In his recent monograph on the demography of Victorian England and Wales, Robert Woods contends that the absence of reliable data has encouraged speculation and loose theory about the origins and causes of English fertility decline. “Hypothesis,” he observes, “has run far ahead of description to the detriment of interpretation” (Woods 2000, p. 112). A lack of reliable fertility data is perhaps an even greater problem in England’s former North American colonies. Although the United States is believed to have experienced a significant and sustained decline in fertility beginning circa 1800, the vast majority of fertility estimates for the period before 1880 are based on the age structure of the population reported in the federal census. Unfortunately, fertility estimates derived from early nineteenth-century census data—including child-woman ratios and indirect estimates of crude birth rates—are sensitive to mortality, nuptiality, and census underenumeration, hindering interpretation.¹ Upon the weak foundation of child-woman ratios and crude birth rates, however, historians have built increasingly sophisticated theories of United States fertility decline that emphasize the importance of fertility control within marriage.² Here, as in England, researchers have relied on inadequate empirical data to test their hypotheses.³

¹ A decline in the child-woman ratio between two censuses, for example, could reflect a decline in marital fertility—that is, birth rates within marriage—an increase in mortality, an increase in the age of marriage, an increase in the proportion of women remaining spinsters, an increase in the underenumeration of children, or some combination of the above.
² According to the dominant interpretation of fertility decline first posited by Yasukichi Yasuba and subsequently elaborated by a number of historians, the long-term decline in child-woman ratios and crude
This paper relies on new estimates of nineteenth-century mortality and recently constructed public use microdata samples of the 1850, 1860, 1870, and 1880 censuses to reexamine white fertility in the nineteenth-century United States. In the first part of the paper I construct new estimates of the white crude birth rate between 1800 and 1930. Unlike previous estimates that show a long-term decline in fertility beginning at or before the turn of the nineteenth century, the new estimates suggest that white birth rates did not begin their secular decline until circa 1840. Since there is also strong evidence that nuptiality declined over the course of the nineteenth century, I hypothesize that the onset of marital fertility decline in the United States was not as early as previous investigators have suggested. I test this hypothesis in the second part of the paper by using “own-children” methods to estimate white marital fertility for years between 1848 and 1879. The results suggest that the control of marital fertility cannot be detected in the nation as a whole until after 1860. Total marital fertility was nearly identical to marital fertility in birth rates in the early nineteenth-century United States is most closely associated with the cost of establishing new farms. Increasing population densities led to an increase in the cost of farmland, especially near the Atlantic coast and navigable rivers where population densities were highest. As parents increasingly found themselves unable to endow their male children with adequate farmsteads nearby, they adapted by limiting their fertility. Couples in the Northeast, where relatively little undeveloped farmland remained after the turn of the century, were the first to practice successful family limitation strategies. Couples on the frontier, in contrast, where cheap land was readily available, were late in limiting births within marriage. Many variations of the “adaptation” thesis have been posited, including models that account for internal migration, the availability of credit markets, the relative costs and benefits of children, and parental demand for old age support. Although a few researchers acknowledge that rising mortality or declining nuptiality could have contributed to declining fertility, most interpret declining child-woman ratios as evidence of conscious adaptation strategies practiced within marriage. For a recent overview of the literature on nineteenth-century fertility decline in the United States see Haines, M. R. (2000). The white population of the United States, 1790-1920. A population history of North America. M. R. Haines and R. H. Steckel. Cambridge ; New York, NY, Cambridge University Press: 305-370.

England until 1861, when the American Civil War (1861-65) led to a sharp fall in U.S. marital fertility. Indices of marital fertility control constructed from age-specific marital fertility rates also suggest a relatively later onset of conscious fertility control than is typically assumed. Evidence of parity-dependent fertility control, for example, cannot be detected until the period 1877-79. Although this date is still somewhat “early” when compared with most countries in Western Europe, it is not extraordinarily so.

**Previous Estimates of Nineteenth-Century Fertility**

The most commonly reported measure of fertility is the crude birth rate, defined as the annual number of births in a given population divided by the total mid-year population. Typically, births are taken from a birth registration system and the mid-year population from a census enumeration. Unfortunately, a comprehensive birth registration system was not in place in the United States until 1933. As a result, the calculation of crude birth rates in the nineteenth-century United States requires indirect methods. Thompson and Whelpton (1933), Yasuba (1962), and McClelland and Zeckhauser (1982) estimate white birth rates in census years 1800-1860 with stable population methods, and Coale and Zelnik (1963) estimate white birth rates by year in the period after 1855 with reverse-survival techniques. These studies generally agree that the white birth rate was over 50 births per thousand population in 1800, declined to near 40 in 1850, and ended the century below 30, a decline of approximately 45 percent. A plot of the various estimates is shown in Figure 1.

Most cross-sectional studies of fertility in the nineteenth-century United States rely on child-woman ratios, defined as the number of children 0-4 or 0-9 per 1,000
women age 16-44. Unsurprisingly—since both measures are based on the age structure of
the population—trends in the child-woman ratio and indirect estimate of the crude birth
rate closely parallel each other. Child-woman ratios are more easily constructed with
published census data, however. Since the Census Office published age data by state
and county, child woman ratios have proven useful in estimating geographic differentials
in fertility. Yasuba’s groundbreaking study of differential fertility during the antebellum
period revealed that child-woman ratios were closely correlated with state-level measures
of population density, land availability, literacy, and other variables (1962). Yasuba’s
study stimulated other investigations based on the child-woman ratio, including those by
Easterlin (1976; 1978), (Vinovskis 19876), Leet (1977), Foster and Tucker (1972),
Leasure (1982), and Smith (1987), most of which shifted the analysis from the state to the
county level.

