

# ***Education and Fertility in Contemporary Japan***

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## A B S T R A C T

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This paper examines the residue of educational differentials in fertility which can be detected in the final stages of Japan's demographic transition and attempts to ascertain to what extent this residue can be attributed to other factors rather than to real differences in the fertility behavior of couples differing in their educational attainments.

The analyses developed in this paper have revealed that educational differentials in numbers of children ever born and numbers of additional children wanted are insubstantial. This is especially the case after the gross differentials by husband's and wife's education are adjusted for a variety of socioeconomic and demographic factors known to be correlated with fertility behavior.

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## I. Introduction

There is ample reason to suppose that educational and other socioeconomic differentials in fertility themselves change over the course of the demographic transition (United Nations, 1973). During the pre-transition period, when both mortality and fertility are high, there is little control over fertility except by virtue of abstinence and its possible social embodiment in norms governing the ages of brides and grooms at first marriage. Under such a regime, few, if any, socioeconomic differentials in fertility would be expected. The relatively well-to-do and their offspring are most likely to be the immediate beneficiaries of the onset of mortality declines owing to improved sanitation and public health. Thus, one can envision the possibility that the early stages of the demographic transition are characterized by a positive relationship between socioeconomic position and completed family size, even though current fertility remains largely undifferentiated by socioeconomic status. The advance of industrialization is likely to undermine the value of children among, especially, the owners of production, whose own security is guaranteed by their profits and whose family fortunes would tend to be diluted if distributed among a large number of offspring. Among workers, however, the value of children remains largely unchanged, since child labor in factories and sweatshops remains a significant source of revenue. Furthermore, pension schemes have not yet emerged to undermine old age dependency upon the charity of one's own offspring. These trends are, of course, reinforced by the spread of education, both by increasing the costs of children in upper socioeconomic groups and by delaying marriage and childbearing among their offspring. Thus, one may expect the inverse relationship between socioeconomic position and fertility to emerge over the course of the demographic transition, perhaps reaching its pinnacle during the period when mortality has bottomed out and fertility is still decreasing.

The continuing spread of education, itself propelled by the increasing skill levels required of workers in an industrial regime of growing technological complexity, ultimately raises the costs of children to workers, as well as to owners, managers, and professionals. The spread of social security and other pension schemes rein-

forces the impact of rising educational standards by reducing the dependency of parents upon their offspring for support in their retirement years. Thus, in the latter phases of the demographic transition one can expect socioeconomic differentials in fertility to diminish gradually, perhaps ultimately disappearing.

At its present stage of demographic development, Japan has clearly passed into the twilight, if she has not already reached the end, of her demographic transition. The 16th Mainichi Survey of Fertility and Family Planning, conducted in the Spring of 1981, revealed, for example, that about three-fifths of Japanese women of childbearing age regard three children as the ideal number for a Japanese couple; an additional three-tenths put the number at two. These stated ideals are not large, but the actual desires of these same women are even smaller. Although three-fifths reported three as the ideal number of children, only about two-fifths themselves want three children. The actual number of children ever born has, of course, been declining in successive cohorts. In the Mainichi Survey of 1981, married women aged 45-49 reported 2.25 children ever born on the average; the figure for those aged 40-44 was 2.21. Thus, the family of two to three children has clearly emerged as the norm in Japanese society, both with respect to ideals and personal desires. In actual behavior, the two-child family is more nearly the norm. In a world like this, where there is considerable homogeneity in perceived ideals, personal wishes, and actual behavior, it would be startling, indeed, to find large socioeconomic differentials in fertility. In this paper, we examine the residue of educational differentials in fertility which can be detected in the final stages of Japan's demographic transition and attempt to ascertain to what extent even this small residue can be attributed to other factors rather than to real differences in the fertility behavior of couples differing in their educational attainments.

