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PART IV

THE DISTRIBUTION OF PERSONAL WEALTH

CHAPTER 9

The Wealth, Income, and Social Class of Men in Large Northern Cities of the United States in 1860

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There is a need for an organized study of the wealth of men in urban areas which covers the full gamut from those with no wealth to those who are the most affluent. One would like to have a consistent compilation of the characteristics of men in various wealth classes, since wealth is thought to be such an important variable in helping to delineate social classes and social hierarchy in urban society. We are fortunate, indeed, to have records of wealth declarations and other characteristics for every free individual in the United States for the year 1860; the microfilms of the manuscripts of the Census enumerators are made available by the National Archives in Washington.

One finds Abraham Lincoln from entries for Springfield, Illinois, recorded in about June 1860, with age, occupation, birth state, personal estate, and real estate listed as 51, lawyer, Kentucky, \$5,000, and \$12,000. More affluence was shown further north in Chicago where William Ogden had entries of 55, lawyer, New York, \$1,500,000, and \$1,000,000; and Cyrus McCormick had entries of 50, reaper factory, Virginia, \$278,000, and \$1,750,000. It is certainly not difficult to find the entries of the many, many people with personal estate and real estate of \$0 and \$0. It is fascinating to study those individuals with large estates as they appear on the Census rolls because so much information is available. Entries are given for each member of the family, including the wife, children, servants, gardeners, and other individuals involved in maintaining the family unit. It is often possible to ascertain, with high probability, the mobility of the family by tracing the birth places of the oldest to youngest children. One loses some of his ardor for fine individual details of successful men when he realizes that certain large cities had more than half of their population declaring no wealth whatsoever.

This paper is concerned with the frequency distribution of wealth among men in ten large urban areas of the United States in 1860 and with two models approximating this distribution. We first present characteristics of the frequency curve, stressing relative inequality and the proportion who were propertyless. A descriptive binomial model of social classes will be developed almost solely on the basis of the proportion who were propertyless. This model adequately depicts social classes in the sense that it yields both frequency tables similar to those of W. Lloyd Warner and, in one sense, the 1860 wealth distribution. The second approximation of wealth distribution is obtained by applying an orthodox consumption function to a realistic Pareto-type model of income distribution. The resulting relative distribution of saving is similar to relative distribution of wealth.

I. THE WEALTH STUDY OF TEN URBAN AREAS IN 1860

A probability sample of men in urban areas has been drawn from microfilm of the Census manuscripts of 1860 for the United States. Emphasis was placed on the wealth declarations for real and personal property. Very briefly, real estate value was reported wherever it was owned. The individual decided whether or not he wished to subtract debt. Personal estate value was defined as including all bonds, stock, mortgages, notes, livestock, plate, jewels, or furniture, but excluding wearing apparel. Aggregates for Northern states and our selected urban areas appear to be in excellent accord with the backward extrapolations and interpolations of data of Goldsmith, Kuznets, and Easterlin. It is found that the data yield exciting configurations, including implications of strong economic growth from 1800 to 1860.

A sample of 8,966 adult males was obtained from the manuscripts in all of 10 urban counties in 1860 as listed in Table 1. This represents a population of 449,640 adult males, which was 36.3 percent of the adult males of the 22 counties in the United States having cities with a total population of 40,000 or more, and 5.6 percent of the adult males in the 2,105 counties of the entire country. The use of counties made it possible to check average wealth values in various counties, as explained in the note to Table 1. The arithmetic-mean wealth of individuals in the 10 counties was only 3.3 percent higher than that in the 22 counties. It was 25 percent larger than the arithmetic mean of all individuals in the states and territories. The results of Table 1 indicate consistency of average wealth of about $2,300 and remarkable consistency of level of inequality of slightly more than .9, as measured by the Gini coefficient of inequality.[1] The median age is also constant with but two exceptions. Only nativity varies significantly, with western cities having larger percentages of foreign born. It is reasonable to combine the ten distributions so that we may generalize urban holdings.

New York County presents a special problem, since its population was 50 percent of the population in the ten cities. It was decided not to include New York in the general analysis because of its size. A rather small sample of New York was drawn, however, and its results are reported separately in Table 1. It is contrasted with a sample for St. Paul, Minnesota, the youngest and most affluent city at that time. A judgment was made that the ten middle cities of the listed twelve probably convey a better picture of highly urbanized society at that time than do the twelve.

A. Wealth Distribution

The data of Table 2 show that there was extreme inequality in the distribution of wealth in 1860. The top one-tenth of 1 percent had 15 percent of the wealth in the urban areas. The richest 6,000 men had as much wealth as the poorest 450,000. A statistician might find it difficult to cite another example of similar skewness, one in which the arithmetic mean to median ratio was very large, if not infinite. The 50 percent who were propertyless truly had little material wealth. It is doubtful that many would have guessed that this level of inequality existed prior to the Civil War. The

[1] A measure of relative dispersion, Gini's coefficient of concentration, or *R*, is calculated by determining the area between the actual Lorenz curve and the straight-line curve of perfect equality. This area as a ratio of the triangular area under the line of perfect equality was .924 for the ten counties in 1860.

TABLE 1 The Number, Wealth, Nativity, and Age of Males 20 Years Old and Over in Each of Ten Urban Counties in 1860

		Sample of Adult Men				
Listing by Major City of Each County	*Census Tabulation of Number of Adult Males*	*Number of Men*[a]	*Average Wealth of Men (Dollars)*	*Gini Coefficient of Concentration*	*Proportion That Are Foreign Born*	*Median Age*
Boston	53,024	55,203	2,828	.944	.48	33
Philadelphia	145,172	148,216	2,679	.932	.47	34
Newark	25,893	28,377	1,894	.904	.52	38
Washington, D.C.	18,474	17,493	2,373	.898	.30	34
Pittsburgh	44,198	42,679	1,962	.894	.53	37
Cleveland	20,233	18,877	1,946	.859	.61	36
Cincinnati	60,330	62,090	2,200	.932	.70	35
Chicago	40,740	40,737	2,393	.920	.68	31
Milwaukee	15,897	15,382	2,371	.893	.82	35
San Francisco	25,679	27,633	1,137	.915	.65	33

All ten counties	449,640	456,687	2,346	.924	.55	36
Five Eastern	286,761	291,967	2,507	.927	.47	37
Five Western	162,879	164,720	2,062	.919	.69	36
Median of the ten	33,300	34,600	2,286	.909	.57	35
New York	219,642	219,600	1,911	.933	.64	36
St. Paul	3,523	3,523	3,423	.918	.61	33

SOURCES: The sample of the ten counties was taken from Schedule 1 of the 1860 Census. One line was chosen at random from each one, two, or four pages of the manuscripts, where one page contained forty lines. County populations are from Table 1 of the *Census of Population, 1860.* The sum of the individual wealth declarations was published for each county in Table 3 of *Mortality and Miscellaneous Statistics, 1860.* When these county sums are divided by the respective number of adult males, averages are obtained which are as much as 10 percent larger than those given above. The average of *Census* Table 3 values for the ten counties is $2,544, or 8.8 percent larger than the sample value of $2,346. The aggregates of *Census* Table 3 include the estates of women and a few young males under 20.

[a] These totals are obtained from weighting the sample items in each city. Thus, 148,216 for Philadelphia stems from 160 × 923 + 4 × 134 where approximately one of every 160 men was sampled of those with wealth under the cutoff of $100,000 and approximately one of every four men was sampled of those with wealth above $100,000. The sample size for the ten cities was 8,966, including presumably all these 885 men above $100,000 in nine cities and 134 of the presumed 536 above $100,000 in Philadelphia. The New York sample is 588 in size, including 40 rich, and that of St. Paul is 391, including presumably all 43 rich above $100,000.

TABLE 2 The Distribution of Wealth Among Males 20 Years Old and Over in Ten Urban Counties in 1860

		All the 456,687 Adult Men in the Ten Counties				
Lower Limit of Wealth Class, in Dollars, X	*Total Number of Males in the Wealth Class*	*Total Amount of Wealth, in Millions of Dollars, in the Wealth Class*	N_X, *or the Percent of Total Males Above the Lower Limit,* X	A_X, *or the Percent of Total Wealth Above the Lower Limit,* X	N_X *of the 207,422 Native Born in Ten Counties*	N_X *of the 679,810 Adult Men in the Twelve Counties*
0	234,540	–	100.	100.	100.	100.
10	1,360	–	48.64	100.	48.86	45.88
20	10,280	–	48.35	100.	48.65	45.68
50	18,720	1	46.09	99.97	47.74	43.75
100	31,900	4	41.99	99.87	45.54	40.32
200	40,290	11	35.01	99.54	40.42	34.11
500	26,320	16	26.18	98.52	31.68	24.48
1,000	26,440	34	20.42	96.99	26.47	19.19

2,000	29,100	86	14.63	93.85	20.73	14.10
5,000	15,720	104	8.26	85.85	12.83	8.08
10,000	11,100	145	4.82	76.18	7.70	4.51
20,000	6,881	212	2.39	62.64	4.31	2.45
50,000	2,615	164	.88	42.83	1.76	.72
100,000	983	128	.31	27.53	.59	.27
200,000	361	105	.10	15.62	.17	.095
500,000	59	34	.017	5.85	.032	.022
1,000,000	18	25	.004	2.42	.006	.006
Total	456,687	1,072				
Arithmetic mean (dollars)	2,346				3,878	2,211
Median (dollars)	0				0	0
Gini coefficient	.924				.913	.927

SOURCE: The sample of sizes 8,966; 588; and 391 are from schedule 1 of the 1860 Census. See Table 1.

finding casts some doubt on the prevailing notion that inequality increased until the turn of the century.[2]

In spite of the inequality level in 1860, the literature of the time stressed not only the free play that one had for his talents; emphasis was also placed on the reward one would obtain for his abilities and efforts, rather than on the penalties for lack of abilities. One may well wonder how this reward "myth" could prevail if so few held so much wealth. Our problem, then, entails resolving the apparent conflict between the fact of extreme inequality and the belief in individual economic growth from effort. One must examine data from the standpoint of the age and background of the individual. By all measures, the best proxies for measuring the abilities, feelings, and accumulative ingenuity of the individual in the period are his age and whether he was born in the United States or emigrated from a foreign country. We shall begin by examining characteristics of the poor.

