

# The Baby Boom and World War II: The Role of Labor Market Experience\*

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## Abstract

The past century has witnessed major changes in the economic choices of American women. Over the long term, there has been a marked trend towards lower fertility and higher female labor force participation. However, change did not occur in a uniform fashion: during the post-war Baby Boom, fertility rates increased substantially, until the long-term downward trend reestablished itself in the 1960s. Similarly, the labor market participation of younger women declined for a while during the same period. What can explain these reversals? In this paper, we propose a joint explanation for these changes through a single shock: the demand for female labor during World War II. Many of the women of the war generation continued to work after the war. We argue that this crowded out younger women from the labor market, who chose to have more children instead.

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# 1 Introduction

For a little over a century, economic growth in the U.S. has been accompanied by major changes in the choices and economic opportunities of women. A key dimension of these changes is fertility decline. In 1900, the average women in the U.S. had a little less than 4 children over her lifetime; by the year 2000, this number has declined to a little more than two. The flipside of this development is increased participation of women in the labor market. The fraction of women formally employed has increased from 20 percent in 1900 to 57.5 percent by 1990. Among married women, the increase was even larger, from 5.6 percent in 1900 to 50.1 percent in 1980 (Goldin 1990, Blau and Kahn 2000). At the same time, the difference in earnings between men and women, the “gender gap,” has shrunk: in 1900, the average working woman earned a wage equal to 55 percent of the wage of the average working man. By 1999, the relative wage of women had risen to 76 percent of average wages for men (Goldin 1990, Blau and Kahn 2000).

While these developments for the most part occurred gradually over the course of the past century, there is one major episode during which the long-term trends were temporarily reversed. The end of World War II marked the beginning of a baby boom during which fertility increased sharply. The baby boom lasted for about 15 years; after 1960, fertility dropped sharply, and the long-term downward trend reestablished itself. The total fertility rate (TFR) which was 2.4 in 1940, increased to more than 3.7 by 1957, and subsequently returned to its pre-war level by 1970 (see Figure 1). For the most part, the baby boom is accounted for by high birth rates among mothers who turned adult only after the end of the war. As Figure 2 shows, the highest fertility rates are achieved by mothers born between 1925 and 1935, who would have been between 10 and 20 years old at the end of the war. The baby boom was also accompanied by a temporary reversal in the narrowing of the gender gap. Relative female wages declined for about a decade from the mid-1950s, until they started to rise again substantially during the 1970s and 1980s.

The baby boom and the later baby bust had a substantial impact on the age structure of the American population. The effects of that are being felt today, as social

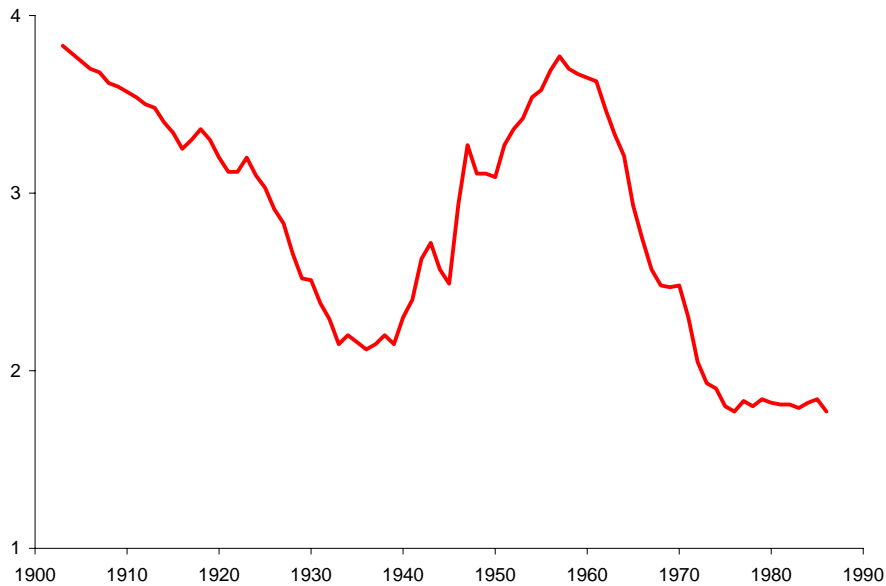


Figure 1: The Total Fertility Rate in the U.S.

insurance systems are expected to being tested to their limits by the impending retirement of the baby boom cohorts. Examining the causes of the boom are one of the key challenges for demographic economics. Yet, surprisingly little has been put forward in terms of explanations of the boom.

