subsequent Depression-era cohorts who were born between 1906 and 1915, we find small and insignificant effects, suggesting that any temporary decrease in their fertility in

of high school graduates (0.4), we calculate that average nationwide decrease in per capita retail sales (0.202) led to a $1.25\% = (0.155 \times 0.4 \times 0.202)$ decrease in the population share of female high school graduates. Given an average difference in fertility rates of 1.8 by high school diploma status, these estimates imply an increase in county fertility rates due to selective migration of 2.25 ($= 1.25 \times 1.8$) points. In comparison, difference in the trough-to-peak estimates from Figure 5 imply that the Depression led to a nationwide 27.4 point increase in annual fertility rates.

[32] Information on the total number of children ever born is not recorded in later censuses.

[33] This analysis relies on state-level variation in exposure to the Depression since we are unable to identify county of residence or birth after the 1950 census.

the early 1930s was offset by higher post-Depression fertility rates. We find positive and significant estimates for the 1916 to 1940 birth cohorts, suggesting that the Great Depression contributed to the mid-20th century increase in completed fertility among these women.

The estimates in Figure 7 are large in magnitude, and imply that the Great Depression was an important driver of the aggregate swings in completed fertility across cohorts. Combining the coefficient estimates with the average nationwide decline in retail sales in the early 1930s, we calculate that the Great Depression can account for 45 percent of the trough to peak changes in completed fertility across cohorts.[34]

#### 5.3.2 Decomposing the Impact of the Depression on Completed and Lifecycle Fertility Patterns

To what extent were the estimated impacts of the Great Depression on annual fertility rates driven by cross-cohort changes in completed fertility versus changes in lifecycle fertility patterns? We explore this question in two different ways. First, we combine the county-level estimates for annual fertility rates with cross-cohort estimates for completed fertility to derive the implied change in lifecycle fertility attributable to the Great Depression. Second, we assume that the Depression had no impact on fertility timing, and assess whether cross-cohort changes in completed childbearing alone could plausibly replicate the estimated impacts on annual fertility rates.

Both approaches are based on the insight that the Depression's impact on annual fertility rates in any year, $\hat{\beta}_t$, is the sum of two independent effects: 1) changes in completed fertility rates among all childbearing women during that year and 2) changes in lifecycle fertility patterns among all childbearing women during that year. Analogous to the decomposition of annual fertility rate changes in Section 2.1, we decompose the $\hat{\beta}_t$ estimates as follows:

$$\begin{aligned}\hat{\beta}_t &= \hat{\beta}_t^{completed} + \tilde{\beta}_t^{lifecycle} \\ &= \sum_{cohort} \hat{\beta}^{cohort} \cdot \text{share}_t^{cohort} + \tilde{\beta}_t^{lifecycle}\end{aligned}$$

where $\hat{\beta}^{cohort}$ captures the estimated impact of the Depression on completed fertility across cohorts

[34] We calculate the implied change in completed fertility rates across the 1906-1910 and 1936-1940 birth cohorts implied by our estimates: $\Delta CFR = (\hat{\beta}_{36-40} - \hat{\beta}_{06-10}) \cdot \overline{\Delta \text{Retail Sales}}_{'29\text{-}'33} = (1.05 - (-0.85)) \cdot 0.2 = 0.38$. We compare this implied change in completed fertility to the observed change across these same cohorts (0.84).

(Figure 7), $\text{share}_t^{cohort}$ denotes the share of annual births attributable to each cohort in year $t$, and $\tilde{\beta}_t^{lifecycle}$ denotes the (unobserved) contribution of lifecycle fertility changes in year $t$ to the main estimate.[35]

The first term, $\hat{\beta}_t^{completed}$, captures the Depression's impact on annual fertility driven *solely* by changes in completed fertility rates across cohorts. It reflects a weighted average of the Depression's impacts on completed fertility across all cohorts that were of childbearing age in year $t$. Intuitively, as different birth cohorts reach childbearing age, their changes in completed fertility patterns will contribute to changes in annual fertility rates.

The second term, $\tilde{\beta}_t^{lifecycle}$, is the residual component of the annual estimates, $\hat{\beta}_t$, that cannot be attributable to changes in completed fertility. This term captures the extent to which the Depression's impact on fertility rates in any particular year was driven by changes in lifecycle fertility behavior.

Figure 8 reports the results from this decomposition. First, we find that the Depression's large negative impact on annual fertility rates in the early- and mid-1930s can be largely attributable to significant decreases in completed fertility among Depression-era women, whose peak fertility years overlapped with the shock. At the same time, the lifecycle fertility component is also negative through the mid-1930s, consistent with delayed fertility among these cohorts. Second, the subsequent fertility dynamics were driven largely by changes in lifecycle fertility patterns across cohorts. Although the completed fertility component remains positive through the 1940s and 1950s, the sharp rise in annual fertility rates over this period is largely attributable to changes in lifecycle fertility patterns. These patterns align with both "catch-up" fertility among Depression-era cohorts and the shift towards earlier childbearing among post-Depression cohorts that were documented in Figure 2. Overall, we estimate that 49 percent of the trough-to-peak estimates for annual fertility rates was a result of the Depression's impact on changes in the timing of lifecycle fertility.[36] Third, the figure highlights the importance of the lifecycle component for the baby bust of the mid-1960s. In contrast, the completed fertility component predicts a much more gradual decline in annual fertility over this period.

[35] To assign the fertility shares to each cohort, we rely on baseline age-specific fertility rates based on the lifecycle fertility profile of the 1896-1900 cohort (Figure A.1). We choose this reference group to limit the influence of potentially endogenous changes in fertility timing after the Depression's onset.

[36] This calculation is as follows: $(\tilde{\beta}_{1953}^{lifecycle} - \tilde{\beta}_{1934}^{lifecycle})/(\hat{\beta}_{1953} - \hat{\beta}_{1934}) = (44.1 - (-22.5))/(101.3 - (-34.1)) = 49\%$.

The previous decomposition relies on the $\hat{\beta}^{cohort}$ estimates to construct the completed fertility component, $\hat{\beta}_t^{completed}$. These estimates, in turn, were derived based on state-level variation in Depression severity, and so may be more subject to omitted variables bias concerns. For example, if cross-state changes in maternal mortality declines in the late 1930s were spuriously related to the severity of the Depression, we may overstate the importance of the completed fertility channel. To address these concerns, we adopt an alternative approach that does not require us taking a stand on the Depression's impacts on completed fertility across cohorts. Instead, we assume that the Depression had *no* impact on fertility timing, assigning all cohorts the same lifecycle fertility profile as the 1896-1900 birth cohort, so that $\beta_t^{lifecycle}$ is assumed to equal zero in every year. Following this restriction, we derive the values of $\beta^*_{cohort}$ that best replicate the time series estimates for annual fertility rates, $\hat{\beta}_t$.[37]

Figure 9 presents the values of $\beta^*_{cohort}$ from the minimization problem. The patterns of $\beta^*_{cohort}$ broadly align with the estimates that we previously obtained based on state-level data: taking on negative values for Depression-era cohorts and positive values for post Depression cohorts. Nevertheless, the magnitudes of the two sets of estimates do not align. The $\beta^*_{cohort}$ values imply that the Depression led to a baby bust among the 1901-1905 cohort and to a boom among the 1921-1935 cohorts that was twice as large as those implied by the empirical estimates of $\hat{\beta}^{cohort}$. Similarly, the $\beta^*_{cohort}$ values display more rapid swings in completed fertility across cohorts than we find in the state-level analysis.

The results in Figures 9 confirm that the estimated impacts of the Great Depression on annual fertility rate could not have stemmed from changes in completed fertility alone. The values of $\beta^*_{cohort}$ imply that, absent changes in the timing of childbearing, the Depression would have contributed to an increase of 1.3 children per household across Depression and post-Depression cohorts.[38] This gap is implausibly large, exceeding even the overall trough-to-peak increase in completed childbearing during this era (Figure 1). Moreover, the trough-to-peak increase in completed fertility implied by the $\beta^*_{cohort}$ estimates occurred much more rapidly than the overall trends in completed fertility

[37]Specifically, we evaluate $\beta^*_{cohort}$ that solves the following minimization problem across the trough-to-peak-to-trough estimates from 1933 to 1975:
$\sum_{1933}^{1975} \left(\hat{\beta}_t - \sum_{cohort} \beta_{cohort} \cdot \text{share}_t^{cohort}\right)^2$, where the weights, $\text{share}_t^{cohort}$, are calculated as before (Figure A.1).

[38]This estimate is obtained by multiplying the difference in the values of $\beta^*_{cohort}$ across the 1901-1905 and 1921-1925 birth cohorts by the 0.202 nationwide decline in per capita retail sales.

observed in this era.

Together, the patterns in Figures 8 and 9 suggest that changes in lifecycle fertility were a crucial driver of the bust-boom-bust fertility patterns associated with the Great Depression. Intuitively, over this 40-year period, the swings in annual fertility rates were simply too fast and too large to be entirely the result of changes in completed fertility.

### 5.3.3 Effects of the Depression on Age-specific Fertility

To what extent was the baby boom of the 1940s and 1950s a result of "catch-up" fertility among Depression-era women and/or earlier childbearing among subsequent cohorts? In this section, we study the effects of the Great Depression on age-specific fertility rates for both Depression-era and post Depression-era cohorts of women.

The analysis draws on individual-level data from the complete count censuses for decennial years 1910, 1940, and 1950 Ruggles et al. (2024). We estimate the following long-difference regression model separately for decadal years 1910-1940 and 1910-1950:[39]

$$y_{ict} = \alpha + \beta^{Age}\big(GD_c \times Age_{ict}\big) + \gamma_{st} + \lambda_c + X'_{ict}\Lambda + V'_c \times Year_t\Gamma + \epsilon_{ict} \qquad (2)$$

where $y_{ict}$ denotes fertility outcome for individual $i$ in county $c$ in year $t$. The main outcomes of interest are indicators for a child born last year and for the presence of a child under five years old in the household. The model includes a vector of state-by-year fixed effects, $\gamma_{st}$ and county fixed effects, $\lambda$. The term $X'_{ict}$ denotes individual controls including dummies for each 5-year age group and race. The model also includes controls for baseline (1910) county controls for log population, fraction nonwhite, fraction foreign born, and the share of farm households, all interacted with year fixed effects to allow for differential trends across counties according to underlying county characteristics.[40]

The main explanatory variable of interest is $GD_c$, which measures the change in county per capita retail sales from 1929 to 1933. We interact this variable with a set of five-year age group dummy variables, $A_{ict}$, to allow the Great Depression to differentially impact the labor market

[39] We find similar estimates in models that pool all census years from 1910 to 1950.

[40] For models based on the decennial years 1910-1950, we also include controls for World War II mobilization, based on county-level casualties (Brodeur and Kattan, 2023).

outcomes across different cohorts of women. These estimates allow us to trace out the Great Depression's impact on the subsequent fertility behavior for different cohorts.

Table 1, cols. (1) and (2), report the results for women aged 20 to 44 in 1940. The bulk of these women were Depression-era cohorts (highlighted in blue), whose childbearing years overlapped with the economic downturn of the early 1930s. For these Depression-era cohorts, we find that the shock led to an increase in fertility rates in the late 1930s and 1940s. With the exception of the 40-44 age group, we find positive and significant effects for both measures of fertility outcomes across all Depression-era cohorts in 1940. Columns (3) and (4) report the estimated effects for 1950. Again, for Depression-era cohorts (highlighted in blue), we find positive and generally statistically significant effects on both fertility measures. For post-Depression cohorts (highlighted in red), we also find evidence of higher fertility rates in early adulthood.

Together, the patterns in Table 1 are consistent with "catch-up" fertility among Depression-era, following the baby bust of early 1930s. Similarly, we find evidence that subsequent post-Depression cohorts had higher fertility rates in early adulthood. Unfortunately, because individual-level data at the county-level are only available in the census microdata until 1950, we are unable to track the lifecycle fertility patterns among post-Depression women through the 1950s fertility boom and subsequent bust of the 1960s.

# 6 Mechanisms

What explains the Depression's long-lasting impacts on women's fertility? In this section, we explore the mechanisms underlying the main empirical findings. We begin by developing a simple overlapping generations model of fertility and study how a one-time negative income shock affects the childbearing incentives across different cohorts of women. We then investigate the empirical content of the labor market "crowd-out" mechanism predicted by this framework.

## 6.1 A Simple Overlapping Model of Women's Fertility

### 6.1.1 Model Setup

We consider an overlapping generations framework, in which each cohort of adult women, $t$, lives for two periods. Mothers are fecund in both periods and make decisions over per period consumption, $c_1^t, c_2^t$, leisure, $\ell_1^t, \ell_2^t$, and fertility, $n_1^t, n_2^t$ to maximize the following utility function:

$$U\left(c_i^t, \ell_i^t, n_i^t\right) = \sum_{i \in \{1,2\}} \alpha_i \ln c_i^t + \beta_i \ln n_i^t + \gamma_i \ln \ell_i^t$$

We assume each adult belongs to a two-parent household, with each partner endowed with one unit of time in each period. Husbands are assumed to devote their entire time endowment to market work at salaries $y_1^t$ and $y_2^t$. Mothers allocate time to either childrearing, leisure, or market work according to the following two time constraints:

$$\begin{aligned} h_1^t + \ell_1^t + \tau^y n_1^t &\leq 1 \\ h_2^t + \ell_2^t + \tau^o n_1^t + \tau n_2^t &\leq 1, \end{aligned}$$

where $h_1^t, h_2^t$ denote time spent in market work. Children are time intensive to raise. Early-born children are assumed to remain in the household for both periods, where $\tau^y$ and $\tau^o$ denote their per-period time cost. Late-born children remain in the household for one period, where $\tau > \tau^o$ denotes their time cost.[41] [42]

Finally, we assume that families consume hand-to-mouth, and face the following per period consumption budget constraints:

$$\begin{aligned} c_1^t + pn_1^t &= w_1 h_1^t + y_1 \\ c_2^t + pn_2^t &= w_2 h_2^t + y_2 \end{aligned}$$

where $p$ denotes the goods costs of raising young children.[43] The assumption of hand-to-mouth consumption is motivated by the limited capabilities of households to borrow in an effort to smooth consumption in response to the Great Depression (Temin, 1976; Mishkin, 1978)

[41]This asymmetry in the number of periods in which early- and late-born children remain in the household plays no role in the analysis. Indeed, if $\tau = \tau^y + \tau^o$, then each child requires an identical amount of maternal time to raise, regardless of when they are born. In this case, the model is observationally equivalent to a three-period model in which only late-born children remain at home in the last period.

