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12 The Fertility Transition in the United States

Tests of Alternative Hypotheses

Richard H. Steckel

12.1 Introduction

The secular decline of fertility in the United States and its East-West gradient have intrigued several generations of economists, historians, and demographers. The fertility transition was well underway before substantial industrial or urban development, which has led to explanations that feature a rural setting. A prominent model emphasizes land availability, while alternative, yet complementary, explanations rely on changes in education, wealth, occupational structure, ethnic composition, saving behavior, family-limitation techniques, and child wages.

The average age at first birth, the average age at last birth, the average spacing interval, and the share of women who eventually have children determine average completed family size.[1] While a comprehensive study would examine all four aspects, nearly all explanations of nineteenth-century fertility patterns accept, or at least do not deny, that decisions made within marriage partly influenced completed family size. Specifically, decisions on birth control, the frequency of intercourse, and breastfeeding practices may have influenced the number of births within marriage. Despite the importance of these types of decisions for completed family size, there has been little research on marital fertility per se for the early part of the transition.

This essay has two major objectives. The first is to describe regional and temporal patterns of fertility for the white population in the United States

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1. Richard H. Steckel, *The Economics of U.S. Slave and Southern White Fertility* (New York, 1985) discusses an equation for completed family size in terms of these components.

during the nineteenth century and to assess the extent to which variations in marital fertility contributed to fertility patterns in the United States at mid-century.[2] The second is to describe and evaluate empirically the major alternative hypotheses for variations in marital fertility.

Early work on the formulation of hypotheses was guided heavily by analysis of group data, principally evidence at the regional and state levels.[3] Difficulties of identifying operative mechanisms in highly aggregate data led to subsequent work at the county or township level and more recently to study of individual and household data in cross-sectional or longitudinal form.[4] The cross-sectional samples from the federal censuses have the advantage (beginning in 1850) of including substantial socioeconomic information about the household but are silent on adaptations to changing circumstances. Longitudinal data from genealogies have the advantage of tracking fertility over the life cycle but may require tedious matching with other sources as a prelude to socioeconomic analysis.

The empirical research here rests on longitudinal data assembled from the manuscript schedules of the federal censuses of 1850 and 1860. By using a child's reported state of birth to track changes in residence, I have assembled a national sample of 638 rural families that contained wives of childbearing age and that had husbands and wives who survived through the decade of the 1850s.[5] I measure fertility by surviving additions to the family that occurred from 1850 to 1860 as indicated by the number of children aged 10 or less listed on the 1860 census manuscripts. The fertility measure, combined with information from the manuscript schedules on household features and with data from the published census on county-of-residence characteristics, enables the estimation of models on the determinants of marital fertility.

2. As used in this paper the term "marital fertility" refers to the behavior from 1850 to 1860 of the subset of married women who had at least one child by 1850.

3. Richard A. Easterlin, "Does Human Fertility Adjust to the Environment?" *American Economic Review,* 61 (May 1971), pp. 399–407; Colin Forster and G. S. L. Tucker, *Economic Opportunity and White American Fertility Ratios, 1800–1860* (New Haven, 1972); Maris A. Vinovskis, "Socioeconomic Determinants of Interstate Fertility Differentials in the United States in 1850 and 1860," *Journal of Interdisciplinary History,* 6 (Winter 1976), pp. 375–96; Yasukichi Yasuba, *Birth Rates of the White Population in the United States, 1800–1860* (Baltimore, 1961).

4. Don R. Leet, "The Determinants of the Fertility Transition in Antebellum Ohio," *Journal of Economic History,* 36 (June 1976), pp. 359–78; Maris A. Vinovskis, "A Multivariate Regression Analysis of Fertility Differentials among Massachusetts Regions and Towns in 1860," in *Historical Studies of Changing Fertility,* Charles Tilly, ed. (Princeton, 1978), pp. 225–56; Michael R. Haines, "Fertility and Marriage in a Nineteenth-Century Industrial City: Philadelphia, 1850–1880," *Journal of Economic History,* 40 (Mar. 1980), pp. 151–58; Richard H. Steckel, "Antebellum Southern White Fertility: A Demographic and Economic Analysis," *Journal of Economic History,* 40 (June 1980), pp. 331–50; Jenny Bourne Wahl, "New Results on the Decline in Household Fertility in the United States, 1750–1900," in *Long-Term Factors in American Economic Growth,* Stanley L. Engerman and Robert E. Gallman, eds. (Chicago, 1986), pp. 391–437.

5. See Richard H. Steckel, "Census Matching and Migration: A Research Strategy," *Historical Methods,* 21 (Spring 1988), pp. 52–60, for discussion of details and limitations of the matching process.

12.2 Child-Woman Ratios

Because the system of vital registration was substantially incomplete in the United States during the nineteenth century, studies of childbearing for this era often use an indirect measure of fertility such as the child-woman ratio. Usually tabulated from census age distributions, the numerator of this ratio consists of the number of young children, while the denominator is the number of women of childbearing age. Because the numerator includes only surviving children, variations in the ratios may reflect differential mortality rather than genuine differences in fertility. Moreover, the fertility history captured by the numerator may include children born outside the region or state under study. Despite these shortcomings, this measure of fertility has been shown to be highly correlated with direct measures such as total fertility and the refined birth rate.[6]

Table 12.1 presents evidence on long-term trends and regional differences in the number of white children under age 10 per thousand white women aged 15 to 49. During the nineteenth century the ratio diminished by varying magnitudes within each region and by 41 percent in the nation as a whole. Roughly one-half of the national decline in the century had occurred by 1850. Regions within the North had the largest rates of decline, especially the East North Central region (60 percent), while southern regions, particularly the West South Central (24 percent), experienced lesser reductions.[7] In any year the ratio was usually higher in western compared with eastern states. In 1830, for example, the ratio in the East North Central states exceeded that in the Northeast by 43 percent, while it was 12 percent below that in the West North Central region. A similar pattern prevailed in most of the South. An exception is found in the western states in the early decades of the century, but the anomaly may be explained by the numerical dominance of the city of New Orleans, which probably had low fertility and high childhood mortality rates.[8] The re-

6. Donald J. Bogue and James A. Palmore, "Some Empirical and Analytic Relations Among Demographic Fertility Measures, with Regression Models for Fertility Estimation," *Demography*, 1 (1964), pp. 316–38.

7. The possible influence of mortality differences and trends on the child-woman ratios is substantially unknown because information is scanty before the end of the nineteenth century. A time series on human stature indicates, however, that cohorts of the late 1700s and early 1800s experienced improving levels of net nutrition while those born after 1830 witnessed declines. See Robert William Fogel, "Nutrition and the Decline in Mortality since 1700: Some Preliminary Findings," in *Long-Term Factors in American Economic Growth*, Stanley L. Engerman and Robert E. Gallman, eds. (Chicago, 1986), pp. 439–555. Since adult stature is sensitive to environmental conditions in childhood, one may argue that childhood mortality rates followed the cycle in heights. If so, the child-woman ratios may understate the extent of fertility decline in the early part of the century but exaggerate the decline after the 1830s.

