Siblings and Family Size from Generation to Generation

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ABSTRACT

This paper deals with an analysis of the persistence of family size from generation to generation in contemporary Japan, utilizing data collected in the 16th Mainichi Survey of Fertility and Family Planning conducted in 1981.

A detailed examination of the data disaggregated by age of wife has led to the following findings. Firstly, the impact of husband's siblings on husband's age at marriage was observed for all the age groups. The parallel effect of wife's siblings on wife's age at marriage was found only in two of the cohorts. Secondly, desired number of children was consistently affected by wife's siblings in all of the age groups, but the impact of husband's siblings was statistically significant only in the oldest group. Thirdly, the direct impact of wife's siblings on number of living children was found only in the youngest cohort. Husband's siblings were related to number of living children in the oldest and youngest cohorts, but its impact was in both cases quite negligible. Fourthly, no consistent relationship could be detected within the cohorts between number of additional children wanted and either husband's or wife's size of family of origin.

I. Introduction

According to conventional sociological wisdom, the family is the first crucible in which personalities are molded and conceptions of value are formed. What one learns in one's family of origin can, of course, be altered and reshaped, as well as cemented and fixed, by other agencies of socialization such as the church and the school. Nonetheless, certain features of family life tend to persist from one generation to the next, in part because nucleated families linked together by bonds of blood and marriage are often part of larger cultural groupings which share common norms and values, but also, in part, because parents impart more directly their own values, ideals, and goals to their offspring, independent of whatever reinforcement these elements receive from the cultural group to which the family belongs and/or the larger society of which it is a part.

Among the characteristics of families which tend to persist from one generation to the next, one would surely count the distribution of power within them, their sexual division of labor, and surely their size. Power within families and the familial division of labor are closely intertwined and both serve to define, through deference and activities, what it means to be a man, a woman, an elder, an adult, a parent, and a child in both the family itself and in the society at large. The behavioral content of such basic roles is unlikely to change rapidly and it is no surprise that they should persist in large measure from one generation to another. These roles, especially those of man and woman and of husband and wife, often have reproductive content. Role fulfillment can be achieved only through reproductive activities, thus securing some continuity in family size from generation to generation. In the Caribbean, for example, the idea of <u>machismo</u> (Stycos, 1964) is thought to be implicated in the persistence of large families.

There are, however, mechanisms other than the acting out of familial roles which insure some measure of continuity in family size from generation to generation. One such factor is the persistence of cultural groupings with their own distinctive family size norms, such as the black and white communities in the United States and the groupings of Sephardic and Askenazi Jews in Israel. The between group covariance across successive generations is, thus, one component of the total covariance in family size from one generation to the next generation. But even within cultural groupings, other factors operate to secure some measure of continuity in sizes of families of orientation and families of procreation. Not the least of these are the socioeconomic consequences of family size. Duncan (1964), for example, has shown that the educational levels achieved by those from large families are inferior to those reached by persons from small families. But education is, itself, linked inversely to fertility (see, e.g., Freedman, 1962), thus creating a mechanism maintaining some degree of continuity from generation to generation in family size. Beyond these factors, one should recognize that intergenerational continuity in occupational pursuit should provide some continuity in the economic value of children from generation to generation and, hence, contribute to the covariance between the sizes of families of orientation and families of procreation. Also, one should not rule out the simple forces of imitation and replication--the tendency for persons to work out in their own lives situations parallel to those experienced in their childhood.

The persistence of family size from generation to generation, by whatever mechanism, is plainly a force to be reckoned with in any society, whether it be facing a shortfall in the supply of labor such as Japan or a rate of population growth which makes serious drains on the capital investments required development, as is the case in China and many other less developed nations. In this paper, we examine the persistence of family size from generation to generation in contemporary Japan, utilizing data collected in the 16th Mainichi Survey of Fertility and Family Planning. This investigation was completed in the spring of 1981. Questionnaires were returned by 3078 currently married women of childbearing age, who were selected from every part of the Japanese archipelago by means of a stratified, area probability sample. The completion rate approached 90 percent, which is excellent by contemporary standards. Our purpose in this exercise, quite apart from providing contemporary evidence on the Japanese case, is to expose the mechanisms whereby family size persists from generation to generation. In this sense, we aim to provide a basic framework, within the limitations of the Japanese data, which can be extended and eventually applied in other research settings.

II. Persistence in Family Size: Some Basic Data for Japan

From the 16th Mainichi Survey of Fertility and Family Planning, a variety of variables thought to be implicated in the process of family size persistence are available for analysis. These include husband's number of brothers and sisters (= S_H), wife's number of brothers and sisters (= S_W), husband's educational level (= E_H), wife's educational level (= E_W), a measure of urban experience (= U), husband's age at time of present marriage (= M_H), wife's age at marriage (= M_W), the number of children desired by the wife (= D), the number of living children (= L), and the number of additional children wanted by the wife (= A). In addition, we included in the analysis another variable, terminal desired family size (= F), which was simply defined as the sum of the number of living children and the number of additional children wanted, i.e., F = A + L. Excepting husband's and wife's education and the measure of urban experience, all of the variables are measured in the manner indicated by their definitions. The educational levels of husbands and wives were measured in a series of four educational steps. Both variables take on the value 1 if the subject attended only an old primary school or a new system primary school or junior high school, the value 2 if husband or wife attended an old junior or a new senior high school, the value 3 if either attended junior college or a new or old system technical or commercial college, and the value 4 for those who advanced to a new or old system university. The measure of wife's urban exposure is constructed from two items included in the survey. The urban index takes on the value 2 if the wife both lived in an urban area while attending primary school and at the time of her marriage, the value 1 if she lived in an urban area at one, but not both of these times, and the value 0 if she lived in a rural area at the time of her marriage and while she was attending primary school. The two items used to define the indicator of urban exposure are related to one another in the way the items falling on a Guttman scale are ideally related. There are virtually no women who lived in an urban area while attending primary school and in a rural area at the time of marriage. Thus, women with mixed, i.e., urban and rural, backgrounds are composed almost entirely of those who migrated from rural to urban areas between the completion of primary school and the time of their marriage.

The means and standard deviations of the variables are shown in Table 1, while the intercorrelations between them are displayed in Table 2. These results are based on 2706 of the 3078 sample cases, since any sample ages with missing data on one of the variables were deleted from the analysis. In addition, women who were not capable of having any additional children were omitted from this analysis, since the question about future fertility desires was not posed to them.

Inspection of the means reported in Table 1 reveals that, in the aggregate, Japanese both desire and are almost certainly headed toward families of procreation smaller than the average size of their families of origin. On the average, Japanese women have about three and one-half brothers and sisters, which means they grew up in families

Table 1. Means and Standard Deviations of Variables in a Model of Family Size Continuity, for Married Japanese Women of Childbearing Age, 1981

Variable Description	Measure		
	Symbol	Mean	Standard Deviation
Husband's Number of Siblings	S_H	3.72	2.14
Wife's Number of Siblings	S_W	3.52	2.09
Husband's Educational Level	E_H	2.19	1.038
Wife's Educational Level	E_W	1.92	0.770
Urban Experience Index	U	1.132	0.878
Husband's Age at Present Marriage	M_H	26.8	3.71
Wife's Age at First Marriage	M_W	23.8	3.08
Desired Number of Children	D	2.54	0.765
Number of Living Children	L	1.95	0.861
Additional Children Wanted	A	0.330	0.670
Terminal Desired Family Size	F	2.28	0.762

Table 2. Correlations Between Variables in a Model of Family Size Continuity, for Married Japanese Women of Childbearing Age, 1981

Variable Description and Symbol	Variable Symbol										
	S_H	S_W	E_H	E_W	U	M_H	M_W	D	L	A	F
Husband's Siblings (= S_H)	. . .	.1873	-.2199	-.2091	-.0935	.1134	-.0010	.0590	.1591	-.2032	.0011
Wife's Siblings (= S_W)		. . .	-.1950	-.2433	-.1717	.0089	.0273	.0724	.1430	-.1566	.0239
Husband's Education (= E_H)			. . .	.6090	.2064	.0710	.1196	-.0029	-.1474	.1476	-.0368
Wife's Education (= E_W)				. . .	.2012	.0457	.1107	-.0169	-.1826	.2181	-.0145
Urban Experience (= U)					. . .	.0576	.1238	-.0317	-.1291	.0745	-.0803
Husband's Age at Marriage (= M_H)						. . .	.5745	-.1030	-.1740	.0276	-.1724
Wife's Age at First Marriage (= M_W)							. . .	-.1220	-.2512	.0765	-.2166
Desired Children (= D)								. . .	.4163	.1366	.5905
Living Children (= L)									. . .	-.5283	.6654
Additional Children (= A)										. . .	.2823
Terminal Family Size (= F)											. . .

with about four and one-half children. What is true of the families of origin of women is also basically true of the families of origin of their husbands, which, if anything, were a little larger. By way of contrast to their families of origin, Japanese women report, on the average, a desire for only about two and one-half children, or two children less than the number of their parent's children. On the average, Japanese women of childbearing age have already had about two children. On the average, they want only about one-third more of a child. If they act out their desires for additional children, Japanese women will wind up with about two and one-quarter children on the average a figure less than the number they state they desire and substantially less than the size of their families of origin. Thus, the declining size of the Japanese family implies that there can be no substantial persistence in the actual size of Japanese families from generation to generation. There could, however, still be continuity in the relative, but not absolute sizes of families across generations.

The remaining means in Table 1 require no extensive commentary, since they are generally consistent with what is well known about Japanese society. They show that husbands are about three years older than their wives and have slightly higher and more variable educational backgrounds. If one interprets the mean observed for the urban index, it implies that the average Japanese woman attended primary school in a rural area, but was living in an urban area by the time she was first married.