B. The Propertyless

The single most important parameter of wealth distribution is the proportion of men with no wealth, $P_{\$0}$. It depicts the proportion of persons in society at a point in time who are failing to participate in accumulation—the proportion of persons who are consuming at least their total incomes. These individuals may be young, they may be foreign born. They may be plagued by full or partial unemployment brought about by sickness, lack of knowledge of job opportunities, or general economic conditions dominated by seasonal or cyclical factors. It may have been true that there was some general queuing process, first for employment, and second for employment which provided income larger than some minimum consumption need.

[2] There would have been about 50 millionaires in large cities if our 18 millionaires represent 36 percent of the highly urban sector. Consider that the number of adult males in 1900 was 2.73 times the number in 1860, and that average wealth in 1900 would have been 2.20 times that in 1860 if compounded annually at 2 percent per capita. Thus, 135 individuals in 1900, each above $2,200,000, would be consistent with the mean and inequality of the 1860 distribution. The 77 individuals above $500,000 in Table 2 would have been consistent with 580 millionaires in 1900 in the United States. Prices in the two years were similar. Our focus here is on large cities. However, in 1860 in Louisiana alone, there were 36 large slaveholders with wealth above $500,000.

It has been determined that $P_{\$0}$ was .514 for the ten major cities in the North in 1860. Thus the have-nots were as many as the haves! The have-nots had little more than clothing and petty cash. The definition of personal estate presumably included such items as furniture, so we are considering the fact that median wealth value was close to being nothing. (Some might maintain that \$10 to \$40 would be a more appropriate figure. This would be roughly \$40 to \$160 at 1970 prices.) Table 3 indicates that $P_{\$0}$ was higher in the East and lower in the West, reaching 58 percent in New York City but only 34 and 39 percent in Milwaukee and Minneapolis, respectively. Part of these differences could be explained by the importance of nonurban populations in the counties.

W. Lloyd Warner's nomenclature of social classes prominently distinguishes persons with and without wealth. His lower class encompasses the lower-lower and the upper-lower categories, each of which contains people with essentially no wealth. This lower class constituted 58 percent of the population of Yankee City in the early 1930s. It is not surprising that the figure is similar to our $P_{\$0}$ of .514, since conditions of the early 1930s were part of the Great Depression, and since a rigid standard of \$0 was not applied in delineating the lower group. The 1860 proportion of wealth-holders in the ten cities having less than \$100 was $P_{\$0\text{-}99} = .58$, a figure which was the same as that stated by Warner.[3]

There is an appealing probability calculation involving $P_{\$0}$ and average age. The average age of males 20 and older in the ten cities in 1860 was about 35. If one assumed that individuals could accumulate wealth only during their adult years, say, $age - K = age - 20$, then they would have had on the average about 15 years exposure in the adult labor force. The probability of nonaccumulation, calculated for a year by assuming independent and constant annual probabilities, would be $(P_{\$0,year}) = (P_{\$0})^{1/(age - K)}$; $.957 = (.514)^{1/15}$. The probability of remaining in the zero class in a year might be estimated as .957. The probability of advancement in a year, $P_{\$1\text{-},year} = 1 - (P_{\$0})^{1/(age\ K)}$, is calculated to be .043.

[3] W. Lloyd Warner and Paul S. Hunt, *The Social Life of a Modern Community,* Vol. I, Yankee City Series (New Haven: Yale University Press, 1941) p. 88; W. Lloyd Warner and Associates, *Democracy in Jonesville,* (New York: Harper Torchbook, 1964) pp. 24-25; W. Lloyd Warner, Marchia Meeker, Kenneth Eells, *Social Class in America* (New York: Harper Torchbook, 1960) pp. 14, 140-41, 165.

TABLE 3 The Proportion of Men 20 Years Old and Over With No Wealth for Each of the Ten Cities and New York and St. Paul in 1860

		Sample of Adult Males			
		Proportion With No Wealth			
Listing by Major City of Each County	*Census Tabulation of Number of Adult Males*	*All* ($P_{\$0}$)	*Native-Born* ($P_{\$0, NB}$)	*Nonfarm* ($P_{\$0, NF}$)	*Proportion With Wealth Less Than $100* ($P_{\$0\text{-}99}$)
Boston	53,024	.520	.530	.522	.616
Philadelphia	145,172	.564	.539	.570	.594
Newark	25,893	.523	.454	.535	.568
Washington, D.C.	18,474	.466	.485	.465	.546
Pittsburgh	44,198	.400	.443	.423	.537
Cleveland	20,233	.441	.402	.494	.498
Cincinnati	60,330	.474	.503	.482	.614
Chicago	40,740	.489	.432	.500	.513
Milwaukee	15,897	.340	.415	.332	.425
San Francisco	25,679	.674	.662	.682	.674
All ten counties	449,640	.514	.511	.524	.580
Five Eastern	286,761	.524	.516	.531	.587
Five Western	162,879	.495	.497	.511	.568
Unweighted average of ten		.489	.486	.500	.559
New York	219,642	.601	.560	.602	.634
St. Paul	3,523	.392	.373	.363	.460

This might be interpreted as meaning that an individual without wealth faces the year with only a 4.3 percent chance of joining the group of people who save, who have wealth. An alternative interpretation might be that 4.3 percent of people in the lower class escape to the middle class or choose the middle class in a given year.

At least two qualifications should be applied to the notion of probability of escape, $P_{\$1\text{-},\, year}$. We have an average figure for the population based on the experience of those who were young and old. It will be shown later that $P_{\$1\text{-},\, year}$ varies with age, being greater when one is young, smaller in middle age and quite small in later life. The concept of adult age is also subject to criticism, particularly in dealing with social classes. Since family connections, family wealth, and inheritance are an important part of wealth accumulation, it might very well be argued that the *K* in *age–K* should be 10, 0, or even a negative value. A calculation of $P_{\$1\text{-},\, year,\, K=0}$ gives $1 - (.514)^{1/(35-0)}$, or .019. Empirical testing of age-wealth configurations suggests that a *K* of 16 is often appropriate. This yields $P_{\$1\text{-},\, year,\, K=16} = .035$. In all these calculations, the product of the average age times the probability of escaping is about the same; thus, .043(35–20) = .65, .019(35–0) = .66, .035(35–16) = .66, and $(P_{\$1\text{-},\, year,\, K})\,(age - K) \approx c$.

It might be thought that the have-not proportion would be larger for foreign-born than native-born. This, strangely enough, was not the case, since $P_{\$0,\, FB} = .515$ and $P_{\$0,\, NB} = .511$. A correction for the fact that there were relatively more native-born among the young and old camouflages a native-born advantage appearing among older age groups. The ten counties did have some farm populations, since there were rural areas in most of the counties. The farm group constituted about 5 percent of the population of adult males with $P_{\$0,\, farm} = .338$. This was substantially less than $P_{\$0,\, nonfarm} = .524$. Part of this difference could be explained by differences in age composition and nativity composition, but there certainly was a larger propertyless group in the cities. People must have elected, in part, to participate in urban rather than in rural life. This was in spite of the fact that it was more difficult to accumulate in cities. The difference, $P_{\$0,\, nonfarm} - P_{\$0,\, farm}$ might have been an indicator of an upper-lower class–a class which is able and willing to save in rural society but not in urban society.

II. A BINOMIAL MODEL RELATING SOCIAL AND WEALTH CLASSES

Suppose the probability of escaping the zero class in a year was $P_{\$0,\, year,\, K} = .04$ where K is 20 (but could be as low as 16). If one of age 20 does advance in a year (i.e., at age 21) to the class which has saved, he is part of a select group. It seems reasonable to distinguish him from those who will become haves at age 22 or later. Surely his expected wealth will be larger than that of one entering the have class at age 22 if one considers the year in which he has been able to employ his wealth. The forces producing the 4 percent group at age 21 might, then, be expected to create a have-have group at age 22. This might very well be 4 percent of 4 percent or .16 percent of those 22 years of age. The argument could be extended to a have-have-have group of $(.04)^3 = (.04)^{23-20}$ at age 23. Alternatively, the proportion remaining in the have-not group at age 23 would be $(.96)^3$. A series of rungs would be established which would become increasingly difficult to reach. The probability of movement from rung to rung in a given year would be $P_{\Delta rung} = P_{\$1\text{-},year}$.

A. Binomial Probabilities

The probability of success in a year would remain constant, and the process could be described with the binomial probability distribution, $B(X;N_t,P)$, where X is the rung level (X=0,1,2, . . . , N_t), N_t is $age_t - K_t$ or $age_0 - 20_0$ in year t=0, and P is $P_{\Delta rung}$. An example for a given age cohort is:

			B(X,N_t.04)				
t	age_t	N_t	X=0	X=1	X=2	X=3	X≥4
1845	20	0	1.0000				
1846	21	1	.9600	.0400			
1847	22	2	.9216	.0768	.0016		
1848	23	3	.8847	.1106	.0046	.0001	
–	–	–	–	–	–	–	–
1860	35	15	.5421	.3388	.0988	.0179	.0024

If one were examining urban population in a given year, he would have to weight the $B(X,N_t,P)$ for each age group by its relative population.

The probabilities $B(X,N_{1860},.04)$ are given for the selected age group $N_{1860} = 35 - 20 = 15$ in columns 3 and 4 of Table 4. This is taken as an initial approximation for adult men in that year. (Poisson probabilities for $NP = 15\ (.04) = .6$ are essentially the same as those presented, since P is relatively small and N is fairly large; other products of N and P of .6 give about the same binomial results.) The very interesting aspect of the probabilities is that they generate classes which have about the *same frequencies* as those found by W. Lloyd Warner for Yankee City! The similarities displayed in Table 4 for X of 1 and the lower-middle class, X of 2 and the upper-middle class, and X of 3 and the lower-upper class are remarkable. Even the $X = 4$ frequency is of the same general magnitude as the upper-upper class as quantified for Yankee City. Table 4 includes a column for $B(X,N,.05)$ as well as for $B(X,N,.04)$. This allows one to judge how sensitive the calculation is to changes in the probability of escape.

