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Availability of Kin and the Demography of Historical Family Structure

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Dimensions of the Problem

In 1965, Marion Levy called for the development of models to aid in understanding the relationship between demographic conditions and extended family structure. He observed that "actual construction of the demographic models involved appears to be an interestingly complex matter," a comment that has proven to be an understatement.[1]

A great deal of variation in family structure is a product of variation in demographic conditions. The frequency and timing of births, deaths, and marriages in a population determine the number and characteristics of kin available for coresidence. This pool of available kin provides the context within which residence decisions are made. Accordingly, attempts to account for differentials of family structure must weigh the influence of demographic factors on residence patterns.

This research was prompted by an interest in the effects of demographic changes on the frequency of extended families during the eighteenth and nineteenth centuries. Contrary to the predictions of mainstream sociological theory, the percentage of extended families *increased* in England in this period. At the same time, there were dramatic changes in demographic conditions. I wanted to know the extent to which the rise of the extended family could be explained in demographic terms.[2] For example, it has been suggested that the relatively low frequency of three-generation families in Northwestern Europe prior to the industrial revolution was a consequence of early death and late marriage—some parents died before their children were married, and many others died shortly thereafter. Under these conditions, only a relatively small percentage of parents would have living grandchildren with whom they could reside.[3] Rising life expectancy and declining age at marriage in the nineteenth century may have relaxed this demographic constraint on three-generation families.

Thus, changes in family structure may have been dictated more by demographic imperative than by economic or cultural factors. The present paper proposes a strategy for estimating the influence of demographic factors on the frequency of extended families and applies this strategy to the demographic experience of the West during the past two centuries.

There are other historical issues that call for analysis of the effects of demography on family structure. Regional differences in historical family structure can result from variation in demographic conditions. Before the industrial revolution, extended families were more frequent in Eastern and Southern Europe than in Northwestern Europe. This pattern is at least partly explainable in terms of earlier marriage and higher fertility in Eastern and Southern Europe, which provided greater opportunities to form extended families.[4]

The importance of demography for family structure is not limited to historical studies of extended living arrangements. Demographic factors are largely responsible for changes in family structure over the life course. The percentage of thirty-year-old women who live with their married daughters is always very small, not because thirty-year-old women have any special aversion to living with their married daughters, but because very few thirty-year-olds *have* married daughters. Similarly, people in their sixties infrequently reside with their grandparents, and pre-adolescents seldom reside with their parents-in-law.

In addition, demographic constraints and opportunities influence family structure because they determine the frequency of "unattached" individuals in a population. In the nineteenth century, widows, widowers, older bachelors and spinsters, and orphans were much more likely to reside with extended relatives than was the rest of the population because they had no nuclear family with whom they could reside. In recent years, such unattached individuals have tended to reside alone.

Either way, the frequency of unattached individuals has important consequences for family structure. Such demographic factors as age structure, age at marriage, marriage rates, and age intervals between spouses dictate the frequency of unattached individuals in a population.

In each of these examples, the demographic mechanism operates by determining the characteristics of the pool of available kin. Our concern, then, is with those demographic factors which can determine entry into or departure from the kin group. Thus for the most part my discussion is limited to demography in the narrowest sense: specifically, as employed in this paper, demography refers to those variables most directly connected with the frequency and timing of births, deaths, and marriages.

These particular demographic factors are not necessarily the most important determinants of household structure. Other demographic factors—such as migration and race—also exert considerable influence.[5] Moreover, living arrangements are profoundly affected by residence decisions based on economic and cultural considerations such as family economies, inheritance systems, and social norms. In order to uncover the ways in which these broader demographic and non-demographic factors affect family structure, we must distinguish the basic demographic context in which residence decisions are made. If we are interested in family structure because it provides a means of assessing social behavior, then it is crucial that we determine what kinds of living arrangements are demographically feasible.

The Calculation of Residential Propensities

Daniel Scott Smith has emphasized the importance of filtering out the effects of purely demographic factors in order to analyze the independent influence of economic and cultural conditions. He argues that family structure should ideally be measured according to the "propensity" of individuals to reside with their relatives.[6] "Propensity" is defined as the extent to which individuals who have the demographic possibility of residing with a given set of kin actually do so. For example, instead of measuring the percentage of the population that lives with its grandchildren, we should measure the percentage of grandparents who live with their grandchildren. The use of propensities allows us to measure family structure relative to the population at risk of residing with a given set of kin.

The determinants of family structure can be broken down into two categories. First, there are the demographic factors, narrowly conceived. This includes all of those variables that can affect the frequency and characteristics of living kin available for coresidence. The second category consists of everything else; it encompasses all influences on family structure which are not a function of the structure of the pool of available kin. Hereafter, this second category is referred to as residential preferences. This term should not be taken to imply volition; in some cases, residential preferences as defined here may be involuntary. Residential propensities are a measure—albeit an imperfect one—of residential preferences.

