The Baby Boom and World War II: A Macroeconomic Analysis*

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Abstract

We argue that one major cause of the U.S. postwar baby boom was the rise in female labor supply during World War II. We develop a quantitative dynamic general equilibrium model with endogenous fertility and female labor force participation decisions. We use the model to assess the impact of the war on female labor supply and fertility in the decades following the war. For the war generation of women, the high demand for female labor brought about by mobilization leads to an increase in labor supply that persists after the war. As a result, younger women who reach adulthood in the 1950s face increased labor market competition, which impels them to exit the labor market and start having children earlier. The effect is amplified by the rise in taxes necessary to pay down wartime government debt. In our calibrated model, the war generates a substantial baby boom followed by a baby bust.

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All the day long, whether rain or shine,
She's a part of the assembly line.
She's making history, working for victory,
Rosie the Riveter.[1]

1 Introduction

In the two decades following World War II the United States experienced a massive baby boom. The total fertility rate[2] increased from 2.3 in 1940 to a maximum of 3.8 in 1957 (see Figure 1). Similarly, the data on cohort fertility show an increase from a completed fertility rate[3] of about 2.4 for women whose main childbearing period just preceded the baby boom (birth cohorts 1911–1915) to a rate of 3.2 for the women who had their children during the peak of the baby boom (birth cohorts 1931–1935; see Figure 2). The change in relative cohort sizes brought about by the baby boom had major repercussions for the macroeconomy, and the impact on social insurance systems will be felt for decades to come now that the baby boomers are reaching retirement age.[4] The baby boom was followed by an equally rapid baby bust. The total fertility rate fell sharply throughout the 1960s, to below 2.0 by 1973. The baby boom constituted a dramatic, if temporary, reversal of a century-long trend towards lower fertility rates. Understanding its causes is a key challenge for demographic economics.

In this paper, we propose a novel explanation for the baby boom, based on the demand for female labor during World War II. As documented by Acemoglu, Autor, and Lyle (2004), the war induced a large positive shock to the demand for female labor. While men were fighting the war in Europe and Asia, millions of women were drawn into the labor force and replaced men in factories and offices.[5] The effect of the war on female employment was not only large, but also persistent: the women who worked during

[1]"Rosie the Riveter," lyrics by Redd Evans and John Jacob Loeb, 1942.

[2]The total fertility rate in a given year is the sum of age-specific fertility rates over all ages. It can be interpreted as the total number of children an average woman will have over her lifetime if age-specific fertility rates stay constant over time.

[3]The completed fertility rate is the average lifetime number of children born to mothers of a specific cohort. Dynamic patterns of total and completed fertility rates can deviate if there are shifts in the timing of births across cohorts.

[4]See Macunovich (2002) for an overview of the impact of the baby boom on trends in education, the labor market, marriage and divorce, and macroeconomic fluctuations, and Mankiw and Weil (1989) and Lim and Weil (2003) regarding effects on the housing and stock markets.

[5]The U.S. government actively campaigned for women to join the war effort. "Rosie the Riveter," a central character in the wartime campaign for female employment, has become a cultural icon and a symbol of women's expanding economic role.

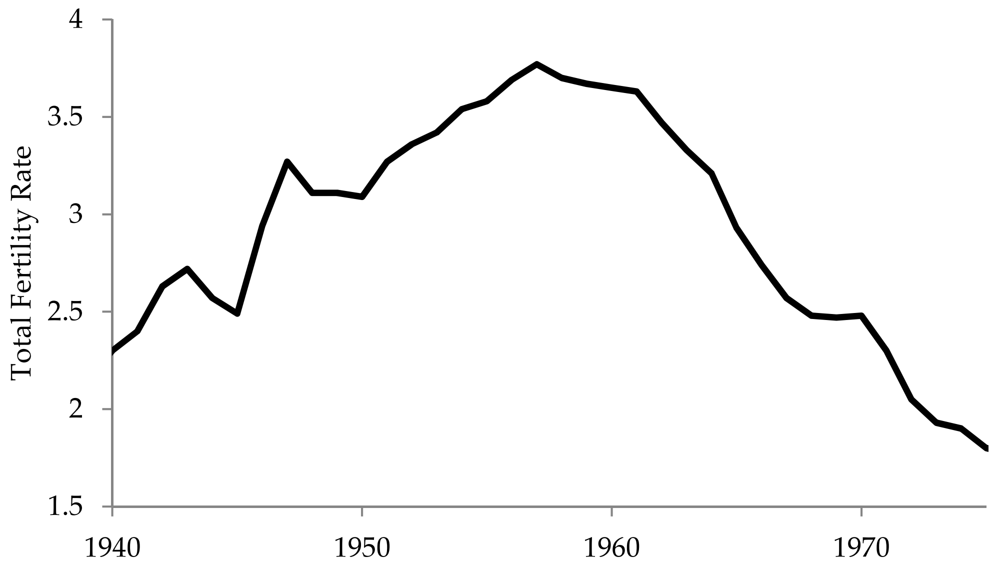

Figure 1: The Total Fertility Rate in the United States (Source: Chesnais 1992)

the war accumulated valuable labor market experience, and consequently many of them 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 decide to have fewer of them. The key to our argument, however, is that the one-time demand shock for female labor had an *asymmetric* effect on different cohorts of women. The only women who stood to gain from additional labor market experience were those who were old enough to work during the war. For younger women who were still in school during the war, the effect was negative. When these women reached adulthood after the war and entered the labor market, they faced increased competition not only from men who returned from the war, but also from experienced women of the war generation who remained in the labor force. We argue that this competition led to less demand for inexperienced young women who, crowded out of the labor market, chose to have more children instead. This, we argue, explains the bulk of the baby boom.

Our explanation is consistent with the observed patterns of female labor force participation before the war and during the baby boom. In the years leading up to the war, the vast majority of single women in their early twenties were working. In contrast, labor force participation rates for married women were low. Hence, a typical woman would enter the labor force after leaving school, and then quit working (usually permanently) once she got married and started to have children. Figure 3 shows how the

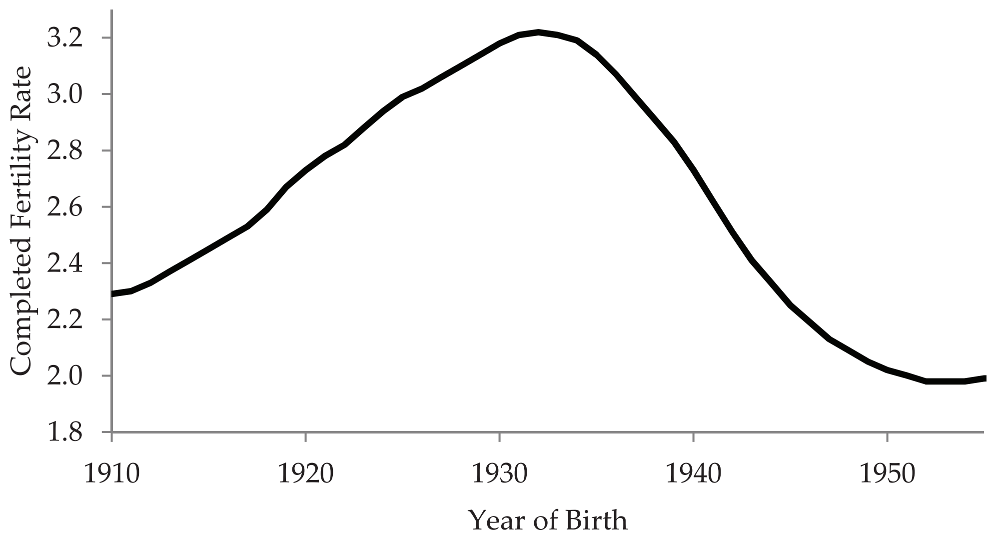

Figure 2: The Completed Fertility Rate in the United States by Cohort (i.e., by Birth Year of Mother. Source: Observatoire Démographique Européen)

labor supply of young (ages 20–32) and older (ages 33–60) women evolved after the war. During the baby boom period, the labor supply of older women increased sharply, whereas young women worked less. A substantial part of the drop in young female labor supply is due to a compositional shift from single to married women. On average, these women decided to marry younger than earlier cohorts had, which (given the low average labor supply of married women) lowered the total amount of labor supplied by young women. Our theory generates the same pattern as a result of the wartime demand shock for female labor.

We interpret the decline in young women's labor supply as a crowding-out effect of higher participation by older women. This interpretation is consistent with the observed decline in the relative wages of young women during the baby boom period. Figure 4 displays the wages of single women aged 20–24 relative to the wages of men in the same age group. Relative female wages decline in both 1950 and 1960, and recover strongly only in 1970 during the baby bust.[6] Our theory reproduces these relative wage shifts through the war-induced increase in the labor force participation of older women. In contrast, a model in which young women withdraw from the labor market for other

[6] Results for other age groups are provided in the online appendix. Notice that the decline in relative wages for *young* women does not imply that the *overall* gender gap widens. In fact, related to changes in the composition of the female labor force, the average relative wages for all working women rise from 1940 to 1950 and 1960. For this reason, theories of the baby boom that link fertility to the average female wage (Butz and Ward 1979) are inconsistent with the data (as shown by Macunovich 1995).

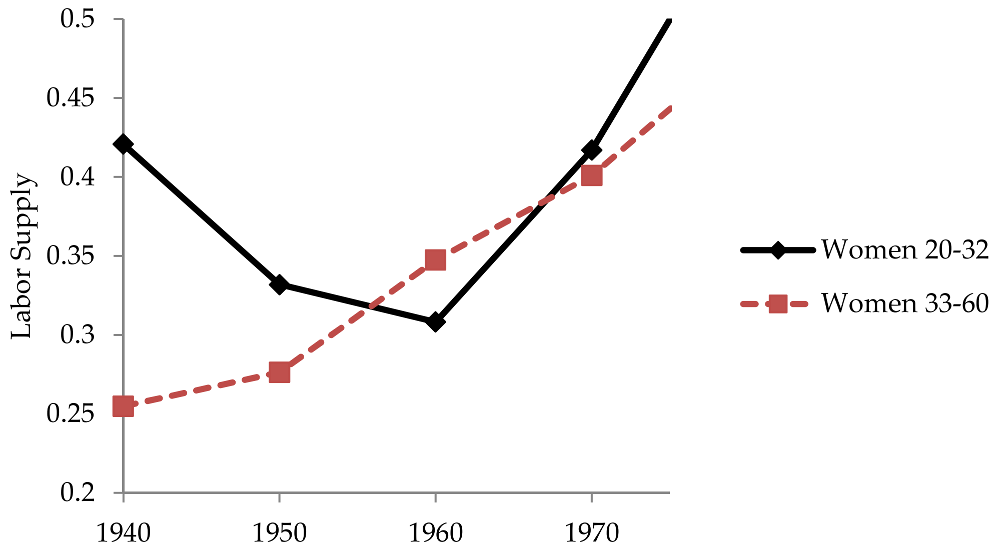

Figure 3: Labor Supply by Young (20–32) and Old (33–60) Women in the United States relative to Men in the same Age Group (includes women of all races and marital statuses; see Appendix A.2 for details)

reasons would predict that relative female wages should have risen in the baby boom period.

Our theory is supported also by the observation that most of the baby boom is accounted for by young mothers. Figure 5 displays data on age-specific fertility for the three age groups of women that account for most births, namely 20–24, 25-29, and 30–34 years of age.[7] Generally, fertility is highest for women in their twenties, when fecundity is still at its peak. However, while both before (pre-1945) and after (post-1970) the baby boom birth rates are virtually identical for the 20–24 and 25–29 age groups, during the baby boom the younger group experiences a much larger rise in fertility. For women in their thirties, the increase in fertility during the baby boom is small. In line with these numbers, the average age at first birth dropped by more than 1.5 years between 1940 and the late 1950s. This divergence in fertility between younger and older women is exactly what our theory predicts. In our theory, fertility increases because women exit the labor force and start having children earlier, which implies that, as observed in the data, the increase in fertility takes place at the beginning of the childbearing period.

To provide direct empirical evidence for the proposed mechanism, we follow the ap-

[7]Number of Births per 1,000 Women in Different Age Groups in the United States, from Vital Statistics of the United States, 1999, Volume I, Natality (Table 1–7). Even younger and even older age groups contribute little to overall fertility.

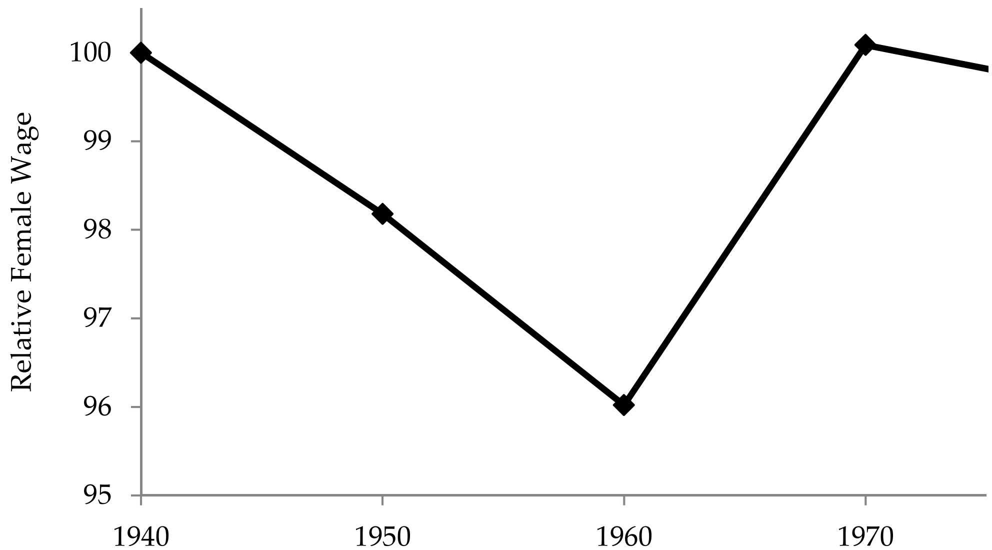

Figure 4: Ratio of Average Female to Average Male Wages for Singles aged 20–24, 1940=100 (Source: U.S. Census; see Appendix A.2 for details)

proach of Acemoglu, Autor, and Lyle (2004) of using variation in mobilization rates across states to identify the effect of the war. In line with the first part of our hypothesis, Acemoglu, Autor, and Lyle show that the wartime increase in female labor supply led to a persistent increase in the labor force participation of older women and lower relative female wages. Building on these results, we show that states with a greater mobilization of men during the war (and thus a higher wartime demand for female labor) also had a larger postwar increase in fertility. In addition, in high-mobilization states young women were less likely to work and more likely to be married during the baby boom period. These are exactly the relationships our theory predicts.

We then develop a dynamic general equilibrium model to demonstrate that the labor market mechanism outlined above can account for much of the increase in fertility during the baby boom. In addition, the model allows us to consider additional driving forces of the baby boom that do not vary across states (in particular changes in taxation) and to evaluate whether our theory can explain the timing of the baby boom and baby bust. The model focuses on married couples' life cycle decisions on fertility and female labor force participation. In the model, all women start out working when young, but ultimately quit the labor force in order to have children. Since fecundity declines with age and the fecund period is limited, having more children requires leaving the labor market earlier. Due to the time cost of having children and an adjustment cost of reentering the labor market, only some women resume work after having children. Since fertility and

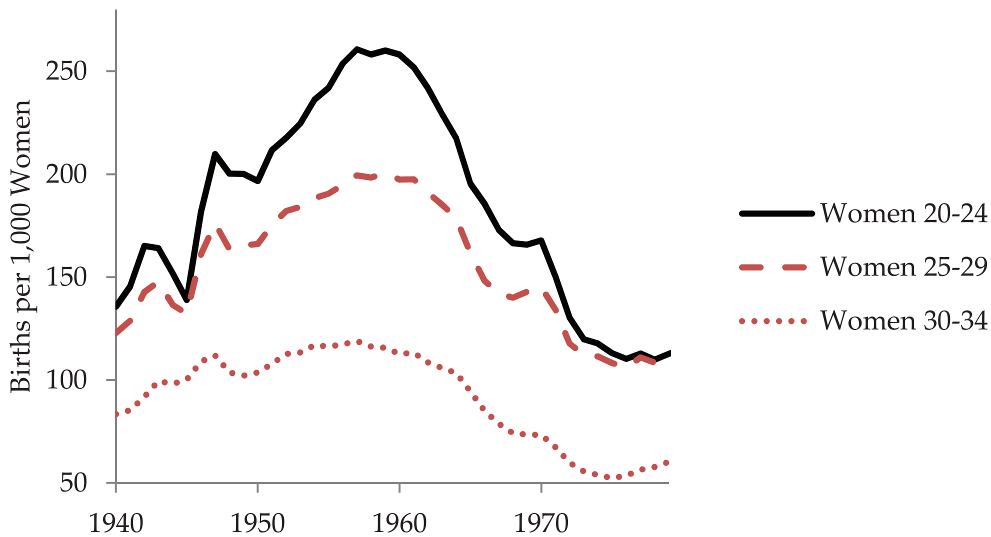

Figure 5: Fertility for Different Age Groups of Women in the United States (Source: Vital Statistics of the United States)

labor force participation decisions are discrete, the model incorporates preference heterogeneity to generate heterogeneous behavior in these dimensions. At the aggregate level, the model features a standard production technology with limited substitutability of male and female labor. We calibrate the model to U.S. data, and then shock the model's balanced growth path with World War II, represented as a shock to government spending, a reduction in male labor supply, and an increase in female labor supply.

