DEMOGRAPHY© Volume 13, Number 1 February 1976

FAMILY SIZES OF CHILDREN AND FAMILY SIZES OF WOMEN

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Abstract—This paper demonstrates the relation that obtains between the average family size of women and the average family size of offspring of those women. It estimates the value of these two measures for cohorts of American women aged 45–49 in various years from 1890 to 1970. It shows that children born during the post-war baby boom actually derived from smaller families than those born during the low-fertility 1930's; that under current patterns a woman would have to bear an average of almost two children fewer than were borne by her mother merely to keep population fertility rates constant from generation to generation; and that average family size for nonwhite children exceeds that for white by 50 percent, although the racial difference in family sizes of women is only 19 percent.

The size of a child's family of orientation has been suggested to be a negative influence on his or her survivorship, intelligence, physical growth, access to higher education, and, during the adult years, income and occupational achievement (Wray, 1971; Clausen and Clausen, 1973; Blau and Duncan, 1967; Duncan, 1969). Such demonstrations have added force to the call for demographic approaches to problems of lagging socioeconomic development (Leibenstein, 1971; Revelle, 1972).

Standard demographic measures, which are woman-based, are not perfectly indicative of the size of a child's family of orientation. The average number of children ever borne by a group of women differs, in general, from the average family size of children of those women. Each woman contributes equally to the former average, while women with large families contribute disproportionately to the latter. For example, if half of a group of women have four children and half have none, the average family size for a woman will be two but for a child it will be twice as large. The transformation of all one-child women to childless women will always reduce average family size for women but will always raise average family size for children. It is intuitively clear that the relation between the two averages depends in some manner upon the variance in family sizes among women.

This paper demonstrates the simple and exact relation that exists between average number of children ever born in a cohort of women and the average family size of orientation of children of those women. It estimates the value of the measures for various cohorts of women and their offspring in the United States. Large white-nonwhite differences in relations between the measures are demonstrated; American fertility history is briefly reinterpreted in light of the findings; and implications are drawn for the maintenance of zero-growth fertility levels.

Formal Relation Between Family Size of Women and That of Children

By "family size" we shall mean the total number of children ever born to a woman who has completed childbearing. That is, we exclude the number of parents from the measure and neglect mortality. The measures might more appropriately be termed "brood size."

Let $f(X)$ = proportion of women in a cohort that has completed childbearing who have X children.

Then the mean family size for women, $\bar{X}$, will be

$$\bar{X} = \sum_{X=1}^{n} f(X) \cdot X,$$

where n is the maximum family size attained. The proportion of children of these women who come from families of size X, $b(X)$, will be

$$b(X) = \frac{f(X) \cdot X}{\sum_{X=1}^{n} f(X) \cdot X}.$$

The average family size for children $\bar{C}$ is thus

$$\bar{C} = \sum_{1}^{n} b(X) \cdot X$$

$$= \sum_{1}^{n} \frac{f(X) \cdot X^2}{\sum_{1}^{n} f(X) \cdot X}$$

$$= \frac{\sum_{1}^{n} f(X) \cdot X^2}{\bar{X}}.$$

Adding and subtracting $\Sigma_1^n f(X)\bar{X}^2$ in the numerator of this last expression gives

$$\bar{C} = \frac{\sum_{1}^{n} f(X) \cdot (X^2 - \bar{X}^2) + \sum_{1}^{n} f(X)\bar{X}^2}{\bar{X}}$$

$$= \frac{\sigma_X^2}{\bar{X}} + \frac{\bar{X}^2}{\bar{X}},$$

or

$$\bar{C} = \frac{\sigma_X^2}{\bar{X}} + \bar{X}, \qquad (1)$$

where σ_X^2 is the variance of the distribution of family sizes among women.

Equation (1) says simply that the mean family size of a child will be equal to the mean family size of women plus a term equal to the variance of women's family sizes divided by their mean. We will refer to this second term as the "standardized variance" of women's family sizes. If all women have the same family size, the variance is zero and $\bar{C} = \bar{X}$. Otherwise, the mean family size of a child must exceed the mean family size of women, regardless of how women's family sizes are distributed. The greater the spread of family sizes among women, the more the children's average family size exceeds that of women. The equation is an appropriate expression of several other useful relationships: that between the average group size and the average size of the group to which an individual belongs; that between average city size and the average size of the city in which an individual resides; and that between average household size and the average size of the household in which an individual lives. There are equivalent relations between the average span over which women bear children and the average spacing between children, which might also influence child "quality." The timing as well as the volume of fertility would figure into this relation, which is not pursued in the present paper.