Measuring family structure in terms of residential propensities automatically accounts for the main effects of demographic factors. Demography affects family structure by determining the structure of the kin group; measurement by residential propensities means measurement relative to the pool of available kin. By restricting ourselves to the population at risk of residing with a given set of kin, we shift our focus from an experiential description of residential patterns to analysis of residential preferences. If we wish simply to describe the living arrangements of people in the past as a means of reconstructing daily life, then measurement by propensities is not necessary; we need only measure the overall percentage of the population residing in each type of household. If we wish to go beyond description and analyze the reasons why people made their residence decisions, then we must isolate the overarching effects of demography on the kin pool. The use of residential propensities frees us to investigate the economic and cultural reasons why people adopted particular living arrangements.

Smith does not suggest a practical means of measuring living arrangements in terms of propensities, and it is not a simple task. The measurement of family structure in terms of propensities requires knowledge of the potential living arrangements of each individual. We must know in particular what kinds of relatives existed —both inside and outside the household—with whom each individual could reside. Although historical sources tell us much about family structure within the household, they generally provide little direct evidence about kin relationships outside the household. Thus, to take Smith's example, we ordinarily have no direct means of measuring the percentage of elderly who were grandparents. In order to better interpret data on family relationships within the household, we must obtain information about kin groups generally.

The characteristics of kin groups in a population are a function of demographic conditions. Therefore, even though we cannot directly measure the availability of kin in most historical contexts, we can infer a great deal about kin groups as long as we know enough about demographic conditions. In order to draw such inferences, we must calculate the relationship between demographic parameters and kinship patterns. To carry out such a calculation, we need to construct a demographic model of kinship.

Several demographers have devised models to assess the effects of demography on extended family structure. These models have not, for the most part, proven to be

very useful. David Glass, E. A. Wrigley, and others have constructed simple analytic models to estimate the effects of demographic conditions on the frequency of three-generation families, but the methods are too crude to provide more than a rough indication of magnitude. For example, Wrigley's model assumes that all married couples were 40 years old and all their parents were 72. Glass, on the other hand, assumes that all parents had six children, all of whom were born when both parents were 30, and all six children had their first child at 25. As Glass himself observed, "life is not like that"; we need something a bit more sophisticated.[7]

Demographic microsimulation is a strategy versatile enough to achieve that sophistication. The broadest definition of simulation would include all attempts to mimic reality; the term has been applied to models of such diverse phenomena as the outbreak of World War I and the process of photosynthesis. But a demographic microsimulation is a fairly specific kind of model. It is demographic because it models the occurrence of births, deaths, and marriages. It is microsimulation because these events are modeled at the individual level rather than at the level of groups. The model assigns demographic events to individuals in order to build up life histories. The allocation of vital events to individuals is governed by predetermined probabilities in accordance with such characteristics as age, sex, and marital status.[8]

I have developed a demographic microsimulation model to estimate the availability of kin given a specific set of demographic conditions. In particular, the model can generate the proportion of individuals of each age, sex, and marital status who would have living kin or combinations of living kin of specific types. The types of kin generated by the model include maternal and paternal grandparents, parents, parents-in-law, aunts, uncles, aunts-in-law, uncles-in-law, spouses, siblings, siblings-in-law, cousins, children, children-in-law, nieces, nephews, nieces-in-law, nephews-in-law, and grandchildren. These relational categories can be further broken down by age, sex, and marital status. I will forgo a description of the mechanics of the model; it is quite complex, and my main purpose here is to discuss techniques for interpreting the results.[9]

If we possess detailed information about the living arrangements and demographic conditions of a population, my simulation model allows us to calculate detailed residential propensities. The calculation of propensities for specific types of kin is illustrated in Tables 1 through 3. Table 1 is a fragment of output produced by the model; it shows estimates of the availability of sisters and grandsons in the United States in 1900. The United States in 1900 was chosen because excellent data on both demographic conditions and living arrangements are available. These figures represent the approximate percentage of persons in 1900 who had extended kin of particular types available for coresidence.[10]

TABLE 1
Percentage of Individuals with Available Kin of Selected Types, United States 1900*

Age	Single	Married	Widowed
	Sisters of Head		
0-9	1.44%	0.00	0.00
10-19	8.34	1.13	0.07
20-29	8.17	15.62	0.84
30-39	4.26	29.72	2.92
40-49	1.65	29.50	4.29
50-59	1.74	16.26	5.11
60-69	0.36	6.60	4.16
70+	0.10	1.36	1.85
	Grandsons of Head		
0-9	10.66%	0.00	0.00
10-19	5.34	0.13	0.00
20-29	1.28	1.03	0.00
30-39	0.05	0.43	0.00

* See note 10.

From the census, we can measure the proportion of persons in 1900 who resided in families which actually contained particular types of extended kin. These figures are contained in Table 2. Note that all of the figures are low, especially those for married and widowed sisters and grandsons.