Indirect estimates of the crude birth rate and interpretation of trends and
differentials in child-woman ratios require reliable estimates of mortality by age and sex.
Until recently, however, few life tables were available for the nineteenth-century United
States. Indirect estimates of the crude birth rate typically relied on a life table constructed
from the ten states that were part of the Death Registration Area in 1901 and one or two
scattered life tables constructed with nineteenth-century Massachusetts data, although
they differ somewhat in their underlying assumptions. Thompson and Whelpton (1933)

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4 Some interpolation of age groups is required in early census years. Most researchers do not attempt to
adjust child-woman ratios for mortality, implicitly or explicitly assuming that trends in mortality or
geographic differentials in mortality do not bias their results.

5 Paul Jacobson’s life table, for example, is based on mortality data from Massachusetts and Maryland for
Memorial Fund Quarterly 35(2): 197-201. For a critique of the Jacobson table, see Vinovskis, M. A.
Journal of Interdisciplinary History 8(4): 703-724. The ten states in the death registration area—Maine,
New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Michigan,
assumed a long-term decline in mortality between 1800 and 1880 and acceleration thereafter. Yasuba (1962) relied on Jacobson’s 1850 life table for Massachusetts and Maryland to represent the entire nation and assumed no change in mortality between 1800 and 1860, as did McClelland and Zeckhauser (1982), although both included “high” and “low” mortality estimates. Coale and Zelnik (1963) assumed no change in mortality between 1800-1850 and a linear decline in mortality between 1850 and 1901.

Our knowledge of nineteenth-century mortality has improved dramatically in the last decade. Michael Haines has recently published life tables for census years between 1850 and 1910 that show mortality was variable without trend for most of the late nineteenth century. According to Haines’s estimates, mortality did not begin its long-term secular decline until after 1880 (1998). Our knowledge of early nineteenth century mortality is more fragmentary, but also improved. Somewhat surprisingly, given rising per capita incomes, recent research indicates that mortality increased in the first half of the century. Genealogical-based investigations by Kent Kunze and Clayne Pope suggest that adult life expectancy at age 20 fell about 4 years between 1830 and 1850 (Kunze 1979; Pope 1992). A recent study of Yale graduates by J. David Hacker also shows an decline in adult life expectancy of about 1.5 years during the first few decades of the nineteenth century (1997). Indirect confirmation of increasing mortality in the period is provided by data on the stature of North American males, which declined several inches in the antebellum period (Steckel 1995). If mortality did increase in the period between

1800 and 1860, as these results suggest, then previous estimates of white birth rates obtained from indirect methods are in error.

Figure 2 plots new estimates of the white crude birth rates constructed with life tables derived from Pope, Kunze, and Haines. Series ‘A’, which is based on Pope’s period estimates of adult life expectancy 1800-1850 fitted to Haines’s 1850 life tables, suggests little or no change in the white birth rate between 1800 and 1860. Series ‘B’, which assumes a more moderate 1.5-year decline in adult life expectancy between 1830 and 1850, suggests a decline of about 6 percent in the white birth rate between 1800 and 1840 and an accelerated decline thereafter. Finally, an annual birthrate series derived with the back projection method used by Coale and Zelnik suggests no change in the white birth rate until 1860. Although there is admittedly still some doubt about the level and trend in early nineteenth-century mortality, these results suggest that we should be

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6 I relied on Haines’s “U.S. Model” life tables of the white male population for the census years in which they were constructed, averaged the 1850-1860 life tables to represent years between 1850 and 1860, averaged the 1860-1880 life tables to represent the years between 1860 and 1880, and interpolated between the tables for years between 1880, 1890, and 1900. Haines’s tables were derived from age-specific death rates at age 5, 10, and 15 reported in the 1850-1900 U.S. Censuses of Mortality fitted to the life table constructed from the 1901 Death Registration Area. Rather than rely on Haines’s life tables for white females—which appear to understate mortality during childbearing years—I constructed new tables by applying the male-female ratio in age-specific death rates observed in the censuses of mortality to the male life tables. For years before 1850 I produced two sets of estimates. The first fits male and female life expectancy at age 20 reported by Pope—adjusted down by 1.5 years to account for the overstatement of genealogical-based estimates of life expectancy—to the 1850 life tables with a two-parameter logit model. Pope’s estimates show a decline of approximately 4.0 years in life expectancy at age 20 in the antebellum period. In the second set of estimates I assumed a more moderate 1.5 year-decline in adult life expectancy. All abridged tables were then converted to single years of age using the method outlined in Cho, L.-J., R. D. Retherford, et al. (1986). The Own-Child Method of Fertility Estimation. Honolulu, HI, East-West Center, University of Hawaii Press. Finally, I modified the \( q_x \) figures in 1864 to account for estimates of Civil War mortality and converted the period life tables to cohort tables.

cautious about interpreting the shift in the population’s age structure between 1800 and 1860 as evidence of declining fertility.