The correlations reported in Table 2 reveal that, even though there may be little persistence in the actual, numerical size of families from one generation to the next, there is a modest degree of persistence in their relative sizes. Weak positive associations are observed between desired number of children and the number of both husband's and wife's siblings. Somewhat larger, though still quite modest, positive associations are found between actual number of living children and the sizes of both husband's and wife's families of origin. Thus, there appears to be some persistence from generation to generation in the relative, if not the absolute sizes of families.

Although current family size of procreation is positively associated with the sizes of both husband's and wife's families of origin, family of origin size is inversely correlated with the number of additional children wanted. Thus, although those from larger families have relatively larger families than their peers, they seem especially intent on limiting their own families to a size which is absolutely less than the size of their families of origin. In any event, these contrary associations of family origin size with number of living children and number of additional children wanted, cancel each other out, so that there is virtually no association between either husband's or wife's number of siblings and desired terminal family size, which was a variable constructed by totalling living children and additional children wanted.

Further discussion of the bivariate relationships exhibited in Table 2 is not merited here, since we are shortly going to examine all of these associations in a multivariate context. However, before turning to our efforts to causally model these relationships, it is instructive to inspect the relationship between number of wife's siblings, number of husband's siblings, and number of living children in somewhat greater detail. The upper panel of Table 3 shows the mean number of living children by the sizes of both husband's and wife's family of orientation. As can be seen from the table, the mean number of living children rises as either the size of husband's or wife's family of orientation increases. Although there are some modest perturbations, this pattern holds for either variable when the other is controlled. That is, within size categories of husband's family of orientation, mean number of living children tends to rise as the size of wife's family of origin increases. The same statement applies to the relationship between number of living children and the size of husband's family of origin, within size categories of wife's family of orientation.

The most striking thing about Table 3, however, is not the relationship it exhibits between size of family of procreation and size of husband's or wife's family of orientation, but the discrepancy between the sizes of the two families. Excepting husbands and wives who themselves came from one or two child families, the mean number of living children never comes even close to the size of family of origin of either husband or wife. In a single generation, the Japanese family has moved from a quite heterogeneous size distribution to one which is centered on a two-child norm. The table thus illustrates, in a way the correlations in Table 2 do not, a simple fact about

Table 3. Mean Number of Living Children by Size of Husband's and Wife's Family of Orientation, for Married Japanese Women of Chilbearing Age, 1981

Size of Wife's Family of Orientation	Size of Husband's Family of Orientation						
	Total	1-2 Children	3	4	5	6	7 or More
	Mean Number of Living Children						
Total	1.933	1.695	1.819	1.890	1.978	2.139	2.071
1-2 Children	1.801	1.459	1.584	1.771	2.000	2.289	2.013
3	1.775	1.496	1.672	1.831	1.839	1.831	2.102
4	1.874	1.843	1.864	1.737	1.853	2.053	1.957
5	2.048	1.761	2.000	2.074	2.033	2.350	2.031
6	2.101	2.000	2.000	2.224	2.035	2.097	2.156
7 or more	2.080	1.982	2.027	1.944	2.117	2.258	2.115
	Frequencies						
Total	2953	420	524	546	459	368	636
1-2 Children	483	85	101	96	80	45	76
3	590	113	125	118	87	59	88
4	542	83	103	118	68	76	94
5	438	46	79	67	90	60	96
6	347	37	43	58	57	62	90
7 or more	553	56	73	89	77	66	192

family size persistence in contemporary Japan. There is persistence in <u>relative</u> family size, but there is very little persistence in the actual, numerical size of families across generations. Such persistence in numbers as does exist, occurs for the most part among men and women who grew up in small families and have small families themselves.

III. Towards a Model of Family Size Persistence

We have organized the variables whose intercorrelations were examined in the previous section into a causal model of the process of family size persistence. This basic model is displayed in Figure 1 in the form of a path diagram. The numbers entered beside the arrows drawn in the figure are estimates of the standardized path coefficients. The path regressions in raw score form are presented below in conjunction with the discussion of the model and its properties.

As can be seen by inspection of Figure 1, there are five exogenous variables: husband's number of siblings, wife's number of siblings, husband's educational level, wife's educational level, and the index of wife's premarital urban exposure. It would certainly be plausible to let husband's educational level and wife's educational level be dependent upon their respective number of siblings. We have ignored that possibility not only for the sake of simplicity, but also because there are factors other than size of family of origin which affect educational attainment. Many of these factors, like father's occupation and education, were not included in the survey at hand.

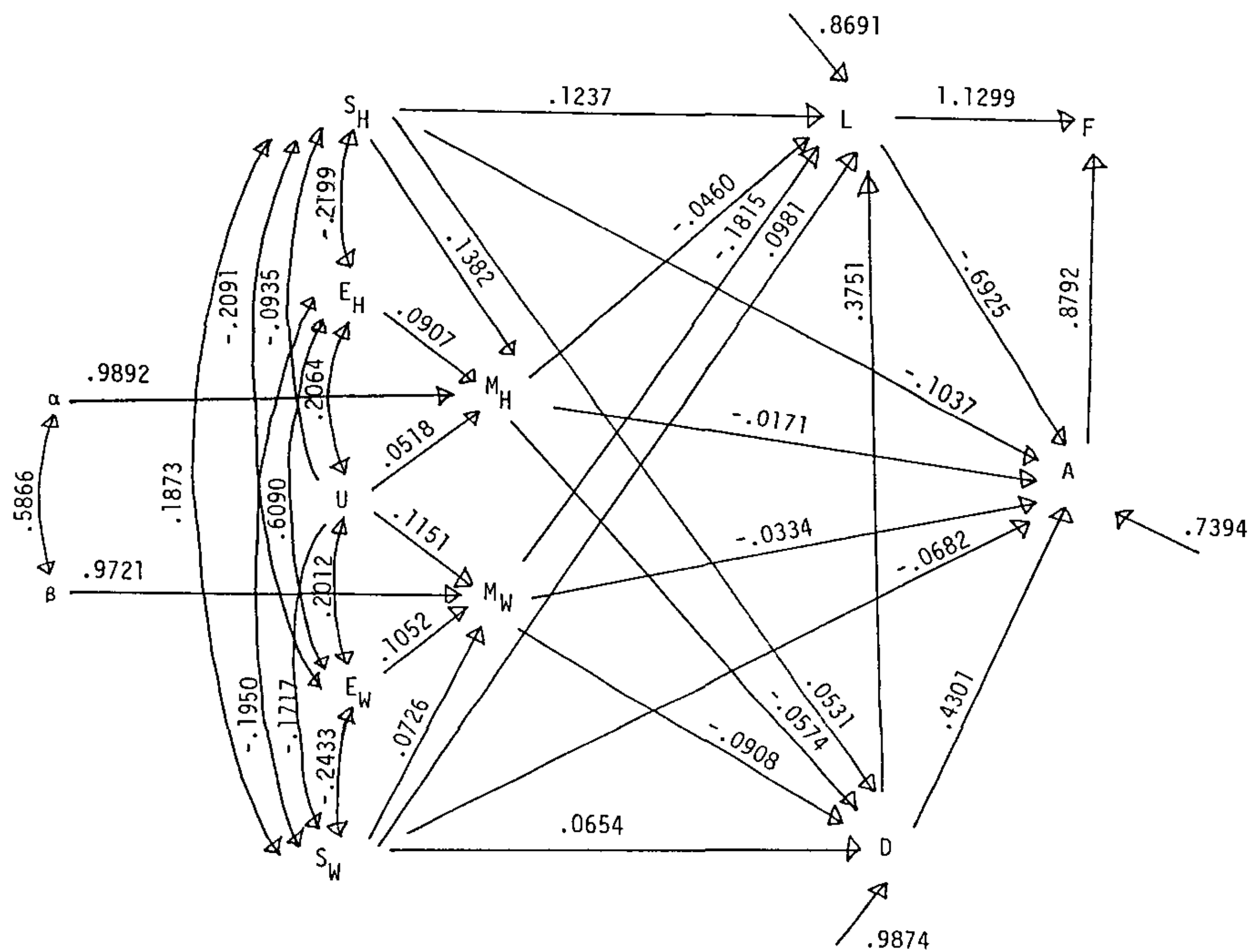
The first pair of endogenous variables are husband's age at present marriage and wife's age at marriage. Husband's age at marriage is regarded as dependent upon his own educational level and the number of his siblings, as well as the index of urban experience. A parallel equation is postulated for wife's age at marriage, with her own educational level and number of siblings replacing the corresponding variables for husbands. The two estimated equations (in raw score form) are as follows:

$$M_H = \underset{(0.239)}{24.99} + \underset{(0.0337)}{0.2392}(S_H) + \underset{(0.0708)}{0.3238}(E_H) + \underset{(0.0821)}{0.2186}(U), \qquad \text{(Eq. 1)}$$

and
$$M_W = \underset{(0.219)}{22.20} + \underset{(0.0290)}{0.1070}(S_W) + \underset{(0.0793)}{0.4206}(E_W) + \underset{(0.0685)}{0.4039}(U), \qquad \text{(Eq. 2)}$$

where the standard errors of the coefficients are reported in parentheses beneath their estimated values. As can be seen from the results, all of the coefficients are at least twice as large in absolute value as their standard errors. Thus, both wife's and husband's age

Figure 1. A Basic Model of Family Size Persistence



at marriage are conditioned by their educational levels and their number of siblings, as well as by the wife's urban experience (which, in the case of husbands, is only a proxy for his own urban experiences). It is, of course, well known that marriage is often postponed so that one may pursue educational goals and that ages of marriage are somewhat earlier in rural areas. The interesting feature of these equations, then, is the significant role attributed to husband's and wife's family size of orientation.

The results indicate that both husbands and wives from larger families tended to marry later than those with small families of origin. The actual mechanisms producing this association must, of course, remain unknown, but it is easy to envision what they might be. Older children in large families often acquire considerable responsibilities for looking after their younger brothers and sisters. Parents are dependent upon this help from older children, who are thus constrained from contracting marriages until their younger siblings can either look after themselves or their supervision can be taken over by middle children. Younger children in large families are, of corse, under some constraint to postpone their own marriages until theirolder siblings have left home and launched their own families. Thus, there is reason to suppose that all children from large families will tend to marry somewhat later, either owing to their own responsibilities in the family or to postonement of marriage until their older siblings have formed families.