[42]Because children overlap in the household, parents face an implicit tradeoff between the number of early- versus late-born children.This tradeoff emerges even though $n_1$ and $n_2$ are complements in the utility function. Similar results would be obtained if we assumed no overlap in childrearing costs, but parents have preferences over the total number of children, regardless of when they are born.

[43]Given freely available schooling and the relative high rates of youth employment, we assume that older children did not pose a net financial cost on families.

We assume that children are relatively time intensive, a standard assumption in fertility models, so that the time cost of raising young children is larger than the goods costs: $\tau^y > p/y$.[44] More precisely, this assumption requires that the time cost of a child is a larger fraction of the household's time endowment than the goods cost is of the household's income endowment.

Given this setup, we can derive the first order conditions for the household's problem (see Appendix A.2). We use these results to derive the predicted impacts of the Great Depression on the lifecycle fertility patterns across cohorts.

### 6.1.2 The Great Depression and Fertility Patterns across Cohorts

We apply the results from the stylized model to study the impact of the Great Depression on the fertility patterns of Depression-era and post-Depression-era cohorts. We model the Great Depression as a one period unanticipated decrease in husband's earnings for adult cohorts. Denote $t = D$ as the cohort entering adulthood during the Great Depression, and $t+1 = PD$ as the cohort entering adulthood one-period after the shock.

We have the following two propositions describing the impact of the Great Depression on Depression-era and post-Depression-era cohorts:

**Proposition 1** *Assume that the Great Depression causes a one-period decrease in husband's income, $y_1^D$, for the Depression-era cohort, $t = D$. We have the following predicted impacts:*
*(a) The Great Depression leads to a decrease in fertility in early adulthood and an increase in fertility in late adulthood: $\frac{\partial n_1^D}{\partial y_1^D} > 0$, $\frac{\partial n_2^D}{\partial y_1^D} < 0$.*
*(b) The Great Depression leads to a decrease in completed fertility: $\frac{\partial n_{total}^D}{y_1^D} > 0$.*
*(c) The Great Depression leads to an increase in women's employment in early adulthood and has an ambiguous impact on employment in late adulthood: $\frac{\partial h_1^D}{\partial y_1^D} < 0$, $\frac{\partial h_2^D}{\partial y_1^D} \lesseqgtr 0$.*

**Proof.** See Appendix A.2. ■

Proposition 1(a) shows that the negative income shock of the Great Depression leads young families to reduce fertility during the crisis and increase fertility in later-life. Intuitively, because

[44] Since children are typically assumed to be normal goods, the time cost plays a crucial role in generating the negative relationship between fertility and women's wages observed in the data (Jones, Schoonbroodt and Tertilt, 2008).

these families lack access to formal credit, they adjust the *timing* of childbearing in an effort to smooth their own lifetime consumption.

Proposition 1(b) shows that the net effect of the Great Depression on completed fertility is negative. In particular, the decline in fertility among young families is not fully compensated by the increase in fertility in later-life. This result reflects a standard income effect: because children are normal goods, a decline in lifetime income reduces desired completed fertility.[45]

Proposition 1(c) shows that the Great Depression leads to an increase in women's employment in early adulthood. This effect rises directly from the loss in husband's income, which increases the marginal utility for women's work. Moreover, this effect is reinforced by the shift in fertility timing, which reduces the opportunity cost of women's employment.

Proposition 1(c) also shows that the Great Depression has an ambiguous impact on women's employment in later-life. The result stems from two offsetting mechanisms. On the one hand, the marginal utility from women's work has increased due to the decline in lifetime family income. On the other hand, the shift in fertility to later-life increases the opportunity cost of working during this period. Although theoretically ambiguous, empirical evidence suggests that the Great Depression did indeed cause a long-run increase in women's work among Depression-era cohorts (Bellou and Cardia, 2021). The accumulation of labor market experience may have reinforced the incentive for this cohort to remain at work, an effect that is not explicitly modelled. Thus, for the remainder of this section, we assume that the former effect dominates, and that the Depression-era women had higher long-run employment rates.

**Proposition 2** *Assume that the Great Depression had no direct impact on husbands' earnings, $y_1^{PD}, y_2^{PD}$, for post-Depression-era cohorts. Suppose that the Great Depression caused a long-run increase in employment among Depression-era women, $\frac{\partial h_2^D}{\partial y_1^D} < 0$. Further, assume that $\tau^y > p/y$. We have the following predicted impacts among post-Depression-era cohorts:*

*(a) The Great Depression leads to an increase in fertility in early adulthood and a decrease in fertility in late adulthood: $\frac{\partial n_1^{PD}}{\partial w_1^{PD}} < 0$, $\frac{\partial n_2^{PD}}{\partial w_1^{PD}} > 0$.*

*(b) The Great Depression leads to an increase in completed fertility: $\frac{\partial n_{total}^{PD}}{w_1^{PD}} < 0$.*

[45]This effect would be reinforced by age-related differences in fecundity, which would imply that it is more difficult for older families to make-up for foregone childbearing in early adulthood.

**Proof.** See Appendix A.2. ■

Proposition 2(a) shows that Great Depression affects the timing of fertility among post-Depression-era cohorts, causing them to increase fertility in early adulthood and reduce fertility in later-life. Intuitively, the increase in long-run Depression-era women's employment crowds out the labor market opportunities for subsequent cohorts, reducing their opportunity cost of childrearing.[46] Since Depression-era women retire in period two, the later-life wages of post-Depression women, $w_2^{PD}$ are unaffected by the shock. Nevertheless, their period two fertility rates decrease. This effect stems both from the negative lifetime income effect due to forgone maternal earnings in the first period, and the increased demands on maternal time resulting from the larger family size.

Proposition 2(b) shows that Great Depression causes an increase in completed fertility among post-Depression-era cohorts. This is due to the fact that the rise in fertility in adulthood is not fully offset by the decline in fertility in later-life.

#### 6.1.3 Summary

This simple framework yields several key insights related to the Depression's impact on fertility patterns in the era. First, we find that in the absence of credit markets, Depression-era families will adjust the timing of lifecycle fertility in an effort to smooth lifetime consumption. Women who entered childbearing ages around the time of the crisis will reduce fertility in early adulthood only to increase fertility in later-life after the shock has subsided. At the same time, the losses in household income will induce many of these women to enter the labor market and remain working into later-life. This positive long-run labor supply response may also be reinforced by accumulated labor market experience.

Second, a long-run shift in the labor supply of Depression-era women will impact the fertility decisions of subsequent cohorts of women, even though they were not directly exposed to the crisis. By reducing the shadow price of fertility, these "crowd-out" forces cause post-Depression women to increase fertility in early adulthood. Meanwhile, the eventual retirement of Depression-era cohorts expanded the labor market opportunities for younger generations, causing post-Depression women to decrease fertility in later-life.

[46] This effect is partially offset by a negative income effect due to the decline in women's wages, although the substitution effect dominates because of the earnings of husband's income (Jones, Schoonbroodt and Tertilt, 2008).

Finally, the framework shows how the Depression can generate the bust-boom-bust trend in aggregate fertility rates, as well as the evolution in lifecycle fertility profiles across different cohorts of women in this era. Although the model offers predictions for the broad patterns in aggregate fertility rates, it provides no guidance on the relative magnitude of the initial "baby bust" of the 1930s versus the subsequent "boom" of the 1940s and 1950s. This is because the strength of "crowd-out" mechanism influencing post-Depression era women's fertility choices does not depend on the magnitude of the initial fertility decline among Depression-era women. Indeed, there may be scenarios in which the initial shock leads to a modest contemporaneous decline in fertility, only to be followed by a larger post-Depression fertility boom.[47]

## 6.2 The Great Depression and Changing Patterns of Women's Employment

The Great Depression had positive effects on local fertility rates that extended through the 1950s and 1960s, well beyond the childbearing years of Depression-era cohorts (Figure 5). In Section 6.1, we outlined a labor market mechanism that can account for these intergeneration effects, and demonstrated how a long-run shift supply response among Depression-era women may have impacted the labor market conditions for subsequent generations. In this section, we explore the empirical content of this mechanism.

Figure A.10 presents age-specific employment rates for married white women for decennial years 1930 to 1960. In every decade, Depression-era cohorts had among the highest employment rates. These broad trends align with previous research showing that the Depression caused a substantial rise in married women's employment (Bellou and Cardia, 2021). Cohorts that were more exposed to the shock entered the labor market in the 1930s as secondary family wage earners, and continued to have higher employment rates through the 1940s and 1950s (Bellou and Cardia, 2021).

To further explore the role of this labor market channel, we begin by estimating the effects of the Great Depression on labor market outcomes for women of different ages in decennial years 1940 and 1950. The analysis follows the specification outlined in equation (2) for decadal years 1910-1940 and 1910-1950. We construct a series of binary outcomes variables including an indicator for whether the woman is currently employed and dummy variables for employment in specific

[47] This result is analogous to the main calibration results in Doepke, Hazan and Maoz (2015), who find that the rise in women's wartime participation coincided with a modest decrease in contemporaneous fertility rates, but, through labor market crowd-out forces, contributed to a much larger postwar fertility boom.

occupational groups.

Table 2 reports the estimates for women's employment. Among Depression-era cohorts (outlined in blue), we find a significant *positive* relationship between county Great Depression severity and employment in both 1940 and 1950. These patterns hold across virtually all cohorts of women who were directly exposed to the economic crisis of the early 1930s. Columns 3-5 also demonstrate a non-uniform relationship of the Great Depression across Depression-era and post-Depression-era cohorts. Among younger cohorts (outlined in red), who were too young to have been directly impacted by the crisis, we find significant and *negative* effects on employment rates in 1950.[48]

The positive employment effects among Depression-era women spanned a range of different occupations, but were particularly large in white collar sectors, such as clerical work, sales, and professional occupations (Table A.3). These occupations provided women with more "respectable" employment with shorter hours (Goldin, 2006). In contrast, the effects in service sector employment are small and generally statistically insignificant. For post-Depression cohorts, the negative employment effects were felt across a range of different occupations including both blue and white collar jobs (Table A.4). The sole positive employment effect among this group is for clerical work. This result may stem from a broader nationwide increase in demand for clerical workers during this era (Goldin, 2006). Indeed, the estimates suggest that the local impacts of the Depression may have reinforced a broader shift in women's occupational outcomes, as younger cohorts of women were also induced to seek work in clerical jobs at the expense of other occupations.

The striking reversal in the relationship between the Great Depression and women's employment outcomes is consistent with the mechanisms laid out in the conceptual framework, in which the downturn in the early 1930s induced labor market entry among Depression-era women. The persistently high rates of employment among these cohorts, which may have been reinforced by an accumulation of labor market experience (Bellou and Cardia, 2021), ultimately crowded-out the labor market opportunities of subsequent cohorts.

[48]The results for 1950 employment are robust to county-level exposure to World War II mobilization and wartime expenditure. The fact that the estimates are unaffected by these controls is unsurprising. Although the war led to a sharp rise in women's employment, the demand shock was short-lived, and the vast majority of wartime workers had left the labor market by 1950 (Goldin, 1991; Rose, 2018). As a result, the war does not appear to have altered the Depression's longer-run impact women's labor market opportunities.

### 6.2.1 The Great Depression, Labor Market Crowd-out, and the Baby Boom

The estimated effects of the Depression on women's employment outcomes are broadly consistent with the crowd-out mechanism emphasized in the conceptual framework. At the same time, this period coincided with fundamental changes in the demand for female labor, which may have altered the saliency of this channel. Additionally, the empirical relevance of the crowd-out forces depends on the magnitude of the labor supply response of Depression-era women. In this section, we explore these issues in more detail.

The mid-20th century witnessed substantial increases in women's employment, driven by increased demand for office and clerical workers (Goldin, 2006). How did these broader economic changes interact with the Great Depression to affect longer-run women's labor market outcomes? Importantly, our estimates capture *relative* differences in employment outcomes across counties that were more or less impacted by the shock. So, the negative impacts on employment outcomes among post-Depression cohorts reflect a decline in their labor market opportunities *relative* to the nationwide increase in women's employment and improved occupational opportunities. Moreover, to the extent that an accumulation of labor market experience increased the elasticity of labor supply among Depression-era cohorts, the crowd-out forces may actually have been reinforced by the nationwide increase in female labor demand. Intuitively, this effect stems from the fact that in more severely impacted counties, new employment opportunities were disproportionately taken up by Depression-era women.

The labor supply response to the shock of the 1930s among Depression-era cohorts was large in magnitude and persistent. Among Depression-era cohorts, we estimate that the Depression led to an average nationwide increase in women's employment of 8.4 percent in 1940; by 1950, the average effect was 12 percent.[49] These lasting effects contrast with the female labor response to World War II, which, although large in magnitude, was much more short lived (Goldin, 1991; Rose, 2018).

To shed light on the potential influence of this labor supply shift for the employment opportunities of subsequent cohorts of women, we construct estimates of the implied changes in women's wages from 1940 to 1970 that can be attributable to the changes employment patterns of Depression-era

[49] These estimates are obtained by multiplying the age-specific coefficient estimates from Table 2, cols. 1 and 3, by the 0.202 nationwide decrease in per capita retail sales.

women.[50] These estimates are obtained by combining the employment estimates for Depression-era women in 1940 from Table 2 with demand elasticities from Acemoglu, Autor and Lyle (2004), and applying these to the share of Depression-era women among the working aged women. Intuitively, a large *ceteris paribus* labor supply increase among Depression-era women should lead to a decline in women's wages in 1940, given that they comprise a substantial share of the working age population in this period. Thirty years later, in 1970, assuming the same labor supply response among the Depression-era cohorts, there will be a smaller decrease in local wages, as Depression-era cohorts represent a much smaller share of the working age population.[51]

Our back-of-the-envelope calculations imply that the supply response among Depression-era cohorts led to a 6 to 7 percent decrease in women's wages in 1940.[52] The estimates also imply large differences in local women's wages across counties that were more or less severely impacted by the crisis. Among counties in the top quartile of Depression severity, we estimate implied decreases of 11 to 13 percent in women's wages; among counties in the bottom quartile, implied women's wages decreased by 1.5 to 2 percent. Over time, as Depression-era women reflected a smaller share of the working-age population, the implied wage effects attenuated. By 1970, the negative wage effects attenuate to just 1 percent.[53] Intuitively, the crowd-out mechanism diminishes as Depression-era cohorts age out of the labor market, and thereby contribute less to local equilibrium wages.

Together, these findings suggest that the rise in Depression-era women's participation significantly impacted local labor market in counties that were hit hardest by the shock. Indeed, the average decreases in women's wages attributable to the Depression are larger in magnitude than the respective wage decreases attributable to World War II.[54] To the extent that Depression-era women were disproportionately employed in higher paying jobs such as clerical and professional-managerial occupations (Table A.4), the crowd-out forces affecting the wages of subsequent cohorts of women

[50]Since information on wages is unavailable prior to 1940, we are unable to estimate the impact of the Depression on local women's wages directly.

