DID RISING OUT-MIGRATION CAUSE FERTILITY
TO DECLINE IN ANTEBELLUM NEW ENGLAND?
A LIFE-CYCLE PERSPECTIVE ON OLD-AGE SECURITY MOTIVES,
CHILD DEFAULT, AND FARM-FAMILY FERTILITY

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ABSTRACT

A model of fertility based on the life-cycle model of intertemporal optimization is presented in which fertility, children's schooling, saving, and bequest planning are simultaneously determined. The paper hypothesizes that sometime shortly after the beginning of the nineteenth century, Americans began to adopt this life-cycle strategy and abandon the older, traditional family-based system of providing for old age. As a consequence the overall fertility rate began to fall. The change in attitudes was, it is argued, triggered by the high incidence of "child default" as young adults left the seaboard states for land in the west. The change to life-cycle strategies was gradual and proceeded at different rates in different parts of the country. This differential timing of the "life-cycle transition" allows empirical tests to be based on cross-sections of state data drawn from the 1840 U.S. Census. The model is shown to predict well. An alternative hypothesis, Richard Easterlin's "target-bequest model" is rejected by these tests.
DID RISING OUT-MIGRATION CAUSE FERTILITY TO DECLINE IN ANTEBELLUM NEW ENGLAND?

A Life-Cycle Perspective on Old-Age Security Motives, Child Default, and Farm Family Fertility

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Eighteenth-century American farms were family owned, family operated, and self-sufficient. At the same time, the fertility of the population inhabiting those farms was extremely high. This association, we feel, was more than coincidence. Large families were desirable on these autarkic farms for at least three reasons:

1. First, grown children provided economic security for their parents' old age. As the children grew up, the work load of the family farm could be gradually shifted from the older to the younger generation and parents could rely upon their children to care for them in the case of sickness or infirmity. [An exception to this rule should be allowed for the case of slave owners whose servants could care for them in old age and whose overseer and field hands could maintain the plantation.]

2. Second, large families permitted an expansion of the scale of the farm and perhaps led to an increase in per capita output. Since hired, non-family labor was scarce and expensive in this period, the effective size of a farm was limited by the number of workers in the family. The labor constraint was felt only during the brief seasonal periods devoted to planting and harvesting, but that was sufficient to allow family size to control the scale of the farm. [The exception to this rule was in the South where slave labor permitted the establishment of plantation-scale agricultural holdings and the seasonal pattern of labor requirements was less pronounced; Gavin Wright 1978: Chapter 3, Ralph Anderson and Robert Gallman 1979].


1. Jeffrey Nugent has written an excellent review of the old-age security motive for fertility (1985). He lists eight basic conditions for old-age security to be an important motive for large families [p. 76]. The situation on eighteenth-century American farms seems to fit his conditions very well (Sundstrom and David 1986: 19-30). The case that an old-age security motive is relevant to colonial America can be found in Philip Greven 1978, Daniel Scott Smith 1973, David Hackett Fischer 1977: 52-58, and James Henretta 1978.

Third, a large family with many sons satisfied the family’s dynastic motive to continue and enhance the family name and destiny. In an environment where land was abundant, it was possible to hope that each son might eventually be established on a farm of his own and parents had less cause to fear a fall in the family’s standing as the consequence of a partition of the family estate (Henretta 1978). (Again, an exception must be allowed for the southern colonies where primogeniture prevailed; Richard Morris 1927, Lee Alston and Morton Schapiro 1984.)

The high fertility of the rural population and the self-sufficiency of agriculture were mutually reinforcing. Self-sufficiency meant an absence of well-developed markets that, in turn, required a reliance upon family-based mechanisms of reciprocity to provide farm labor and old-age security. Large families supplied the needed labor during the seasonal peaks of agricultural work but they also supplied a surplus of labor in the off-season. This energy was employed in the home manufacturing of textiles, tools, and the like. The low opportunity cost of off-peak labor, in turn, inhibited the rise of urban manufacturing and retarded the development of markets (Hymer and Reanick 1969, Clark 1979). The absence of an urban alternative to agriculture assured that the primary emphasis of parents would be to raise their children to continue the tradition of family farming.

Given the self-reinforcing nature of this relationship, it might seem that a regime of high fertility and self-sufficient family farming should have continued far into the nineteenth century. After all, the entire century was characterized by the continuous availability and gradual exploitation of large tracts of unpopulated land. Many eighteenth-century observers, of course, predicted just that. Thomas Jefferson, it is well known, foresaw an agrarian democracy populated by independent yeoman. With equal foresight he predicted a continuing high rate of natural increase. In a letter dated July 1787, he wrote:

A century’s experience has shown that we double our numbers every twenty or twenty-five years. No circumstance can be foreseen at this moment which will lessen our rate of multiplication for centuries to come. (Jefferson, 1787)

Jefferson was wrong. At about the beginning of the nineteenth century, a long-sustained and sharp decline in fertility began. It is an essential part of our argument to note that this dramatic development coincided with a revolution in the structure of the American family. Sometime not long after the

3. Benjamin Franklin and Adam Smith also explained the high American birth rate by the abundance of land and on that basis predicted the continuation of high birth rates for many generations (Franklin 1751, Smith 1776: 70, 392). Had they foreseen the American acquisition of the trans-Mississippi territory or the coming transportation revolution, it would have only strengthened their confidence in the argument.
beginning of the nineteenth century, Americans began to think differently about family responsibilities, inter-generational relationships, and their economic goals in life. This change in family and individual values -- in fact, it was a change from family values to individual values -- has been the subject of much recent discussion and research by social historians, several of whom have proposed that the fertility decline was caused by these changes in values and family structure. We suspect that both changes were precipitated by a third: the opening of western lands to settlement at the beginning of the nineteenth century.

I. CHILD DEFAULT AND THE AMERICAN FERTILITY DECLINE

The colonial family-oriented value system had originally served the function of securing old-age protection for parents by placing a responsibility for their care on their grown children. This cultural norm was reinforced by rewarding the second generation with an inheritance of land and other property. Those who abrogated their responsibilities to the family could be disinherited and deprived of the land necessary to maintain their economic wellbeing and their social position within the community. This system of providing for old age served well as long as the ownership of land was essential to economic success.

4. The term gaining favor to describe this value reorientation is "modernization." The connection between the changes in values and the fertility decline is discussed by Maria Vinovskis 1981: Chapter 6, and Robert Wells 1982.

and access to land by purchase was restricted, but it began to break down with the opening of the trans-Appalachian west. Accessible, cheap, and highly-productive western land gave sons and daughters an alternative to familial obedience. The increasing incidence and constant threat of "child default" put such stress on the traditional system that a search was begun for a more reliable strategy of securing old age. In the process, the modernization of values was accelerated.

Child Default and the Life-Cycle Transition

The term "child default" is used by Jeffrey Williamson to suggest that children were once viewed as a type of "asset" by their parents (Williamson 1985). At a time when markets for financial and liquid physical assets either did not exist or were unreliable, intertemporal reallocations of income were accomplished by relying upon reciprocity and implicit contracting with family members. A large family, then, was like money in the bank -- provided the children remained nearby and could be relied upon or coerced to live up to their family responsibilities. Since raising children entailed costs, fertility in this pre-modern world can be modeled as an investment decision (Peter Lindert 1978 and 1983).

Williamson noted that in rural England the out-migration which rose to considerable magnitude in the mid- and late-nineteenth century consisted almost entirely of young men and
women between 15 and 39. Older individuals rarely moved (Williamson 1985: 8-10). Because the departing young rarely, almost never, returned and because remittances of money to family members who remained behind was also very rare, these departures of the young were tantamount to a default on the parents' investment in their children. "If children were viewed as assets by their parents, and if the returns to those assets dropped as children fled to England's cities and the New World," Williamson asks, "wouldn't parents have had fewer children, seeking alternative ways to accumulate for old age?" (Williamson 1985).

A high incidence of child default also appeared in New England and in the Middle Atlantic States around 1800. A great out-migration from the rural areas of those states began with the opening of the trans-Appalachian territory following the suppression of the Indian resistance at Fallen Timbers and the Treaty of Greenville in 1795. Although checked somewhat by the War with England in 1812, the flow became a flood after the peace in 1815. 6.

The aggregate data is far from perfect, but estimates of interregional migration based on calculations by Peter McClelland

6. There is no comparable data for the colonial period, though what evidence we have suggests a much lower rate of geographical mobility. However, a study of the place of birth of men who enlisted in the Colonial militia during the Revolutionary War undertaken by Georgia Villaflor and Kenneth Sokoloff reported, in the words of the authors, a "high level of mobility" (1982: 560). If this finding could be generalized to the entire rural population of colonial America, it would cast doubt on our suggestion that child default was not a common problem in the eighteenth century. However, the persistence and migration rates reported in Villaflor and Sokoloff's tabular presentations lead us to the exact opposite of their conclusion. Over 82 percent of the militiamen who were born in New England or New York enlisted in their state of birth and only one-half of one percent were residing in a colony outside of the region (calculated from data presented in Villaflor and Sokoloff 1982: Tables 1 and 2: pp. 541-542; also see p. 549). Residential persistence rates were somewhat lower in the slave states as would be expected given their laws of primogeniture and the slave-based alternative to the family old-age security system. It is also relevant to note that the sample of militiamen examined by Villaflor and Sokoloff seriously under represents farmers (only 37 percent listed themselves as such (Table 8, p. 553)). We can confidently assume that eighteenth century farmers were less mobile than the artisans, seamans, and laborers who made up the majority of the Revolutionary Militia. Our contradictory interpretation of Villaflor and Sokoloff is supported by Daniel Scott Smith 1983.
Table 1
Rate of Out-Migration from New England, White Population, 1800-1820
(Percent of Persons at Outset of Period)

<table>
<thead>
<tr>
<th>Age at End of Period</th>
<th>1800 to 1810 Males</th>
<th>1800 to 1810 Females</th>
<th>1810 to 1820 Males</th>
<th>1810 to 1820 Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-19</td>
<td>4.30</td>
<td>6.30</td>
<td>5.25</td>
<td>6.11</td>
</tr>
<tr>
<td>20-29</td>
<td>6.67</td>
<td>6.00</td>
<td>6.26</td>
<td>12.66</td>
</tr>
<tr>
<td>30-39</td>
<td>7.89</td>
<td>4.92</td>
<td>6.43</td>
<td>12.45</td>
</tr>
<tr>
<td>40 and up</td>
<td>8.38</td>
<td>4.79</td>
<td>4.08</td>
<td>6.50</td>
</tr>
<tr>
<td>Total</td>
<td>5.38</td>
<td>5.27</td>
<td>5.30</td>
<td>8.72</td>
</tr>
</tbody>
</table>


Sources: The number of net out-migrants were estimated by Peter D McClelland and Richard J. Zeckhauser, *Demographic Dimensions of the New Republic: American Interregional Migration, Vital Statistics, and Manumissions, 1800-1860* (Cambridge University Press, 1982): Table C-1, pp. 138-139. These estimates were calculated using a technique known as the "census survival method." Only net migration, the difference between out-migration and in-migration can be estimated by this technique. This method depends for its accuracy on reliable estimates of the age specific mortality schedule which in this case McClelland and Zeckhauser were forced to estimate from fragmentary data. They warn their readers of the "aura of precision that belies the tenuous nature of many of [the] data inputs" [p. 85]. For the denominator of the migration rate we calculated the age distribution of the white population using the McClelland-Zeckhauser interpolation technique [pp. 23-25] and the age distributions of the white population reported in the U.S. Census Office, Second Census (1800), Second Census of the United States (1801); p. 2; and U.S. Census, Third Census (1810), Aggregate Amount of Persons within the United States in the Year 1810 (1811): p. 1.