Even if we do accept the fact that U.S. fertility was declining in the early half of the nineteenth century, we should not be too eager to assume that the decline was due to conscious fertility control within marriage. An increase in the average age at marriage, an increase in the proportion of the female population remaining spinsters, or a decline in remarriage will result in a decline in general fertility, even if marital fertility remains unchanged. Daniel Scott Smith notes that early observers such as Benjamin Franklin and Thomas Malthus explained higher fertility in America than in Europe with the pattern of very early and near universal marriage. The ready availability of inexpensive land in the colonial period allowed couples to marry earlier than their European counterparts, who had to delay marriage until they had accumulated enough resources to set up an independent household. By the early nineteenth century, land was becoming increasing scarce and expensive in the eastern United States, with the probable consequence on lower nuptiality. Although Smith ultimately concludes that the decline in child-woman ratios between 1800 and 1860 reflects some decline in marital fertility, he sees the neglect of nuptiality as a major weakness in the U.S. fertility research. “Declining fertility as a consequence of later and less universal marriage,” he contends, “requires no special theory of the uniqueness of the American experience; America was simply becoming Europeanized in its fundamental economic environment” (Smith 1987, p. 76).

Although data are scarce, it is clear that nuptiality declined between the colonial period and 1890, when the Census Office first published data on marital status (Haines 1996). The recent construction of Integrated Public Use Microdata Samples (IPUMS) of
the 1850-1880 federal censuses allows nuptiality to be examined in the period 1850-1880 for the first time. Although the 1850-1870 censuses did not include a question on relationship to household head or current marital status, it is possible to impute relationship using surname, age, sex, and position in the household (see Ruggles 1995, for details), and from the imputed relationship, whether each person was “ever married” or “never married” with a high degree of accuracy.8

Table 1 depicts the imputed proportion of white women “ever married” in the 1850-1870 IPUMS samples, the reported proportion ever married in 1880, and the singulate mean age at marriage (SMAM) for a synthetic cohort of women in each year. The results indicate that the mean age at marriage for white women rose approximately 1 year from 22.7 in 1850 to 23.8 in 1890. The trend in marriage age before 1850 was also likely upwards, although the magnitude of the increase remains unclear. Haines reports an average SMAM of 22.7 years centered at 1780 from community studies—implying no change between 1780 and 1850—but notes that the greater representation of older settled communities in New England and the Mid Atlantic region likely imparts an upward bias to the estimate (1996). Using indirect methods, Warren Sanderson (1979) has suggested an average SMAM of 19.5 years for white women in 1800, although Haines has shown that Sanderson’s method underestimates the average SMAM reported by the 1880-1920

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8 Women with imputed spouses or children present in the household were considered “ever married.” Because separated, divorced, and widowed women living without children are imputed as “never married,” some adjustment is required, especially at older ages. I used the 1880 IPUMS sample—which includes imputed relationship to household head, reported relationship, and reported marital status—to estimate the error for each 5-year age group and to construct an adjustment factor for each age group. The uncorrected imputed never-married variable, for example, suggests that 11 percent of women 45-49 were never married. The actual percentage was 7.6, implying the need for a 0.77 correction factor. Correction factors were near one for most other ages. I calculated SMAMs for white women by census region in 1880 to test the accuracy of the procedure. Despite a wide range of marriage patterns—SMAMs ranged from 21.4 in the Mountain and Pacific to 24.6 in New England—the greatest error in imputed SMAM was –0.19 years in the East-South Central region.
censuses by as much as one year. Daniel Scott Smith suggests a reasonable compromise estimate of 21 years (1993), which implies a 1.7-year increase in the white female age at marriage between 1800 and 1850, and a 2.8-year increase between 1800 and 1890. Given this increase and the more modest decline in crude birth rates noted in Figure 2 above, it seems reasonable to hypothesize that marital fertility did not decline in the first half to the nineteenth century.

**Own-Child Estimates of General and Marital Fertility**

Relationship information included in the IPUMS samples allows researchers to use own-child fertility methods to construct age-specific fertility estimates in the mid nineteenth-century United States for the first time (Ruggles, Sobek et al. 1997). I rely on the 1850, 1860, 1870, and 1880 IPUMS samples to estimate white general fertility in the years 1835 to 1879 and white marital fertility in the years 1847-1879. Various indices of fertility are constructed from age-specific marital fertility rates to measure the level of fertility in the United States relative to “natural” fertility populations and to date the onset of parity-dependent fertility control.

The own-child method of fertility estimation was developed by Grabill and Cho in the 1960s for research on tabulations of young children by age of mother in the 1910 and 1940 censuses (1965). It is a reverse-survival method for estimating age-specific births in years preceding a census. The method has subsequently been refined and elaborated (Cho, Retherford et al. 1986) and applied to public use microdata samples of the U.S. census, including the 1960 and 1970 PUMS (Rindfuss and Sweet 1977) and the 1900
PUMS (Tolnay, Graham et al. 1982). Michael Haines has applied the method to the 1850-1900 censuses of the Pennsylvania Anthracite region (Haines 1978). 9

Own-children are defined as children who can be identified in the census as living with their mothers. 10 By linking own-children in census microdata samples to their mother’s record, it is possible to create a partial birth history for each mother in the sample. In the basic method of own-child fertility analysis, own-children are cross-tabulated by their mother’s age, and then reverse survived to estimate the number of births by age of mother in years preceding the census. Women present in the census are also reverse survived to estimate the total number of women alive in a given year. Age-specific birth rates are then calculated by dividing the number of back-projected births by the number of back-projected women of a particular age, and the total fertility rate is obtained by summing the age-specific birth rates of women age 15-49. Finally, age-specific marital fertility rates are obtained by multiplying the age-specific fertility rates by the inverse of the proportion of the women at each age group currently married.