8. The West South Central region consisted exclusively of Louisiana before 1840, and in 1850 the state represented about 45 percent of the population in the region. About 25.9 percent of the population in Louisiana resided in urban areas (towns or cities having a population of 2,500 or more) in 1850 compared with 8.3 percent in the South as a whole. It is well established that urban areas traditionally have relatively low fertility rates. The warm climate and high concentration of

Table 12.1 **Number of White Children under Age 10 Per Thousand White Women Aged 15 to 49 by Census Year and Region**

Year	NE	ENC	WNC	SA	ESC	WSC	WEST	U.S.
1800	1,462	2,143		1,580	2,065			1,541
1810	1,448	1,998		1,542	1,961	1,632		1,542
1820	1,321	1,870		1,480	1,820	1,582		1,465
1830	1,226	1,755	2,000	1,430	1,783	1,562		1,413
1840	1,138	1,579	1,761	1,405	1,711	1,604		1,348
1850	984	1,366	1,478	1,261	1,563	1,404		1,186
1860	973	1,280	1,411	1,211	1,350	1,432	1,285	1,164
1870	878	1,156	1,311	1,047	1,161	1,171	1,260	1,056
1880	833	1,037	1,220	1,167	1,266	1,421	1,044	1,042
1890	739	926	1,082	1,080	1,160	1,308	937	939
1900	762	864	1,001	1,059	1,126	1,240	885	914

Notes: Interpolation of the age categories, based on the distribution of exact ages in a random sample of households drawn from the 1860 census manuscript schedules (see Richard H. Steckel, *The Economics of U.S. Slave and Southern White Fertility* [New York, 1985], pp. 660–74), was required for women in the census years of 1800 to 1820. NE = Northeast, ENC = East North Central, WNC = West North Central, SA = South Atlantic, ESC = East South Central, WSC = West South Central, WEST = Mountain and Pacific.

Sources: Published federal population censuses, 1800–1900.

gional contrasts tended to diminish during the course of the century. By 1900 the excess of the ratio in the West North Central states over that in the Northeast, for example, was 31 percent compared with 63 percent in 1830.

The net additions of children to families from 1850 to 1860, shown in Table 12.2, are consistent with the regional gradient of child-woman ratios given in Table 12.1, but the contrasts, although substantial, are less than those observed for child-woman ratios. Regional differences existed for women of all ages and ranged from a high of nearly one child between the Northeast and the frontier for women aged 20 to 24 to a low of 0.64 children among those aged 25 to 29. In an era when the total fertility rate was approximately 5.2 for white women in the country as a whole, these regional differences in the number of surviving children aged 10 or less were important relative to average fertility behavior.[9] If all ages are combined, a married woman on the frontier had about one-third more children than a married woman in the Northeast, while the child-woman ratio in the West North Central and the West South Central states (an approximation of the frontier) was about 46 percent above

population living near waterways or swamps suggests that children had high rates of exposure to disease. Data on adult stature are consistent with the argument of poor health. According to union army records, enlisters from Louisiana were shorter than those from the other southern states that furnished significant numbers of troops (Kentucky, Tennessee, Maryland, and Missouri). See Benjamin Apthrop Gould, *Investigations in the Military and Anthropological Statistics of American Soldiers* (New York, 1869), pp. 94–95.

9. Estimates of total fertility are available in Ansley J. Coale and Melvin Zelnik, *New Estimates of Fertility and Population in the United States* (Princeton, 1963), p. 36.

Table 12.2 **Average Number of Children Aged 10 or Less among Rural Families in 1860 by Region of Residence in 1850**

	Wife's Age in 1850								
	20–24			25–29			30–34		
Region	Mean	Stand. Dev.	N	Mean	Stand. Dev.	N	Mean	Stand. Dev.	N
Northeast	2.76	1.23	25	2.79	1.65	81	2.10	1.54	63
North Central	3.23	1.54	35	3.12	1.42	52	2.58	1.19	52
South	3.42	1.47	84	3.33	1.53	110	2.85	1.60	80
Frontier[a]	3.71	1.45	17	3.43	1.80	23	2.94	1.48	16
Total	3.30	1.46	161	3.13	1.58	266	2.56	1.51	211

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses.
[a]Includes Minnesota, Iowa, Kansas, Texas, and states farther west.

that in the Northeast. Therefore variations in other determinants of child-woman ratios, such as the age at first birth and the share of women who ever had children, must have been important influences on regional fertility patterns.

12.3 Alternative Hypotheses

Alternative hypotheses of long-term declines and regional differences in fertility differ considerably in the details of their operative mechanisms. Newcomers to this literature may find these distinctive features—land availability, bargaining between parents and children, literacy, occupation, and ethnicity—unrelated and not elements of an integrated model of fertility. Yet, all these hypotheses have underpinnings in the standard framework of household choice. From this common starting point explanations differ in the emphasis given to the components of choice and in their selection of proxies for determining variables.

Land-availability models follow a Malthusian tradition that views the couple's ability to support children as crucial to fertility decisions.[10] Proponents argue that opportunities for financial independence depended heavily on the cost of acquiring new land in the agricultural setting of the early nineteenth century. When land was expensive, the present value of future income was small and many prospective couples could not afford to marry.[11] The desired number of births was attained by regulating the age at marriage or, if effective

10. See, for example, Yasuba, *Birth Rates;* and Forster and Tucker, *Economic Opportunity.* According to Forster and Tucker (p. 4), opportunities for the establishment of new households could have affected the incentives of married people to restrict family size.

11. If credit markets were poorly developed, then cash was required to buy land. If credit was available, then couples needed to amass a downpayment. In either case, higher land prices, other things being equal, discouraged family formation.

knowledge was available, by control of births within marriage. A central tenet of the land availability–Malthusian reasoning is that couples desired children; births would increase if parents could afford to support a larger family. Adherents claim this reasoning explains the high child-woman ratios in western relative to eastern states and that the growth in population density led to the long-term fertility decline.

Richard Easterlin developed a variant of the land-availability thesis, called the target-bequest model, that empowered farmers with motives to establish children on nearby land.[12] Couples in an area of land scarcity, such as New England in the early nineteenth century, anticipated the cost of providing land for their children and took steps to limit family size. Higher prices for land increased the cost of children, effectively shrinking the couple's opportunity set. This variant has the same implications as the general land-availability model for regional patterns and the long-term decline in fertility.

High correlations between child-woman ratios and measures of population density at the state or county level have supported the land-availability thesis. But the results of research using household-level data have been mixed.[13] Nancy Landale, for example, found that men at the end of the nineteenth century delayed marriage when agricultural opportunity (measured by the average value of a farm in the county of residence) diminished. Marvin McInnis, however, has questioned the strength of the mechanism using Canadian data.[14] In addition, I note that long-term declines in child-woman ratios in frontier areas are troublesome for the hypothesis.[15] Roger Ransom and Richard Sutch observe that the land-scarcity model does poorly in the South, a region that began its fertility decline later than the North and that experienced a more gradual decline despite a settlement history similar to that of the Midwest.[16]

William Sundstrom and Paul David have developed a model of bargaining between parents and children to explain the fertility decline.[17] The traditional

12. Richard A. Easterlin, "Population Change and Farm Settlement in the Northern United States," *Journal of Economic History,* 36 (Mar. 1976), pp. 45–75. See also Richard A. Easterlin, George Alter, and Gretchen A. Condran, "Farms and Farm Families in Old and New Areas: The Northern States in 1860," in *Family and Population in Nineteenth-Century America,* Tamara K. Hareven and Maris A. Vinovskis, eds. (Princeton, 1978), p. 72.