Like the out-migration from rural England studied by Williamson, the out-migration from New England was highly selective of the young. Table 2 presents the estimates of the age distribution of the New England migrants from these regions between 1800 and 1820. The age distribution of the white population of New England in 1810 is presented for comparison. Note that approximately one half of the out-migrants were between 15 and 34. The clear implication of these figures is that many young adults left their parents behind when they left New England. Table 1 suggests that, at a minimum, ten percent of the young adults of New England left the region in the 1810-1820 period. There is ample testimony in the traditional historical sources examined by Levis Stilwell and Hal Barron to confirm that this was the case (Stilwell 1948, Barron 1984).
Table 2

(Percent of Persons 5 and Over)

<table>
<thead>
<tr>
<th>Approximate Age at Migration</th>
<th>1800 to 1810</th>
<th>1810 to 1820</th>
<th>1810 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
</tr>
<tr>
<td>5-14</td>
<td>26.3</td>
<td>37.6</td>
<td>22.4</td>
</tr>
<tr>
<td>15-24</td>
<td>30.8</td>
<td>27.6</td>
<td>37.0</td>
</tr>
<tr>
<td>25-34</td>
<td>19.1</td>
<td>12.6</td>
<td>18.7</td>
</tr>
<tr>
<td>35 and up</td>
<td>23.8</td>
<td>22.2</td>
<td>22.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>


If our conjecture about the American case is correct, then we can draw a chain of causal links that begins with the frontier land policy of the new nation. The opening of the west induced a high out-migration from the settled areas which increased the incidence of child default. As the century proceeded, the development of manufacturing and commerce and the consequent growth of urban areas gave young adults another alternative to remaining on the family farm. The risk of departure of the children to cities or the new lands of the west gave parents reason to have fewer children. At the same time, parents would seek new ways to accumulate for old age.

7. Our reasoning provides a triggering mechanism for the "mobility transition" described by Wilbur Zelinsky 1971. Zelinsky suggested that a increase in geographic and social mobility is an essential component of the modernization process which produces both industrialization and the demographic transition.

8. A perverse theoretical possibility has been suggested by Harvey Leibenstein 1975: 24. A safety-first strategy on the part of parents might induce them to have more children as the risk of child default as they attempted to produce at least one or two children who would not default. We do not view this as very likely in the American case, however, since, as we show below, marital fertility was at a biological maximum at the time child default first appeared as a significant problem. A moderate level of child-default risk, through death as well as departure, however, might have been a contributing factor producing the high fertility rates of the colonial period.

9. Nancy Folbre, in a detailed study of wealth holding in Deerfield, Massachusetts has found evidence of a transition in the behavior controlling saving, inheritance, and wealth accumulation occurring in Deerfield about 1800. She explains the change as the consequence of a weakening of patriarchal control and the increasing independence of young adults (Folbre 1985: 214-217). These changes, in turn, "diminished the economic
In the new regime, parents provided for their old-age by accumulating assets during their working life which were then used to finance their consumption in old age. As asset markets and financial intermediaries developed to meet the new demands, the life-cycle strategy of accumulation spread even to those who had little to fear from child default. Elsewhere, we have described this process as the "Life-Cycle Transition" since the basis of the new strategy was life-cycle saving and the new mode of behavior can be described as the result of life-cycle optimization."

We conjecture that the post-transition household had a demand for fewer children. Three reasons parallel those for the high fertility of the Colonial era:

» First, parents could no longer rely upon their children during old age; they might move away. The promise of an inheritance of land was, in any event, becoming a less-important and a less-credible reward. The household’s accumulated assets became its new source of security. Once parents were no longer "benefits of children, and encouraged early fertility decline" (Folbre 1985: 200; also see Folbre 1983).


obligated by family conventions and expectations to pass the family farm intact to their heirs, even land could serve as a life-cycle asset. In this context a large family with its consequent consumption requirements actually became a threat to old-age security.

» Second, parents could no longer rely upon their grown children to provide faithful labor on the family farm. At one time, the promise of an inheritance had been used by parents as an incentive to hard work and obedience. The loss of this bargaining chip undermined patriarchal authority. Contributing to the reduced value of child labor on the farm was a reduction in their relative productivity. New crops, the rise of animal husbandry, and agricultural developments such as the introduction of crop rotations evened out the farm’s seasonal labor requirements. At about the same time, the rise of urban manufacturing provided commercial substitutes for home manufactures.

» Third, the spirit of individualism and independence favored quality rather than quantity when it came to establishing a posterity of descendants. The new ethic placed the children in school rather than in the field.

These considerations provide a motive to examine the trends and cross-sectional patterns of farm-family fertility for evidence of the life-cycle transition and its impact on family
size. As we have already noted, and will discuss in more detail below, American fertility was very high at the end of the eighteenth century and it began a sustained decline coinciding with the onset of the family revolution shortly after the beginning of the nineteenth century. But these findings, which support in a general way the argument just presented, give an added urgency to a close examination of fertility trends and patterns since the prevailing explanation of the American fertility decline among economic historians is one that rests on an assumption that a transition to life-cycle modes of behavior did not take place.

This alternative view is associated with Richard Easterlin. In an influential series of articles, Easterlin and his students have proposed that American farmers had a strong target-bequest motive which persisted throughout the nineteenth century. The farmer's goal, according to this argument, was to leave each son and daughter a farm at least as productive as the one the farmer received with his own inheritance. Easterlin goes on to suggest that the fertility of farm families declined as rural population grew and suitable farm locations for the children became increasingly scarce.

Our examination of the American fertility decline in this working paper has two objectives. We wish to show that the observed patterns and trends of American fertility are consistent with conjecture about the life-cycle transition and we wish to show that the trends and cross-sectional pattern of fertility is not well-explained by the target-bequest behavior.

The American Fertility Decline

Samuel Blodget, America's first statistical economist, estimated in 1806 that the crude birth rate of the free population had been 56 per thousand during the preceding fifteen years. His estimate was based on a surprisingly


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sophisticated study of the growth of population between the first American census, taken in 1790, and the second, taken ten years later. He made corrections for net immigration using the "best records and estimates at present attainable" and for mortality using an impressionistic average established after reviewing the statistics on deaths for a scattered collection of cities and regions, taking notice of variances produced by "the size of the cities as well as for the difference of their climates, seasons, &c." (Blodget 1806: 76).

Subsequent research has left Blodget's estimate in remarkably good shape. Modern analysis of the early census returns suggests that the birth rate for white women was perhaps somewhat lower than Blodget's estimate, but he was certainly within the modern range of error. Table 3 presents several estimates for the early decades of the nineteenth century. By any standards these rates, all over 45 per thousand, are enormously high; as high, indeed, as the birth rate in any country in the world today and considerably higher than the birth rates in western Europe at the outset of the nineteenth century. Table 4 provides a sampling for comparison purposes.

record that our interpretation of Blodget's Table differs somewhat from that of Wilson H. Grubbill 1959: n. 3, p. 292. He suggested that Blodget's estimated both white and slave births at the same rate.

Table 3
Estimates of The Crude Birth Rate, White Population, 1800-1820
(Births per Thousand Population)

<table>
<thead>
<tr>
<th>Year</th>
<th>Thompson-Whelpton*</th>
<th>Low</th>
<th>High</th>
<th>Low &quot;Best&quot;</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800</td>
<td>55.0</td>
<td>47.6</td>
<td>52.9</td>
<td>49.8</td>
<td>53.8</td>
</tr>
<tr>
<td>1810</td>
<td>54.3</td>
<td>47.3</td>
<td>52.7</td>
<td>49.9</td>
<td>53.8</td>
</tr>
<tr>
<td>1820</td>
<td>52.8</td>
<td>45.9</td>
<td>51.1</td>
<td>47.6</td>
<td>50.5</td>
</tr>
</tbody>
</table>

a. Thompson and Whelpton's estimates are averages for five years centered on the year given.


-- continued on next page --
Source Notes for Table 3 -- Continued


More recently Peter D. McClelland and Richard J. Zeckhauser, *Demographic Dimensions of the New Republic* (Cambridge University Press, 1982), constructed a large dynamic model of the population designed to replicate the census counts between 1800 and 1860 with a consistent set of figures on immigration, vital rates, and underenumeration. Their "most reasonable" estimate for the white birth rate is 53.8 per thousand (p. 71). Their low estimates are reported in Table C-14, p. 156; the high in Table C-19, p. 158; and the "most reasonable" in Table C-15, p. 156.

Table 4

<table>
<thead>
<tr>
<th>Country, date(s)</th>
<th>Birth Rate</th>
<th>Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lombardy, 1798-1799</td>
<td>40-45</td>
<td>Cipolla</td>
</tr>
<tr>
<td>Finland, 1798-1802</td>
<td>38-40</td>
<td>Gille, Mitchell</td>
</tr>
<tr>
<td>England, 1798-1802</td>
<td>34-39</td>
<td>Wriley and Schofield</td>
</tr>
<tr>
<td>Tuscany, 1810-1814</td>
<td>35-37</td>
<td>Cipolla</td>
</tr>
<tr>
<td>France, 1798-1802</td>
<td>33-37</td>
<td>Blayo</td>
</tr>
<tr>
<td>Norway, 1796-1800</td>
<td>32-33</td>
<td>Gille</td>
</tr>
<tr>
<td>Denmark, 1798-1802</td>
<td>30-33</td>
<td>Gille, Mitchell</td>
</tr>
<tr>
<td>Sweden, 1798-1802</td>
<td>29-34</td>
<td>Gille, Mitchell</td>
</tr>
<tr>
<td>Kenya, 1979</td>
<td>52-53</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>Ethiopia, 1977</td>
<td>42-52</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>Nigeria, 1971-73</td>
<td>48-51</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>Uganda, 1969</td>
<td>46-50</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>Bangladesh, 1974</td>
<td>49</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>Afghanistan, 1979</td>
<td>48</td>
<td>Statistical Abstract</td>
</tr>
<tr>
<td>Iraq, 1977</td>
<td>46-48</td>
<td>Statistical Abstract</td>
</tr>
</tbody>
</table>

The birth rate, though, gives a misleadingly low measure of fertility for a population with a preponderance of men and children, since it reflects the fertility of the population as a whole rather than of its women. A more precise measure used by demographers is the "total fertility rate." Total fertility measures the average number of children that would be born to a group of women experiencing throughout their life the average fertility observed among women of each age in the actual population. A total fertility rate of 7, for example, suggests a woman experiencing average fertility would give birth seven times during her lifetime.

There is insufficient data to calculate the total fertility rate in the early nineteenth century directly, but estimates can be derived using various models of population growth. Ansley Coale and Melvin Zelnik employ this approach to estimate that the total fertility rate in 1800 was 7.04 for white women (1963: Table 2, p. 36). Warren Sanderson, also using a modeling technique, puts the figure even higher: 8.03 (Sanderson 1976: Table 1, p. 14). Given what is known about the average age of marriage and the proportion of women ever married, marital fertility rates had to have been very close to the biological maximum to produce total fertility rates as high as these. Alfred Lotka's estimate for 1790, also based on a model of population growth, was 7.76 children per mother (Lotka 1927: Table IV, p. 1651). Lotka went on to calculate that this rate implied an average interval between births for young mothers of 14.27 months (Table VI, p. 167). Nine months for gestation and three to five months of post-partum non-susceptibility places an average birth interval of 14.3 months at the extreme limit of reproductive frequency. 13

Our view that American white fertility was close to a biological maximum in 1800 is supported by demographic studies of local populations. The consensus that emerges from the few family reconstitution studies that have been carried out for colonial populations is that the married women studied were not attempting to reduce their fertility. The child-spacing patterns and the mean age of mothers at the birth of their last child revealed in these studies are consistent with the absence of

13. Paul David and Warren Sanderson report an estimate for the average interval between a birth and the first subsequent menstruation of 5.17 months based on a sample of well-to-do American women who gave birth between 1892 and 1920 (David and Sanderson 1985: Table 7 following p. 63). Post-partum non-susceptibility is likely to last a month or two beyond the resumption of menstruation. The length of the period that elapses before the first post-natal menstruation would depend upon nursing practices and the typical age at which infants are weaned. In the sample studied by David and Sanderson the average lactation period was between six and seven months. We are not prepared to say whether nursing periods were definitely shorter than this in the late eighteenth century, but surely a three to five-month period of nonsusceptibility would be low by any standards.
fertility control. What is known about contraceptive knowledge and practice suggests that the high fertility exhibited was the consequence of deliberate behavior (La Sorte 1976, Reed 1978). Daniel Scott Smith noted that a temporary period of reduced fertility in Hingham at the turn of the eighteenth century demonstrates that the potential existed for colonial populations to limit their family size before 1800, had they chosen to do so (Smith 1972: 183).

Since the age of marriage in colonial America was low, most women were married during the age period of peak fecundity. That, and the lack of evidence for any significant fertility control within marriage, suggests that white marital fertility was probably at its all-time peak for the United States at the end of the eighteenth century. Some scholars maintain that total fertility, as opposed to marital fertility, had been declining in the years before 1800 (Yasuba 1962: 71-72). If so, that would imply the age of marriage had been slightly younger or the proportions married higher at the earlier dates. But, there is no clear evidence that such was the case and most speculation on the subject suggests that total fertility was stable, and even, perhaps, rising during the eighteenth century.14

Despite the uncertainty about the precise trends in fertility before 1800, all studies agree that a long-term decline in fertility began in America sometime around 1800 or 1810 and continued in an almost linear fashion until the baby boom of the post-World War II period. Figure 1 plots the estimates of total fertility of whites according to two different authorities (Coale and Zelnik 1963: Table 2, p. 36; Sanderson 1976: Table 1, p. 11). The declining trend is evident in both series.