A widely recognized statistical fallacy is to use a value of $\bar{C}$ derived from survey responses of offspring as an estimate of $\bar{X}$, the average family size of their mothers. Bytheway (1974) is apparently the latest author to draw attention to this error and to suggest means of correcting it.

Values of $\bar{C}$ and $\bar{X}$ in the United States

Table 1 presents estimates of the values of $\bar{C}$ and $\bar{X}$ for American women aged 45–49 during various years and for their offspring. These data, which are

TABLE 1.—Average Family Size of U.S. Women Aged 45–49 ($\bar{X}$) and Average Family Size of Orientation of Offspring of Those Women ($\bar{C}$): 1890–1970

Year	$\bar{C}$	$\bar{X}$	$(\bar{C} - \bar{X}) = \sigma_X^2/\bar{X}$
1890	7.782	4.986	2.796
1910	7.166	4.089	3.077
1940	5.356	2.655	2.701
1950	4.909	2.292	2.617
1960	4.410	2.247	2.163
1970	4.461	2.705	1.756

Sources: Data for women aged 45-54 in 1890 are derived from reports by women aged 65-74 in 1910, taken from U.S. Bureau of the Census, 1945b, Tables 4-6. Data in these tables aggregate women in the fifth and sixth parities as well as women in parities 7-9. Distribution within these two groups for native white and Negro women was made on the basis of single-parity reports by native white and Negro women with unbroken marriages, appearing in U.S. Bureau of the Census, 1945a, Tables 3 and 4. Distribution within these groups for foreign-born whites was made by using the average of native white and Negro proportions, since this average pattern fit the general fertility contour of foreign-born white women better than did either group's pattern separately. Data are based on an 8 percent (approximately) sample. Women with 10 or more children are assumed to have borne exactly 11.657 children; this is the number required to reproduce exactly the total number of children reported by the women.

For women 45-49 in 1910 and 1940 a weighted average of native white and Negro women is calculated from U.S. Bureau of the Census, 1945b, Tables 1, 3, 4, 6. Data on foreign-born white women are not available for age group 45-49. Distribution within categories 5-6 and 7-9 was performed in fashion described above from U.S. Bureau of Census, 1945a, Tables 1-4. Women in terminal category 10+ assumed to have 11.495 children apiece in 1910 and 11.335 in 1940. Data based on an 8 percent (approximately) sample in 1910 and a 2 1/2 percent sample (approximately) in 1940.

Data for 1950 are from U.S. Bureau of the Census, 1955, Table 2. Women of parity 8-9 assumed to have 8.5 children, in parity 10-11, 10.5, and in parity group 12+, 12.972. These distributions account for all children reported. Based on 3 1/3 percent sample.

Data for 1960 are from U.S. Bureau of the Census, 1964, Tables 2 and 3. Women in terminal category 12+ assumed to have 13.000 children apiece. Based on 5 percent sample.

Data for 1970 are from U.S. Bureau of the Census, 1973, Table 8. Based on 15 percent sample. Distribution of women within grouped parities performed by using (weighted) average distribution of white and Negro women from Tables 2 and 3 (based on 5 percent sample). Women in terminal category 12+ assumed to have 12.885 children apiece.

derived from various census reports, are subject to a number of errors. First, the census question on number of children ever born is not asked of women who have never married, an omission tending to produce an underestimate of the average number of children ever born to the cohort. Second, some women may forget or for other reasons fail to report children, particularly young or deceased children. Third, higher mortality for women of higher parity may make surviving women in a cohort unrepresentative of those who entered the reproductive years. All of these factors would tend to deflate the census reproductive reports. However, Kiser et al. (1968, p. 301) showed that the bias is not particularly large in recent years. Reports by women aged 45–49 in the 1960 census, after adjustment for non-response, yielded an average number of children ever born that was only 3 percent smaller than the number reconstructed from vital registra-

tion records. A similar comparison by Whelpton (1954, p. 447) showed the number of births reported by 40-year-old native white women in the 1940 census to be smaller than the number implied by adjusted registration figures by 9.2 percent. Such comparisons could not be made for older cohorts because of insufficient completeness of registration. The bias probably operates in such a way as to reduce the family size of children proportionately more than the family size of women, since the omission of children, probably the most serious problem, is likely to be more common among higher-parity women.