13. Yasuba, *Birth Rates;* Leet, "Determinants of the Fertility Transition"; Morton Owen Schapiro, "Land Availability and Fertility in the United States, 1760–1870," *Journal of Economic History,* 42 (Sept. 1982), pp. 577–600.

14. Nancy S. Landale, "Agricultural Opportunity and Marriage: The United States at the Turn of the Century," *Demography,* 26 (May 1989), pp. 203–18; R. M. McInnis, "Childbearing and Land Availability: Some Evidence from Individual Household Data," in *Population Patterns in the Past,* Ronald Demos Lee, ed. (New York, 1977), pp. 201–27.

15. Steckel, *The Economics of U.S. Slave and Southern White Fertility,* pp. 132–33.

16. Roger L. Ransom and Richard Sutch, "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," Working Papers on the History of Saving no. 5 (University of California, Apr. 1986).

17. William A. Sundstrom and Paul A. David, "Old-Age Security Motives, Labor Markets, and Farm Family Fertility in Antebellum America," *Explorations in Economic History,* 25 (Apr. 1988), pp. 164–97.

family structure on farms of the colonial and early national periods placed old-age care for parents in the hands of their grown children, a system that was enforced through inheritance and inter vivos transfers. Sundstrom and David maintain that the terms of intergenerational exchange of parental wealth for old-age support were arrived at through a process of intrafamily bargaining. Their analysis concludes that the bargaining power of the young was enhanced, and the marginal value of children to nonaltruistic parents was diminished, by improved labor market opportunities for children and young adults outside agriculture. From the parents' perspective these new labor market opportunities effectively increased the net cost of raising children. The implications of this model regarding changes in the economy for parental choice are identical to those of Easterlin's bequest motive but the operative mechanism differs in its reliance on events beyond agriculture.

Roger Ransom and Richard Sutch also link the long-term decline in fertility to the demise of the old-age security motive for having children.[18] Like Sundstrom and David they emphasize family structure, but connect the beginning of the fertility decline to westward migration. In their view the Sundstrom-David mechanism (job market opportunities outside agriculture) played only a supporting role. The opening of western lands after 1815 triggered out-migration of young people who, they argue, effectively defaulted on implicit obligations to care for their parents in old age. Child default led prospective parents to curtail childbearing and accumulate financial assets that would later be spent for old-age care, a process that Ransom and Sutch call the "life-cycle transition."

Analysts have suggested several possible explanations for the inverse relationship often observed between fertility and the education or literacy of the parents.[19] Those who emphasize a connection between education and knowledge of family-limitation methods recognize that children are not acquired in the manner of market products such as apples and oranges, but are produced by a biological process over which couples have only partial control. Thus, parents may have difficulty implementing desired family size. Biological constraints may generate less than the optimum in some cases, but it is likely that a significant share of couples produced more than the desired number. Higher levels of education might have led to greater awareness of effective birth control methods. The regional patterns and time trends in fertility can be explained by noting that additional schooling and greater exposure to reading materials and ideas characterized the eastern compared with western states

18. Ransom and Sutch, "Rising Out-Migration"; Roger L. Ransom and Richard Sutch, "Two Strategies for a More Secure Old Age: Life-cycle Saving by Late-Nineteenth Century American Workers," Paper presented at the NBER Summer Institute on the Development of the American Economy, Cambridge, Mass. (July 1989).

19. The connection may be bi-directional and complex. For a discussion of issues see Harvey J. Graff, "Literacy, Education, and Fertility, Past and Present: A Critical Review," *Population and Development Review,* 5 (Mar. 1979), pp. 105–40.

and that levels of schooling improved during the century.[20] Survey information on family limitation is scanty, but that which has been analyzed as well as indirect evidence on spacing and age patterns of fertility, suggest that by the mid to late 1800s some couples, particularly those who resided in the North, effectively limited conception.[21]

Parental goals or social norms for educating children may have influenced desired family size. Industrialization during the nineteenth century increased the returns to human capital for some workers and much of the burden of financing skill accumulation fell on parents in the form of direct costs of education and foregone earnings of child labor. The net rise in child costs noted by John Caldwell and others can be represented by a diminished opportunity set for prospective parents.[22] The human capital approach associated with Gary Becker and others emphasizes the value of mother's time in child-rearing costs.[23] If market opportunities for women improved with industrialization, child costs rose correspondingly and couples were led in Becker's analysis to reduce births but not child "services" by substituting child "quality" for "quantity."[24] Although it often has been taken for granted that married women's market opportunities improve with industrialization, Claudia Goldin's recent study of women in the labor market reports that factual support for this view is lacking before 1920.[25] Despite the increased employment of single women during industrialization, Goldin notes that married women did not experience increased employment outside the home until the second decade of the twentieth century.

Richard Easterlin argues that education may have adversely affected tastes and preferences for children.[26] Growth in literacy and wider distribution of books, periodicals, and magazines could have changed the preference functions of couples away from children and toward travel, entertainment, and the consumer goods of the Industrial Revolution.

The effect of wealth on the desired number of children depends upon the

20. Lee Soltow and Edward Stevens, *The Rise of Literacy and the Common School in the United States: A Socioeconomic Analysis to 1870* (Chicago, 1981). Soltow and Stevens note the East (high literacy)–West (low literacy) gradient (p. 195) and on the time (p. 201) trend report that: "By 1800 the level of illiteracy was between 30 and 40 percent for those who occupied the lower half of the wealth distribution. This rate probably declined moderately until 1830, at which point it began to decline rapidly, especially between 1840 and 1860."

21. Paul A. David and Warren C. Sanderson, "Rudimentary Contraceptive Methods and the American Transition to Marital Fertility Control, 1855–1915," in *Long-Term Factors in American Economic Growth*, Stanley L. Engerman and Robert E. Gallman, eds. (Chicago, 1986), pp. 307–79; Warren C. Sanderson, "Quantitative Aspects of Marriage, Fertility and Family Limitation in Nineteenth Century America: Another Application of the Coale Specifications," *Demography*, 16 (Aug. 1979), pp. 339–58; Wahl, "New Results."

22. John C. Caldwell, *Theory of Fertility Decline* (New York, 1982).

23. Gary S. Becker, *A Treatise on the Family* (Cambridge, Mass., 1981).

24. Using intergenerational household-level data, Jenny Bourne Wahl finds that the nineteenth-century fertility decline is consistent with the quantity-quality model. See Wahl, chapter 13 in this volume.