I applied the procedures detailed by Cho, Retherford, and Choe (1986) to the 1850-1880 IPUMS samples. Adjustments were made for net census underenumeration (see Hacker 2000) and the proportion of children not living with their own mother before reverse surviving children and mothers. Because children leave home at an increasing rate after age 15, I limit own-children to ages 0 to 14, corresponding to births 1 to 15

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10 Census data do not allow researchers to distinguish accurately between biological and social children for all mothers, although a few children can be flagged as probable adopted children or stepchildren. This paper does not attempt to make those distinctions, however, so “own-children” in the following analysis probably includes some adopted and stepchildren.
years before the census. The use of the 1850, 1860, 1870, and 1880 censuses allow rates to be averaged for the periods 1845-49, 1855-59, and 1865-69.

**General fertility**

Age-specific and total fertility rates were calculated for synthetic cohorts of white women in each year between 1835 and 1879. Total fertility rates are shown with Coale and Zelnik’s estimates in Figure 3. Although Coale and Zelnik’s estimates are based on different mortality assumptions and a mathematical relationship between the estimated number of births and the estimated number of females aged 20-39, there is close agreement between the two series (Coale and Zelnik 1963, p. 36, pp. 69-89). The own children estimates constructed with the IPUMS samples indicate that the white total fertility rate was approximately 6.3 in 1840. The rate remained level and even increased slightly until 1845, after which it dropped rapidly, reaching 5.4 in 1852. The sharp drop in total fertility in the late 1840s was also evident in the crude birth rates plotted in Figure 2. No trend in total fertility is evident in the 1850s, but the rate dipped sharply during the Civil War, reaching a low of 4.6 in the last few years of the conflict. Rates recovered slightly after the war to about 4.8 and then remained relatively stable until 1879. Over the 43-year span of the series, total fertility fell from 6.3 to 4.7, a decline of 25 percent.

Table 2 aggregates the data into five-year age groups and aggregated time periods. A plot of age-specific birth rates by period, shown in Figure 4, indicates that fertility fell in each age group between 1835-39 and 1875-79. Although declines at ages between 25 and 34 had the greatest impact on overall fertility decline, the greatest

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11 Since the census was taken on June 1 in each census year, estimates were converted to calendar-year estimates before plotting.
percentage declines occurred at older ages. The fertility rate of women 45-49, for instance, fell 56 percent between 1835-39 and 1875-79 compared to an 18 percent decline among women 25-29.

Marital fertility

While valuable, general fertility measures are sensitive to the timing and incidence of marriage. An increase in the average age at marriage or an increase in the level of divorce, separation, or widowhood would, all else being equal, tend to lower the average number of children women have in their lifetimes. As noted above, the mean age at marriage of white females increased an estimated 2.8 years between 1800 and 1890. Thus, despite the long-term decline in total fertility rates evident in Figure 3 above, rates of childbearing within marriage may have remained unchanged, indicating no substantial change in the desire or the ability of parents to limit family size. Although there is qualitative evidence that some women in the mid nineteenth century desired to control their fertility (Degler 1980; Brodie 1994), there are currently no national estimates of marital fertility available for the period.

Using indirect estimates, Warren Sanderson estimates that roughly one-half of the decline in child-woman ratios up to approximately 1850 was due to the effects of nuptiality. Thereafter, most of the decline could be attributed to reductions in marital fertility Sanderson, W. C. (1979). “Quantitative Aspects of marriage, fertility, and family limitation in nineteenth century America: Another application of the Coale specifications.” Demography 16(3): 339-358. Jenny Wahl’s analysis of family histories kept at the Genealogical Society’s libraries in Utah suggests similar results, although a decline in the proportion of women ever marrying and in the life expectancy of women during their childbearing years were found to be the principal factors associated with falling fertility for women born before 1850 Wahl, J. B. (1986). New results on the decline in household fertility in the United States from 1750 to 1900. Long-Term Factors in American Economic Growth. S. L. Engerman and R. E. Gallman. Chicago, Ill., The University of Chicago Press: 391-437.

Age-specific and total marital fertility rates can be calculated with the 1850-1880 IPUMS samples, although the data are less than ideal. With the exception of the 1880 census, we lack information on women’s current marital status. None of the four censuses included a question on duration of marriage. As noted in the discussion of marriage age above, however, it is possible to impute current marital status in each census year with a high level of accuracy.\textsuperscript{14} The results are shown in Table 3. Following Cho et al. (1986, p. 18), age-specific proportions of white women currently married in five-year age groups were interpolated for all years between 1850-1880. Also, the proportions currently married were extrapolated to years 1840-1849 by fitting a simple OLS regression to the proportions currently married in 1850-1880. Term by term division of the age-specific fertility rates in each year by the proportion currently married yields age-specific marital fertility rates for each year between 1840 and 1879. The procedure assumes that all births occur within marriage. It should be noted that since nuptiality is believed to have declined at a faster rate in the first half the nineteenth century than in the second half the century, the estimates of marital fertility before 1850 could be biased upwards.