14. Daniel Scott Smith (1972) examined the records of Hingham, Massachusetts; Nancy Osterud and John Fulton (1976) studied Sturbridge, Massachusetts; and H. Temkin-Greener and A. C. Svedlund (1978) drew their records from Franklin County [Deerfield, Greenfield, and Shelburne], Massachusetts. Temkin-Greener and Svedlund place the beginnings of fertility control sometime between 1760 and 1780. The other two studies find no reason to suggest that deliberate control was practiced before 1800.

15. Coale and Zelnik assume a mean age of marriage for white women of 20 (1963: 371). Sanderson’s assumptions are consistent with a mean of 19.8 years (1979: 343). The Massachusetts family reconstitutions revealed somewhat higher mean ages. For Hingham, Smith reports an age at first marriage of 23.7 at the end of the eighteenth century (1972: Table 3, p. 177). For Sturbridge, the age for a comparable group was 22.46 years (Osterud and Fulton 1976: Table 2, p. 484), and in Franklin County it was 23.3 years (Temkin-Greener and Svedlund 1978: Table 6, p. 34).

16. There was no clear trend in marriage age over the course of the eighteenth century revealed by the Massachusetts family reconstitution studies. Osterud and Fulton report a slight decline from 22.85 for marriages occurring between 1760 and 1779 to 22.46 for the marriage cohort of 1780-1799 (1976: Table 2, p. 484), but the difference is not statistically significant. Smith reported virtually no change between the cohort of 1716-1740 (23.8 years) and the one for 1781-1800 (23.7) (1972: Table 3, p. 177). Temkin-Greener and Svedlund report an increase from 20.9 to 23.3 years over a comparable period (1978: Table 6, p. 34). For speculations about the eighteenth-century trend in total fertility, see Potter (1965: 646 and 672), who guesses it was rising, and Grabill, Kiser, and Whelpton (1958: 5-9) and Smith (1973: 426), who seem inclined to accept stability.
On an accompanying chart, Figure 2, we plot Yasuba’s index of fertility, which he called the “refined birth ratio,” along with the Coale-Zelnik fertility rate for comparison. The two alternative measures closely follow the same downward path. Yasuba’s index is a convenient measure of fertility since, unlike total fertility, it can be easily calculated from available census data. It is defined as the number of children under ten per one thousand women of child-bearing age, that is from 16 to 44. Because data required for calculating this ratio are available for states, counties, and cities in many of the early censuses, it has become the standard used in studies of antebellum fertility patterns. Figure 2 confirms that it is a good proxy for the total fertility rate, a point that has been affirmed in more sophisticated tests (Bogue and Palmore 1964, Sundstrom and David 1986: Appendix II). Table 5 presents some of the numbers plotted in Figures 1 and 2.

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17. The data for 1800 to 1860 come from Yasuba 1962: Table II-7, pp. 61-62. We have extended Yasuba’s series to 1900. See the source note to Table 5 for details.

18. At some census dates interpolations are required to calculate the denominator of Yasuba’s ratio since the age categories used for the published data do not always break at 16 and 44. Yasuba introduced a method of interpolation (1962: 32-34) that he claimed was superior to the standard method (Walter Wilcox 1911). We use Yasuba’s method whenever necessary throughout this study.
Figure 2. Yasuba Fertility Index, Whites, 1800-1980

Source: Table 3.

Table 5
Trends in the Fertility of White Women, 1800-1980

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Fertility Rate</th>
<th>Yasuba Index</th>
<th>Crude Birth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coale-Zelnik</td>
<td>Sanderson</td>
<td>Children under 10 per 1000 Women 16 to 44</td>
</tr>
<tr>
<td>1800</td>
<td>7.04</td>
<td>8.02</td>
<td>1844</td>
</tr>
<tr>
<td>1810</td>
<td>6.92</td>
<td>7.92</td>
<td>1824</td>
</tr>
<tr>
<td>1820</td>
<td>6.73</td>
<td>7.42</td>
<td>1735</td>
</tr>
<tr>
<td>1830</td>
<td>6.55</td>
<td>6.93</td>
<td>1586</td>
</tr>
<tr>
<td>1840</td>
<td>6.14</td>
<td>6.56</td>
<td>1514</td>
</tr>
<tr>
<td>1850</td>
<td>5.42</td>
<td>6.03</td>
<td>1335</td>
</tr>
<tr>
<td>1860</td>
<td>5.21</td>
<td>5.52</td>
<td>1308</td>
</tr>
<tr>
<td>1870</td>
<td>4.55</td>
<td>5.13</td>
<td>1197</td>
</tr>
<tr>
<td>1880</td>
<td>4.24</td>
<td>4.67</td>
<td>1185</td>
</tr>
<tr>
<td>1890</td>
<td>3.87</td>
<td>4.40</td>
<td>1069</td>
</tr>
<tr>
<td>1900</td>
<td>3.56</td>
<td>3.75</td>
<td>1038</td>
</tr>
<tr>
<td>1910</td>
<td>3.42</td>
<td>3.61</td>
<td>959</td>
</tr>
<tr>
<td>1920</td>
<td>3.17</td>
<td>3.31</td>
<td>962</td>
</tr>
<tr>
<td>1930</td>
<td>2.45</td>
<td></td>
<td>849</td>
</tr>
<tr>
<td>1940</td>
<td>2.19</td>
<td></td>
<td>871</td>
</tr>
<tr>
<td>1950</td>
<td>2.97</td>
<td></td>
<td>871</td>
</tr>
<tr>
<td>1960</td>
<td>3.52</td>
<td></td>
<td>1089</td>
</tr>
<tr>
<td>1970</td>
<td>3.01</td>
<td></td>
<td>888</td>
</tr>
<tr>
<td>1980</td>
<td>1.75</td>
<td></td>
<td>627</td>
</tr>
</tbody>
</table>

a. Estimates for 1800 to 1950 are averages for five years centered on the census year given. Thereafter the figures are for the calendar year specified.

Sources: See next page.
Source Notes for Table 5


The crude birth rate for 1800 to 1850 was estimated by Warren S. Thompson and P. K. Whelpton, *Population Trends in the United States* (McGraw Hill, 1933): Table 74, pp. 263-264. For 1870 to 1950 we have calculated five-year centered averages from the annual estimates made by Coale and Zelnik 1963: Table 1, pp. 21-23. Thereafter annual figures are given. The Coale and Zelnik series was extended with data from *Statistical Abstract* 1984: Table 85, p. 64.

These charts and the statistics in Table 5 tell a story that seems clear enough: a powerful demographic force was set into motion shortly after the turn of the century that acted to reduce total fertility from over seven to under four within four generations. Determining what that force was and how it operated has been the goal of a good deal of research over the last ten to fifteen years. The American fertility decline is particularly puzzling to historical demographers since it does not conform to the standard pattern of demographic transition.

That scenario begins by postulating an initial state of "Malthusian equilibrium" during which high and uncontrolled fertility is offset by high mortality. The transition begins when the death rate starts to fall as the consequence of advances in sanitation, public health, and medical science. The resulting period of rapid population growth puts pressure on a fixed supply of resources (land). After a transition period of "Malthusian stress," the population responds by taking steps to limit its fertility. The demographic transition is completed when a new "post-Malthusian" equilibrium of low mortality and low fertility is achieved. This, at least, seems to be the pattern followed by many European countries (France is a notable exception) and also by Japan.

19. The first discussion of the "Demographic Transition" seems to be by Warren S. Thompson (1929), although he did not use that term. Perhaps, Kingsley Davis (1945) coined the expression.
The American case is clearly not described by the model of the orthodox demographic transition. Mortality did not begin to fall in the United States until sometime after 1880, at least two generations after the onset of the fertility decline. If anything, mortality rates were increasing in the eighteenth and early nineteenth century. The American case is also perplexing because the fertility decline is accompanied by the continued abundance of unpopulated but potentially productive land. This vast expanse of unexploited resources would be expected to stimulate fertility throughout the period if we hold to the standard Malthusian version of the transition model.

Another early discussion can be found in Frank Notestein 1953. A good general introduction is that by Donald O. Cowgill 1963. Statistical evidence for 53 countries is summarized in Satin 1969. On the special case of France see David Weir 1982. On Japan see Carl Mok 1983.

20. On early nineteenth century trends in mortality see Potter 1965: 646 and 663, Yasuba 1962: 86-96, Vinovskis 1972, Meeker 1972, and McClelland and Zeckhauser 1982: 54-68. The lack of any downward trend in death rates perhaps reflects two offsetting tendencies. There was probably some improvement in mortality, particularly infant mortality, in both rural and urban areas during this period. On the other hand, the shift in population from rural districts to cities where mortality was significantly higher was sufficient to more than offset any gains.


II. RICHARD EASTERLIN'S TARGET-BEQUEST HYPOTHESIS

The Easterlin hypothesis alluded to earlier is an ingenious attempt to salvage the Malthusian relationship between resource abundance and fertility from the dilemma posed by the declining American fertility rate (Easterlin JEH 1976). Despite the general availability of land in nineteenth-century America, Easterlin argued that land became "scarce" in any given agricultural community as its population grew and number of suitable farm sites in the vicinity declined. Young couples, having chosen a community to settle in, would foresee the difficulty of providing an inheritance of land for numerous offspring and thus would take steps to limit the size of their family. In Easterlin's model there is no period of Malthusian stress or economic hardship because the parents foresee the problem of land scarcity and take effective birth control measures to protect the living standards of their children.

Cross-Section Evidence on Land-Scarcity

Easterlin was inspired to formulate the target-bequest hypothesis by the observation that the antebellum fertility decline was more advanced in the more-densely populated states of New England, New Jersey, Delaware, and Maryland than in the newly-settled territory west of the Appalachian Mountains (Easterlin 1971: 402-403, and JEH 1976: 52). Figure 3 illustrates the point by displaying the Yasuba index of fertility
for the northern states in 1840. Because the states of New York, Pennsylvania, and Virginia also contained substantial territory that had only been recently settled by 1840, we have divided those states along traditional boundaries into eastern and western portions. A perfect division of the northern states is evident in Figure 3. All of the states with less than 1,360 children per women are east of the Appalachian Mountains. The western territory uniformly shows evidence of much higher fertility. Even Maine fits the pattern since it was sparsely settled in 1790 and attracted migrants throughout the next fifty years.

The southern states exhibit the same rising east-west fertility gradient, although the Yasuba index is uniformly higher in the southern states than in the north. Both of these points are evident in Figure 4 which presents the data for all of the states of the Union.

22. The data were calculated by Yasuba (1962): Table II-7, pp. 61-62. It should be noted that in 1840 Wisconsin Territory (spelled at that time "Wiskonsin") included what is now eastern Minnesota. Iowa Territory was a vast expanse including what is now western Minnesota, North and South Dakota.

23. The division of these states was part of the presentation of the 1840 Census tabulation. In the census report Pennsylvania and Virginia were each divided into Eastern and Western Districts; New York was divided into a Northern District and a Southern District. The Southern District of New York included only counties in the south-eastern tip of the State; all of the western counties were part of the "Northern" District. To avoid confusion, Figure 3 refers to "Eastern New York" and "Western New York." The data for the partition of these states comes from the Sixth Census (1840): 112, 124, 156, 186, 210, and 216.

Figure 3. Yasuba Fertility Index, Northern States, 1840

states and territories in 1840. Slave states are shaded in the figure.

The cross-section pattern seen in 1840 consistently appears at each census date from 1800 to 1860. As an illustration, Figure 4 follows the trend in the Yasuba index for six states over the period. Three New England States (Massachusetts, Rhode Island, and Connecticut) show nearly identical fertility levels at each date and these are consistently below those of three western states illustrated (Ohio, Indiana, and Illinois).

**Figure 4.** Yasuba Fertility Index, Free and Slave States, 1840


Time-Series Evidence on Land-Scarcity

Despite the success of the Easterlin model in predicting the cross-sectional pattern of fertility, we have at least three a priori problems with the model’s time-trend predictions:

»First, acceptance of the land-scarcity argument as an explanation of the fertility decline requires the view that families found it increasingly difficult to provide farms for their children throughout the nineteenth century. In fact, improvements in transportation and communication, the continuing release of the public domain at land auctions, and rising agricultural incomes should have made it easier, at the margin, 24.