25. Claudia Goldin, *Understanding the Gender Gap: An Economic History of American Women* (New York, 1990).

26. Easterlin, "Does Human Fertility Adjust to the Environment?"

relative strength of two opposing influences, a true wealth effect and a price effect. Under Malthusian assumptions the positive wealth dominates the negative price effect. Earlier empirical studies are mixed on the question of the net effect of wealth on family size. Marvin McInnis and I, for example, find a direct relationship between wealth and fertility for predominantly rural populations of Canada and the American South in the mid-nineteenth century. On the other hand, Gary Becker and H. Gregg Lewis report that fertility was lower among the wealthier in twentieth-century America. In a study of nineteenth-century families that uses genealogies, Jenny Wahl reports that the relationship between family size and wealth is complex. The number of children first declines, then increases, and eventually declines as wealth moves from low to high levels.[27]

The possible persistence of habits or cultural traditions adapted to environments of the country of birth suggests that ethnicity may have influenced the demand for children. This phenomenon could be represented in the model of choice by the persistence of Old World tastes among New World residents or that it took time for newcomers to accurately perceive and respond to their new economic surroundings. Consistent with these notions, several studies report that fertility was higher among immigrants compared with the native born in the late nineteenth century. There is some controversy, however, whether the same ethnic differences in fertility existed during the antebellum period. Studies by Maris Vinovskis, Jeremy Atack and Fred Bateman, and Colin Forster and G. S. L. Tucker report that differences were small, while Jenny Wahl found that the foreign born had higher fertility that was attributable to tighter spacing intervals.[28]

Numerous studies report systematic occupational patterns of fertility. These patterns might be attributable to differences in income or wealth, levels of education, differential bequest motives, or the value of children in home production. Birth rates in modern data tend to be higher among populations of manual compared with white-collar or professional occupations.[29] Fertility in the nineteenth century tended to be higher among farmers compared with nonfarm occupations.[30] In a sample of genealogies for the eighteenth and nineteenth centuries the number of children was lower among professionals, proprietors, and craftsmen compared with unskilled workers.[31]

27. McInnis, "Childbearing and Land Availability"; Steckel, *The Economics of U.S. Slave and Southern White Fertility;* Gary S. Becker and H. Gregg Lewis, "Interaction between Quantity and Quality of Children," in *Economics of the Family,* T. W. Schultz, ed. (Chicago, 1974); Wahl, "New Results."

28. Maris A. Vinovskis, *Fertility in Massachusetts from the Revolution to the Civil War* (New York, 1982), pp. 108–11; Jeremy Atack and Fred Bateman, *To Their Own Soil: Agriculture in the Antebellum North* (Ames, 1987); Forster and Tucker, *Economic Opportunity;* Wahl, "New Results."

29. United Nations, *The Determinants and Consequences of Population Trends: New Summary of Findings on Interaction of Demographic, Economic, and Social Factors* (New York, 1973).

30. Atack and Bateman, *To Their Own Soil;* Wahl, "New Results."

31. Wahl, "New Results."

12.4 Selection of Proxies

In designing tests of alternative hypotheses it is important to recognize that variables constructed from empirical evidence seldom correspond precisely to theoretical concepts of economic models. The lack of data often forces empirical researchers to use constructions that approximate desired variables. Therefore empirical tests are usually tests of two joint hypotheses: that the proxies adequately represent theoretical concepts and that theoretical concepts are potent explanations of behavior. In tests of the hypotheses outlined above I generally use proxies of conceptual variables favored by their proponents. For land availability there are two: the ratio of improved acres in the county of residence to the maximum acres ever improved and the ratio of the rural population in the county to the maximum rural population.[32] Because some families changed county (or state) of residence between 1850 and 1860, the choice widens, and I chose the average of the values in 1850 and 1860. Thus, the improved-acres measure is the average of the values that existed in the county of residence in 1850 and that in 1860. The use of average values of variables extends beyond density measures and includes most of the explanatory variables in the statistical analysis.

In their test of the parent-child bargaining model, Sundstrom and David measure the relative bargaining power of children and parents by off-farm employment opportunities.[33] Their proxies are the ratio of the nonagricultural to the agricultural labor force in the state and the ratio of the daily wage of common labor to the monthly wage of farm labor in the state. Using state-level census data for 1840 they find that the child-woman ratio is negatively related to each proxy. My tests of their model are limited to household heads who were farmers.

Ransom and Sutch use five proxies to identify the change in behavior they term the "life-cycle transition."[34] The variables they employ to explain child-woman ratios at the state level in the 1840 census are: 1) the rate of growth of the rural population from 1830 to 1840, a measure of out-migration that is a rough index of the chances of child default; 2) the proportion of children under age 10 who were male, which is used as a measure of selective family migration and as a measure of differential care given to children; 3) the ratio of children who attended school to the number of children aged 5 to 19; 4) the ratio of the nonagricultural to the agricultural labor force; and 5) the ratio of the daily wage of common labor to the monthly wage of farm labor. The last two variables, which are measures of the risk of child default, are identical to those used by Sundstrom and David. Data limitations of the 1840 census forced Ransom and Sutch to use ad hoc measures of migration and education.

32. The maximum was determined for the period from 1850 to 1920. See discussions of land-availability measures in Easterlin, Alter, and Condran, "Farms and Farm Families," and Schapiro, "Land Availability."

33. Sundstrom and David, "Old-Age Security Motives."

34. Ransom and Sutch, "Rising Out-Migration."

In place of their proxies I am able to substitute the percentage of the population born in the state that was living outside the state for their measure of migration and a household-specific measure of children's education—the proportion of children aged 10 to 15 in the family who attended school—for their school enrollment ratio.[35]

Ransom and Sutch briefly mention the existence and reliability of markets for financial assets in their discussion of the life-cycle transition, but proxies for the condition of these markets are completely absent from their empirical work and from their discussion of research needs.[36] Yet, the condition of financial institutions could have influenced desired family size. Well-developed financial markets give prospective parents the option of accumulating financial assets instead of investing in children as a means of providing old-age care. Indeed, an intergenerational model of parental choice under conditions of financial development predicts the substitution of financial instruments for children.[37] Consistent with this argument, John Knodel reports that fertility in administrative areas of Germany was inversely correlated with the number of bank accounts per capita.[38] Alternatively, the condition of financial institutions could be viewed as an indicator of the pace of the life-cycle transition. Which view is appropriate depends upon the importance of life-cycle savings in overall savings. If the emergence of savings for old age was relatively important in boosting banks and other financial institutions, then financial development should be viewed as an indicator of the extent of the transition. If banks and financial institutions arose primarily for other reasons, then the lack of financial development could be viewed as a constraint on the evolution of life-cycle economic processes. In either case, fertility should have been positively correlated with the condition of financial markets. For these reasons I investigate what I term the "financial-institutions hypothesis" by examining measures of the extent of financial development for their possible influence on fertility behavior. Accordingly, the regression analysis incorporates the number of banks (and branches) per 100,000 white population in the state of residence as an explanatory variable.

Years of schooling are unavailable for the early and mid-nineteenth century. I adopt the often used, but crude, proxy of the husband's and the wife's literacy as reported by the 1850 census enumerators. Information on wealth is also meager for 1850. The census of that year recorded only the value of real estate. I employ the household's value of real estate as a measure of wealth.[39]

35. I confine the measure to the ages at least as old as 10 because there was little opportunity cost of education at younger ages. Above age 15, children left home at increasing rates, leaving behind a group more likely to have been selected for attending school.

36. See Ransom and Sutch, "Two Strategies," p. 5.

37. Philip A. Neher, "Peasants, Procreation, and Pensions," *American Economic Review,* 61 (June 1971), pp. 380–89.

38. John E. Knodel, *The Decline of Fertility in Germany, 1871–1939* (Princeton, 1974), pp. 232–36.

39. A sample of 1,581 male-headed households from the 1860 census indicates that the value of real estate was an excellent predictor of total wealth (real and personal estate) beyond low levels

Occupations of the household head reported by the 1850 census are grouped into white collar, blue collar, unskilled, farmers, and other and unknown categories. The white-collar group consists of clerks, clergymen, doctors and physicians, lawyers and attorneys, merchants, and teachers, among others. Blue-collar workers are composed primarily of blacksmiths, bricklayers and masons, carpenters, coopers, shoemakers, tailors, and wagon makers. About 89 percent of the unskilled were laborers.