Two competing hypotheses for the Baby Boom have been proposed. Easterlin (1961) advocates the relative income hypothesis. He argues that people growing up in the Great Depression had low material aspirations. Overwhelmed by the prosperity during the post-war years, they increased their demand for children. One of the problems with this explanation is that the timing is not quite right. During the baby boom fertility peaked right before 1960. Most of the baby boom was accounted for by young mothers aged 20–24. These mothers were born between 1936 and 1940, and spent most of their childhood during the prosperous post-war period.

Greenwood, Seshadri, and Vandenbroucke (2005) propose an alternative theory based on improvements in household technology. They argue that the widespread diffusion of appliances such as washers, dishwashers, electric stoves etc. enabled women to run their households in much less time than before. This technological improvement freed up time that became available for raising more children in-

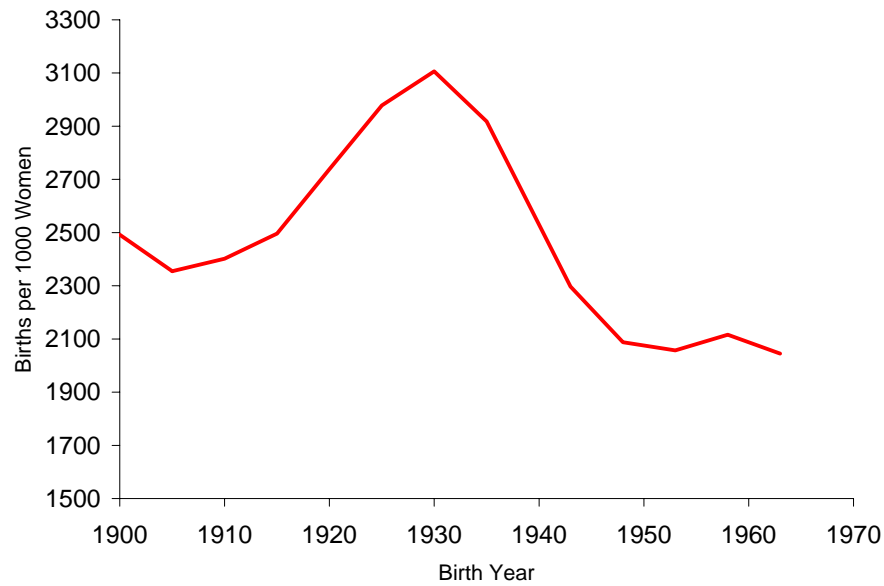


Figure 2: Completed Fertility by Birth Year of Mother in the U.S.

stead. One problem with this theory is that while it may contribute to explaining the rise in fertility at the beginning of the baby boom, it has trouble generating the sharp decline of fertility at the end of the baby boom.

Both existing theories dismiss a link between World War II and the baby boom, despite the fact that the substantial rise in fertility coincides with the end of the war. The data certainly suggests that the baby boom has to be more than just a “catch up” in fertility to make up for “missing babies” that were not born during the war, when many husbands were in the armed forces instead of with their families. Indeed, in the data the drop in fertility during the war is made up for the most part by 1947, whereas fertility continued to rise for an extended period after 1947 and stayed high for 15 years.

Despite this argument, in this paper we argue that World War II was one of the prime causes behind the baby boom. The mechanism in our theory, however, is more subtle than “catch up” fertility, and revolves around the demand for female labor. As documented by Goldin (1991) and Acemoglu, Autor, and Lyle (2004), the war induced a huge positive shock to the demand for female labor. While men were fighting the war in Europe and Asia, many women were drawn into the labor force and replaced men in factories and offices. The women who

worked during the war accumulated valuable labor market experience. As a consequence, many of these women continued to work after the war.

At first sight, it might seem that this additional supply of female labor should generate the opposite of a baby boom: women who work have less time to raise children and usually have fewer of them. The key to our argument, however, is that the one-time demand shock for female labor during the war had an *asymmetric* effect on younger and older women. The extra labor market experience gathered during the war obviously benefited only the women who were old enough to work during that period. For younger women who were still in school during the war the effect was a negative one: when they turned adult after the war and had to decide whether to enter the labor market, they faced increased competition. In addition to the men who returned from the war, at that time a large number of women from the war generation were still in the labor force, who also had a lot of work experience. This led to less demand and lower wages for inexperienced young women, who were crowded out of the labor market and chose to have more children instead.

A key advantage of this theory for explaining the baby boom is that it can account not only for the initial rise in fertility, but also for the abrupt end of the baby boom and the accompanying dynamics in the gender gap. The negative effect on the labor market opportunities of young women lasts only as long as the war-generation of women stays in the labor market. When this cohort starts to retire 10 to 15 years after war, effective female labor supply drops sharply, and labor market opportunities for young women improve. The young women in the 1960s did not face competition from experienced older women, since the preceding cohort consisted of the mothers of the baby boom, who worked relatively little. The theory therefore predicts that labor force participation of young women should rise sharply in the 1960s, and fertility should fall, which is exactly what the data shows. This crowding out young women from the labor force after the war affected the average experience of women in the labor force, which generated the narrowing in the gender gap in the post war period. When the experienced war generation retires and is replaced by less experienced, younger women, average female experience falls, which accounts for the fall in relative

female wages in the 1960s.