As can be seen by inspection of the correlations between the exogeneous variables in Figure 1, there is some assortative mating with respect to family size of origin and a great deal of assortative mating with respect to educational level. There is also appreciable assortative mating with respect to age at marriage in contemporary Japan. Women marrying late tend to marry somewhat older husbands and vice versa. Assortative mating with respect to size of family of origin and education are insufficient to account for assortative mating with respect to age at marriage. Knowing the intercorrelations between the determinants of husband's and wife's age at marriage is insufficient to acocunt for the association between their ages at marrige. Consequently, in order to capture fully the association between husband's and wife's age at marriage, one must postulate a substantial association between the portions of the variance in husband's and wife's marital age which is not explained by urban experience, number of siblings, and educational level. In Figure 1, this is reflected in the association be α and β, the two, unmeasured exogeneous variables which are introduced to achieve complete determination of husband's and wife's age at marriage.

The next two successive endogeneous variables are, unlike husband's and wife's marital age, themselves causally related. We regard actual number of living children as dependent upon desired number of children. In addition, both actual and desired number of children are viewed as dependent upon husband's age at marriage, wife's age at marriage, husband's size of family of origin and wife's size of family of origin. The estimated structural equations for desired and actual number of children are as follows:

$$\hat{D} = \underset{(0.13)}{3.24} - \underset{(0.0048)}{0.0119}(M_H) - \underset{(0.0058)}{0.0226}(M_W) + \underset{(0.0070)}{0.0190}(S_H)$$

$$+ \underset{(0.0071)}{0.0240}(S_W), \qquad \text{(Eq. 3)}$$

and
$$\hat{L} = \underset{(0.14)}{2.05} + \underset{(0.0191)}{0.4219}(D) - \underset{(0.0048)}{0.0107}(M_H)$$

$$- \underset{(0.0058)}{0.0508}(M_W) + \underset{(0.0069)}{0.0497}(S_H) + \underset{(0.0070)}{0.0404}(S_W), \qquad \text{(Eq. 4)}$$

where as before the standard errors of the coefficients are given in parentheses beneath their estimated values. As before, all of the coefficients are at least twice as large in absolute value as their standard errors. Thus, these results are consistent with the hypothesis that both desired and actual number of children increase as the size of family of origin of both husbands and wives increases. These are, in a sense, the two key equations in the present model, since they imply that people from large families both want and have relatively large families. These effects are, to be sure, not large, but they are statistically significant. Furthermore, they are found in an environment in which there is considerable homogeneity in family size desires and family size achievements; one might well speculate that these effects would be larger in less developed nations where there is greater variation in completed family size. In addition, the results reveal that it is not only the wife's, but also the husband's size of family of origin which are implicated in the formation and realization of family size goals.

The estimated equations also reveal that both husband's and wife's age at marriage are inversely and significantly related to both desired and actual number of children. This is not surprising, since tose marrying late have passed through a greater fraction of their reproductive periods before launching the process of family formation. These effects do, however, set up an indirect mechanism which promotes disassociation of family sizes from one generation to the next. We already know that those from large families tend to marry late, but this, in turn, fosters relatively smaller rather than relatively larger families of procreation. Consequently, one can surmise that there would be even greater persistence in family size if size of family of origin were not implicated in the determination of age at marriage.

Before passing to a discussion of the final stochastic equation in the model displayed in Figure 1, it may be helpful to put the results bearing on family size persistence in the comparative perspective of another social phenomenon which has preoccupied students of stratification since the appearance of Blau and Duncan's The American Occupational Structure (1967) over a decade and a half ago. If we examine Fig. 1, we see that the direct path coefficients linking number of living children to husband's and wife's origin family sizes are both about .1, implying that, ceteris paribus, if either a husband or a wife came from a family which was one standard deviation above the mean family size in the preceding generati on, then their number of living children would be about one-tenth of a standard deviaton above the mean for their own generation. In the Blau-Duncan model, the direct path coefficient linking son's occupational SES to father's occupational SES is just .115. Thus, these data suggest that the direct effect of family size of orientat ion upon family size of procreation is about the same as the direct impact of father's occupation on son's occupation.

The final stochastic equation in the model at hand views the number of additional children wanted as a function of number of living children, number of children desired, husband's and wife's ages at marriage, and husband's and wife's family origin sizes. An equation like this necessarily implies that there is an important conceptual distinction between fertility desires and fertility wants. One could, for example, argue cogently that the number of additional children a woman wants can be obtained by the simple calculation of subtracting how many she already has from the number she says she wants. If this was the case, then the equation for number of additional children wanted would be deterministic, save for the presence of measurement error. Alternatively, one can view desires and wants as conceptually distinct. A woman formulates the number of children she regards as desirable from a variety of considerations, including her experiences, background, and demographic circumstances. She then sets about fulfilling those desires. After some experience in the process of family formation, a woman must ascertain whether or not and, if so, how many additional children she wants. This number may or may not bring her actual family size into accord with her desires. For example, she might like to have four children and she already has two. But she decides she only wants one, rather than two additional children because her last pregnancy was difficult and she feels she is getting too old to have all the children she desires. In this view, social factors other than number of living children and desired number of children may enter into the equation for number of additional children wanted. It is plainly this view which has been embodied in the basic model at hand.

The estimated structural equation for number of additional children wanted is as follows:

$$A = \underset{(0.096)}{0.881} - \underset{(0.0127)}{0.5389}(L) + \underset{(0.0137)}{0.3766}(D) - \underset{(0.0032)}{0.0031}(M_H)$$

$$- \underset{(0.0039)}{0.0073}(M_W) - \underset{(0.0046)}{0.0325}(S_H) - \underset{(0.0047)}{0.0219}(S_W), \qquad \text{(Eq. 5)}$$

where the standard errors of the coefficients are reported in parentheses beneath their estimates. The results reveal, as expected, that there is a substantial inverse relationship between number of additional children wanted and number of living children and a substantial positive association between number of additional children wanted and number of children desired. However, other factors also enter into the equation for number of additional children wanted. Husband's age at marriage is not associated with the number of additional children wanted, as its coefficient is less in absolute value than its standard error. However, wife's age at first marriage is inversely related to number of additional children wanted, its coefficient being significantly different from zero at the .05 level with a one-tailed test.

Paradoxically, both husband's and wife's number of siblings are significantly and inversely related to number of additional children. The coefficients of both variables are several times larger in absolute value than their standard errors. Thus, while those from larger families desire more children and already have more children, they want fewer additional children than those from smaller families of origin. There are several interpretations of this result. The most obvious is that there is simply a difference between those with large and small family backgrounds in the timing and spacing of children, with those from larger families establishing their families of procreation somewhat earlier than those from smaller families who space their children over wider intervals. Alternatively, the result may be rooted in the experience differential between those from large and small families. Although those from large families of origin already have somewhat larger families of procreation than those from smaller families of origin, these families are, on the average, still much smaller than the families in which those from large families grew up as can be seen from Table 3. Thus, those from large families can easily imagine the implications of adding another child to their family. In this sense, those from large families may know from their own experiences when their families are large enough, while those from smaller families continue to entertain the possibility of expanding their families of procreation.

The final equation in the model at hand is deterministic, being derived from the definition of desired terminal family size as the sum of number of additional children wanted plus number of living children. As can be seen by reference to Table 1, the variance in desired terminal family size is less than the variance in number of living children. This occurs because number of additional children wanted and number of living children are, themselves, inversely related.

Thus, if these women fulfill their wants as they close out their reproductive periods, final completed family size will be even more homogeneous than current family size.

IV. Assessing a Basic Model of Family Size Persistence

The basic model postulated in Figure 1 is clearly overidentified, since a number of potential causal effects have been set equal to zero. The main sociological feature of the model is the assumption that urban experience, educational level of husband, and educational level of wife exert their entire causal influence upon fertility via their impacts on husband's and wife's age at marriage. This gives family size of origin and age at marriage of husbands and wives relatively favorable circumstances to influence fertility desires and achievements, since they are not forced to compete with education and urban experience to capture explained variance. Consequently, it is instructive to evaluate the adequacy of the model at hand to reproduce the associations between all of the variables implicated in it.

The fundamental theorem of path analysis simply states that the correlation between the _ith_ variable and the _jth_ is equal to the sum of the products of the path from the _kth_ variable to the _ith_ variable with the correlation between the _kth_ variable and the _jth_ variable. This rule holds when either the _jth_ variable is causally antecedent to the _ith_ variable or the _ith_ and _jth_ variables are not themselves causally ordered as is, for example, the case with husband's and wife's ages at marriage in the model at hand. In symbols, the fundamental theorem is given by

$$r_{ij} = \sum_{k} p_{ik} r_{kj}, \qquad \text{(Eq. 6)}$$

subject to the condition of causality noted above. In making the computation of the right hand side of Eq. 6, it should be noted that _k_ can equal _j_, which amounts to saying that the direct causal impact of the _j_ variable on the _ith_ variable is part of the correlation between them. The fundamental theorem can be applied to an estimated model to work out the correlations, $\hat{r}_{ij}$, implied by the model. This is achieved by simply substituting $\hat{r}_{kj}$ for r_{kj} on the right hand side of Eq. 6 in all of those cases where the implied correlation between a pair of variables is not constrained by the estimating procedures to be equal to the actual correlation between that pair of variables.