Figure 5 compares the total marital fertility for white women in the United States between 1840 and 1880 with the total marital fertility of women in England. Although England did not follow a “typical” pattern of demographic transition (Woods 2000), it is an appropriate comparison because of the large proportion of the U.S. white population

\textsuperscript{14} Since we are here only interested in the proportion of women currently married, the problem of incorrectly identifying separated, divorced, and widowed women with no children present in the 1850-1879 IPUMS samples as “never married”, described in note 8 above, is not a significant source of error. Only the accuracy of the imputed spouse present/location variable— included in the 1850-1880 IPUMS samples—will potentially bias the results. The 1880 IPUMS sample—which includes both the imputed spouse location and the reported spouse location variables—suggests that the imputation is robust at all ages
with English origins and because of the consensus view that the onset of marital control of fertility in England was after 1880. Despite the fact that marital fertility decline is believed to have occurred at a much earlier date in the United States, the results indicate that total marital fertility was somewhat higher in the United States than in England before 1850. Because of the probable understatement of the proportions married before 1850, however, this interpretation should be treated with caution. In the period 1850-1860, when the reported proportions currently married are less likely to be in error, total marital fertility in the United States and England was almost identical at 7.4. It was only with the onset of the American Civil War that marital fertility in the United States declined below that in England. Some convergence in the rates occurred in the 14 years after the war, but U.S. total marital fertility remained approximately 0.5 below England’s in 1879.

Dating the onset of marital fertility decline has been a contentious issue in historical demography. Early efforts focused on indirect methods to infer fertility “controlling” and “non-controlling” populations from age-specific marital birth rates. Non-controlling populations (or “natural” fertility populations) exhibit a similar pattern in age-specific marital birth rates. Although the absolute level of total marital fertility may differ, age-specific birth rates display a convex shape at older ages, suggesting no conscious attempt to limit births after a desired number of children had been born. Controlling populations, in contrast, tend to concentrate childbearing at younger ages. Age-specific birth rates at older ages display a concave shape, suggesting that couples expect 15-19, when it overstates the number of currently married women by 7.5 percent. At ages 20-49, however, the average error is 0.026 percent, with the greatest error (0.261 percent) at ages 40-44.
consciously attempted to prevent future pregnancies after obtaining a desired number of children, and that their efforts were largely successful.\textsuperscript{15}

Two indices of marital fertility developed by Ansley Coale and James Trussell have proven to be popular measures for inferring the degree of conscious fertility control. Termed $M$ and $m$, the indices estimate the degree that marital fertility in a given population departs from “natural” fertility. $M$ and $m$ are defined by the equation

$$r(a) = M \times n(a) \times \exp m \times v(a)$$

where $a$ is the standard five-year age groups 20-49, $r(a)$ is the age-specific marital fertility rate of the population being investigated, $n(a)$ is a model schedule of natural fertility at age $a$, and $v(a)$ is a standard schedule of age concentration. Both $n(a)$ and $v(a)$ were derived from empirical populations (Coale and Trussell 1974). Natural fertility was first assumed to be equal to the age-specific birth rates of Hutterite women, but was later modified slightly (Coale and Trussell 1974; Coale and Trussell 1975; Coale and Trussell 1978).

$M$ can be thought of as a scale factor for the underlying level of marital fertility (or, more simply, as the ratio of marital fertility at age 20-24 to that of natural fertility), and $m$ as the degree to which couples stop having children after reaching a desired number. Values of $m$ near zero suggest natural fertility, and values of $m$ near or above 1.0 indicate a high degree of conscious fertility control. In practice, demographers assume

\textsuperscript{15}As explicated by Louis Henry, natural fertility implies the absence of deliberate control. Further, for control to exist, fertility must be parity-dependent: couples must have a desired number of children, and they must modify their reproductive behavior as they approach or obtain the ideal number. Thus behaviors that may limit fertility but are not parity dependent, such as a taboo against intercourse during lactation, are not inconsistent with natural fertility Henry, L. (1961). “Some data on natural fertility.” Eugenics Quarterly 8(2): 81-91. For good discussions of the concept of natural fertility see Bean, L. L., G. P. Mineau, et al. (1990). \textit{Fertility Change on the American Frontier: Adaptation and Innovation}. Berkeley, University of California Press. Wood, J. W. (1994). \textit{Dynamics of Human Reproduction: Biology, Biometry, Demography}. New York, Aldine De Gruyter.
values of $m$ below 0.3 or 0.2 are indicative of non-controlling populations. Coale and Trussell, for instance, contend that “any value of $m$ less than 0.2 can be taken as evidence of no control” (Coale and Trussell 1978, p. 203).

Table 4 compares recent age-specific marital birth rates, total marital fertility rates, and various indices of marital fertility among white women in the three years before the 1850-1880 censuses. Figure 6 plots the age-specific marital birth rates at ages 20 and above with Coale and Trussell’s composite “natural” fertility population and Tolnay, Graham, and Avery’s estimates for age-specific marital fertility in the period 1886-1889 (Tolnay, Graham et al. 1982, p. 134). Age-specific marital fertility rates in the nineteenth-century were well below those for natural fertility, but generally traced similar curves. Birth rates tended to be tightly bunched at ages 20-24, but diverged after age 25. Compared to estimates for 1886-1889, age-specific marital birth rates derived from the 1850-1880 IPUMS samples were higher at older ages, especially the estimates derived from the 1850 and 1860 samples. Older white women in the 1870s and 1880s had far fewer children than women the same age before the Civil War. Total marital fertility rates for ages 20-49 fell from 7.9 in the period 1847-1849 to 6.6 in 1877-79 period. Tolnay, Graham, and Avery estimated a total marital fertility rate of 5.3 in the period 1886-1889, implying a rapid decline in the early 1880s, but Douglas Ewbank has cautioned that their estimates appear to be too low (Tolnay, Graham et al. 1982; Ewbank 1991).