12.5 Tests of Hypotheses

The previous section discussed several socioeconomic variables that may have influenced marital fertility. A statistical methodology is required to measure the independent effects of these possible influences on family size, to test for their statistical significance, and to assess their practical importance. This section views the number of children aged 10 or less in 1860 as the outcome of a decision process governed by household, county, and state characteristics in 1850 and 1860. Because none of the models placed constraints on the estimating procedures, the objective is to discover which variables are correlated with fertility.

Econometric models of qualitative response are designed to portray situations in which decision outcomes assume discrete values. The number of surviving children is an example suitable for this class of models. The analysis uses a basic model in this class, the Poisson.[40] In particular, it is assumed that the number of surviving children Y_i, born in the decade of the 1850s, in the ith of N families is distributed according to the probability density

$$Pr(Y_i = y_i) = e^{-\lambda_i} \lambda_i^{y_i}/y_i\,!, \quad y_i = 0, 1, 2, \ldots; i = 1, 2, \ldots, N$$

where y_i is the realized value of the random variable and λ_i is both the mean and variance of Y_i. To incorporate exogenous variables X_{ij} ($j = 1, \ldots, K$), including a constant, the parameter λ_i is specified to be a nonnegative function of the exogenous variables

$$\lambda_i = exp\,(X_i\beta)$$

The results below were estimated using the method of maximum likelihood.

Because simultaneous tests of these hypotheses increase the chance of multicollinearity, which biases estimated standard errors, I proceed with a series

of total wealth. See Richard H. Steckel, "Poverty and Prosperity: A Longitudinal Study of Wealth Accumulation, 1850–1860," *Review of Economics and Statistics*, 72 (May 1990), pp. 275–85.

40. Colin A. Cameron and Pravin K. Trivedi, "Econometric Models Based on Count Data: Comparisons and Applications of Some Estimators and Tests," *Journal of Applied Econometrics*, 1 (Jan. 1986), pp. 29–53. Specifically, I used the model they call Negbin I (see p. 33). Because the variance of the number of surviving children was significantly below the mean, I used the formula on page 46 to estimate a, which led to an upward adjustment of t-values by approximately 15 percent.

of pair-wise tests. The land-availability model has been widely discussed in the historical fertility literature of the past three decades and several studies show that its implications are consistent with aggregate data for several regions in the United States. On this basis I test the land-availability model against alternative hypotheses that emphasize wealth, ethnicity, occupations, education (of parents), intrafamily bargaining, life-cycle processes, and financial institutions.[41] The findings reported are based on the land-density measure chosen by Easterlin et al., but the results are similar if the rural-population measure, preferred by Morton Schapiro, is used.[42] Several tables present two specifications, the second of which differs from the first only by the inclusion of a dummy variable for the South as a way of assessing the capability of the models to explain the higher fertility observed in that region. Biological considerations justify the inclusion of dummy variables for the wife's age in all equations.

The results in Tables 12.3 through 12.9 fail to support the wealth and the education hypotheses. Supporters of these arguments may claim, however, that the relevant variables are simply measured inadequately. The value of real estate may be a poor proxy for total wealth, and literacy has obvious shortcomings as a measure of education. The findings are mixed for the bargaining and the life-cycle approaches; the negative and statistically significant coefficient on the agricultural labor force variable favors these hypotheses, but the positive and sometimes significant coefficient on the wage variable is contrary to the arguments. In the case of the life-cycle hypothesis, the migration and the school variables also have the wrong sign. The size of the t-value on the variable for southern residence indicates that separate explanations for higher fertility in the South are required when wealth, ethnicity, occupations, and literacy are used, but not in cases involving intrafamily bargaining, life-cycle transition, and financial institutions. The land-availability measure is significant in all equations with the exception of cases involving variables for intrafamily bargaining and financial institutions.

Table 12.9 shows that the measure of financial development is the only statistically significant variable in a regression that also includes population density and a dummy variable for the South. Moreover, the bank variable is reasonably potent in explaining regional differences in fertility. The marginal effect on the number of surviving children of a one-unit increase in banks per

41. The occupational classifications follow those outlined in the appendix of Stephan Thernstrom, *The Other Bostonians* (Cambridge, Mass., 1973). For additional discussion see Steckel, "Census Matching." Given the debate over appropriate classifications, the vagueness of descriptions employed by the census, and the possibilities of multiple employment, the results merely approximate the actual underlying relationships.

I have conducted some experiments on functional forms and the results are insensitive to choice of linear or semi-log specifications. Because foreign-born husband and foreign-born wife are highly correlated, I use only one (the husband) to represent ethnicity.

42. See Easterlin, Alter, and Condran, "Farms and Farm Families"; and Schapiro, "Land Availability." The correlation between these measures is about 0.73 in this sample.

Table 12.3 **Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, Wealth, and Region of Residence**

Variable	Coefficient	$\partial y/\partial x_i$	t-value	Coefficient	$\partial y/\partial x_i$	t-value
Age 25–29	−0.0333	−0.099	−0.69	−0.0183	−0.054	−0.38
Age 30–34	−0.223	−0.662	−4.17	−0.200	−0.594	−3.75
Density (improved acres)	−0.199	−0.591	−2.78	−0.193	−0.573	−2.73
Wealth (real estate)						
$ 1–499	0.0399	0.118	0.65	0.0604	0.179	0.99
500–1,499	−0.0180	−0.053	−0.30	−0.00713	−0.021	−0.12
1,500–4,999	−0.0451	−0.134	−0.69	−0.0330	−0.098	−0.51
5,000+	−0.0775	−0.230	−0.93	−0.0935	−0.278	−1.13
South				0.135	0.400	3.39
Constant	1.292		19.59	1.202		17.02
N = 638	$-2\log(\lambda) = 29.06$			$-2\log(\lambda) = 36.88$		

Notes: The omitted variables are Age 20–24 and Wealth = 0.

Table 12.4 **Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, Nativity of the Husband, and Region of Residence**

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0439	−0.130	−0.92	−0.0260	−0.077	−0.55
Age 30–34	−0.235	−0.697	−4.45	−0.207	−0.611	−3.92
Density (improved acres)	−0.189	−0.561	−2.68	−0.176	−0.519	−2.52
Foreign-born husband[a]	0.171	0.506	2.49	0.0231	0.682	3.32
South				0.155	0.459	3.84
Constant	1.268		25.06	1.163		17.23
N = 638	$-2\log(\lambda) = 31.50$			$-2\log(\lambda) = 42.18$		

Notes: The omitted variables are Age 20–24 and Born in the United States.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses and published federal population censuses, 1850–1920.

[a]Because foreign-born husband and foreign-born wife are highly correlated, I use only one (the husband) to represent ethnicity.

100,000 of population is approximately − 0.07, but the interstate difference in this variable exceeds 20 and the interregional difference is as large as 14. Therefore, differences in financial development are capable of explaining a substantial portion of differences in regional fertility behavior.

The favorable results for the financial-institutions hypothesis warrant a second series of tests against others that could not be rejected in round one, namely the ethnicity, occupations, intrafamily bargaining, and life-cycle explanations. Tables 12.10 through 12.13 give these results. The banking variable is statistically significant in all regressions and the occupations and ethnicity variables also perform well, but the intrafamily bargaining and life-cycle models are less powerful predictors. With the exception of the first comparison (Table 12.10) the variable for the South is statistically insignificant.