We have computed all of the implied correlations between the variables. These are reported in Table 4, where it can be seen that there is generally a close correspondence between the actual correlations between the variables and those implied by the model. Out of the 38 implied correlations which can logically differ from their actual counterparts, only five have a discrepancy as large as .05 in absolute value from the actual correlations. These discrepancies involve the associations of husband's and wife's education with number of living children and number of additional children wanted and the association of urban experience with number of living children. In view of these discrepancies, it seems likely that either husband's or wife's education, if not both, influence the number of living children and the number of additional children wanted. This is especially true of the impact of wife's education upon the number of additional children wanted, where the discrepancy between the actual and implied zero order correlation is a substantial .14. Otherwise, the model appears to duplicate the actual pattern of zero order associations satisfactorily enough to serve as a working framework for the analysis of family size persistence from generation to generation.

V. Tinkering with a Basic Model

In the foregoing basic model, we treated number of additional children wanted as a stochastic variable, adopting the view that women do not just calculate the number of additional children they want by subtracting the number they have from the number they desire. We argued that the number of living children and the number wanted do not necessarily have to equal the number desired, because women may choose, depending upon their socioeconomic, physical, and other circumstances, to forgo their own desires. They may, for example, decide to have fewer children than they desire to improve the quality of life of those they already have. They could also decide to have more children than they desire to satisfy the wishes of their husbands and other relatives. (In some countries, of which Japan is not one, they could have more children than they report to desire simply because they do not wish to forego their economic value.)

Table 4. Implied Correlations and Discrepancies Between Actual and Implied Correlations in a Model of Family Size Persistence, for Married Japanese Women of Childbearing Age, 1981
(Implied correlations, above diagonal; discrepancies, below diagonal)

Variable Description and Symbol	Variable Symbol										
	S_H	S_W	E_H	E_W	U	M_H	M_W	D	L	A	F
Husband's Siblings (= S_H)	. . .	x[1]	x	x	x	x	-.0192	.0606	.1631	-.2047	.0043
Wife's Siblings (= S_W)	o	. . .	x	x	x	-.0007	x	.0729	.1437	-.1567	.0246
Husband's Education (= E_H)	o	o	. . .	x	x	x	.0737	-.0352	-.0762	.0693	-.0252
Wife's Education (= E_W)	o	o	o	. . .	x	.0368	x	-.0392	-.0862	.0768	-.0299
Urban Experience (= U)	o	o	o	o	. . .	x	x	-.0307	-.0650	.0481	-.0312
Husband's Age at Marriage (= M_H)	o	.0096	o	.0089	o	. . .	x	-.1036	-.1752	.0288	-.1726
Wife's Age at First Marriage (= M_W)	.0182	o	.0459	o	o	o	. . .	-.1230	-.2538	.0798	-.2166
Desired Children (= D)	-.0016	-.0005	.0323	.0223	-.0010	.0006	.0010	. . .	.4168	.1361	.5906
Living Children (= L)	-.0040	-.0007	-.0712	-.0964	-.0641	.0012	.0026	-.0005	. . .	-.5285	.6652
Additional Children (= A)	.0015	.0015	.0782	.1413	.0264	-.0012	-.0033	.0005	.0002	. . .	.2820
Terminal Family Size (= F)	-.0032	.0007	.0116	.0154	-.0491	.0002	.0000	-.0001	.0002	.0003	. . .

1. x means implied and actual correlations are necessarily equal.

Now suppose, contrary to this argument, we adopt the somewhat more parsimonious view that a woman simply calculates the number of additional children she wants by comparing the number she has with the number she desires. In this view, the true number of additional children a woman wants has no stochastic component, but is uniquely determined by the true number of children she desires and the true number of living children she already has. The measured variables do not, of course, reflect this identity, because they are composed of the true variables plus the noise of measurement error. In this section we revise the basic model by imposing this identity relating the true number of desired and living children to the true number of additional children wanted. A revised model with this feature should prove instructive because it will eliminate from the basic model studied above the somewhat paradoxical finding that couples from large families have more children than those from smaller families of orientation, but want fewer additional ones than those from small families.

There is no way we could possibly obtain estimates of a model which incorporates the assumption that the true number of living and desired children are related by an exact identity to the true number of additional children wanted without imposing some further assumptions upon the structure of the data. Let D_T, L_T, and A_T be, respectively, the true numbers of desired, living, and additionally wanted children. For purposes of exposition, also let D_1 and D_2 be two independent, but equivalent measures of desired number of children and let A_1 and A_2 be two independent, but equivalent measures of the number of additional children wanted. Evidently, the true and measured variables are related by the following equations:
$D_1 = D_T + e_1$, $D_2 = D_T + e_2$, $A_1 = A_T + f_1$, and $A_2 = A_T + f_2$. Our analysis proceeds on the following assumptions. First, we assume that number of living children is measured without error, i.e., that $L_T = L$. This assumption is not critical and it could be relaxed by borrowing a reliability coefficient for number of living children from some other source. However, the number of living children is generally measured quite well, especially in developed nations, and it is certainly measured with greater accuracy than the other two attitudinal variables which are subject to some unknown component of variation reflecting mood and recent experiences with living children.

Second, we assume the errors of measurement in both desired number of children and number of additional children wanted are measured with random error. This is perhaps the most tenuous of the assumptions involved here. It implies, for example, that a woman who erroneously reports that she desires more children than she actually cares to have is no more likely than any other woman to over or under-report the number of additional children she wants. This assumption is, however, critical if any estimates are to be made at all with the present data set. The best justification for it is the fact that the items involved are separated in the Mainichi questionnaire by a number of other items. Nonetheless, this assumption is almost surely violated in the actual data and the best one can hope for is that the violation is modest and does not distort the basic relationships. The third assumption is just the basic identity we are imposing upon the data. This identity, in view of the previous assumptions and notation, can now be written as

$$A_T = D_T - L, \qquad \text{(Eq. 7)}$$

since we assumed that L_T was measured without error. The last assumption rests on the third, although it cannot be logically deduced from it. We assume that the number of additional children wanted is measured with the same reliability as the <u>difference</u> between number of desired and number of living children. In symbols, this reduces to asserting that

$$r_{A_1A_2} = r(D_1 - L)(D_2 - L) = a^2, \qquad \text{(Eq. 8)}$$

where a^2 is introduced for notational convenience. It follows, however, from the assumptions of random and equivalent errors of measurement that

$$a^2 = r^2_{A_TA_T} = r^2_{A_TA_2} = r_{A_TA_1}r_{A_TA_2}. \qquad \text{(Eq. 9)}$$

With these assumptions, the analysis is tedious, but straightforward.

The explicit formula for the correlation between $D_1 - L$ and

$D_2 - L$ is as follows:

$$a^2 = r_{(D_1 - L)(D_2 - L)} = \frac{Cov[D_1 - L, D_2 - L]}{Var[D_1 - L] \quad Var[D_2 - L]}. \qquad \text{(Eq. 10)}$$

However, D_1 and D_2 are equivalent measures, so $Var[D_1] = Var[D_2]$ and $Var[D_1 - L] = Var[D_2 - L]$. Consequently, we may rewrite Eq. 10 as

$$a^2 = \frac{Cov[D_1, D_2] - 2Cov[L, D_1] + Var[L]}{Var[D_1] - 2Cov[L, D_1] + Var[L]}. \qquad \text{(Eq. 11)}$$

Since L and D_1 are measured variables, we observe, using data from the Mainichi Survey on all cases for which data on D, A, and L are available, that

$$Cov[L, D_1]/Var[D_1] = b_{LD} = .472339 \qquad \text{(Eq. 12a)}$$

and

$$Var[L]/Var[D_1] = (.86013)/(.76737)^2$$

$$= 1.25637. \qquad \text{(Eq. 12b)}$$

Dividing the numerator and denominator of Eq. 11 by $Var[D_1]$, setting $r_{D_1D_2} = Cov[D_1, D_2]/Var[D_1] = d^2$, and substituting Eqs. 12a and 12b, we find that Eq. 11 reduces to

$$a^2 = [d^2 - 2(.472339) + 1.125637]/[1 - 2(.472339) + 1.25637]$$

or

$$a^2 = .76237d^2 + .23763, \qquad \text{(Eq. 13)}$$

an identity relating the reliabilities of the numbers of desired and additionally wanted children which must hold given the assumptions stated above and the observed relationships and variances in the Mainichi data at hand.

The path diagram embodying the assumptions made above is displayed in Figure 2, where the unknown path coefficients are represent-

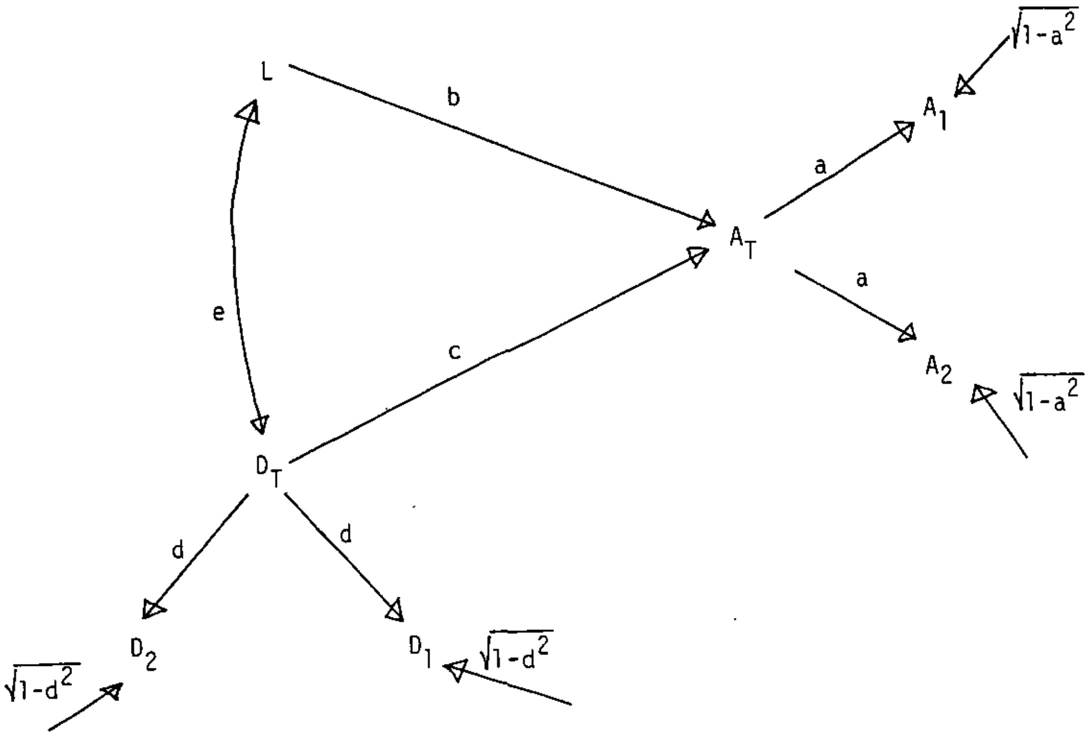


Figure 2. A Revised Model of Relationships Between Desired, Living, and Additionally Wanted Children