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16 I limited the results to the three years before the census because of the increasing potential for error in extrapolating proportions currently married in years before 1850 and the potential impact of the American Civil War in the years 1862-1866.

17 Age-specific marital birth rates at age 15-19 appear to be unreliable, perhaps because of the retrospective legitimization of illegitimate births.
\(M\) and \(m\) parameters were calculated with the weighted least squares procedure recommended by Broström (1985). In addition the Coale and Trussell parameters, Table 4 also reports the index of marital fertility, \(I_g\). \(M\) and \(m\) parameters calculated with the British standard fertility schedules suggested by Hinde and Woods (1984; Woods 2000), and the Mean Age at Childbearing (MAC) suggested by David Weir (1993).\(^{18}\) The results indicate that \(I_g\) declined from .735 to .611 between 1847-49 and 1877-79, a decline of 17 percent. Most of the decline occurred in the 1860s. \(I_g\) in England in 1851 has been estimated at .675; the level did not fall below .61 until 1901. Similar values have been estimated for most European countries, although the experience of France is a noticeable exception. In 1851, \(I_g\) in France is estimated at .48. In 1881 it is estimated at .46 (Coale and Treadway 1986, p.88, 94). Although these results place U.S. marital fertility between England and France, they are much closer to the former than the later.

Coale and Trussell’s \(m\) parameter exceeds 0.2—assumed by many demographers as the minimum threshold for indicating the onset of conscious parity-dependent fertility control—only after the Civil War. There could, of course, have been small minorities of couples effectively curtailing fertility before that date, but the results suggest that the majority of white couples in the antebellum period were not practicing effective “stopping” behavior.\(^{19}\) All values of \(m\) are under 0.3, indicating little conscious parity-dependent control of fertility as late as 1877-79. These results suggest that the long-term decline in fertility between 1800 and 1860 was not due to couples’ conscious efforts to

\(^{18}\) The mean age at childbearing is intuitive and valuable as an index of changing age patterns in marital fertility. The MAC will fall if women begin to concentrate their childbearing at earlier ages.

\(^{19}\) As used by historical demographers the term “stopping” does not imply one hundred percent effective truncation of childbearing, but rather the detection of parity-dependent control.
truncates childbearing, and that the continued decline in fertility after 1860 was only partially the result of stopping behavior.

In the last decade, however, critics have charged that neither \( I_s \) nor \( m \) accurately detects the early stages of a fertility transition. Using simulation techniques, Guinnane, Okun, and Trussell have demonstrated that the \( m \) parameter cannot reliably detect the presence of a significant minority of controllers in the pre-transition period (Guinnane 1994). More critically, a number of researchers have argued that “spacing behavior” at low parities has always been an important means of limiting family size, especially in the context of the relatively ineffective contraceptive methods available in the nineteenth century. Only with improvements in contraceptive technology does it make sense to practice stopping behavior.

Unfortunately the \( m \) parameter cannot detect spacing behavior, and may therefore confuse the onset of conscious fertility control with a shift in birth control strategies from spacing to stopping (Bean, Mineau et al. 1990). David and Sanderson’s cohort-parity analysis of the 1900 and 1910 PUMS concluded that both spacing and stopping behaviors were important in the decline of nineteenth-century fertility, although Tolnay and Guest’s analysis of the 1900 data suggest that only stopping was important (Tolnay and Guest

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21 Spacing behavior is consistent with many nineteenth-century women’s desires. In 1856, during her third pregnancy in as many years of marriage, Ella Clanton Thomas, a Georgia plantation woman, confided to her diary that “I would dislike to think I would never have other children but then I would willingly have a considerable lapse of time between them.” Quoted in McMillen, S. G. (1990). Motherhood in the Old South: Pregnancy, Childbirth, and Infant Rearing. Baton Rouge, LA, Louisiana State University Press.
1984; David and Sanderson 1986). Finally, Charles Wetherell has argued that the utility of $m$ for assessing nineteenth-century U.S. fertility control may be limited because of the substantial amount of fertility that took place under age 20. Coale and Trussell’s focus on the European experience and its low age-specific birth rates under age 20 led them to rely on fertility at age 20-24 as the first meaningful point of comparison to the natural fertility population. As a result, reliance on $m$ may understate any shift to increased childbearing at younger ages in the United States (Wetherell 2001). As a result of these criticisms, we should be wary of relying on $m$ as the sole indicator of marital fertility control. Taken in the context of declining $M$, $I_g$, and total marital fertility in the period after 1860, however, the increase in $m$ provides further support that marital fertility decline in the United States was later than typically assumed.