We find that the model does an excellent job reproducing the main qualitative features of the U.S. baby boom. The patterns for fertility, the timing of births, female labor force participation rates, and relative female wages all are consistent with empirical observations. The model does particularly well reproducing the timing of the baby boom and baby bust. The baby boom reverses once the war generation of working women starts to retire from the labor market. This model implication results in a sharp reduction in fertility 15 to 20 years after the war shock, which closely matches the baby bust period of the 1960s.

Turning to quantitative implications, we find that in our baseline calibration the model can account for a major fraction of the increase in cohort fertility during the baby boom. The model generates a maximum increase in fertility of 0.6 children per woman, which compares to a maximum of 0.8 in the data. About 80 percent of the increase in fertility generated by the model is due to a crowding-out effect generated by higher labor force participation of the war generation of women, with the remainder accounted for by the fiscal consequences of the war. The model also closely tracks the actual changes in labor supply by younger women throughout the baby boom period, and is consistent with the magnitude of changes in relative female wages.

In addition to Acemoglu, Autor, and Lyle (2004), another important source of evidence on the impact of World War II on the female labor market is Goldin (1991), who documents that many of the women who were working during World War II left the labor force before 1951. While at first sight this observation may seem to imply that the labor market effects of the war were small (and often Goldin's paper is interpreted this way), our mechanism in fact is fully consistent with Goldin's observations. It is not surprising that many of the women who worked during the war subsequently left the labor force, in part because many were young and still wanted to have children. Goldin's results turn out to be consistent with a sizeable increase in the representation of older women in the labor force after the war, and we find that our model simulations provide a close match for the labor market flows that she documents.[8]

Another way to assess the empirical relevance of the labor market mechanism is to consider data on the baby boom in countries other than the United States. Most industrialized countries experienced a baby boom after World War II, but only some of them also underwent a substantial mobilization of female labor during the war. Our theory predicts that countries with bigger wartime increases in the female labor force should also experience larger baby booms. The international data is consistent with this prediction. In particular, we compare the baby boom in countries that had a wartime experience similar to the United States (Allied countries that mobilized for the war but did not fight on their own soil, namely Australia, Canada, and New Zealand) with neutral countries that did not experience a large demand shock for female labor (Ireland, Portugal, Spain, Sweden, and Switzerland). We find that the Allied countries experienced large baby booms similar to the United States', whereas the increase in fertility was much smaller in the neutral countries.

We regard the larger baby booms in the Allied countries as a strong indication that our mechanism is relevant and can explain a sizeable fraction of the U.S. baby boom. At

[8]There is also a recent paper by Goldin together with Claudia Olivetti on the labor market impact of the war (Goldin and Olivetti 2013). This paper is less directly relevant here because of the specific cohort of women considered (younger than the older women who drive the change in the labor market in our model, and older that the women who become the mothers of the baby boom). Nevertheless, the evidence presented does suggest a sustained impact of the war on the female labor market. See also Clark and Summers (1982) for additional evidence supporting an important role of World War II for the rise in female employment.

the same time, the fact that some neutral countries had baby booms at all suggests that our mechanism cannot be the only explanation: some factor other than the dynamics of the female labor market must have played a role, too. We therefore conclude our analysis with a discussion of potential complementary mechanisms for explaining the baby boom (such as Easterlin's relative-income hypothesis and the household-technology hypothesis of Greenwood, Seshadri, and Vandenbroucke 2005) and amplification mechanisms that may help account for the pervasive nature of changes in fertility during the baby boom and baby bust.

The remainder of the paper is organized as follows. In the following section, we provide empirical evidence on the effect of wartime mobilization on fertility during the U.S. baby boom. The model economy is described in Section 3. Our main findings are presented in Section 4, where we discuss the model's quantitative implications for the effect of World War II on post-war fertility. International evidence is discussed in Section 5. In Section 6, we relate our work to other mechanisms that have been proposed in the existing literature and discuss potential amplification mechanisms. Section 7 concludes.

2 Evidence from Mobilization Rates

In a seminal contribution, Acemoglu, Autor, and Lyle (2004) use variation in mobilization rates across U.S. states to document the impact of the war on the labor market for women. The authors show that U.S. states with a greater mobilization of men during the war (and thus a higher demand for female labor) also had a larger postwar increase in female employment and lower relative female wages compared to states with lower mobilization rates. These results confirm the link between the rise of female employment in World War II and the subsequent increase in competition in the female labor market that is an essential ingredient of our mechanism.

In this section, we build directly on Acemoglu, Autor, and Lyle to establish that states with higher mobilization rates during the war subsequently experienced higher fertility, higher marriage rates, and lower labor force participation of young women (those turning adult after the war). Figure 6 displays cross plots of state mobilization rates for World War II with the change in fertility and the marriage rate for two time periods: 1930 to 1940, and 1940 to 1960. The measure of fertility (computed from census data) is the average number of own children under age 5 living in the household for women of ages 25–35. For the 1960 census, the fertility measure corresponds to births that occurred between 1955 and 1960, which covers the peak of the baby boom. The measure

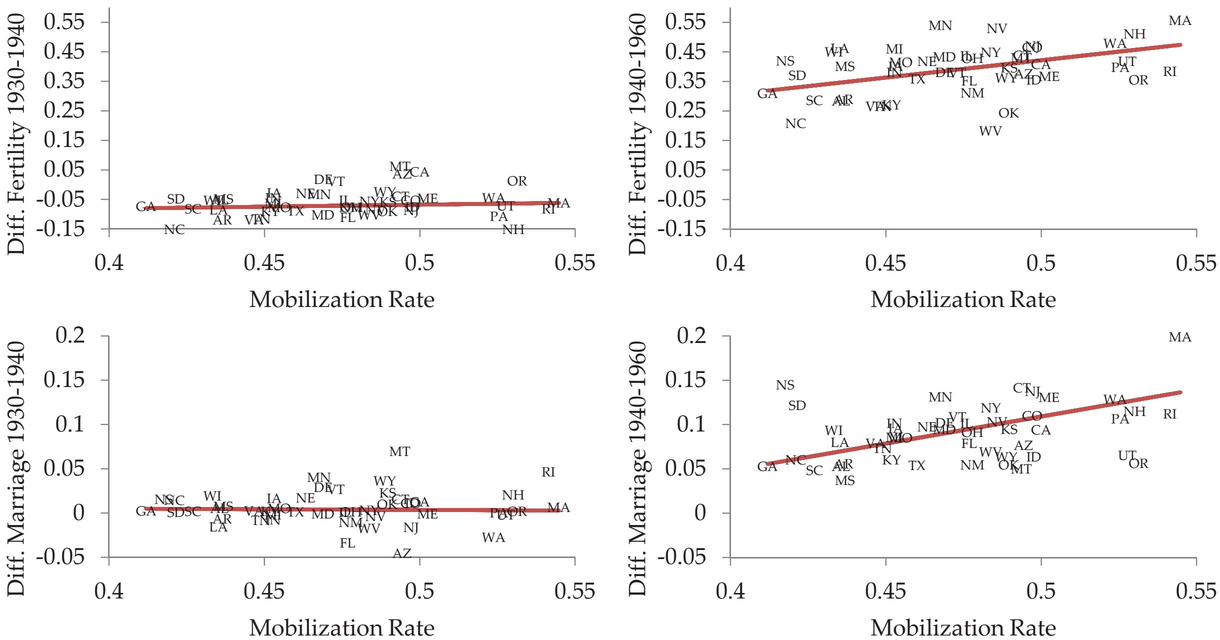

Figure 6: State Mobilization Rates for World War II and Change in Fertility and Marriage from 1930 to 1940 and 1940 to 1960 (Average Number of Own Children Under Age 5 in Household and Fraction Ever Married for Women of Ages 25–35). Assignment of Women to States is by State of Birth.

of marriage is the fraction of women ever married in the 25–35 age group. The figure reveals a clear positive association between mobilization and the change in fertility and marriage from 1940 to 1960, i.e., from before the war to the peak of the baby boom. A regression of the fertility change on the mobilization rate gives a coefficient of 1.17 with a t-statistic of 2.9.[9] For the marriage rate, we get a coefficient of 0.61 with a t-statistic of 3.7. In contrast, there is no significant association between mobilization and the change in fertility and marriage between 1930 and 1940 (t-statistics are 0.58 for fertility and -0.37 for marriage), suggesting that the finding is not driven by pre-existing trends.[10] The size of the coefficient on fertility is economically and demographically significant. When comparing two states with a difference in the mobilization rate of five percentage points, in the high-mobilization state fertility (in terms of children under 5 years of age)

[9]States weighted by population in 1940.

[10]Given the centrality of the effect of mobilization on fertility in our analysis, we further investigate the possibility of pre-existing trends by running full regressions with additional individual-level controls for fertility in 1930 and 1940, specified as in Table 2 (except that we do not control for the education variable, which is not available in 1930). The coefficient on the interaction of mobilization and the time dummy for 1940 (which in these regressions measures the impact of mobility on the change in fertility) is statistically indistinguishable from zero in all specifications.

would be higher by 0.06 in 1960, which is a significant portion of the overall increase in this fertility measure between 1940 and 1960.

Of course, correlation does not imply causation, and it is possible that states differed in other dimensions that are correlated with mobilization rates and that also affected fertility. To deal with such concerns, we now examine the link between wartime mobilization and fertility in more detail.

2.1 Data Sources

For data on fertility, labor supply, and other individual characteristics we use the 1 percent Integrated Public Use Microdata Series (IPUMS) from the 1940 and 1960 censuses (Ruggles et al. 2010). We use data from the 48 contiguous states (Alaska and Hawaii did not gain statehood until the 1950s) and also omit Washington, D.C. We exclude women living in group quarters. As the main fertility measure for a woman we use the number of own children under the age of 5 living in the same household, and we also consider the number of children ever born.[11] For labor supply, we use a dummy variable representing whether a woman is currently employed, and the number of weeks worked in a year. We also consider information on marital status, namely an indicator of ever having been married (i.e., currently married, widowed, divorced, or separated), because in the data the beginning of childbearing is closely associated with marriage. We distinguish two different age groups, namely women aged 25–35 as the "young" group and women aged 45-55 as the "old" group. In line with our theoretical ideas, we choose the young age range such that in 1960 women in this group are at the peak of their fertility.[12] However, since the women in this age group were between 10 and 20 years old at the end of World War II, some of the older ones among them may have entered the labor force during the war in their late teens. To examine whether this group was differentially affected, we also present results for a split of the young group into ages 25–29 (who were too young to work during the war) and 30–35. The older group (ages 45–55) sampled in the 1960 census was between 30 and 40 years old at the end of the war, an age range for which the war had a large direct effect on labor force participation. Moreover, unlike the

[11]We prefer the number of children under the age of 5 mainly because of sample size; in 1940, only sample line women where asked about children ever born, which reduces the sample size in this year by more than 70 percent. Also, given that the total number of children varies over a wider range, nonlinearities and outliers are a larger concern (reported numbers of children ever born range up to 50). To deal with outliers, for children ever born we restrict the sample to women where the reported number of children is no larger than seven. This reduces the sample size by less than 1.2 percent.

[12]Notice that the fertility measure picks up births in the preceding 5 years, thus starting at age 20 for the youngest women. The baby boom had only a small effect on fertility rates before age 20.

young group many of these women would have already completed their fertility before the end of the war.

Table 1 displays the mean and standard deviations for our main variables of interest. Fertility increased strongly from 1940 to 1960, with the mean number of own children under age 5 for women aged 25–35 increasing from 0.48 to 0.87, and the number of children ever born going from 1.68 to 2.43.[13] Young women were also more likely to be married in 1960. For labor supply, there is little change for young women of ages 25–35 between 1940 and 1960, which is explained by more women being married (which lowers labor supply), but a higher probability of working conditional on being married. Hence, there are offsetting movements between the youngest women in our sample (25–29), for whom the probability of marriage rises sharply and whose labor supply declines, and the slightly older women (30–35), who experience a smaller rise in marriage. For the older generation (ages 45–55) there is a large increase in labor supply, with more than a doubling in employment.

For mobilization rates we use the same variable as Acemoglu, Autor, and Lyle (2004), which is the fraction of registered men between the ages of 18 and 44 who were drafted or enlisted for war, by state.[14] The mobilization rates vary between 41.2 and 54.5 percent, with an average of 47.8 percent.

2.2 Results

Our main results are based on individual-level regressions of the form:[15]

$$y_{ist} = \lambda_s + \pi d_{1960} + X_{ist}'\omega + \mu d_{1960} m_s + \epsilon_{ist}$$

using pooled census data from 1940 and 1960. Here y_{ist} is an outcome variable of interest (fertility, labor supply, or marriage) for woman i from state s in year t, λ_s is a state fixed effect, d_{1960} is a dummy for 1960, X_{ist} is a vector of individual-level controls, and m_s is the state mobilization rate for World War II. The main parameter of interest is μ, the interaction of mobilization with the 1960 dummy. For example, in a fertility regression a

[13]The increase in 0.75 in children ever born compares to an increase in completed fertility between the 1910 and 1930 cohorts of 0.9. Women in the 25–35 age group haven't completed their fertility yet, but the observation that this age group accounts for most of the increase in completed fertility from the Great Depression trough to the peak of the baby boom is consistent with young mothers driving the baby boom.

[14]We thank the authors for making the data available to us.

[15]The empirical setup broadly follows Acemoglu, Autor, and Lyle (2004): see their regression equation (8). However, we focus on different outcome variables, and there are some differences in controls.

Table 1: Mean and Standard Deviation (in Parentheses) of Fertility, Marriage, and Labor Supply in the 1940 and 1960 Censuses

Variable	Age 25–35		Age 25–29		Age 30–35		Age 45–55	
	1940	1960	1940	1960	1940	1960	1940	1960
Children Under Age 5	0.48	0.87	0.55	1.10	0.42	0.70		
	(0.75)	(0.96)	(0.78)	(1.02)	(0.71)	(0.88)		
Children Ever Born	1.68	2.43	1.47	2.25	1.86	2.55		
	(1.56)	(1.54)	(1.45)	(1.46)	(1.62)	(1.59)		
Ever Married	0.83	0.92	0.79	0.90	0.87	0.94		
	(0.38)	(0.27)	(0.41)	(0.30)	(0.34)	(0.24)		
Employed	0.30	0.33	0.32	0.32	0.28	0.34	0.20	0.45
	(0.46)	(0.47)	(0.47)	(0.47)	(0.45)	(0.47)	(0.40)	(0.50)
Weeks Worked/Year	15.5	15.3	16.4	15.4	14.5	15.2	11.0	20.6
	(22.5)	(20.9)	(22.8)	(20.7)	(22.2)	(21.0)	(20.3)	(22.8)

positive estimate for μ would indicate that fertility increased by more between 1940 and 1960 in states with high mobilization rates than in states with low mobilization rates.

Table 2 displays results for the fertility, labor supply, and marriage decisions of young women. Each entry in Table 2 shows the estimate of the interaction term μ for a different specification. All regressions include dummy variables for observation year, age, race, and state/country of birth. In the regressions for the number of children under age 5, we also control for the number of children older than 5. In columns (1)–(3) women are assigned to states based on their state of birth, and in columns (4)–(6) based on their current state of residence. Ideally we would like to assign women to states based on where they lived when they were exposed to the mobilization shock. Since the 1960 observation is 15 years after the end of the war, it is not obvious whether state of birth or residence is a better predictor, and hence we consider both possibilities.[16]

Column (1) in Table 2 displays results for our most parsimonious specification. We find that young women from states with high mobilization rates had substantially more children, worked less, and were more likely to be married than women from states with low mobilization rates. The parameter estimates are all highly statistically significant and imply a large quantitative impact of mobilization. The estimates imply that when comparing two states with a five percentage point difference in the mobilization rate, in the higher mobilization state fertility (in terms of children under 5 years of age) would be higher by 0.07 in 1960, and female labor supply lower by 1.7 weeks per woman/year.

The results in column (2) of Table 2 add individual-level controls for years of education and farm status. Introducing these lowers the size of the coefficient estimates, but the signs remain the same and the estimates for children under the age of 5, employment status, and marriage remain highly significant. For children ever born, the coefficient estimate remains large, but is imprecisely measured and falls short of being statistical significant. This may be partly due to the fact that this measure is available only for a smaller (sample line) group of women in 1940, reducing sample size in this year by more than 70 percent. In addition, the measure has a wider range of variation than the number of children under the age 5, so that nonlinearity is a more important concern. In Section B.2 in the online appendix, we show that estimates are significant when an ordered probit specification is employed.