Table 12.5 **Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, Occupation, and Region of Residence**

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0310	−0.091	−0.64	−0.0197	−0.058	−0.41
Age 30–34	−0.237	−0.700	−4.49	−0.218	−0.643	−4.11
Density (improved acres)	−0.170	−0.501	−2.39	−0.172	−0.508	−2.44
Husband's occupation (1850)						
White collar	−0.191	−0.565	−2.43	−0.183	−0.541	−2.34
Blue collar	−0.184	−0.545	−3.26	−0.155	−0.457	−2.70
Unskilled	−0.459	−0.136	−0.63	−0.0212	−0.062	−0.29
Other and unknown	0.0560	0.166	0.52	−0.0666	0.197	0.62
South				0.105	0.311	2.61
Constant	1.314		26.25	1.244		21.92
N = 638		−2 log(λ) = 38.78			−2 log(λ) = 43.72	

Notes: The omitted variables are Age 20–24 and Farmer.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses and published federal population censuses, 1850–1920.

Table 12.6 **Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, Literacy, and Region of Residence**

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0475	−0.141	−0.99	−0.0281	−0.083	−0.58
Age 30–34	−0.244	−0.724	−4.61	−0.217	−0.641	−4.07
Density (improved acres)	−0.195	−0.581	−2.74	−0.194	−0.574	−2.73
Husband illiterate	−0.0321	−0.095	−0.40	−0.756	−0.224	−0.93
Wife illiterate	0.101	0.300	1.60	0.861	0.255	1.37
South				0.126	0.373	3.14
Constant	1.281		24.60	1.204		21.14
N = 638		−2 log(λ) = 28.70			−2 log(λ) = 36.08	

Note: The omitted variable is Age 20–24.

Sources: Manuscript schedules of the 1850 and 1860 federal population census and published federal population censuses, 1850–1920.

Table 12.14 contains regressions testing those hypotheses that could not be rejected in round two, namely the financial-institutions, ethnicity, and occupations arguments. In addition, the life-cycle model, though a weak performer, is also tested. The financial-institutions, ethnicity, and occupations hypotheses all emerge as contenders and constitute a package that does not require separate arguments for higher southern fertility.[43] Indeed, data in Table 12.15 on regional characteristics of the white population and the partial deriv-

43. If the life-cycle variables are dropped from the regression reported in Table 12.14, the coefficient for the South remains insignificant at the conventional level of 0.05.

Table 12.7 Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, the Ratio of the Nonagricultural to the Agricultural Labor Force, the Ratio of the Wage of Common Labor to that of Farm Labor, and Region of Residence

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.00194	−0.006	−0.03	−0.00106	−0.003	−0.12
Age 30–34	−0.174	−0.541	−2.76	−0.175	−0.544	−2.78
Density (improved acres)	−0.137	−0.426	−1.48	−0.131	−0.408	−1.37
Log (labor force ratio)	−0.102	−0.318	−2.49	−0.105	−0.328	−1.76
Log (relative wage)	0.366	1.138	1.39	4.001	12.451	1.11
South				0.0275	0.086	0.42
Constant	2.133		3.07	1.005		3.86
N = 401	$-2\log(\lambda) = 19.478$			$-2\log(\lambda) = 19.716$		

Note: The omitted variable is Age 20–24.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses and published federal population censuses, 1850–1920.

Table 12.8 Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, the Ratio of the Nonagricultural to the Agricultural Labor Force, the Ratio of the Wage of Common Labor to that of Farm Labor, the Percentage of those Born in State Who Resided Out of State, the Proportion of Children Aged 10–15 in the Family Who Attended School, and Region of Residence

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0357	−0.105	−0.74	−0.0347	−0.103	−0.72
Age 30–34	−0.220	−0.651	−4.16	−0.219	−0.647	−4.12
Density (improved acres)	−0.252	−0.745	−2.75	−0.257	−0.759	−2.73
Log (labor force ratio)	−0.0900	−0.266	−2.94	−0.0831	−0.245	−1.91
Log (relative wage)	0.539	1.593	2.40	0.519	1.532	2.13
Log (migration)	0.0707	0.209	1.58	0.0712	0.210	1.59
School	0.0376	0.111	0.86	0.0394	0.116	0.89
South				0.139	0.041	0.22
Constant	2.406		4.07	2.349		3.65
N = 638	$-2\log(\lambda) = 42.96$			$-2\log(\lambda) = 42.98$		

Note: The omitted variable is Age 20–24.

Sources: Manuscript schedules of the 1850 and 1860 federal population census and published federal population censuses, 1850–1920.

atives in Table 12.14 suggest that fertility was lower in the North despite a greater presence of the foreign born largely because the South had a poorly developed banking system and secondarily because the region had a higher concentration of farmers and laborers.[44] Comparison of the regional age dis-

44. Essentially the same conclusion is reached if characteristics of the sample of matched households are used in place of characteristics of the population.

Table 12.9 Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, Banks Per 100,000 White Population, and Region of Residence

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0343	−0.101	−0.72	−0.0262	−0.077	−0.55
Age 30–34	−0.222	−0.654	−4.21	−0.210	−0.620	−3.98
Density (improved acres)	−0.0104	−0.031	−0.13	−0.0358	−0.105	−0.43
Banks	−0.0242	−0.071	−4.30	−0.0209	−0.062	−3.62
South				0.0777	0.229	1.87
Constant	1.282		25.83	1.236		22.31
N = 638		−2 log(λ) = 43.16			−2 log(λ) = 45.74	

Note: The omitted variable is Age 20–24.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses; published federal population censuses, 1850–1920; and U.S. Census Office, *Statistics of the United States in 1860* (Washington, D.C., 1866), p. 292.

Table 12.10 Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Banks Per 100,000 White Population, Nativity of the Husband, and Region of Residence

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0354	−0.104	0.61	−0.0245	−0.072	−0.42
Age 30–34	−0.217	−0.640	−3.48	−0.201	−0.591	−3.21
Banks	−0.0241	−0.071	−4.76	−0.0207	−0.601	−3.97
Foreign-born husband	0.183	0.540	1.86	0.225	0.661	2.24
South				0.106	0.311	2.18
Constant	1.260		25.13	1.181		19.15
N = 638		−2 log(λ) = 48.26			−2 log(λ) = 52.86	

Note: The omitted variable is Age 20–24.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses; published federal population censuses, 1850–1920; and U.S. Census Office, *Statistics of the United States in 1860* (Washington, 1866), p. 292.

tributions in the sample indicates that a lower proportion in the age group 30 to 34 was also a minor factor in the South's higher rate of marital fertility. These data also suggest that higher fertility on the frontier compared with the Northeast was largely the consequence of differences in the development of the banking system and to some extent the result of differences in occupational structure.