It might be claimed that knowledge of (1) the proportion of adults without wealth, and (2) the average of adult age, can be used to construct social classes by employing a binomial model. These two parameters suggest the proportions in the next four classes, LM, UM, LU, and UU classes. They also suggest a super fifth class at $X = 5$ for cities of size 10,000, a super-super class at $X = 6$ for cities of size 100,000, and a seventh class for an urban population[4] of 1,000,000. The first characteristic of the binomial classes is $P[X_t \mid (X-1)_{t-1}] = P_{\Delta rung}$. The probability of moving from any one class to the next higher class in the course of a year is constant for all classes. This includes movement from the lower class to the lower-middle class. No allowance is made for movement from a higher to lower class except insofar as $P_{\Delta rung}$ is a net upward movement. The second characteristic is $P_{\Delta rung} = 1 -$

[4] Theoretically, a village of 10 would have one individual in the UM class at $X = 2$ and none for $X \geqslant 3$, in the case of $B(X,N,.04)$. A town of 100 would have 2 persons in the LU class and none for $X \geqslant 4$. A population of 10^n would have a top class at $X = n + 1$. The relative dispersion of persons in classes in a given town would be $\sigma_X/\mu_X = \sqrt{NP(1-P)}/NP = \sqrt{(1-P)/NP} = \sqrt{(.96)/(.04N)} = \sqrt{(24)/N}$, where $P = .04$ and $N_t = age_t - K$. Thus, relative dispersion of persons distributed by social class would *not* be a function of size of city if average age and $P_{\Delta rung}$ were the same in each city.

TABLE 4 Status Hierarchy in Yankee City, Binomial Probabilities Based on Adult Age and Persons With No Property in the Ten Northern Cities in 1860, and Wealth in the Ten Northern Cities in 1860 for Classes Having These Binomial Probabilities

Warner Classes for Yankee City			*Binomial Probability* B(X, N, P) *Cumulative Frequency*		*Wealth, W, in the Ten Cities (Using* $N_W = N_X$*)*	
Class Name, YC *(1)*	*Cumulative Frequency,* N_{YC} *(2)*	*Class Rung,* X *(3)*	N_X *for:* B(X, 15, .04) *(4)*	N_X *for:* B(X, 15, .05) *(5)*	W *Using Column 4 Frequencies (Dollars) (6)*	W *Using Column 5 Frequencies (Dollars) (7)*
		7	.000001	.000004		2,900,000
		6	.00002	.00005	1,240,000	775,000
		5	.0002	.0006	450,000	250,000
UU	.0144	4	.0024	.0055	110,000	65,000
LU	.0300	3	.0203	.0362	22,000	12,400
UM	.1322	2	.1191	.1710	2,500	1,250
LM	.4134	1	.4579	.5367	50	0
UL	.7394					
LL	.9916	0	1.0000	1.0000	0	0

SOURCES: W. Lloyd Warner and Paul S. Hunt, *The Social Life of a Modern Community*, Vol. I, Yankee City Series (New Haven: Yale University Press, 1941), p. 88; W. Lloyd Warner and Associates, *Democracy in Jonesville* (New York: Harper Torchbook, 1964), pp. 24-25; W. Lloyd Warner, Marchia Meeker, Kenneth Eells, *Social Class in America*, (New York: Harper Torchbook, 1960), pp. 14, 140-41, 165. Wealth data are from the sample size 8,966 drawn from the manuscripts of the Census of 1860.

Cumulative frequencies for Yankee City are based on class frequencies of .0144, .0156, .1022, .2812, .3260, and .2522. Binomial values of *N* and *P* were chosen because the average adult age was 35 – 20 = 15 and *P*'s of .04 and .05 encompassed $P(\Delta rung) = .0434$. The proportion of individuals with no wealth was $P_{\$0} = .514 = (9.566)^{15}$ and $P(\Delta rung)$ is $1 - (P_{\$0})^{1/15}$.

Binomial probabilities are taken from U.S., Department of Commerce, National Bureau of Standards, Applied Mathematics Series 6, *Tables of*

$(P_{\$0})^{1/(age-K)}$ where $P_{\$0}$ is the proportion of people without wealth, *age* is the average age of people, and $0 \leqslant K \leqslant 20$. Calculations are determined from the size of the lower class. The classes are not chosen arbitrarily. Probability of movement is the same for an individual throughout the system.

B. *Transformation of Variables for the Binomial Model*

The system is characterized not only by frequencies, $f(X)$, but by the various variate values $X = 0,1,2, \ldots, 7$. Let N_X be the cumulative frequencies above each X, that is, above each rung. What will be the dollar wealth value, W, at these various rungs? We let $N_X = N_W$, find the W of column (6) of Table 4, and speculate about the relationship of W and X. An example of a transformation might possibly be of the form $W = aX^b$ or $W = cd^X$ for $X > 0$ and $W = X$ for $X = 0$. Illustrations are:

	$W = aX^b$		$W = cd^X$	
X	$W = X^2$	$W = 50X^{5.6}$	$W = 2^X$	$W = 400\,(3.9)^X$
0	$ 0	$ 0	$ 0	$ 0
1	1	50	2	(1,600)
2	4	2,300	4	(6,100)
3	9	22,000	8	24,000
4	16	110,000	16	93,000
5	25	380,000	32	361,000
6	36	1,100,000	64	1,400,000
7	49	2,520,000	128	5,500,000

The elasticity form, $W = aX^b$, means that wealth ratios of two bordering classes would decrease as one climbs the social ladder; values of X would be considered as cardinal numbers with an origin value of zero embedded in the lower class. If the severe test of constant wealth ratios were applied, the climb from rung 1 to 2 is commensurate with the climb from rung 2 to 4, and this is commensurate with the climb from rung 4 to 8. It would mean that the quantitative jump from LM to UM is the same as the double jump from UM to UU, at least from the standpoint of wealth ratios. In Chart 1, it is shown that an elasticity coefficient

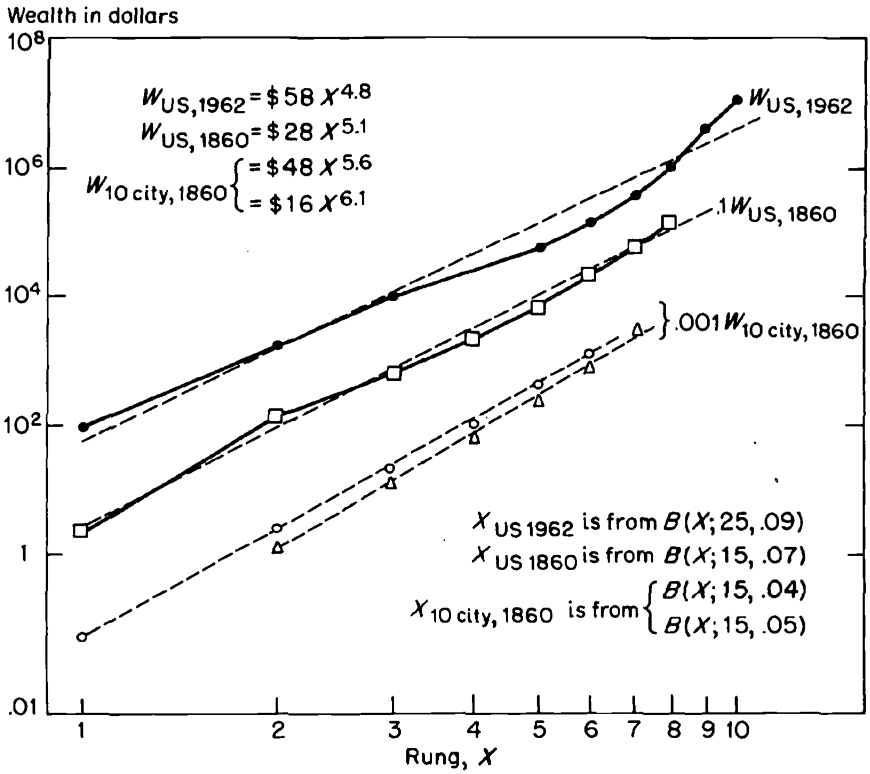

CHART 1: Indirect Elasticity Correlations Between Binominal Rung Values, X, and Wealth Values, W (Obtained by Letting $N_X = N_W$)

SOURCE: See Table 4.

of 5.6 accords very well with the data for $X > 0$. A 1 percent change in class rank, X, corresponds with a 5.6 percent increase in wealth. It is difficult to understand why one has a product concept where X is multiplied by itself five or six times. Perhaps an explanation lies in inheritances, generations, time in a social class, or economic power of a social class.

There is an appealing aspect of the model $W = cd^X$ since X may be considered as time and d is 1 plus a rung interest rate. If $W = 2^X$, then wealth would double at each rung, the interest or growth rate of wealth would be 100 percent for the length of time one remained in a given social class. Chart 2 demonstrates that there is some empirical evidence for believing that this configuration

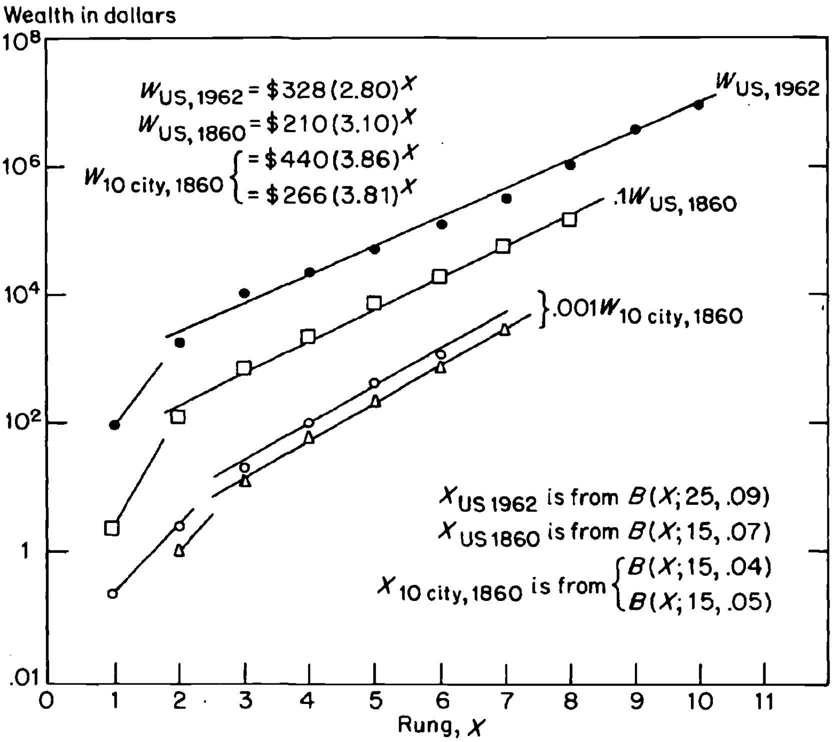

CHART 2: Exponential Correlations Between Binomial Rung Values, X, and Wealth Values, W (Obtained by letting $N_X = N_W$)

SOURCE: See Table 4.

holds for the four social classes $3 \leqslant X \leqslant 6$ for the cities in 1860 with the form $W = c(3.9)^X$. If the differential change in X each year were .04, then percentage growth in wealth for the individual would be approximated as $dW/W = .04 \log 3.9 = .05$.