Adding in marital status dummies further lowers the size of the estimates (column (3)),

[16]In addition, in Section B.3 in the online appendix we show that results are robust to removing state of birth controls and to limiting attention to women who have not moved in the previous five years.

Table 2: Impact of WWII Mobilization Rates on Fertility, Labor Supply, and Marriage of Women Aged 25–35 (Coefficient Estimates from OLS Regressions for Variable "Mobilization Rate × 1960")

Dependent Variable	Regression with Mobilization Assigned by:					
	State of Birth			State of Residence		
	(1)	(2)	(3)	(4)	(5)	(6)
Children Under Age 5	1.403	0.953	0.855	1.146	0.665	0.573
	(0.257)	(0.237)	(0.211)	(0.259)	(0.232)	(0.208)
R^2	0.117	0.123	0.198	0.115	0.119	0.196
Children Ever Born	2.032	0.818	0.825	2.425	0.781	0.749
	(0.717)	(0.543)	(0.543)	(0.741)	(0.540)	(0.537)
R^2	0.088	0.143	0.149	0.092	0.142	0.147
Employed	-0.944	-0.608	-0.385	-0.820	-0.395	-0.204
	(0.157)	(0.137)	(0.098)	(0.149)	(0.129)	(0.096)
R^2	0.017	0.046	0.203	0.020	0.046	0.204
Weeks Worked	-33.358	-23.173	-12.904	-26.022	-12.338	-3.558
	(7.903)	(7.065)	(5.179)	(7.670)	(7.087)	(5.066)
R^2	0.017	0.040	0.201	0.020	0.041	0.203
Ever Married	0.474	0.488		0.384	0.377	
	(0.118)	(0.119)		(0.119)	(0.122)	
R^2	0.045	0.063		0.046	0.063	
Education and Farm Controls	no	yes	yes	no	yes	yes
Marital Status Controls	no	no	yes	no	no	yes

Notes: Standard errors (in parentheses) are adjusted for clusters of state of birth/residence (depending on how mobilization is assigned) and year of observation. Estimates are from separate regressions of pooled micro data from the 1940 and 1960 censuses. All regressions are OLS. Each outcome variable is regressed on the WWII mobilization rate interacted with a 1960 year indicator variable and indicator variables of observation year, age, race, and state/country of birth. Regressions where mobilization is assigned by state of residence also contain indicator variable for state of residence. Regressions for children under age 5 also contain number of children older than 5. Where applicable, the number of older children and the farm, race, age, and marital status indicator variables are also interacted with the 1960 indicator variable. For children ever born, the sample is restricted to observation where the number of children does not exceed seven. The number of observations is 225,613 for columns (1)–(3) and 243,554 for columns (4)–(6) (foreign-born women are omitted in regressions that assign mobilization by state of birth), except for children ever born, where the sample size is 132,934 for columns (1)–(3) and 143,637 for columns (4)–(6) (the sample size is lower because in children ever born is only available for married women, and in 1940 only for sample-line married women). All data are weighted using census person weights (sample line weights in case of children ever born).

but the effect on fertility remains quantitatively large. Moreover, marriage, education, and farm status are all endogenous decisions that may respond to the labor market changes implied by the war, so it is not obvious whether these should be controlled for. In particular, our conjecture is that in high-mobilization states women exited the labor market to start their families at a younger age, which should be reflected in marital status.

Columns (4) to (6) repeat the regressions of columns (1) to (3) with an assignment of women to states based on their current state of residence. The results are qualitatively the same as with assignment by state of birth, but in most cases the size of the effects is somewhat smaller. The estimates continue to imply a quantitatively important effect of mobilization on fertility, labor supply, and marriage.

Table 3 breaks down the regression results for two sub-groups of young women, namely ages 25–29 and 30–35.[17] Women who were in the 30–35 group in 1960 were between 14 and 19 years old in 1944, and many of them gained some work experience during the war.[18] These women may be differentially impacted compared to the younger group, who were of ages 9–13 in 1944 and thus not yet in the labor market. In addition, we would expect that controlling for marital status has a larger impact on the estimates for the younger group, because the changes in the timing of marriages mostly took place in the 20s, whereas by age 30 most women were married both before and after the war. The results are in line with these predictions. The estimates for the fertility coefficients are similar in magnitude, but the mobilization rate has a larger impact on the labor force participation of the younger compared to the older group, suggesting that work experience during the war lessened the exposure to the displacement effect. In addition, controlling for marital status (columns (3) and (6)) has a large impact on the size of fertility coefficient for the young group, but leaves the estimate for the older group essentially unchanged. This finding is consistent with the theory's prediction that the war shock changed the timing of marriage rather than the fraction of women who ultimately get married. The larger impact of mobilization on the probability of being married for younger women compared to older women also backs up this prediction.

Table 4 presents analogous regression results for the employment of the older women of ages 45–55. Women who were in this age group during the 1960 census were between

[17] Assignment is by state of birth; results for assignment by state of residence are similar.

[18] The labor force participation rate for women aged 14–19 was 41.8 percent in 1944, compared to 19.9 percent in 1940 (Goldin 1991, Table 1).

Table 3: Impact of WWII Mobilization Rates on Fertility, Labor Supply, and Marriage of Women Aged 25–29 and 30–35 (Coefficient Estimates from OLS Regressions for Variable "Mobilization Rate $\times$ 1960")

Dependent Variable	Age Group:					
	Age 25–29 (N = 102,767)			Age 30–35 (N = 122,846)		
	(1)	(2)	(3)	(4)	(5)	(6)
Children Under Age 5	1.442	1.059	0.789	1.306	0.831	0.864
	(0.295)	(0.282)	(0.256)	(0.246)	(0.225)	(0.206)
R^2	0.120	0.127	0.237	0.083	0.092	0.136
Children Ever Born	1.874	0.968	0.961	2.079	0.754	0.795
	(0.725)	(0.575)	(0.589)	(0.783)	(0.630)	(0.622)
R^2	0.104	0.175	0.180	0.060	0.108	0.115
Employed	-1.041	-0.730	-0.376	-0.823	-0.478	-0.379
	(0.178)	(0.163)	(0.115)	(0.152)	(0.127)	(0.102)
R^2	0.016	0.051	0.224	0.020	0.045	0.187
Weeks Worked	-36.588	-28.575	-12.017	-28.414	-17.115	-12.909
	(9.533)	(8.779)	(6.429)	(7.138)	(6.176)	(5.042)
R^2	0.017	0.049	0.220	0.018	0.035	0.187
Ever Married	0.675	0.733		0.281	0.268	
	(0.146)	(0.143)		(0.095)	(0.097)	
R^2	0.047	0.070		0.025	0.041	
Education and Farm Controls	no	yes	yes	no	yes	yes
Marital Status Controls	no	no	yes	no	no	yes

Notes: Standard errors (in parentheses) are adjusted for clusters of state of birth and year of observation. Estimates are from separate regressions of pooled micro data from the 1940 and 1960 censuses. All regressions are OLS. Each outcome variable is regressed on the WWII mobilization rate interacted with a 1960 year indicator variable and indicator variables of observation year, age, race, and state/country of birth. Regressions for children under age 5 also contain number of children older than 5. Where applicable, the number of older children and the farm, race, age, and marital status indicator variables are also interacted with the 1960 indicator variable. Mobilization rate assigned by state of birth. For children ever born, the sample is restricted to observation where the number of children does not exceed seven. The sample size for children ever born is 57,690 for columns (1)–(3) and 75,244 for columns (4)–(6). All data are weighted using census person weights (sample line weights in case of children ever born).

Table 4: Impact of WWII Mobilization Rates on Labor Supply of Women Aged 45–55 (Coefficient Estimates from OLS Regressions for Variable "Mobilization Rate × 1960")

Dependent Variable	Regression with Mobilization Assigned by:					
	State of Birth			State of Residence		
	(1)	(2)	(3)	(4)	(5)	(6)
Employed	0.078	0.231	0.227	0.058	0.185	0.174
	(0.082)	(0.084)	(0.074)	(0.074)	(0.081)	(0.077)
R^2	0.073	0.108	0.197	0.081	0.112	0.200
Weeks Worked	16.682	18.390	18.143	17.998	17.349	16.552
	(3.889)	(3.775)	(3.735)	(4.384)	(4.326)	(4.641)
R^2	0.056	0.081	0.182	0.066	0.088	0.182
Education and Farm Controls	no	yes	yes	no	yes	yes
Marital Status Controls	no	no	yes	no	no	yes

Notes: Standard errors (in parentheses) are adjusted for clusters of state of birth/residence (depending on how mobilization is assigned) and year of observation. Estimates are from separate regressions of pooled micro data from the 1940 and 1960 censuses. All regressions are OLS. Each outcome variable is regressed on the WWII mobilization rate interacted with a 1960 year indicator variable and indicator variables of observation year, age, race, and state/country of birth. Regressions where mobilization is assigned by state of residence also contain indicator variable for state of residence. Where applicable, the farm, race, age, and marital status indicator variables are also interacted with the 1960 indicator variable. All data are weighted using census person weights. The number of observations is 164,408 for columns (1)–(3) and 191,715 for columns (4)–(6) (foreign-born women are omitted in regressions that assign mobilization by state of birth).

30 and 40 years old in 1945, and thus are likely to have entered the labor force during the war. The regression results confirm that mobilization had a substantial long-run impact on these women's labor supply. The coefficient estimates on weeks worked are all highly statistically significant and quantitatively large. When comparing two states with a five percentage point difference in mobilization rates, the estimates imply that in the higher mobilization state female employment in this age group would be higher by about 0.9 weeks per woman/year. The effect on the probability of employment is significant as long as education and farm status are controlled for.

A potential concern about the regression results is that employment and marriage are binary variables and fertility is a discrete variable. In the online appendix, we present regression results for probit regressions for employment and marriage and ordered probit regressions for fertility. Both qualitatively and quantitatively these results are very similar to our findings reported in Tables 2 and 4. We also present additional robustness checks that include state-level determinants of the mobilization rate in the main regressions and that explore the impact of inter-state mobility for our findings.

In our theoretical analysis below, we interpret the findings in this section through the lens of a model in which different generations of women compete in the labor market, i.e., the labor inputs provided by young and old women are substitutes. This interpretation is consistent with both our own findings and those of Acemoglu, Autor, and Lyle (2004). Additional support for the assumption of substitutability between young and old women comes from evidence on women's occupational choices. The most recent contribution to this literature is Bellou and Cardia (2013), who study the impact of World War II on the occupational choices of three generations of women, and find evidence in line with competition between the younger and older cohort (see their Table 7 and the related discussion).[19]

To summarize, our empirical results show that wartime mobilization is associated with higher fertility and lower labor force participation by young women during the baby-boom period. These findings do not yet pin down which mechanism provides the link between the war and young women's decisions in the following decades. In the next section, we develop a model that spells out this link, and assess its ability to account for the baby boom and baby bust.

3 The Model Economy

We now describe the model economy that we employ to evaluate our explanation for the U.S. baby boom quantitatively. At the aggregate level, the model is a version of the standard neoclassical growth model that underlies much of the applied literature in macroeconomics. We enrich this framework in three dimensions. First, we model married couples' life cycle decisions on fertility and female labor force participation.[20] Since fertility and labor force participation decisions are discrete, the model incorporates

[19]See also Palmer (1954) for an early study of labor mobility after World War II and Kremer and Thomson (1998) for a theoretical analysis of the implications of the degree of substitutability between young and old workers.

[20]Life-cycle models of fertility and female labor force participation have also been developed and estimated in the labor literature (see for example Eckstein and Wolpin 1989 and in particular Adda, Dustmann, and Stevens 2011, who incorporate a detailed model of the timing of births). One feature that we share with this literature is the endogenous accumulation of work experience. However, the labor papers focus on the estimation of partial equilibrium choice models, and therefore lack the general equilibrium aspect that is essential for our mechanism. Our modeling of fertility is related to Da Rocha and Fuster (2006), who also consider the interaction of female work and fertility in an environment characterized by declining fecundity over the life cycle.

preference heterogeneity so as to generate heterogeneous behavior in these dimensions. Second, the production technology features limited substitutability of male and female labor, which implies that changes in the relative labor supply of men and women affect the gender wage gap. Third, we introduce a government that buys goods, employs soldiers, levies taxes, and issues debt. Modeling the government in detail will allow us to trace out the effects of war finance on labor supply and fertility.

3.1 Couples' Life-Cycle Choices of Fertility and Labor Supply

The model economy is populated by married couples who live for $T+1$ adult periods, indexed from 0 to T. Men work continuously until model period R, after which they retire. Women can choose in every period whether or not to participate in the labor market. Working women also retire after period R. Apart from deciding on labor supply, the main decisions facing our couples are how many children to have, and when to have them. Parents raise their children for I periods, at which time the children turn adult. All decisions are taken jointly by husbands and wives. A couple turning adult in period t maximizes the expected utility function:

$$U_t = E_t \left\{ \sum_{j=0}^{T} \beta^j \left[\log(c_{t,j}) + \sigma_x \log(x_{t,j} + x_{t,j}^W) \right] + \sigma_n \log(n_t) \right\}.$$

Here $c_{t,j}$ is consumption at age j of a household who turned adult in period t, $x_{t,j}$ is female leisure, and n_t is the number of children. Male leisure does not appear in the utility function, as men are continuously employed until retirement and their leisure is therefore fixed. $x_{t,j}^W$ represents a preference shock that shifts leisure preferences during wartime. This shock can be interpreted as patriotism and allows us to match labor supply during the war. In regular times we have $x_{t,j}^W = 0$; what happens during the war is discussed in Section 4.1 below.

The before-tax labor income of a couple at age j who turned adult in period t is given by:

$$I_{t,j} = w_{t+j}^m e_{t,j}^m + w_{t+j}^f e_{t,j}^f l_{t,j}.$$

Here w_{t+j}^m is the male wage, $e_{t,j}^m$ is male labor market experience (i.e., labor supply in efficiency units), w_{t+j}^f is the female wage, $e_{t,j}^f$ is female labor market experience, and $l_{t,j}$ is female labor supply, which can be either zero or one (male labor supply is always assumed to be one). The flow budget constraint that a couple turning adult in period t

faces in period $t+j$ is:

$$c_{t,j} + a_{t,j+1} = (1 + r_{t+j})a_{t,j} + I_{t,j} - T_{t+j}(I_{t,j}, r_{t+j}a_{t,j}).$$

Here $a_{t,j}$ are assets (savings), r_{t+j} is the interest rate in period $t+j$, and $T_{t+j}(\cdot)$ is the income tax as a function of pre-tax labor and capital income. People are born and die without assets ($a_{t,0} = a_{t,T+1} = 0$), and borrowing (negative assets) is possible up to the natural borrowing limit (i.e., the lifetime budget constraint has to be satisfied).[21]

For $j < R$ (i.e., until retirement age), labor market experience evolves according to:

$$\begin{aligned} e^m_{t,j+1} =& (1 + \eta_{m,j})e^m_{t,j}, \\ e^f_{t,j+1} =& (1 + \eta_{f,j}l_{t,j} + \nu(1 - l_{t,j}))e^f_{t,j}, \end{aligned}$$

where $\eta_{m,j}$ is the age-dependent return to male experience, $\eta_{f,j}$ is the age-dependent return to female experience, and ν is the return to age for a woman who is currently not working.[22] We do not separately model the male return to age since men are continuously employed. Initial experience is normalized to one for both sexes, $e^m_{t,0} = e^f_{t,0} = 1$. For $j > R$ we have $e^m_{t,j} = e^f_{t,j} = 0$, i.e., men and women are no longer productive once they reach retirement age.

For young women who haven't had children yet, leisure is given by:

$$x_{t,j} = h - l_{t,j} - z_{t,j}.$$

Here h is the time endowment, and the variable $z_{t,j} \in \{0, \bar{z}\}$ is an adjustment cost (in terms of time) that has to be paid when a woman reenters the labor force, i.e., switches from non-employment to employment. This cost captures the job search effort and any other costs, pecuniary or emotional, that are incurred when reentering the labor force. The cost has to be paid only once for a female employment spell.[23] The general leisure

[21] Borrowing is a realistic feature because in the data many households carry debt. However, the possibility of borrowing is not critical for our quantitative results below; in the balanced growth path, only 5.6 percent of households have negative assets.

[22] In principle, ν could be negative, implying that experience depreciates when women don't work. See Olivetti (2006) for a macroeconomic study of the importance of the return to experience for explaining female labor supply.