We document that the evidence on the age distribution of fertility and labor force participation after the war is consistent with our theory. In particular, most of the baby boom is accounted for by young women aged 20–24, who were too young to work during the war. The relative labor force participation of younger versus older women after the war evolves as predicted by the theory. Participation by older women rises sharply after the war, while participation of the youngest women falls. After 1960, the rise in participation by older women slows down, while participation by younger women rises sharply.

The remainder of the paper is organized as follows. In the following section, we outline a theoretical framework that captures the main elements of our theory, and display the reaction of the model economy to a one-time demand shock for female labor such as World War II. In Section 3, we discuss evidence on fertility, female labor force participation, and the gender gap, and argue that the evidence supports our theory. Section 4 concludes.

## 2 A Basic Model

There are overlapping generations of individuals who live for six periods, two as children and four as adults. The interpretation of a period is 10 years, so that people live to age sixty. There are equal numbers of women and men, and each woman pairs up with a man at the beginning of adulthood to form a household. Men supply labor inelastically, while women allocate time between work, leisure, and child care. Since we focus mostly on the implications of the model for fertility and female labor supply, the time allocation of women is the key object we are interested in. We use leisure as a stand-in for all non-market and non-child-rearing activities that women engage in. Apart from true leisure, this also includes, for example, home production and household work. Since we do not model these other activities explicitly, we will only refer to leisure throughout.

Women can give birth during first adult period. All adults can work during the first three adult periods, and are retired in the final period. The household utility

function is given by:

$$U = \sum_{j=1}^T \beta^{j-1} \left[ \frac{1}{1-\gamma_c} c_j^{1-\gamma_c} + \frac{\sigma_n}{1-\gamma_n} n^{1-\gamma_n} + \frac{\sigma_l}{1-\gamma_l} l_j^{1-\gamma_l} \right].$$

Here  $c_j$  is consumption,  $n$  is the number of children, and  $l_j$  is leisure. Notice that fertility  $n$  does not carry a time subscript, because fertility is chosen only once in the first period of adulthood, so that the number of children is the same in all adult periods. Since people are retired in the final period, we have  $l_4 = 1$ . The number of children is given by:

$$n = \phi x_1,$$

that is, each child requires a fixed amount of time.

Utility is maximized subject to the budget constraint:

$$c_j + a_{j+1} = (1 + r_j)a_j + [e_{m,j} + (1 - x_j - l_j)e_{f,j}]w_j - \psi_j.$$

Here  $a_j$  are assets (savings),  $r_j$  is the interest rate,  $w_j$  is the wage,  $e_{m,j}$  is the labor market experience (i.e., the efficiency units of labor) of the man, and  $e_{f,j}$  is the labor market experience of the woman. Female labor supply is given by  $1 - x_j - l_j$ , where 1 is the time endowment,  $x_j$  is the time spend on child care, and  $l_j$  is leisure. People are born without assets ( $a_0 = 0$ ), and since children are born in the first period of adulthood, we have  $x_2 = x_3 = x_4 = 0$ .

The variable  $\psi_j$  is a fixed cost that needs to be paid if a woman who has not worked in the preceding period enters the labor market in period  $j$ . This fixed cost captures job search, lower income during early job tenure, and other adjustments to working life. The presence of a fixed cost generates a discrete jump in the labor supply decision of women: they may choose not to work at all, but once they enter they supply a substantial fraction of their time to the labor market.

So far, apart from the fixed cost  $\psi_j$  the model is an entirely standard life-cycle model with endogenous fertility and endogenous labor supply. The key new element of our theory is the role of female labor market experience for the dynamics

of fertility and the gender gap. The fixed cost  $\psi_j$  captures one aspect of the role of experience, namely, experienced women have a lower cost of participating in the labor market. A second aspect of labor market experience is that more experienced workers earn higher wages. To capture this dimension, we assume that experience evolves according to:

$$\begin{aligned} e_{m,j+1} &= (1 + \theta_m)e_{m,j}, \\ e_{f,j+1} &= (1 + \theta_f(1 - x_j - l_j))e_{f,j}, \end{aligned}$$

where  $\theta_m$  is the return to male experience, and  $\theta_f$  is the return to female experience. This equation implies that the more a woman works, the faster her experience level increases. A one-time shock in labor demand has a persistent effect on female experience, as well as the relative incentives to work versus having children.