Table 3 shows the propensities to reside with specific types of sisters and grandsons—that is, the percentage of persons who could have resided with an extended rel-

TABLE 2
Percentage of Individuals Actually Residing with Kin of Selected Types, United States 1900

Age	Single	Married	Widowed
	Sisters of Head		
0-9	0.067%	0.000	0.000
10-19	0.418	0.000	0.000
20-29	0.657	0.078	0.087
30-39	0.472	0.067	0.081
40-49	0.375	0.034	0.066
50-59	0.188	0.037	0.074
60-69	0.121	0.070	0.032
70+	0.066	0.000	0.041
	Grandsons of Head		
0-9	2.580%	0.000	0.000
10-19	1.015	0.009	0.000
20-29	0.154	0.027	0.000
30-39	0.006	0.000	0.001

ative of the indicated type who actually did so. These figures are derived by dividing Table 2 by Table 1. The highest propensity shown is for elderly never-married sisters. Of course, very few family heads had single elderly sisters available for coresidence, so this figure is not especially important for the determination of household structure. The relatively high propensity to reside with more numerous young never-married grandsons and sisters carries much more weight.

A fuller set of residential propensities for 1900 is given in Table 4. The minor kin types—such as aunts, uncles, and cousins—have been omitted because the propensities to reside with such relatives are uniformly low and thus have little impact on family structure. A number of patterns in Table 4 deserve mention. Most important, the propensities to reside with married kin are uniformly low compared with the propensities to reside with single and widowed kin. Typically, the propensity to reside with unattached kin is tenfold or more the propensity to reside with married kin of the same type, age, and sex; thus, the proportion of adult unattached individuals in the population is clearly an important in-

TABLE 3
Propensities for Individuals to Reside with Available Kin of Selected Types, United States 1900 (Table 2 divided by Table 1)

Age	Single	Married	Widowed
	Sisters of Head		
0-9	4.65%	0.00	0.00
10-19	5.01	0.00	0.00
20-29	8.04	0.50	10.31
30-39	11.08	0.22	2.80
40-49	22.75	0.11	1.53
50-59	10.81	0.23	1.47
60-69	33.74	0.10	0.79
70+	65.71	0.00	2.26
	Grandsons of Head		
0-9	24.21%	0.00	0.00
10-19	19.01	6.89	0.00
20-29	12.05	2.61	0.00
30-39	11.62	0.00	1.45

TABLE 4
Residential Propensities for Major Kin Groups in 1900 (Percentages of those persons who could have resided with a given type of extended kin who actually did so)

Age of siblings of head	Brothers			Sisters		
	Single	Married	Widowed	Single	Married	Widowed
0-9	6.1%	(0.0)	(0.0)	4.7	(0.0)	(0.0)
10-19	5.6	(0.0)	(0.0)	5.0	0.0	(0.0)
20-29	6.4	0.8	(8.6)	8.0	0.5	(10.0)
30-39	4.8	**0.2**	(2.7)	11.1	**0.2**	2.8
40-49	4.8	**0.2**	2.6	22.8	**0.2**	1.5
50-59	4.8	0.1	1.9	10.8	0.2	1.5
60-69	8.3	0.0	3.3	(33.7)	0.1	0.8
70+	(13.8)	0.0	1.9	(65.7)	0.0	2.3
Age of siblings-in-law of head	**Brothers-in-law**			**Sisters-in-law**		
	Single	Married	Widowed	Single	Married	Widowed
0-9	0.8%	(0.0)	(0.0)	(1.2)	(0.0)	(0.0)
10-19	2.2	(0.0)	(0.0)	3.9	1.3	(2.8)
20-29	3.2	0.8	(0.0)	4.5	0.9	2.1
30-39	2.2	**0.4**	(6.8)	7.3	**0.2**	0.7
40-49	1.8	**0.2**	2.2	16.4	**0.1**	1.8
50-59	4.4	0.2	(1.6)	(10.8)	0.1	1.6
60-69	(6.5)	0.3	(2.9)	(26.8)	0.1	0.7
70+	(27.3)	(0.8)	(1.9)	(29.4)	(0.1)	(5.0)

Note: Categories of relatives for which the availability of kin is under 1 percent are shown in parentheses; for these kin types, coresidence will tend to be low even if propensities are high. By contrast, categories of relatives for which the availability of kin reaches 20 percent--which are more likely to have important effects on family structure—appear in boldface type.

(Table continued on next page.)

TABLE 4 (Continued)

Age of parents of head	Fathers			Mothers		
	Single	Married	Widowed	Single	Married	Widowed
40-49	—	1.5%	(12.8)	—	2.6	(28.4)
50-59	—	1.1	(3.4)	—	1.8	17.3
60-69	—	1.8	8.6	—	3.4	14.4
70+	—	3.2	17.3	—	3.2	20.4
Age of parents-in-law of head	**Fathers-in-law**			**Mothers-in-law**		
	Single	Married	Widowed	Single	Married	Widowed
40-49	—	0.5%	(10.9)	—	1.2	(11.6)
50-59	—	0.6	4.6	—	0.7	8.8
60-69	—	0.8	7.0	—	1.6	12.2
70+	—	2.7	13.0	—	2.5	16.1
Age of grandchildren of head	**Grandsons**			**Granddaughters**		
	Single	Married	Widowed	Single	Married	Widowed
0-9	24.2%	(0.0)	(0.0)	24.1	(0.0)	(9.6)
10-19	19.0	(6.9)	(0.0)	19.1	(2.4)	(11.1)
20-29	12.1	2.6	(0.0)	(13.0)	1.4	(11.1)
30-39	(11.6)	(0.0)	(1.5)	(11.0)	(0.0)	(0.0)
Age of nephews/nieces of head	**Nephews**			**Nieces**		
	Single	Married	Widowed	Single	Married	Widowed
0-9	**0.6%**	(0.0)	(0.0)	**0.6**	(0.0)	(0.0)
10-19	**0.9**	0.0	(0.0)	**0.9**	0.0	(0.0)
20-29	**0.5**	**0.0**	(0.0)	**0.6**	**0.0**	0.0
30-39	0.3	**0.0**	0.0	0.4	**0.0**	0.1
40-49	0.2	**0.0**	0.0	1.5	**0.0**	0.1