It is obvious from the data in Table 1 that the average family size of children, $\bar{C}$, exceeds the average family size of women, $\bar{X}$, by substantial amounts throughout the 80-year period. The excess amounts to over 3 children in 1910 and 1.76 children as late as 1970. It appears that no group of American children in completed families where the mother survived to the end of childbearing years has ever averaged a family size smaller than 4.4.

Between 1890 and 1950, the decline in $\bar{X}$ was more rapid than the decline in $\bar{C}$. The average number of children per woman fell by 53 percent during these years while the number of children per child fell by only 37 percent. The difference in the magnitude of the two trends must be attributable to the relatively slow decline in the standardized variance of family sizes of $(\sigma_X^2/\bar{X})$. A slow decline in this factor, or even a rise such as occurred between 1890 and 1910, can be expected during a period of fertility transition. When the vast majority of women are pursuing high family size goals, the variance in family sizes is considerable because of differences in primary and secondary sterility, age at marriage, breast-feeding practice, and rates of marital disruption. But the diffusion of small family size norms clearly introduces for a time an additional source of variance in women's family sizes, a variance that impedes the reduction of family size for children. (In the extreme, when the small family norm is equivalent to childlessness, its diffusion would be accompanied by no change whatsoever in children's family sizes.) Thus, even though the cohort of women aged 45–49 in 1950 achieved what was for them replacement level fertility, the average family size of orientation of their children was still 4.91, more than double the average family size for women. The standardized variance was, as in 1940, larger than the value of $\bar{X}$ itself. These patterns are a disconcerting precedent for those concerned with issues of population quality in less developed countries; the pace of reductions in family size for children can be expected to lag behind that for women in the process of fertility transition.

After 1950, however, the pattern has been reversed: the standardized variance has declined more rapidly than $\bar{X}$ as the diffusion of small family desires and of the means and inclination to achieve them has become almost complete. In fact, it is clear that the average family size for women 45–49 rose between 1950 and 1970 by some 18 percent, while the average family size of their children actually declined by 9 percent. The reason, of course, is the increased concentration of $\bar{X}$ in the range of 2–4 children. Figure 1 displays the proportionate distribution of women by completed family size in the various cohorts. A higher proportion of women aged 45–49 achieved each of the family sizes 2, 3, and 4 in 1970 than in any previous year.

A significant contraction in the standardized variance of family sizes has almost certainly occurred in most western countries, but there is one which has retained substantial dispersion. Women aged 45–49 in Ireland, 1961, had borne an average of 3.063 children, but the average family size of those children was 6.271 (compiled from Table 17 of Ireland, 1965; figures refer to nonwidowed