The production side of the model is entirely standard. Production is carried out by competitive firms using the production function:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha}.$$

As the baseline case, we abstract from productivity growth:

$$A_t = \bar{A}.$$

We now want to demonstrate how a one time demand shock for female labor affects fertility and the gender gap. We choose parameters such that the steady state of the model generates realistic values for fertility and macroeconomic variables. The steady state is chosen such that women work in all adult periods, and consequently pay the fixed cost for entering the labor market only in the first period of adulthood. The chosen parameter values are given in Table 1. The implied capital-output ratio is 2.5 on an annual basis.

Table 2 shows the implications of the parameterized model for fertility, female labor supply, and female labor market experience over the life cycle. Women work in all adult periods, with the highest labor supply in the second adult pe-



Parameter	Value per Period	Value per annum
$\gamma_c$	1	
$\gamma_l$	0.8	
$\gamma_n$	0.8	
$\sigma_l$	0.625	
$\sigma_n$	0.07	
$\beta$	0.725	0.97
$\theta^f$	0.3	0.027
$\theta^m$	0.3	0.027
$\phi$	12	1.2
$\psi$	0.045	
$\alpha$	0.3	
$A$	1	
$\delta$	0.4	0.05

Table 1: Parameter Values

Variable	period 1	period 2	period 3	period 4
Number of Children	2.50			
Female Labor Supply	0.27	0.31	0.13	retirement
Female Human Capital	1.00	1.08	1.18	retirement

Table 2: Life Cycle Decisions

riod. Fertility is calibrated to 2.5, which approximates the actual level in the U.S. before the start of the baby boom.

Let us now assume that the model is in steady state when World War II arrives. For our purposes, the war is a shock to the availability of of male labor. We model this shock as a one-time decline of  $e_m$  by 50 percent. In the period after the shock (i.e., when the men return from the war),  $e_m$  rebounds to the level that would have occurred without the shock. An immediate consequence of the war is a substantial increase in the wage (and corresponding decline in the interest rate) due to the labor shortage. Women will react to this increased demand for labor by increasing their labor supply during the war period. In the period after war, the price movement reverses. The capital stock is now below steady state due to lower income during the war, whereas effective labor supply moves above steady state due to the additional labor market experience of women. As a consequence, the wage declines, while the interest rate is above the steady state. In the absence of further shocks, the economy returns to the steady state in the next periods.

At this time, we have not computed the full transition path of the model yet. To illustrate the general implications, however, we have computed partial equilibrium results for a price path that follows the basic pattern described above. Table 3 displays the assumed path for the interest rate.

The fertility response to this price path is displayed in Figure 3

Figure 3 displays the fertility response to this one-time shock together with U.S. data. In the impact period (labeled as “1940”), fertility drops sharply. The reason is that the increased demand for female labor induces women of all ages to work much more, which lowers the time available for raising children for women in

Period	Period's Interest Rate	per annum Interest Rate
Steady State	0.796	0.060
1940-49	0.716	0.056
1950-59	0.875	0.065
1960-69	0.836	0.063
Steady State	0.796	0.060

Table 3: Interest Rate Path

childbearing age. In the next period (labeled as “1950”), male labor supply is back at its steady-state level. We see a substantial increase in fertility in this period relative to the steady state. The reason for this increase is that young women no longer find it worthwhile to participate in the labor market given the increase labor market competition. In essence, the experienced war generation crowds out the younger women from the labor market. The young women stay at home and have more children instead.

This effect is repeated in the second post-war period (corresponding to “1960”). Young women at this time are still confronted with extra labor market competition. In the final period (“1970”) a sufficient number of war-generation women has retired for the experience effect to wash out, and fertility is low.

In summary, we see that our simple model can generate a baby boom, including the ultimate reversal to lower fertility, as a result of a single demand shock for female labor. In the following section, we assess whether the qualitative predictions of the model are in line with empirical evidence from the U.S. from the baby boom period.

### 3 Empirical Evidence

One of the key assumptions of our theory is that the World War II shock had asymmetric effects on younger and older women. In our theory, it is the younger women who did not work during the war who are crowded out of the labor