Note: Categories of relatives for which the availability of kin is under 1 percent are shown in parentheses; for these kin types, coresidence will tend to be low even if propensities are high. By contrast, categories of relatives for which the availability of kin reaches 20 percent—which are more likely to have important effects on family structure—appear in boldface type.

fluence on the extent of family extension. In addition, the residential propensities tend to be higher for female kin than for male kin, and the head's blood relatives are more likely to coreside than are in-laws. Age of kin is also related to residential propensities. For siblings, siblings-in-law, parents, and parents-in-law, the highest propensities tend to cluster in the oldest age groups. High propensities also occur, however, for parents and parents-in-law who are unusually young.

A critical point, for the present purpose, is that there is tremendous variation in propensities with age, marital status, and type of kin. These characteristics are highly sensitive to variation in demographic conditions. For example, in a population with early marriage, the frequency of single kin will be lower than in a population characterized by late marriage. The propensity to reside with single kin—at least in 1900—was much greater than the propensity to reside with married kin. Therefore, in order to capture the full impact of demography we must keep track of the marital status of kin. More broadly, propensities should be calculated for narrow subgroups of kin, broken down by demographic characteristics as well as type of relative; it is not adequate simply to measure the propensity to reside with extended kin in general.

The detailed propensities for 1900 constitute a useful index of residential preferences. Unfortunately, we cannot calculate residential propensities for the period before the late nineteenth century because sufficiently detailed demographic and residential data are not available. Even if it were feasible to calculate detailed residential propensities for the preindustrial period, that would not constitute an effective answer to the questions that prompted this research. In their raw form,

residential propensities cannot tell us the extent to which demographic change could explain change in family structure.

The Standard Propensities Approach

The residential propensities provide a measure of family structure with the demography removed. By themselves, the propensities cannot tell us about the role of demography. We need to put the demography back in and boil down these detailed figures into a form that is conceptually accessible and that focuses on those kin relationships which are most significant.

In order to distinguish the role of demographic change from the role of changing residential preferences, we must isolate the independent effects of each of these two factors. Demographic conditions and residential preferences change simultaneously. Together they produce the observed changes of family structure. By asking how demographic change affects family structure, we are implicitly asking how family structure would have changed if residential preferences had remained constant, but demographic conditions had varied.

The residential propensities from 1900 can be employed as *standard* propensities. By standard propensities, I mean a set of residential propensities which are used to define a constant relationship between the availability of kin and residential patterns. By combining a set of standard propensities with data on availability of kin corresponding to alternate demographic conditions, we can infer—at least approximately—the influence of demographic changes. Thus, standard propensities can be used as a yardstick for assessing the independent role of demography in determining residence patterns. The use of standard propensities allows us to calculate what aggregate family structure would have been like under varying demographic conditions if residential propensities had been constant and had conformed to those of the standard population.

We can calculate the availability of specific types of kin under differing demographic conditions. As demographic conditions change, so does the distribution of available kin of different types. In terms of extended family structure, some types of kin—such as widowed mothers—are much more important than others—such as cousins. In order to assess the overall effect of changing availability of kin on the frequency of extended living arrangements, we can adopt a standard set of weights which reflects the relative importance of each kin type in the standard population. This is the purpose of standard propensities. They can be viewed as a means of systematically weighting specific kinds of kin in order to derive meaningful summary measures of the effects of demography on family structure.

The use of standard propensities to evaluate the effects of varying demographic conditions on family structure is analogous to the use of a price index to assess inflation. A price index is a summary measure of the prices for a group of commodities. Prices do not change uniformly, and not all commodities are equally important. In order to compare the general level of prices across time, we adopt a standard set of weights for different commodities according to their relative importance. The imposition of a standard set of weights is unrealistic, since the relative importance of different commodities is constantly changing. But the distortion is inescapable. In the real world, both the distribution of prices and the distribution of consumption of commodities are in constant flux. If we did not adopt a standard set of weights reflecting the relative importance of different commodities, we would be unable to disentangle the effects of changing prices from the effects of changing consumption patterns.

My use of standard propensities is also comparable to the use of direct standardization of age structure to compare death rates between populations. In order to distinguish the effects of differences in the age distribution from the effects of differences in the level of mortality, we make the counterfactual assumption that the populations have an identical age distribution. If the standard age distribution is inappropriate and the populations differ radically in their age pattern of mortality, direct standardization can yield highly misleading results. Standardization does not, therefore, uncover the pure differences of mortality with the intervening factor of age structure removed. Nevertheless, the use of a standard set of weights does allow us at least to get a handle on the problem.