24. Louisiana has been partitioned into Eastern Louisiana (the Parishes around New Orleans) and Western Louisiana (the territory west of the Mississippi River) using data from the Sixth Census (1840: 258-262). Eastern Louisiana was settled territory in 1840 and might be properly regarded as similar in this respect to the seaboard east of the Appalachians.
Figure 5. Yasuba Fertility Index: Illinois, Indiana, Ohio, Rhode Island, Connecticut, and Massachusetts; 1800-1860


Figure 5. Fertility Trends [Yasuba Index] New England vs. The Old Northwest

To purchase a farm. Throughout the nineteenth century, moreover, settled farm communities experienced a continually decreasing cost and rising attractiveness of out-migration. As Dov Friedlander has argued, this should have reduced the necessity of an adjustment in reproductive behavior (Friedlander 1969).**

"Second, the land-scarcity model has difficulty explaining why fertility was so high in the late eighteenth century and why the onset of the fertility decline occurred at the time it did. Fertility began to fall at precisely the time American land policy changed opening up vast expanses of public domain to settlement. Relatively speaking, the threat of land scarcity must have appeared much greater in 1800 than at any time during the period between 1815 and 1840. The land-scarcity model would also predict that the fertility decline should halt shortly after a community had reached its peak population density, yet states like Vermont and Delaware continued to show fertility declines long after their rural population had ceased to grow."

"Third, the land-scarcity model does not easily provide an explanation for the case of the Deep South. That region began its fertility decline later than was the case in the North and

25. Easterlin addressed this point by suggesting that the American case "raises doubts" about the demographic escape value of out-migration (Easterlin 1976: 46). Perhaps so, but since the escape-value mechanism is, like the land-scarcity model, founded in the Malthusian tradition, it seems to us that the theoretical inconsistency between Easterlin and Friedlander has not yet been adequately addressed."
exhibited a more gradual decline in white fertility despite a
settlement history not unlike that of the states of the Old
Northwest. Despite this challenge to his model, Easterlin
concentrated his attention upon the northern farm areas in his
empirical work "because of the more plentiful supply of data for
this region, and the fairly homogeneous structure of agricultural
organization." However, he suggested the land-scarcity model
ought to fit the American South and called for research on the
subject (Easterlin JEH 1976: 46 and 73).**

A Cross-Section Empirical Test: The 1840 Census Revisited

The search for a mechanism underlying the antebellum
fertility decline goes back to a contemporary, George Tucker.
Writing in 1843 and reflecting upon the recently-released results
of the Census conducted in 1840, Tucker noted the declining

26. Richard Steckel took up the challenge but reported that in
his regression analysis the "measure of population pressure [was]
statistically insignificant or [had] a sign unfavorable to the
population pressure hypothesis" [Steckel 1977: 15 and 170-176,
also see Steckel 1979]. The southern case seems not to have been
pursued by the supporters of the target-bequest hypothesis. Don
Leet confined his examination to Ohio (1975, 1976, 1977) and
Morton Schapiro specifically excluded the southern states from
his analysis because of their "idiosyncratic economic and social
structures." As he put it, "slavery played an important role" in
the south [Schapiro 1982: 585-586]. Schapiro did not, however,
offer a comment on how or why slavery should effect white
fertility rates.

proportion of children at the various censuses between 1800 and
1840." He went on to state:

We find that each of the States exhibits a similar
diminution in the ratio of increase to that which we
have seen in the whole Union, and that it is equally
[sic] manifest whether population is dense or thin -- is
rapidly or slowly advancing -- is sending forth
emigrants, or receiving them from other States. This
fact, which seems hitherto not to have been suspected,
will clearly appear in the following [table]...

[Tucker 1855: 103]

We reproduce Tucker's table (correcting a few minor errors) as
Table 6.

Tucker pointed out the inverse relationship between the
child-female ratio and the population density which is evident
upon inspection of the table. But despite the obvious temptation
offered by the cross-state relationship between population
density and fertility, Tucker did not suggest that the decline in
fertility he observed was explained by increasing population
density. Instead, he attributed the decline to the forces of
"prudence" and "pride."*** "It is even probable," he went on,

27. George Tucker's book Progress of the United States in
Population and Wealth was first published in 1843. It was
reissued "With an Appendix, Containing an Abstract of the Census
of 1850" in 1855. A modern reprint of the 1855 edition was
published in 1964. It is that version we cite.

28. Elsewhere Tucker referred to "a slight retardation of
marriage" that he suspected had occurred over the forty-year
period (Tucker 1855: Appendix p. 27).
Table 6

George Tucker’s Original Table

“Showing the Number of White Females, of White Children under 18 years of age, and of Persons to a Square Mile, in Twenty States, in 1800 and 1840; the Proportion of Children to Females, at the same time ...”

<table>
<thead>
<tr>
<th>State</th>
<th>Year</th>
<th>Children under 10</th>
<th>Persons per 100</th>
<th>Children Increase</th>
<th>Females Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine</td>
<td>1800</td>
<td>74,869</td>
<td>54,869</td>
<td>5.8</td>
<td>74.1</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>247,449</td>
<td>148,856</td>
<td>16.7</td>
<td>68.2</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>1800</td>
<td>91,740</td>
<td>64,465</td>
<td>19.9</td>
<td>65.9</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>145,832</td>
<td>78,387</td>
<td>39.9</td>
<td>48.5</td>
</tr>
<tr>
<td>Vermont</td>
<td>1800</td>
<td>74,500</td>
<td>57,692</td>
<td>13.7</td>
<td>77.4</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>144,409</td>
<td>84,111</td>
<td>23.9</td>
<td>65.3</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>1800</td>
<td>211,293</td>
<td>124,566</td>
<td>48.3</td>
<td>59.8</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>368,351</td>
<td>173,837</td>
<td>84.3</td>
<td>47.0</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>1800</td>
<td>33,379</td>
<td>19,466</td>
<td>53.1</td>
<td>56.8</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>54,225</td>
<td>25,384</td>
<td>83.7</td>
<td>46.8</td>
</tr>
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<td>Connecticut</td>
<td>1800</td>
<td>123,389</td>
<td>73,682</td>
<td>49.2</td>
<td>59.6</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>153,556</td>
<td>71,783</td>
<td>68.7</td>
<td>46.7</td>
</tr>
<tr>
<td>New York</td>
<td>1800</td>
<td>159,587</td>
<td>95,840</td>
<td>47.6</td>
<td>56.1</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>1,171,533</td>
<td>681,091</td>
<td>35.7</td>
<td>58.1</td>
</tr>
<tr>
<td>New Jersey</td>
<td>1800</td>
<td>95,600</td>
<td>57,462</td>
<td>28.2</td>
<td>70.5</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>174,533</td>
<td>103,382</td>
<td>49.2</td>
<td>59.2</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>1800</td>
<td>284,627</td>
<td>202,856</td>
<td>12.6</td>
<td>71.3</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>631,345</td>
<td>504,189</td>
<td>36.5</td>
<td>51.3</td>
</tr>
<tr>
<td>Delaware</td>
<td>1800</td>
<td>24,819</td>
<td>15,878</td>
<td>25.2</td>
<td>56.0</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>29,382</td>
<td>17,846</td>
<td>25.4</td>
<td>59.4</td>
</tr>
<tr>
<td>Maryland</td>
<td>1800</td>
<td>185,676</td>
<td>93,648</td>
<td>38.6</td>
<td>65.9</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>159,480</td>
<td>92,972</td>
<td>42.1</td>
<td>58.4</td>
</tr>
<tr>
<td>Virginia</td>
<td>1800</td>
<td>252,151</td>
<td>173,761</td>
<td>11.7</td>
<td>71.3</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>365,745</td>
<td>248,143</td>
<td>18.6</td>
<td>65.0</td>
</tr>
<tr>
<td>North Carolina</td>
<td>1800</td>
<td>166,116</td>
<td>102,191</td>
<td>9.6</td>
<td>73.6</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>244,833</td>
<td>162,282</td>
<td>15.2</td>
<td>66.3</td>
</tr>
<tr>
<td>South Carolina</td>
<td>1800</td>
<td>95,339</td>
<td>72,475</td>
<td>18.5</td>
<td>75.6</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>128,568</td>
<td>86,566</td>
<td>18.7</td>
<td>67.3</td>
</tr>
<tr>
<td>Georgia</td>
<td>1800</td>
<td>48,296</td>
<td>38,248</td>
<td>2.6</td>
<td>75.2</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>197,161</td>
<td>150,317</td>
<td>11.2</td>
<td>76.2</td>
</tr>
<tr>
<td>Mississippi</td>
<td>1800</td>
<td>2,262</td>
<td>1,962</td>
<td>.2</td>
<td>86.7</td>
</tr>
<tr>
<td></td>
<td>1840</td>
<td>2,818</td>
<td>1,689</td>
<td>6.1</td>
<td>79.8</td>
</tr>
</tbody>
</table>

(continued on next page)
that these checks (to 'natural multiplication') operate
sooner in this country than they have operated in other
countries, by reason of the higher standard of comfort
with which American people are content, and of that pride of
personal independence which our political institutions
so strongly cherish.

[Tucker 1855: 103]

Tucker did not offer an explanation to account for the
association between population density and fertility. His only
comment was an assertion that the fertility patterns evident in
his table were "certainly" not "arising from the difficulty of
obtaining subsistence" (p. 103). The land-scarcity model is of
recent origin. Yasukichi Yasuba was the first to suggest that
the availability of easily-accessible land provided an
explanation for the density-fertility relationship. Yasuba
explained,

as time passed, the acquisition of new land in the
settled areas became increasingly difficult and
costlier and the average distance from the settled to
the new areas where land was plentiful became farther.
Consequently, fertility in the older communities may
have been reduced directly in response to the decreased
demand for children or indirectly as a result of the
rise in the age at marriage and the fall in the
incidence of marriage.

[Yasuba 1962: 159]

To test this possibility, Yasuba calculated a measure that he
supposed would be a better indicator of land availability than
population density. Yasuba's variable was the number of persons
per thousand acres of arable land. Arable acreage was defined as
the total amount of crop land in 1949 [Yasuba 1962: 158-169].

For his statistical tests, Yasuba calculated a measure of
fertility, a child-woman ratio, that we call the "Yasuba Index."
Since the appearance of Yasuba's work, however, additional
refinements have been introduced in an attempt to bring his
statistical measures into closer conformity with the land-
bequest model. Colin Forster, G.S.L. Tucker, and Helen Bridge
(1972) argued that the land-availability hypothesis should apply
with greatest force to the rural population. Accordingly, they
recalculated the Yasuba index to include only the rural
population of each state. This measure is clearly more
appropriate than Yasuba's, since the land-scarcity specification
applies to farm families, not to urban families."

Forster, Tucker, and Bridge also introduced a new measure of
land availability, the "adult-farm ratio." This is defined as
the ratio of the adult white population to the number of farms

23. In the literature under discussion here only the rural
variant of target-bequest behavior has been empirically
specified. Land scarcity, presumably, would have little rele-
ance to the fertility decisions of the urban population. Yet,
throughout the nineteenth century, fertility declined in urban
areas as well as in rural communities in what seems to many to
have been a closely parallel phenomenon [Easterlin AER 1971: 401-
404; Vinovskis 1976: 396]. We should be careful to preserve the
distinction between the land-scarcity specification and the
original target-bequest hypothesis. The latter 'theory is not,'
Easterlin suggested, "confined to the behavior of agricultural
populations. It embodies, more generally, the concerns of
propertied persons about the preservation and transmission of
their wealth" [Easterlin JEH 1976: 74]. However, as far as we
are aware, only Richard Steckel has attempted to apply the
target-bequest hypothesis to explain urban fertility [1977: 155-
161]. The results were mixed and difficult to interpret.
existing at a future date arbitrarily chosen to reflect "full settlement." They experimented with both 1860 and 1880 as the target; the 1860 measure proved to be the superior predictor of rural fertility in 1840 [Forster, Tucker, and Bridge 1972: 19-21 and 41]. Marias Vinovskis was critical of the adult-farm ratio and proposed, we think correctly, that the average value of a farm is a more direct and conceptually superior measure of the cost of assisting one's children in establishing a household of their own [Vinovskis 1976]. Morton Schapiro took a different approach in his attempt to improve on the adult-farm ratio. He calculated the density of rural settlement as the ratio of the rural population of the state divided by the "first clear peak" in rural population in a subsequent census [Schapiro 1982: 586-587].