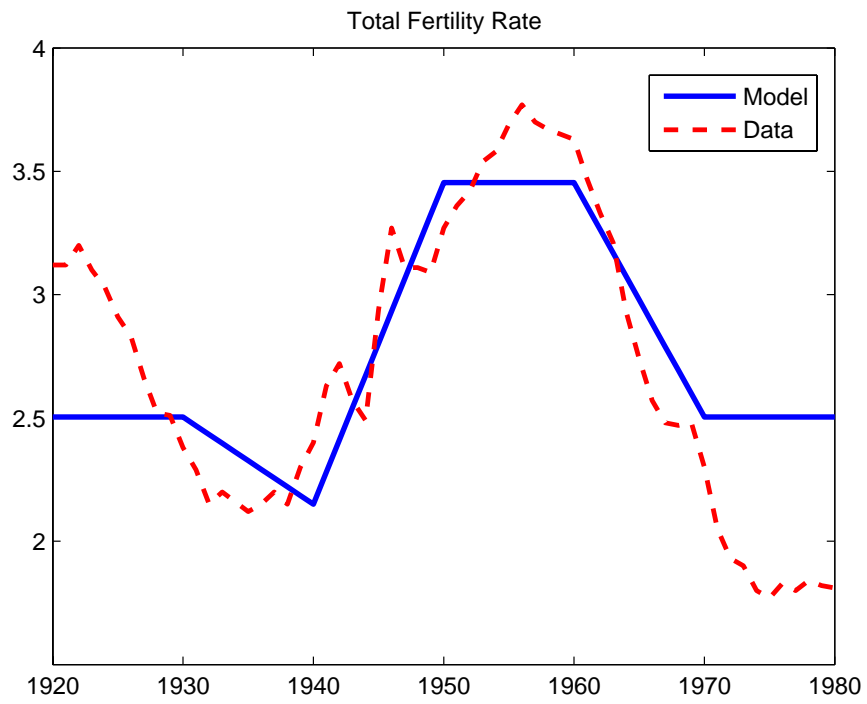


Figure 3: Total Fertility Rate - Model and Data

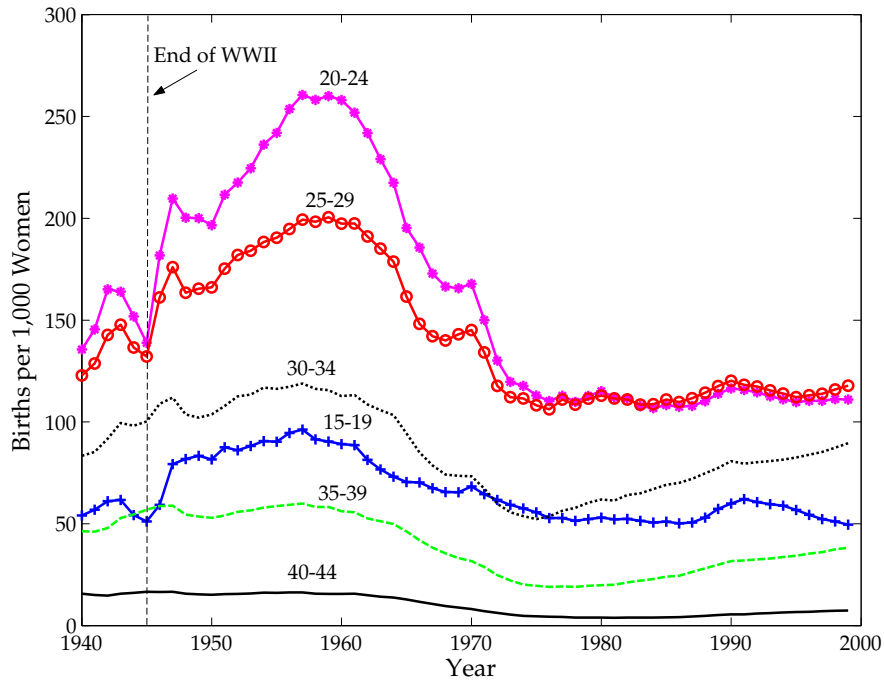


Figure 4: Fertility by Age in the U.S.

market and decide to have more children. Figure 4 shows that this implication is in line with evidence on fertility by age for the U.S. The figure shows that the substantial increase in post-war fertility was mostly due to young women. The group from 20–24 years of age has by far the largest increase in fertility. Most mothers in this group were too young to work during the war. In particular, for the two age groups 20–24 and 25–29 fertility peaks in 1960. These mothers were aged between 5 and 15 at the end of the war.

As figure 4 shows, the increase in fertility was not uniform across the different age groups. Older women aged 30 years or older show hardly any increase in fertility during the baby boom. This pattern is consistent with our theory, but not with a theory in which the baby boom is due to improvements in household technology alone. If children became cheaper due to better appliances, the change in fertility should have been more uniformly distributed across the different age groups.