[51]To the extent that labor markets adjusted to the influx of Depression-era women over time, long run demand elasticities will be larger, and the negative wage effects will be further attenuated by 1970.

[52]Among Depression-era cohorts (age 25+ in 1940), we estimate that the Depression led to an average nationwide increase in women's employment of 8.4 percent in 1940. Given these cohorts represented all of the 25+ working age population in 1940, the implied wage effect, given a labor demand elasticity of -1.2 to -1.5 (Acemoglu, Autor and Lyle, 2004), is 5.6 to 7 percent.

[53]In 1970, Depression-era women represented just 22 percent of the working age population, so holding constant the other values, their implied wage effect falls to 1.2 to 1.4.

[54]In their calibrated model, Doepke, Hazan and Maoz (2015) estimate that the World War II contributed to a 5 percent decrease in nationwide women's wages by 1950.

may have been even larger than those implied by these estimates.

As a final piece of evidence for the crowd-out mechanism, we explore heterogeneity in the impacts of the Great Depression on county fertility rates based on the underlying age structure of the county at the onset of the shock. This analysis is based on the intuitive notion that crowd-out effects should be larger in locations with relatively larger cohorts of Depression-era women, whose large-scale labor market entry disproportionately influences the opportunities for subsequent generations of women. To explore this hypothesis, we construct a measure of relative population size based on the ratio of young Depression-era women (aged 15-24 in 1930) to post-Depression women (aged 0-9 in 1930).[55] We re-estimate equation (1), allowing the main effects to differ across counties that had above- versus below-median values of this ratio.

Figure 10 reports the results.[56] We find that counties with a larger fraction of Depression-era women experienced a more pronounced initial decline in fertility in response to the Great Depression in the early 1930s, followed by a relative increase in fertility in the 1940s and 1950s. By the mid-1960s, we find little difference in the Depression impact across these two groups. These patterns are consistent with a crowd-out mechanism. In places with a large share of Depression-era women, fertility rates declined sharply during the Depression as young families delayed childbearing in an effort to mitigate the consumption impacts of the shock and increase women's work. Over time, this large cohort of women in the labor market decreased the opportunity cost of childbearing for subsequent generations, causing the boom in fertility through the 1950s. Eventually, as Depression-era women retired, this crowd-out mechanism abated.

In summary, we find that the economic crisis of the 1930s induced a large-scale and persistent increase in employment among Depression-era women, which temporarily impacted the childbearing incentives among subsequent cohorts of women. Although we are unable to track the local labor market impacts of the crisis beyond 1950, the timing of Depression-era women's retirements throughout the 1960s coincides with the Depression's diminishing impacts on fertility rates and the baby bust. At the same time, women's labor market opportunities in the 1960s and 1970s were reshaped by a host of social, economic, and technological changes including evolving norms regard-

[55] We focus on the population shares of younger Depression-era women, who are more likely to be substitutes in the labor market with subsequent cohorts of women, and whose employment decisions are likely to impose longer-lasting effects on local labor markets.

[56] For reference, Figure A.11 reports the corresponding results with confidence intervals.

ing women's labor force participation (Fernández, Fogli and Olivetti, 2004), real wage growth for women (Smith and Ward, 1989; Goldin, 1990), the diffusion of labor-saving household technology (Greenwood, Seshadri and Yorukoglu, 2005), and the Pill (Goldin and Katz, 2002; Bailey, 2006). These factors, in turn, may have reinforced the declining long-run influence of the Depression on women's fertility.

## 7 Conclusions

The United States experienced major swings in fertility over the course of the early and mid-20th century that have had enduring consequences on the economy until present day. This paper shows that these fertility swings cannot, in large part, be explained by changes in completed childbearing across cohorts, which have been the focus of the prior literature. Instead, we document how changing patterns in the lifecycle fertility profiles of subsequent generations of women was the major source of the bust-boom-bust cycles in annual fertility rates throughout this era.

We provide a novel explanation for the bust-boom-bust patterns of women's fertility based on the Great Depression, and show theoretically how this one-time economic shock can generate both the large swings in completed fertility across cohorts as well as the changing patterns in lifecycle fertility that we observe in the data. We document empirically how the Great Depression was a quantitatively important driver of the swings in annual fertility rates and can also account for both the changes in completed fertility and the timing of lifecycle fertility across cohorts in this era.

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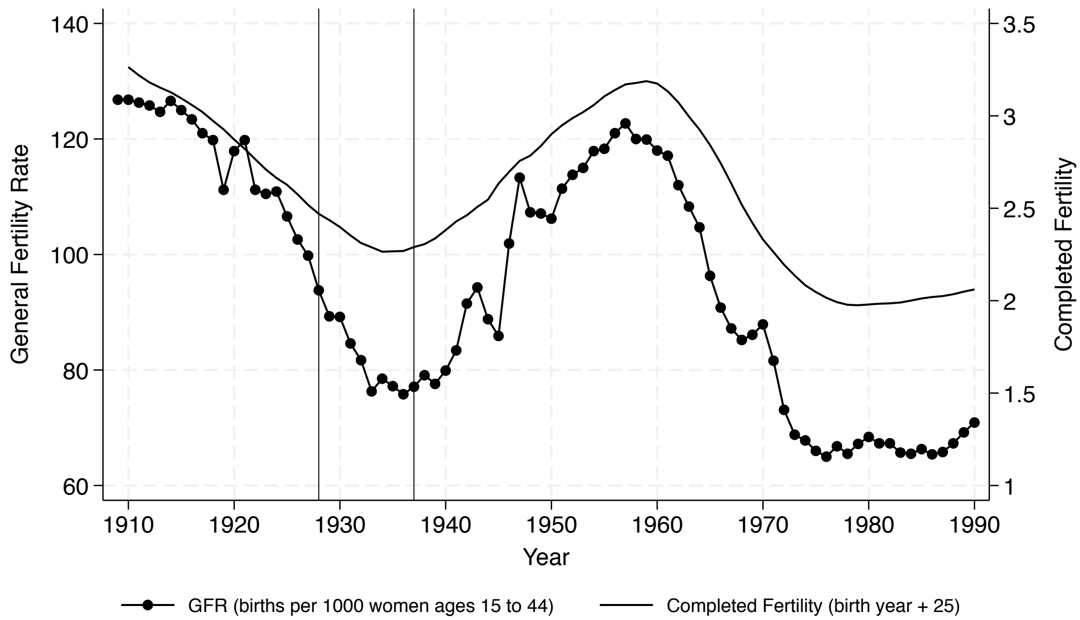
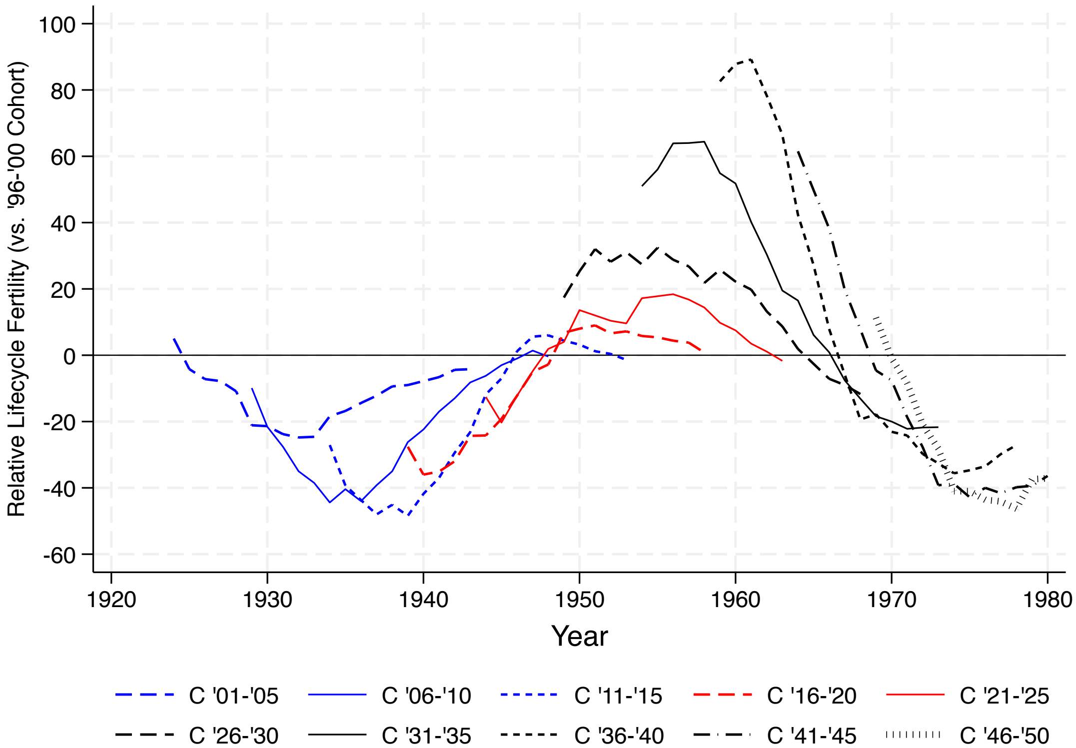
# 8 Figures and Tables

Figure 1: Annual U.S. Fertility Rates and Completed Fertility by Cohort



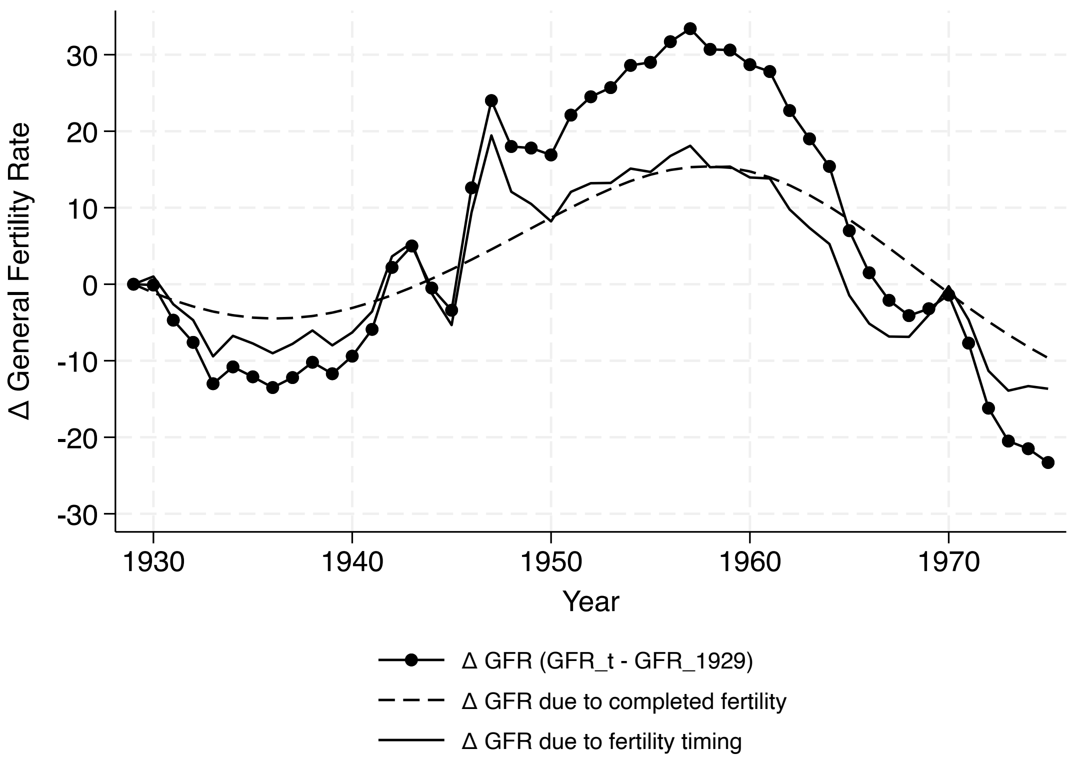

*Notes:* This figure reports the annual fertility rate (births per 1,000 women aged 15 to 44) by year and the completed fertility rate (total number of births per woman) by birth cohort. Birth cohorts are presented as the year of birth year + 25 on the x-axis.
*Sources:* Bailey et al. (2018*b*); Heuser (1976); CDC (2023)

Figure 2: Annual U.S. Fertility Rates and Completed Fertility by Cohort



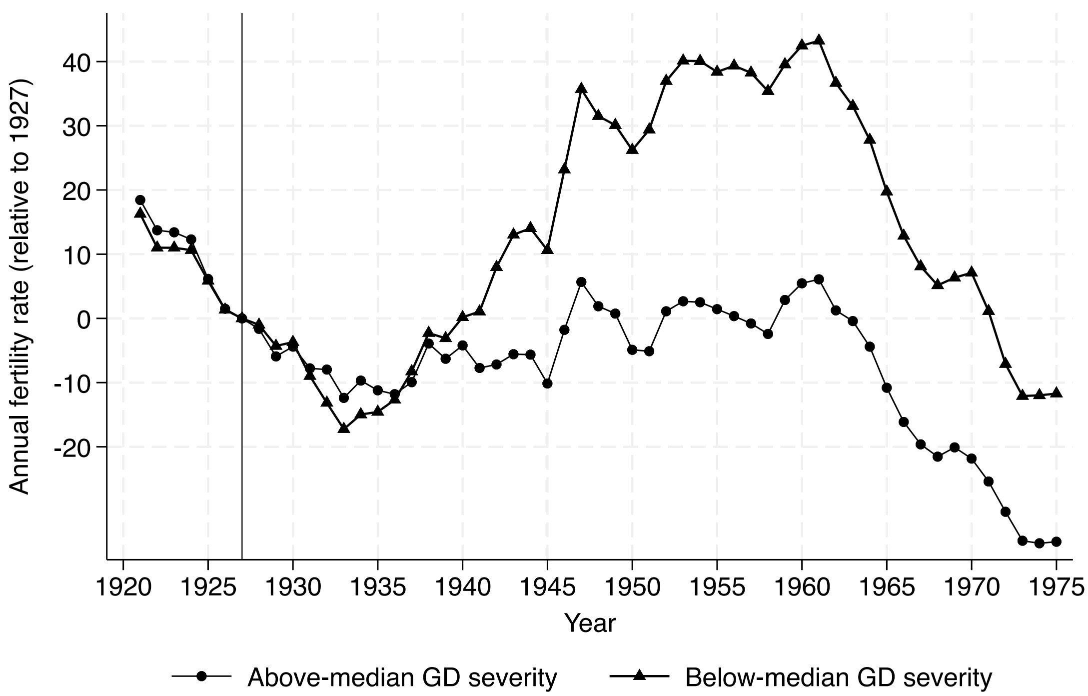

*Notes:* This figure reports relative age-specific fertility rates across cohorts. Each observation corresponds to the difference in the age-specific fertility rate relative to the fertility rate for the reference cohort (born between 1896-1900). Average relative fertility rates are reported by year for ages 21 to 40 for every five-year birth cohort from 1901 to 1950. Blue colors denote Depression-era cohorts born between 1901 and 1915, red colors denote the 1916-1925 birth cohorts whose peak fertility coincided with WWII, and black colors denote post-Depression cohorts born after 1925.
*Sources:* Heuser (1976); CDC (2023)