**Conclusion**

The “early” decline in nineteenth-century American fertility has long fascinated social scientists. Unfortunately, the quality of quantitative data has limited our understanding of the onset of marital fertility control, and therefore the factors associated with the transition to smaller families. Most prior evidence on fertility decline is based on indirect estimates of the crude birth rate and child-woman ratios, which are sensitive to changes in the age at marriage, the proportions ever marrying, mortality, and census underenumeration. These studies suggest that fertility differentials between regions were pronounced early in the nineteenth century, and thus most scholars speculate that

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American couples were consciously changing their reproductive behavior to control family size as early as 1800.

This paper relied on the 1850, 1860, 1870, and 1880 IPUMS samples and new estimates of nineteenth-century mortality to revise estimates of the crude birth rate in the nineteenth-century United States and to make “own-children” estimates of white marital fertility. The results challenge the view that a large proportion of white couples was actively engaging in family limitation practices in the early nineteenth century. Revised estimates of the crude birthrate suggest little or no change in general fertility before 1840. The moderate decline in the birth rate that was observed between 1800 and 1850 can be explained by changes in nuptiality, which is believed to have declined significantly during the period.

The conclusion that the onset of marital fertility control in the United States should not be dated until the late nineteenth century is further supported by own-child estimates of marital fertility, which comprehend changes in nuptiality, mortality, and census underenumeration. The results indicate that total marital fertility in the United States was equal to or higher than that in England until the onset of the American Civil War in 1861. The index of marital fertility remained over 0.600 as late as 1877-79, also suggesting the likely absence of deliberate fertility control within marriage. Finally, Coale and Trussell’s $m$ parameter, which estimates the degree that couples limit childbearing after obtaining a desired number of children (engage in parity-dependent control), suggests little evidence of conscious fertility control until the period 1867-70. Although recent criticism of the Coale and Trussell model strongly suggests that it should not be used as the sole means of identifying the onset of marital fertility, the results
correspond with the other measures noted above. Thus, American marital fertility decline
should perhaps be dated to the period 1860-1870, bringing the United States’ fertility
transition more in line with the fertility experience of most other western countries.
References


Figure 1. Existing estimates of the white birth rate in the United States, 1800-1930
Figure 2. New estimates of the white birth rate in the United States, 1800-1930.
Table 1. Proportion ever married by 5-year age group and the singulate mean age at marriage (SMAM), white women in the United States, 1850-1890

<table>
<thead>
<tr>
<th>Census Year</th>
<th>1850</th>
<th>1860</th>
<th>1870</th>
<th>1880</th>
<th>1890</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>0.122</td>
<td>0.124</td>
<td>0.109</td>
<td>0.110</td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td>0.518</td>
<td>0.531</td>
<td>0.518</td>
<td>0.494</td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td>0.761</td>
<td>0.773</td>
<td>0.752</td>
<td>0.761</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>0.842</td>
<td>0.860</td>
<td>0.837</td>
<td>0.854</td>
<td></td>
</tr>
<tr>
<td>35-40</td>
<td>0.887</td>
<td>0.887</td>
<td>0.880</td>
<td>0.891</td>
<td></td>
</tr>
<tr>
<td>40-44</td>
<td>0.886</td>
<td>0.895</td>
<td>0.892</td>
<td>0.909</td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>0.901</td>
<td>0.911</td>
<td>0.911</td>
<td>0.924</td>
<td></td>
</tr>
<tr>
<td>SMAM 15-49</td>
<td>22.7</td>
<td>22.7</td>
<td>23.1</td>
<td>23.3</td>
<td>23.8</td>
</tr>
</tbody>
</table>

Sources: 1850-1880 IPUMS samples (Ruggles and Sobek 1997), Haines (1996)
Note: 1850-1880 estimates based on an imputed relationships.

Table 3. Proportion currently married by 5-year age group, white women in the United States 1840-1890

<table>
<thead>
<tr>
<th>Census Year</th>
<th>1840</th>
<th>1850</th>
<th>1860</th>
<th>1870</th>
<th>1880</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>0.129</td>
<td>0.120</td>
<td>0.120</td>
<td>0.106</td>
<td>0.102</td>
</tr>
<tr>
<td>20-24</td>
<td>0.516</td>
<td>0.492</td>
<td>0.512</td>
<td>0.493</td>
<td>0.464</td>
</tr>
<tr>
<td>25-29</td>
<td>0.731</td>
<td>0.720</td>
<td>0.733</td>
<td>0.706</td>
<td>0.710</td>
</tr>
<tr>
<td>30-34</td>
<td>0.788</td>
<td>0.780</td>
<td>0.801</td>
<td>0.767</td>
<td>0.785</td>
</tr>
<tr>
<td>35-40</td>
<td>0.813</td>
<td>0.807</td>
<td>0.804</td>
<td>0.784</td>
<td>0.792</td>
</tr>
<tr>
<td>40-44</td>
<td>0.774</td>
<td>0.772</td>
<td>0.775</td>
<td>0.769</td>
<td>0.770</td>
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<tr>
<td>45-49</td>
<td>0.757</td>
<td>0.746</td>
<td>0.760</td>
<td>0.756</td>
<td>0.738</td>
</tr>
</tbody>
</table>