The same generalizations apply to the use of standard propensities for analyzing the effects of demographic change on family structure. To isolate the role of demography we must assume constant propensities. Just as in the case of price indices or direct standardization, however, there is a catch: residential propensities were not really constant. Moreover, the propensities themselves are to some extent a function of demographic conditions.[11] This is a potential source of bias. We should bear in mind, however, that the same potential error exists whenever social scientists hold one or more variables constant in order to assess the independent effects of another variable.

I developed the standard propensities approach with a specific problem in mind: I wanted to determine the implications of demographic changes of the past two centuries for the frequency and characteristics of extended families. My strategy is to calculate what family structure would have been like in the preindustrial period and in the mid-twentieth century if residential propensities had not changed and always remained the same as they had been in the United States in 1900. At present, this is about as close as we can come to isolating the effects of demographic change on extended family structure. I am

not assuming that propensities were in fact constant; indeed, if the propensities were really constant, there would be no need to undertake this analysis, since all changes in family structure would necessarily be a function of demographic change. Moreover, this strategy can provide insight into the changes in residential propensities that did occur. By comparing the hypothetical family structure which would have occurred under constant residential propensities with the observed family structure of the past two centuries, we can infer much about the ways in which residential preferences must have changed.

The standard propensities approach contrasts sharply with previous strategies for analyzing the interaction of demography and family structure. Earlier models—most importantly the work of K. W. Wachter and E. A. Hammel—have relied upon the use of hypothetical household residence rules.[12] These rules are hypotheses about residential preferences which are plugged into a model to see what effect they have. Individuals within the simulated population are assigned to households on the basis of the postulated rules. In general, the rule systems have been designed to maximize the frequency of stem families or three-generational families.

I have elsewhere devoted considerable space to discussion of the limitations of hypothetical rules as a strategy for understanding the interaction of demography and family structure.[13] Here, I confine my comments to the points of similarity and difference between hypothetical rules and standard propensities. Hypothetical rules are simply a means of systematically describing a set of residential preferences. Given a constant set of residence rules, one can vary the demographic parameters of a model in order to see how family structure would be affected. Standard propensities are also a means of describing residential preferences, and the strategy of analysis is similar. But the propensities are not designed to maximize any particular type of family, such as three-generation families. Standard propensities may be viewed as a sort of probabilistic set of residence rules. Unike residence rules, however, standard propensities are empirically based.

The adoption of any standard set of residential preferences is a distortion. The more stylized the assumed standard is, the greater will be the risk of misleading results. This generalization holds for the examples of price indices and standardization of demographic rates as well as for the standardization of residential preferences.

In fairness, hypothetical rules are not intended to be realistic. Rather, they are designed to test specific hypotheses about residential behavior. These hypotheses assume uniform behavior with regard to residence decisions. Real populations are not so consistent. The use of hypothetical rules can provide insight into the interaction of demography and family structure, but only in the abstract context of unrealistic residential preferences. If our goal is to assess the impact of demographic factors on family structure in the real world, our description of standard residential preferences should be as realistic as possible.

An Application of Standard Propensities

Standard propensities are a powerful analytic technique. The utility of the method is best illustrated by example. The procedure for calculating what family structure would be like if we combined the standard propensities from the United States in 1900 with demographic conditions corresponding to a different time and place is fairly straightforward. First, we calculate the residential propensities for the standard population, as described above. Next, we run the model using alternate demographic parameters. This will yield data on the proportion of persons in the alternate population with available kin of each type, age, sex, and marital status. These figures are then multiplied by the corresponding standard propensities from 1900. The products represent the proportion of the population which would have resided with each specific type of kin if propensities had remained constant.[14]

Table 5 shows the alternate demographic parameters which I chose for this example, together with the demographic parameters for the standard population. The parameters of the 1900 standard population are labeled STD. The PRE parameters, which mimic the demographic regime of England in the first half of the eighteenth century, include relatively late marriage, a high proportion never marrying, and moderately high fertility and mortality.[15] The MOD parameters are a rough approximation of demographic conditions in mid-twentieth century Western industrial societies: low fertility, low mortality, and moderate age at marriage.