Figure 3: Determinants of Changes in Annual Fertility Rates, 1929 – 1975



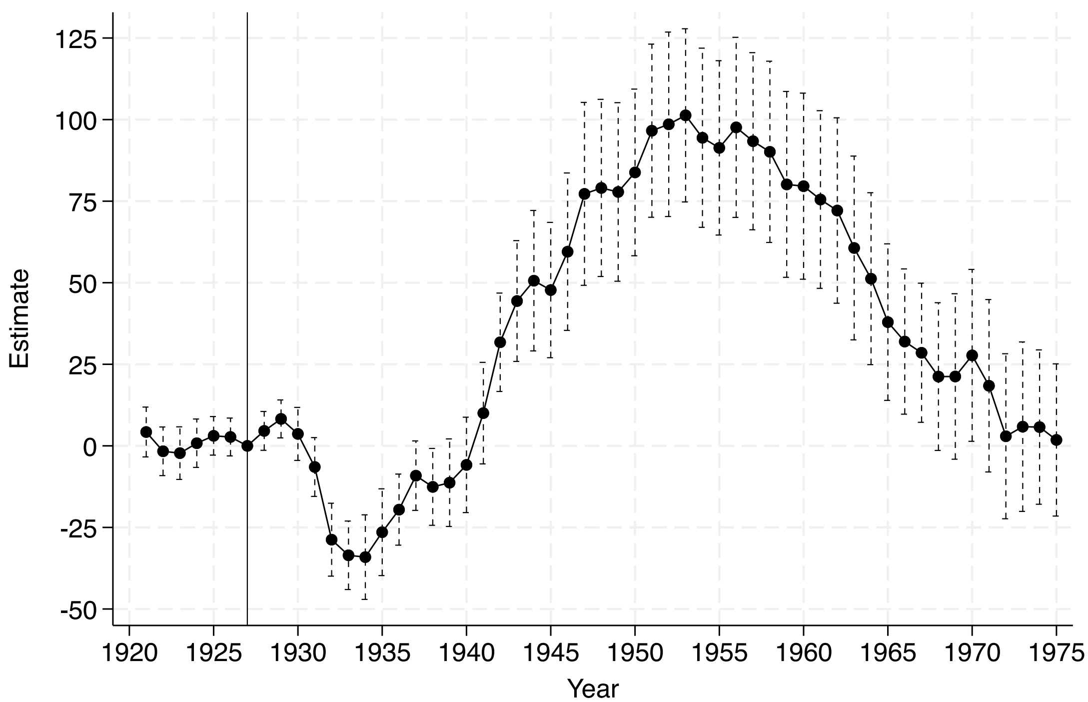

*Notes:* This figure presents changes in the annual fertility rate relative to the year 1929. The figure also presents a decomposition of this series into changes in completed childbearing across cohorts and changes in lifecycle fertility patterns based on the methodology described in Section 2.
*Sources:* Heuser (1976); CDC (2023).

Figure 4: Annual Fertility Rates by Great Depression Severity



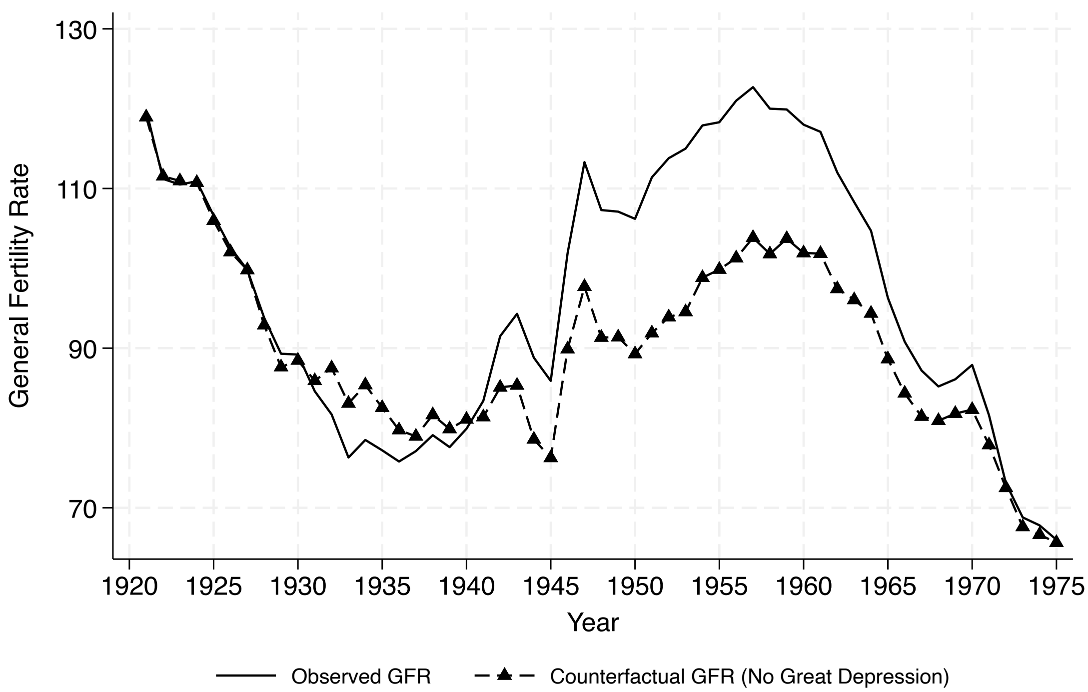

*Notes:* This figure reports within-state trends in mean fertility rates across counties with above-median versus below-median declines in retail sales per capita between from 1929 to 1933. Annual fertility rates are reported relative to the 1927 reference year.

Figure 5: Impacts of the Great Depression on Annual County Fertility Rates



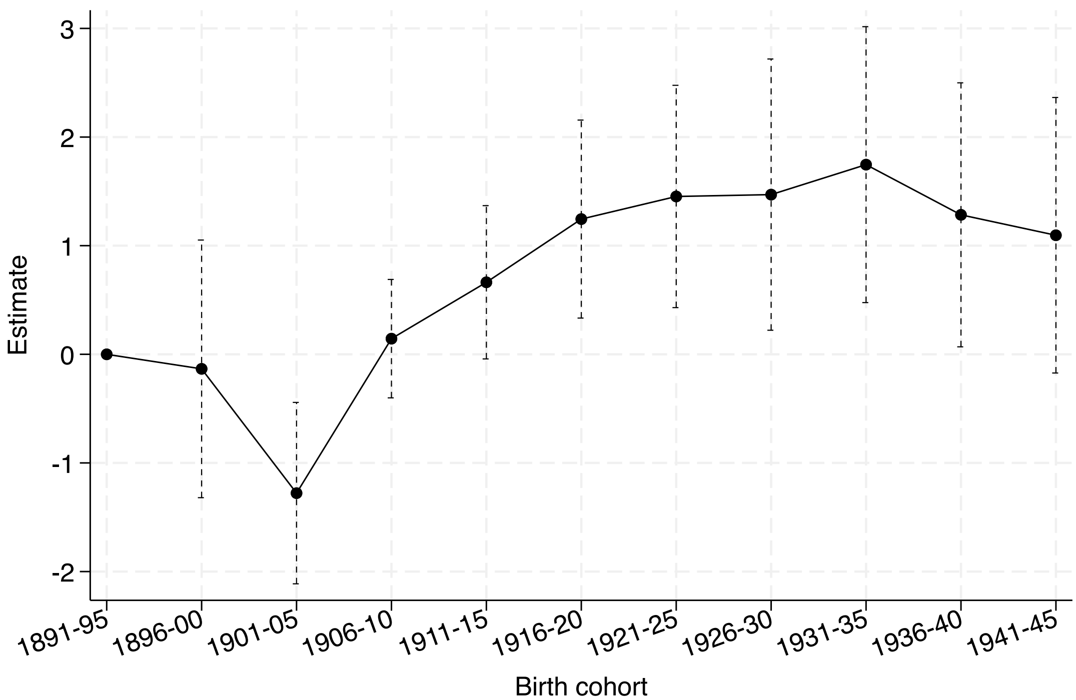

*Notes:* This figure reports estimates of $\beta_k$ from equation (1) along with the 95% confidence intervals. Standard errors are clustered at the county-level. The year 1927 is the omitted reference year.

Figure 6: Observed and Counterfactual Annual Fertility Rates



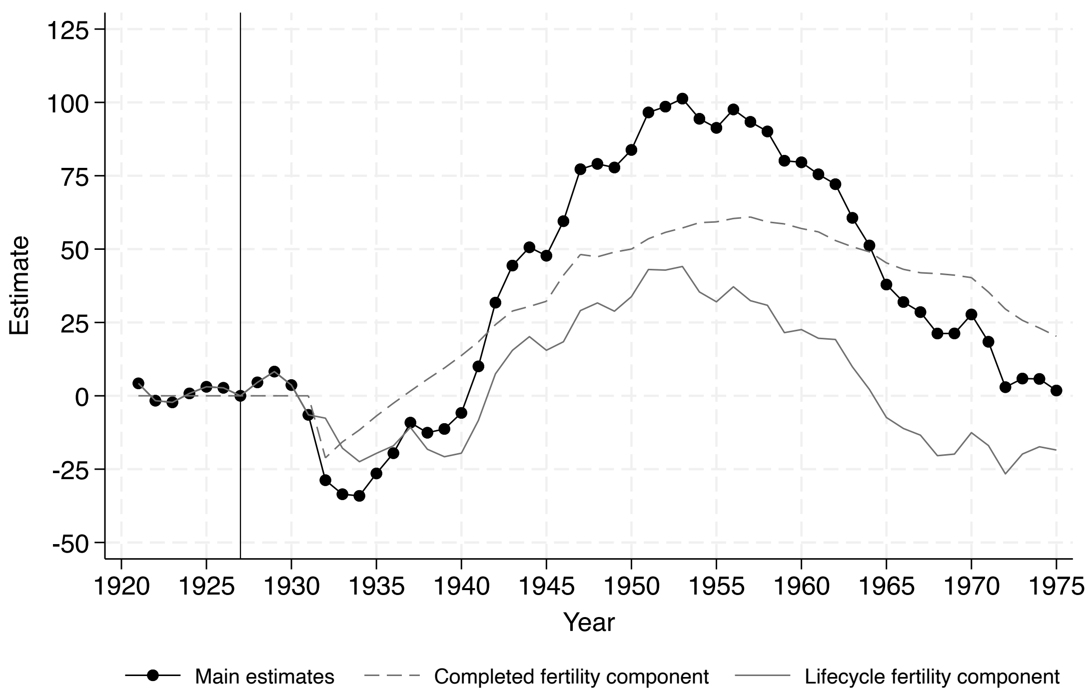

*Notes:* This figure reports the observed and counterfactual annual fertility rates for the period 1921 to 1975. The counterfactual fertility rate series, CGFR, reflects the trend in the nationwide annual fertility in the absence of the Great Depression. This series is obtained by combining the annual $\beta_k$ estimates from equation (1) with the average nationwide decline in per capita retail sales from 1929 to 1933.

Figure 7: Impacts of the Great Depression on Completed Fertility Across Cohorts



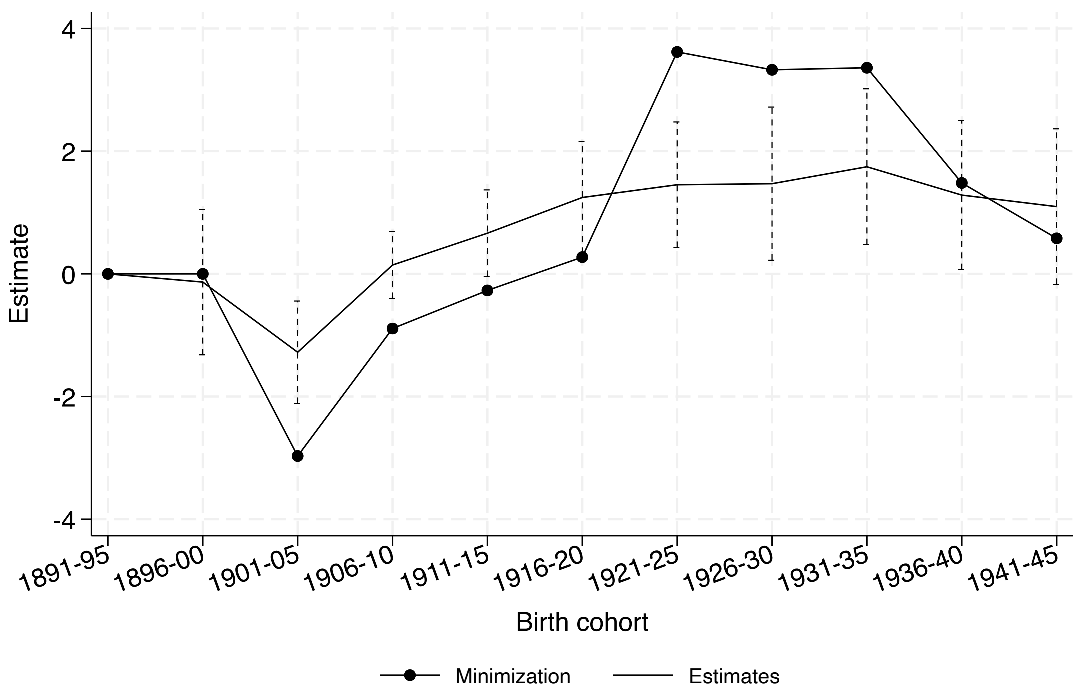

*Notes:* This figure reports the impacts of the Great Depression on completed fertility for cohorts born between 1896 and 1950.The figure reports the estimated impacts and 95% confidence intervals. The analysis is conducted based on cross-state regressions, where we assign the change in per capita retail sales from 1929 to 1933 based on state-of-birth. Standard errors are clustered at the state-level.