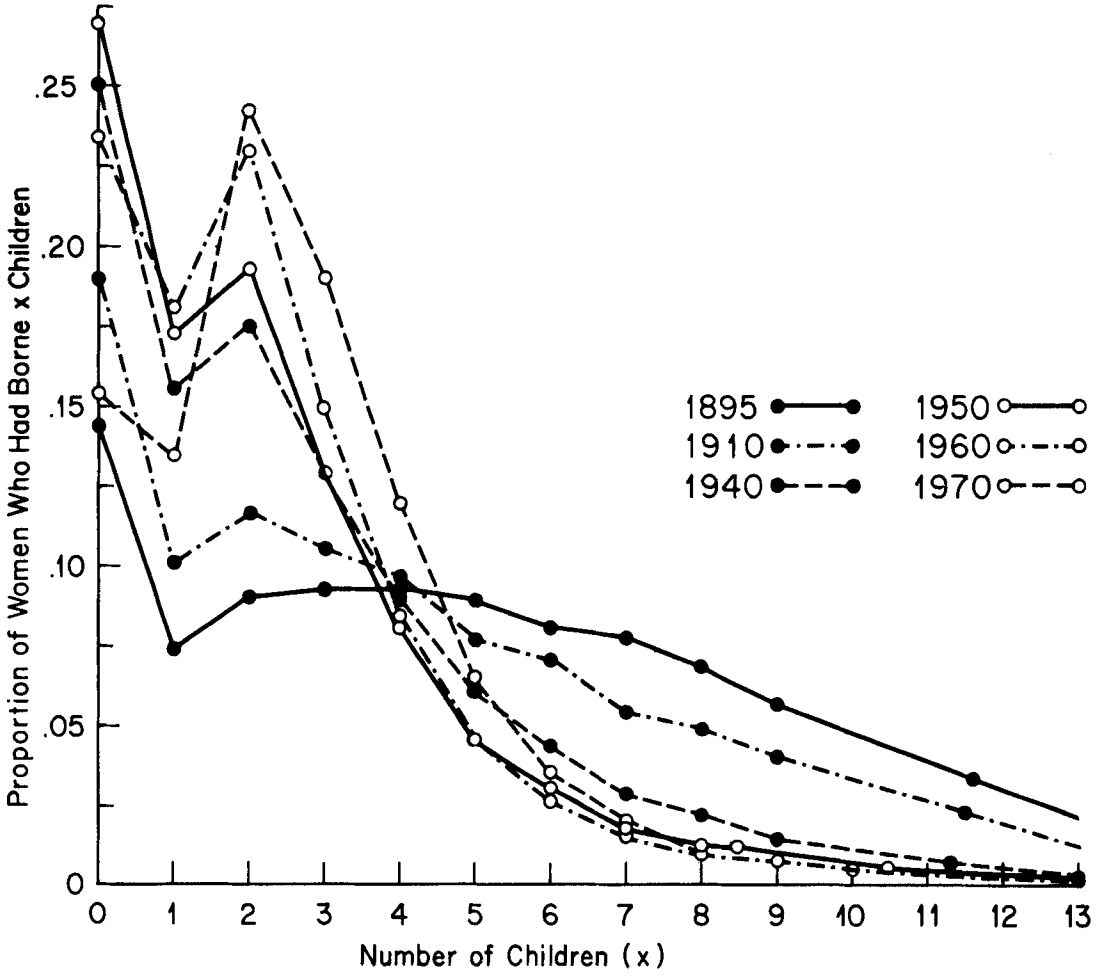

FIGURE 1.—Distribution of U.S. Women Aged 45–49 in Different Years by Number of Children Ever Born

women). The large standardized variance is a product of high proportions who never married combined with high fertility for those who did.

It is worth emphasizing that the American post-war baby boom, partly resulting from an increased average family size among women, was *not* accompanied by larger family sizes for children. Children born during the depression decade of the 1930's came from what were on average slightly larger families than those of children born during the booming 1950's (comparing $\bar{C}$ for 45–49-year-old women in 1950 to that of women 45–49 in 1970). Attempts to trace unusual traits or behavior of the baby boom offspring back to family circumstances must take this fundamental fact into account. Moreover, the occupational upgrading of the labor force and the contraction of class differentials in reproduction produced a much higher proportion of children of women aged 45–49 in 1970 who were offspring of white collar classes (.394) than was true for women in 1950 (.272) (U.S. Bureau of Census, 1955, 1973; figures refer to married

women with husbands present and employed). Prospects for baby boom offspring have been enhanced rather than depressed by circumstances in their families of orientation. Socially, of course, their numbers have presented significant problems of educational and occupational absorption. The suggested disparity between relatively rich family endowments and strained social opportunities would seem to make these cohorts uniquely susceptible to disenchantment with the level of social rewards.

Results Interpreted in Light of Correlation Between Family Sizes in Successive Generations

Both sociologists and economists have stressed the importance of experiences in the family of orientation for a person's subsequent fertility. As the principal socializing agent, the family helps both to define roles available and to guide by example and by dictum the choice among them. Since children of each generation are drawn disproportionately from families of women with high fertility achievement in the past, it may be expected that a pronatalist selective bias operates each generation with respect to the transmission of "tastes" for children. It has also been suggested that personality traits which may affect fertility achievement, such as the ability to defer gratification, may be transferred to some extent between parent and child (Kantner and Potter, 1954). It is also reasonable to suggest that biological fecundability is partially inherited. The positive correlation between the social classes of parent and child implies that economic constraints impinging on the childbearing process tend to be similar for the two generations. Finally, Easterlin's suggestion (1968, Chapter 5) that childbearing is a negative function of living standards in the family of orientation implies that children from larger families, who would *ceteris paribus* have been subjected to lower living standards, should themselves have larger families.