## II. Children Ever Born and the Educational Attainment of Couples

The relationship between children ever born and both husband's and wife's educational attainment is shown in the upper panel of Table 1. These data refer to married women of childbearing age and are derived from the 16th Mainichi Survey of Fertility and Family

Table 1. Mean Number of Children Ever Born by Education of Husband and Education of Wife, for Japanese Women of Childbearing Age, 1981

Education of Wife	Education of Husband			
	Total	Primary	Secondary	Some Junior College or More
Mean Number of Children Ever Born				
Total	<u>1.974</u>	<u>2.207</u>	<u>1.944</u>	<u>1.785</u>
Primary	<u>2.222</u>	2.297	2.113	1.871
Secondary	<u>1.912</u>	1.941	1.915	1.885
Some Junior College or More	<u>1.724</u>	2.077	1.805	1.680
Expected Means from Additive Model				
Total	..	..	..	..
Primary	..	2.270	2.143	2.075
Secondary	..	2.038	1.911	1.844
Some Junior College or More	..	1.895	1.768	1.701
Actual Minus Expected Means				
Total	..	..	..	..
Primary	..	0.027	-0.030	-0.204
Secondary	..	-0.097	0.004	0.011
Some Junior College or More	..	0.182	0.037	-0.021
Frequencies				
Total	<u>2684</u>	<u>709</u>	<u>1305</u>	<u>670</u>
Primary	<u>814</u>	526	257	31
Secondary	<u>1414</u>	170	930	314
Some Junior College or More	<u>456</u>	13	118	325

Planning mentioned above. These data were collected in the Spring of 1981, using a stratified, multistage sampling procedure. Cities, towns, and villages throughout Japan were first stratified on the basis of population and local characteristics. Using Basic Resident Registers, respondents were randomly chosen from each primary sampling unit. Details of the sampling procedure are available elsewhere and will not, therefore, be recited here; they are similar to those employed in previous surveys in this series (see, e.g., Population

Problems Research Council, 1978). The original sample was, however, comprised of 3,078 currently married women of childbearing age. The present analysis is restricted to the 2,684 respondents for which complete information was available on all variables included in the present analysis of number of children ever born.

As can be seen by inspection of Table 1, there is a slight inverse association between children ever born and both husband's and wife's educational level. Women who have themselves attended at least a junior college or an old or new system technical or commercial college have, on the average, about half a child less than those who attended an old primary school or a new primary or junior high school. The gross differential observed by wife's education is replicated quite closely when women are grouped by their husband's rather than by their own educational level. Although greatly attenuated, owing to the substantial association between the educational level of husbands and wives, systematic differentials in the mean number of children ever born can be observed for levels of wife's education within categories of husband's education and vice versa.

Since the differentials observed in the upper panel of Table 1 suggest that both husband's and wife's education exert an influence over the number of children ever born, the initial steps in our subsequent analysis were to ascertain, first, whether this can be statistically demonstrated and, if so, to determine if the two effects are additive. For this purpose we constructed the following dummy variables:

$EW_1 = 1$ , if wife attended only primary school and 0, otherwise;  
 $EW_2 = 1$ , if wife attended secondary school and 0, otherwise;  $EH_1 = 1$ , if husband attended only primary school and 0, otherwise; and  $EH_2 = 1$ , if husband attended secondary school and 0, otherwise. The regression of number of children ever born (= C) on these four dummy variables is given by

$$\hat{C} = 1.701 + .375(EW_1) + .143(EW_2) + .194(EH_1) + .066(EH_2),$$

(.044)
(.066)
(.054)
(.062)
(.048)

where the standard errors of the coefficients are shown in parentheses beneath their estimated values. As can be seen, three of the four coefficients are more than twice their standard errors, revealing that

women with primary school attendance and with secondary school attendance have more children on the average than those with junior college attendance or more. This is so even after husband's education has been controlled. Similarly, controlling for wife's education, the regression reveals that women whose husbands attended only primary school, but not those whose husbands attended secondary school, have more children on the average than those whose husbands advanced at least to the junior college level.

The regression does not speak directly to the significance of the difference between the fertility levels of those with primary and secondary school educations, since the dummy variables were constructed to contrast both of these groups with the omitted category of those with at least some junior college attendance. The relevant test can, however, be readily constructed from the variance/covariance matrix of the coefficients. We find that the difference between the average number of children ever born, adjusted for husband's education, of women who attended primary school and women who attended secondary school is given by  $(.375) - (.143) = .232$ . We find that the standard error of this difference is given by

$$[(.00436321) - (2)(.00250799) + (.00287915)]^{1/2} = .047,$$

which is clearly less than half the observed difference in adjusted means. A parallel test likewise reveals that women whose husbands attended only primary school have more children on the average than those whose husbands attended no more than secondary school. This difference is, of course, adjusted for wife's educational level. These tests, coupled with the regression analysis, lead one to conclude that both husband's and wife's educational levels have independent, statistically significant influences upon the number of children ever born among contemporary Japanese women of childbearing age.