Figure 8: Effects of the Great Depression on Completed and Lifecycle Fertility



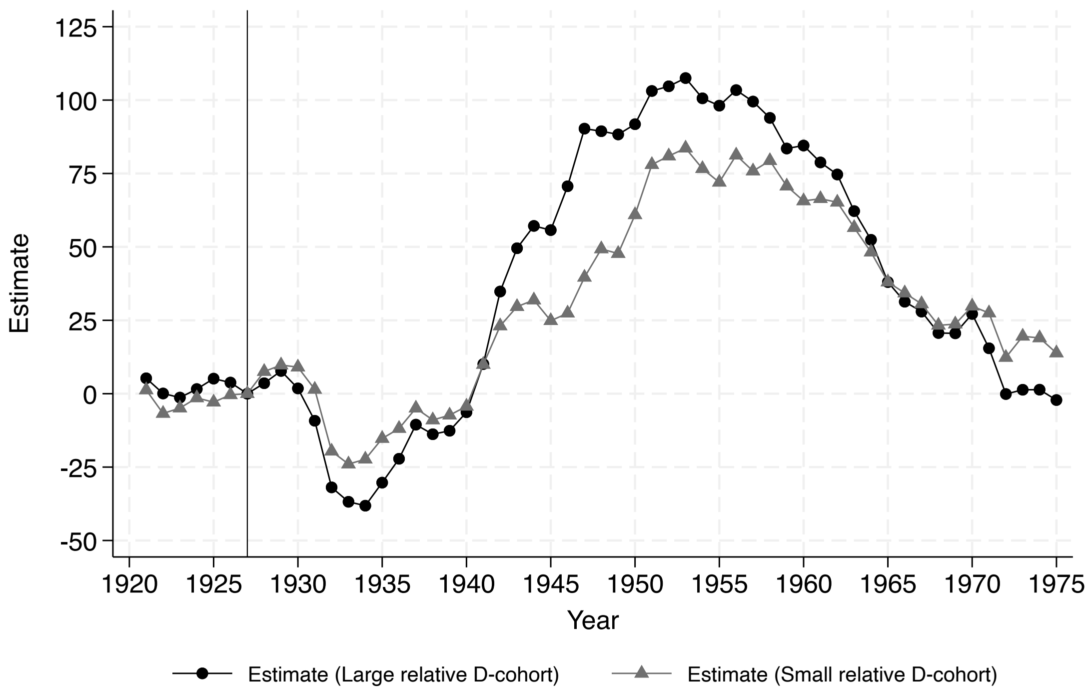

*Notes:* This figure decomposes the main estimated effects of the Great Depression on annual fertility rates into a completed fertility component and a lifecycle fertility component.

Figure 9: Counterfactual Impacts of the Great Depression on Completed Fertility




*Notes:* This figure presents the counterfactual impacts of the Depression on completed fertility assuming it had no impact on the timing of lifecycle fertility. The dotted line presents these counterfactual estimates, which are obtained by the minimization procedure described in the text. For reference the figure also reports the impacts of the Great Depression on completed fertility for cohorts born between 1896 and 1950 and 95% confidence intervals reported in Figure 7.

Figure 10: Impacts of the Great Depression on Annual County Fertility Rates by Relative D-cohort Population Size




*Notes:* This figure reports estimates of $\beta_k$ from equation (1). Each coefficient is allowed to differ across counties that had above- versus below-median ratio of Depression-era women (age 15-24 in 1930) to post-Depression women (aged 0 to 9 in 1930).

Table 1: Effects of the Great Depression on Women's Fertility Patterns

| | Census years 1910 – 1940 | | Census years 1910 – 1950 | | | |
|---|---|---|---|---|---|---|
| Dep var: | Child born last year | Has child age < 5 | Child born last year | | Has child age < 5 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| GD × | | | | | | |
| Age 20-24 | 0.024** | 0.015 | 0.038*** | 0.039*** | 0.039* | 0.040* |
| | (0.008) | (0.019) | (0.010) | (0.010) | (0.023) | (0.024) |
| Age 25-29 | 0.043*** | 0.048** | 0.062*** | 0.063*** | 0.082*** | 0.083*** |
| | (0.008) | (0.017) | (0.011) | (0.011) | (0.021) | (0.021) |
| Age 30-34 | 0.045*** | 0.066*** | 0.067*** | 0.068*** | 0.123*** | 0.124*** |
| | (0.007) | (0.017) | (0.009) | (0.009) | (0.020) | (0.020) |
| Age 35-39 | 0.036*** | 0.059*** | 0.053*** | 0.054*** | 0.117*** | 0.118*** |
| | (0.007) | (0.018) | (0.009) | (0.009) | (0.022) | (0.022) |
| Age 40-44 | 0.000 | 0.026 | 0.001 | 0.002 | 0.042* | 0.043* |
| | (0.008) | (0.019) | (0.010) | (0.010) | (0.023) | (0.022) |
| County & Year FE | Y | Y | Y | Y | Y | Y |
| State-by-Year FE | Y | Y | Y | Y | Y | Y |
| 1910 county controls X Year FE | Y | Y | Y | Y | Y | Y |
| Individual controls | Y | Y | Y | Y | Y | Y |
| WWII controls | N | N | N | Y | N | Y |
| Observations | 38,009,134 | 38,009,134 | 40,954,390 | 40,954,390 | 40,954,390 | 40,954,390 |
| Mean (S.D.) of GD | 0.203 (0.135) | | | | | |

Notes: Each column reports the point estimate from a different regression. Blue cells denote Depression-era cohorts. Red cells denote post-Depression cohorts (see Figure 2). GD measures the decline in per capita county retail sales from 1929 to 1933. 1910 controls include log population, share nonwhite, share foreign born, and share in agriculture. Individual controls include indicators for age and race. Standard errors are clustered at the county level. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

Table 2: Effects of the Great Depression on Women's Employment

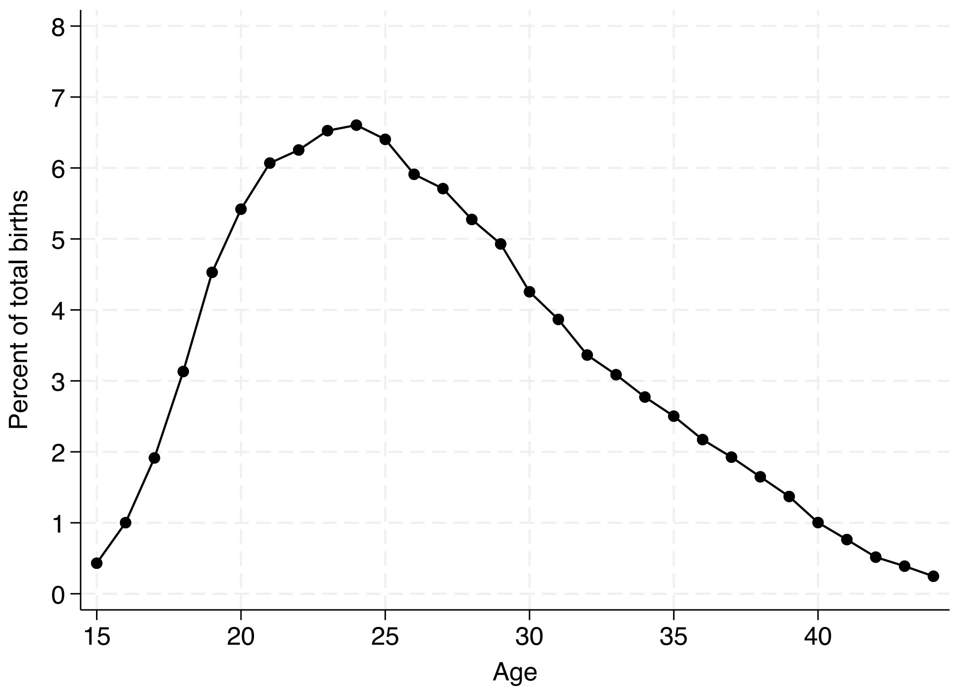
| | Dep var: Currently Employed | | |
|---|---|---|---|
| | Census years 1910 – 1940 | Census years 1910 – 1950 | |
| | (1) | (2) | (3) |
| Mean Dep. Var. | 0.28 | 0.34 | 0.34 |
| GD × | | | |
| Age 20-24 | -0.036<br>(0.025) | -0.117***<br>(0.024) | -0.118***<br>(0.024) |
| Age 25-29 | 0.039**<br>(0.020) | -0.008<br>(0.019) | -0.009<br>(0.021) |
| Age 30-34 | 0.074***<br>(0.014) | 0.022<br>(0.018) | 0.021<br>(0.018) |
| Age 35-39 | 0.098***<br>(0.016) | 0.066***<br>(0.018) | 0.065***<br>(0.017) |
| Age 40-44 | 0.119***<br>(0.016) | 0.132***<br>(0.019) | 0.131***<br>(0.018) |
| Age 45-49 | 0.130***<br>(0.018) | 0.179***<br>(0.020) | 0.178***<br>(0.020) |
| Age 50-54 | 0.111***<br>(0.019) | 0.174***<br>(0.019) | 0.173***<br>(0.019) |
| County & Year FE | Y | Y | Y |
| State-by-Year FE | Y | Y | Y |
| 1910 county controls X Year FE | Y | Y | Y |
| Individual controls | Y | Y | Y |
| WWII controls | N | N | Y |
| Observations | 47,787,885 | 51,022,796 | 51,022,796 |
| Mean (S.D.) of GD | 0.203 (0.135) | | |

Notes: Each column reports the point estimate from a different regression. Blue cells denote Depression-era cohorts. Red cells denote post-Depression cohorts (see Figure 2). GD measures the decline in county retail sales from 1929 to 1933. 1910 controls include log population, share nonwhite, share foreign born, and share in agriculture. Individual controls include indicators for age and race. Standard errors are clustered at the county level. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

# A Appendix (For Online Publication)

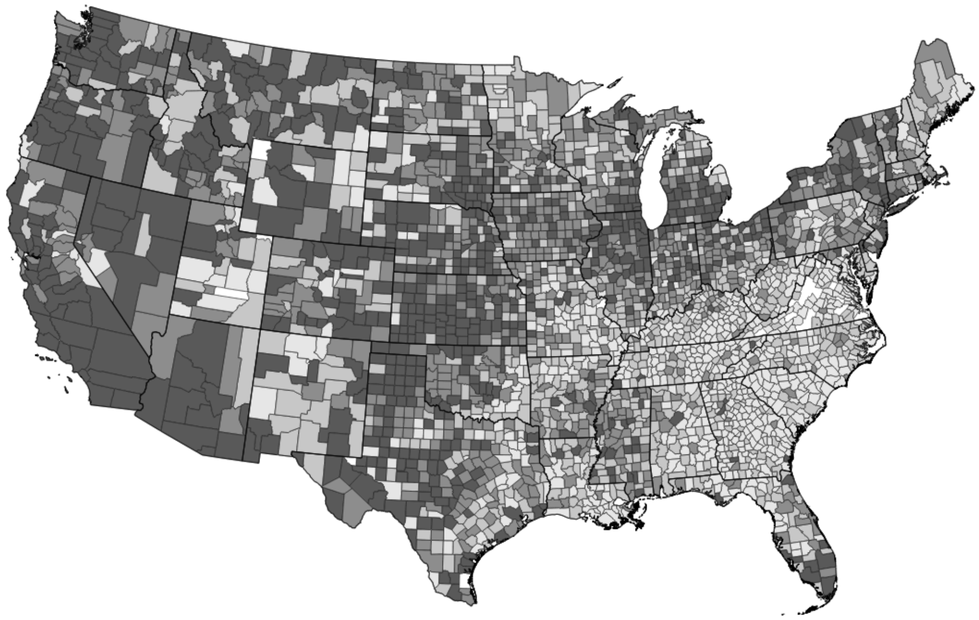
## A.1 Additional Figures and Tables

Figure A.1: Percent of Total Births by Age, 1896-1900 Cohorts of Women



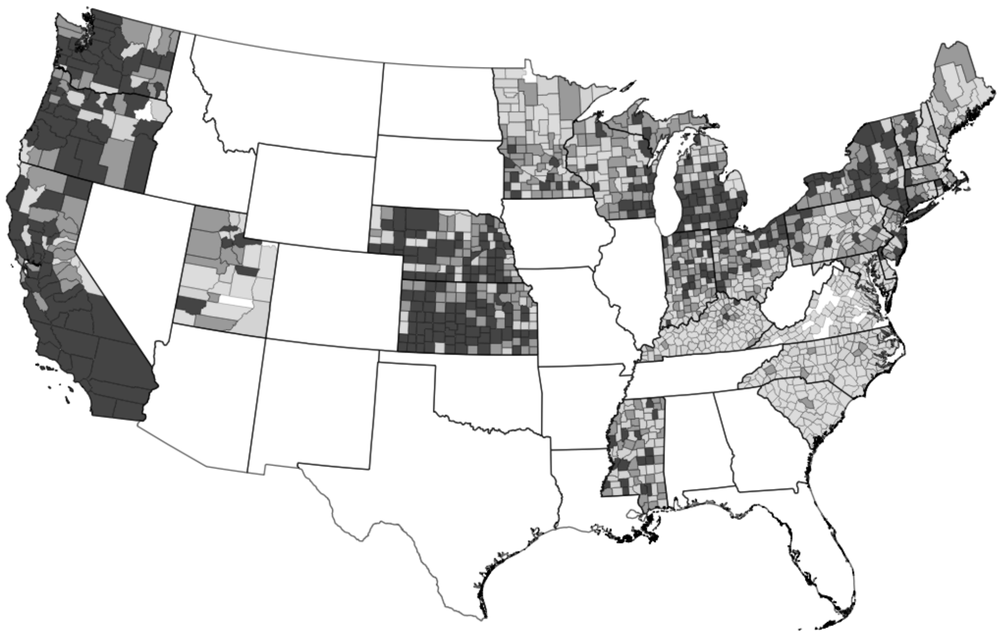

*Notes:* This figure reports the percent of total births occurring at each age from 15 to 44 for the 1896-1900 birth cohorts of women. These values are obtained by dividing the age-specific fertility rates at each age from 15 to 44 by the cohort's cumulative fertility rate by age 44.
*Sources:* Heuser (1976); CDC (2023).