Empirical investigations have uncovered a relatively small but usually statistically significant relationship between the completed fertility of parent and child. Berent (1950) studied 1,482 female patients of British obstetricians and gynecologists in 1946. The coefficient of correlation between wife's number of siblings and her own fertility is +.199 among women using birth control and +.174 among nonusers (Berent, 1950, p. 47). Kantner and Potter (1954, pp. 1077–1079) found among women in the Indianapolis Fertility Study a correlation of +.09 between fertility and wife's number of siblings among "efficient planners" but a negligible correlation among inefficient planners. The correlations increase to .29 and .16 when both husband and wife had the same number of sociological siblings (Kantner and Potter, 1954, p. 1079). There is a strong suggestion in their study that the relationship is nonmonotonic. Duncan et al. (1965) reported that, among women in the Growth of the American Family Study and in a 1962 Current Population Survey, one additional child in the family of orientation was associated with .06 −.08 additional children in the family of procreation. Approximately half of this effect was attributable to the earlier marriage and reduced educational attainment of women from larger families. Bumpass and Westoff (1970, pp. 90–91) found similar effects among Protestants but essentially no relationship among Catholics. Consistent with the view that tastes for children are acquired by a process of social reinforcement, the relationship was found to be weakest among those who reported unhappy childhoods.

In a context in which the fertility of one generation provides a model for that of the next, reductions in women's family sizes during the twentieth century seem remarkably large. The 45–49-year-old women who had produced an average of

2.66 children in 1940 were themselves born into families that averaged over seven children (assuming for convenience that they were all born to women aged 30 and thus matching them with women 45–49 in 1910). The reduction in $\bar{X}$ itself from 4.09 to 2.66 between 1910 and 1940 grossly understates the extent of intergenerational movement to small families. Likewise, between 1940 and 1970, $\bar{X}$ actually rose slightly, but the women who averaged 2.71 children in 1970 came from families that were, on average, twice as large (5.36). What may appear to be a period of revived parenthood in fact represented a major rejection by women of the family size to which they were first and most intensively exposed. Fertility was higher than in their parents' *generation* but much lower than that of their parents *themselves*.

The implications for population growth are obvious. Members of each generation must, on average, bear substantially fewer children than were born into their own family of orientation merely to keep population fertility rates constant. This required reduction amounted to three children per woman in the early years of the century and is still 1.76 children per woman. The replacement-level fertility achieved by women aged 45–49 in 1950 could only have been maintained if members of each successive generation bore an average of 2.62 fewer children than were in their family of orientation, a reduction of more than 50 percent. A major intergenerational change at the individual level is required in order to maintain intergenerational stability at the aggregate level. Such a result applies by extension to conditions that influence fertility, especially to marriage and women's roles. Those who exhibit the most traditional behavior with respect to marriage and women's roles will always be overrepresented as parents of the next generation, and a perpetual disaffiliation from their model by offspring is required in order to avert an increase in traditionalism for the population as a whole.

Thus, there is a behavioral momentum to population growth whose strength depends on the degree to which adults tend to replicate the family size of their childhood. If everyone bore a number of children equal to that of their parents, the system would quickly explode. Offspring of the women who averaged 2.705 births in 1970 would themselves bear, on average, 4.461 children, who would in turn bear 5.986, and so on. The system would stabilize only when all women achieved the maximum family size, n, at which time $\sigma_X^2 = 0$ and $\bar{C} = \bar{X}$. Perhaps this momentum is cause for little concern in view of the ease with which women have historically abandoned their parents' family sizes. However, it is possible that these mechanisms will achieve more importance in the future. Berent (1953), Kantner and Potter (1954), and Duncan et al. (1965) found the correlation between the family sizes of successive generations to be larger when the later generation was, respectively, "birth controllers," "efficient planners," and "fecund planners" than when these traits were absent. Kantner and Potter (1954) found the relationship to be considerably stronger among persons whose family size of orientation was less than 5 ($r = .15$). These groups are, of course, increasing in relative importance. One might also suppose the relationship to be stronger when urban-rural background is identical for members of the two generations, which is an increasingly common occurrence. Unfortunately, this proposition has not been tested.

White-Nonwhite Differences

American fertility history is essentially the history of the preponderant white majority, and the data reviewed thus far described primarily the white population. But nonwhite fertility differs in respects that are quite important in the present context. Table 2 shows that the stand-

TABLE 2.—Average Family Size of U.S. White and Nonwhite Women Aged 45–49 ($\bar{X}$) and Average Family Size of Orientation of Offspring of Those Women ($\bar{C}$): 1890–1970

Year	White			Nonwhite		
	$\bar{C}$	$\bar{X}$	$(\bar{C} - \bar{X}) = \sigma_X^2/\bar{X}$	$\bar{C}$	$\bar{X}$	$(\bar{C} - \bar{X}) = \sigma_X^2/\bar{X}$
1890[a]	7.206	4.449	2.757	9.775	6.696	3.079
1910[a]	6.761	3.859	2.902	9.126	5.845	3.281
1940[b]	5.204	2.602	2.602	6.456	3.138	3.318
1950[b]	4.723	2.251	2.472	6.339	2.663	3.676
1960[c]	4.148	2.200	1.948	6.334	2.657	3.677
1970	4.201	2.651	1.550	6.316	3.161	3.155

a- Native white and Negro.
b- White and nonwhite.
c- White and Negro.