Despite the fact that the refinements introduced by these investigators were intended to bring the data into closer conformity with the target-bequest hypothesis, the predictive power of the model was weakened by the improvements. To provide a consistent set of statistical tests for comparison, we have estimated ten cross-state regression equations using data from 1840, the same census data that yielded George Tucker's original discovery. In each regression the dependent variable is a measure of fertility: the Yaquba index either for the state or for the rural population of the state. Five alternative land-scarcity measures are tested sequentially and the results presented in Table 7. The regression R's are reported as a measure of the success of the linear model. One consistent result is that the rural fertility index is more difficult to predict with land-scarcity variables than the inclusive statewide measure. This is not what a proponent of the target-bequest hypothesis would have expected; and suggests that the correlation between land-scarcity and fertility may be spurious.

31. The rural population is not available after 1840 [Forster, Tucker, and Bridge 1972: n. 5, p. 108; and Weiss 1985]. Also, there was a serious Cholera epidemic in 1850 which would distort the fertility indexes calculated for some states from that census [Vinovskis 1976]. Other variables to be introduced below are not available before 1840. For these reasons, we have confined our statistical work to that year.

32. One distinct possibility is that density reflects the extent of the urbanization of a population. Since urban fertility was lower than rural fertility throughout the country in 1840, this may produce a strong correlation between density and fertility. This effect would be weaker with rural population data because the larger towns and cities have been excluded. Before Yaquba and Easterlin developed the land-scarcity hypothesis, Wendell Bash (1963) used population density as an index of the degree of urbanization in an impressive study of the fertility decline in New York State.

30. Sundstrom and David make an improvement in Schapiro's land-availability index by switching from the first clear peak to the maximum rural population achieved at any census between 1800 and 1940 [Sundstrom and David 1986: 47-48].
Table 7
Sequence of Tests of the Land-Availability Hypothesis, Cross-Section Linear Regressions, Twenty-Seven States, 1840
(Ajusted R², Ordinary Least Squares)

<table>
<thead>
<tr>
<th>Measure of Land Availability</th>
<th>Dependent Variable</th>
<th>Reference</th>
<th>Yasuba</th>
<th>Yasuba</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons per Square Mile</td>
<td>Tucker</td>
<td>.637</td>
<td>.573</td>
<td></td>
</tr>
<tr>
<td>Persons per 1000 Arable Acres</td>
<td>Yasuba</td>
<td>.545</td>
<td>.496</td>
<td></td>
</tr>
<tr>
<td>Adults, 1830, per Farm, 1860</td>
<td>Forster</td>
<td>.744</td>
<td>.675</td>
<td></td>
</tr>
<tr>
<td>Value of Average Farm, 1850</td>
<td>Vinovskis</td>
<td>.270</td>
<td>.163</td>
<td></td>
</tr>
<tr>
<td>Density of Rural Settlement</td>
<td>Schapiro</td>
<td>.538</td>
<td>.527</td>
<td></td>
</tr>
</tbody>
</table>

mean of the dependent variable
standard deviation 1579 1695 347 380

Note: The twenty-seven states included in these tests are Alabama, Arkansas, Connecticut, Delaware, Florida Territory, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, and Virginia.

Sources: The Yasuba index of white fertility is the number of children under ten per thousand women, 16 to 44. Yasukichi Yasuba, *Birth Rates of the White Population in the United States, 1800-1860* (Johns Hopkins University Press, 1962): Table II-7, pp. 61-62. The rural Yasuba index is defined using the white rural population of each state and has been standardized to correct for the effect of the age distribution of the women. Our source is Colin Forster, G.S.L. Tucker, and Helen Bridge, *Economic Opportunity and White American Fertility Ratios, 1600-1860* (Yale University Press, 1972): Table 6, pp. 40-41.

--- continued on next page ---

Source Notes for Table 7 -- Continued


Yasuba's measure of the availability of land is the number of persons per thousand acres of crop land in 1849. Our source is Yasuba, op cit: Table V-9, pp. 163-164.

Forster, Tucker, and Bridge use a measure of economic opportunity they call the "adult-farm ratio." The white population over the age of 15 in 1830 is divided by the number of farms in 1860 (see Forster, Tucker, and Bridge, op cit: pp. 11-12, 19-21, and 41, for an explanation of this variable). We have calculated this ratio using the population data in U.S. Census Office, *Fifth Census* (1850), *Fifth Census or Enumeration of the Inhabitants of the United States, 1850*, and the number of farms for each state reported in *Historical Statistics: Series K20-K63*.

Maris A. Vinovskis, "Socioeconomic Determinants of Interstate Fertility Differentials in the United States in 1850 and 1860," *Journal of Interdisciplinary History* 6 (Winter 1976), used the average value of farms as a measure of the relative cost of obtaining a working farm (p. 381). He entered the 1850 average value into a regression explaining the Yasuba index for 1850. The average value of a farm is not available from the census of 1840. As a rough substitute we have entered the 1850 value into our 1840 regression. This procedure may perhaps be justified by suggesting that the expected cost of a farm fifteen to twenty years in the future should be relevant to the child-bearing decisions of the 1830s. The R² for a linear regression with the 1850 Yasuba index as the dependent variable and the 1850 average farm value (27 observations) was 0.268. The rural Yasuba index is not available for 1850. Our data on the average value of a farm in 1850 is taken from *Historical Statistics: Series K20-K63*.
Source Notes for Table 7 -- Continued

The density of rural settlement is a measure designed by Morton Owen Schapiro, "Land Availability and Fertility in the United States, 1760-1870," Journal of Economic History 42 (September 1982). It is defined as the rural population of the state in 1840 divided by the local maximum rural population observed for that state [pp. 586-587 and Table 1, p. 589]. We used the variant of the Schapiro measure advocated by William A. Sundstrom and Paul A. David, "Old-Age Security Motives, Labor Markets, and Farm Family Fertility in Antebellum America," Stanford Project on the History of Fertility Control Working Paper Number 17 (February 1986): 47-48. This replaces the "first clear peak" in rural population with the maximum rural population observed between 1790 and 1940. For this variable the data on rural populations come from Historical Statistics: Series A203.

Another striking result is that the improvements in the land-scarcity measure introduced by Yasuba and Vinovskis both reduce the adjusted R² of the regression. It is particularly surprising that the conceptually-superior measure proposed by Vinovskis is actually the least-successful independent variable of all. Even the latest refinement in land-availability measures, Schapiro's index of the density of rural settlement, proves inferior to Tucker's." Indeed, the only variable that improves on the predictive power of George Tucker's 1843 original is the adult-farm ratio. But that variable has been criticized by Vinovskis, Leet, and Schapiro as inappropriate, conceptually fuzzy, and arbitrarily defined [Vinovskis 1975: 379-380, Leet 1976: 365, Schapiro 1982: 586]. On the whole, this battery of

33. It is worth reflecting on why the raw population density outperforms variables fine tuned to capture the land-scarcity effect. While the results shed doubt on the land-scarcity model, they may also be providing information about alternative socioeconomic mechanisms that influence fertility behavior. One intriguing suggestion has been offered by Anita Ilta Garey 1985. She notes that "for women, density meant community and the support of other women, which may have provided the context in which fertility on the frontier could decline" [p. 54]. This, we feel, is quite likely. However, we remain skeptical of her further suggestion that the primary means of support offered by a community of women was advice and information about "woman-controlled contraceptives" [p.52]. We discuss the issue of access to and knowledge of contraceptive techniques below and merely note at this point that it could be just as likely that the community and support of others was important encouragement and reinforcement for the spreading tendency to reject traditional family values and substitute life-cycle objectives as the basis of family planning.
tests cannot be viewed as strong support for the target-bequest model.  

The most recent blow to the land-scarcity approach has been delivered William Sundstrom and Paul David. They point out, quite correctly, that the relationship between the Yasuba index and land scarcity could not be strictly linear (Sundstrom and David 1986: 54-55). Fertility is bounded by a minimum value of zero, yet an inverse linear relationship would predict negative values of fertility when land becomes sufficiently scarce. Sundstrom and David suggest a logarithmic transformation of both variables.  

Surprisingly, this innovation, when applied to the multiple regression model favored by Schapiro, drives the measured impact of land scarcity into statistical insignificance (Sundstrom and David 1986: Table 4, p. 58).  

34. The results we report in Table 7 are paralleled by Don Leet’s examination of an 1850 cross-section of Ohio counties (1977). Leet calculated the simple correlation between the Yasuba index for each county and several of the measures of land scarcity discussed here (in logarithmic transform). The highest correlation appeared with population density which was superior both to the adult-farm ratio and the average farm value. Leet reported a high correlation between the Yasuba index of fertility and the average assessed value of farm land per acre, but this variable is not available on a national basis for 1840.

35. Leet observed in his examination of Ohio counties that logarithmic transformations gave more satisfactory results than linear relationships but did not carry this insight over into his own regression model (Leet 1977: 398).

36. Yasuba relied on non-parametric correlation methods so his results are not compromised by a linearity assumption. Forster, Tucker, and Bridge employed a semi-logarithmic specification

III. AN EMPIRICAL MODEL OF LIFE-CYCLE FERTILITY

A successful empirical model of the rural American fertility decline must pass at least three tests. First, the quantitative variables it proposes must move over time in a way that explains the timing and the pace of the fertility decline. In particular, it ought to explain the timing of the onset of the fertility decline, a task the target-bequest model fails to tackle. Second, the model should be able to explain the cross-sectional patterns of fertility: low in the east, high in the west and south. The land-scarcity variables pass this test in the east and west, but their success is uncertain, at best, when applied in the south. The model’s inability to encompass the slave states in its generalization should be considered worrisome. Third, the successful model must either incorporate the land-scarcity variables in a synthesis or prove to be empirically superior to them in a properly-designed test of alternative hypotheses.

The difficulty of converting the life-cycle hypothesis we have proposed into a form suitable for such testing should be obvious. Our argument postulates a diffusion of a new form of the utility function (that is, it postulates the spread of "modern" values) governing intergenerational responsibilities and

behavior with respect to saving, labor force participation, and fertility. Utility functions are, of course, abstract theoretical constructs, not tangible items subject to measurement or enumeration. We are therefore forced to look for "proxy variables" or indexes that can plausibly be associated with the life-cycle transition.

Models that rely upon proxy variables begin with an inherent disadvantage. Any empirical test that can be designed will necessarily be a simultaneous test of two hypotheses: in our case, the hypothesis about the fertility decline and the hypothesis that the proxies chosen are adequate measures of the extent to which life-cycle behavior has been adopted by the child-bearing population. If the joint hypothesis fails the test designed, it is impossible to know whether the outcome was caused by the failure of the primary hypothesis, the secondary hypothesis introduced to quantify the first, or both. On the other hand, if the joint hypothesis is deemed an empirical success by its proponents, it may still fail to convince a skeptic. In a typical case, it is not hard to hypothesize an alternative mechanism capable of explaining the correlation displayed between the dependent variable and the proxies. Once such a counter-hypothesis has been introduced, it may not be easy to choose between the two rival explanations on the basis of the already-examined data.

These difficulties are unavoidable. We attempt to deal with them here by proposing a number of distinct proxy variables for life-cycle behavior and testing each separately against the target-bequest model. We hope thereby to demonstrate the consistent superiority of the life-cycle fertility model and to take some comfort in that consistency. We also hope that it will prove more difficult to devise a counter-hypothesis capable of simultaneously rationalizing our success with each of the variables.

37. Whether a phenomenon like the life-cycle transition is modeled as a shift in the form of the utility function (a change in values) as we have done or as the response to a change in the "price" of some "good" entering into a more-generalized utility framework is largely a matter of theoretical style. Sundstrom and David prefer the latter conceptualization viewing child-default as something that would raise the price of child-assets; we prefer the former as more descriptive of reality. It is not obvious, at least to us, that there is any substantive differences between the two approaches at the empirical level pursued in this paper. There is, however, a difference relevant to the applicability of these models in a broader context. In principle, the Sundstrom-David mechanism is reversible; if child-default were to decline, then the price of child assets would fall and fertility would rise. We believe this is an unlikely response, since the modernization of values and the institutional changes that resulted (the rise of financial intermediaries, for example) are surely irreversible phenomenon.

38. The target-bequest model is plagued with the same difficulties. There is no direct information on the cost of reaching a given bequest target. The land-scarcity variables employed by Schapiro and others in tests of the bequest model are proxies for the magnitude of the target. This should become obvious by considering how these variables were actually constructed. The density of rural settlement, for example, bears no direct relationship to the intended size of inheritances.
The variables we have investigated as part of this plan of attack include:

» the rate of growth of the 1830 rural population,
» the masculinity proportion of children under ten,
» the ratio of non-agricultural to agricultural employment,
» the ratio of non-agricultural to agricultural wages, and
» the school enrollment ratio.