Our theory is also consistent with patterns of labor market participation after the war. Figures 5 and 6 show labor force participation rates by age for different

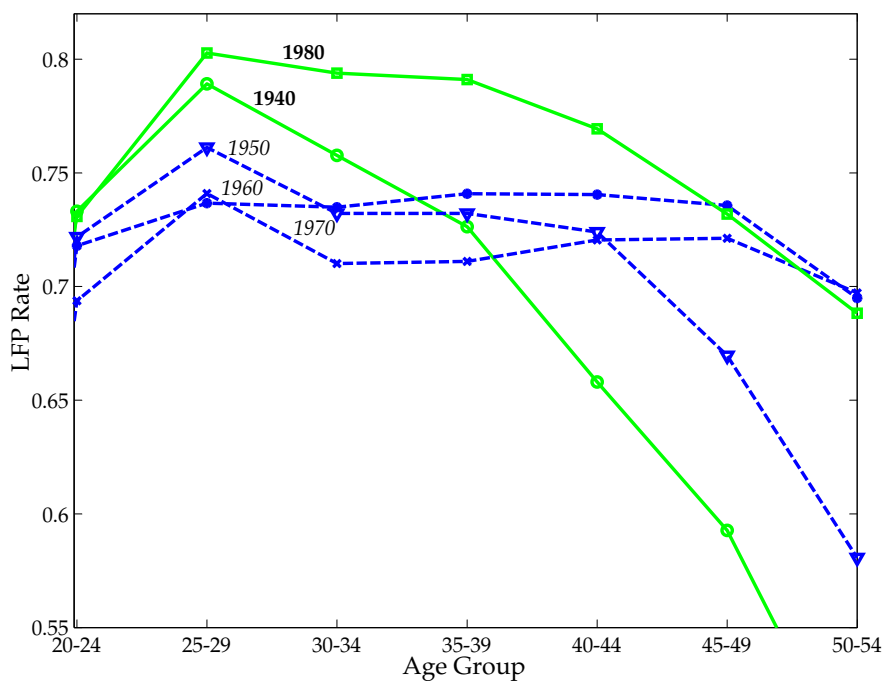


Figure 5: Labor Force Participation of Single Women in the U.S.

decades from 1940 to 1980. In each case, the long-term trend (comparing 1940 and 1980) is towards higher participation. In the post-war period (comparing 1940, 1950, and 1960), however, we observe a very rapid increase among older women (35 and above), and only a slow increase or even decline among the younger women. In 1940, the female labor force consisted mostly of young single women who were working for a few years before getting married. In 1950 and 1960, participation by young single women is sharply lower, while participation of older women is much higher.

Figure 7 provides a different way of looking at this data. The figure plots the change in labor-force participation decade-by-decade for young and old women. This time, the series is for all women, i.e., both married and single. As our theory predicts, the two series move in opposite directions. After the war, participation of older women rises, while participation of young women declines. After 1960, the series are reversed, and participation among younger women rises much faster than that of older women.

We turn to the gender gap next. As mentioned before, the long-term trend is

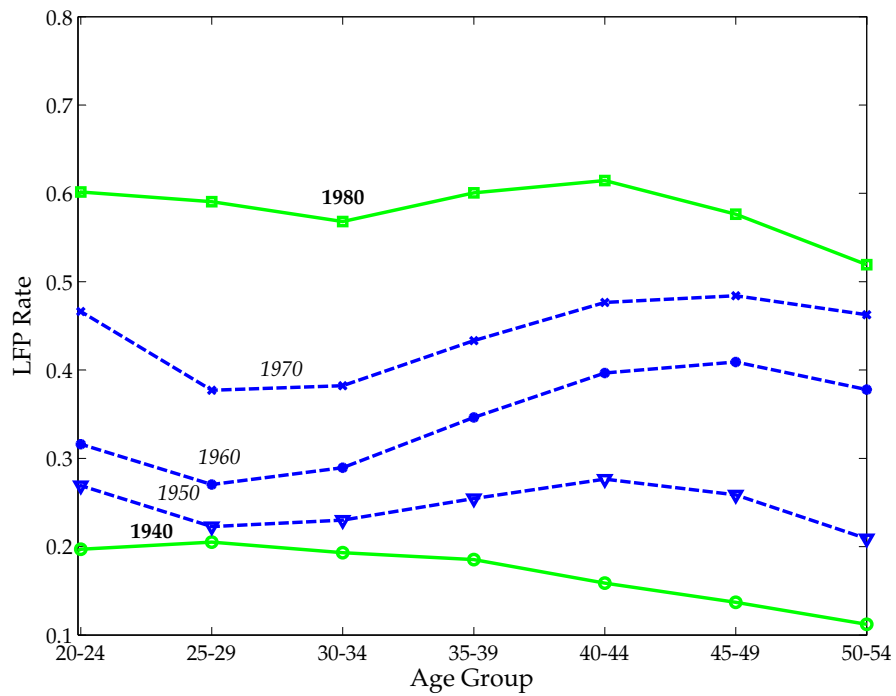


Figure 6: Labor Force Participation of Married Women in the U.S.