ed by Latin characters. Although the symbols used in Figure 2 to represent the variables are identical to those used above when the metric variables were under discussion, it is assumed in Figure 2 that all of the variables are in standard form with mean zero and unit variance. (Note that the relationship derived from analysis of the metric variables, Eq. 13, is a statement about correlations.) Using the rules for path analysis and the three correlations between D, L, and A observed in the Mainichi data for all women reporting on all three variables, we observe by simply reading off the relevant correlations from Figure 2 that

$$r_{LA} = ab + ace = -.51980, \qquad \text{(Eq. 14)}$$

$$r_{AD} = acd + abde = .13278, \qquad \text{(Eq. 15)}$$

and

$$r_{LD} = de = .42140. \qquad \text{(Eq. 16)}$$

One final equation is available to us and comes from the assumption that A_T is completely determined by L and D_T. Thus, we have

$$1 = b^2 + 2bce + c^2. \qquad \text{(Eq. 17)}$$

We are now left with five equations, Eq. 13 through Eq. 17, in the five unknown parameters in Figure 2.

The equations at hand are nonlinear in the parameters, so there is no guarantee that they have a solution at all. In fact, as some tiresome arithmetic will reveal, these equations have multiple solutions, but only one is substantively meaningful. No useful purpose is served by expositing the derivation of the solution here, since the reader has all the relevant information to derive at his or her leisure if he or she desires to do so. We simply observe that the relevant solution to these equations is by the following estimates: a = .79610, b = -1.1974, c = .93137, d = .72085, and e = .58459. (Those wishing to duplicate this calculation will most likely find that the easier path is to eliminate all of the parameters except d, yielding a single polynomial in d and powers of it.) The only particularly worrisome point about this solution is the fact that b is greater than 1, but that can and does happen to standardized path coefficients when multicollinearity is present and, in fact, as can be seen from Figure 1, it happened in the standardized equation for F in that model. In the present case, the value of b does not engender any nonsensical zero order correlations, such as those greater than one, which can also happen in situations like the present one involving unmeasured variables. In further work, we simply take this solution as given.

The estimates of the path coefficients in Figure 2 yield the equation for A_T in the revised model on which we are working. Three steps *remain to complete the solution. First, since the number of* additional children is subject to measurement error, it is necessarily the case that F = L + A is also subject to measurement error. Thus, we must first devise a new equation which represents $F_T = L + A_T$ in standard form. Second, in the equation for L, number of living children, we must introduce D_T, rather than the measured variable D as a predictor. Finally, we desire an equation for D_T, rather than for the measured value of desired number of children.

We may begin by revising the equation for desired terminal family size, the measured value of which must be subject to measurement error since one of its components is regarded as error-prone. The reliability of the measure of terminal desired family size may be written as

$$r_{F_1F_2} = r_{(L + A_1)(L + A_2)} \tag{Eq. 18}$$

$$= \frac{\mathrm{Cov}[L + A_1, L + A_2]}{\mathrm{Var}[L + A_1]} = \frac{\mathrm{Var}[L] + 2\mathrm{Cov}[L, A_1] + \mathrm{Cov}[A_1, A_2]}{\mathrm{Var}[L] + 2\mathrm{Cov}[L, A_1] + \mathrm{Var}[A_1]}$$

where $F_1 = L + A_1$ and $F_2 = L + A_2$. This formula follows owing to the equivalence of the two measures of A_1 and A_2. We may compute from Figure 2 that $r_{A_1A_2} = \mathrm{Cov}[A_1, A_2]/\mathrm{Var}[A_1] = a^2 = (.79610)^2 = .63378$. Further, we observe that $\mathrm{Cov}[L, A_1]/\mathrm{Var}[A_1] = b_{LA_1} = -.66711$ and $\mathrm{Var}[L]/\mathrm{Var}[A_1] = (.86013)/(.67019)^2 = 1.64715$, using data for the 2800 women for which there are no missing data on the numbers of desired, living, and additionally wanted children. Dividing the numerator and the denominator of the expression on the far right hand side of Eq. 18

by Var A_1 and making the numerical substitutions for the resulting quantities, we have

$$r_{F_1F_2} = [1.64715 + 2(-.66711) + .63378]/$$

$$[1.64715 + 2(-.66711) + 1]$$

$$= (.94671)/(1.31293) = .72107, \qquad \text{(Eq. 19)}$$

which implies $r_{F_TF_1} = r_{F_TF_2} = .84916$, since $r_{F_1F_2} = r_{F_TF_1}r_{F_TF_2}$. This result implies, of course, that the reliability of desired terminal family size is greater than that of the number of additional children wanted, as, indeed, it *should be since terminal desired* family size, composed of the sum of additional children wanted and number of living children, is assumed to be error free.

We may compute from Figure 2 and its solution that the correlation between the true number of additional children wanted and the actual number of living children is given by

$$r_{A_TL} = b + ce = (-1.1974) + (.93137)(.58459)$$

$$= -.65293. \qquad \text{(Eq. 20)}$$

This result, the foregoing computation of the reliability in terminal desired family size, and the relevant estimated portions of Figure 2 are embedded in Figure 3 which diagrams the revised causal model for desired terminal family size. (Although the symbols used in the diagram to represent the variables are the same as those used in the text for the metric form of the variables, one must remember that all of the variables in Figure 3 are assumed to have mean zero and unit standard deviation.) In the revised model for terminal desired family size, one has to allow for correlated errors of measurement between A_1 and F_1 and between A_2 and F_2. The reason for this is self evident: A_1 is contained in F_1 and A_2 is contained in F_2, so the errors of measurement in A_1 and A_2 will reappear, respectively, in F_1 and F_2.

We can read off from Figure 3, using the rules of path analysis, the equations for the correlation between F_1 and A_1, the correlation between F_1 and L, and the correlation of F_T with itself. This yields

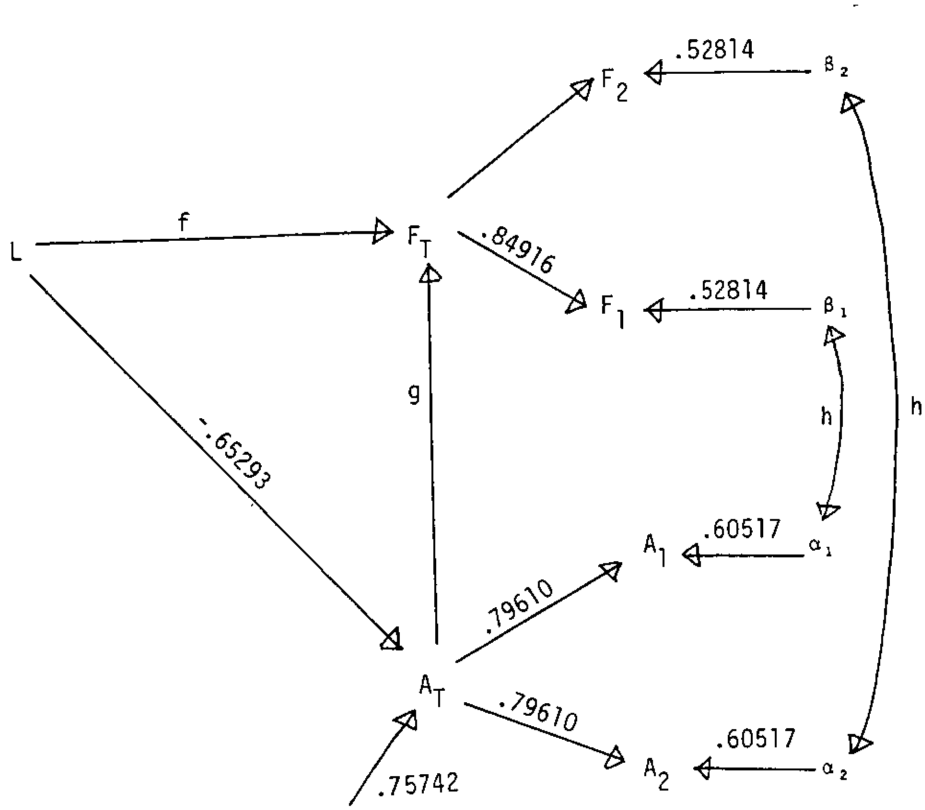


Figure 3. A Revised Model for the Determination of Terminal Desired Family Size

$$r_{F_1A_1} = (.84916)(.79610)(g - .65293f) + (.52814)(.60517)h$$

$$= .29052, \qquad \text{(Eq. 21)}$$

$$r_{F_1L} = (.84916)(f - .65293g) = .66642, \qquad \text{(Eq. 22)}$$

and $$1 = f^2 - (2)(.65293)fg + g^2. \qquad \text{(Eq. 23)}$$

The last two equations may be solved for f and g by first using Eq. 22 to find f = .78480 + .65293g and, then, substituting this intermediate result into Eq. 23 to find g^2 = .66952 and g = .81824. It then follows that f = 1.31905. These results may be substituted into Eq. 21 to obtain h = 1.000, indicating the perfect association between the errors of measurement in F_T and A_T. Anyone doubting this result, can see it clearly from the following considerations. $A_1 = A_T + f_1$, by definition, and $F_1 = L + A_1$, by construction. Substituting the former into the latter yields $F = L + A_T + f_1$, so evidently the errors in measurement of A_T, i.e., f_1, are identical to the errors in measurement of $F_T = L + A_T$.