[23] More precisely, we have $z_{t,j} = \bar{z}$ if $l_{t,j} = 1$ and $l_{t,j-1} = 0$, and $z_{t,j} = 0$ otherwise. The role of the reentry cost is to make female labor supply persistent, which is necessary to match the rise in female employment after the demand shock of World War II.

constraint, which also includes the costs of having children, is given by:

$$x_{t,j} = h - \phi(n^y_{t,j})^\psi - \kappa_j\, b_{t,j} - l_{t,j} - z_{t,j}.$$

Here $n^y_{t,j}$ is the number of young (i.e., non-adult) children who are still living with their parents, $\phi > 0$ and $\psi > 0$ are parameters governing the level and curvature of the cost of children, $b_{t,j} \in \{0, 1\}$ indicates the decision to have a baby in period j, and $\kappa_j \geq 0$ is the additional time cost for making and caring for a baby over and above the general time cost of children. The cost κ_j may vary with age j to capture that conceiving a child becomes more difficult at an older age. Children live with their parents for I periods, after which they turn adult, form their own households, and are no longer costly to their parents. For simplicity, and realistically for the period, we assume that women who choose to have a baby do not work during the same period. Women can give birth only up to age M, and only one birth per period is possible. Fecundity is declining with age; the parameter f_j denotes the probability that an attempt to have a baby at age j will result in a live birth. Hence, a couple that has $n_{t,j}$ children at age j will have $n_{t,j} + b_{t,j}$ children at age $j + 1$ with probability f_j, and stay at $n_{t,j}$ children with probability $1 - f_j$ conditional on trying to conceive. The total number of children is given by the number of children at the end of the childbearing period: $n_t = n_{t,M+1}$.

The population is heterogeneous in terms of the appreciation of leisure, i.e., the parameter σ_x in the utility function varies across couples.[24] In particular, in any cohort the distribution of σ_x is governed by the distribution function $F(\sigma_x)$. The distribution of σ_x determines the average female labor force participation rate at different ages.

3.2 The Aggregate Production Function

The production technology is given by:

$$Y_t = A_t^{1-\alpha} K_t^\alpha \left(\theta (L_t^f)^\rho + (1-\theta)(L_t^m)^\rho\right)^{\frac{1-\alpha}{\rho}},$$

[24]Our aim is to introduce heterogeneous behavior in terms of fertility and labor force participation while keeping the model parsimonious. We therefore introduce preference heterogeneity only along the leisure dimension. Introducing heterogeneity in terms of the preference for children would be less effective, because conditional on the number of children all women would have identical preferences at the labor-leisure margin. In principle, heterogeneous behavior could also arise with homogeneous preferences, as long as couples are indifferent between all bundles that are chosen in equilibrium. However, such a model would have the unattractive feature that aggregates are infinitely elastic with respect to infinitesimal price changes.

where A_t is productivity, K_t is the aggregate capital stock, L_t^f is female labor supply in efficiency units, and L_t^m is male labor supply in efficiency units. The aggregate capital stock depreciates at rate δ per period. The production function allows for limited substitutability between male and female labor, governed by the parameter ρ. Productivity increases at a constant rate γ every period:

$$A_{t+1} = (1+\gamma)A_t.$$

In the balanced growth path, the growth rate of output per capita will be equal to γ. The production technology is operated by perfectly competitive firms, so that all factors are paid their marginal products and profits are equal to zero in equilibrium.

3.3 The Government

The government buys goods G_t (which include military goods), drafts soldiers L_t^D into the military (measured in efficiency units of male labor), and finances government spending via taxes and government debt B_t. We consider a tax system consisting of a flat capital income tax τ_k, a flat labor income tax τ_l with an exemption level of ξ_t, and a lump-sum tax τ_{LS}, so that the tax function is:

$$T_t(I_l, I_k) = \tau_{l,t} \max\{I_l - \xi_t, 0\} + \tau_{k,t} I_k + \tau_{LS,t},$$

where I_l is labor income and I_k is capital income. Following Ohanian (1997) and McGrattan and Ohanian (2010), we assume that the monetary compensation of draftees equals the wage received by comparable civilian workers. This formulation has the advantage that we need not distinguish between draftees and civilians in the formulation of the household problem. Let P_t denote the size of cohort t (i.e., the number of couples who enter adulthood in t). The government budget constraint is:

$$G_t + w_t^m L_t^D + (1+r_t)B_t = B_{t+1} + \sum_{s=1}^{T} P_{t-s} \int_0^\infty T_t(I_{t-s,s}, r_t\, a_{t-s,s})\, dF(\sigma_x),$$

The government budget constraint shows how government spending $G_t + w_t^m L_t^D$ and service of existing debt $(1+r_t)B_t$ are financed through issuing new debt B_{t+1} and through tax revenue.

3.4 Market Clearing

The market-clearing condition for capital is given by:

$$K_t + B_t = \sum_{s=1}^{T} P_{t-s} \int_0^\infty a_{t-s,s} \, dF(\sigma_x),$$

that is, the sum of the capital stock and government debt is equal to the sum of the assets of all cohorts that are currently alive, where in the integral it is understood that assets $a_{t-s,s}$ are a function a household's leisure-preference parameter σ_x. Similarly, the market-clearing condition for male labor is given by:

$$L_t^m + L_t^D = \sum_{s=0}^{R} P_{t-s} \int_0^\infty e_{t-s,s}^m \, dF(\sigma_x),$$

and female labor supply satisfies:

$$L_t^f = \sum_{s=0}^{R} P_{t-s} \int_0^\infty e_{t-s,s}^f \, l_{t-s,s} \, dF(\sigma_x).$$

Here L_t^m and L_t^f are the total efficiency units of labor that men and women supply to the civilian labor market. Finally, given that children turn adult after spending I periods with their parents, the cohort sizes P_t evolve according to the law of motion:

$$P_{t+I} = \frac{1}{2} \sum_{s=0}^{M} P_{t-s} \int_0^\infty f_s \, b_{t-s,s} \, dF(\sigma_x).$$

The factor $\frac{1}{2}$ enters the law of motion because fertility is measured in terms of individuals while cohort size is measured in terms of couples. More precisely, $f_s \, b_{t-s,s}$ describes the expected number of births (between zero and one) of a couple born in period $t-s$ at time t. We assume that a law of large numbers applies for conceiving a child, so that $f_s \, b_{t-s,s}$ is also the average number of babies for a given type. Integrating over all couples and multiplying by cohort size P_{t-s} gives the total number of children born in period t to parents from cohort $t-s$. Summing this over all cohorts who are in childbearing age in period t (i.e., those aged zero to M) yields the total number of children born in period t. Dividing by 2 results in the number of couples P_{t+I} turning adult I periods later.

3.5 What Drives Fertility?

Before turning to quantitative results, it is instructive to consider how fertility and female labor force participation decisions are determined in the model. In the calibration considered below (Section 4), all women initially enter the labor force when turning adult, and then quit in order to have children. Fecundity is declining after women reach their early 30s, and most women prefer to have their babies before the probability of conceiving drops substantially. At the same time, it turns out to be optimal to extend the initial work period as much as possible, because then more earnings can be generated while the opportunity cost of work is still low. Hence, most women plan their fertility such that they have births up to the age when fecundity drops sharply (with a smaller fraction trying for one more baby after). A key implication of this timing of fertility is that the marginal child is the first one: women who want to have an additional child for sure must leave the labor force one period earlier.[25] What, then, determines whether a woman will have an additional child?

Consider, first, the case of a woman who does not anticipate reentering the labor force after having children. For her, both the marginal utility of having another child and the disutility (in terms of reduced leisure) of raising the child are fixed numbers. The only variable part of the tradeoff is the opportunity cost of having to exit the labor force earlier, which depends on forgone wage income in this period. Thus, young women's wages are a key determinant of fertility. However, what matters is not the absolute level of the young female wage, but the product of the wage and the marginal utility of consumption. The marginal utility of consumption, in turn, is driven by the present value of a couple's lifetime income. Given that the remainder of household income is earned by husbands, fertility ends up being determined by female wages relative to male wages. In a balanced growth path, female wages increase in proportion to male wages, so that fertility rates are constant. During the transition after the war shock, in contrast, relative wages will fluctuate, leading to changes in fertility.[26]

The tradeoff for having another child is more complicated for women who would adjust their labor supply later in life if they had another child, in which case relative wage

[25]Our emphasis on the timing of fertility is shared with Caucutt, Guner, and Knowles (2002), who use an integrated model of the marriage market, female labor supply, and fertility to explain patterns of fertility timing in the United States.

[26]A similar link between the opportunity cost of children and the relative female wage can also be found in Galor and Weil (1996). However, unlike Galor and Weil, we develop a life cycle model where the interaction between successive cohorts is key for the economic mechanism.

at older ages is also relevant. However, this margin operates only for relatively few women. The fertility implications of the war shock in our model therefore are primarily driven by the impact of the shock on young women's wages relative to young couples' lifetime income. A second channel through which the war affects fertility is changes in labor taxation. To assess the quantitative significance of these channels, we now turn to the calibration procedure for our model economy.

4 The Quantitative Experiment: World War II and the Baby Boom

We would like to assess the impact of the shock of World War II on subsequent fertility. We first discuss how the war is modeled as both a shock to the labor market and as a shock to government spending and taxes. Next, since we are looking for quantitative results, we calibrate the model economy to match certain characteristics of the United States in the pre- and post-war periods and during the war itself. We then present our main results and discuss the sensitivity of the findings to alternative assumptions.

4.1 Modeling the War Shock

Our overall computational strategy is to model World War II as an unexpected shock that displaces the economy from a pre-war balanced growth path. The representation of the war builds on the analyses of Ohanian (1997), Siu (2008), and McGrattan and Ohanian (2010) of the war's fiscal implications in a neoclassical framework. The war shock consists of three components. First, during the war the government drafts men for military service. We set the number of draftees to $L_t^D = 0$ both before and after the war and to a positive number $L_t^D > 0$ during the war. Draftees are not available for civilian production, so that the male labor input in the production function drops during the war.

The second aspect of the war shock is a change in fiscal policy. The war led to a massive increase in government spending, which was financed by higher taxes and a large increase in government debt. Accounting for the war's fiscal implications is important for our analysis because our theory revolves around work incentives for young women during the baby boom period, which are affected by marginal labor taxes. Accordingly, we match the increase in government spending during the war to data and allow labor taxes to increase permanently. Government debt also increased during the war. For our analysis, government debt matters, too, because of the fiscal burden that it places on

Illustration 1: U.S. Government World War II Recruitment Posters

families during the baby boom period. With this in mind, we set the level of government debt at the end of the war such that ratio of debt service to GDP in the post-war period matches the data.

The third component of the war shock consists of a "patriotism" shock that increases female labor force participation during the war. In particular, the preference shock $x^W_{t,j}$ is set to zero both before and after the war. In contrast, we set $x^W_{t,j} = \bar{x}^W > 0$ for those women who enter the labor force during the war. $\bar{x}^W$ is chosen such that the rise in the overall female labor force participation rate during the war matches the data. Given that our theory is about how the female labor market after the war is affected by the rise of female employment during the war, matching this increase is essential for our exercise.

In principle, one might expect that female participation should rise even without a patriotism shock, because of the drop in male labor supply and because of the wealth effect of high taxes. Indeed, in the analysis of McGrattan and Ohanian (2010) these factors are sufficient to explain the rise in female employment. However, McGrattan and Ohanian use a model with infinitely-lived agents and focus exclusively on the war period. In contrast, we employ a life cycle model with a parametrization that is geared towards being consistent with evidence on female labor supply and fertility from before the war. We find that our model does not reproduce the large wealth effect on labor supply that drives the results in McGrattan and Ohanian. Rather, our findings line up with the analysis of Mulligan (1998), who argues that in the United States after-tax real wages actually fell during the war, so that other factors, such as patriotism, are required to explain the large increase in female labor force participation. Indeed, the U.S. government ran a public campaign to recruit women for the war effort (see Illustration 1). Whereas previously society was often prejudiced against the employment of married women,[27] during the war joining the labor force was actively encouraged. The patriotism shock captures this change.

4.2 Calibrating the Model Parameters

We now describe how we choose the model parameters and the different components of the war shock. Given that the war shock includes a permanent change in tax rates, after the war the economy converges to a new balanced growth path corresponding to the new fiscal environment. We calibrate the model such that the pre- and post-war balanced growth paths match a specific set of characteristics of the actual U.S. economy. For the macro side of the model, we choose a set of target moments that characterize long-run U.S. growth. Fertility and patterns of female labor force participation are matched to observations in the pre-war period, mostly from the 1940 census. The war shock is calibrated to match data on mobilization rates, female labor force participation, and fiscal changes during World War II.

One central aspect of the calibration is to pin down how strongly fertility and labor supply react to the war shock. Here our strategy is to constrain the model to be consistent with the cross-state evidence on the impact of mobilization rates on fertility presented in Section 2. Relying on this evidence is ideal for our purposes, because the empirical setting consists precisely of the historical episode that we are trying to understand. Of course, this strategy implies that the quantitative results from the model do not provide independent evidence on the magnitude of the reaction of fertility to the war shock. Rather, the added value of the quantitative analysis is to make explicit the causal connection between the war and the rise in fertility; to assess the implications of the theory for changes in female labor supply (which are not constrained by the calibration) and for the timing of the rise and fall in fertility; and to enable us to carry out counterfactual experiments demonstrating the relative importance of alternative channels linking World War II and the baby boom.

[27]See Goldin (1990) for a discussion of marriage bars (which excluded married women from employment in certain professions, in particular clerical work and teaching), which were widely practiced before World War II.

The first calibration choice concerns the length of a model period. The main characteristic that defines a period in the model is that women can have one child per period. The length of the model period therefore corresponds to the average time between births. In the United States, the average spacing of births narrowed from over three years for the cohort of mothers born 1916–1920 to slightly above two years for the cohort 1931–35 (Whelpton 1964). As a compromise, we set the model period as corresponding to 2.5 years in the data. We also set the length of childhood to $I = 8$, so that the age of adulthood corresponds to 20 years in the data. The fecundity limit is set at $M = 6$ (women can give birth until 37.5 years old), the last period of work is $R = 15$ (retirement starts at age 60), and the last period of life is $T = 19$ (people die at age 70).[28]

At the aggregate level, we match the capital income share, the depreciation rate, and the return to capital to long-run U.S. data. Where possible, we use the same calibration targets as Greenwood, Seshadri, and Vandenbroucke (2005) for these macroeconomic statistics to yield comparable results. Consequently, we set the capital income share to 0.3 ($\alpha = 0.3$), the depreciation rate to 4.7 percent per year ($\delta = 1 - (1 - 0.047)^{2.5}$), and the annualized pre-tax return to capital to 6.9 percent.[29] The return to capital is a function of the capital-output ratio which, in turn, is mostly governed by the time-preference parameter β. Given the other calibration choices, the return to capital is matched by setting $\beta = 0.987$.[30] We also follow the real-business-cycle literature in assuming that full-time work takes up one-third of discretionary time (Cooley and Prescott 1995). Given that the time cost of full-time work is normalized to one (i.e., $l_{t,j} \in \{0, 1\}$), the time endowment is set to $h = 3$. The parameters ρ and θ govern the substitutability between male and female labor, and relative wages. The share parameter θ is chosen to match a ratio of average female to male wages of 0.66 in 1940, which results in $\theta = 0.35$.[31] The elasticity parameter ρ has been estimated by Acemoglu, Autor, and Lyle (2004) using census data. They suggest a range of 0.583 to 0.762 for ρ; following this estimate, we set $\rho = 0.65$. The implied elasticity of substitution between male and female labor is about 2.9. The

[28]In the real world, of course, women can conceive at ages older than 37.5, but actual fertility rates were very low in this age range during the period that we consider.

[29]See Cooley and Prescott (1995) for details on how these statistics can be computed from aggregate U.S. data. The return to capital is matched for the post-war steady state; however, matching the return in the pre-war steady state leads to mostly identical results.

[30]Since we model a life cycle economy, the direct correspondence between the discount factor, the growth rate, and the return to capital that holds in infinitely-lived agent economies does not apply in our framework.

[31]Average wages are computed across ages 20–60 and all race groups from the 1940 Census, see Appendix A.2 for details.

annualized productivity growth rate of the economy is set to 1.8 percent ($\gamma = 1.018^{2.5}$), which corresponds to the average growth rate of real GDP per capita in the U.S. during the period 1950-2003.[32]

The parameters governing the returns to experience in the labor market determine the steepness of age-wage profiles, both in the cross section and over the life cycle. To calibrate the experience accumulation function, we estimate an earnings equation for men using data from the 1940 census. The earnings equation contains linear and quadratic terms in experience, and we choose the $\eta_{m,j}$ parameters to match the empirical estimate of the return to experience. The resulting parameter values are given by:

$$\eta_{m,j} = \exp(0.125 - 0.00053(12.5j - 6.25)) - 1.$$

We also assume that the return to experience for women and men is the same, $\eta_{f,j} = \eta_{m,j}$ for all j. We then choose the return to age ν such that in the pre-war balanced growth path, at age 32.5 the productivity of working women is larger by a factor of 1.42 than at age 20. This factor is obtained by estimating an earnings function for women and predicting women's wages at ages 20 and 32.5. The return parameter matches this ratio by setting the slowdown in experience accumulation when women leave the labor force for childbearing. The procedure yields a return to age (per model period) of $\nu = 0.003$ (thus, the return to age is close to zero).[33]

The child cost parameters are chosen such that the average private cost of a child (which in the model consists of forgone female earnings) amounts to 40 percent of GDP per capita in the balanced growth path, thus matching the estimate by Haveman and Wolfe (1995) of the total private cost of a child in the United States.[34] The curvature parameter in the child cost function ψ (which determines the returns to scale to having children) and the additional costs of young children κ_j are estimated from U.S. time-use data (see Appendix A.4 for details). We assume that the cost κ_j increases once women reach age 32.5, where the increase is chosen to match the observed difference in fertility in 1940 between women in their late twenties and women in their early thirties. Given other parameters, the overall cost of children is matched to its target by setting the level parameter of the child cost function to $\phi = 0.417$. Fecundity (the probability of conceiving a child conditional on trying) is assumed to be unimpaired until age 32.5, hence $f_j = 1$

[32]Data from Penn World Table Mk. 6.2, see Heston, Summers, and Aten (2006).

