



## The Life Cycle in Economic History

J. R. Kearn; Clayne L. Pope

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# *The Life Cycle in Economic History*

J. R. KEARL AND CLAYNE L. POPE

The life cycles of income and wealth form important traces of the economic history of households. Comparisons of cross-sectional estimates of the age-wealth profiles from 1774 to 1962 reveal little change in the basic pattern although cross-sectional age-income or earnings profiles peak later in modern periods because of the increased investment in human capital. The wealth-income ratio appears to be declining. Multivariate regressions for Utah households show wealth-income patterns consistent with a life cycle model based on smoothing of consumption with little interaction between age and other determinants of economic position. Foreign birth has a positive effect on income while reducing wealth.

**T**HE life cycles of income and wealth form a trace of the economic behavior of households across time. Household decisions relative to savings, fertility, mortality expectations, migration, investment in human capital, and intergenerational transfers can all be studied from the traces left by the age profiles of income and wealth. Value judgments about inequality are affected by our impressions of the life cycle since inequality due to age variation is often considered unimportant.<sup>1</sup> The rate of change of productivity may well be affected by interactions between demographic change and that part of the age-income profile produced simply by aging. Judgments about the level of living at a particular time must certainly be tempered by the life cycle experience of the population. In spite of the general empirical position of life cycle patterns in income and wealth in the economic history of the household, however, historians have not focused directly upon the life cycle even though it has been a prominent feature of many studies.<sup>2</sup>

In this paper we first discuss the identification problem that distorts measurement of the life cycle when either cross-sectional or cohort data are used. We then briefly review evidence drawn from a number of sources to sketch changes in household life cycles and life cycle behavior through time. Finally, we use a data set drawn from nineteenth-century Utah to study the life cycle of households where income,

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<sup>1</sup> See Morton Paglin, "The Measurement and Trend of Inequality: A Basic Revision," *American Economic Review*, 65 (Sept. 1975), 598-609.

<sup>2</sup> Robert Fogel and Stanley Engerman, *Time on the Cross* (Boston, 1974); Claudia Goldin, "The Historical Evolution of Female Earnings Functions and Occupations," NBER Working Paper No. 52 (1980); Goldin, "Women in the American Labor Experience: Issues, Life Cycle Participation and Earnings Function Cliometrics Conference (1979)"; Michael Haines, *Fertility and Occupation* (New York, 1979); Alice H. Jones, *Wealth of a Nation to Be* (New York, 1980); Lee Soltow, *Men and Wealth in the United States, 1850-1870* (New Haven, 1975).

wealth, and household characteristics that could possibly affect the shape of the age-income and age-wealth profiles are observed.

#### THE IDENTIFICATION PROBLEM

Measured life cycles normally relate income, wealth, or consumption to the age of the decision maker.<sup>3</sup> One would like that relationship to isolate effectively the effect of age from all other factors that might influence the measured variable (income, wealth, or consumption). Then the effects of other variables such as education, migration, economic growth or occupation could be examined for their effects upon the slope and level of the particular measured life cycle. Unfortunately, three variables—experience, vintage, and growth—are necessarily commingled with age so that a *ceteris paribus* age-income or age-wealth relationship may not be observable. The problem is that there may be a logically identified model that is empirically underidentified primarily because of the nature of the available proxy variables.

In cross-sectional data, age varies directly and usually constantly with measures of economic experience and with the vintage of a person's investment in human capital through formal education, on-the-job training, or entry point into the economy. That is, all 40-year-old individuals with college degrees observed in 1950 received their college education around 1930, had nearly 20 years of work experience, and entered the labor force about 1932. Individuals 25 years old in 1950, on the other hand, received their formal education in the postwar boom, had two or three years of work experience, and entered the labor force in prosperous times. Thus, an age-income relationship based on the cross-section in 1950 cannot distinguish how much of the difference in income between individuals aged 40 and 25 is the result of age as opposed to the times (1930 and 1947) they invested in education and gained work experience. This confounding of age, experience, and "vintages" in cross-sectional measures of income or wealth might tempt one to believe that cohort observation through time would be superior. In some respects it is, but an identification problem remains.