The final two pieces of the revised model incorporating the identity between the true levels of desired, living, and additionally wanted children may be obtained by considering the path diagram given in Figure 4, which provides the relevant information from Figure 1, Figure 2, and Table 2 for deriving the new equations for living children and the true level of desired children. The intercorrelations between the predictors of the number of desired children are not affected by the allowance for measurement error. Furthermore, according to the rules of path analysis, it follows that the correlation between any one of the predictors and the true level of desired number of children is just equal to the correlation between the predictor and the measured number of desired children times the correlation between the true and measured levels of desired number of children. Thus, the estimating equations, in matrix form, are as follows:

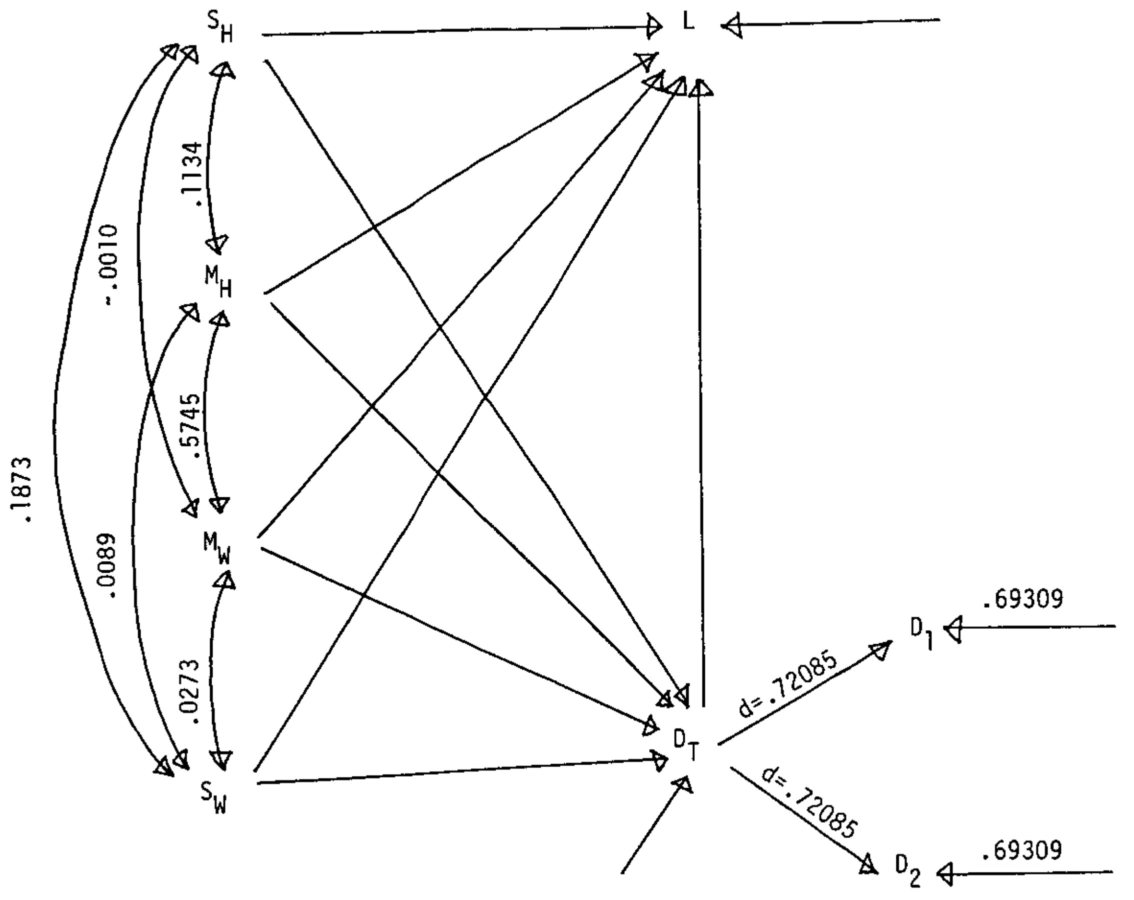


Figure 4. Number of Living Children and Desired Family Size in a Revised Model of Family Size Persistence

$$\begin{bmatrix} r_{D_T S_H} \\ \\ r_{D_T M_H} \\ \\ r_{D_T M_W} \\ \\ r_{D_T S_W} \end{bmatrix} = \begin{bmatrix} (k)r_{DS_H} \\ \\ (k)r_{DM_H} \\ \\ (k)r_{DM_W} \\ \\ (k)r_{DS_W} \end{bmatrix} = \begin{bmatrix} 1.000 & r_{S_H M_H} & r_{S_H M_W} & r_{S_H M_W} \\ \\ r_{S_H M_H} & 1.000 & r_{M_H M_W} & r_{M_H S_W} \\ \\ r_{S_H M_W} & r_{M_H M_W} & 1.000 & r_{M_W S_W} \\ \\ r_{S_H S_W} & r_{M_H S_W} & r_{M_W S_W} & 1.000 \end{bmatrix} \begin{bmatrix} p_{D_T S_H} \\ \\ p_{D_T M_H} \\ \\ p_{D_T M_W} \\ \\ p_{D_T S_W} \end{bmatrix}, \quad \text{(Eq. 24)}$$

where $k = d^{-1} = (1)/(.72085) = 1.38725$. Let β be the vector of path coefficients already obtained and entered in Figure 1, i.e.,

$$\beta = \begin{bmatrix} b^*_{DS_H} & & p_{DS_H} \\ \\ b^*_{DM_H} & = & p_{DM_H} \\ \\ b^*_{DM_W} & & p_{DM_W} \\ \\ b^*_{DS_W} & & p_{DS_W} \end{bmatrix}. \qquad \text{(Eq. 25)}$$

Further, let Y_T be the vector of correlations between the predictors and the <u>true</u> number of desired children, Y be the vector of correlations between the predictors and the <u>measured</u> number of desired children, A be the matrix of intercorrelations between the predictors, and P be the vector of unknown path coefficients on the far right hand side of the matrix equation. We can then compactly write the matrix equation as

$$Y_T = (k)Y = AP, \qquad \text{(Eq. 26)}$$

and its solution as

$$P = A^{-1}Y_T = A \quad (k)Y = (k)A^{-1}Y = k\beta. \qquad \text{(Eq. 27)}$$

Thus, the unknown coefficients in the equation for the true number of desired children may be simply obtained by inflating the path coefficients already reported in Figure 1 by the factor of $k = 1.38725$.

Obtaining estimates of the final equation, that for number of living children, is equally straightforward. The relevant matrix of intercorrelations among the predictors is just the matrix A above, augmented by an additional row and an additional column to reflect the intercorrelations between the true level of desired number of children and the remaining predictors. These associations are given above in the vector $Y_T = (k)Y$. Thus, the required coefficients can be obtained by solving

$$L = XB, \qquad \text{(Eq. 28)}$$

where

$$L = \begin{bmatrix} r_{LS_H} \\ r_{LM_H} \\ r_{LM_W} \\ r_{LS_W} \\ r_{LD_T} \end{bmatrix}, \qquad \text{(Eq. 29)}$$

x is a five by five matrix with the structure

$$X = \begin{bmatrix} A & (k)Y \\ (k)Y' & 1 \end{bmatrix}, \qquad \text{(Eq. 30)}$$

and

$$B = \begin{bmatrix} p_{LS_H} \\ p_{LM_H} \\ p_{LM_W} \\ p_{LS_W} \\ p_{LD_T} \end{bmatrix}, \qquad \text{(Eq. 31)}$$

the unknown vector of path coefficients. In the vector L of correlations between the dependent variable and the predictors, the value of r_{LD_T} is just that which was already estimated in conjunction with Figure 2. The remaining associations in this vector are just those already observed in Table 2. This completes the derivation of the estimates of the revised model.

The relevant portions of Figures 1, 2, 3, and 4 are pulled together in Figure 5 which shows the full revised model and the estimates of the path coefficients in it. The main feature of the revised model is, of course, the treatment of the determination of the number of additional children wanted, which removes the paradoxical finding that women from large families have more children, but want fewer additional ones. Size of family of orientation now operates directly only up to age at marriage, desired number of children, and number of living children.

Two other features of the revised model are worthy of comment before turning to its evaluation. First, as was evident from the estimation strategy, the path coefficients relating husband's and wife's siblings and marital ages to number of desired children are now substantially inflated. (The metric coefficients given in Eq. 3 are not, however, changed, since only random error in the dependent variable is at stake.) Second, the path coefficient linking number of living children to desired children is now substantially increased by more than 40 percent owing to the allowance for measurement error.

Despite this adjustment, the coefficients for the impacts of the sizes of wife's and husband's families of origin remain relatively healthy, as does that for wife's marital age. However, the coefficient linking number of living children to husband's age at present marriage nearly vanishes. Thus, the main link between actual fertility and husband's marital age is the indirect route via number of children desired.