Since none of these variables may be self-evident proxies for life-cycle fertility, we shall discuss each in turn, sketching out the secondary hypothesis that, in our view, links it to life-cycle modes of behavior.

**Out-Migration and Child Default**

We have suggested that rising out-migration may have caused fertility to decline. The argument suggests that the departure of young adults left parents less secure about their support in old age. The evident risk of child default would have encouraged others in the community to attempt fertility control and to adopt life-cycle strategies of wealth accumulation. An obvious candidate for a quantitative index of this effect would be a measure of the volume of out-migration, particularly the out-migration of teenagers and young adults.

It is not clear, however, how such an index should be used in a cross-section analysis. Child default, we suspect, was more of a catalyst to the life-cycle transition than an ingredient.

In that case, the magnitude of the rate of out-migration may not be particularly relevant. Perhaps only the direction of migration should be measured. Moreover, the hypothesis applies directly only to the regions experiencing out-migration. Would married women living in states experiencing an in-migration be oblivious to the threat of child default, or would the newcomers import life-cycle values and strategies from their home states?

Even if these questions are resolved, there remains the problem of measurement. There is no comprehensive data on interstate migration. Investigators have been forced to infer the migration flows between states using a technique known as the "census survival method," for which detailed age breakdowns of the population at two census dates are required. If the number of people of a given age residing in a state at the second census exceeds the number that can be expected to have survived from that age cohort as measured at the first of the two censuses, it is assumed that the increase was produced by in-migration. If fewer people remain in the cohort than can be expected after taking account of normal mortality, it is presumed that those missing have left the state.

The census survival method measures net migration, the balance of inflows and outflows. For states like New York and Massachusetts where the out-migration of native residents to western states occurred simultaneously with substantial inflows...
of foreign immigrants, the net migration figures may be inadequate indicators of the child-default mechanism. The use of the census survival method also requires estimates of mortality by age, sex, and region. Such detailed data do not exist, although a plausible assumption might be substituted for evidence.13

Despite the conceptual and methodological difficulties of designing an appropriate test of the link between out-migration and fertility, we have undertaken a crude experiment. As a rough index of the magnitude of net migration we have calculated the ratio of the rural white population ten and over in 1840 to the rural white population of all ages in 1830.14 Since the children below ten years of age are excluded from the 1840 population, this growth ratio is unaffected by state differences in fertility. If the mortality rate applicable to the 1830

39. McClelland and Zeckhauser used the census survival technique to produce estimates of net migration between 1860 and 1860 for several broad regions: New England, the Mid-Atlantic states, the Old South, the West South, and the Old Northwest (McClelland and Zeckhauser 1982: Map 1, p. xiv). In the absence of reliable data, they assume a uniform death rate, constant across all regions. We made use of their figures for New England in Tables 1 and 2. McClelland and Zeckhauser report that it would be "prohibitively complex" to estimate the net migration separately for each state [p. 28 and n. 9, p. 190]. At this time, there are no state-by-state estimates of the net migration of the white population covering the period of interest.

40. The data on rural population are taken from worksheets underlying estimates of urban populations by Thomas Weiss 1985. We are grateful to Professor Weiss for making this data available to us.

population can be assumed to have been roughly constant over the states, then the growth ratio will order the states by the magnitude of the net migration flows. A high value suggests that the state or territory experienced a net in-migration and a low value suggests an out-migration.

We have calculated the growth ratio of the rural white population of 1830 between the census of 1830 and the census of 1840 for 25 states.15 The scatter diagram displayed in Figure 6 illustrates the relationship between the Yasuba index of fertility and this measure of out-migration. Clearly the two variables are related. It is also clear that a difference remains between the slave states, plotted with dark points in the diagram, and the northern states. As might be anticipated from the earlier discussion, the southern states have a higher fertility ratio than the northern states even after the relative magnitude of the out-migration is taken into consideration. We take account of this by generating a "dummy variable" that takes on the value of "one" for the slave states and the value "zero" for the northern states. When entered into a log-linear regression along with the growth ratio the results are:

41. Iowa and Wisconsin Territories did not exist in 1830. The 1830 population of Michigan and Missouri Territories are not comparable to the data for the states of Michigan and Missouri in 1840. Otherwise, the states included in the regression are the same as those listed in the note to Table 7.
\[
\ln(CW40) = 7.305 + 0.268 \text{ SOUTH} + 0.434 \ln(RG) \\
(0.043) (0.058) (0.094)
\]

Adjusted \( R^2 = 0.624 \)

\( n = 25 \)

\( CW40 \) indicates the Yasuba index of fertility for the rural white population and \( RG \) is the growth ratio for the rural population which we defined above. A logarithmic transformation is indicated by the expression: \( \ln(\cdot) \). Standard errors of the coefficient estimates are reported in parenthesis directly below the equation. All three parameter estimates are highly significant.

Despite the conceptual uncertainty about the out-migration variable and the imperfect measurement of the extent of child default by a variable as crude as the growth ratio, the regression experiment is quite successful. Also impressive is the fact that when the density of rural settlement is added to the regression it fails the standard significance test and appears with a positive coefficient, opposite of the sign predicted by the target-bequest hypothesis.". Yet the coefficient of the growth ratio is largely unaffected by the

42. Similar results are obtained using population density (Tucker’s variable), the price of a farm (Vinovskis’ variable), or the density of rural settlement in 1830 as the measure of land-scarcity. The persons per arable acre (Yasuba’s variable) and the adult-farm ratio (Forster-Tucker-Bridge’s variable) both survive a joint appearance with the growth ratio.
The estimated regression line is:

\[ \ln(C/M) = 7.328 + 0.251 \text{ SOUTH} + 0.476 \ln(R6) \]

The land-scarcity model cannot be salvaged by including the sex ratio or by lagging the density of rural settlements ten years, a procedure favored by Schapiro (1963). It would appear that even a crude proxy for the lifecycle fertility model can outperform the target-beating propositions.

The Child Manularity Proportion and Selective Migration

A curious phenomenon revealed by early American censuses is the preponderance of males among children enumerated in the south and in newly settled regions compared with the proportion found among the children of New England and the Middle Atlantic States. The states are not large, about one or two percent, but they are persistent and systematic, Jaffe, Johanson, Ginsberg, 1963. Table 8 presents data on the fraction of males, technically called the "manularity proportion," among children under ten for the rural area of each state in 1840. The states are ranked by this proportion and the Table is designed to illustrate the geographical pattern by assigning each state to a
### Table 8
Regional Pattern of the Child Masculinity Proportion, Rural White Population, 1840
(Proportion of Males under Ten)

<table>
<thead>
<tr>
<th>Rank</th>
<th>New England</th>
<th>Mid-Atlantic</th>
<th>North-West</th>
<th>South</th>
<th>Frontier</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>New Hampshire</td>
<td>.508</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Massachusetts</td>
<td>.509</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Vermont</td>
<td>.510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>New Jersey</td>
<td>.510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Delaware</td>
<td>.510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>New York</td>
<td>.510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Connecticut</td>
<td>.510</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Pennsylvania</td>
<td>.511</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>South Carolina</td>
<td>.511</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Virginia</td>
<td>.511</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Wisconsin Territory</td>
<td>.512</td>
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<tr>
<td>12</td>
<td>Ohio</td>
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<td>.512</td>
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</tr>
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<td>14</td>
<td>Maryland</td>
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<td>15</td>
<td>Louisiana</td>
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<td>16</td>
<td>North Carolina</td>
<td>.514</td>
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<td></td>
</tr>
<tr>
<td>17</td>
<td>Kentucky</td>
<td>.515</td>
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<tr>
<td>18</td>
<td>Michigan</td>
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<td>Indiana</td>
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<td>20</td>
<td>Tennessee</td>
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<td>21</td>
<td>Missouri</td>
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<tr>
<td>22</td>
<td>Iowa Territory</td>
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<td>23</td>
<td>Alabama</td>
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<td>Georgia</td>
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<td>25</td>
<td>Mississippi</td>
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<td>Arkansas</td>
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<td>Illinois</td>
<td>.518</td>
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<tr>
<td>28</td>
<td>Rhode Island</td>
<td>.520</td>
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</tr>
<tr>
<td>29</td>
<td>Florida Territory</td>
<td>.524</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rural United States .5129
Urban United States .4995
Total United States .5117


Eugene Hammel, Sheila Ryan Johansson, and Caren A. Ginsberg (1983) have proposed that the pattern displayed in our Table can be explained as the result of differential migration and differential child care. On various grounds they reject the possibility that the higher proportion of male children in the west can be attributed to differences in the rates of conception, birth, or infanticide. Generally speaking, females start life with an initial biological superiority over males, so one is inclined to rule out the possibility that childhood diseases discriminated against female children in a way that could produce the systematic geographical pattern of female deficits that are observed. Hammel, Johansson, and Ginsberg find grounds in Maria Vinovskis' work on mortality in Massachusetts (Vinovskis 1972) for suspicion that differential care offered by parents to children ill with tuberculosis reduced the relative likelihood of survival by girls. But they focus most of their attention on the possibility that families with a high proportion of male children were more likely to migrate from the old to the new regions of settlement, thus creating an excess of males at their destination and leaving a deficit of males in the regions supplying migrants.

Hammel, Johansson, and Ginsberg explain this selective migration (which is only inferred) by observing that the labor (of male children) is more valuable in agricultural zones, but the difference declines (or even reverses) in urban zones where
industry and commerce provide expanded opportunities for female labor participation" (Hamel, Johansson, and Ginsberg 1983: 354). To this argument we might add the observation that in families where old age was secured by life-cycle saving, the potential contributions of children's labor would be less important than in pre-transition families. Moreover, the socio-cultural bias against girls would be muted or absent among parents who had abandoned the dynastic ethic associated with the traditional patrilineal family. The same arguments help explain why parents in newly-settled regions provided better nursing care for ailing boys than ailing girls.

These considerations suggest that the relative masculinity proportion might be a useful index of the influence of life-cycle considerations on economic and demographic behavior. The time trend in the ratio of boys is consistent with our life-cycle hypothesis of the fertility decline; the ratio drops from .513 in 1800 to .508 in 1860 (Hamel, Johansson, and Ginsberg 1983: Table 1, p. 347). The simple cross-section relationship between the masculinity proportion and the Yasuba index of rural fertility is also consistent with this view. The scatter diagram presented in Figure 7 reveals a generally close association, only Rhode Island and Florida stand apart from the relationship. The fitted line

Figure 7. The Relationship between the Value of Children and Fertility, 1840.

Source: See text.
shown in the diagram was estimated as a least-squares regression after transforming the two variables into logarithms:

\[
\ln(CW40) = 29.423 + 32.981 \ln(MP40)
\]

\[
(2.727) \quad (4.087)
\]

\[
\text{Adjusted } R^2 = .711
\]

\[
n = 27
\]

MP40 is the masculinity proportion reported in Table 8.

If the masculinity proportion is accepted as a plausible index of the extent to which a region has adopted life-cycle behavior patterns, then it is interesting to note that this variable dominates variables used with some success by other investigators to represent the target-bequest model. For example, if we enter the logarithms of the density of rural settlement (Schapiro's variable) and the logarithms of the rural adult male-female ratio into the equation above, neither prove to be statistically significant and the land-scarcity variable takes on the wrong sign (positive instead of negative). The target-bequest variables are not recovered by lagging them ten years. The log of the adult-farm ratio, a measure of land scarcity proposed by Forster, Tucker, and Bridge (1972) does take on the correct sign (negative), but fails to achieve statistical significance. These tests are summarized in Table 9.

The Non-Agricultural Labor Market and Child Default

The expansion of non-agricultural occupations as manufacturing and commerce developed in the years after 1815 was a major threat to the stability of the traditional farm family. Young men and, increasingly, young women were tempted by the opportunities promised by such employment to leave their parents' farms. So we might suppose that a rough indicator of the threat of child default and hence of the degree to which families were beginning to adopt life-cycle attitudes would be the relative size of the non-agricultural sector in the region. Since the census of 1840 recorded the occupational distribution of the population, figures are available from which to construct an index of the proportion of persons engaged in non-agricultural pursuits.