It has been demonstrated that $B(cX^{5.6},15,.04)$ is an excellent description of the 1860 wealth data. It is essentially an excellent fit of Warner's social classes if no distinction is made between the lower-lower and upper-lower class. Some further evidence is offered in Table 5 for a Warner dollar index. He suggested that the size of the business could be used in placing proprietors and managers in one rating technique for occupation. The reader may agree that values of this size are about the same as the $W = cX^{5.6}$ for 1860.

TABLE 5 Average Value of Businesses of Proprietors and Managers in Yankee City and Average Wealth in the Ten Northern Cities in 1860, Classified by Status Hierarchy and Binomial Rung

Warner Classes for Yankee City		*Wealth, W, in the Ten Cities (Using $N_W = N_X$)*		
Class Name, YC	*Average Value of Business (Dollars)*	*Class Rung,* X	W, *Using* B(X, *15, .04) (Dollars)*	W, *Using* B(X, *15, .05) (Dollars)*
		7		2,900,000
		6	1,240,000	775,000
		5	450,000	250,000
UU	75,000[a]	4	110,000	65,000
LU	26,000	3	22,000	12,400
UM	1,960	2	2,500	1,250
LM	12	1	50	0
UL				
LL	0	0	0	0

SOURCES: W. Lloyd Warner, Marchia Meeker, Kenneth Eells, *Social Class in America*, (New York: Harper Torchbook, 1960) Table 7, pp. 140-41, and Table 9, p. 165. The Index of Status Characteristics ratings of Table 6, p. 127, imply linearity in social-class equivalents. Thus, lower-limit ratings of 17 for U, 33 for UM, 50 for LM, 62 for UL, and 84 for LL leave intervals of 16, 16, 17, 12, and 22; Table 19, p. 183, with lower limits of 17, 32, 46, 61, and 75 illustrates the same linearity with intervals of 14 or 15 points. The stated linear equation of $Y = .21X - 1.12$ (of page 183), with Y as social-class placement on the 15 point scale and X as the weighted total for status characteristics, could be adapted to $z = (60 - X)/15$ in giving binomial values of 3, 2, 1, 0 and −1.

[a] The average values are weighted geometric means obtained from the values \$75,000; \$20,000; \$5,000; \$2,000; \$500; and (assumed) \$1, as listed for occupational ratings 1, 2, 3, 4, 5, and 6. The weights are obtained from a table of the number of old Americans cross classified by ratings on occupation and social class (Evaluated Participation). An example is:

$$\sqrt[50]{(75{,}000)^{29} \times (20{,}000)^{7} \times (5{,}000)^{11} \times (2{,}000)^{1} \times (500)^{2}}.$$

C. The Binomial Distribution and Specific Age Classes

The binomial model yielding $P_{\Delta rung}$ and $W = cX^d$ fortunately gives results which are generally consistent with statistical data on wealth for specific age groups. The proportion with no wealth in an age group, $P_{\$0, age}$, can be estimated fairly well from $P_{\Delta rung}$ for all age groups; native-born probabilities, $P_{\$0, age, NB}$ are quite well represented by $P_{\Delta rung, NB}$. The linear relationship in logarithms of W and X for each age group produces a slope about the same as that produced among all age groups.

*1. **Probabilities of Advancement for Specific Age Groups.*** The proportion with wealth, $P_{\$1\text{-}} = .486 = 1 - .514$, is a population-weighted average of $P_{\$1\text{-},age}$ figures varying from near zero at age 20 to between .67 and .75 for those of old age. The proportions given in Table 6 for all adult males in the ten counties show a rapid rise from .168 for ages 20-24 to a peak at .681 in the age group 55-59. Suppose the binomial model is applicable, with $P_{\Delta rung}$ of .04 (or, more specifically, .043). If $B(X, 35 - 20, .043)$, then presumably $B(X, age_t - 20, .043)$ would be applicable for $age_t = 20_{1860}, 21_{1860}, \ldots, 99_{1860}$. Results for this situation are given in the table in the column $1.0 - (.957)^{age-20}$. The predicted values at each age are less than $P_{\$1\text{-}, age}$ for those under 40 and more than $P_{\$1\text{-}, age}$ for older ages. A better fit is achieved with a probability of advancement of .05 in the earlier stages and .03 in the later stages.

A theoretically more attractive model in this context is obtained from $P_{\Delta rung} = .034$ and $age - 16$, where accumulation is considered to begin at least a few years before age 20. The $P_{\$0, age}$ at ages 20, 21, and 22 were actually .10, .13, and .17. This suggests that $age - 16$ or $age - 17$ is a more appropriate year to start the process. If one is to make this consistent with the ten-county average of $P_{\$0} = .514$, then $P_{\Delta rung}$ would be $1 - (.514)^{1/(age-16)} = .034$. The values generated from $B(0, age_{1860} - 16, .034)$ for $age_t = 20_{1860}, \ldots, 77_{1860}$ are given in Table 6. This series is particularly appealing since it generates values similar to those for native-born in the counties in 1860. The figures in Table 6 for $P_{\$1\text{-}, NB}$ are a little larger than the theoretical values at ages 32 and 37. However, consider those at ages 20-24, 25-29, 40-44, 45-49, 50-54, 55-59, and 60-64, of .16, .36, .61, .66, .67, .76, and .77; they are faithfully duplicated by .19, .32, .60, .66, .72, .76, and .80. It seems rather amazing that there was this consistency of probability movements from the have-not classes to have classes.

TABLE 6 The Proportion of Men 20 Years Old and Over With Wealth in the Ten Cities (Counties) for Various Age Groups and Suggested Binomial Values

	Proportion With Wealth			*Probability Calculations Based on $P_{\$0} = .514$*[a]			
Age	*All* ($P_{\$1\text{-}}$)	*Native* ($P_{\$1\text{-}, NB}$)	*Nonfarm* ($P_{\$1\text{-}, NF}$)	$1.000 - (.957)^{a-20} = P'_{\$1\text{-}}$	$1.000 - (.966)^{a-16} = P'_{\$1\text{-}}$	$1.000 - (.981)^{a-0} = P'_{\$1\text{-}}$	*Age* = a
20-24	.168	.157	.168	.085	.189	.341	22
25-29	.386	.363	.358	.267	.320	.401	27
30-34	.535	.563	.528	.413	.429	.455	32
35-39	.596	.627	.584	.530	.521	.505	37
40-44	.577	.608	.561	.623	.598	.549	42
45-49	.651	.666	.634	.698	.662	.590	47
50-54	.641	.666	.636	.758	.716	.627	52
55-59	.681	.760	.674	.806	.762	.661	57
60-64	.667	.769	.637	.845	.800	.692	62
65-69	.660	.757	.602	.876	.832	.720	67
70-99	.516	.559	.474	.920	.882	.786	77
20-99	.486	.489	.476	.486	.486	.486	35

SOURCES: See Tables 1 and 2.

[a] The proportion with no wealth in the 10 counties was .514; $.514 = (.957)^{35-20} = (.966)^{35-16} = (.981)^{35-0}$.

There is some attractiveness in generating a series from $P_{\Delta rung} = .514^{1/(35-0)} = .981$. It would be assumed that an individual would begin at birth to inherit his ability to climb from class to class. Calculations would yield only potential class position in younger age. The potential class position would be realized only in later life when actual inheritances would materialize. It is seen in Table 6 that this series generates values consistent with actual values after age 40. The mystifying aspect of this is that $P_{\$0} = 1.0 - .981 = .019$. This implies a lifetime growth rate in advancement of .019 rungs per annum. Those of age 50 or 60 would have an expected value or NP of about 50(.019) or 60 (.019), that is, about 1.0 rungs. This, in turn, implies an annual growth rate of about .019 rungs per year/1.0 rungs, or a little less than 2 percent a year. This proposition will be tested again, using probabilities of dying.

2. ***Transformation of the Variable for Specific Age Groups.*** It is to be expected that the power parameter d in $w = cX^d$ will be less than 5.6 in all but the youngest age class. It is perhaps surprising that the d values in Table 7 do not drop very much below the 5.6 value for all age groups. There is little evidence that the figure is less than 4.6. One concludes that the original formulation $B(cX^{5.6}, 35 - 20, .043)$ does not need to be qualified greatly in adapting it to specific age groups. Accumulation begins as early as 16 and the power 5.6 might be decreased to 5.0 for middle age groups.