[33]Further details on the calibration of the accumulation of experience are provided in Appendix A.3.

[34]This approach to calibrating the cost of children has been previously used by Doepke (2004) and Lagerlöf (2006), among others.

for $j \leq 4$ (the first period of adulthood is $j = 0$, so that $j = 4$ corresponds to ages 30–32.5). For ages 32.5–35 and 35–37.5, we set $f_5 = 0.75$ and $f_6 = 0.5$, based on the rates of impaired fecundity by age reported in Table 4 of Menken, Trussell, and Larsen (1986) (see Appendix A.6).

Turning to preferences, we impose a uniform distribution for the taste for leisure σ_x in the population. The distribution of σ_x together with the fertility weight in utility σ_n determine female labor force participation, the level of fertility, and the elasticity of the fertility reaction to the war shock. Intuitively, fertility decisions are discrete and take place on the extensive margin. Women with different numbers of children are distinguished by their σ_x, and the density of the distribution for σ_x around the cutoffs between women with different numbers of children determines how elastic fertility is in the aggregate. We choose these parameters to match three targets. First, we set the labor force participation rate of married women aged 33–60 in the pre-war balanced growth path to 13 percent, the observed value for the United States in 1940.[35] Second, we target a completed fertility rate of 2.4 in the pre-war steady state, which matches the completed fertility rate of women born between 1911 and 1915, who were in their prime fertility years (average age 27) in 1940. We match a completed fertility rate rather than the total fertility rate because total fertility rates are sensitive to changes in the timing of births. Third, we choose the distribution of σ_x to match the empirical evidence in Section 2. Specifically, regression (5) in Table 2 (which includes education and farm controls) yields an estimate of 0.665 of the impact of the state mobilization rate on the number of children under age 5 in 1960 (using the more conservative assignment of mobility by state of residence).[36] We compute an analogous statistic in our model by comparing the average number of children under age 5 in 1960 in two different scenarios, one in which we match the actual mobilization rate during the war, and a counterfactual simulation in which we set the mobilization rate during the war to zero, while keeping everything else the same.[37] The model-implied regression coefficient is the fertility difference between the war scenario and counterfactual scenario, divided by the mobilization rate. However, one concern about this procedure is that the number of children under age 5 is a measure of period

[35]Data from the 1940 U.S. Census, see Appendix A.2 for details.

[36]Including education and farm controls is appropriate, given that these factors are not modeled and we do not want to pick up potentially different trends across education and occupation groups. In contrast, entry into marriage is closely related to entry into childbearing, which is endogenous in the model. The model therefore suggests that marital status controls should not be included.

[37]The counterfactual simulation still includes all fiscal changes related to the war. The fiscal changes do not vary at the state level and are therefore not picked up by cross-state regressions, so that the fiscal side needs to be held constant in the simulations as well.

fertility. We know that empirically, period fertility increased by much more than cohort fertility during the baby boom, due to a change in the timing of births. Given that the timing of births is nearly constant in our model, it is appropriate to target the smaller change in cohort fertility. We therefore divide the target for the reaction in fertility by the ratio of the increase in total fertility to cohort fertility during the baby boom, resulting in a more conservative parameterization with smaller changes in fertility.[38] This procedure yields upper and lower bounds for the distribution of leisure taste of $\min(\sigma_x) = 1.135$ and $\max(\sigma_x) = 1.589$. The distribution of leisure taste also pins down the distribution of family sizes. This statistic was not explicitly targeted (which would require a more general distribution than uniform), but reassuringly the implications of the calibrated model are broadly realistic in this dimension also.[39]

Before the war, income taxes and government debt were low. From 1932 to 1940, the tax rate for the lowest bracket of the federal income tax was 4 percent, and the next-higher bracket applied at more than triple the average household income.[40] Consequently, we set the labor income tax to 4 percent in the pre-war steady state and set government debt to zero. During the war, taxes rapidly increased and remained high subsequently. The marginal tax rate for average-income households reached 22 percent in 1943, and moved between 20 and 25 percent from 1944 to 1964.[41] We model this change as a permanent jump (starting from the war period) in the marginal tax on labor income to 22 percent, which is the average marginal tax at average income from 1943 to 1960. Unlike labor taxes, capital taxes were already fairly high before World War II. For simplicity, we set capital taxes to be constant throughout. The level is chosen such that revenue from capital taxes matches the total revenue from the corporate income tax, a proportionate share of individual income tax (based on the share of capital income in total income), and federal excise taxes to GDP from 1950 to 1960.[42] This procedure results in a tax rate

[38]Cohort fertility increased by 0.93 from 1910 to the peak in 1932, whereas the total fertility rate increased by 1.37 from 1940 to 1957. We therefore divide the target by $1.37/0.93 = 1.47$.

[39]In the balanced growth path of the model, 13 percent of families have one child, 34 percent have two children, and 53 percent have three children. In the data for the 1911–1915 birth cohorts, among women with children 23 percent have one child, 31 percent have two children, and 46 percent have three or more children.

[40]For data on average household income we rely on Piketty and Saez (2007).

[41]These rates are based on combining average household income from Piketty and Saez (2007) with tax bracket information from "Federal Individual Income Tax Rates History, Nominal Dollars, Income Years 1913-2013," published by the Tax Foundation and available online at: http://taxfoundation.org/sites/taxfoundation.org/files/docs/fed_individual_rate_history_nominal.pdf (retrieved on 2/5/2015), assuming filing status "married, filing jointly."

[42]An alternative to matching actual tax rates and tax revenue is to follow McGrattan and Ohanian (2010) and rely on the estimates of Joines (1981) of effective marginal taxes. Results would be broadly similar,

of $\tau_k = 0.45$.[43]

The increase in government spending during the war is financed partially through government debt that is repaid after the war. Government debt matters for our analysis through the fiscal burden it presents during the baby boom period. To this end, we set the level of government debt to match the amount of interest payments on government debt to data. From 1946 to 1960, interest on government debt averaged 1.5 percent of GDP, with little variation from year to year. Consequently, we assume that after the war shock, the economy converges to a new balanced growth path with a constant debt/GDP ratio and a ratio of interest payments to GDP of 1.5 percent. During the transition to the balanced growth path, government debt is assumed to increase at the trend growth rate of total GDP from year to year. This procedure implies the amount of government debt outstanding at the end of the war.

We next turn to government spending G_t. For the pre-war balanced growth path, we set government spending to balance the government budget given tax revenue in the absence of government debt. During the war period, we set G_t to 44.5 percent of GDP, which corresponds to the average of government expenditures as a fraction of GDP for the period 1943 to 1945. To close the government budget constraint during the war period, we allow the government to levy a one-time lump-sum tax, which amounts to 10.9 percent of GDP.[44] Government spending dropped rapidly right after the war, and remained around 20 percent of GDP until the 1970s. We assume that after the war the economy converges to a balanced growth path in which government spending is at 19.9 percent of GDP, which is the average spending/GDP ratio from 1950 to 1960 in the data. The exemption level ξ_t for labor income is set to zero for the pre-war balanced growth path, and for the post-war balanced growth path we choose ξ_t to balance the government budget given the other assumptions on taxes, spending, and debt.[45] This

with the main difference that Joines' estimates of marginal capital taxes are about 10 percentage points higher than our estimate for the post-war period. However, given our focus on fertility behavior, we are more interested in matching tax rates faced by average households as opposed to average owners of capital (who are rich), so that we use numbers that are not driven by tax rates in high income brackets faced by a small number of taxpayers.

[43]Data from "Budget of the United States Government, Fiscal Year 2012," Government Printing Office.

[44]The lump sum tax is equal to zero in all other periods. An alternative way to close the government budget constraint (pursued by Siu 2008) is to allow for an even higher level of government debt, part of which is then removed through surprise inflation right after the war. Since a surprise inflation has similar effects to a lump-sum tax, we opted for the simpler modeling option.

[45]This is almost equivalent to the procedure in McGrattan and Ohanian (2010), who balance the budget with a lump-sum rebate, except that the exemption does not benefit retired households without labor income.

exemption level amounts to 17.5 percent of average income. During the transition to the balanced growth path, the exemption level grows at the trend growth rate. We adjust the level of government spending period-by-period during the transition to balance the government budget. The resulting fluctuations in spending are small, with the spending varying between 19.9 and and 20.9 percent of GDP.

The remaining elements of the war shock are the mobilization of male soldiers and the patriotism shock. Given that a model corresponds to 2.5 years (see Section 4.2 below) and that mass mobilization did not start before 1943, we assume that the war lasts for a single period. During the war period, L_t^D is set to 30 percent of the total male labor force, which matches the actual male mobilization rate during the final years of the war.[46] Hence, the male labor input in the production function drops by 30 percent during the war. The patriotism shock $\bar{x}^W$ (which lowers the disutility of labor for women entering the labor force during the war) and the fixed cost $\bar{z}$ for reentering the labor market govern the increase in female participation during the war and the persistence of the increase in female labor supply after the war. We choose $\bar{x}^W$ to match an overall female labor force participation rate of 34 percent in the war period (Acemoglu, Autor, and Lyle 2004), which yields $\bar{x}^W = 1.25$. Once $\bar{z}$ is set above a certain threshold, the majority of women who enter the labor force during the war continue working after the war, given that the fixed cost for entry has already been paid. It turns out that different values for $\bar{z}$ above the threshold lead to similar predictions (provided that σ_n and the distribution of σ_x are adjusted accordingly to match the targets for fertility and overall female labor supply). For simplicity we set $\bar{z} = \bar{x}^W$.[47] The calibrated parameter values are summarized in Table 6 in the appendix.

4.3 The Impact of the War on Post-War Fertility

We are now ready to describe the impact of the war shock on the post-war economy in our calibrated model. Even though the war shock lasts for only one period, it has long-term consequences. One reason is the rise in government debt during the war and the related shift to higher tax rates. The second reason for long-term effects is persistence in female labor supply. For the most part, the war draws older women into the labor force (the youngest women are working anyway, and women who are currently having children are less willing to enter). Once they have paid the fixed cost of entering the

[46]See Appendix A.5 for details.

[47]This value implies that for households where the wife re-enters the labor market, the fixed cost on average amounts to 58 percent of labor income in that period.

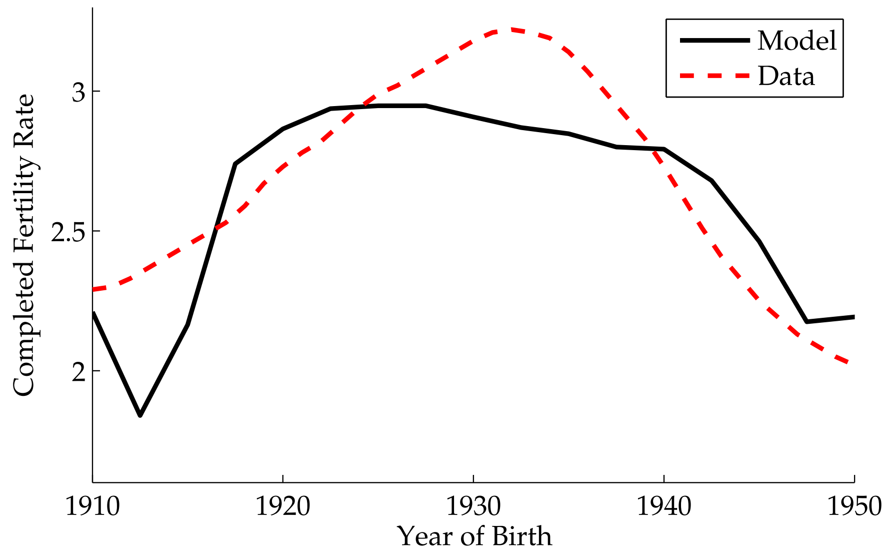

Figure 7: Completed Fertility Rate by Birth Cohort (i.e., by Birth Year of Mother), Model versus Data

labor market, many of these women choose to keep working after the war. This increases the ratio of female to male labor supply, and depresses female wages. It is this decline in the relative female wage after the war that is responsible for most of the war shock's long-term effects.

Figure 7 displays the response of the cohort fertility rate to the war shock in the model. Some women born around 1915 start to work during the war rather than have another child, resulting in low fertility for the cohort. Fertility rises, however, for the subsequent cohorts. The women born between about 1920 and 1940 begin childbearing after the war, while also facing increased labor market competition from the older war-generation of women. Among the younger women, many decide to leave the labor market earlier in order to have another child, resulting in higher cohort fertility. In essence, the experienced war generation crowds out younger women from the labor market. In the model simulation, cohort fertility peaks at 2.95, compared to a peak of 3.22 in the U.S. data. Thus, the model accounts for most of the increase in cohort fertility during the baby boom period. The model also accounts for the baby bust. By the time women born in the mid to late 1940s enter the labor market, most of the war generation of women have retired, relieving the pressure on the female labor market. As a consequence, these women work more and have fewer children, bringing a drop in cohort fertility that closely matches the data.

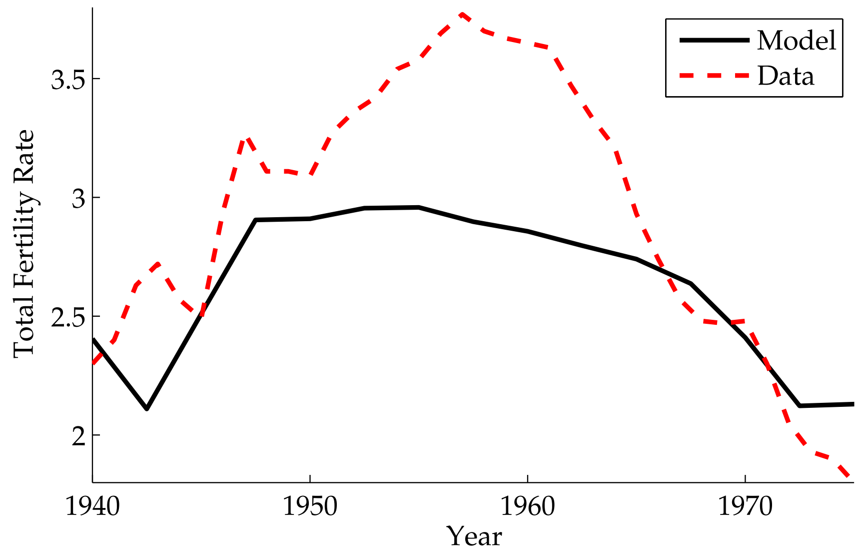

Figure 8: Total Fertility Rate, Model versus Data

The main deviation between model and data is that the model predicts a decline in cohort fertility for the women whose main childbearing years coincide with the war, whereas this dip is not observed in the data. This deviation is likely related to the simplifying assumption of a fixed spacing of births, which makes it more difficult for women who deferred childbearing during the war to make up for the missing babies right after the war. The timing of births is more flexible in reality, leading to a smoother evolution of cohort fertility rates.[48]

As Figure 8 shows, the model explains a comparatively smaller fraction of the increase in the total fertility rate, which rises to a maximum of 3.8 in the data. The deviation between the patterns for total fertility and cohort fertility is due to changes in the timing of births. In particular, in the mid-1950s older cohorts of women were having children late while younger women were having them early, resulting in total fertility rates much higher than the lifetime fertility rates of any given cohort. Since our model does not capture these shifts in the timing of births, it cannot account for the larger increase in the total fertility rate. Nevertheless, the model is able to generate a sizeable increase in

[48]That a postponement of childbearing actually happened can be gleaned from differences in the evolution of cohort fertility and period fertility. Cohort fertility evolves smoothly and does not show a dip for the war generation. In contrast, period fertility (i.e., the total fertility rate) drops markedly during the war, and then rises sharply right afterwards, with an increase of 0.8 between 1944 and 1947. This pattern is consistent with a temporary postponement of fertility during the war, with little immediate effect on cohort fertility.