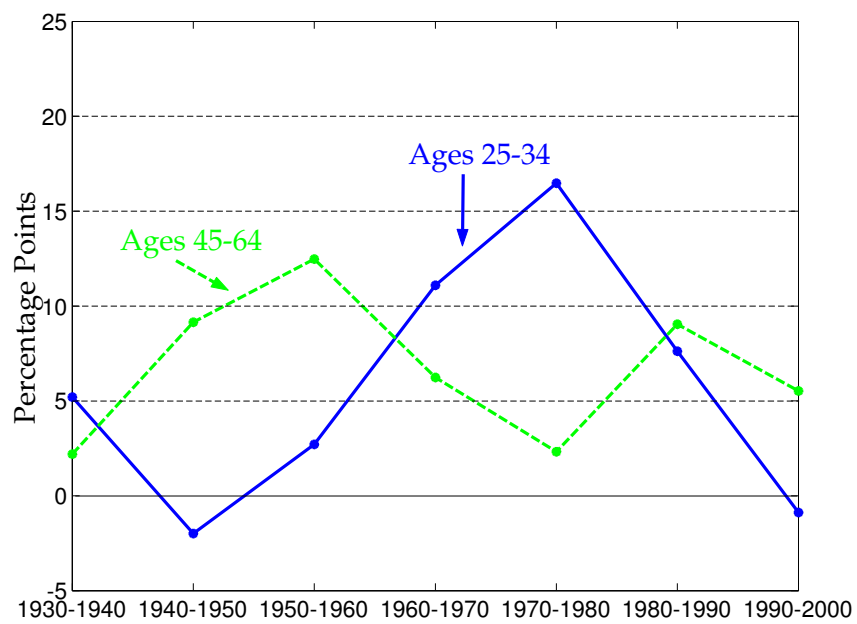


Figure 7: Change in Labor Force Participation by Age in the U.S.

one of rising relative female wages. After the war, however, the trend was temporarily reversed. Figure 8 shows that the gender gap closed quickly after 1945. During the 1950s, however, the gap starts to widen again, and it only starts to close again after 1970 (which is explained by rising female education during this later period). The dynamics after the war are consistent with rising average female experience after the war (when inexperienced young women choose not to enter the labor force), and declining average experience later on when experienced older women of the war generation are replaced by inexperienced young women.

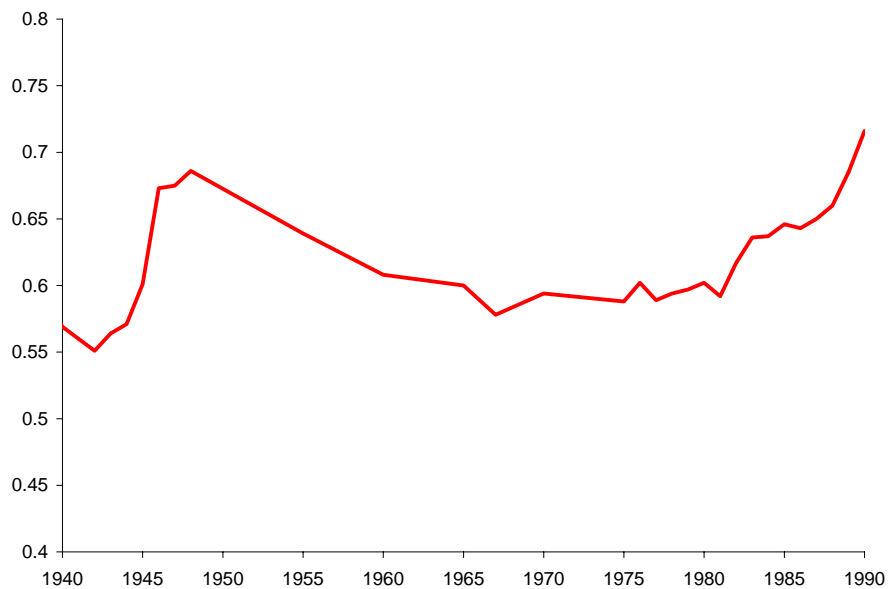


Figure 8: The Gender Gap in the U.S.

As a final test of our theory, we turn to state level data. During the war, mobilization rates differed from state to state. In our theory, it is the war-time demand for female labor due to the mobilization of men that ultimately causes the baby boom. We would therefore expect our mechanism to lead to particularly pronounced effects in states where relatively more men were mobilized.