Figure A.2: Change in Per Capita Retail Sales, 1929-1933



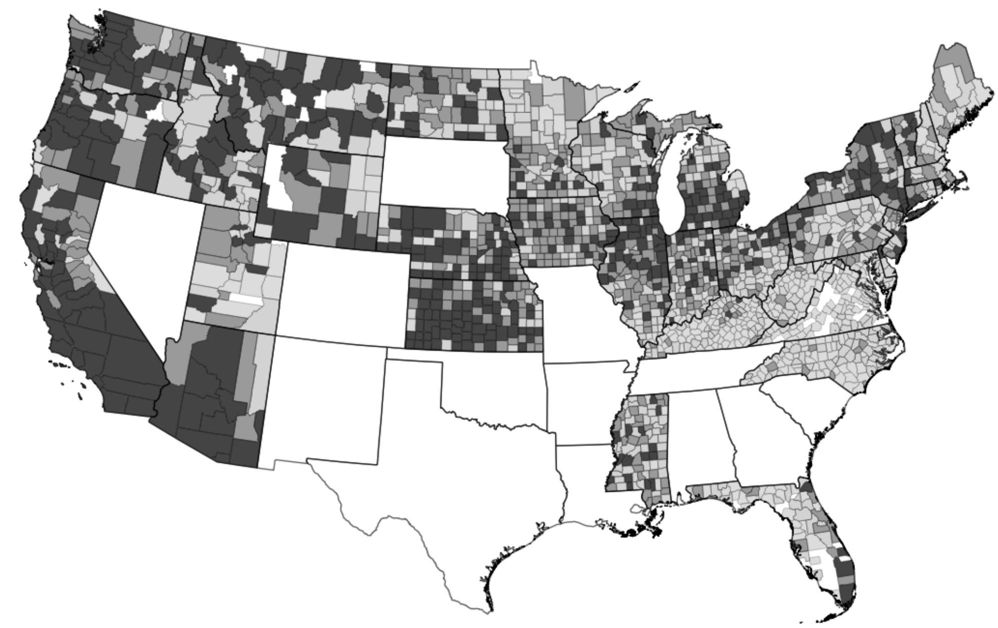
*Notes:* This figure reports the change in retail sales per capita from 1929 to 1933 across counties. The magnitudes of the retail sales changes are categorized by quartile, where darker shades indicate larger declines.
*Sources:* Fishback et al. (2005).

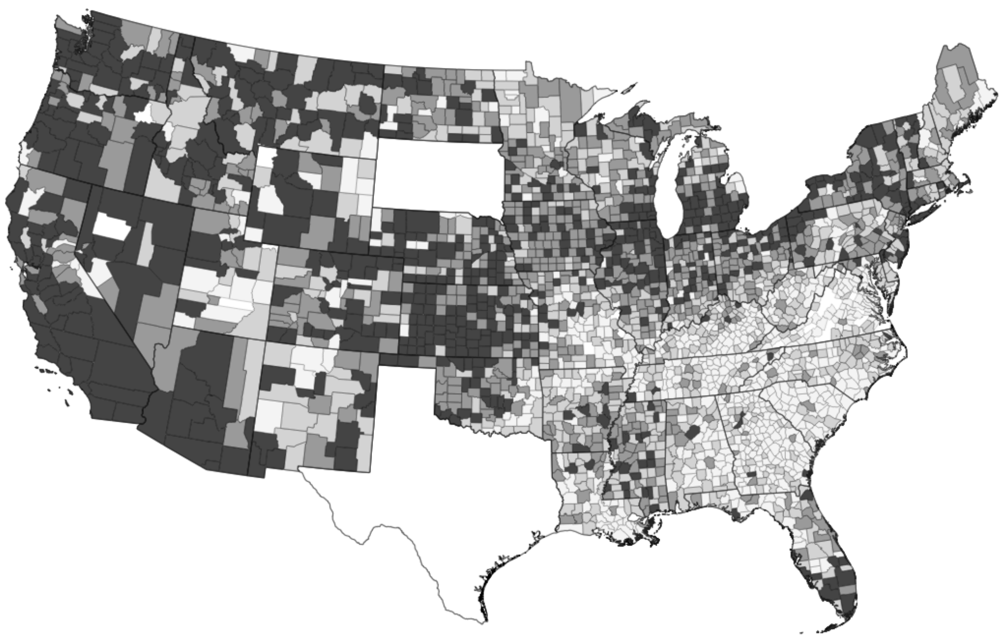
Figure A.3: Main Sample



*Notes:* This figure reports the change in retail sales per capita from 1929 to 1933 across the main sample of 1,470 counties that reported annual fertility rates by 1921 (see Section 3.1). The magnitudes of the retail sales changes are categorized by quartile, where darker shades indicate larger declines.
*Sources:* Fishback et al. (2005).

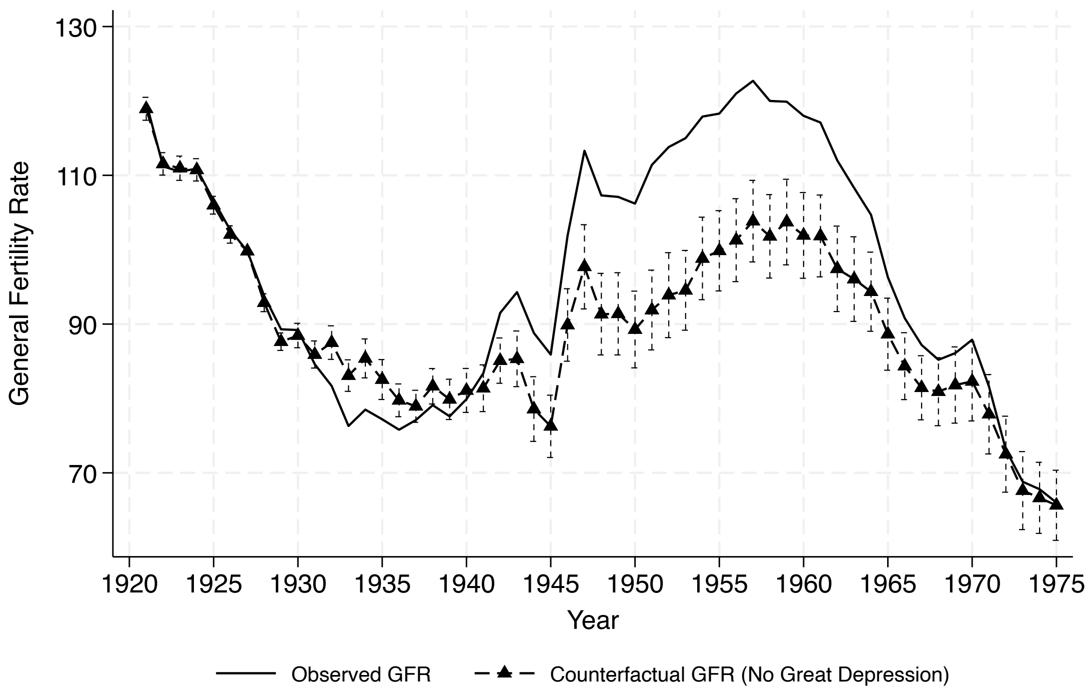
Figure A.4: Alternate Samples





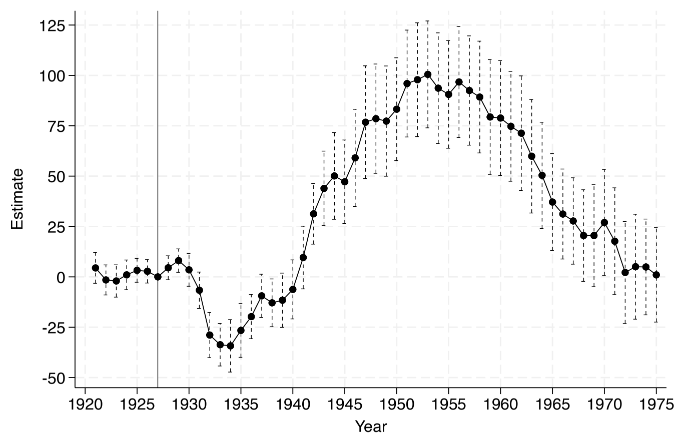
*Notes:* This figure reports the change in retail sales per capita from 1929 to 1933 across two alternate samples that begin in 1926 and 1930, respectively. The magnitudes of the retail sales changes are categorized by quartile, where darker shades indicate larger declines.
*Sources:* Fishback et al. (2005).

Figure A.5: Observed and Counterfactual Annual Fertility Rates

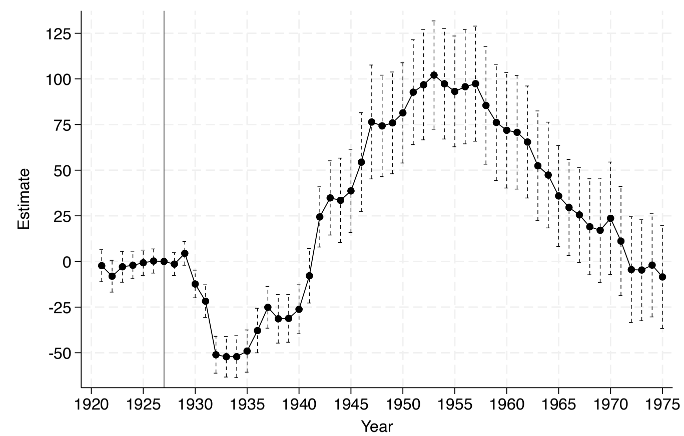



*Notes:* This figure reports the observed and counterfactual annual fertility rates. The counterfactual fertility rate series reflects the trend in the nationwide annual fertility in the absence of the Great Depression. This series is obtained by combining the annual $\beta_k$ estimates from equation (1) with the average nationwide decline in per capita retail sales from 1929 to 1933. The figure reports both the counterfactual fertility rate along with its 95% confidence interval.

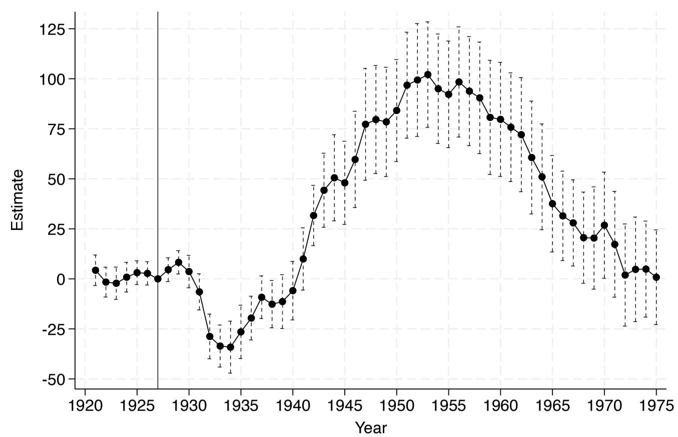
Figure A.6: Robustness tests: New Deal Spending, the Dust Bowl, and WWII



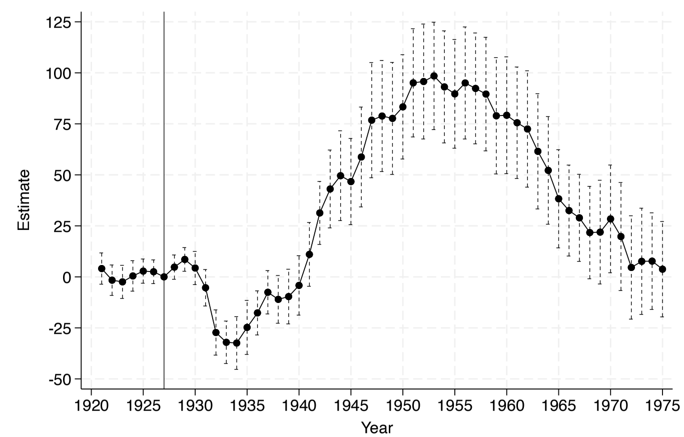

(a) Control for New Deal spending




(b) Exclude Dust Bowl counties



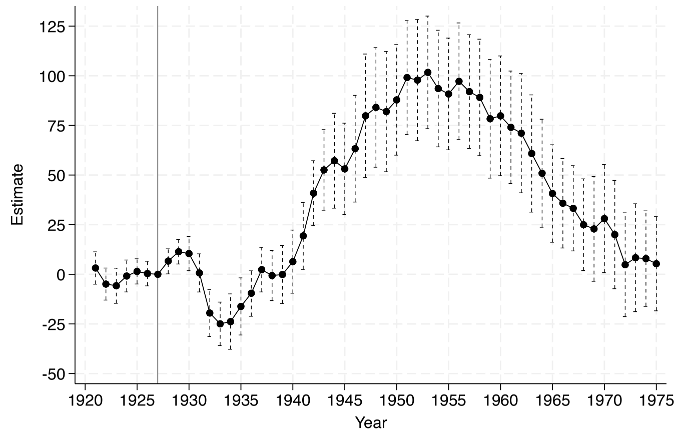

(c) Control for WWII casualties



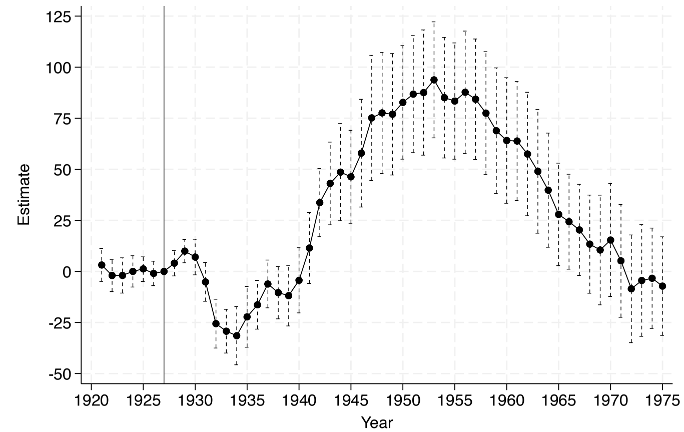

(d) Control for war-related expenditure

*Notes:* These figures present the estimates of $\beta_k$ from various robustness exercises. Panel (a) reports estimates from models that control for total per capita county spending on New Deal programs interacted with year fixed effects. Panel (b) excludes counties exposed to the Dustbowl. Panel (c) controls for county WWII casualties interacted with year fixed effects. Panel (d) controls for per capita WWII expenditure interacted with year fixed effects.