Sources: See Table 1 for sources and procedures used. Women in terminal categories were assumed to have borne the following number of children apiece:

Year	Category	White	Nonwhite
1890	10+	11.344	12.398
1910	10+	11.246	12.093
1940	10+	11.328	11.359
1950	12+	12.941	13.063
1960	12+	13.000*	13.000*
1970	12+	13.000*	13.000*

*The figures for 1960 and 1970 are an assumption made by the U.S. Bureau of the Census.

ardized variance of family sizes for nonwhite women ($\sigma_X^2/\bar{X}$) actually increased monotonically between 1890 and 1960. The movement from South to North and from farm to urban areas exposed major segments of nonwhite women to new reproductive contexts and ideals. While these women were adapting their fertility to the new setting, reproductive performance in the rural South continued at high levels. Partially as a result, the standardized variance in family sizes among nonwhite women tended to increase from a level that was already higher than that of whites in 1890. A second but related factor tending to raise the variance of nonwhite women's family sizes was an increase in the proportion childless among ever-married women (from .086 in 1910 to .175 in 1970) and a smaller increase in the proportion never married (from .047 to .068) (U.S. Bureau of Census, 1945b; 1973). The trend toward increased childlessness among whites was much weaker, and proportions never married declined between the two dates.

The average family size of the nonwhite child in 1890 was 9.78, and in 1970 it was still 6.32. This reduction of 35.4 percent is considerably smaller than the reduction in the mean family size of nonwhite women of 52.8 percent (from 6.696 to 3.163). When it is recognized that only 64 percent of nonwhite children survived to age 10 under the official U.S. life table of 1900–1902, whereas 96 percent survived to that age under the life table of 1969 (U.S. National Center for Health Statistics, 1973, pp. 5–11), it becomes clear that the average number of *living* children in the family of a nonwhite child is scarcely different now from its level in 1890.

Although fertility of nonwhite women aged 45–49 in 1970 exceeded that of

white women by only 19.2 percent, the average family size of a nonwhite child exceeded that of a white child by 50.3 percent. The difference between an average family size of 4.2 and one of 6.3 becomes more salient in view of the fact that many of the effects of family size on child development operate only in the range above four children. For example, the Health Examination Survey, conducted by the U.S. National Center for Health Statistics, administered the Vocabulary and Block Design subtests of the Wechsler Intelligence Scale for Children to a representative national sample of 7,119 children aged 6–11 in 1963–1965 (Roberts and Engel, 1974). Scores on combined tests ranged from means of 99.8 to 103.0 for children with a family size of 1–4 but declined quickly to 94.7 for those with a family size of 6 and to 90.5 for those of 8 or more (Roberts and Engel, 1974, p. 28). The decline in vocabulary scores was more rapid still. The relationship appears to be equally strong within groups of father's education. The different family size distributions of white and Negro children were sufficient by themselves to have produced a mean group difference of 3.3 points on the combined score and 4.4 on the vocabulary score.

The nonwhite's family size is larger not so much because the level of nonwhite fertility is higher but because of the much greater standardized variance in the family sizes of nonwhite women. Seventy-six percent of the racial difference in $\bar{C}$ in 1970 is attributable to this factor. That this greater variance is primarily caused by the birth of "unwanted" children to nonwhite women of high parity is strongly suggested by the results of Ryder and Westoff (1971). If Negro married women who had not completed childbearing in 1965 were to achieve their stated desired family size, the mean family size for women ($\bar{X}$) would be 3.081, and the mean family size for their children ($\bar{C}$) would be 3.635 (compiled from Ryder and Westoff, 1971, p. 32). The standardized variance would be reduced by fully 82 percent from its level of 1970. It appears that successful family planning programs should have a much more substantial effect on the family sizes of nonwhite children than on those of nonwhite parents. But preventative measures will have little effect on prospects for children already born, who have begun life with a demographic disadvantage whose effects cannot be eliminated through application of "universalistic" standards.

Acknowledgments

This research was supported by National Institute of Mental Health Training Grant 5 T01 MH 11673–06. William Grady and George Nelson provided computational assistance.

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