The results of the standard propensities analysis are shown in Table 6. The figures in the first column outline

TABLE 5
Basic Demographic Parameters for Simulation Runs

Name of run	PRE	STD	MOD
Median female age at marriage	25.2	22.2	22.2
Median male age at marriage	26.1	25.0	24.3
Mean age interval between spouses	2.1	4.0	2.5
Mean age at childbirth for women surviving to age 45	34.7	31.3	29.6
Percentage of women never married at 40	14.1	8.6	7.5
Female expectation of life at birth	34.8	48.3	76.7
Male expectation of life at birth	32.5	44.7	73.4
Total fertility rate	4.62	3.79	2.51

TABLE 6
Simulation Runs: Measures of Family Structure Assuming 1900 Standard Propensities

Name of run	PRE	STD	MOD
Percentage of individuals residing in:			
Extended families	12.8	21.0	22.2
Vertically extended families	5.3	11.9	15.3
Horizontally extended families	8.4	11.1	9.3
Percentage of individuals residing with kin, by kin's relation to head:			
Siblings	3.7	4.8	4.0
Siblings-in-law	2.8	3.6	3.0
Nephews/nieces	2.6	3.4	2.8
Uncles/aunts	0.3	0.5	0.6
Parents	2.7	4.2	4.7
Parents-in-law	1.8	2.9	3.3
Grandchildren/children-in-law	1.2	5.0	7.5
Percentage of individuals residing with kin, by kin's sex and marital status			
Single males	3.4	8.0	7.7
Married males	0.8	1.7	2.6
Widowed males	1.5	1.9	1.7
Single females	6.7	8.3	9.2
Married females	1.0	1.9	3.0
Widowed females	2.9	5.3	4.1
Percentage of individuals residing with kin, by kin's age group:			
0–9	1.7	4.6	5.3
10–19	2.1	4.5	4.3
20–29	2.6	3.8	3.6
30–39	2.6	2.1	2.3
40–49	1.7	2.3	2.1
50–59	1.0	1.8	1.2
60–69	1.9	2.9	3.1
70+	2.9	4.7	6.4

the family structure that would result in a population that shared the PRE demographic conditions and the residential propensities characteristic of the United States in 1900. The STD run—which reflects the actual demographic conditions of 1900—is shown in the second column for purposes of comparison.

The top row of Table 6 shows the percentage of persons that would have resided in extended families given the demographic conditions shown in Table 5 and the residential propensities shown in Table 4. These figures indicate that the demographic conditions in England before 1750 profoundly discouraged extended family structure. Overall, if there had been no differences in residential propensities, only about 13 percent of the eighteenth-century population would have resided in extended families, compared with 21 percent in 1900.

The results from the PRE and the STD runs are consistent with the interpretation that there was no change in residential propensities over the course of a century and a half. According to this reasoning, the rise of the extended family in the nineteenth century was entirely a consequence of demographic change.

Although the simulation results indicate that pre-industrial demographic conditions discouraged the formation of extended families, these findings are not necessarily incompatible with a hypothesis of changing residential preferences. Between the first half of the eighteenth century and the close of the nineteenth century, there may have been radical changes in the patterns of residential propensities which tended to cancel each other out. Under these circumstances, the empirically observed frequency of extended families might still be similar to the frequency produced by the model under the assumption of constant propensities.

Clues to whether residential propensities actually underwent significant change may be gleaned from the more detailed breakdowns near the top of Table 6. The second and third rows of the table provide a measure of the specific types of extended families which would occur under each demographic regime. Vertical extension is defined here as residence with parents, parents-in-law, children-in-law, or grandchildren; horizontally extended families contain other types of extended kin.

Most of the difference in the overall frequency of extended families between the PRE and the STD runs results from variation in the prevalence of vertical extension. Only 5 percent of persons would reside in vertically extended families under the PRE demographic conditions, compared with 12 percent in the STD run. The low frequency of vertically extended families in the PRE run is a consequence of both late marriage and early death.

The variation in horizontal extension shown in Table 6 is less dramatic. Demographic effects on family structure often cancel one another out. In this case, pre-industrial late marriage and high percentage never marrying encouraged horizontal extension by increasing the frequency of unattached individuals. At the same time, early death decreased the availability of horizontal kin generally. As a result, the difference between the two runs in the frequency of horizontal extension is smaller than the difference in vertical extension.[16]

Only a few statistics on the relative frequency of vertical and horizontal kin are available for the pre-industrial period. None of these data is comparable in form to the statistics produced by the simulation, so only cautious comparison is justified. The best data available suggest that the proportion of vertically extended kin, relative to all extended kin, was somewhat lower before 1750 than in the late nineteenth century. This is consistent with the interpretation that demographic factors were the main source of changes in extended family structure.[17]

The third column of Table 6 shows the patterns of extended family structure which would result in a population with both the MOD demographic conditions and the residential propensities of our standard population. The

overall percentage of the population residing in extended families given the mid-twentieth century parameters would be quite close to the figure for the 1900 standard population, despite marked differences in demographic conditions. The high life expectancy characteristic of the developed world favors the formation of extended families, but this effect is almost cancelled out by low fertility. Although there is little change in the aggregate frequency of extended families, the MOD demographic conditions do encourage a further shift from horizontal to vertical extension.

The PRE, STD, and MOD runs of the simulation reflect, at least in rough outline, the sequence of demographic change in the West over the past two centuries. The figures in Table 6 therefore allow some cautious generalizations about the long-term effects of demographic conditions on extended family structure. Overall, demographic change has relaxed constraints on the formation of extended families. At the same time, we can be quite confident that there has been a continuous shift toward conditions favoring the formation of vertically, rather than horizontally, extended families.