45. Rhode Island and Florida were omitted from the regression for the reasons mentioned in the preceding two footnotes.

46. The sex ratio of adults was initially proposed by H. Yuan T'ien (1959) as an index of the proportion of women who were married (a statistic unavailable from the 1840 census). The higher the ratio, he argued, the greater would be the excess demand for women as marriage partners. This variable was rejected by Yasuba (1962: 125-128), but reintroduced with some success by Schapiro 1982.
Table 9
The Failure of the Target-Bequest Fertility Model in the Presence of the Masculinity Proportion Variable, Log-Linear Regressions, Rural Yamasuba Index, 1840
(Coefficient Estimates and their Standard Errors)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Eq. I</th>
<th>Eq. II</th>
<th>Eq. III</th>
<th>Eq. IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>29.4*</td>
<td>29.5*</td>
<td>29.2*</td>
<td>28.4*</td>
</tr>
<tr>
<td></td>
<td>(2.7)</td>
<td>(3.3)</td>
<td>(4.7)</td>
<td>(4.5)</td>
</tr>
<tr>
<td>Ln(MP40)</td>
<td>33.0*</td>
<td>33.1*</td>
<td>32.9*</td>
<td>31.2*</td>
</tr>
<tr>
<td></td>
<td>(4.1)</td>
<td>(5.0)</td>
<td>(7.0)</td>
<td>(7.2)</td>
</tr>
<tr>
<td>Ln(MFR40)</td>
<td>0.21</td>
<td>0.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(DRS40)</td>
<td>0.027</td>
<td>0.056</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(MFR30)</td>
<td>0.24</td>
<td></td>
<td>(0.55)</td>
<td></td>
</tr>
<tr>
<td>Ln(DRS30)</td>
<td>0.018</td>
<td></td>
<td>(0.071)</td>
<td></td>
</tr>
<tr>
<td>Ln(AFR)</td>
<td>-0.018</td>
<td></td>
<td>(0.042)</td>
<td></td>
</tr>
</tbody>
</table>

Adjusted R² | .711 | .69 | .688 | .700

* Statistically significant at a level better than 95 percent.

a. Iowa Territory and Wisconsin Territory were omitted because the variables MFR30, DRS30, and AFR require data for 1830. These territories had yet to be organized at that time.

Maria Vinovskis calculated such an index for each state directly from the published census returns [Vinovskis 1981: Table 5.1, p. 82]. William Sundstrom and Paul David use a similar variable, the ratio of the agricultural to the non-agricultural labor force [1986: Table 3, p. 50]. Rather than calculate this ratio directly from the enumeration of employment reported by the census, they employ the adjusted figures reported by Richard Easterlin who made corrections for a number of serious but localized deficiencies apparent in the census returns [Easterlin 1960: Table A-1, pp. 97-98, and pp. 126-132]. Sundstrom and David's justification for including the relative employment share in a cross-state model of fertility is the same as ours: "This variable is designed to take account of the fact that ... the development of more ubiquitous employment openings in construction, trade and manufacturing industries would influence perceptions of the potential attraction such outside opportunities would exert upon the farm family's young" [Sundstrom and David 1986: 56].

In Sundstrom and David's work, the relative employment share is combined with a second variable designed to measure the

47. Vinovskis' interest in this variable was to indicate the fraction of the population of each region that were not farm operators. The land-scarcity variables employed in an analysis of fertility patterns would presumably not be relevant to non-agricultural households, so Vinovskis' variable was intended as an indicator of the anticipated strength of the land-availability effect.
strength of the pecuniary attraction afforded by (as opposed to the ubiquity of) non-agricultural employment. This, they assumed, was indicated by the ratio of the average daily earnings of common laborers, with board, to the average monthly earnings of farm laborers, also with board. Because they could not find suitable data on wages in 1840, Sundstrom and David use wage data from the 1850 census adding the rationalization that this data would have the advantage of capturing parents' expectations about future wages (Sundstrom and David 1986: Table 3, p. 50, and p. 56).**

Taken as a pair, the two Sundstrom-David variables can be viewed as modeling the child-default mechanism proposed by Williamson in so far as it was induced by the expansion of non-agricultural employment. Presumably other variables would be needed to capture the impact of the attractiveness of western agricultural opportunities on the child-default rates of the east. In any case, these two labor-market variables (denoted here by the notation RES40 for the relative employment share and RW50 for the ratio of wages) do remarkably well in explaining the cross-state variation the rural fertility index. Using data from all 29 states and territories, the log-linear regression equation looks like this:

48. The wage data come from Stanley Lebergott's compilation of the reports by the U.S. Marshals who took the census of 1850 (Lebergott 1964: 263, 271, 539, and 534).

\[
\text{Ln(CW40)} = 4.87 - 0.192 \text{Ln(RES40)} - 0.773 \text{Ln(RW50)}
\]

\[
(0.68) (0.025) (0.235)
\]

Adjusted \(R^2 = .721\)

\(n = 29\)

Both coefficients are negative and highly significant. As Sundstrom and David report, when these variables are joined with the target-bequest variables (DRS40 and MFR40) in a joint test, the coefficients of the labor-market variables retain both their magnitude and their statistical significance. Neither of the bequest-model variables achieve significance at a level better than 92.5 percent and the density of rural settlement appears with the wrong sign (Sundstrom and David 1986: Table 4, p. 58).** Once again it would appear that our model of life-cycle fertility is superior to a target-bequest model of fertility driven by land scarcity.

The Common School and Life-Cycle Values

Once families found alternatives to patriarchal dominance as a means of providing old-age security, parents would no longer feel compelled to withhold bequests from their children until death. After the life-cycle transition was underway, parents began to transfer resources to children at much earlier points in

49. In a log-linear regression in which the two Sundstrom-David variables were jointly tested with the Forster-Tucker-Bridge adult-farm ratio, the land-scarcity variable had the correct sign and was statistically significant at a level of 92.9 percent confidence.
their life. In many cases this meant that parents helped
children establish themselves on a farm or in some other
occupation when the children were still in their early twenties.
Such help might take the form of an outright gift or, more
typically, the parents would offer their children a loan on
favorable terms.50

The most extensive change in the traditional pattern of
inter-generational transfers produced by the life-cycle
transition, however, had to do with the choice between labor and
schooling. In the traditional farm family, children were
expected to work year-round on their parents farms both as
teenagers and as young adults. The loss of their labor was seen
as too dear a price to pay for extensive schooling.51 Besides,
parents perhaps felt that their children would have little need
for more than a rudimentary education, if they were slated to
eventually take over the family farm.

50. Parents loaned money to children on favorable terms or even
sold them the family farm on a favorable mortgage as a way of
assisting them to start their own household. This was also an
excellent life-cycle strategy. With these transactions, parents
were able to convert current assets into a stream of future
income. This is equivalent to purchasing an annuity.

51. We do not mean to suggest that most children in eighteenth
century New England grew up illiterate. Literacy was encouraged
for religious reasons and literacy rates were quite high. Formal
schooling beyond the point of acquiring an ability to read the
Bible, however, did not become common until the early decades of
Chapter 1.

After the life-cycle transition, child labor and schooling
were viewed quite differently. The idea that parents should put
their children to full-time labor and thus compel them to
contribute to the family income was rapidly becoming
unfashionable. Parents began to excuse children from year-round
farm labor and to provide for their schooling. In this way,
parents made transfers when their children were still young and
the children received an inheritance well before their parents
died.52 There was no reason for the parents to defer a
transfer until death, since a bequest was no longer needed to
insure continued support in old age. This change enhanced the
freedoms of both generations. The new ethic gave children the
freedom to leave home and parental control and to establish their
own household when they were still young. It gave the parents
freedom to manage their assets (including the farm) to suit
themselves.

52. The cost to parents of permitting their children to attend
school should not be underestimated. The major component of
that cost was the foregone labor of the children. But there were
tuition expenses as well. Before the 1840s even the public
schools were not free. In New York parents were charged user
fees called "rate bills" and those who did not pay could not send
their children to school. In Massachusetts only a short regular
session was provided at public expense, parental fees were
charged to lengthen the term (Kaestle and Vinovskis, 1980: 16).
Initially, the fees were often relatively high, but they were
abolished in the 1850s and 1860s (Kaestle, 1983: 117).
We introduce a variable measuring the extent of enrollment in schools into the cross-state analysis of fertility. The variable is based on the census returns for 1840. The number of students who were enrolled in academies and grammar schools and the number of scholars enrolled in primary and common schools at any time during the preceding year was recorded in the 1840 census. We have divided the total enrollment enumerated by the white population aged 5 to 19 to provide a rough index of enrollment rates. The variable thus defined is called SCH40.

53. Susan Carter (1986) correctly notes that the fertility decision and the schooling decision are made simultaneously in a life-cycle plan. The same point has also been made in a discussion of fertility in India by Mark Rosenzweig and Robert Evenson 1977. Nigel Toms (1981) found evidence of simultaneity between education and family size in a study of high-IQ children in twentith-century California. Carter has estimated a simultaneous system of equations for schooling and fertility in the ante-bellum United States using county-level census data for 1840 and 1850 and two-stage estimation procedures. Our state-level data set has an insufficient number of observations to conduct simultaneous-equation estimation. We are pleased to report that Carter's tests support our hypothesis.

54. The index is rough because the numerator represents the cumulative enrollment over the preceding year whereas the denominator counts the population at the time of the census. The measure will thus overstate the average enrollment rate and may be distorted in unpredictable ways by the impact of migration. Nevertheless, the measure is the best we can devise with the available data and has often been used as an index of schooling intensity by other scholars. See the careful discussion of this problem by Kaestle and Vinovskis (1980: 13-14 and 29-31). The reliability of the enrollment figures may also be questioned, particularly when they are to be compared with figures from subsequent censuses to discern trends. Albert Fishlow, however, has pronounced the 1840 data usable as a cross-section index after a review of the strengths and weaknesses of the census procedures (1966: 58-67).

The simple univariate log-linear relationship between SCH40 and the Yasuba index of rural fertility is quite strong:

$$\text{Ln}(\text{CW40}) = 7.090 - 0.292 \text{Ln}(\text{SCH40})$$

Adjusted $R^2 = .654$

$n = 29$

The accompanying scatter diagram in Figure 8 illustrates the relationship vividly.

When this particular index of life-cycle behavior is introduced into an equation simultaneously with the target-bequest variables, DRS40 and MFR40, the result is by now familiar. Once again the coefficient of the life-cycle proxy retains its significance and magnitude while the bequest-model variables fail:

$$\text{Ln}(\text{CW40}) = 7.090 - 0.292 \text{Ln}(\text{SCH40}) + 0.126 \text{Ln}(\text{DRS40}) + 0.712 \text{Ln}(\text{MFR40})$$

Adjusted $R^2 = .679$

$n = 29$

Here again, the land-scarcity variable has the wrong sign."

We are not the first to enter an educational variable into cross-state fertility regressions. Maris Vinovskis demonstrated

55. The adult-farm ratio, however, survives this test.
that the illiteracy rate for those over twenty "was the single best predictor of fertility differentials among the states in 1850 and 1860" (Vinovskis 1976: 393). His other variables included the sex ratio, the percentage of the free population that was foreign born, the degree of urbanization, and the value of an average farm. Despite the fact that school enrollment rates and the illiteracy rates of those over twenty are highly correlated (the correlation between the respective logarithms of the two measures in 1840 is -0.84), the two variables measure very different phenomenon. The schooling rate refers to children between the ages of 5 and 19; illiteracy rates say something about those children's parents.

In his original paper, Vinovskis clearly intended the illiteracy rate to capture the direct impact of their own education on the parents' desire or ability to control fertility (Vinovskis 1976: 381). Elsewhere, Vinovskis interpreted measures of adults' educational attainment as indexes of "modernization" (Vinovskis 1981: 118-129) and he cited demographers and development economists who interpret literacy as an indicator of knowledge about contraceptive technique (p. 123). Our own interpretation of schooling rates is that they serve as an indirect marker for the life-cycle behavior of the children's parents. In this regard, we have the same view of the matter as John Caldwell, whose work on less-developed countries today has
emphasized the importance of the change in the direction and
timing of intergenerational income transfers on fertility rates
in those countries [Caldwell 1982]. Caldwell takes the parents’
decision to send a child to school as evidence of their
willingness to transfer resources to their children while still
alive and consequently as evidence that they no longer relied
upon children to provide old-age security.

If Vinovskis’ idea of a “modern” cultural outlook means
nothing more or less than what we mean by life-cycle modes of
behavior or what Caldwell means by a regime that favors
intergenerational transfers from parents to children, than we
have no disagreement about the interpretation of an educational
variable in fertility models. However, we would claim in that
case that the schooling variable ought to be superior to the
illiteracy variable as an index of life-cycle behavior since the
schooling decision by the parents is contemporaneous with the
data, whereas the illiteracy variable is the result of decisions
about education made many years in the past by the preceding
generation. When both variables are entered simultaneously into
a regression model, the schooling variable retains its
significance while the coefficient of the illiteracy variable
dwindles both in magnitude and in statistical significance.