The cohort life cycle, much more difficult to observe, gives the actual history of a generation's experience with regard to income or wealth accumulation. Clearly, the effects of vintage are minimized. Cohort observation of income or wealth through time combines the effects of

<sup>3</sup> For contemporary examples see Gilbert Chez and Gary Becker, *The Allocation of Time and Goods over the Life Cycle* (New York, 1975); Franco Modigliani and Albert Ando, "Tests of the Life Cycle Hypothesis of Savings," *Bulletin of the Oxford Institute of Economics and Statistics* 19 (May 1957), 99–124; A. F. Shorrocks, "The Age-Wealth Relationship: A Cross-Section and Cohort Analysis," *Review of Economics and Statistics*, 57 (May 1975), 155–63; Yoram Ben-Porath, "The Production of Human Capital and the Life Cycle of Earnings," *Journal of Political Economy*, 75 (July/August 1967), 352–65.

age and economic growth, however, so that the observation of an individual at ages 30 and 50 yields the sum of the effects of aging the 20 years and the impact of whatever economic growth took place over that 20 years. One would like to measure the pure effect of age on income or wealth accumulation. Neither cross-sectional observations nor observations on a cohort through time readily yield such a measurement.

It is important for an interpretation of the historical record to be sensitive to the fact that cross-sectional data confound age, experience, and vintage while cohort data commingle age and growth. The typical concave shape of the cross-sectional age-income profile could be the result of the effects of vintage without which the income profile might not peak or might peak at a later age. Similarly, a cohort profile that does not peak might lead us to misestimate the effect of age upon productivity unless we remind ourselves that economic growth has pushed the age-income relationship upward through time making the slope of the age-income relationship steeper than it would have been in absence of economic growth.

#### HISTORICAL LIFE CYCLE PATTERNS

Over the past two centuries there have been significant changes in the economic life of households that probably had some effect upon the life cycles of income and wealth. The shift away from family agriculture, in which households invested their own capital in the "firm" in which they worked, to urban manufacturing and services, where households did not normally invest their own capital in the firm to which they sold their labor, should have changed the life cycle. *A priori* one might expect this shift to give more concavity to the age profile of gross wealth since young farmers probably had more gross wealth and more debts than young urban workers. The trend toward increasing investment in human capital through formal education as well as general improvements in technology would move the peak in earnings (and therefore the peak in wealth) to a later age, since physical strength is less important for the jobs of the well-educated and those working with advanced technology. The decline in fertility would reduce the level of bequests *ceteris paribus* unless bequests are independent of the number of children in a family. The development of extensive consumer capital markets in the twentieth century would make the age-profile for gross wealth flatter while increasing the disparity between gross wealth and net worth. Finally, the provision of an old-age annuity by the government through Social Security would reduce the need for accumulation of wealth for consumption in later years. These impacts may go in opposite directions, and all are empirically undocumented. But such probable effects do make a preliminary case for the expectation of significant change in

TABLE 1  
BENCHMARK LIFE CYCLES

Age	Total Wealth			Net Worth		Ratio of Mean Wealth for Each Age Group to Mean Wealth for 55-64 Age Group				
	1774 <sup>a</sup>	1870 <sup>b</sup>	1962 <sup>c</sup>	1774	1962	1774	1870	1962	1774	1962
Less than 35	155	\$ 929	\$ 6,304	155	\$ 2,165	.30	.20	.19	.25	.07
35-44	261	2,510	16,068	216	10,587	.50	.55	.49	.35	.36
45-54	367	4,193	22,581	352	17,459	.70	.91	.69	.57	.59
55-64	525	4,599	32,527	619	29,810	1.00	1.00	1.00	1.00	1.00
65 and older	413	5,128	30,838	429	29,515	.79	1.12	.95	.69	.99

Sources:

<sup>a</sup> The data for 1774 came from Alice Hanson Jones, *Wealth of a Nation to Be* (New York, 1980). The total wealth figures for 1774 are total physical wealth which excludes financial assets and liabilities. Consequently total physical wealth is always less than or equal to gross wealth. It may be less or more than net worth.

<sup>b</sup> The data for 1870 came from Lee Soltow, *Men and Wealth in the United States, 1850-1870* (New Haven, 1975). These data came from a sample of the 1870 manuscript census that asked households to give the value of their personal wealth and their wealth in real estate.

<sup>c</sup> The data for 1962 came from Dorothy S. Projector and Gertrude S. Weiss, *Survey of Financial Characteristics of Consumers* (Washington, D.C., 1966). These data are based on a survey of 2,557 households who were asked detailed questions about their wealth.

the life cycle through time. The data presented in Table 1 suggest, however, that relatively little change has taken place over two centuries.