D. Social Class Averages of Nativity Groups in 1860

The wealth limits, W, suggested by $B(X,15,.043)$ for the ten counties in 1860 at $X = 0, 1, 2, 3, 4, 5$, and 6 are given in Table 8. Let us turn the problem around by considering X as this step function of W. Substitute X for W in a computer run of the sample items to determine the number of persons in the various social groups. This procedure will yield information about nativity, occupation, and age for the various social classes. It is recalled that the population was half native-born. These native-born naturally dominate the higher social classes, including the upper-middle, upper-lower, upper-upper, and classes 5 and 6. The cumulative frequency columns almost show $N_{X,\,native\text{-}born} \geqslant N_{X\text{-}1,\,foreign\text{-}born}$ for these classes. The pattern would be consistent with the idea of moving one rung in a generation, since the children of foreign-born

TABLE 7 Indirect Exponential Correlations Between Binomial Rung Values, X, and Wealth Values, W, Classified by Age for the Ten Cities

(obtained by letting $N_X \doteq N_{W,\ age}$)

Age	*($P_{\$1\text{-},\ age}$)*	*Implied* $P_{\Delta\ Rung}$	*Average* $P_{\Delta\ Rung}$	*Age Midpoint*	*Binomial Formula, for* $X \geqslant 0$	*Least-Squares Results for the Specification* $W = cX^d$
20-29	.284	.065	.043	25	$B(X, 05, .06)$	$W = \$\ 39X^{6.2}$
				25	$B(X, 05, .05)$	$W = 91X^{5.8}$
				25	$B(X, 05, .04)$	$W = 128X^{5.8}$
30-39	.563	.054	.043	35	$B(X, 15, .05)$	$W = 66X^{5.3}$
				35	$B(X, 15, .04)$	$W = 28X^{5.4}$
40-49	.609	.037	.043	45	$B(X, 25, .04)$	$W = 40X^{5.0}$
				45	$B(X, 25, .03)$	$W = 102X^{4.8}$
50-59	.656	.030	.043	55	$B(X, 35, .04)$	$W = 118X^{5.5}$
				55	$B(X, 35, .03)$	$W = 53X^{5.1}$
				55	$B(X, 35, .02)$	$W = 233X^{4.8}$
60-69	.665	.024	.043	65	$B(X, 45, .03)$	$W = 30X^{5.3}$
				65	$B(X, 45, .02)$	$W = 77X^{5.3}$

70-99	.516	.013	.043	75	$B(X, 55, .02)$	$W = 125X^{4.6}$
				75	$B(X, 55, .01)$	$W = 293X^{5.2}$

NOTE: Details for fitting the above 14 equations are:

d	*Number of Points*	*Range for* X	*Unadjusted Coefficient of Determination*	*Standard Error of* d
6.2	4	1-4	.999	.072
5.8	4	1-4	.998	.176
5.8	4	1-4	.996	.254
5.3	6	1-6	.997	.138
5.4	6	1-6	.978	.399
5.0	6	2-7	.999	.076
4.8	6	1-6	.997	.132
5.5	7	2-8	.997	.136
5.1	6	2-7	.991	.237
4.8	6	1-6	.998	.109
5.3	6	2-7	.994	.202
5.3	6	1-6	.995	.198
5.6	7	1-7	.978	.309
5.2	5	1-5	.994	.223

SOURCE: See Table 4.

TABLE 8 The Distribution of Adult Native- and Foreign-Born Men in the Ten Cities in 1860, by Wealth and Social Class as Determined From the Binomial Distribution, $B(X, 15, .043)$

Class Rung, X	*Cumulative Frequency,* N_X, *for* $B(X, 15, .043)$	*Wealth, W, Determined by Letting* $N_W = N_X$ *(Dollars)*	*Cumulative Frequencies Determined From W Values of Preceding Column* — *Native-Born* $(N_{X,NB})$	*Foreign-Born* $(N_{X,FB})$	*Average Age*
7	.000001				
6	.000023	1,180,000	.000434	.000040	52.4
5	.000320	382,000	.000959	.000148	55.3
4	.003290	94,000	.006340	.000814	51.2
3	.025100	18,000	.046600	.008280	48.6
2	.136200	2,000	.207600	.095700	43.2
1	.486000	1	.488600	.484700	37.6
0	1.000000	0	1.000000	1.000000	33.0
Arithmetic mean, $\overline{X}$	.66		.75	.59	
Gini coefficient, R_X	.61		.62	.59	

SOURCE: See Tables 4 and 7, N_W is the proportion of all adult males above the wealth value, W.

would be essentially first-generation Americans. The average class rung for native-born, $\overline{X}_{NB}$, is only 25 percent larger than the foreign-born average, $\overline{X}_{FB}$. If we limit ourselves to those in classes 2 through 6, we find the difference is 11 percent. One might maintain that these differences are not substantial and that wealth accumulation provided the avenue of escape for the progeny of foreign-born.

There are substantial differences in average rung levels among age groups. Figures demonstrating $\overline{X}_{age}$ patterns are given in Table 9. One would expect a linear relationship between $\overline{X}$ and adult age, *age* – *K*, because the binomial model would have an almost constant $P = P_{\Delta\, rung}$. As $N = age - K$ increases in $B(X,N,P)$, $\Delta\overline{X} = P$, since $\overline{X} = NP$. The best demonstration of linearity is the column for native-born. A plot of $\overline{X}_{age,\,NB}$ gives a satisfying verification of the model; the least-squares equation is $\overline{X}_{age,NB} = .0312\ [(.0024)]\ (age - 11.5), n = 9, R^2 = .96, 20 \leqslant age \leqslant 64$. The predicted slope from $(age - K)P$ would be 4.3 percent a year. The

TABLE 9 Average Class Status of Adult Males in the Ten Cities in 1860, Classified by Age and Nativity (Using $B(X, 15, .0434)$ in Establishing $X = 0, 1, \ldots, 6$ in the Wealth Ranges \$0; \$1-1,999; . . . ; \$1,180,000 and Up)

	The Average[a] Social Class, Value $\overline{X}$				
Age	*All*	*Native-Born*	*Foreign-Born*	*Nonfarmers*	*Farmers*
20-24	.20	.20	.21	.20	.18
25-29	.45	.45	.45	.44	.64
30-34	.64	.72	.58	.62	.98
35-39	.78	.94	.68	.76	1.24
40-44	.83	1.01	.72	.80	1.38
45-49	.96	1.12	.81	.93	1.33
50-54	1.00	1.19	.83	.99	1.27
55-59	1.09	1.34	.88	1.08	1.22
60-64	1.15	1.59	.72	1.06	1.68
65 and up	.96	1.12	.72	.82	1.48
20 and up	.662	.749	.589	.638	1.048

[a] The ten-city (county) rungs are established from $B(X, 15, .0434)$ such that $X = 0$ for $W = \$0$; $X = 1$ for W of \$1-1,999; $X = 2$ for \$2,000-17,999; $X = 3$ for \$18,000-93,999; $X = 4$ for \$94,000-381,999; $X = 5$ for \$382,000-1,179,999; and $X = 6$ for wealth of \$1,180,000 or more. The method of letting $N_W = N_X$ is described in Tables 4 and 8.

actual slope of .0312 rungs, expressed as a proportion of X_{NB} = .75, is 4.2 percent. This is excellent verification. The relative slopes for all persons of 3.3 percent and that for foreign-born of 2.2 percent are less than the expected 4.3 percent.

E. Social Classes of the Deceased

One might entertain the bold hypothesis that the social status of the deceased could be given to the progeny. The reason is that the wealth provides the means for status; it is, as a minimum, a proxy for attainment. One dying with $\bar{X}$ = 1.10 *rungs* might figuratively leave to each of three children a little over a third of a rung. He certainly makes it possible for them to avoid the zero class.

Social-class data for deceased can be obtained in an indirect fashion by using death rates. Age-specific death rates for persons in Massachusetts are available for the year 1865. These may be treated in probability terms in generating death distributions for 1860. The transformation for frequencies would be $freq_{dead,age}$ = $death\ rate_{age} \times freq_{living,\ age}$. When this is applied to the 1860 urban sample, the following results are obtained:

				$\bar{X}$			R_X		
	Number	*Age*	$P_{\$0}$	*All*	NB	FB	*All*	NB	FB
Living	456,687	36.3	.514	.662	.749	.589	.609	.621	.586
Deceased	6,860	42.3	.493	.729	.844	.624	.753	.782	.719

The number of adult deceased in the year was about 1.5 percent of the living population. Their average status relative to that of the living was (.729/.662) = 1.10. It could be asserted that the status value of the deceased was .0152 × 1.10 = .017 of the aggregate status of the living.

There is some rather meager evidence about growth in the status average over time. The growth in status points of 4.2 percent for the living is buoyed up in part by inheritances. Net growth might be .042 – .017, or 2.5 percent a year. If the population growth were not more than 2.5 percent, there could be growth per capita.

It has been determined that population in the ten counties was growing about 5 percent a year at that time.[5] Thus, it would be doubtful if there was per capita improvement in status. It should be remembered that we are dealing with the urban sector, and that this sector was strongly dominated by population growth.

F. Social Classes in the United States in 1860 and 1962

There are data available for the entire free population in the United States in 1860 and for all families in 1962. One could apply the binomial method to these data in a fashion similar to the method applied to the urban data. However, there is certainly no reason to believe that Warner classes are applicable to a labor force in 1860 which was half urban and half rural. It would be better to have wealth figures for the highly urban regions of the country. It is not the purpose of this paper to describe the United States data in any detail. Summary information is given in Charts 1 and 2 indicating that $B(c_1X^{5.1}, 35 - 20, .07)$ for 1860 and $B(c_2X^{4.8}, 45 - 20, .09)$ for 1962 are rough approximations. Better specifications for $X > 2$ are $B[c_3(3.1)^X, 35 - 20, .07]$ for 1860 and $B[c_4(2.8)^X, 45 - 20, .09]$ for 1962. The probability of advancement has increased a little but there is at least one more rung or super class. There is evidence of progress since $P_{\Delta rung}$ has increased. The have-nots constituted 33 percent of the population of all free men in 1860 and perhaps 10 percent of the population in 1962.[6] There has been an increase in the $X = 1$ class and probably the $X = 2$ class. The very elite at X of 7 and 8 in 1860 certainly has its counterpart[7] in 1962 at X of 9 and 10.

[5] The average annual percent of change in the number of adult males in the ten counties was 5.2 percent for the period from 1830 to 1860 and 4.5 percent for the period from 1850 to 1860.

[6] Dorothy S. Projector and Gertrude S. Weiss, *Survey of Financial Characteristics of Consumers* (Washington, D.C.: Federal Reserve Board, 1966) pp. 150, 151, 110; and John B. Lansing and John Sonquist, "A Cohort Analysis of Changes in the Distribution of Wealth," in Lee Soltow, ed., *Six Papers on the Size Distribution of Wealth and Income*, Vol. 33, Studies in Income and Wealth (New York: NBER, 1969) p. 42. Figures vary from 5 to 17 percent.