VI. Evaluation and Reestimation of a Model of Family Size Persistence

The revised model displayed in Figure 5 can be evaluated in the same way as the original one, viz., by contrasting the actual associations observed in the data with those implied by the model. This task is accomplished in Table 5 in a manner generally similar to that in Table 4. There are, however, a couple of significant differences between the two tables. First, in Table 4, all of the correlations contrasted were between measured variables. In Table 5, we have utilized the correlations involving the true, rather than measured values of number of desired children. The reason for this is simple enough. The methods of estimation employed in the initial and revised model require that their performance be identical with respect to the associations among all of the variables through the measured value of desired number of children. By using the unmeasured true value of desired children as a variable in Table 5, we obtain a line of contrasts between actual and implied correlations which would have been identical to those in Table 4 had we used the measured value of desired number of children. Second, the reader should note that the discrepancies reported below the diagonal in Table 4 were obtained by simply subtracting the implied correlations above the diagonal in Table 4 from the actual correlations reported in Table 2. The same is generally true for the discrepancies reported below the diagonal in Table 5, but it does not hold for any of the contrasts involving the true level of desired children. In those instances, the contrasts in Table 5 were made <u>after</u> inflating the observed correlations in Table 2 which involve the measured value of desired children by the factor of $(1)/(r_{D_T D}) = (1)/(.72085) = 1.38725$ <u>or</u>, in several instances, borrowing correlations from the work based on Figures 2, 3, or 4, where applicable.

Comparison of Tables 4 and 5 reveals that the revised model does

Figure 5. Estimates of a Revised Model of Family Size Persistence

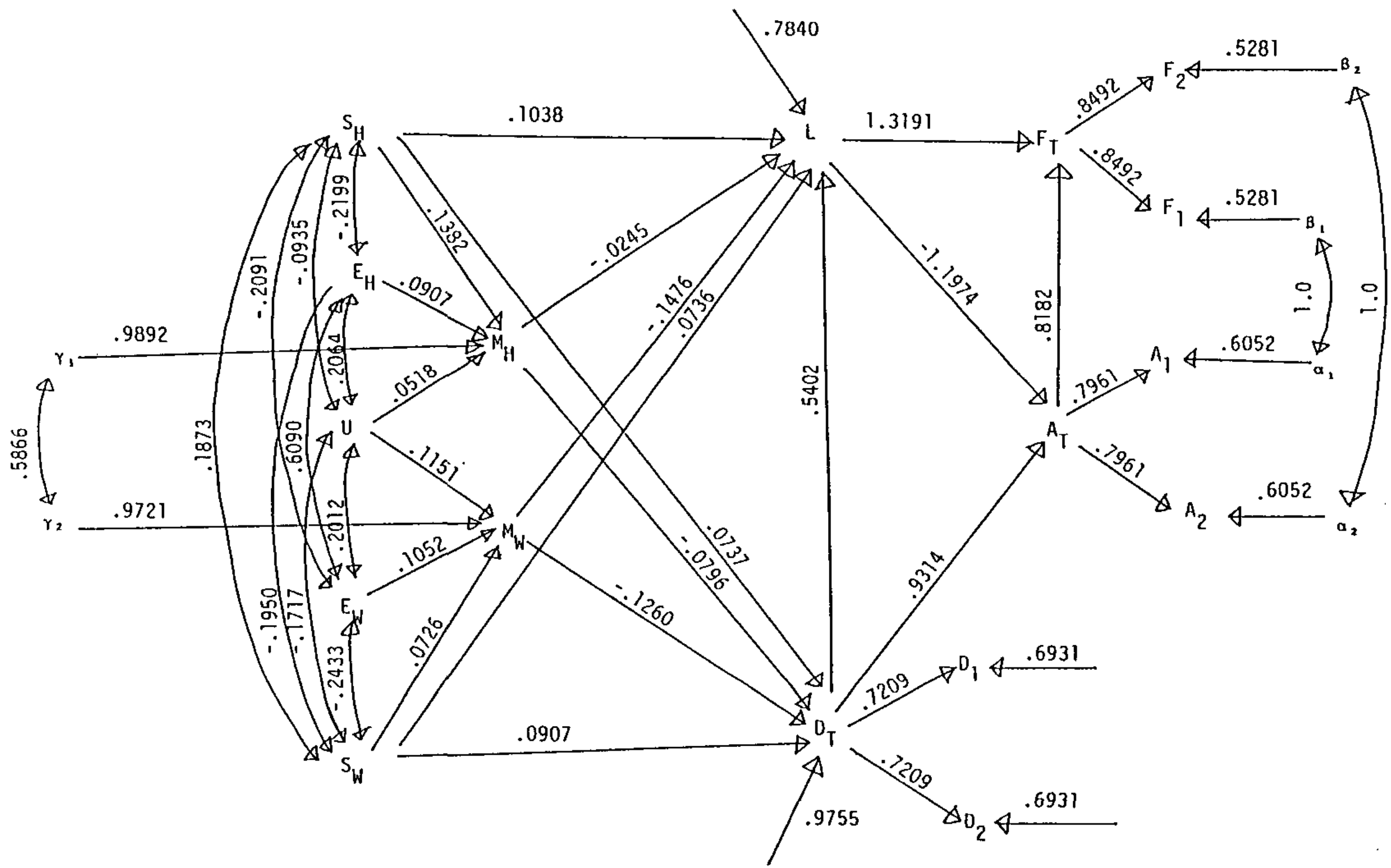


Table 5. Implied Correlations and Discrepancies Between Actual and Implied Correlations in a Revised Model of Family Size Persistence, for Married Japanese Women of Childbearing Age, 1981 (Implied correlations, above diagonal; discrepancies, below diagonal)

Variable Description and Symbol	Variable Symbol										
	S_H	S_W	E_H	E_W	U	M_H	M_W	D_T	L	A	F
Husband's Siblings (= S_H)	. . .	x[1]	x	x	x	x	-.0192	.0841	.1631	-.0931	.1180
Wife's Siblings (= S_W)	o	. . .	x	x	x	-.0007	x	.1011	.1436	-.0619	.1178
Husband's Education (= E_H)	o	o	. . .	x	x	x	.0737	-.0488	-.0762	.0365	-.0600
Wife's Education (= E_W)	o	o	o	. . .	x	.0368	x	-.0544	-.0860	.0416	-.0674
Urban Experience (= U)	o	o	o	o	. . .	x	x	-.0426	-.0650	.0304	-.0517
Husband's Age at Marriage (= M_H)	o	.0096	o	.0089	o	. . .	x	-.1437	-.1752	.0605	-.1542
Wife's Age at First Marriage (= M_W)	.0182	o	.0459	o	o	o	. . .	-.1707	-.2539	.1155	-.2042
True Level of Desired Children (= D_T)	-.0023	-.0007	.0448	.0310	.0014	.0009	.0014	. . .	.5851	.1837	.7831
Living Children (= L)	-.0040	-.0006	-.0712	-.0966	-.0641	.0012	.0027	-.0005	. . .	-.5194	.6669
Additional Children (= A)	-.1101	-.0947	.1111	.1765	.0441	-.0329	-.0390	.0058	-.0089	. . .	.2909
Terminal Family Size (= F)	-.1169	-.0939	.0232	.0529	-.0286	-.0182	-.0124	.0361	-.0015	-.0086	. . .

1. x means implied and actual correlations are necessarily equal.

not perform as well as the original model in which the number of additional children was treated as a stochastic variable. The points at which the original model were defective are also ones at which the revised model performs poorly. Like the original model, the new one fails to capture the associations of husband's and wife's educational levels with both the number of living children and the number of additional children wanted and, to a lesser extent, the association of the measure of urban experience with the number of living children. In addition, the new model misses the associations of both husband's and wife's siblings with number of additional children wanted and terminal desired family size by fairly wide margins.

Although the new model plainly performs worse than the original one, we believe it is nonetheless superior in some regards. First, the equations for desired and living children strike us as more attractive than those in the original model because they allow for measurement error in a key attitudinal item. Second, the revised model is considerably more parsimonious than the original one. Some additional errors, none absurdly large, may not be too high a price to pay for the gain in simplicity. Finally, the revised model eliminates what we regard as the somewhat paradoxical implication of the original model that those from large families have more children, but want fewer additional children than do couples whose families of origin were smaller. The reader may, of course, prefer the original model and, indeed, it is surely preferable if one chooses to regard the number of additional children wanted as a variable having a stochastic component.

Neither the revised nor the original model is wholly satisfactory, since both clearly fail to capture the association of husband's education, wife's education, and urban experience prior to marriage with number of living and/or number of additional children wanted. This defect in both models also leaves open the crucial question as to whether or not the observed direct effects of husband's and wife's siblings on cumulative fertility and additional children wanted would still remain if these variables had to compete with education and urban experience to capture variance in number of living children and number of additional children wanted. As it turns out, inclusion of the urban experience and education variables in the equations for number of living children and number of additional children wanted does little to the coefficients of the family size of origin variables or, for that matter, to the coefficients of the remaining variables in those equations. Table 6 presents a variety of ordinary least squares estimates of the coefficients observed when wife's education, husband's education, or both are entered into the equations for the number of living children and number of additional children. The results do, however, indicate that wife's, but not husband's education and urban experience enter the equation for number of living children. Wife's education and probably urban experience also enter the equation for number of additional children wanted. The coefficient of husband's education is marginally significant in the equation for number of additional children wanted, but this occurs only when wife's education is in the equation and its sign is contrary to that of wife's education (and to the sign expected). Consequently, we would be inclined to delete husband's education from both the equation for number of living children and the equation for additionally wanted children.