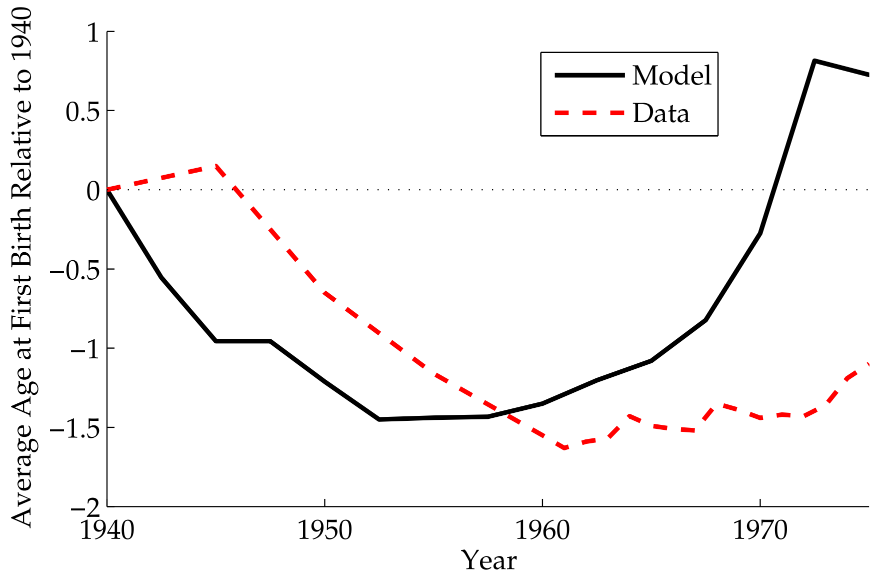

Figure 9: Average Age at First Birth, Deviation from 1940, Model versus Data

total fertility and matches the timing of the rise and fall of fertility rather well.

The increase in fertility predicted by our model is generated by a specific mechanism: younger women who did not work during the war are crowded out of the labor market, and decide to start having children at a younger age. We can evaluate this mechanism by comparing changes in the average age at first birth between model and data, which we do in Figure 9. In both model and data, the average age at first birth drops substantially during the baby boom period, and then recovers. The initial decline proceeds more quickly in the model, mirroring the faster rise in fertility compared to the data, but the size of the reduction in the age at first birth is almost identical between model and data. These results suggest that the mechanism for fertility reduction captured by the model is indeed empirically relevant, and that the model captures most of the increase in fertility that is generated by this channel.

4.4 Implications for the Female Labor Market

In our theory, the increase in fertility during the baby boom is driven by changes in the female labor market. It is therefore important to check that the model matches the data in this dimension, too. Figure 10 displays labor force participation rates for women aged 20–32 (the prime child-bearing years) throughout the transition after the war shock. Even though changes in labor supply are not pinned down by the calibration

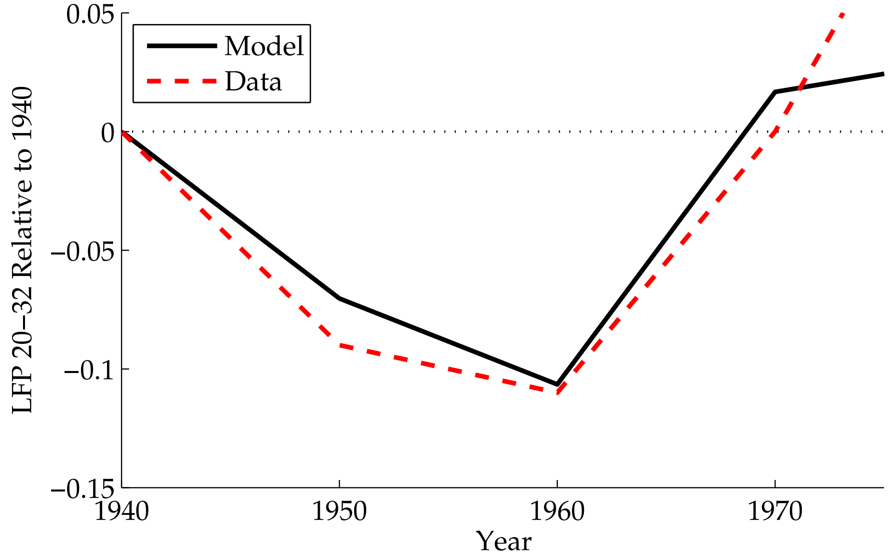

Figure 10: Labor Force Participation Rate of Women aged 20–32, Deviation from 1940, Model versus Data

procedure, the model matches the data remarkably well. For 1950, the decline in young female labor supply is slightly smaller in the model than in the data, and for 1960 the match is almost exact.

We can also compare our simulations to the data on labor market flows provided by Goldin (1991). Goldin uses the Palmer Survey, which consists of retrospective work histories for 4,350 women employed in 1951. These data are combined with CPS data to measure the flows of women into and out of the labor force from before World War II to during and after the war. For evaluating the realism of our mechanism, the most important statistic documented by Goldin is that in 1951, World War II entrants made up 25.6 percent of the female labor force, whereas the remaining three-quarters entered either before or after the war. Our baseline simulation matches this number (although it was not targeted) closely, with a fraction of 22.8 percent. Goldin also points out that more than half of wartime entrants left the labor force before 1951, which again is true in our simulations .[49]

[49] At first sight, it may appear surprising that our model implies large labor market effects even though most wartime entrants soon leave the labor force. However, these results are to be expected given the structure of the female labor market at the time. First, many of the wartime entrants were young, and then left as they started to have children. Second, men returned from the war and increased competition in the labor market, pushing out some older women as well. Both effects can be seen in Goldin's data, and both are present in our model. Nevertheless, a 25 percent share of wartime entrants in the 1951 female labor market presents a large deviation from the pre-war benchmark, and is consistent with a

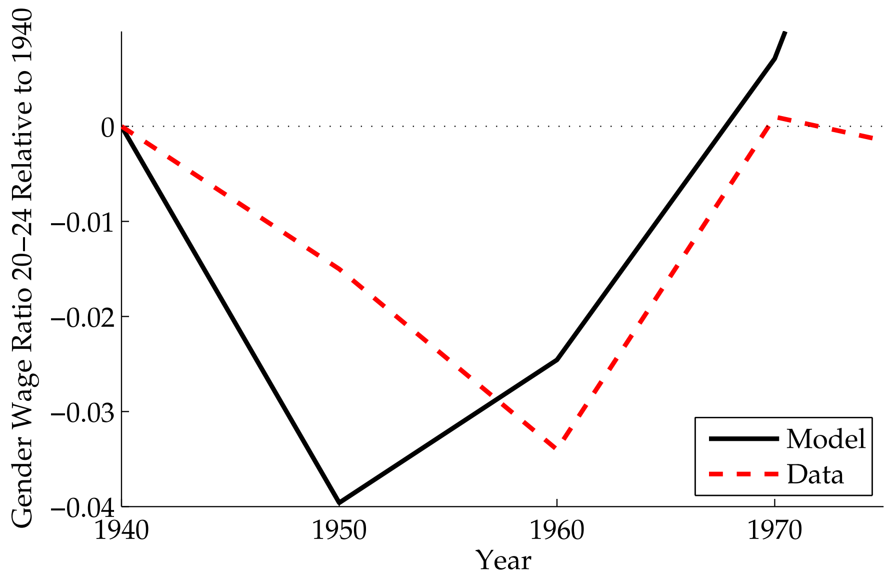

Figure 11: Ratio of Average Female to Average Male Wage for Singles aged 20–24, Deviation from 1940, Model versus Data

In the model, the changes in labor supply and fertility are ultimately driven by changes in the wages paid to young women. For the results to be plausible, it is important that the model does not overstate the wage implications of the rise of female employment. Figure 11 displays the average wage of young women (20–24) in the model as a fraction of the average wage of men in the same age group. Since these women are permanently employed, there is no variation in average labor market experience in this group over time, so that variations in the wage are entirely due to changes in the wage per efficiency unit of female labor. The change in relative female wages in the model is close to what we observe in the data.[50] However, the timing is somewhat different, with the model generating a larger drop in relative wages in 1950 compared to 1960; the opposite pattern is observed in the data.[51]

One potential explanation for the different timing in relative wage changes is that in the real world additional factors moved relative female wages, such as gender-biased technological change. Our theory suggests that these other factors also should have an

large, sustained impact on the female labor market and fertility.

[50]Notice that female wages decline only in relative, but not in absolute terms: sustained productivity growth implies that average wages rise for both men and women.

[51]It may be the case that the data understate the true decline in the relative female efficiency wage between 1940 and 1950, because the average education of women increased relative to men during this period. Selection issues may also be present, but are unlikely to be a major problem because (in the data) we focus on the wages of single men and women aged 20–24, the vast majority of whom were working.

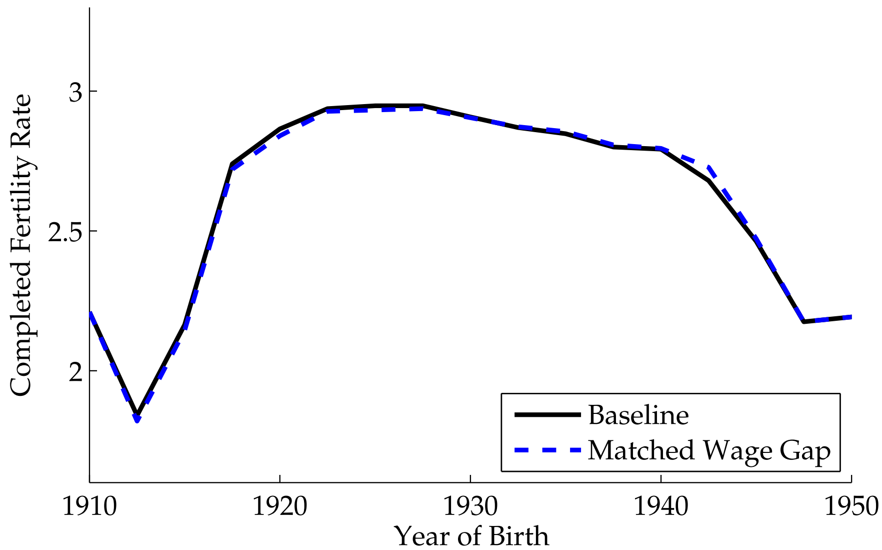

Figure 12: Completed Fertility Rate by Birth Cohort (i.e., by Birth Year of Mother), Baseline versus Matched Wages

impact on fertility rates. As a consequence, one may wonder how well our predictions for fertility would hold up if we incorporated other sources of shifting relative wages in the theory. Figure 12 answers this question. We compare the fertility predictions of the baseline model with an alternative model in which we allow θ, the relative weight of female labor in the production function, to vary over time. Specifically, we choose the time path for θ such that the changes in relative female wages from 1940 to 1950, 1960, and 1970 are matched exactly (i.e., in Figure 11 model and data would coincide), with a linearly interpolated path within each decade. Perhaps surprisingly, the fertility predictions of the baseline case and the matched-wages simulation are almost identical, with the main difference being a slightly higher fertility rate in the matched-wages case for cohorts who have their babies around 1960. This difference arises because in the data, relative female wages in 1960 are lower compared to our baseline simulation. In principle, one would expect that the higher relative female wages in 1950 would lead to lower fertility compared to the baseline for earlier cohorts. However, this effect remains small due to the discrete nature of fertility. Most women in these cohorts are having three children, and only few women are close to being indifferent between having two and three. While the higher relative wages in the matched-wages simulation generally imply lower fertility, for most women the difference in wages is not big enough to change this decision.

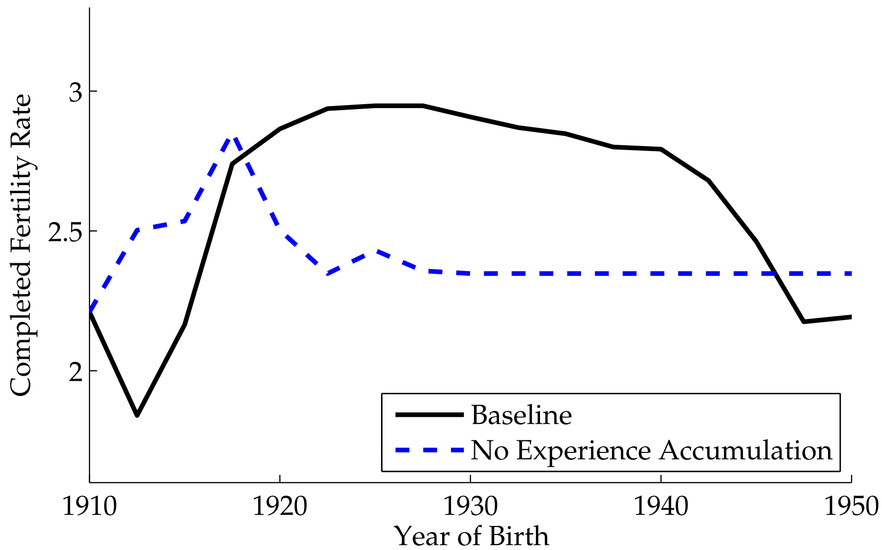

Figure 13: Completed Fertility Rate by Birth Cohort (i.e., by Birth Year of Mother), Baseline versus Fixed Experience

The model incorporates two features that make the impact of the war on the female labor market persistent. First, there is a fixed cost for labor market reentry. This is a crucial feature; without the fixed cost, joining the labor force during the war would have a small effect on future labor supply, and thus there would be no prolonged repercussions for labor force participation and fertility. The second feature that contributes to persistence is the endogenous accumulation of work experience. Once women join the labor force, they accumulate additional human capital, which further increases their incentives for continued employment in the future. Figure 13 demonstrates that endogenous experience is also essential for our results. Here we show the evolution of fertility for a counterfactual simulation where the endogenous accumulation of experience is shut down, i.e., women's human capital at every age is what it would have been in the original balanced growth path, rather than increasing with the length of employment. The figure shows that the model without endogenous experience does generate a baby boom, but this baby boom is smaller and lasts only for a few years, compared to decades in the baseline model. Thus, to explain the duration of the baby boom, allowing for endogenous work experience is a crucial feature of the model. This finding is consistent with a recent literature that emphasizes the importance of human capital accumulation through work experience for explaining female labor supply in the decades after the baby boom; see Olivetti (2006), Attanasio, Low, and Sanchez-Marcos (2008), and Guner,

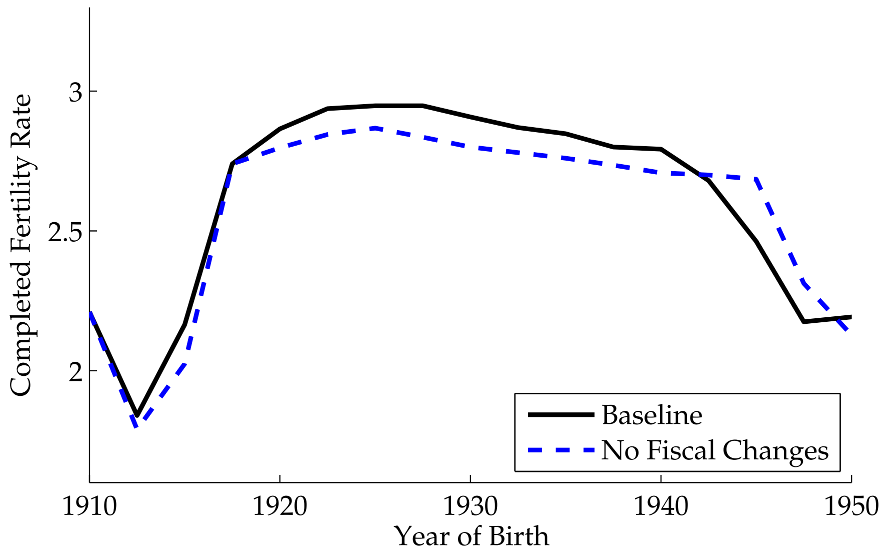

Figure 14: Completed Fertility Rate by Birth Cohort (i.e., by Birth Year of Mother), Baseline versus No Fiscal Changes

Kaygusuz, and Ventura (2012).

4.5 The Labor Supply Channel versus the Fiscal Channel

In our analysis there are two principal channels through which the war affects fertility in the post-war period. First, there is the labor market channel, i.e., the war generation of women continues to work after the war, which creates pressure on the female labor market. The second is the fiscal channel. War expenditures lead to the issuance of government debt and higher taxes in the post-war period. Notice that the empirical results in Section 2 speak only to channels that vary at the state level. These do not include fertility changes that stem from higher federal income taxes.

Our model can help decompose the changes in fertility into those generated by the fiscal channel and those generated by the labor market channel. To this end, Figure 14 compares the fertility predictions of the baseline simulation to a counterfactual simulation that removes all fiscal changes. More precisely, in this alternative simulation there is no change in taxes, no rise in general government spending, and no issuance of government debt during or after the war. However, the labor market consequences of the war (mobilization and the patriotism shock, which increase female labor supply) are still present. Given that in this simulation the war does not have permanent effects, the economy ultimately converges back to the pre-war balanced growth path. We can interpret the results of this simulation as the implications of the labor market channel alone, whereas the gap between the baseline simulation and the simulation without fiscal shocks represents what is generated by the fiscal consequences of the war.