[7] Consider two possible bounds, $B(X,15,.01)$, representing a very stagnant society, and $B(X,15,.5)$, representing a very mobile society. The stagnant case for a manorial society of 100 men would have 86 men in the lower class, 14 in a lower-middle class and 1 lord in an upper-middle class. The stagnant

G. Summary

The most important figure revealed by study of 1860 urban wealth inequality is that 51.4 percent of the adult males were propertyless. Some might maintain that this lower-lower and upper-lower group provided the basis for the existence of other groups in the socioeconomic hierarchy. Indeed, a binomial model, $B(X, N, P)$, of the number of persons in the middle and upper classes can be constructed in which N is average adult age of 35 – 20 and P is the probability of escaping the propertyless class in a given year, or $1 - (.514)^{1/N} = .043$. The frequency distribution generated by this model conforms closely to that offered by W. Lloyd Warner for social classes in Yankee City in the 1930s. It is also determined that $B(cX^{5.6}, 35 - 20, .043)$ and possibly $B[d(3.9)^X, 35 - 20, .043]$ represent urban wealth distribution in 1860 where coefficients are related to inheritance and annual economic growth. The model is consistent with wealth classifications for specific age groups.

III. AN INCOME-WEALTH MODEL FOR THE TEN CITIES

It is intriguing to try to construct an income distribution and consumption function which would yield saving and wealth distributions similar to the wealth distribution in the ten cities in 1860. I have been successful in developing a model which achieves this feat, but admittedly the desired results may arise, at least in part, because of compensating errors. Yet the model is sufficiently interesting to be presented, because it adds the dimension of distribution to the concepts of income, consumption, saving, and wealth. The stakes are high since an urban income distribution for the entire labor force would materially enhance the study of one-hundred-year changes in income distribution; it would in some ways be more attractive than one for the entire urban-rural economy. Historical comparisons could be made without the confounding influence of the urban movement.

A. Requirements for the Model

What characteristics should the model have? We first have requirements for have-nots and various averages: (1) The model

society of 1,000,000 men would have $0 \leqslant X \leqslant 4$ with a Gini coefficient $R[B(X^5, 15, .01)] = .96$. The mobile society would have 16 classes with $R[B(X^5, 15, .50)] = .56$.

should have about 50 percent of the population with wealth and about 50 percent without wealth. This necessarily means that half the people do not have net saving from the time they enter the labor force until the point in time when they are part of a census of wealth. (2) It should yield an average income, $\overline{Y}$, of about \$500 (\$450 to \$550). Kuznets has found[8] that product per worker in the United States in 1860 was \$526. (3) The average propensity to save, $\overline{S}/\overline{Y}$, should probably not be larger than 21 percent. Kuznets has found gross domestic capital formation was 21 percent of GNP.[9] Perhaps the saving average per person might not be too far from \$100-\$120 per annum. Most saving studies have shown that the personal gross saving ratio does not fall too much short of 20 percent.[10] It seems reasonable that the ratio might be substantial if one includes capital gains and savings through consumer durables. (4) The saving-wealth ratio, $\overline{S}/\overline{W}$, might not differ greatly from 5 to 6 percent. This is because the interest rate on government bonds was 5 percent at the time.[11] The wealth average of the ten cities was \$2,346. This would indicate that $\overline{S}$ was at least \$115-\$120. (5) There should be some rough correspondence between the wealth-saving ratio, $\overline{W}/\overline{S}$, and adult age. This could be $\overline{W} \approx \overline{S}\ (\overline{age} - 19)$ if wealth and adult age are linearly related. The average age of adult males in the ten cities of 36.1 and average wealth in the ten cities of \$2,346 lead to the expression \$138(36.1 − 19) = \$2,346, where $\overline{S}$ of 138 is slightly larger than the indicated range in point 3. We are assuming that the individual would save in some linear fashion during his productive life. The scatter diagram of wealth values for *different* individuals in various

[8] Simon Kuznets, *Economic Growth and Structure* (New York: W. W. Norton, 1965) p. 305.

[9] Simon Kuznets, *Modern Economic Growth* (New Haven: Yale University Press, 1966), p. 237; House Document No. 94-64, Part 1, *Institutional Investor Study Report of the Securities and Exchange Commission* (March 10, 1971), p. 91. Gross saving of households, including capital gain dividends, savings through consumer durable purchases, and capital consumption allowances, amount to 22 to 23 percent of personal disposable income since 1950. See also *Federal Reserve Bulletin* October 1971, p. A73.3.

[10] Dorothy S. Projector, *Survey of Changes in Family Finances* (Washington, D.C.: Federal Reserve System, 1968), pp. 7-10. She finds a saving rate of 17 percent for 1963.

[11] Sidney Homer, *A History of Interest Rates* (New Brunswick: Rutgers University Press, 1963), pp. 286-88.

ages in 1860 does substantiate the general plausibilities of the linear hypothesis. We have[12]

A. All adult males $W = \$175\ (age - 22.9)$,
(14) $W/\bar{W} = .0747\ (age - 22.9)$

B. All with positive wealth $W = \$254\ (age - 13.0)$,
(30) $W/\bar{W} = .0526\ (age - 13.0)$

All native-born and all native-born with positive wealth have forms of .0680 (*age* − 21.6) and .0451 (*age* − 18.8).

We next have requirements about distribution of income, consumption or saving, and wealth. (6) It is often felt that income is distributed as a Pareto curve among the upper 30 to 50 percent of income recipients. The income (and wealth) distribution is sometimes thought to be log-normal in shape. We shall find that income distribution in 1970 and 1962 was of the Pareto form for approximately the upper 30 percent of income earners and was approximately uniform in distribution among the lower 70 percent of income earners ($N_Y = \alpha Y^{-b}$ for $Y > Q_{70}$ and $N_Y = \kappa Y$ for $0 \leqslant Y \leqslant Q_{70}$). Evidence will also be presented that income in the upper tail in the 1860s was of the Pareto form. (7) Almost all saving from income must come from upper-income groups if only half the individuals have wealth. The implication is that there is some threshold income, T, at about the median income, above which saving occurs. Perhaps a consumption function $C = T + d(Y - T)^E$ is appropriate above median income.[13] The distribution of saving resulting from the application of the consumption function

12 Standard errors from computer runs have been multiplied by the square root of (456,687)/(8,966) since regression equations were fitted to weighted sample items.

13 Consumption function data for 1874-75 and 1889-91 essentially have this form as do the consumption and income figures developed by the Federal Reserve wealth and saving studies of 1963. *Historical Statistics of the United States,* series C 315-316, 324-326; Projector, *Family Finances,* p. 9.

The threshold income, T, perhaps remained constant over time while incomes initially below T were increasing at a real rate of 1.3 percent per annum, a figure similar to the 1.4 percent growth rate found by Kuznets for per capita income in the period. Suppose that income is uniformly distributed below the median, that $P_{\$0,\ 1860\ U.S.\ free} = .33$ or slave-adjusted is $P_{\$0,\ 1860\ U.S.\ all} = .37$ and that $P_{\$0,\ 1962} = .10$. The implication is that incomes rise inversely as lower-tail frequencies decrease. The average annual percent of change is computed as $.37 = .10(1.013)^{1962\text{-}1860}$.

to income should have a relative distribution not materially different from wealth distribution; $R_S \approx R_W$ even though $R_S > R_Y$.[14] (8) The Gini coefficient of the derived wealth (or saving) distribution should be between .91 and .93 since the coefficient in 1860 was .92. This coupled with the requirement that $P_{\$0} = .5$ means that the Gini coefficient for those with wealth should be about $R_{\$1-} = (.924 - .514)/.486 = .846$. (9) Far more important than any overall measure that the model might have is the exacting necessity that the Lorenz curve of the wealth model (and probably the saving model) must be the same as that for actual wealth. The ($N_X = N_W, A_W$) points should be similar to those in Table 10 for wealth for the ten cities.

B. Income Distribution

The distribution of income among males in the United States in 1970 was of the Pareto form for about the top 30 percent of recipients and of a rectangular form for the bottom 70 percent of recipients. We are unable to state with certainty that this Pareto-rectangular form existed in 1860 for free men, because no complete income distributions for that period are extant.

Fortunately, there are some upper-tail income distributions available for Philadelphia in 1864, Milwaukee in 1864, Cleveland in 1865, and New York in 1863. These interesting figures purportedly include net income, as defined, to as low as an exemption level of \$600. In spite of deficiencies of coverage, it seems clear that these upper-tail data are of the Pareto type. This shape will be extended below \$600 to the point Y_{Nc} where frequency density is equal to that of uniform density from \$0 to Y_{Nc}. The resultant Pareto-rectangular forms are not precise, but this does not detract from their usefulness. It will be shown that the Philadelphia income density function, coupled with a con-

[14] Projector and Weiss in *Survey of Financial Characteristics*, p. 30, list inequality of wealth among consumer units in the United States in 1962-63 as yielding a Gini coefficient of .76. Projector in *Family Finances*, pp. 6, 52, 214, and 321, gives a distribution of saving which yields $R_S = .74$ if dissavers are considered as having zero saving. The Lorenz curves for wealth and saving are very similar in 1962-63.

Distributions of savings of urban wage earners in Ontario were estimated from samples for the years 1884 to 1889. These too are highly suggestive of urban wealth inequality (*Annual Report of the Bureau of Industries for the Province of Ontario, 1887*, Toronto, 1888, p. 61).

TABLE 10 Relative Wealth Distribution in the Ten Cities and Its Derivation from a Pareto-Rectangular Distribution of Income and Saving

(relative distribution (N_X, A_X), where N_X is the proportion of all cases above the variate X, and A_X is the proportion of all wealth, income, or saving above the variate X)

			The Pareto-Rectangular Model for (b; c; N) = *(.9; .473; 1,000)*	
			Saving From Income Where ($P_{\$1-}$; $T/\bar{Y}$) = *(.50; .39)*	
Proportion of Cases (N_X)	*Ten-City Wealth* (A_W)	*Income* (A_Y)	*(A_S for E = .97)*	*(A_S for E = .98)*
.001	.159	.099	.157	.158
.002	.224	.152	.238	.240
.005	.335	.240	.368	.371
.010	.452	.318	.418	.482
.020	.592	.405	.594	.597
.050	.769	.531	.747	.750
.100	.889	.635	.855	.857
.200	.968	.747	.945	.946
.300	.991	.816	.982	.983
.400	.998	.868	.996	.996
.500	1.000	.908	1.000	1.000
1.000	1.000	1.000	1.000	1.000
R	.924	.712	.912	.913
S / Y			.241	.172

SOURCES: See Tables 1 and 2. Consumption, C, is computed from $C = T + (Y - T)^E$, $S = Y - C$, for $Y > T$ and $C = Y$ otherwise. The Gini coefficient sumption function, leads to a saving function that is not materially different from relative wealth distribution in the ten cities and in Philadelphia.