The second step in our initial analysis was to study whether or not the demonstrated influences of both husband's and wife's education upon children ever born are, in fact, additive ones. There are reasons to surmise that the impacts of husband's and wife's educations may interact in their impact upon fertility. For example, Japanese society remains a male dominated one; it is, therefore, possible that, in those cases where the educational levels of husbands and wives are

inconsistent with one another, the couple's fertility behavior will be more nearly consonant with the education of husbands rather than with the education of wives.

The second panel of Table 1 exhibits the number of children ever born which would be observed among couples with different educational backgrounds if the effects of husband's and wife's schooling upon fertility were additive ones. The third panel exhibits the discrepancies between the actual numbers of children ever born and those expected from the additive model estimated above. The additive model evidently fits the data rather well; excepting the two extreme cells where the educational levels of husbands and wives are at polar opposites of the educational continuum, the differences between the actual and expected number of children ever born diverge by as much as one-tenth of a child in only one case. In the extreme cases, where the wife has attended at least junior college and the husband has attended only primary school or vice versa, the discrepancies are more substantial, amounting to .2 of a child. Furthermore, the pattern of these discrepancies is consistent with the view that husband's educational level is the dominant force when the couple has divergent educational backgrounds. Women who themselves progressed at least to junior college, but whose husbands did not advance beyond primary school, have about .2 of child more than expected from the additive model. Just the reverse is observed for women who did not progress beyond primary school, but whose husbands advanced to junior college or beyond. They have about .2 of a child less than expected from the additive model. Although these discrepancies are consistent with the view that husband's education dominates when couples have disparate educational experiences, they are based, as can be seen from the bottom panel of Table 1, upon a very small number of cases. Consequently, they do not detract very much from the overall goodness of fit of the additive model.

Statistically, one cannot reject the hypothesis that the additive model adequately describes the sample means in the upper panel of Table 1. The sum of squares between the means in the upper panel of Table 1 is just 97.495. The within group sum of squares is 2164.679. The sum of squares accounted for by the additive model estimated above is 92.705, which is based on four degrees of freedom as opposed to the eight degrees of freedom upon which the total between mean sum of

squares rests. A test for the fit of the additive model is, therefore, given by

$$F = [(97.495 - 92.705)/(4)]/[(2164.679)/(2675)] = 1.479,$$

which is not significant at the .10 level with 4 degrees of freedom in the numerator and 2,675 degrees of freedom in the denominator. One cannot, therefore, reject the hypothesis that the influence of husband's and wife's educational levels upon fertility are additive.

Having ruled out the possibility of statistically significant interaction between the influence of husband's and wife's educational level on fertility, we may further inquire if their impacts are identical. This hypothesis can be tested by constraining the coefficients of similar categories of wife's and husband's education to be identical to one another. To accomplish this, we define the following new variables:

$$EF_1 = EW_1 + EH_1$$

$$\text{and } EF_2 = EW_2 + EH_2$$

The regression of children ever born on these two new variables is given by

$$\hat{C} = 1.710 + .282(EF_1) + .103(EF_2),$$

(.043) (.028)                      (.027)

where the standard errors of the coefficients are reported in parentheses beneath their estimated values. The sum of squares explained by this regression is 90.631, as compared with the sum of squares of 92.705 associated with the additive model. The residual sum of squares from the additive model is 2169.469, so we can test the difference between the constrained and unconstrained model by

$$F = [(92.705 - 90.631)/(2)]/[(2169.469)/(2679)] = 1.28,$$

which is not significant by any conventional criterion. We may further compare the constrained model, in which the force of husband's

and wife's educational levels are equated, with the total between mean variance. The relevant test is given by

$$F = [(97.495 - 90.631)/(6)]/[(2164.679)/(2675)] = 1.14,$$

which is likewise insignificant. We are, thus, unable to reject the hypothesis that the effects of husband's and wife's educational attainment on the number of children ever born are both additive and equal among currently married Japanese women of childbearing age.