The results suggest that both the labor market channel and the fiscal channel contribute to the size of the baby boom, but that the contribution of the labor market channel is quantitatively much more important. At the height of the baby boom, fertility is higher by about 0.1 in the baseline simulation (with both the labor market channel and the fiscal channel) compared to the simulation with the labor market channel only. Relative to a pre-shock fertility rate of 2.4, the labor market channel accounts for about 80 percent of the maximum rise in fertility, with the remaining 20 percent due to the fiscal channel. The intuition for this finding is that the rise in taxation after the war generates offsetting income and substitution effects of similar size. In fact, given that the model is consistent with balanced growth, a proportional income tax would generate exactly offsetting effects and have no impact on fertility at all. The reason why we are picking up at least some impact on fertility is that the exemption level for labor income drives a wedge between the marginal and the average tax rates. However, given that postwar marginal tax rates were still fairly moderate, this wedge does not lead to a large reaction in fertility.[52]

5 International Evidence: Allied versus Neutral Countries in World War II

We now turn to international evidence to assess the empirical relevance of our mechanism from a different perspective. Many industrialized countries experienced a baby boom after World War II, but only some also underwent a substantial mobilization of female labor during the war. Our theory predicts that countries with larger wartime increases in the female labor force should experience larger baby booms. We assess this prediction by comparing the baby boom in two sets of countries: the Allied countries that, like the United States, did not fight on their own soil (Australia, Canada, and New Zealand), and the major European countries that remained neutral in the war (Ireland,

[52] Zhao (2014) points at the increase in income taxes after the war to pay down debt as an important cause of the baby boom. In particular, he argues that higher taxes lowered the opportunity cost of child-rearing and therefore increased fertility. In our model, the proportional changes in taxes that Zhao focuses on do not affect fertility because of balanced-growth preferences. We use balanced-growth preferences to be consistent with the observation of roughly constant labor supply per capita in the post-war period. Moreover, the fiscal channel alone cannot explain the baby bust, given that taxes did not come down after the peak of the baby boom.

Portugal, Spain, Sweden, and Switzerland).[53] The results confirm our hypothesis. The Allied countries mobilized a substantial fraction of working-age men for the war, which resulted in a large increase in female labor force participation. Subsequently, all of the Allied countries experienced baby booms and baby busts that are remarkably similar to those of the United States. In contrast, in the neutral countries the war did not mark a watershed for female labor force participation, and the post-war baby boom was of a much smaller magnitude than in the Allied countries. In what follows, we present more detailed information on the involvement of these two groups of countries in the war and their subsequent fertility experience.

Australia joined the war on September 3, 1939, the same day Britain and France declared war on Germany. In September 1939, only 14,903 men were enlisted in the Royal Australian Navy, the Australian Military Forces, and the Royal Australian Air Force. Enlistment grew rapidly, however. By November 1941, 364,874 men were enlisted, and within less than a year the size of the armed forces nearly doubled to 634,645 in August 1942. During the years 1942–1945, between 23 and 27 percent of all males age 15–64 were serving in the armed forces.[54] New Zealand joined the war on the same day Australia did. In September 1939, 20,806 men were serving, but this number grew rapidly to a peak of 154,549 in July 1942. During the years 1942–1944, between 30 and 37 percent of all males age 20–59 were serving in the armed forces.[55] Canada joined the war seven days after Australia and New Zealand. At that time, only 9,000 individuals were in the armed services. By 1941 enlistment had reached 296,000, and the peak was reached in 1944 with 779,000 men under arms. At this time, nearly 19 percent of all males age 15-64 were serving in the armed forces.[56]

As in the United States, the mobilization of men led to a large increase in female employment during the war, with active encouragement by government campaigns (see Illustration 2). For the generation of women old enough to work during the war, the increase in labor force participation persisted in the following decades. For example, in Canada the labor force participation of women aged 35–64 increased by more than 30 percent between 1941 and 1951 and by another 50 percent between 1951 and 1961. In contrast, the participation rate of women aged 25–34 in 1951 was down nearly 10 per-

[53] Australia was subject to some aerial bombing and naval shelling, but destruction was on a much smaller scale than in the United Kingdom.

[54] Authors' calculation using series WR24, POP211 and POP274 in Vampley (1987).

[55] Authors' calculation using Tables II.4 and VIII.17 in Bloomfield (1984).

[56] Authors' calculation using series A32-A41 and C48 in Urquhart and Buckley (1965).

Illustration 2: Australian Government World War II Recruitment Poster

cent compared to 1941, and by 1961 it exceeded the 1941 level by merely 5 percent.[57] This pattern closely resembles our findings for the United States.

The fertility dynamics in the Allied countries in the post-war period display a striking resemblance to the United States. Figure 15 displays the completed fertility rate in the United States, Canada, Australia, and New Zealand for women born between 1910 and 1960.[58] In all four countries, the completed fertility rate increased steadily from the cohorts born in the 1910s to those born in the early 1930s. Subsequently, completed fertility declined in all four countries. In the United States and Australia, the completed fertility rate peaks for women born in 1932. In Canada the peak is reached with the 1931 birth cohort, and in New Zealand with the 1930 cohort. The similarity of the fertility experience of these countries lies not only in the timing but also in the magnitude of the baby boom. Measured as the absolute difference between the completed fertility rate of women born in 1913 and women born in the early 1930s, the size of the baby boom equals 0.8 in the United States and New Zealand, 0.79 in Australia, and 0.48 in Canada.

[57]Source: Historical Estimates of the Canadian Labour Force, 1961 Census Monograph, Statistics Canada, Catalogue 99-549. The data for New Zealand and Australia are less detailed. For Australia, Beaton (1982) reports that the total number of employed women during the war rose by nearly 200,000 between 1939 and 1943, and while it had dropped by nearly 70,000 from that peak by 1946, by 1948 the total number of employed women had risen above the 1943 peak by 4000.

[58]Data on completed fertility rates were kindly provided by Jean-Paul Sardon of the Observatoire Démographique Européen, which maintains a database on fertility in Europe. Some of these data are published in Sardon (1990) and Sardon (2006).

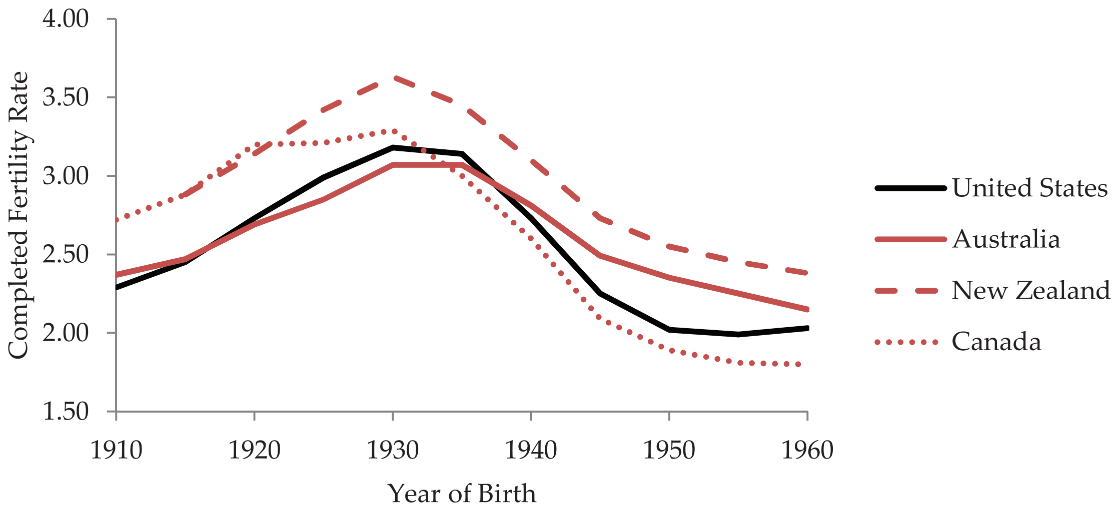

Figure 15: Completed Fertility Rate by Birth Cohort in Australia, Canada, New Zealand, and the United States

Five major European countries remained officially neutral in World War II: Ireland, Portugal, Spain, Sweden, and Switzerland. While there was some wartime mobilization even in these countries (particularly in Switzerland), these countries did not experience a substantial increase in female employment during the war.[59] Our mechanism for the baby boom therefore does not apply to these countries, and consequently we would expect to observe smaller post-war baby booms (which must then be due to other mechanisms). Figure 16 shows the completed fertility rate in the five neutral countries in comparison to the United States. The figure shows that Portugal did not experience any baby boom at all. In Ireland there is a small rise in fertility between the 1910 and 1925 cohorts, but both the initial rise and the subsequent decline are more gradual than in the United States, without a sharp boom-bust pattern. Fertility also went up in Spain, Sweden, and Switzerland, but again much less so than in the United States. Among the neutral countries, Ireland experienced the largest increase in fertility, but even here the size of the baby boom (in terms of the increase in the completed fertility rate) is only 0.3, less than half of the increase in the United States.

We focus on neutral countries as the control group because the other major industrialized countries at the time (Italy, Japan, France, Germany, and the United Kingdom) all experienced massive wartime destruction and loss of life, which are likely to have had a major impact on subsequent fertility. For what it's worth, we can report that post-war

[59]Nor did female participation rise quickly after the war. For example, Sweden and Switzerland do not show any marked increase in the female labor force participation rate between 1940 and 1960.

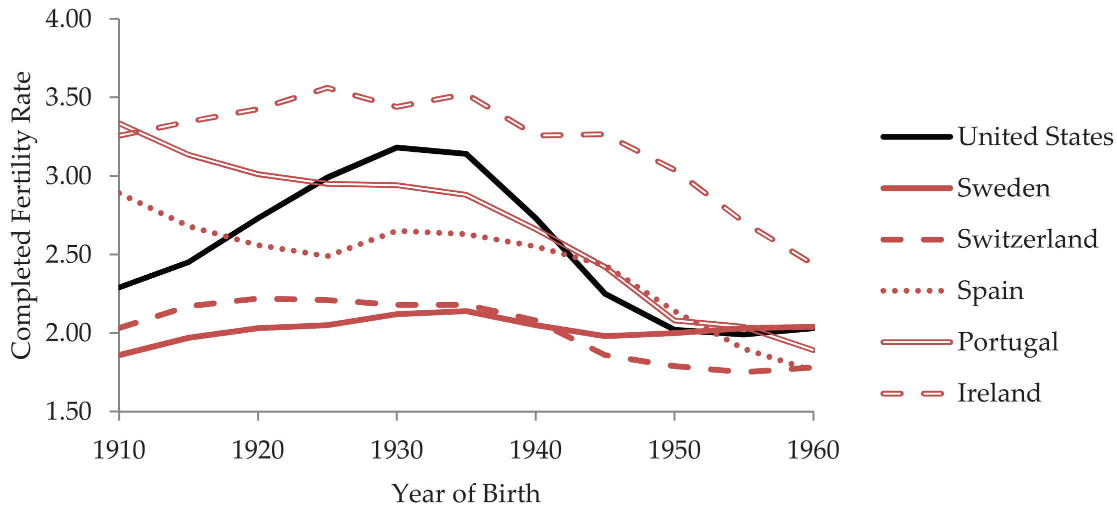

Figure 16: Completed Fertility Rate by Birth Cohort in Ireland, Portugal, Spain, Sweden, Switzerland, and the United States

fertility in these countries does not display the pronounced baby boom and baby bust observed in the United States and the other Allies. In Japan, fertility recovered right after the war, but then dropped sharply from the early 1950s. The European countries experienced baby booms that were substantially smaller and occurred substantially later than in the United States, with peak total fertility rates between 2.6 and 2.9 in 1964 (in the United States, the peak of the baby boom was in 1957 with a fertility rate of 3.8). In terms of female labor force participation, only the United Kingdom saw widespread female employment during the war and rising overall female participation afterwards.[60] We conjecture that the much larger loss of capital and life explains the difference in post-war fertility regimes between the United Kingdom and the other Anglo-Saxon Allies.

In our international comparison, we focus on cohort fertility rates because these correspond most closely to the predictions of our model. However, an analysis in terms of period fertility (using total fertility rates) leads to the same results.[61] A full comparison of Allied and neutral countries in terms of total fertility rates is provided in the online

[60]The Axis countries promoted traditional role models and relied much less on female labor.

[61]Greenwood, Seshadri, and Vandenbroucke (2005) also consider the international data and, unlike us, argue that Ireland, Sweden, and Switzerland experienced large baby booms. However, Greenwood et al. use birth rates to measure fertility. Compared to cohort fertility or total fertility rates, birth rates are a less informative measure because they depend on the age structure of the population. Specifically, ceteris paribus birth rates are high when the ratio of women of child-bearing age to total population is high, which, in turn, depends on past fertility and mortality. In addition, Greenwood et al. measure of the size of the baby boom as the area under the birth rate series for a flexibly defined beginning and ending of the baby boom period, which in many cases starts before and ends well after the post-war period that we consider.

appendix. In sum, regardless of the fertility measure employed, the international evidence suggests that our mechanism is quantitatively important for explaining the baby boom and baby bust of the 1950s and the 1960s. Allied countries that were shielded from wartime destruction experienced large baby booms that are remarkably similar in terms of timing and magnitude, while baby booms in the neutral countries were small or non-existent.

6 What Is Missing from the Picture?

While we argue that World War II can explain a large portion of the rise and fall of fertility during the baby boom and baby bust, our account is still incomplete. In this section, we address what our model leaves out, and discuss the extent to which mechanisms proposed in the existing literature, or alternatively new amplification mechanisms, might help close the gap.

There are two aspects to what's missing in our model, relating to the timing of changes in fertility and to which women, precisely, were having babies. In terms of timing, in the United States we observe a rise in fertility that pre-dates the post-war baby boom, starting in the late 1930s and ending during the war. Similarly, some of the neutral countries (in particular Sweden and Switzerland) experienced rising fertility in the first half of the 1940s. While our theory addresses precisely the so-called baby boom (the U.S. Bureau of the Census defines a "baby boomer" as a person born between 1946 and 1964), it is important to know whether the forces that drove the earlier rise in fertility were present also during the main phase of the baby boom.

As for exactly who was having babies, our theory focuses on the specific dimension of an earlier entry into childbearing that is associated with leaving the labor force. While empirically the shift towards earlier motherhood explains most of the baby boom, it does not account for all of it: fertility also increased at older ages and for mothers who stayed in the labor force.

We would like to consider whether mechanisms proposed in the existing literature may help account for these deviations. The perhaps most widely known existing explanation for the baby boom is Easterlin's (1961) relative income hypothesis.[62] Easterlin postulates

[62] Also well known is what might be termed the "catch-up fertility" hypothesis, i.e., the idea that fertility rates rose after the war because couples were making up for babies they were not able to have during the war. However, while this mechanism probably contributed to the spike in fertility in 1946 and 1947, the literature has long recognized that it cannot explain the main phase of the baby boom in the 1950s. Most

that fertility decisions are driven by the gap between couples' actual and expected material well-being. Applying this theory to the U.S. baby boom, Easterlin argues that people who grew up during the Great Depression had low material aspirations. Overwhelmed by the prosperity of the post-war years, they increased their demand for children.

A general difficulty with the Easterlin hypothesis is that there is no obvious way to quantify the magnitude of the effect. Empirical studies of the hypothesis have found mixed results (Macunovich 1998). A more specific shortcoming is that the timing is not quite right for explaining the peak of the baby boom in the 1950s.[63] As we documented above, much of the baby boom was accounted for by young mothers aged 20–24. During the baby boom fertility peaked in 1957. Mothers who were 20–24 years old in 1957 were born between 1933 and 1937, and hence spent much of their childhood and adolescence during the prosperous post-war period. In contrast, a contribution of the relative-income mechanism to the recovery in fertility right after the Great Depression appears more plausible.

A related possibility is that the state of the economy has an immediate impact on fertility, rather than working with a lag as in Easterlin's hypothesis. Along these lines, Jones and Schoonbroodt (2014) argue that economic shocks like the Great Depression can have large effects on fertility behavior, potentially explaining a significant fraction of the large drop in fertility in the early 1930s. The notion that the rise in fertility in the late 1930s and early 1940s was due to the recovery from the Great Depression is consistent with the observation (see Section 5) that most countries affected by the depression subsequently experienced some recovery in fertility, whereas only the countries with a sizeable mobilization of the female labor force during the war (where our mechanism operates) experienced a much larger additional increase in fertility in the post-war period.