VII. Components of Family Size Persistence

One of the major features of path analysis and other structural equation methods is the framework they provide for decomposing the gross or zero order associations between variables, thereby indicating how total associations are built up out of direct effects, indirect effects via intervening variables, and spurious components owing to non-causal associations with other causal factors. Using the rules of path analysis, we have decomposed the relationships of number of living children with both husband's and wife's number of siblings. In making these decompositions, we have utilized the revised model presented in Figure 5. Although we have treated education, like number of siblings, as an exogenous variable, we have assumed in making the decompositions that the relationship between husband's or wife's number of siblings and, respectively, husband's or wife's educational level is a causal one. There is no question that size of family of origin is in the equation for educational level, as we noted above. However, some of the observed associations between education and number of siblings are themselves spurious, so the small causal effects found in the decomposition to operate through education are

Table 6. Alternative Equations for Number of Living Children and Number of Additional Children Wanted in a Model of Family Size Persistence, for Married Japanese Women of Child-bearing Age, 1981

Independent Variables	Dependent Variable					
	Number of Living Children			Additional Children Wanted		
	Model 1	Model 2	Model 3	Model A	Model B	Model C
	Regression Coefficients in Standard Form					
Husband's Siblings ($=S_H$)	.1059*	.1021*	.1002*	-.1010*	-.0933*	-.0963*
Wife's Siblings ($=S_W$)	.0769*	.0662*	.0656*	-.0683*	-.0569*	-.0578*
Husband's Age at Marriage ($=M_H$)	-.0439*	-.0464*	-.0457*	-.0181	-.0171	-.0160
Wife's Age at First Marriage (=M)	-.1661*	-.1617*	-.1611*	-.0327	-.0372*	-.0363*
Desired Number of Children (=D)	.3778*	.3775*	.3780*	.4293*	.4252*	.4262*
Urban Experience (=U)	-.0557*	-.0517*	-.0503*	-.0216	-.0289+	-.0265+
Husband's Education ($=E_H$)	-.0735*	--	-.0192	.0210	--	-.0318+
Wife's Education Education ($=E_W$)	--	-.1083*	-.0975*	--	.0778*	.0956*
Number of Living Children (=L)	--	--	--	-.6922*	-.6842*	-.6847*
	Coefficients of Determination					
Unadjusted R^2	.2525	.2580	--	.4540	.4589	.4595

+Coefficient Significant at .05 level with 1-tailed test.
*Coefficient greater than twice its standard error in absolute value.

almost certainly overstated.

The decompositions are presented in Table 7, in both standardized magnitudes and in percentage form. As can be seen from the table, the decompositions of the relationships between number of living children and both husband's and wife's siblings are broadly similar. First, most of the total associations are causal, either directly or indirectly. This amounts to roughly four-fifths of either total association. Second, the main indirect effect is that which operates via desired children alone and amounts to at least one-fifth of the total association. Third, the main spurious component of the total association between number of living children and size of family of origin can be traced to assortative mating with respect to size of family of origin. This amounts to somewhat more than ten percent of the gross relationship between number of living children and either husband's or wife's siblings. Fourth, the impact of number of siblings upon marital age and the subsequent impacts of marital age on number of siblings directly and via desired children tends to decrease family size persistence. These indirect effects are, however, small and their absolute magnitude comes to around 10 percent of the gross positive associations between number of living children and either husband's or wife's siblings. The broad similarities between the decompositions of the relationships of number of living children with the size of husband's and wife's families of origin obscure some minor differences between the ways the two total associations are built up. The causal impact of wife's siblings operates somewhat more indirectly, both in magnitude and in percentage terms, than does the causal impact of husband's siblings. Much of this difference rests on the somewhat stronger indirect influence of wife's siblings via the intervening variable of desired children. Other, quite minor differences in the two decompositions could be detailed, but to do so would involve a discussion of differences which are surely substantively, as well as statistically, insignificant. The main conclusions are clear; (1) both husband's and wife's size of family of origin exert an impact upon number of living children, thus establishing family size persistence in both the paternal and maternal lines; (2) the components of both these impacts are quite similar, and (3) the major component of both total causal impacts operates directly, from family size in one generation to family size in the next.

Table 7. Decomposition of the Gross Associations Between Number of Living Children and Husband's and Wife's Size of Family of Origin, Married Japanese Women of Childbearing Age, 1981

Component	Living Children With: Husband's Siblings	Living Children With: Wife's Siblings
	Magnitude	
Total Association (Implied by Model)	.1630	.1438
A. Direct Effect	.1038	.0736
B. Indirect Effects (total)	.0319	.0389
1. Via Desired Children	.0398	.0490
2. Via Marital Age	-.0034	-.0107
3. Via Marital Age and Desired Children	-.0059	-.0049
4. Via Education (total)	.0014	.0055
a. Through Marital Age	.0005	.0038
b. Through Marital Age and Desired Children	.0009	.0017
C. Spurious (total)	.0273	.0313
1. Through Urban Experience	.0026	.0049
2. Through Spouse's Education	.0047	.0012
3. Through Spouse's Siblings	.0200	.0252
	Percent of Total Association	
Total Association (Implied by Model)	100.0	100.0
A. Direct Effect	63.7	51.2
B. Indirect Effects (total)	19.6	27.1
1. Via Desired Children	24.4	34.1
2. Via Marital Age	-2.1	-7.4
3. Via Marital Age and Desired Children	-3.6	-3.4
4. Via Education (total)	0.9	3.8
a. Through Marital Age	0.3	2.6
b. Through Marital Age and Desired Children	0.6	1.2
C. Spurious (total)	16.7	21.7
1. Through Urban Experience	1.6	3.4
2. Through Spouse's Education	2.9	0.8
3. Through Spouse's Siblings	12.2	17.5

VIII. Summary and Discussion

In this paper, we have examined a causal model of family size persistence in contemporary Japan. We have found small, albeit statistically significant effects of size of family of origin upon number of living children. This result in itself must be regarded with some mild surprise, since the women studied herein have, for most part, lived through Japan's demographic transition. Their families of origin are quite large, as was revealed in Table 3, while their own families are relatively small. That there should be any persistence in family size at all between generations with such different sizes of families must itself be regarded at least as surprising, if not outright amazing.

Our purpose in documenting the contemporary Japanese case was not only to exhibit the degree and nature of family size persistence in Japan, but to set forth a framework of analysis which could be employed in future inquiries, especially in less developed nations where we would generally expect family size persistence to be relatively greater. In studying the Japanese data, several important points have emerged which we believe demand attention in future inquiries. First, it is quite clear from the Japanese data that family size persistence works in both the paternal and maternal lines; thus, it is imperative that both husband's and wife's size of family of origin be included in analyses of family size persistence.

An important corollary of the first observation is that the level of assortative mating with respect to size of family of origin is itself implicated in the process of family size persistence. Because both husband's and wife's size of family of origin exert direct influences upon size of family of procreation, the correlation between husband's and wife's family of origin size is itself a factor in the gross level of family size persistence from generation to generation. A few illustrative calculations will clarify this point. Suppose, as is the case in contemporary Japan, the impacts of husband's and wife's siblings, independent of each other, on size of family of procreation are approximately equal to each other. Set this impact equal to k and let a be the correlation between husband's and wife's siblings. It can then be shown that the joint impact of both husband's and wife's siblings on the nuclear family, expressed as the proportion of common variance, is given by 2k (1 + a), which plainly increases as assortative mating with respect to husband's and wife's sizes of family of origin increases. One can venture the speculation that, in general, as development proceeds, assortative mating with respect to family size of origin most likely declines. New opportunities open up for those from large families, including chances for continuing their schooling and migrating from rural to urban areas where they fall into relatively open marriage markets. Such a decline in positive assortative mating with respect to size of family of origin would itself generate a decline in the extent of family size persistence. This is one of the reasons why the findings presented here for Japan cannot be generalized, especially for less developed nations.

A second observation from the Japanese case hinges on the role of age at marriage in the determination of fertility and the way it is affected by size of family of orientation. Again, the Japanese data suggest the importance of considering both husband's and wife's age at marriage, though the latter exerts somewhat greater influence over fertility. For both husbands and wives, those from larger families tend to marry late and, since late marriage reduces completed fertility, the impact of size of family of origin on ages of marriage is translated into a reduction, rather than an augmentation of family size persistence. In the Japanese case, this indirect effect is quite small, but it need not be so elsewhere. Attention must be paid in subsequent studies to this factor.

A third factor which emerges from consideration of the Japanese data is the role of desired children, which is shaped by both husband's and wife's siblings, as well as their ages at marriage. Fertility desires prove in Japan to be a signal way in which family size is transmitted from one generation to the next. This factor cannot be ignored and it would doubtless prove instructive to conduct interviews with both husbands and wives so that the family size desires of both could be ascertained and modelled.

A fourth and final point emerges from the data and the models of it reviewed herein. The Japanese evidence is plainly consistent with the view that those from large families have more children than those from small families, but they also want fewer additional children than those with small family origins. The combination of these two factors leaves virtually no association between size of family of origin and terminal desired family size. This suggests two possibilities: (1) the major impact of family size of origin may be on childspacing and other aspects of family formation, rather than on completed family size and (2) since the women studied here are still forming their families, there is the distinct prospect that, if their fertility wants are fulfilled, the relationships exhibited here between size of family of origin and number of living children may dwindle as these cohorts pass through their reproductive cycles. Although we have not reported the results in the present paper, we have explored both of these possibilities in a limited way.

First, we studied the relationship between husband's and wife's siblings and the interval between marriage and first birth for women with at least one child. We also studied the interval between first and second births for women with at least two children and between second and third birth for those with three or more children. We could detect no systematic relationships between these birth intervals and the size of either husband's or wife's family of origin. Second, we disaggregated the data studied here by age of wife and examined the relationships surveyed above within the groups of women currently aged 20-29, 30-39, and 40-49. The impact of husband's siblings on husband's age at marriage was observed for all the groups. The parallel effect of wife's siblings on wife's age at marriage was found in two of the cohorts. Desired number of children was consistently affected by wife's siblings in all of the groups, but the impact of husband's siblings was statistically significant only in the oldest group. However, the direct impact of wife's siblings on number of living children was found only in the youngest cohort. Husband's siblings were related to number of living children in the oldest and youngest cohorts, but its impact was in both cases quite negligible. No consistent relationship could be detected within the cohorts between number of additional children wanted and either husband's or wife's size of family of origin. All of these relationships are net ones, i.e., associations adjusted for the relevant control variables indicated by the model displayed in Figure 1. In general, these disaggregated findings underscore the relatively slight degree of family size persistence to be found in contemporary Japan. This need not prove the case elsewhere; comparative inquiries are clearly needed if we are to get a firm handle on the extent of family size persistence and how it changes over the course of economic change and demographic transition.

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