We would give very little credence to an argument that
explains the power of educational variables in empirical
fertility models by claiming some level of education is necessary
to master contraceptive technology. There is evidence that
American women practiced fertility control within marriage as
early as the first decades of the nineteenth century [Sanderson
1979, Osterud and Fulton 1976] and also in response to unusual
situations in the early decades of the eighteenth century [Wells
1971, Smith 1972]. The primary birth control methods at that
time were infrequent intercourse, coitus interruptus, long
lactation periods, abstinence, and induced abortion. Douching
and the vaginal pinsary were introduced at least as early as
1832. Knowledge of these methods was commonplace and did not
seem to depend upon literacy or educational attainment [La Sorte
1976, Reed 1978: 6-11, and David and Sanderson 1984].

Perhaps the most impressive evidence that schooling is a
useful variable in a model of the American fertility decline is
that presented by Avery M. Guest and Stewart E. Tolnay (1983).
Influenced by Caldwell’s work, Guest and Tolnay examined the
time-series relationship between total fertility (measured by the
Coale-Zelnik series) and the trend in schooling (measured by a
composite variable known as the Ayres index). The time period
considered was 1871 to 1900. During that time the correspondence
between the two series is remarkable. The time-series
correlation is -.925 (Guest and Tolnay 1983: 361). If the enrollment ratio is viewed as a reliable proxy for life-cycle fertility behavior, then the results obtained by Guest and Tolnay are testimony to the power of the life-cycle model to explain the nineteenth century trends in American fertility.**

A Multivariate Test of the Life-Cycle Fertility Model

The battery of tests with life-cycle fertility proxies has been remarkably successful. In each case the proxy tested was significantly correlated with the rural fertility index.*** In each case the proxy retained its significance in the presence of variables intended to measure a target-bequest effect. In each case the target-bequest variables proved to be statistically insignificant in the presence of the life-cycle variables and often appeared with perverse sign. Given this success, it might seem appropriate to combine all of the life-cycle proxies into a single regression with multiple independent variables. There is, of course, considerable multicollinearity between these variables, so it would be remarkable if each one proved to contain unique information.

56. Note that an illiteracy variable would not have the same success in a time-series context. Illiteracy among whites was at very low levels by 1860 and it would be difficult to explain the continued downward trend in fertility after that date by the small improvements in literacy achieved during the balance of the century.

57. Skeptics might wonder how many other proxies were tested and failed. The answer is none.

Table 10 reports the results of a sequence of multivariate tests. The first regression reported contains all five of the life-cycle proxies. Each retains the appropriate sign, but the growth ratio (RG) and the masculinity proportion (MP40) do not achieve statistical significance by the standard criteria. Because of its weak influence in the presence of the other variables, the masculinity proportion is dropped from the collection of independent variables in the second equation. That change allows the remaining four variables to appear with significant and correctly-signed coefficients. Deleting the masculinity proportion also permits us to reintroduce the observations for Florida and Rhode Island. The results of expanding the number of observations to 25 are reported in the third equation. The results are essentially unchanged.
Table 10
The Life-Cycle Fertility Model, Multivariate Formulation, Log-Linear Regressions, Rural Yassua Index, 1840
(Coefficient Estimates and their Standard Errors)

<table>
<thead>
<tr>
<th>Variable</th>
<th>23 States*</th>
<th></th>
<th>25 States*</th>
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<tbody>
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<td>Eq. III</td>
<td>Eq. IV</td>
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<td>5.80*</td>
<td>5.97*</td>
</tr>
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<td>(5.71)</td>
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<td>(0.55)</td>
<td>(0.61)</td>
</tr>
<tr>
<td>Ln(RG)</td>
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<td>0.170*</td>
<td>0.179*</td>
<td>0.149</td>
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<td>(0.094)</td>
<td>(0.067)</td>
<td>(0.064)</td>
<td>(0.078)</td>
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<td>Ln(MP40)</td>
<td>5.56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(8.24)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln(RES40)</td>
<td>-0.0770*</td>
<td>-0.0869*</td>
<td>-0.0946*</td>
<td>-0.105*</td>
</tr>
<tr>
<td></td>
<td>(0.0365)</td>
<td>(0.0328)</td>
<td>(0.0295)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>Ln(RW50)</td>
<td>-0.492*</td>
<td>-0.518*</td>
<td>-0.447*</td>
<td>-0.379</td>
</tr>
<tr>
<td></td>
<td>(0.232)</td>
<td>(0.225)</td>
<td>(0.198)</td>
<td>(0.217)</td>
</tr>
<tr>
<td>Ln(SCH40)</td>
<td>-0.117*</td>
<td>-0.136*</td>
<td>-0.134*</td>
<td>-0.162*</td>
</tr>
<tr>
<td></td>
<td>(0.047)</td>
<td>(0.038)</td>
<td>(0.036)</td>
<td>(0.055)</td>
</tr>
<tr>
<td>SOUTH</td>
<td></td>
<td></td>
<td>-0.0600</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0872)</td>
<td></td>
</tr>
</tbody>
</table>

Adjusted R²: .838 .843 .857 .853

* Statistically significant at a level better than 95 percent.

a. The twenty-three states included are Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, and Virginia.

b. Florida Territory and Rhode Island included.

The Anomalous South? Slavery and White Fertility

As we have noted, the life-cycle hypothesis ought to be applicable to the white population of the slave states.** Higher fertility in the South was the consequence of a delayed and partial transition to life-cycle behavior. For the minority of whites who were slave owners, the threat of child default would be minimized by the presence of servants and field hands. This effect was reflected in the empirical tests that employed the growth ratio as an independent variable. That proxy was an attempt to quantify the potential threat of child default. Not surprisingly, the regression was improved by the inclusion of a dummy variable designed to shift the constant of the equation for the slave states.

Other life-cycle proxies, such as the school enrollment ratio, measure the extent of the life-cycle transition directly. In regressions containing those variables the relationship between fertility and the independent variable for the southern states was not significantly different than that for the northern states. Equation 4 in Table 10 is a final test of the life-cycle

58. The fertility history of slaves is an entirely different issue. There is abundant evidence that slave fertility was, at least in part, subject to the influence of the slave owners and, in any case, the problems of old-age security and the accumulation of a bequest were hardly ones to trouble or motivate slaves. On the subject of slave breeding, see Sutch 1975 and 1986.
hypothesis' ability to incorporate the southern states into its
generalization. The dummy variable SOUTH is entered into the
multiple regression with the four surviving life-cycle proxies.
The slave-state dummy is not only rendered insignificant, but it
now appears with a negative sign. The anomaly of southern
white fertility seems to be adequately explained by the life-
cycle fertility hypothesis. 

Three Conclusions
This working paper proposes an explanation for the American
fertility decline based on the idea that life-cycle determinants
of fertility gradually came to dominate the traditional old-age
security motive for high fertility. This was part of a more
general development, which we have called the life-cycle
transition, initiated by the rising out-migration of young
adults.

We asserted that a satisfactory model of the American
fertility decline should be able to pass three tests. It should
explain the time trend of the decline and particularly the onset
of the decline shortly after 1800. It should be able to explain
the pattern of regional fertility differences that existed in an
intermediate year such as 1840. It should be able to explain the
special case of white fertility in the slave states. We have
assembled what evidence is at hand to demonstrate that our life-
cycle transition model successfully passes all three tests.

Finally, we believe we can draw three specific conclusions:

1. Child default was the catalyst that triggered the American
fertility decline. As the public domain was opened to settlement
and as the non-agricultural labor market expanded, children
frequently left home to take up new opportunities. This reduced
the value of children as "assets" who could provide old-age
security for their parents.

2. The target-bequest model specified with land-availability
variables intended to be applicable to the fertility decisions of
a nineteenth-century rural population is rejected. That model,
first introduced by Richard Easterlin, is difficult to reconcile
with the time-series evidence on fertility, performs poorly in
cross-section tests, and consistently fails in the presence of

59. Our prediction is that the presence of slavery should have
had the direct effect of lowering white fertility, other things
equal. Slave-owning families would have had less reason to
depend upon children for old-age security and less reason to
adopt life-cycle strategies in response to the increased risk of
child default. An indirect effect of slavery, reflected through
the other variables in the equation (primarily schooling and non-
aricultural labor opportunities), was responsible for the high
fertility actually observed. The negative sign on SOUTH in the
equation reported, although not statistically significant, is
encouraging. Susan Carter found a significant negative effect of
slavery on white fertility in tests more appropriately designed
than ours to test the hypothesis [Carter 1986: 14].

60. When the target-bequest variables are entered into the
fourth equation in a final joint test of the two hypothesis, all
of the land-scarcity variables fail. This is also true of the
adult-farm ratio which survived several of the univariate tests.
alternative variables suggested by the life-cycle model of fertility proposed in this paper.

A variety of proxy variables intended to measure the adoption of life-cycle behavior do remarkably well in explaining the cross-sectional variation of fertility in 1840. We find ample reason to encourage the further exploration of life-cycle models of fertility in American demographic history.

References

Alston and Schapiro, 1984

Anderson and Gallman, 1977

Barron, 1984

Butler, 1963

Bidwell, 1921

Bidwell and Falconer, 1925

Blayo, 1977

Blodgett, 1806

Bogue, 1976
Bogue and Palmore, 1964

Bourgeois-Pichat, 1965

Caldwell, 1982

Carlton, 1968

Carter, 1986

Cipolla, 1965

Clark, 1979

Coale and Zelnik, 1963

Covgill, 1963

David and Sanderson, 1985

Davis, 1945

Easterlin, 1960

Easterlin, 1971

Easterlin, 1971

Easterlin, 1976

Easterlin, 1976
Easterlin, Alan, and Conrady, 1978

Fischer, 1977

Fishlow, 1966

Folbre, 1983

Folbre, 1985

Forster, Tucker, and Bridge, 1972

Franklin, 1751

Friedlander, 1969

Gallman, 1982

Garey, 1985

Gille, 1949

Grabill, 1959

Grabill, Kiser, and Whelpton, 1958

Greven, 1970

Guest and Tolnay, 1983

Hammel, Johansson, and Ginsberg, 1983

Henretta, 1976

Hymer and Reznick, 1969
Jacobson, 1957

Jefferson, 1787

Kaesel and Vinovskis, 1980

Kaesel, 1983

La Sorte, 1976

Lebergott, 1964

Leet, 1975

Leet, 1976

Leet, 1977

Leibenstein, 1975

Lindert, 1978

Lindert, 1983

Lotka, 1927

McClelland and Zeckhauser, 1982

Meeker, 1972

Mitchell, 1975

Modigliani, 1980

Morris, 1927

Mosk, 1982

Neher, 1971
Notestein, 1953

Nugent, 1985

Osterud and Fulton, 1976

Potter, 1965

Ranis and Sutch, 1986

Reed, 1978

Rohrbough, 1978

Rosenzweig and Evenson, 1977

Sanderson, 1976

Sanderson, 1979

Satin, 1969

Schapiro, 1982

Schumacher, 1949

Smith, 1776

Smith, 1977

Smith, 1973

Smith, 1983
Steeke, 1977

Steeke, 1979

Stilwell, 1948

Sundstrom and David, 1986

Sutch, 1975

Sutch, 1986

T'ien, 1959

Temkin-Greener and Svedlund, 1978

Thompson and Whelpton, 1933

Thompson, 1929

Tomes, 1981

Tucker, 1855

Turner, 1893

U.S. Bureau of the Census, 1975

U.S. Bureau of the Census, 1984

U.S. Census, Second Census, 1800

U.S. Census, Third Census, 1810
United States, Census Office, Third Census [1810]. *Aggregate Amount of Persons within the United States in the Year 1810.* 1811.

U.S. Census Office, Fifth Census, 1830
United States, Census Office, Fifth Census [1840]. *Fifth Census or Enumeration of the Inhabitants of the United States, 1830.* 1830.
U.S. Census Office, Sixth Census, 1840
United States, Census Office, Sixth Census [1840]. Sixth Census or Enumeration of the Inhabitants of the United States, as Corrected at the Department of State, in 1840. Blair and Rives, 1841.

Villaflor and Sokoloff, 1982

Vinokur, 1972

Vinokur, 1976

Vinokur, 1978

Vinokur, 1981

Weir, 1982

Weiss, 1985

Wells, 1982

Wilcox, 1911

Williamson, 1985

Wright, 1978

Wrigley and Schofield, 1981

Yasuba, 1962

Zelinsky, 1971