In the twentieth century, the frequency of extended families has declined dramatically.[18] If residential propensities had remained constant, the frequency of extended families would have increased during this period. The divergence between the standard propensities results and observed changes in family structure in the twentieth century demonstrates that residential preferences have not, in fact, remained constant since 1900. This finding underlines the fact that demographic factors, while critical, are not the sole source of change in extended family structure. Demographic factors were much more important as an influence on extended family structure *before* 1900 than afterwards.

Conclusion

I do not contend that standard propensities actually allow us to prove or disprove hypotheses about the long-term changes in residential preferences. We can only indirectly infer the ways in which residence decisions must have changed by comparing results produced through the use of standard propensities with empirical measures of historical family structure.

On the other hand, this technique does allow specific generalizations about the demography of the family, and these generalizations have significant implications for the history of the family. The demographic conditions prevailing since the end of the nineteenth century have been highly favorable to the formation of extended families. By contrast, the frequency of available extended kin was substantially lower in pre-industrial England. We may be fairly confident that demographic change was a necessary condition for the rise of the extended family in the nineteenth century.

The effects of demographic changes are not always obvious. Different demographic factors may cancel one another out; their effects may be additive; or they may not interact at all. I have only alluded to these theoretical issues in this paper. Readers who wish to know more about the interactions of demographic conditions and family structure should examine my forthcoming book on the topic.[19]

More broadly, this exercise demonstrates that the supply of kin is highly sensitive to variation in demographic conditions. Thus, all studies of family structure —whether concerned with historical change, the life course, or differentials within or between populations —should carefully consider the potential effects of demographic factors.

NOTES

1. Levy, M., ed. 1965. *Aspects of the Analysis of Family Structure*. Princeton: Princeton University Press, p. 51.
2. The generalization that there was an increase in the frequency of extended families in the nineteenth century is based on evidence presented by historians researching household structure in a variety of local contexts. A discussion of this literature appears in Ruggles, S. 1984. Prolonged Connections: Demographic Change and the Rise of the Extended Family in Nineteenth Century England and America. Ph.D. Diss., University of Pennsylvania. Also see my forthcoming book of the same title, University of Wisconsin Press.
3. Berkner, L. K. 1972. The Stem Family and the Developmental Cycle of the Peasant Household: An Eighteenth Century Austrian Example. *American Historical Review*, 77:398–418; and 1975. The Use and Misuse of Census Data in the Historical Study of Family Structure. *Journal of Interdisciplinary History*, 5:721–738. The effects of demographic constraints had been discussed earlier by Levy, *Aspects of the Analysis*, pp. 46-7. Evidence on the low frequency of extended families in pre-industrial England is most coherently presented in Laslett, P., and R. Wall, eds. 1972. *Household and Family in Past Time*. Cambridge: Cambridge University Press, pp. 61, 84; also see Glass, D. 1966. London Inhabitants Within the Walls 1695. *London Record Society*, 2, Introduction.
4. Laslett, P. 1977. *Family Life and Illicit Love in Earlier Generations*. New York: Cambridge University Press, pp. 15-16; Mitterauer, M., and A. Kagan. Russian and Central European Family Structure—A Comparative View. *Journal of Family History*, 7:103–131.
5. I distinguish "narrow" demographic variables from other social variables not because they have different causes, but rather because they determine the membership of the kin group. Once the demographic events of birth, marriage, and death have occurred, the range of potential family members with whom each individual could reside is fixed and cannot be influenced by the individual (except perhaps through murder). Migration and race affect the pool of living kin only because they affect demographic behavior in the narrow sense. Migration is in a different category from race, however, since the act of migrating may make it logistically impossible for an individual to reside with certain relatives. Nevertheless, there are several reasons for considering migration separately from births, marriages, and deaths. First, the act of moving is itself a residence decision; moving between cities or between countries may prevent coresidence, but then moving down the block has the same effect. Second, we lack sufficient historical data on the processes of migration to incorporate it into a demographic model without seriously compromising accuracy. Finally, the consequences of migration for family structure can be directly studied using cross-sectional data; there is really no need to resort to the sorts of methods described in this paper.
6. Smith, D. S. 1981. Historical Change in the Household Structure of the Elderly. In *Aging—Stability and Change in the Family*, edited by Robert W. Fogel, et al. New York: Academic Press, pp. 91–114.