Table 1 summarizes the cross-sectional life-cycle patterns for three important bench mark studies of the distribution of wealth.<sup>4</sup> The data are somewhat difficult to compare since each of the three studies is based on a different source for estimates of household wealth—probate retrieval, census sample, and a survey. Comparison of the three studies implicitly assumes measurement differences in the three approaches are not age correlated. Estimates for gross wealth can be obtained for all three years, although the concept used in the 1774 data is somewhat different. Age profiles for net worth can be compared only for 1774 and 1962. The age profiles yielded by these three major studies of the wealth distribution spanning two centuries are quite similar. In all instances except for gross wealth in 1870, the peak is in the 55–64 age interval.<sup>5</sup> The mean gross wealth of the 35–44 age group is about half of the mean of the 55–64 age group in all three instances while net worth is about a third. The wealth of the young households is roughly a quarter of that of the peak-wealth households. The age patterns of both gross wealth and net worth seem quite homogeneous when one considers all of the trends in the economy that probably had an impact on the age-wealth profile.

There are differences worth noting. Younger households in 1962 evidently did have better access to capital markets since their net worth was only 34 percent of their gross wealth whereas the total physical wealth of young households in 1774 was equal to their net worth. Perhaps the most interesting difference between the data of 1774 and 1962 is the rapid decline in wealth beyond age 65 in 1774 compared with almost no decline in wealth for the elderly in the 1962 data. Many contemporary studies of wealth accumulation have found no decline in wealth with aging, a result clearly disturbing to a life-cycle consumption view of wealth accumulation.<sup>6</sup> This change in the profile is intriguing. It could be that bequests are “income elastic” so that the rise in the standard of living and income through time has engendered an increase in the proportion of the wealth held in old age for purposes of bequest in spite of the fall in fertility. Social Security, which insures a modest consumption path until death, may also have contributed to this change

<sup>4</sup> See Jones, *Wealth of a Nation To Be*; Soltow, *Men and Wealth*; Dorothy S. Projector and Gertrude S. Weiss, *Survey of Financial Characteristics of Consumers* (Washington, D.C., 1966).

<sup>5</sup> The increase of wealth beyond age 65 in 1870 is curious and of interest. Atack and Bateman find a peak in the life cycle of wealth in 1860. See “The ‘Egalitarian Ideal’ and the Distribution of Wealth in the Northern Agricultural Community: A Backward Look,” *Review of Economics and Statistics*, 58 (Feb. 1981), 124–9. We also find a peak in 1860 and one in the life cycle for 1870 as well. Soltow’s sample obviously has the broadest coverage.

<sup>6</sup> See T. W. Mirer, “The Wealth-Age Relationship Among the Aged,” *American Economic Review*, 69 (June 1979), 435–43, and James Smith, ed., *The Personal Distribution of Income and Wealth* (New York, 1975).

TABLE 2  
WEALTH INCOME RATIOS FOR 1870 AND 1962

Age	1962			1870		
	Income	Wealth	Wealth/ Income	Income	Wealth	Wealth/ Income
Less than 35	\$5,707	\$ 6,304	1.1	\$329	\$ 917	2.8
35-44	7,531	16,068	2.1	484	1,531	3.2
45-54	7,845	22,581	2.9	615	2,815	4.6
55-64	6,577	32,527	4.9	525	2,606	5.0
Greater than 65	4,105	30,838	7.5	391	2,095	5.4

Source: 1962 data are taken from Dorothy S. Projector, and Gertrude S. Weiss, *Survey of Financial Characteristics of Consumers* (Washington, D.C., 1966). 1870 data are based on a sample of Utah households.

in the age-wealth profile beyond age 65.<sup>7</sup> In spite of these intriguing differences between the profiles the fundamental similarity remains, suggesting that life-cycle patterns of income and wealth are generated by pervasive and lasting forces such as aging and the bequest motive.

While the cross-sectional wealth profiles have varied little in two centuries, the life-cycle patterns in income or earnings appear to have changed significantly if one is willing to draw inferences from fragmentary data. Investment in education and technological change would be expected to shift the peak of the earnings or income profile to an older age or perhaps eliminate the peak before retirement entirely. Age-income and age-earnings profiles appear to peak at later ages for more contemporary data which is consistent with increased investment in education and technological improvements. Fogel and Engerman find an implied age-earnings peak around age 30 for slaves.<sup>8</sup> For Utah, the peak in income appears around age 40 in cross-sectional data for 12 different years from 1850 to 1900. Haines estimates an earnings function that yields an age peak in the mid-30s for households in the 1889–1900 labor survey.<sup>9</sup> These early peaks in income or earnings may be contrasted with the more numerous studies from the twentieth century. Mincer, for example, disaggregates earnings profiles for white nonfarm males in 1959 by educational categories.<sup>10</sup> He finds that earnings profiles peak (or plateau) at progressively later ages for the higher educational categories. Low educational categories have earnings peaks around the mid-30s while college educated workers continue to have higher earnings until their 50s. Age has a clear concave effect on the earnings profile which is ameliorated, but not eliminated, by investment in human capital.