12.6 Implications

While there are risks in using a model estimated for the 1850s to understand long-term trends, the estimated relationships and the changes in the American economy after 1810 point to development of the banking system and the

Table 12.11 Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Banks Per 100,000 White Population, Occupation, and Region of Residence

Variable	Coefficient	$\partial Y/\partial x_i$	t-value	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0229	−0.067	−0.48	−0.0173	−0.051	−0.36
Age 30–34	−0.218	−0.643	−4.17	−0.210	−0.617	−3.99
Banks	−0.0221	−0.065	−4.58	−0.0205	−0.060	−4.18
Husband's occupation (1850)						
White collar	−0.183	−0.539	−2.35	−0.180	−0.530	−2.32
Blue collar	−0.148	−0.435	−2.62	−0.135	−0.396	−2.36
Unskilled	−0.00301	−0.009	−0.04	−0.0788	0.023	0.11
Other and unknown	0.0736	0.217	0.68	0.0790	0.233	0.74
South				0.0616	0.181	1.49
Constant	1.298		31.49	1.253		24.39
N = 638	−2 log(λ) = 52.24			−2 log(λ) = 53.84		

Notes: The omitted variables are Age 20–24 and Farmer.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses; published federal population censuses, 1850–1920; and U.S. Census Office, *Statistics of the United States in 1860* (Washington, D.C., 1866), p. 292.

Table 12.12 Explaining the Number of Children Aged 10 or Less among Rural Farm Families by Wife's Age, Banks Per 100,000 White Population, the Ratio of the Nonagricultural to the Agricultural Labor Force, the Ratio of the Wage of Common Labor to that of Farm Labor, and Region of Residence

Variable	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	0.0123	0.032	0.18
Age 30–34	−0.160	−0.498	−2.55
Banks	−0.0242	−0.075	−2.99
Log (labor force ratio)	−0.0458	−0.142	−0.74
Log (relative wage)	0.307	0.953	1.07
South	0.00546	0.017	0.07
Constant	2.025		2.70
N = 401		−2 log(λ) = 24.9546	

Note: The omitted variable is Age 20–24.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses; published federal population censuses, 1850–1920 and U.S. Census Office, *Statistics of the United States in 1860* (Washington, 1866), p. 292.

changing occupational structure, particularly after the War of 1812, as important ingredients in the decline of antebellum fertility. In 1811 there were only eighty-eight banks for a population of about six million free Americans, or 1.45 banks per 100,000.[45] The ratio more than doubled by 1820 and by 1840

45. Calculated from U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970* (Washington, D.C., 1975), series X 561–579, X 580–587, and A 91–104.

Table 12.13 Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Density, the Ratio of the Nonagricultural to the Agricultural Labor force, the Ratio of the Wage of Common Labor to that of Farm Labor, the Percentage of those born in State Who Resided Out of State, the Proportion of Children Aged 10–15 in the Family Who Attended School, and Region of Residence

Variable	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0358	−0.105	0.74
Age 30–34	−0.218	−0.640	−4.10
Banks	−0.0237	−0.070	−3.91
Log (labor force ratio)	−0.0443	−0.130	−0.99
Log (relative wage)	0.356	1.049	1.47
Log (migration)	0.0639	0.188	1.58
School	0.0271	0.080	0.61
South	0.00464	0.005	0.08
Constant	1.954		3.02
N = 638		$-2\log(\lambda) = 50.14$	

Note: The omitted variable is Age 20–24.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses and published federal population censuses, 1850–1920.

Table 12.14 Explaining the Number of Children Aged 10 or Less among Rural Families by Wife's Age, Banks Per 100,000 of White Population, the Ratio of the Nonagricultural to the Agricultural Labor Force, the Ratio of the Wage of Common Labor to that of Farm Labor, the Percentage of those Born in State Who Resided Out of State, the Proportion of Children Aged 10–15 in the Family Who Attended School, Nativity of the Husband, and Occupation

Variable	Coefficient	$\partial Y/\partial x_i$	t-value
Age 25–29	−0.0234	−0.069	−0.39
Age 30–34	−0.206	−0.604	−3.20
Banks	−0.0208	−0.061	−3.33
Log (labor force ratio)	−0.0329	−0.096	−0.64
Log (relative wage)	0.283	0.830	0.99
Log (migration)	0.0736	0.216	1.48
School	0.0212	0.062	0.41
Foreign-born husband	0.250	0.734	2.42
Husband's occupation (1850)			
White collar	−0.192	−0.563	−2.37
Blue collar	−0.136	−0.399	−2.05
Unskilled	−0.0109	−0.032	−0.13
Other and unknown	0.0782	0.229	0.54
South	0.0372	0.109	0.52
Constant	1.725		2.24
N = 638		$-2\log(\lambda) = 66.44$	

Notes: The omitted variables are Age 20–24 and Farmer.

Sources: Manuscript schedules of the 1850 and 1860 federal population censuses; published federal population censuses, 1850–1920 and U.S. Census Office, *Statistics of the United States in 1860* (Washington, 1866), p. 292.

Table 12.15 Regional Characteristics of the Population

Variable	Northeast	North Central	North[a]	South	Frontier[b]	Total
Banks	9.07	4.89	7.41	4.52	0.01	6.08
Proportion foreign-born	0.194	0.175	0.186	0.066	0.202	0.153
Proportion farmer or laborer	0.393	0.633	0.475	0.618	0.509	0.514

Sources: U.S. Census Office, *Statistics of the United States in 1860* (Washington, D.C., 1866), p. 292; and U.S. Census Office, *Population of the United States in 1860* (Washington, D.C., 1864), pp. xxix, 656–79.

[a]Includes Northeast and North Central.

[b]Includes Minnesota, Iowa, Kansas, Texas, and states farther west.

had more than quadrupled. If the partial derivative for the banks coefficient (− 0.06) in Table 12.14 is applied to this change in the ratio of banks to population of 4.90, then the number of surviving children that married women had per decade would have declined by approximately 0.3. This is, then, a moderately important factor when compared with the fall in the total fertility rate of 0.78 between 1810 and 1840.[46] But one should recognize that this calculation underestimates the impact of financial development on total fertility because most married women had children over an interval that was considerably longer than ten years and because total fertility measures actual births rather than survivors. Moreover, it is possible that the economic changes that led to lower marital fertility also contributed to lower total fertility through other routes, such as a rise in the age at marriage or a decline in the share of women who married. One should also recognize that the ratio of banks to population actually declined slightly from 1840 to 1860, which suggests that other explanations are required for the continuation of the fertility decline through the late antebellum period.

Labor force data are sparse for the early 1800s, but the evidence points to a changing occupational structure that would have reduced fertility. The share of the labor force engaged in farming declined by approximately 16.5 percentage points between 1810 and 1860.[47] How the decline of farming was apportioned among the rise of white-collar, blue-collar, and other occupations is unknown, but some rough calculations suggest changes in occupational structure contributed modestly to diminished fertility. For example, if the decline in the share of farmers of 16.5 percentage points resulted in an 8-percentage-point rise in each share of white-collar and blue-collar workers, then, given the marginal effects reported in Table 12.14, the number of surviving children per decade would have fallen by approximately 0.08. This mag-

46. According to Coale and Zelnik, *New Estimates* (p. 36), the total fertility rate of white women was 6.92 in 1810 and 6.14 in 1820.