The same income-saving-wealth patterns of density functions, leading to $R_Y < R_S \approx R_W$, exist with less exactitude in the cases of Milwaukee, Cleveland, and New York City. Finally, there is some evidence, based on tabulations for five and six income classes for all persons in the United States for each of the years 1866 through 1872, that the upper tail is of the Pareto type. Its extrapolation to the point Y_{Nc} can be coupled with a uniform distribution below Y_{Nc}. A consumption function with a threshold can be applied to the resulting income distribution in generating a saving distribution which fairly well duplicates the 1860 wealth distribution.

1. The Pareto-Rectangular Form. Suppose we have 1,000 persons with the top 473 conforming to a Pareto distribution from the highest income, Y_1, to the lowest income, Y_{473}, and the bottom 527 conforming to a rectangular (uniform) distribution from Y_{474} to Y_{1000}, where Y_{1000} is effectively zero. We need only the inverse of the Pareto slope, b, to generate the values in a recursive fashion.

$$
\begin{aligned}
& Y_1 \\
& Y_2 = Y_1\ (1/2)^b \\
& Y_3 = Y_2\ (2/3)^b \\
& \cdot \\
& \cdot \\
& \cdot \\
Y_{Nc} = {} & Y_{473} = Y_{472}\ (472/473)^b \\
& Y_{474} = Y_{473}\ (1{,}001 - 474)/(1{,}002 - 474) \\
& Y_{475} = Y_{474}\ (1{,}001 - 475)/(1{,}002 - 475) \\
& \cdot \\
& \cdot \\
& \cdot \\
& Y_{1000} = Y_{999}\ (1{,}001 - 1{,}000)/(1{,}002 - 1{,}000)
\end{aligned}
$$

If Y_1 = \$10,000, $b = .9$, and $c = .473$ in the Pareto portion of 473 items, then $\overline{Y}$ is calculated to be \$101, the Gini coefficient, R_Y, is calculated to be .712, and $Y_{473}/\overline{Y}$ is .39. The relative proportion of persons and income for this distribution are shown in Table 10. These could be fairly good representations of income distribution in the ten cities in 1860. Some other possibilities are:

Y_1	b	$c = \frac{b}{1+b}$	N–Nc	$\bar{Y}$	R_Y	$\frac{Y_{Nc}}{\bar{Y}}$	*Perhaps Realistic of Income Distribution of Males in:*
10,000	.9	.473	527	101	.712	.39	Ten cities, 1860
10,000	.7	.411	589	219	.582	.68	U.S., 1860
10,000	.4	.286	714	857	.422	1.21	U.S., 1970

Of crucial importance is the portion of the upper tail which is of the Pareto form. Fortunately there is a simple relationship between b and c which has appeal in the location of Y_{Nc}. We wish similar frequency density just above and below Y_{Nc} so that one distribution blends into the other. We then obviate any embarrassing discontinuity. This is achieved by letting $Y_{Nc} - Y_{Nc-1} = Y_{Nc+1} - Y_{Nc}$ in generating the N values. Thus $[Nc/(Nc-1)]^b = (N - Nc + 2)/(N - Nc + 1)$, and $c = b/(1 + b)$ when N is large. The greater is upper-tail concentration, the greater is b. The greater is b, the greater is c and the proportion in the Pareto sector. If concentration were relatively weak as in the case of $b = .4$, then only 28.6 percent would be in the upper tail. If it were very strong, then the Pareto portion approaches 50 percent. The maximum b will not usually be greater than 1 since the limiting slope[15] for a continuous density function is 1.0.

Percentile Range	*Share of Total Income in Range*		
	b = .9	b = .7	b = .4
90-100	.635	.481	.296
80- 90	.112	.140	.159
70- 80	.070	.096	.128
60- 70	.051	.076	.111
50- 60	.040	.063	.093
40- 50	.033	.052	.077
30- 40	.026	.040	.059
20- 30	.018	.029	.043
10- 20	.011	.017	.025
0- 10	.004	.006	.009
	1.000	1.000	1.000

[15] An extreme plutocracy might exist with a b of 1.0 or 2.0 and N = 1,000. Although many are in the Pareto sector, only a few would have almost

A decrease in b over time would mean that middle classes would gain relative to lower and upper classes. Consider the lowest, middle, and top third of people, using percentile ranges and $c = b/(1 + b)$. In going from $b = .9$ to $b = .4$, one notes that the poorest one-third would still receive a relatively small share, the middle one-third would have a dramatic increase to a share almost one-third of aggregate income, while the top group would lose; the break-even percentile would be between P_{90} and P_{92} with the top 10 percent losing one-half of its former share.[16]

2. ***Income in 1970 and a Slope, b, of .4.*** A plotting of the Pareto curve for males in 1970 reveals an upper tail that is a straight line with an inverse Pareto slope of about .4. We accordingly generate a model for $b = .4$ using an $N = 1{,}000$—a number sufficient to yield the figures in Table 11. The relative distribution from the model is adjusted to have a mean equal to that for male income in 1970 of $7,537. It is seen that there is remarkable similarity between $N_{Y,\,U.S.\ males,\,1970}$ and $N_{Y,b=.4}$. An alternative procedure for testing is to examine percentages of income held above various percentiles. Some of these results are:

N_Y	A_Y *for 1970*	A_Y *for* b = *.4*
.003	.029	.028
.022	.109	.113
.090	.245	.277
.267	.558	.543
.399	.710	.693
.547	.825	.825
.614	.890	.873
1.000	1.000	1.000

The same procedures were used in determining that the $b = .4$ model was quite appropriate in characterizing income in 1962, as reported by the Federal Reserve Board. The 1970 data are offered only as a preface.

all the income. It is a coincidence for $.9 \leqslant b \leqslant 1.0$ that $.473 \leqslant c \leqslant .499$ is similar to $P_{\$1-} = .489$ for the ten cities.

[16] This break-even point has been found for century changes in both Norway and Scotland. See Lee Soltow, "An Index of the Poor and Rich of Scotland, 1861-1961," *Scottish Journal of Political Economy* 18 (February 1971), p. 58.

TABLE 11 Income Distribution for the United States in 1970 and Pareto-Rectangular Models Adjusted to the Same Mean

	N_Y, *the Cumulative Proportion of Males above* Y		
		Pareto-Rectangular Models	
Y, *Income in 1970 (Lower Class Limit) (Dollars)*	*Males in 1970*	b = *.40* c = *.286* N = *1,000*	b = *.45* c = *.310* N = *1,000*
50,000	.003	.004	.004
25,000	.022	.023	.028
15,000	.090	.083	.087
10,000	.267	.229	.213
8,000	.399	.376	.346
6,000	.547	.532	.510
5,000	.614	.610	.592
4,000	.676	.688	.674
3,000	.744	.766	.755
2,000	.813	.845	.837
1,000	.896	.922	.919
0	1.000	1.000	1.000
$\overline{Y}$	\$7,537	\$7,537	\$7,537
R	.436	.422	.443

SOURCE: U.S., Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-60, No. 80, "Income in 1970 of Families and Persons in the United States" (Washington, D.C., October 1971), p. 89, income of males 14 and up with income. Computations of *R* were made using midpoints of classes to \$15,000 and then, \$19,000 and \$75,000. This gives a mean of \$7,810. The model for *b* = .40 also fits the income distribution for 1962 income presented in Dorothy S. Projector and Gertrude S. Weiss, *Survey of Financial Characteristics of Consumers* (Washington, D.C.: Federal Reserve Board, 1966), pp. 151, 149.

3. ***Philadelphia Income in 1864 and b = .9.*** Incomes for the year 1864 for Philadelphia, as reported on income tax returns, have been published in book form. They include net incomes where income is defined quite comprehensively.[17] I recorded all

[17] See G. S. Boutwell, *The Taxpayer's Manual* (1866), p. 156; Rufus S. Tucker, "The Distribution of Income Among Taxpayers in the United States, 1863-1935," *Quarterly Journal of Economics* 52 (1938): 547-67; J. B. Hill, "Civil War Income Tax," *Quarterly Journal of Economics* 8 (1894):414-52, 491, 498; Philadelphia incomes are given in *Income Tax of Residents of Philadelphia and Bucks County* (Philadelphia: 1865) and those for New York

incomes to \$5,600 and every fifth page for those incomes from \$600 to \$5,599. The estimated total number of returns above \$600 was 22,080 or 15 percent of the 145,172 males 20 years old and over in the county in 1860 (see Table 12).

A plotting was made of 648 points representing 580 incomes above \$20,600 and 68 classes from \$600 to \$20,600. A definite Pareto straight line appears with a slope b of about .9, but it is important to note that it does not extend methodically to the highest income at \$617,000. There is a definite leveling above \$50,000 (b is but .48 among the top 140 persons). The decision was made to fit a least-squares line to the 648 points, minimizing those at the top by weighting each point by its class frequency. This gives the equation $\log Y = 8.5749 - .9242 \log N_Y$, $r^2 = .98$. It was further decided to use a slope $b = .924$ and, since $c = .924/1.924 = .48 \approx .5$, to extend the distribution below \$600 to include half the total population. This gives a $Y_{Nc} \approx$ \$200; the remaining half of the cases below \$200 were distributed evenly[18] in 10 classes with a constant class interval of \$20.

The resulting distribution is shown in Table 12. The arithmetic mean of \$715 is relatively large, presumably because of the high average incomes of the wealthy persons in Philadelphia. This income becomes \$406 when adjusted to 1860 prices and the wealth-income ratio is \$2,679/\$406, or 6 to 1. The income figure is deemed to be too small on the basis of standards already suggested. This is due in part to the definition of income, which did not include salary from federal employment; rent from owner-occupied housing was allowed as a deduction. It is the *relative* distribution of income which will be important.