7. Glass, London Inhabitants; Wrigley, E. A. 1969. *Population in History*. London: McGraw-Hill. A discussion of analytic models of the demography of the family appears in Ruggles, Prolonged Connections, pp. 112-123. Also see Sheps, M. Simulation Methods and the Use of Models in Fertility Analysis. *International Population Conference, London, 1969*. IUSSP, 1:53-64; Barrett, J. C. Criteria for Choosing Between Analytical Methods and Simulation. *International Population Conference, Mexico, 1977*. IUSSP, 1; compare T. Pullum's closing comments in 1982. The Eventual Frequencies of Kin in a Stable Population. *Demography*, 19:549-565.
8. For descriptions of simulation approaches, see Hammersley, J. M., and D. C. Handscomb. 1964. *Monte-Carlo Methods*. London: Methuen; Sheps, Simulation Methods; Dyke, B., and J. W. Macluer. 1973. *Computer Simulation in Human Population Studies*. New York: Academic Press; Menken, J. Models for the Analysis of Fertility Change. *International Population Conference, Manila, 1981*. IUSSP, 3:435-47; Olinick, M. 1978. *An Introduction to Mathematical Models in the Social and Life Sciences*. Reading, Mass.: Addison Wesley Pub. Co.; Ruggles, Prolonged Connections. Applications of microsimulation include Orcutt, G. 1961. *Microanalysis of Socioeconomic Systems: A Simulation Study*. New York: Harper; Gilbert, J. P., and E. A. Hammel. 1966. Computer Simulation and Analysis of Problems in Kinship and Social Structure. *American Anthropologist*, 68:71-93; Horvitz, D. G., et al. POPSIM, a Demographic Microsimulation Model. *International Population Conference, London, 1969*. IUSSP, 1:95-106; Rossi, F. 1975. Un modello di simulazione per lo studio del ciclo di vita della famiglia. *Genus*, 31:34-94; Wachter, K. W., E. A. Hammel, and P. Laslett. 1978. *Statistical Studies in Historical Social Structure*. New York: Academic Press; and Howell, N. 1979. *Demography of the Dobe !Kung*. New York: Academic Press.
9. The model is described in Ruggles, Prolonged Connections, pp. 149-233.
10. Note that relationships are classified according to relationship to family head. A family head is defined as the eldest member of the largest nuclear group within any group of coresident kin. Thus, boarders, lodgers, and servants are considered to constitute independent kin groups. Within the simulated population, the kin frequencies are calculated on the basis of the probability of residing with a family head of each age, sex, and marital status, as calculated from the 1900 census tape. Note also that all measurements are taken at the individual, rather than the household, level. The rationales for these decisions are quite complex. See Ruggles, Prolonged Connections, pp. 149-154, 204-218, 234-246, 297-318, 331-374. All of the probability tables used to calculate the availability of kin in 1900 are based on the 1900 public use sample, with the sole exception of mortality, which comes from the United States life table of 1900-02 known as the Glover life table.
11. Consider, for example, a society in which it was the norm for one child—but no more than one—to reside with its parents after marriage. In such circumstances, we would expect the propensity to reside with parents to decline if fertility increased, and vice-versa. Where such problems are known to exist, they could be handled through the use of conditional propensities, although this would further complicate an already over-elaborate technique. The difficulty could be minimized simply by employing alternate standard propensities populations, e.g., by first combining the residential propensities of population A with the demographic characteristics of population B, and then combining the demographic characteristics of population A with the residential propensities of population B. This approach is analogous to the use of alternate standard age distributions when directly standardizing demographic rates. The strategy cannot be employed, of course, unless the residential propensities corresponding to all the populations being compared are known.

    At the present stage of things, the fact that residential propensities are partly a function of demographic conditions is not a devastating concern. All of our measures of historical living arrangements and demographic conditions are highly approximate, and what we really need to evaluate the role of demography is a set of weights reflecting the approximate importance of different kin types. It is much more important that unmarried kin have tenfold the residential propensities as married kin than it is that propensities to reside with elderly parents may be affected by fertility. As we begin to map the patterns of residential propensities in different times and places, we will be in an increasingly better position to generalize about the ways in which demography affects propensities.
12. Wachter, Hammel, and Laslett, *Statistical Studies*.
13. Ruggles, Prolonged Connections, pp. 123-154.
14. Before the figures can be made really useful, they must be further boiled down into broader categories of family structure. This is complicated because extended kin may occur in combination, and different combinations occur with differing frequencies. I have assumed that the probability of combinations differs from the 1900 standard population only to the extent that the availability of kin is different. To carry through the aggregation of results obtained through the use of standard propensities, we simply add up the percentages of persons residing with any general category of kin and then deflate the total by a factor representing the frequency of combinations for that category in the general population. See Ruggles, Prolonged Connections, pp. 232-3.
15. The parameters conform as closely as possible to those in Wrigley, E. A., and R. S. Schofield. 1983. *The Population History of England, 1541-1871: A Reconstruction*. Cambridge, Mass.: Harvard University Press. The marriage distributions were taken from Laslett, P. 1977. *Family Life and Illicit Love in Earlier Generations*. New York: Cambridge University Press; and mortality is based upon the Level 7 model West life table in Coale, A. J., and P. Demeny. 1983. *Regional Model Life Tables and Stable Populations*. 2nd ed. Princeton: Princeton University Press.
16. My generalizations about the combined effects of different demographic factors and the tendency for different factors to cancel one another out are based on an analysis of the separate effects of each parameter. See Ruggles, Prolonged Connections, pp. 331-374.
17. Wall, R., ed. 1983. *Family Forms in Historic Europe*. Cambridge: Cambridge University Press, p. 500. See my comments in Ruggles, Prolonged Connections, pp. 277-8.
18. Smith, D. S. 1984. Modernization and the Family Structure of the Elderly in the United States. *Zeitschrift fur Gerontologie*, 17:13-17; Wall, *Family Forms*; Ruggles, Prolonged Connections, pp. 1-18.
19. See note 2.