47. Thomas Weiss, "U.S. Labor Force Estimates, 1800 to 1860" (manuscript, University of Kansas, 1990), table 1.

nitude (and others that are likely to emerge from other plausible assumptions) is relatively small compared with the decline of 1.71 in total fertility between 1810 and 1860.[48]

Fertility declined despite a growth in immigration rates over the antebellum period. Inflows represented a trivial share of the population in the early decades of the century but rose thereafter. By the 1820s, for example, the annual rate of immigration reported by the U.S. Immigration and Naturalization Service was about 12,850 compared with a mid-decade white population of slightly over nine million, or a ratio of about 0.14 percent. By the 1850s the ratio of annual immigration to the white population was about 1.2 percent.[49] The regression coefficient estimate reported in Table 12.14 and the magnitude of change in immigration suggest that the total impact on the long-term trend in fertility rates was small. The share of the white population that was foreign born was only 15.3 percent as late as 1860. Even if the share was zero at the beginning of the century, the number of surviving children per married woman would have declined by only 0.11 before 1860. Nevertheless, the rapid increase in immigration rates during the late antebellum period adds to the need for other explanations of the fertility decline in the late antebellum period.

12.7 Child Mortality

It is important to ask whether observed differences in the number of surviving children were simply an artifact of different rates of child mortality. Unfortunately, I cannot address the issue directly; the system of vital registration was poorly developed in this era, leaving modern researchers with inadequate resources to trace the fate of those born during the decade of the 1850s. Some help is available, however, by studying the fate of children born before 1850 who survived to be recorded in the 1850 census.

In a separate study I examined the influence of household and regional characteristics on the survival of young children from 1850 to 1860.[50] In a logistic regression framework I employed several of the regressors included in this study, namely, occupation of the head, wealth (value of real estate), literacy, foreign birth, and region of residence. Losses for children aged 1 to 4 did not vary systematically by wealth, literacy, or foreign birth, but were about 8 percentage points higher on the frontier compared with the Northeast. Therefore, use of surviving children underestimates the East-West gradient in the actual number of births. Among children under age 1 in 1850 the chances of nonsur-

48. The estimates of total fertility are from Coale and Zelnik, *New Estimates*, p. 36.

49. Calculated from U.S. Bureau of the Census, *Historical Statistics*, series C 89–119 and A 91–104.

50. Richard H. Steckel, "The Health and Mortality of Women and Children, 1850–1860," *Journal of Economic History*, 48 (June 1988), pp. 333–45. Because some children may have left home as early as age 15 or 16, the study was confined to those aged 0 to 4 in 1850.

vival were about 18 percentage points higher among the unskilled compared with farmers. This occupational pattern, though large, had little impact on spatial differences in the number of births because the share of laborers in the work force varied by only a few percentage points across regions.[51] Little is known about the trend in the share of laborers in the work force in the early 1800s. A large share were probably employed in farming, however, and the relative decline of this industry suggests that the overall share of these people in the work force may have declined. If correct, the number of surviving births declined despite the diminished importance of a group that had relatively higher child mortality. I did not test the hypothesis that mortality rates were higher in places where banks were relatively more numerous compared with the population; such a test may be warranted, but to my knowledge this idea has not been discussed in the health literature.[52] In conclusion, the study of child survival suggests that systematic differences in mortality rates probably introduces mild to moderate distortions into the number of surviving children as an index of actual births in regional (East-West) and occupational comparisons.

12.8 Conclusions

A national sample of married women from the 1850 and 1860 manuscript censuses is used to test hypotheses that have been developed to explain the East-West gradient and the decline in fertility in the United States during the nineteenth century. Financial institutions and, to a lesser extent, occupational structure emerge as important explanations in a series of pair-wise tests. The number of banks per capita was highly correlated with marital fertility, and the East-West gradient in the density of banks had an important influence on the corresponding pattern of marital fertility, which suggests that the rise of the banking system, or other factors correlated with the spread of financial institutions, contributed substantially to the decline in fertility before 1840. The number of surviving children was systematically lower among white-collar and blue-collar workers compared with farmers and the unskilled. Differences in occupational structure played a supporting role in explaining regional and temporal patterns of marital fertility.

It should be noted that I do not attempt to formulate a comprehensive explanation of fertility patterns. Hypotheses that were rejected in these tests on marital fertility may perform successfully in understanding other aspects of childbearing, such as when and whether women married. Yet, variations in marital fertility did make important contributions to overall variations in fertility.

51. According to the 1860 census, for example, laborers as a percentage of the labor force were 19.9 in the Northeast, 24.4 in the North Central, 21.8 in the South, and 18.4 on the frontier.

52. It is conceivable that the banks variable was positively correlated with knowledge of birth control practices but it is not one of the standard proxies for this type of information.

The findings here suggest several research needs. One is to understand precisely how financial institutions may have influenced fertility behavior. The results are congenial to life-cycle ideas that prospective parents substituted financial instruments for children in their portfolios, but questions about the efficacy of the mechanism are raised by the finding that other variables associated with this framework, such as schooling for children, were not statistically significant. It would be important to study the possible joint nature of decisions on births and schooling and to explore alternative specifications that would appropriately capture this interdependence.

Second, skeptics may wonder whether these early banks had the confidence of the public as safe places for old-age savings. Therefore, additional evidence on life-cycle behavior should be assembled by studying the evolution of household portfolios. If the life-cycle model is substantially correct, then families that reduced births should have been accumulating liquid or semiliquid assets relatively rapidly during the typical childbearing years for depletion in old age. Savings for old age could have taken many forms, including not only deposits but also stocks, bonds, life insurance, and land. If banks were important to the process, then researchers should find a strong relationship between fertility and the volume of deposits, something that might be done by examining the balance sheets of banks and child-woman ratios.

A third line of work would explore whether the measure of financial institutions (banks per capita) is merely a proxy for a different variable that directly influenced fertility, such as economic or commercial development. For example, areas that lacked banks may have been poorly integrated into the market system, which resulted in high prices for manufactured goods but relatively low prices for children who were produced locally. A casual examination of correlations between explanatory variables within the sample does not suggest that this was the case. For example, the correlation between banks per capita and the percent of a county's population residing in an urban area (≥2,500 population) was only 0.215. The correlation was 0.493 with the measure of population density (improved acres), but results in Table 12.9 show that when both variables are included as regressors only the banks variable was statistically significant. This finding suggests that population density may be a proxy for financial development in explaining high correlations between measures of land availability and child-woman ratios reported in other studies.

Access to sound financial institutions also requires further study. We need more information on the proximity of depositors to banks, which is important for knowing the level of geographic analysis appropriate for testing the financial-institutions hypothesis. The rapid growth in numbers of banks during the 1830s may have overstated the use of banks to house life-cycle savings if some of these banks were financially unsound or were remote from large population centers. The estimation of time-series models based on county- or state-level data may help to clarify this issue. Study of the financial development and fertility patterns in other countries is also desirable.

Further study of the relationship between fertility and mortality is warranted; if child mortality rates were higher on the frontier, for example, parents may have had relatively more births in anticipation of excess losses. It is also important to understand why the number of surviving births was lower among white-collar and blue-collar workers compared with farmers and the unskilled. One argument would place the explanation on differential costs and benefits of children. Yet it is also possible that occupation was merely a better proxy for education than literacy or that occupation was a proxy for income.

The most important contribution of this research is the empirical identification of a mechanism that contributed substantially to the early (preindustrial) decline of fertility in the United States. The data analyzed here suggest that growth of financial institutions was important for the decline in marital fertility before 1840. Yet, many questions about the financial-institutions hypothesis remain unanswered and the findings point to the complexity of the process. No single explanation accounts for most of the change in fertility observed before 1860, and the explanatory power of financial institutions seems to diminish in the late antebellum period. Study of when and whether women married will help to find answers to these important questions.