Knowledge about the historical evolution of the life cycles in income and wealth is meager. In particular, little is known about the way that life cycles of income and wealth fit together for individual households, that is, about individual wealth accumulation paths given a particular age-income profile, or about individual decisions that may change the age-income profile given unforeseen changes in wealth positions. Since the Utah sample has several observations in income and wealth for individual households, it forms a useful base for an initial exploration of the relationship of the two life cycles.

#### RELATIONSHIP OF AGE-INCOME AND AGE-WEALTH PROFILES

Table 2 compares the mean wealth-income ratios for households in 1962 (using the Federal Reserve survey data for that year) and 1870

<sup>7</sup> M. A. King and Louis Dicks-Mireaux, "Asset Holdings and the Life Cycle," NBER Working Paper No. 614 (Jan. 1981).

<sup>8</sup> See Fogel and Engerman, *Time on the Cross*, p. 76.

<sup>9</sup> See Haines, *Fertility and Occupations*, p. 42.

<sup>10</sup> Jacob Mincer, *Schooling, Experience and Earnings* (New York, 1974).



(using a sample of households from Utah for which there are both income and wealth observations). The patterns are quite similar. In both samples, separated by nearly one hundred years and substantial differences in income and wealth, income peaks in the 45 to 54 age groupings while wealth peaks in the 55–64 age category. The ratio of wealth to income is consistently higher for the 1870 data except for those who are over 65. The implied secular decline in the wealth-income ratio is to be expected. Increased investment in human capital in the twentieth century would lower the measured wealth-income ratio since human capital is not reflected in the wealth estimate whereas the return to such investment is reflected in income. This change in the wealth-income ratio implies that the level of living increased more rapidly than wealth accumulation.<sup>11</sup> By age 65 nonhuman wealth comprises nearly all of a household's portfolio so that one would not expect the secular trend in the wealth-income ratio at later ages to be as pronounced.

Multivariate regressions illuminate three aspects of the relationship of wealth and income life cycles beyond those aspects inferred from the comparisons of means by ages shown in Table 2. The curve fitting of an age profile implicit in a regression that includes quadratic terms in age as explanatory variables gives a test of the simple life-cycle model. A stylized life-cycle model that views saving and dissaving as a means to smooth the path of consumption over an individual's life would yield a prediction that the slope of the wealth profile would be steeper than that of the income profile prior to the peak in the age-income profile. In addition, the model would suggest that the peak in the wealth profile would occur at a later age than the peak in the income profile, specifically where income and consumption were equal. Within the multivariate regression approach, one can also examine the interactions between age and other household characteristics such as occupation, duration in the economy, and birthplace in determining income and wealth. Do such characteristics simply change the intercepts of the age-income or age-wealth profiles, or are there also effects on the slope and peak of the profiles? One can also compare the differential effects of household characteristics on the two profiles. Some characteristics may shift the income profile significantly while having little affect on the wealth profile.

Table 3 summarizes cross-sectional regressions on the logarithm of income (LNY70) and wealth (LNW70). Duration in Utah is measured by the number of years that the household had been in Utah by 1870. The residential variables (R1 and R2) represent successive rings of settlement around Salt Lake City.

Comparisons of equations 1 and 3 give rough confirmation of the simple life-cycle model of behavior in a nineteenth-century frontier economy. The income profile peaks four years earlier than the wealth

<sup>11</sup> See Jones, *Wealth of a Nation To Be*, chap. 9, and Soltow, *Men and Wealth*, chap. 3, for a discussion of the growth rate of wealth as compared to the growth of income.

TABLE 3  
REGRESSIONS ESTIMATING THE INCOME AND WEALTH PROFILES

<i>Coefficients of Explanatory Variables</i>	(1)	(2)	(3)
	<i>LN70</i>	<i>LN70</i>	<i>LNW70</i>
Age (A)	.051	.036	.103
Age Square (A <sup>2</sup> )	-.00055	-.00041	-.00103
Duration in Utah (T)	.035	.02	.07
Foreign Birth (FB)	.14	.14	-.18
Counties Near Salt Lake (R <sub>1</sub> )	-.52	-.35	-.55
Outer Counties (R <sub>2</sub> )	-.40	-.16	-.23
White Collar (W)	.26 <sup>a</sup>	.03 <sup>a</sup>	.016 <sup>a</sup>
Craftsmen (C)	-.22	0-.11 <sup>a</sup>	-1.00
Service Workers (S)	-.49	-.31	-2.13
Laborers (L)	-.38	-.17	-2.13
LNW70	—	.36	—
Constant	4.40	2.25	3.83
R <sup>2</sup>	.09	.15	.21
Peak Age	46	44	50
Sample Size	3865	2503	4782

<sup>a</sup> Not significant at the .05 level.