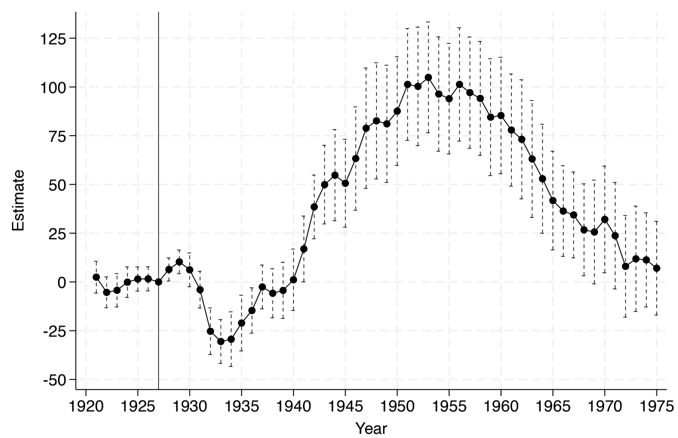
Figure A.7: Robustness tests: Additional sample restriction




(a) Exclude the South



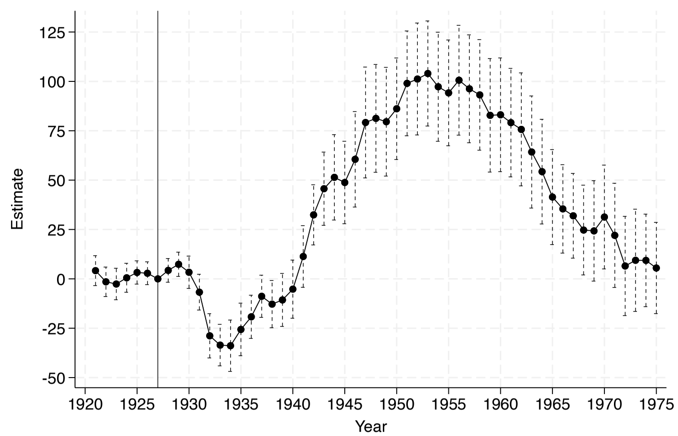

(b) Exclude counties with large shares of agricultural employment



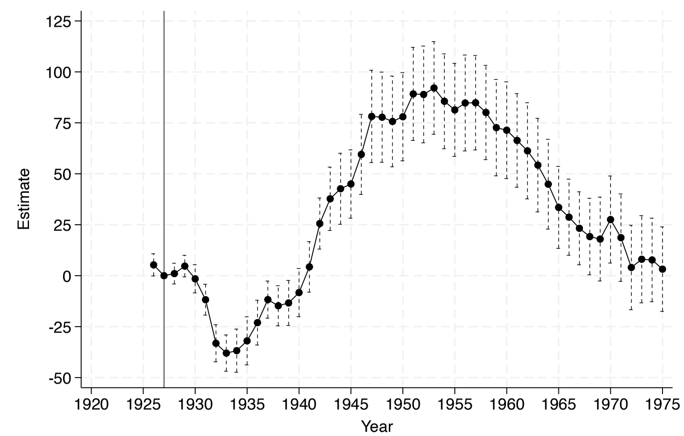

(c) Exclude counties with large shares of African Americans

*Notes:* These figures present the estimates of $\beta_k$ from various robustness exercises. Panel (a) excludes counties in the South. Panel (b) excludes counties in the top 25 percentile of agricultural employment. Panel (c) excludes counties with above-median shares of African Americans.

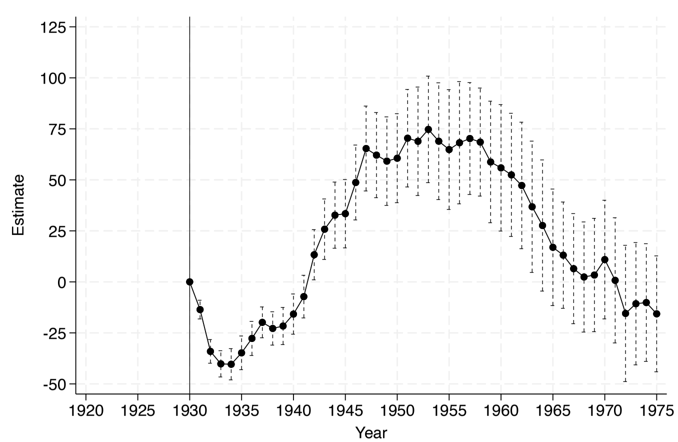
Figure A.8: Additional robustness tests




(a) Omit 1920 socioeconomic controls



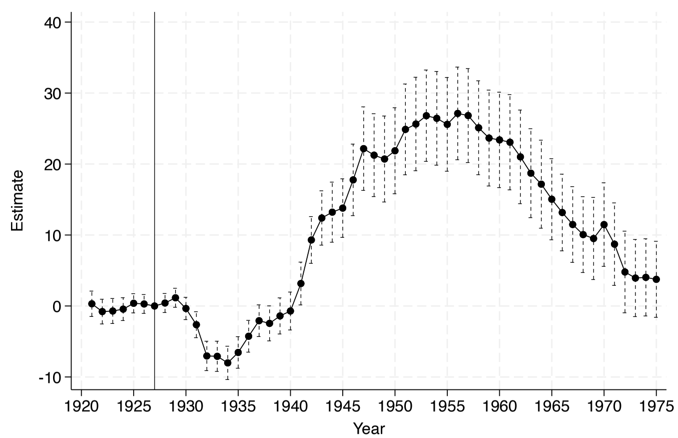

(b) Expanded sample of counties, 1926-1975



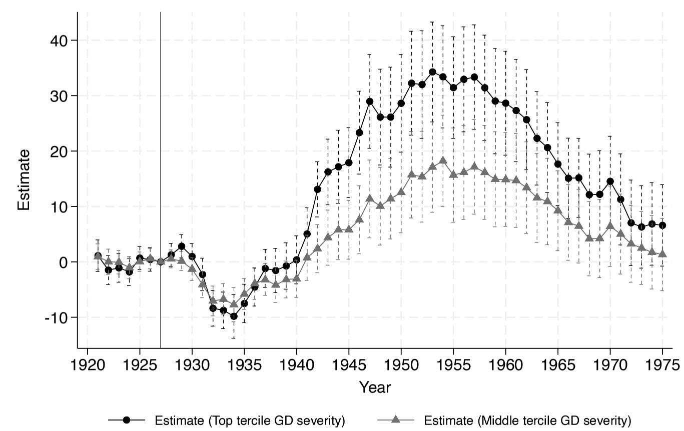

(c) Expanded sample of counties, 1930-1975

*Notes:* These figures present the estimates of $\beta_k$ from various robustness exercises. Panel (a) reports estimates based on versions of equation (1) that exclude demographic covariates. Panel (b) reports the results based on an expanded balanced sample of 1,885 counties that reported fertility rates from 1926 to 1975. Panel (c) reports results based an expanded balanced sample of 2,715 counties that reported fertility rates from 1930 to 1975 (see Figure A.4 for details).

Figure A.9: Additional robustness tests: Non-continuous measures of Depression Severity



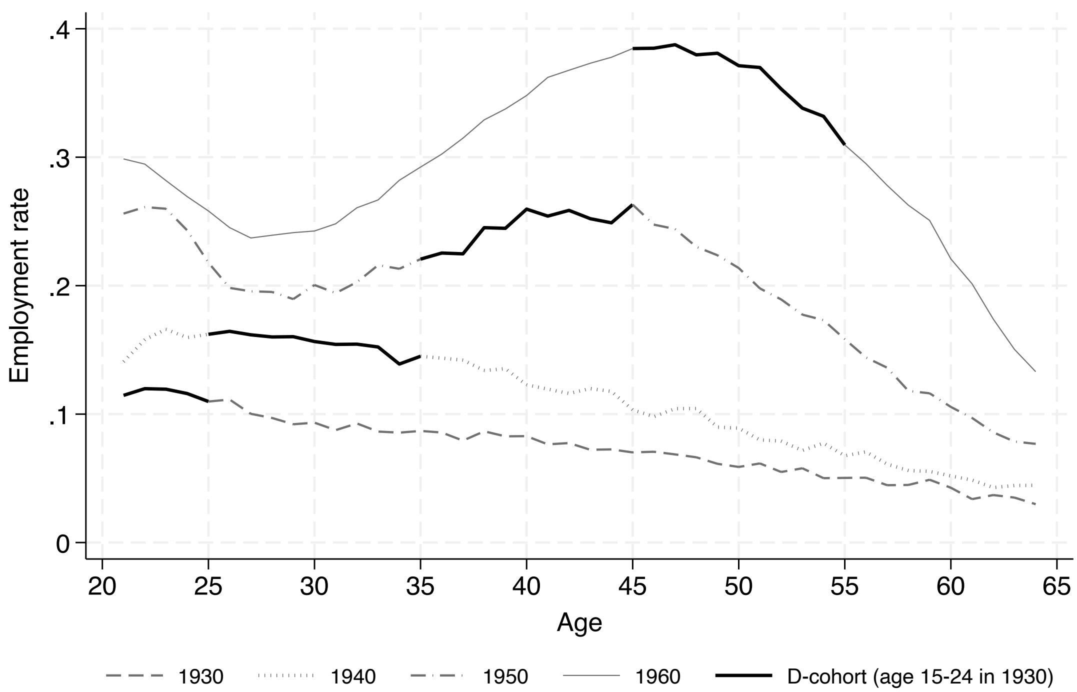

(a) Binary GD Treatment (above vs. below median)




(b) Binary GD Treatment (by tercile)

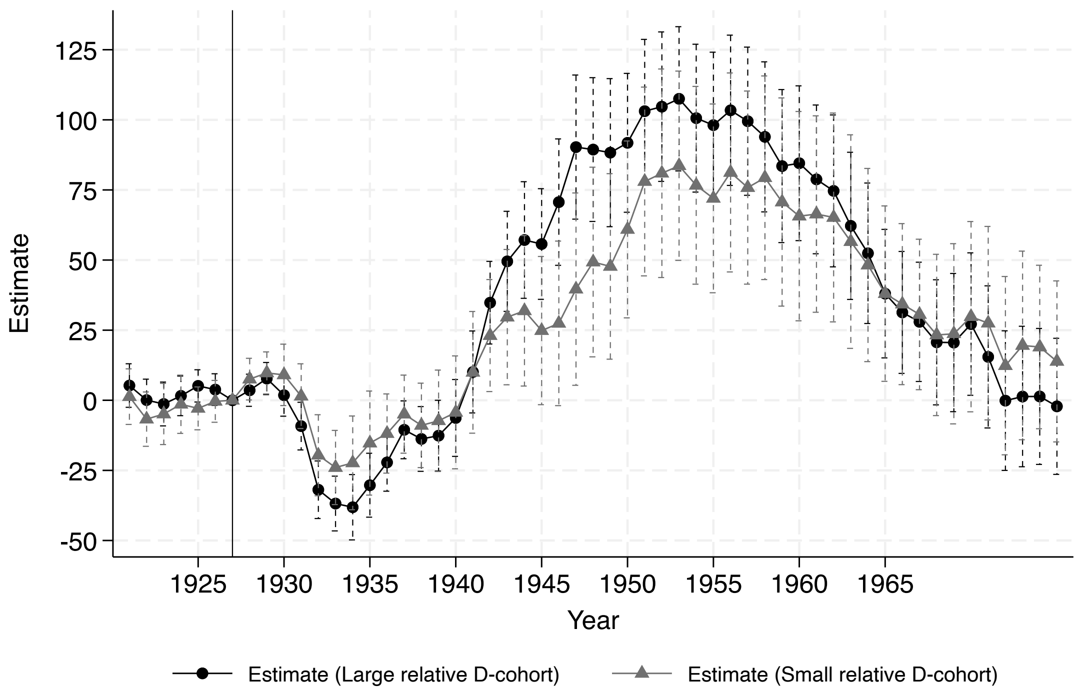
*Notes:* These figures present the estimates of $\beta_k$ using two different non-continuous measures of Great Depression severity. Panel (a) reports results based on a treatment indicator for above- versus below-median Depression severity. Panel (b) reports results based on two separate treatment indicators by tercile of Depression severity.

Figure A.10: Age-Specific Female Employment Rates from 1930 to 1960




*Notes:* This figure reports the age-specific female employment rates among white married women for decennial years 1930, 1940, 1950, and 1960. Dark lines depict Depression-era women (aged 15-24 in 1930).

Figure A.11: Impacts of the Great Depression on Annual County Fertility Rates by Relative D-cohort Population Size




*Notes:* This figure reports estimates of $\beta_k$ from equation (1). Each coefficient is allowed to differ across counties that had above- versus below-median ratio of Depression-era women (age 15-24 in 1930) to post-Depression women (aged 0 to 9 in 1930).

Table A.1: Representativeness of the Census Tree Project Matched Sample

| | National sample | Linked sample | | |
|---|---|---|---|---|
| | | All | Non-migrant | Migrant |
| Migrated | . | .20 | 0 | 1 |
| Age | 31.1 | 36.9 | 37.6 | 34.4 |
| White | .90 | .94 | .94 | .94 |
| Married | .43 | .50 | .50 | .52 |
| # children aged < 18 in household | .81 | 1.08 | 1.08 | 1.07 |
| Urban resident | .57 | .56 | .57 | .52 |
| Currently employed | .23 | .21 | .21 | .21 |

*Notes:* This table reports mean characteristics across women aged 15 to 44 in the complete count censuses in 1930 and 1940 and the corresponding matched sample based on the Census Tree Project.

Table A.2: Impact of Great Depression on Women's Migration Patterns

| | Migrated<br>(1) | Migrated<br>(2) | Migrated<br>(3) | Migrated<br>(4) | Migrated<br>(5) | Migrated<br>(6) |
|---|---|---|---|---|---|---|
| GD | 0.0920*** | | | | | |
| | (0.0182) | | | | | |
| GD × Age 15-19 | | -0.0730*** | | | | |
| | | (0.0278) | | | | |
| GD × Age 20-24 | | 0.102*** | | | | |
| | | (0.0208) | | | | |
| GD × Age 25-29 | | 0.139*** | | | | |
| | | (0.0199) | | | | |
| GD × Age 30-34 | | 0.125*** | | | | |
| | | (0.0209) | | | | |
| GD × Age 35-40 | | 0.109*** | | | | |
| | | (0.0216) | | | | |
| GD × Age 40-44 | | 0.114*** | | | | |
| | | (0.0239) | | | | |
| GD × Non-white | | | 0.0572** | | | |
| | | | (0.0271) | | | |
| GD × White | | | 0.0943*** | | | |
| | | | (0.0182) | | | |
| GD × Rural | | | | 0.0809*** | | |
| | | | | (0.0174) | | |
| GD × Urban | | | | 0.0989*** | | |
| | | | | (0.0190) | | |
| GD × No college | | | | | 0.0520*** | |
| | | | | | (0.0190) | |
| GD × College | | | | | 0.333*** | |
| | | | | | (0.0226) | |
| GD × No high school | | | | | | 0.00172 |
| | | | | | | (0.0192) |
| GD × High school | | | | | | 0.155*** |
| | | | | | | (0.0190) |
| White FE | Y | Y | Y | Y | Y | Y |
| State & Age FEs | Y | Y | Y | Y | Y | Y |
| Observation | 16,023,285 | 16,023,285 | 16,023,285 | 16,023,285 | 15,724,846 | 15,724,846 |

*Notes:* This table reports the impact of the Great Depression on an indicator for whether a women moved from her county of residence in 1930. The analysis is based on the matched sample of women from 1930 to 1940, based on the Census Tree Project. GD measures the decline in county retail sales from 1929 to 1933. Standard errors are clustered at the county level. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