Source: 1850-1880 IPUMS Samples (Ruggles and Sobek 1997)
Note: 1840 estimates extrapolated from 1850-1880 rates.
Figure 3. Total fertility rate of the white population in the United States, 1835-1880.
Table 2. Age-specific birth rates in five-year age groups and total fertility rates for aggregated time periods, estimated by applying the own-child method of fertility estimation to the 1850-1880 censuses, white population.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1835-39</td>
<td>0.093</td>
<td>0.240</td>
<td>0.285</td>
<td>0.273</td>
<td>0.214</td>
<td>0.120</td>
<td>0.029</td>
<td>6.3</td>
<td>5.8</td>
</tr>
<tr>
<td>1840-44</td>
<td>0.080</td>
<td>0.240</td>
<td>0.301</td>
<td>0.281</td>
<td>0.227</td>
<td>0.112</td>
<td>0.025</td>
<td>6.3</td>
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<tr>
<td>1845-49</td>
<td>0.073</td>
<td>0.226</td>
<td>0.279</td>
<td>0.270</td>
<td>0.208</td>
<td>0.111</td>
<td>0.025</td>
<td>6.0</td>
<td>5.6</td>
</tr>
<tr>
<td>1850-54</td>
<td>0.076</td>
<td>0.214</td>
<td>0.262</td>
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<td>0.188</td>
<td>0.097</td>
<td>0.021</td>
<td>5.5</td>
<td>5.1</td>
</tr>
<tr>
<td>1855-59</td>
<td>0.077</td>
<td>0.224</td>
<td>0.263</td>
<td>0.247</td>
<td>0.183</td>
<td>0.096</td>
<td>0.020</td>
<td>5.5</td>
<td>5.2</td>
</tr>
<tr>
<td>1860-64</td>
<td>0.061</td>
<td>0.187</td>
<td>0.232</td>
<td>0.215</td>
<td>0.175</td>
<td>0.089</td>
<td>0.019</td>
<td>4.9</td>
<td>4.6</td>
</tr>
<tr>
<td>1865-69</td>
<td>0.062</td>
<td>0.191</td>
<td>0.229</td>
<td>0.209</td>
<td>0.158</td>
<td>0.085</td>
<td>0.017</td>
<td>4.7</td>
<td>4.4</td>
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<tr>
<td>1870-74</td>
<td>0.066</td>
<td>0.198</td>
<td>0.230</td>
<td>0.206</td>
<td>0.158</td>
<td>0.075</td>
<td>0.014</td>
<td>4.7</td>
<td>4.4</td>
</tr>
<tr>
<td>1875-79</td>
<td>0.055</td>
<td>0.199</td>
<td>0.235</td>
<td>0.210</td>
<td>0.159</td>
<td>0.076</td>
<td>0.013</td>
<td>4.7</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Source: Integrated Public Use Microdata Series (Ruggles and Sobek et al. 1997)
Figure 4. Age-specific birth rates by five-year age groups, white population, 1836-1879
Figure 5. Total martial fertility rates (ages 20-49) for the white population in the United States and the population of England 1840-1880
Table 4. Age-specific marital birth rates in five-year age groups, total marital fertility rates, and various indices of marital fertility, estimated by applying the own-child method of fertility estimation to currently married white women in the 1850-1880 censuses.

<table>
<thead>
<tr>
<th>Rates, Measures, and Period</th>
<th>Women’s age</th>
<th>1847-49</th>
<th>1857-59</th>
<th>1867-69</th>
<th>1877-79</th>
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<tbody>
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<td>ASMBR</td>
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<td>.442</td>
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<td>.365</td>
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<td>.329</td>
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<td></td>
<td>30-34</td>
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<td>.271</td>
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<tr>
<td></td>
<td>35-40</td>
<td>.255</td>
<td>.234</td>
<td>.201</td>
<td>.200</td>
</tr>
<tr>
<td></td>
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<td>.142</td>
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<td>.100</td>
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<tr>
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<td>.027</td>
<td>.023</td>
<td>.018</td>
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<tr>
<td>TMFR</td>
<td>15-49</td>
<td>10.83</td>
<td>10.68</td>
<td>9.54</td>
<td>9.20</td>
</tr>
<tr>
<td></td>
<td>20-49</td>
<td>7.94</td>
<td>7.53</td>
<td>6.65</td>
<td>6.64</td>
</tr>
<tr>
<td>Index of marital fertility</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_g)</td>
<td></td>
<td>0.735</td>
<td>0.700</td>
<td>0.616</td>
<td>0.611</td>
</tr>
<tr>
<td>Coale and Trussell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td></td>
<td>0.924</td>
<td>0.917</td>
<td>0.825</td>
<td>0.855</td>
</tr>
<tr>
<td>(m)</td>
<td></td>
<td>0.089</td>
<td>0.182</td>
<td>0.217</td>
<td>0.289</td>
</tr>
<tr>
<td>Hinde and Woods</td>
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<tr>
<td>(M)</td>
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<td>1.084</td>
<td>1.080</td>
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<td>1.006</td>
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<td>(m)</td>
<td></td>
<td>-0.027</td>
<td>0.075</td>
<td>0.102</td>
<td>0.187</td>
</tr>
<tr>
<td>Weir</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(MAC)</td>
<td></td>
<td>30.2</td>
<td>29.9</td>
<td>29.8</td>
<td>29.6</td>
</tr>
</tbody>
</table>

Figure 6. Age-specific marital birth rates by five-year age groups, white population, 1837-1879

Births per woman-years of exposure

Age group

20-24 25-29 30-34 35-40 40-44 45-49

1837-39
1857-59
1867-69
1877-79
Coale and Trussell "Natural" fertility
Tolnay et al. 1886-89