Note: The dependent variables are the logarithms of income (LN70) and wealth, both for a sample of households in Utah in 1870.

Source: See text.

profile. Moreover, the slope of the wealth profile is steeper than that of income, as implied by a simple life-cycle pattern of accumulation. This pattern does not preclude the possibility that bequest is a motive for saving in addition to the desire to smooth the path of consumption over a lifetime. It does suggest, however, that consumption smoothing was a primary motive for the accumulation of wealth.

It is possible that the cross-sectional pattern is not replicated for the cohort data since cross-sections do not isolate a pure age effect. Cohort age profiles have been constructed in two ways. Observations for different years (1860 and 1870 for wealth, and income estimates at five year intervals from 1870 to 1900) were pooled to reestimate the equations for income and wealth using dummy variables to control for the heterogeneity of economic growth and price changes between years. The effect of this procedure is to push the estimated peaks for both income and wealth profiles to later ages while not changing their relative positions. The income peak in the pooled regression is at age 49 while the age-wealth profile peaks at age 53.

Since income is observed for an extended period of time in Utah, one can also estimate a regression that follows a cohort over 20- to 30-year periods. In order to increase the sample size, cohorts 18–24 years of age in 1855, 1861, 1866, and 1870 were pooled and followed for 30 years, with dummy variables used to control for heterogeneity. The peak of the age-income profiles for these pooled age cohorts occurs at age 41. The data set does not yet allow a similar treatment of wealth cohorts. The effect of age on income is similar from both cohort and cross-sectional viewpoints.

The majority of other variables in the equations estimating income and wealth shift the profiles of income and wealth in the same direction, with the effects on wealth larger than those on income in most cases. There is no statistically significant evidence of interaction between either age and occupation, age and duration, or age and foreign birth. In other words, these characteristics shifted the intercept of the age profile but did not change the slope or position of the peak.

The effects of foreign birth on the age-income and age-wealth profiles, however, did not follow this pattern. Foreign birth reduced household wealth in Utah, a finding consistent with findings for other parts of the United States for the same period.<sup>12</sup> Yet the magnitude of the foreign-birth disadvantage is not great in Utah once corrections are made for time of entry or duration of the economy. The effect on income was quite different. Foreign birth was positively related to income in virtually all of the cross-sectional regressions estimating income from 1861 to 1900, but not significantly correlated with income before 1861 even though foreign birth had an adverse effect on wealth in the cross-sectional correlations in both 1860 and 1850. The positive association between income and foreign birth is also present in the pooled cohort regressions in income. This finding suggests that discrimination was not present in this economy in that foreign birth did not reduce income. Rather, the low wealth position of the foreign born, perhaps due to costs of migration, may have caused the foreign born to choose to work harder in order to achieve a better economic position. The interaction of foreign birth with age produced no statistical significance in regressions on income or wealth.

In summary, these estimates of age-income and age-wealth profiles from both cross-sectional and cohort points of view, give some credence to a simple life-cycle model where, given a concave age-income profile, individuals choose a wealth accumulation path consistent with a smoothed consumption path. In particular, income peaks prior to the peak in wealth holdings. If bequests were the sole motive for wealth accumulation, one might expect a wealth profile that plateaus once the income begins to decline significantly. This does not appear to be the case in the Utah data. Households appear to use wealth as a store for consumption when income declines in later years. Intergenerational correlations of the economic status of fathers and sons reported elsewhere support the position that bequests are also an important motive for wealth accumulation.<sup>13</sup> Moreover, the positive effect of foreign birth on income combined with its negative effect on wealth suggests that a more complex model of the interrelationship of income and wealth profiles is needed to interpret historical experiences.

<sup>12</sup> Compare Soltow, *Men and Wealth*, p. 80, to J. R. Kearl, Clayne L. Pope, and Larry T. Wimmer, "Household Wealth in Utah: 1850-1870," this JOURNAL, 40 (Sept. 1980), 489.

<sup>13</sup> J. R. Kearl and Clayne L. Pope, "Intergenerational Effects on the Distribution of Income and Wealth: The Utah Experience," NBER Working Paper No. 754 (Sept. 1981).

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