As Figures 9 and 10 show, there is no clear relationship between mobilization rates and birth rates until 1950. At this time, many women of the war generation were still in child bearing age. If those who chose to keep on working after the war have lower fertility levels, this would counteract higher fertility among



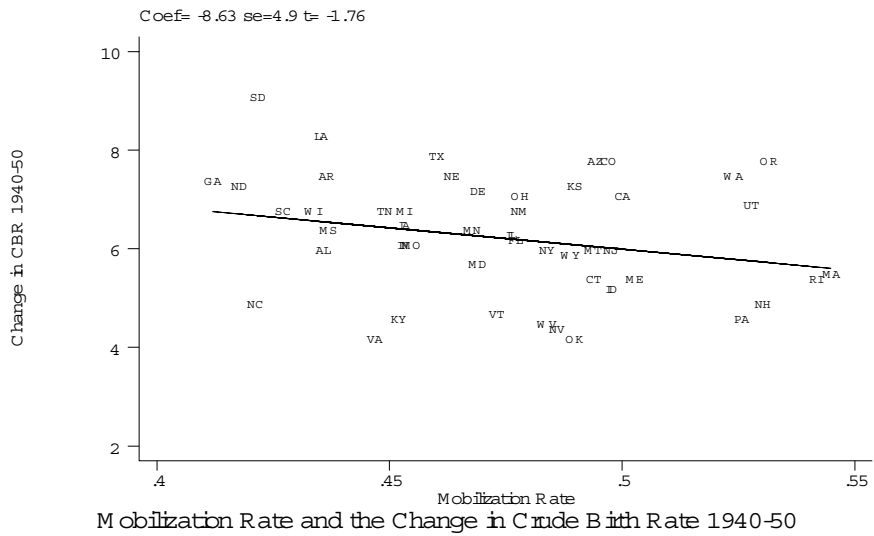


Figure 9: Change in the Birth Rate from 1940 to 1950 vs. Mobilization Rates

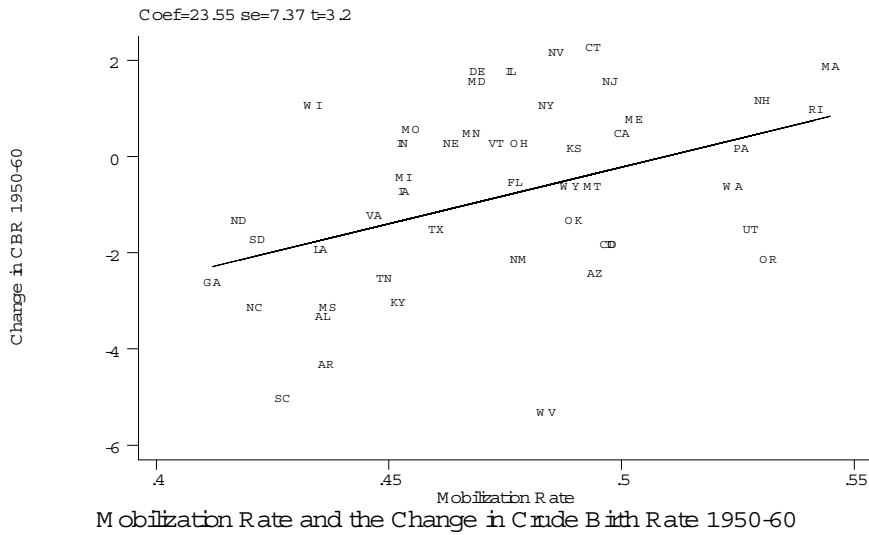


Figure 10: Change in the Birth Rate from 1950 to 1960 vs. Mobilization Rates

younger women. Turning to the change between 1950 and 1960, we now observe a clear positive relationship between mobilization rates and the increase in fertility. During this period, fertility rates are driven by mothers who were children during the war, so that the effect emphasized in this paper should come out clearly. And indeed, the observed correlation is in line with the predictions of our theory.

## 4 Conclusions

In this paper, we have proposed a simple theory that links the post-war baby boom to demand for female labor during World War II. Existing theories of the baby boom have dismissed a causal link between the war and increased fertility, mainly because the baby boom extended for 15 years after the war and is too large to be explained solely by “catch up fertility.” Our theory, however, does not rely on “catch up” fertility, but on the demand for female labor.

We show that if labor market experience is valuable, a one-time demand shock for female labor leads to persistent, asymmetric effects on the labor supply of younger and older women. World War II was a huge demand shock for female labor: average female participation jumped from 16 to 22 percent between 1941 and 1944, and among women whose husbands served in the armed forces participation rates exceeded 50 percent. We show that such a demand shock should lead to a temporary baby boom and an asymmetric evolution of the labor force participation of older and younger women in the decades after the shock. We find, indeed, that age-specific fertility and labor force participation rates after the war behave just as predicted by this theory. We therefore believe that the mechanism outlined in this paper can contribute a great deal to our understanding of the post-war baby boom, as well as the later decline in fertility.

A question yet to be answered is whether this particular mechanism can account for all, or just a fraction of the increase in fertility during the baby boom. To answer this question, we are developing an extended model that captures the secular decline in fertility and the increase in female labor force participation

during the twentieth century. We are currently using a calibrated version of this model to provide a quantitative assessment of the importance of the demand shock for female labor during World War II for explaining the baby boom.

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