Another potential explanation for the early rise in fertility is the household-technology hypothesis of Greenwood, Seshadri, and Vandenbroucke (2005). They argue that the widespread diffusion of appliances such as refrigerators, washers, dishwashers, and electric stoves enabled women to run their households in less time than before, which lowered the time cost of raising children.[64] Given that widespread improvements in

of the baby-boom mothers were too young to be married during the war. More importantly, the data on completed fertility show that women increased their lifetime fertility during the period, which would not be the case if the baby boom represented solely a shift in the timing of births from during to after the war (see Figure 2).

[63]This was pointed out by Greenwood, Seshadri, and Vandenbroucke (2005).

[64]Related papers that also attribute part of the baby boom to a decline in the cost of children are Murphy,

household technology started in the 1930s, one advantage of the household-technology hypothesis is that it can help explain some of the rise in fertility that occurred before World War II. Conversely, one observation that supports the relative importance of our theory for the post-war baby boom is that most of the later rise in fertility is accounted for by young women. If the baby boom was exclusively due to the spread of household appliances, we would not expect to see the largest increase in fertility among the youngest families who were least able to afford them. A second advantage of our theory is that it does better at accounting for the baby bust, i.e., the sharp decline of fertility in the 1960s. Also, Bailey and Collins (2011) find little support for the household technology hypothesis in disaggregated data. Nevertheless, improvements in household technology may well contribute to an explanation for why, during the baby boom, fertility went up even for older households and households where mothers were working.

In our view, there is a promising alternative explanation for the pervasive nature of changes in fertility during the baby boom that has yet to be explored: the presence of social externalities. In the 1950s, fertility went up among young mothers, old mothers, working mothers, and (as Bailey and Collins 2011 document) even Amish mothers, who neither used modern household appliances nor participated in the formal labor market. These observations suggest that there was something infectious about the trend to higher fertility, so that even families that were insulated from the initial driving force ended up with more babies. A related observation concerns the substantial difference between the increase in total fertility rates versus completed fertility rates during the baby boom (see Figures 1 and 2). This discrepancy is due to the timing of births: at the height of the baby boom older cohorts of women were having children late, while younger women were having them early. Once again, this suggests the presence of social externalities that induced women to have their babies at the same time as other women, leading to a coordination in fertility that increased period fertility rates in the late 1950s well above the realized fertility rate of any given cohort. Such externalities (which have been documented for the labor force participation of French mothers by Maurin and Moschion 2009) could be simply a matter of imitation and fads, or alternatively could be due to externalities in child rearing. For example, when many families in a community are already having children, it may be easier to arrange informal child care or children's activities, which lowers the cost of having another child. In our view, the pervasive nature of changing fertility during the baby boom is suggestive of such

Simon, and Tamura (2008), who argue that suburbanization lowered the cost of space; and Albanesi and Olivetti (2014), who focus on medical progress that lowered the risk of childbirth.

externalities. Hence, a portion of the rise in fertility among older and working mothers could be a spillover from the younger mothers, with the mechanism outlined in this paper acting as the ultimate trigger of the change.

Another form of social externalities for which evidence already exists concerns the long-run evolution of female labor supply. Fernández, Fogli, and Olivetti (2004) argue that one factor that held back female employment is husbands' prejudice against working wives. The extent of this prejudice, in turn, depends on whether a husband's own mother was working. The demand for female labor during the war increased married women's labor force participation one generation later, when the sons of the working mothers of the war got married. More generally, it has been argued that simply observing more married women work will reduce prejudice against and misinformation about working women. Along these lines, Hazan and Maoz (2002), Fernández (2013), and Fogli and Veldkamp (2011) have developed models that give rise to the S-shape dynamics in female labor force participation that characterize the data. Incorporating such a mechanism in our model would help explain the secular rise in female employment observed after World War II.

To summarize, the mechanisms developed in the existing literature may indeed explain a substantial fraction of the early rise in fertility leading up to World War II. Further, while there is clear cause to doubt the ability of these mechanisms to explain the post-war baby boom on their own, they may have contributed to the general rise in fertility after World War II. In our view, any likelihood that other mechanisms may matter, too, is not a shortcoming of our theory. It is unrealistic to expect to find a single explanation for all major fertility patterns before and after World War II. The sheer size of the movements in fertility and a number of more specific empirical features (such as the cross-country observation of small baby booms after the Great Depression in many countries, but big ones only in countries similar to the United States) suggest that in reality multiple forces are at work. The key task, we believe, is to quantify how much of the change in fertility can be accounted for by each mechanism. Our results indicate that the female labor market mechanism can account for the majority of the post-war baby boom in terms of completed fertility rates, and in particular for the shift towards an earlier entry into childbearing that empirically accounts for much of the rise in fertility.

7 Conclusion

In this paper, we propose a simple theory to argue that World War II can account for a substantial part of the rise and fall of U.S. fertility through the post-war period. Earlier research has 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 implications of the war for the female labor market.

We show that if female labor supply is persistent, a one-time demand shock for female labor leads to long-lasting, asymmetric effects on the labor supply of younger and older women. World War II entailed a huge demand shock for female labor. As a consequence, the war generation of women continued to work throughout the baby boom period, whereas younger women were crowded out from the labor market and had more children instead. The labor market channel is further amplified by the fiscal consequences of the war, and in particular the persistent rise in labor taxation. Our quantitative analysis suggests that these mechanisms can account for a major portion of the rise and fall in completed fertility rates during the baby boom and baby bust periods.

Given that our mechanism focuses on the specific margin of entry into childbearing, there are some fertility patterns during the baby boom (in particular, changes in fertility for older and working mothers) that our theory does not explain. In our view the data suggest the complementary presence of social externalities that make changes in fertility during the baby boom and baby bust more pervasive. Documenting and quantifying such externalities is an important challenge for future research on the baby boom.

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A Data Appendix

A.1 Fertility Data

Data on total fertility rates (TFR) in Figures 1 and 8 are taken from Chesnais (1992), Tables 2A.3 and 2A.4, pp. 545–548. Data on completed fertility rates in Figures 2 and 7 were kindly provided by Jean-Paul Sardon of the Observatoire Démographique Européen, which maintains a database on fertility in Europe. Some of these data are published in Sardon (1990) and Sardon (2006) (see also Jones and Tertilt 2008, Table A1, p. 56). The average age at first birth is computed from data on first birth rate by age, taken from the Historical Statistics of the United States, Millennial Edition, Vol. 1, Table Ab150–215, pp. 412–413.

A.2 Labor Supply and Wages

Statistics on labor supply and wages are computed from census data. Specifically, we use data from the 1 percent Integrated Public Use Microsample (IPUMS) of the Decennial Census for the decades 1940 to 1990. For 1940, 1950, 1960, 1980 and 1990, we use the general 1 percent sample. For 1970 we use the Form 2 Metro sample. The data are weighted using the appropriate weighting scheme (see Ruggles et al. 2010). We restrict our attention to individuals aged 20–60, living in non-farm households, and whose group quarter status is equal to 1, "Households under the 1970 definition."

Total hours worked in the previous year is computed by multiplying weeks worked last year (WKSWORK1) by hours worked last week (HRSWORK1). In 1960 and 1970, census information on weeks worked last year and hours worked last week is reported only in intervals

(WKSWORK2 and HRSWORK2, respectively). Therefore, for these decades, weeks worked last year and hours worked last week are assigned the midpoint value of each interval as in Fernández, Fogli, and Olivetti (2004).

The variable weeks worked last year (WKSWORK1) is not comparable across all years. Specifically, as noted by Ruggles et al. (2010), in 1940 "It was up to respondents to determine precisely what "full-time" meant in their specific locality, occupation, and industry. If respondents did not know how many hours should be regarded as a full-time week, enumerators were instructed to suggest that 40 hours was a reasonable figure. In essence, respondents were to estimate how many hours they had averaged per week, multiply this figure by 52 weeks, then divide by about 40."

To assure comparability between 1940 and subsequent Census years, we took the following steps. For individuals who reported 52 weeks in the previous year or less than 52 weeks in the previous year but 40 or more hours in the previous week, we left the annual hours unchanged (i.e., WKSWORK1 times HRSWORK1). For those who reported less than 52 weeks in the previous year and less than 40 hours in the previous week, we computed annual hours as weeks worked last year times 40 (i.e., WKSWORK1 times 40).

The measure of labor supply reported in the paper is the ratio between the mean annual hours worked by women to the mean annual hours worked by men in the same group. This measure can be interpreted as a full-time equivalent labor force participation rate. When comparing model to data (see Figure 10) we use data for all women for ages 20–32 but for married women for ages 33–60, because our model does not allow for the possibility of never marrying.

For wages and the gender gap, we use the information on wage and salary income (INCWAGE). N/A code (999999) is treated as a missing value. Following Acemoglu, Autor, and Lyle (2004), top-coded values are imputed as 1.5 times the censored value. To obtain hourly wages, INCWAGE is divided by the total hours worked in the previous year. The relative wage of women to men, i.e., 1 minus the gender gap is computed as the ratio of the mean wage of women to the mean wage of men in the same group. For the gender gap for young women (i.e., before child bearing) we use data on single women aged 20–24 (see Figure 11). While formally in our model all women start out already married, the pre-child-bearing period is best interpreted as corresponding to single life in the data. Empirically, marriage and having one's child were closely related events during the period. In addition, using data for single women is less subject to selection problems, as the vast majority of young single women were working.

A.3 The Accumulation of Work Experience

To calibrate the experience accumulation function, we estimate an earnings equation using data from the 1940 census. The estimation equation is:

$$\ln w_i = \alpha + \omega_0 \text{ education}_i + \omega_1 \text{ experience}_i + \omega_2 \left(\text{experience}_i \right)^2 + \epsilon_i. \tag{1}$$

The equation is estimated for men aged 20–60 using a Heckman selection model. We assume that the selection into the labor force depends on education, marital status, and the number of children under the age of 5. Given that actual work experience is not available, we follow the standard in the labor literature and compute experience as:

$$\text{experience} = \text{age} - \text{education} - 6.$$

We obtain estimates of the return-to-experience parameters of $\omega_1 = 0.05$ and $\omega_2 = -0.00053$. Given that in the model people start work at age $j = 1$ and that a model period corresponds to 2.5 years, we choose the return to experience such that the efficiency units of labor supplied by a man of age j are given by:

$$e^m_{t,j} = \exp(\omega_1 \cdot 2.5(j-1) + \omega_2 \cdot (2.5(j-1))^2).$$

Here we normalize $e^m_{t,1} = 1$. Iterating this expression to age $j+1$ and rearranging yields:

$$e^m_{t,j+1} = \exp(2.5\omega_1 + \omega_2(12.5j - 6.25))e^m_{t,j},$$

so that:

$$\eta_{m,j} = \exp(2.5\omega_1 + \omega_2(12.5j - 6.25)) - 1.$$

Substituting the estimates for ω_1 and ω_2 gives:

$$\eta_{m,j} = \exp(0.125 - 0.00053(12.5j - 6.25)) - 1.$$

We also assume that the return to experience for women and men is the same, $\eta_{f,j} = \eta_{m,j}$ for all j. We then choose the return to age ν such that in the pre-war balanced growth path, at age 32.5 the productivity of working women is larger by a factor of 1.42 than at age 20. This factor is obtained by estimating an earnings function for women (using the same functional form as used for men in (1)) and predicting women's wages at ages 20 and 32.5. The procedure yields a return to age (per model period) of $\nu = 0.003$ (thus, the return to age is close to zero).

In the earnings equations, we do not control for selection by ability, because the model abstracts from heterogeneity in ability as well. The procedure yields the correct average lifetime income profile taking as given who actually does re-enter the labor market; conversely, if we used an estimate that corrects for ability but then did not include ability in the model, the average lifetime profile in the model would be too flat. Put differently, the objective here is not to estimate a "true" return to experience, but to match life-time wage profiles between model and data, conditional on the assumptions of the model.

A.4 The Child Care Cost Function

The level parameter ϕ of the child-care cost function is pinned down using data on the total private cost of children from Haveman and Wolfe (1995), as described in the main text. However, Haveman and Wolfe (1995) do not report information which can be used to back-up the curvature parameter ψ. We therefore use time use data to set ψ. We estimate ψ by running the regression $\ln y_i = \omega_0 + \psi \ln n_i + \epsilon_i$ on time use data. The data come from the American Heritage Time Use Study. Specifically, we follow Hill and Stafford (1980) and use the 1975–1976 American's Use of Time survey. This is a panel study designed and administered by the Survey Research Center at the University of Michigan.[65] We also followed Hill and Stafford (1980) in defining

[65] The data are available online at: http://www.timeuse.org/ahtus and were downloaded from this web-site on September 20th, 2007. The 1975–1976 survey was designed as a nationally representative sample of households and sampled both respondents, and, if the respondent was in a couple, the spouse or partner. Four waves of the survey were carried out to represent all seasons of the year and all days of the week. The study collected most information from one person per household. However, if the diarist had a spouse, the spouse was asked to complete a cut-down version of the diary and questionnaire.

child care as the sum of minutes care for infant, minutes care for older child, minutes medical care for child, minutes play with child, minutes supervise homework, minutes read to/talk to child, and minutes other child care. Restricting attention to women of all marital statuses who live in urban areas, we obtain $\psi = 0.3024$. Similarly, restricting attention to married women, we obtain $\psi = 0.3509$. We use the average of these estimates and fix the curvature parameter at a value of 0.33.

In addition to the two parameters ϕ and ψ, we also need to fix the additional time cost associated with a birth, κ_j. In the time use data described above, we find that mothers with one child in the age group 0–3 spent somewhat more than twice as many minutes per day than mothers with one child who is older than 3 years old. Since time costs make up only a fraction of the total private cost of children, we set $\kappa_j = 0.5\phi$ for younger mothers ($j \leq 4$). For older mothers ($j > 4$), who account for a small fraction of overall births, we set $\kappa_j = 0.5$. This value implies that the ratio of fertility of mothers aged 30–34 to mothers aged 25–29 is 0.9 in the model's prewar balanced growth path, which compares to a ratio of 0.7 in the data. We target a slightly higher ratio because otherwise too few women would be giving birth above the age of 32.5. Conversely, without the rise in κ_j for older mothers, the model would imply counterfactually high fertility for mothers in their 30s and a counterfactually high average age at first birth.

A.5 U.S. Mobilization for World War II

Data on the mobilization of American men to World War II are taken from U.S. Department of Commerce, Bureau of the Census (1975), series Y904, "Military Personnel on Active Duty." To conversion of the absolute numbers to rates we divide this series by the male population in the age group 20–59. These numbers come from Hobbs and Stoops (2002), Table 5: "Population by Age and Sex for the United States: 1900 to 2000 Part A." Since the population in this age group is available only on a decennial basis, we assume a constant growth rate between 1940 and 1950. This procedure yields mobilization rates of 0.013, 0.049, 0.104, 0.242, 0.303, 0.318, 0.079 and 0.041 for the years 1940–1947, respectively. Hence, a reduction of 30 percent of men availability for one period is based on the average mobilization rate during the 1943-1945 period. Note that this is a conservative reduction as we disregard the decline in men's availability during the 1941–1942 period.

A.6 Fecundity by Age

The following table reproduces the rates of impaired fecundity displayed in Table 4 of Menken, Trussell, and Larsen (1986).

A.7 Calibrated Parameter Values

Table 6 summarizes the calibrated parameter values that were used for the computational experiments.

Age	Impaired Fecundity	Infertile
15–19	10.8	
20–24		7.0
25–29	25.2	8.9
30–34		14.6
35–39	55.1	21.9
40–44		28.7

Table 5: Proportion of Married Women with Impaired Fecundity or Who Are Infertile, by Age, in Percent (Source: Menken, Trussell, and Larsson 1986, Table 4)

Parameter	Interpretation	Value
I	Duration of childhood	8
M	Final period of fecundity	6
R	Final period before retirement	15
T	Lifespan	19
α	Capital share	0.3
δ	Capital depreciation rate	0.113
θ	Weight of female labor in technology	0.35
ρ	Elasticity of substitution parameter	0.65
γ	Productivity growth rate	0.046
ν	Return to age	0.003
β	Time discount factor	0.987
σ_n	Utility weight on fertility	2.04
$\min(\sigma_x)$	Minimum utility weight on leisure	1.14
$\max(\sigma_x)$	Maximum utility weight on leisure	1.59
$\bar{z}$	Cost of labor market reentry	1.25
h	Time endowment	3
ϕ	Level of time cost of children	0.417
ψ	Curvature of time cost of children	0.33
f_j, $j \in \{0, \ldots, 4\}$	Fecundity, young parents	1
f_5	Fecundity, parents ages 32.5–35	0.75
f_6	Fecundity, parents older than 35	0.5
κ_j, $j \leq 4$	Additional cost of young children, young parents	0.209
κ_j, $j > 4$	Additional cost of young children, old parents	0.5
τ_k	Marginal tax on capital income	0.45
$\tau_{l,pre-war}$	Pre-war marginal labor tax	0.04
$\tau_{l,post-war}$	Post-war marginal labor tax	0.22
$\bar{x}^W$	Patriotism shock	1.25

Table 6: Calibrated Parameter Values