4. Milwaukee Income in 1864 and $b = .85$. Cards were punched for all of the reported 1,874 incomes above \$600 in Milwaukee County in 1864. Analysis again reveals that the Pareto-curve pattern terminates among the top 1/100 of 1 percent of the population, above \$30,000 in this case. There is a definite Pareto shape from \$30,000 to \$600 and the least-squares equation

are given in American News Co., *Income Record* (New York: 1865). Milwaukee County data are from the *Milwaukee Sentinel*, August 5, 1865, p. 1, and August 7, 1865, p. 1. Those for Cleveland and Cuyahoga County are from the *Cleveland Leader*, August 13, 1866, p. 4, columns 2-6. United States data are given in Lee Soltow, "Evidence on Income Inequality in the United States, 1866-1965," *Journal of Economic History* 29 (June 1969):279-86.

[18] If the \$600 extension were continued until all were included, the lower limit would be \$100 and the overall average would be raised by only \$17.

TABLE 12 Philadelphia Income in 1864 Above \$600 and Its Pareto-Rectangular Extension to \$0

(N_Y and A_Y are the proportions of persons and income above Y)

Y, *Income in 1864 (Lower Class Limit) (Dollars)*	*Philadelphia With Extension Below \$600*		*Pareto-Rectangular Models Adjusted to the Philadelphia Mean*			
			b = *.90*, c = *.473*, N = *1,000*		b = *.95*, c = *.487*, N = *1,000*	
	N_Y	A_Y	N_Y	A_Y	N_Y	A_Y
100,000	.00025	.060				
50,000	.00096	.13	.0016	.13	.0018	.17
25,000	.0030	.22	.0032	.20	.0036	.24
15,000	.0063	.31	.0056	.25	.0061	.30
10,000	.010	.37	.0088	.30	.0094	.35
5,000	.021	.47	.019	.40	.020	.45
2,000	.053	.61	.052	.54	.051	.58
1,000	.11	.72	.11	.65	.11	.68
600	.15	.77	.20	.75	.18	.76
200	.50	.99	.62	.95	.56	.94
0	1.00	1.00	1.00	1.00	1.00	1.00
$\overline{Y}$	\$716		\$716		\$716	
R	.766		.713		.742	

SOURCE: *Income Tax Residents of Philadelphia and Bucks County* (Philadelphia, 1865). The b = .90 model was generated from an initial $Y_1 = 10^7$; this gives a Y = 101,155. Each value was then multiplied by a factor \$716/101,155.

has a slope, b, of .849 and R^2 = .987. This pattern has been extended below \$600 to 50 percent of the cases at Y_{Nc} = \$176. This is coupled with a uniform distribution below Y_{Nc} in giving $\overline{Y}$ = \$458, R_Y = .702, and a population of 15, 897. The average income from the extrapolation is disappointingly small, but the relative distribution is highly suggestive of actual relative distribution.

5. Cleveland in 1865 and New York City in 1863. A sampling was made of the 1,577 reported incomes above \$600 in Cleveland in 1865. Results were combined in 68 classes which had an inverse Pareto slope of .863. Frequencies for New York in 1863 have been published for 9 income classes. A fitting to the seven points from \$600 to \$100,600 gives a slope of .928.

6. An Estimate of b = .9 for the Ten Cities. It seems that a slope of .9 might be appropriate as the parameter from which to build an income distribution. This is about the average one would obtain by weighting the Philadelphia b by the population of eastern cities and the Cleveland and Milwaukee b's by the population in the western five cities. In Table 12, the Philadelphia example for 1864 indicates that a model with a b of .92 or .93 might be better in terms of showing income dispersion if one uses an N of 1,000 in the model. It should be borne in mind that income in 1864 relates to a time after the 1860 date we wish to simulate.

C. Distribution of Saving

We now construct a distribution of saving which is remarkably similar to wealth distribution in 1860. This is done by assuming that the consumption function is $C = T + (Y - T)^E$ for $Y > T$, where C is consumption, Y is income, T is a threshold income below which there is no saving, and E is the elasticity of consumption with respect to income above the threshold. The value of T is placed at the median so that 50 percent save, the case for the ten cities. We also place a value of E at .97 or .98, so that the saving will be about 20 percent of income. The results in Table 10 quite adequately duplicate the distribution of wealth, presumably by having relative saving determine relative wealth.

The model is deficient in not explicitly dealing with age-specific groups. It would have been more challenging had we had an income distribution for each age group. Each in turn would have had its own consumption function and saving. Saving at various ages would be used to estimate long-run saving, and thus wealth accumulation at various ages. These groups would be combined, using population weights, in a grand wealth distribution for the ten cities. It is not possible to construct this model, since income data are not available for individual age groups. The author has constructed an interesting model of this type but assumptions about b_{age}, c_{age}, T_{age}, and E_{age} are questionable.

Our purpose has been to duplicate wealth distribution from income distribution, considering a saving function. The empirical evidence indicates that we have succeeded, and we shall now turn the procedure around.

D. *Income Derived from Wealth Distribution*

Wealth distributions for specific age groups are available. This means that it is possible to say something about income distribution where age is explicitly considered. The method we employ involves adjustment of wealth to saving and saving to income: (1) The wealth value of each individual in the ten-city sample is transformed into a saving figure, using $S = W/(age - 19)$. This involves the assumption that an individual saves the same amount in each of his adult years. Empirical verification of the reasonableness of this assumption has already been presented in the form of regression equations in wealth and age. Results of the transformation give:

Proportion of Men (N_X)	*Wealth Distribution,* $W = \$2,346$; $R_W = .932$ (A_W)	*Saving Distribution,* $S = W/(age - 19)$, $S = \$122$; $R_S = .917$ (A_S)
.001	.159	.157
.002	.224	.240
.005	.335	.368
.010	.452	.475
.020	.592	.589
.050	.769	.755
.10	.889	.875
.20	.968	.959
.30	.991	.988
.40	.998	.998
.50	1.000	1.000

The saving average is about 5 percent of the wealth average. (2) Each individual income value was determined from $Y = S + C = S + T + (Y - T)^E$ for $Y > T$. Those with zero wealth were assigned a $C = Y$ value between 0 and T in order to insure a uniform income distribution. Computer runs were made for various T and E and an accurate approximation method was used in determining Y from S. Some of these runs give results of:

	T=*0*	T=*100*	T=*200*	T=*300*
E=.96				
Mean=Y	$432	$506	$581	$655
S/Y	.28	.24	.21	.19
R_Y	.897	.799	.726	.669
E=.95				
Mean=$\overline{Y}$	$366	$440	$514	$588
S/Y	.33	.28	.237	.21
R_Y	.896	.783	.703	.643

The Kuznets income-saving requirement that $\overline{Y}$ be about $500 and that S/Y be about 20 percent means that income distribution probably had a concentration coefficient of about .70 to .73. Interesting income distributions have been obtained for specific age and urban-rural groups, but they are subject to assumptions of T and E.

E. The Saving and Income of Social Classes

What does the procedure for measuring saving and income from wealth tell us when we apply it to the Warner-Binomial social classes of the first section of the paper? Saving classified by binomial-wealth categories is not quite as strongly confined to the upper classes. Younger individuals with less wealth may save as much as older persons in higher wealth classes. Income is even more weakly related to social class as previously defined. One must have income and consumption to subsist, even though he does not save. It is not surprising that Warner found that amount of income was somewhat tenuously related to social class in his multiple regression equations.[19] We conclude with estimates of the

[19] Warner, Meeker, and Eells, *Social Class in America*, pp. 180-81.

various variables (Table 13). It is the upper social classes which have had the wealth and have done the saving in our urban society. Had it not been necessary for have-nots to consume all of their income, wealth distribution might have been income distribution and urban inequality would not have been so glaring.

F. Summary

A frequency distribution of wealth among males 20 years old and older in ten large cities in the United States in 1860 has been presented. It has been determined that there was extensive inequality, since the Gini coefficient of concentration was .92. Among these adult males, whose average age was about 35, was a propertied group constituting 48.6 percent of the population; 51.4 percent were essentially propertyless. This latter proportion is about that found by W. Lloyd Warner for the lower class in Yankee City in the 1930s. The probability of remaining propertyless in a given year of adult experience was about $(.957) = (.514)^{1/(35-20)}$. The probability of escape averaged 4.3 percent. It is found that the binomial probability distribution $B(X,N,P) = B(X,35-20, .043)$ yields a distribution of social classes very similar to that found by Warner for the lower-middle, upper-middle, lower-upper, and upper-upper classes. It is further determined that $B(cX^{5.6}, 35-20, .043)$ is a good representation of the 1860 distribution of wealth. The model holds well for specific age groups. Thus, knowledge of the proportion of people with no wealth is central and consistent with describing distribution among those having wealth. The magnitude of the lower class seems to govern the number of higher classes; low mobility means few classes and very large relative inequality of wealth.

A second model has been based on how saving, established from a Pareto-rectangular income distribution, could quantitatively determine the 1860 wealth distribution. Models of incomes distributed in Pareto fashion above the median and in rectangular fashion below the median seem to fit the available empirical data for all males in 1970 and for upper income groups in the 1860s. The model with an inverse Pareto slope of .9 can be coupled with an orthodox consumption function in deriving a density function of saving whose relative distribution is quite similar to that of wealth distribution in the ten cities in 1860. This procedure is

TABLE 13 Wealth, Saving, and Income Shares of Social Classes in the Ten Cities in 1860

Class Rung, X	*Cumulative Frequency,* N_X	*Cumulative Percent of Wealth,* A_W	*Cumulative Percent of Saving,* A_S	*Cumulative Percent of Income,* A_Y	
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
7	.000001	—	—	—	—
6	.000022	.017	.014	.007	.008
5	.000320	.086	.059	.033	.036
4	.003120	.276	.207	.124	.137
3	.025500	.639	.514	.354	.391
2	.146000	.938	.911	.679	.735
1	.486000	1.000	1.000	.900	.929
0	1.000000	1.000	1.000	1.000	1.000
Mean		$2,346	$122	$514	$543

NOTE:
(2) These are obtained from the W limits of Table 8. There is bunching.
(4) Each sample item is transformed with $S = W/(age - 19)$.
(5) The equation $Y = S + T + (Y - T)^E$ is employed for $Y > T$, where $E = .95$ and $T = 200$.
(6) Here $E = .97$ and $T = 150$.
SOURCE: See Table 8.

elaborated further in making estimates of saving and income for Warner-Binomial social classes. It is the relatively small number in the upper classes who accumulate the wealth, and who have performed almost all of the saving function in American urban society of the past.