Table A.3: Effects of the Great Depression on Women's Occupational Outcomes in 1940

| | Census years 1910 – 1940 | | | | |
|---|---|---|---|---|---|
| | Dep var: Currently Employed in | | | | |
| | Clerical Work | Sales | Service Work | Operator or Crafts | Professional or Managerial |
| | (1) | (2) | (3) | (4) | (5) |
| Mean Dep. Var. | 0.06 | 0.02 | 0.07 | 0.06 | 0.06 |
| GD × | | | | | |
| 20-24 | 0.013 | -0.006 | -0.004 | -0.066*** | -0.029* |
| | (0.009) | (0.004) | (0.011) | (0.016) | 0.009 |
| 25-29 | 0.047*** | 0.006*** | -0.003 | -0.015 | -0.031*** |
| | (0.010) | (0.002) | (0.010) | (0.011) | (0.005) |
| 30-34 | 0.066*** | 0.006*** | 0.005 | -0.003 | -0.017*** |
| | (0.008) | (0.002) | (0.008) | (0.010) | (0.004) |
| 35-39 | 0.053*** | 0.011*** | 0.001 | 0.014 | 0.009 |
| | (0.006) | (0.002) | (0.008) | (0.009) | (0.005) |
| 40-44 | 0.028*** | 0.016*** | 0.014 | 0.030*** | 0.044*** |
| | (0.006) | (0.002) | (0.009) | (0.009) | (0.006) |
| 45-49 | 0.007 | 0.018*** | 0.024** | 0.038*** | 0.065*** |
| | (0.007) | (0.002) | (0.010) | (0.009) | (0.007) |
| 50-54 | -0.012 | 0.015*** | 0.038*** | 0.045*** | 0.073*** |
| | (0.008) | (0.002) | (0.009) | (0.010) | (0.006) |
| Full controls | Y | Y | Y | Y | Y |
| Observations | 47,787,885 | 47,787,885 | 47,787,885 | 47,787,885 | 47,787,885 |
| Mean (S.D.) of GD | | | 0.203 (0.135) | | |

Notes: Each column reports the point estimate from a different regression. Blue cells denote Depression-era cohorts. The dependent variable is an indicator if the individual is currently working in the stated occupation and zero otherwise. GD measures the decline in county retail sales from 1929 to 1933. 1910 controls include log population, share nonwhite, share foreign born, and share in agriculture. Individual controls include indicators for age and race. Standard errors are clustered at the county level. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

Table A.4: Effects of the Great Depression on Women's Occupational Outcomes in 1950

| | Census years 1910 – 1950 | | | | |
|---|---|---|---|---|---|
| | Dep var: Currently Employed in | | | | |
| | Clerical Work | Sales | Service Work | Operator or Crafts | Professional or Managerial |
| | (1) | (2) | (3) | (4) | (5) |
| Mean Dep. Var. | 0.09 | 0.02 | 0.05 | 0.07 | 0.05 |
| GD × | | | | | |
| 20-24 | 0.032** | -0.033*** | -0.060*** | -0.114*** | -0.020* |
| | (0.015) | (0.004) | (0.010) | (0.025) | (0.011) |
| 25-29 | 0.028*** | -0.010*** | -0.024** | -0.019 | -0.023*** |
| | (0.008) | (0.002) | (0.010) | (0.014) | (0.005) |
| 30-34 | 0.027** | 0.004* | -0.002 | -0.000 | -0.022*** |
| | (0.008) | (0.002) | (0.009) | (0.014) | (0.004) |
| 35-39 | 0.047*** | 0.015*** | -0.000 | 0.005 | -0.01 |
| | (0.008) | (0.002) | (0.009) | (0.014) | (0.006) |
| 40-44 | 0.070*** | 0.023*** | 0.013 | 0.018 | 0.020** |
| | (0.010) | (0.002) | (0.009) | (0.013) | (0.007) |
| 45-49 | 0.062*** | 0.028*** | 0.020** | 0.038** | 0.050*** |
| | (0.009) | (0.003) | (0.010) | (0.013) | (0.007) |
| 50-54 | 0.028*** | 0.031*** | 0.039 | 0.051*** | 0.071*** |
| | (0.008) | (0.003) | (0.010) | (0.013) | (0.007) |
| Full controls | Y | Y | Y | Y | Y |
| Observations | 51,022,796 | 51,022,796 | 51,022,796 | 51,022,796 | 51,022,796 |
| Mean (S.D.) of GD | 0.203 (0.135) | | | | |

Notes: Each column reports the point estimate from a different regression. Blue cells denote Depression-era cohorts. Red cells denote post-Depression cohorts (see Figure 2). The dependent variable is an indicator if the individual is currently working in the stated occupation and zero otherwise. GD measures the decline in county retail sales from 1929 to 1933. 1910 controls include log population, share nonwhite, share foreign born, and share in agriculture. The models also control for WWII mobilization and wartime expenditure interacted with year. Individual controls include indicators for age and race. Standard errors are clustered at the county level. ***,**, * denote significance at the 1%, 5%, and 10% level, respectively.

## A.2 Decomposing Annual Fertility Rate Changes into Changes in Completed Childbearing and Lifecycle Fertility Patterns

In this section, we describe our methodology to decompose the change in the annual fertility rate time series (relative to its value in 1929), $\Delta GFR_t$, into the sum of two independent components: 1) the observed change in completed childbearing across cohorts (holding constant their lifecycle fertility profile), $\Delta GFR_t^{completed}$, and 2) the unobserved (residual) change in lifecycle fertility patterns across cohorts (holding constant their completed childbearing), $\Delta GFR_t^{timing}$. For ease of interpretation, all differences are calculated relative to their 1929 values.

We calculate the following expression:

$$\begin{aligned}\Delta GFR_t &= \Delta GFR_t^{completed} + \Delta GFR_t^{timing}, \\ &= \Big(\sum_c CFR^c \times \frac{1,000}{30} \times \Delta share_t^c\Big) + \Delta GFR_t^{timing}\end{aligned}$$

where $CFR^c$ denotes the completed fertility rate of cohort $c$. This term is multiplied by $\frac{1,000}{30}$ to convert to a rate per 1,000 women aged 15 to 44 (30 years of childbearing age).

The term $share_t^c$ denotes the contribution of cohort $c$ to annual births in year $t$. These weights are derived based on an invariant underlying lifecycle fertility profile, which captures the contribution of different age-groups to the fertility in any year $t$. To construct these weights, we use the age-specific fertility profile of a reference 1896-1900 birth cohort and calculate the share of their total births that occurred at each age from 15 to 44. Figure A.1 reports these weights. The weight assigned to any cohort $c$ in year $t$, is then determined by these weights and the cohort's age in that year.

The series $\Delta GFR_t^{completed}$ evolves over time as different cohorts of women – with different completed fertility – cycle through their childbearing ages. For example, in 1935, women from the 1910 birth cohort were 25 years old, so accounted for 6 percent of births in that year; in 1950, they were 40 years old, so accounted for just 1 percent of births in that year (Figure A.1).

The term $\Delta GFR_t^{timing}$ reflects the residual component of annual fertility changes that cannot be attributable to completed childbearing, and so must reflect changing patterns of lifecycle fertility. For example, if $\Delta GFR_t$ exceeds $\Delta GFR_t^{completed}$, the difference must stem from the fact that some cohorts of women shifted the timing of fertility to year $t$, holding constant their completed fertility.

## A.3 Theoretical Results: Impacts of the Great Depression on Depression-era and Post-Depression-era Cohorts

The first order conditions for the household's problem yield the following expressions that characterize the optimal choices:

$$\left(\frac{\alpha_2 + \alpha_c\beta + \gamma_2}{\alpha_2}\right)(w_2\tau + p)n_2^* + w_2\tau_o n_1^* = w_2 + y_2 \tag{A.1}$$

$$\frac{(\alpha_c + \gamma_1)(w_1\tau^y + p)n_1^*}{w_1 + y_1 - (w_1\tau^y + p)\, n_1^*} + \frac{\alpha_2 w_2 \tau^o n_1^*}{(w_2\tau + p)\, n_2^*} = \alpha_1 \tag{A.2}$$

$$h_1^* = \frac{\alpha_c w_1 - y_1 - (\alpha_c w_1 \tau^y + \gamma_1 p)\, n_1^*}{\alpha_c w_1 + \gamma_1} \tag{A.3}$$

$$h_2^* = 1 - \tau^o n_1^* - \left(\frac{(\alpha_2 + \gamma_2)w_2\tau + \gamma_2 p}{\alpha_2 w_2}\right) n_2^* \tag{A.4}$$

Equations (A.1) to (A.4) can then be used to derive the proofs for Propositions 1 and 2.

**Proposition 1(a):** The Great Depression leads to a decrease in fertility in early adulthood and an increase in fertility in late adulthood: $\frac{\partial n_1^D}{\partial y_1^D} > 0$, $\frac{\partial n_2^D}{\partial y_1^D} < 0$.

**Proof.**

Totally differentiating equation (A.1) with respect to $y_1$, we have the following expression:

$$\frac{\partial n_2^*}{\partial y_1} = -\frac{\alpha_2 w_2 \tau^o}{(\alpha_2 + \alpha_c\beta + \gamma_2)(w_2\tau + p)} \frac{\partial n_1^*}{\partial y_1} \tag{A.5}$$

Next, we totally differentiate (A.2) with respect to $y_1$, and replace $\frac{\partial n_2^*}{\partial y_1}$ using (A.5), which yields the following:

$$\left\{ \frac{(\alpha_c + \gamma_1)(w_1\tau^y + p)(w_1 + y_1)}{\left(w_1 + y_1 - (w_1\tau^y + p)n_1^*\right)^2} + \frac{\alpha_2 w_2 \tau^o}{(w_2\tau + p)n_2^{*2}} \left[ n_2^* + \frac{\alpha_2 w_2 \tau^o n_1^*}{(\alpha_2 + \alpha_c\beta + \gamma_2)(w_2\tau + p)} \right] \right\} \frac{\partial n_1^*}{\partial y_1}$$
$$= (\alpha_c + \gamma_1)(w_1\tau + p)n_1^*$$

Since all terms are positive, this implies that

$$\frac{\partial n_1^*}{\partial y_1} > 0.$$

Given this result, it follows directly from (A.5) that $\frac{\partial n_2^*}{\partial y_1} < 0$. ■

**Proposition 1(b):** The Great Depression leads to a decrease in completed fertility: $\frac{\partial n_{total}^D}{y_1^D} > 0$.

**Proof.** To establish the predicted impact of the Depression on completed fertility, $n_{total}$, we note that $\frac{\partial n_{total}^*}{\partial y_1} > 0$ provided that $\frac{\partial n_1^*}{\partial y_1} > -\frac{\partial n_2^*}{\partial y_1}$. From equation (A.5) it is clear that:

$$\frac{\partial n_1^*}{\partial y_1} > -\frac{\partial n_2^*}{\partial y_1} \quad \text{iff} \quad \frac{\alpha_2 + \alpha_c\beta + \gamma_2}{\alpha_2} > \frac{w_2\tau^o}{w_2\tau + p}$$

Given that $\tau^0 < \tau$, this inequality always holds. ■

**Proposition 1(c):** The Great Depression leads to an increase in women's employment in early adulthood and has an ambiguous impact on employment in late adulthood: $\frac{\partial h_1^D}{\partial y_1^D} < 0$, $\frac{\partial h_2^D}{\partial y_1^D} \lesseqgtr 0$.

**Proof.**

From equation (A.3), we have that:

$$\frac{\partial h_1^*}{\partial y_1} = -\frac{1}{\alpha_c w_1 + \gamma_1}\left(1 + (\alpha_c w_1 \tau^y + \gamma_1 p)\frac{\partial n_1^*}{\partial y_1}\right) < 0$$

From equation (A.4), we have that:

$$\frac{\partial h_2^*}{\partial y_1} = -\tau^o\left(1 - \frac{(\alpha_2 + \gamma_2)w_2\tau + \gamma_2 p}{(\alpha_2 + \alpha_c\beta\gamma_2)(w_2\tau + p)}\right)\frac{\partial n_1^*}{\partial y_1} \lesseqgtr 0$$

■

**Proposition 2(a):** The Great Depression leads to an increase in fertility in early adulthood and a decrease in fertility in late adulthood: $\frac{\partial n_1^{PD}}{\partial w_1^{PD}} < 0$, $\frac{\partial n_2^{PD}}{\partial w_1^{PD}} > 0$.

**Proof.**

Totally differentiating equation (A.1) with respect to $w_1$, we have the following expression:

$$\frac{\partial n_2^*}{\partial w_1} = -\left(\frac{\alpha_2}{\alpha_2 + \alpha_c\beta + \gamma_2}\right) \cdot \frac{w_2\tau^o}{(w_2\tau + p)} \cdot \frac{\partial n_1^*}{\partial w_1} \tag{A.6}$$

Next, we totally differentiate (A.2) with respect to $w_1$, and replace $\frac{\partial n_2^*}{\partial w_1}$ using (A.6), which yields the following:

$$\left\{ \frac{(\alpha_c+\gamma_1)(w_1\tau^y+p)(w_1+y_1)}{\big(w_1+y_1-(w_1\tau^y+p)n_1^*\big)^2} + \frac{\alpha_2 w_2 \tau^o}{(w_2\tau+p)n_2^{*2}}\left[n_2^* + \frac{\alpha_2 w_2 \tau^o n_1^*}{(\alpha_2+\alpha_c\beta+\gamma_2)(w_2\tau+p)}\right]\right\}\frac{\partial n_1^*}{\partial w_1}$$
$$= \frac{\alpha_c+\gamma_1}{\big(w_1+y_1-(w_1\tau^y+p)n_1^*\big)^2}\cdot\big(p-\tau^y y_1\big) < 0 \quad \text{iff} \quad \tau^y > p/y_1$$

Since $\tau^y > p/y_1$ holds by assumption, and all the terms on the right-hand-side are positive, we have that $\frac{\partial n_1^*}{\partial w_1} < 0$. It then follows directly from (A.6) that $\frac{\partial n_2^*}{\partial w_1} > 0$. ■

**Proposition 2(b):** The Great Depression leads to an increase in completed fertility: $\frac{\partial n_{total}^{PD}}{w_1^{PD}} < 0$.

**Proof.** To establish the predicted impact on completed fertility, $n_{total}$, we note that $\frac{\partial n_{total}^*}{\partial w_1} > 0$ provided that $\frac{\partial n_1^*}{\partial w_1} > -\frac{\partial n_2^*}{\partial w_1}$.

From (A.6) we see that this inequality holds provide that

$$\left(\frac{\alpha_2}{\alpha_2+\alpha_c\beta+\gamma_2}\right)\cdot\frac{w_2\tau^o}{\big(w_2\tau+p\big)} < 1$$

which is always holds given that $\tau > \tau^o$. ■