### III. Adjusting the Impact of Education on Fertility for Control Factors

Fertility is evidently influenced by a variety of factors other than the educational attainments of husbands and wives. Furthermore, the educational levels of both husbands and wives are themselves correlated with a number of these factors which contribute to the determination of fertility behavior. In order to reveal the impact of education, if any, upon the fertility experiences of Japanese women, it is imperative that we control for as many of these additional variables as possible. Using dummy variable regression analysis, we have consequently adjusted the mean number of children ever born observed among couples with diverse educational backgrounds for the following variables: (1) farm occupation, (2) urban experience prior to marriage, (3) patrilocality of residence before marriage, (4) wife's work experience prior to marriage, (5) type of marriage, (6) desired number of children, and (7) duration of marriage. We will subsequently refer to these factors collectively as the controls.

All of the control variables were defined either as single dummy variables or as sets of dummy variables. The variable for farm occupation simply took on the value 1 if the husband's occupation was in agriculture or fisheries and the value 0, otherwise. Urban experience prior to marriage was represented by two dummy variables. One of these variables took on the value 1 if the wife was both living in an urban area when she attended primary school and when she was married. The other took on the value 1 if she was living in an urban area at one, but not both of these times. (The second variable primarily captures those who moved from a rural to an urban area

between the completion of high school and marriage, since there is virtually no urban to rural migration over the life span in contemporary Japan.) Patrilocality of residence was indicated by a single dummy variable which took on the value 1 if the couple resided with the husband's parents after marriage and the value 0, otherwise. Wife's work experience and type of marriage were likewise measured by single dummy variables, one taking on the value 1 if the wife worked prior to marriage and the value 0 if she did not and the other taking on the value 1 if the couple met on their own accord and the value 0 if they met through a go-between. As was mentioned above, the vast majority of Japanese women themselves desire to have two or three children. The desired number of children was, consequently, treated as a dichotomous variable taking on the value 1 for women who want two or fewer children and the value 0 for those who want three or more. Duration of marriage was indicated by five dummy variables representing six length of marriage categories, separated into five year groups from less than five to 25 or more years.

The mean number of children ever born observed for women differing in their own and in their husband's education were simultaneously adjusted for all of these control variables. The resulting adjusted means, which represent the impact of husband's and wife's education on children net of these control factors, are shown in the upper panel of Table 2. As can be seen by comparison of the upper panels of Tables 1 and 2, the gross educational differentials in the number of children ever born are virtually eliminated once the controls are introduced. For example, the gross differential in the number of children ever born by women who attended only primary school and those who went on to junior college or beyond amounts to about half a child, .498 of a child to be more precise than these data justify. The net differential between the same two groups amounts to about one-tenth of a child, .107 children being the sample estimate. Thus,  $(100)(.498 - .107)/(.498) = 78.5$  percent of the gross differential can be attributed to differences between these educational groups in the control variables. A similar statement holds for the comparisons of groups of women classified according to their husband's educational level, where  $(100)(.422 - .148)/(.422) = 64.9$  percent of the gross differential between women whose husbands did not advance beyond primary school and those whose husbands advanced to junior college and

beyond can be attributed to the correlated control factors. In sum, educational differentials in fertility in contemporary Japan are small to begin with and those which can still be found are largely attributable to the operation of other factors. Education, quite simply, exerts only a very modest influence over the number of children ever born in contemporary Japanese society.

Although the introduction of the control factors severely attenuates the educational differential in the number of children ever born, the residual effect which remains nonetheless appears to be systematic. Inspection of the upper panel of Table 2 indicates that the number of children ever born declines modestly, even after adjustment, as the educational attainment of husbands rises. The number of children ever born is also less, albeit very modestly, among women who attended secondary school than it is among those stopping at the primary level. There is, however, virtually no difference between the adjusted average number of children ever born among women who reached secondary school and those who advanced to higher levels of achievement.

Just as we did for the unadjusted means, we may query whether or not the adjusted means are adequately described by a model which postulates only an additive influence of the education of husbands and that of wives. The sum of squares associated with a model that includes both the control variables and terms representing every combination of husband's and wife's education is 747.25 and is based on 21 degrees of freedom. The residual sum of squares from this model is 1514.924 and is based on 2663 degrees of freedom. A model which incorporates only additive effects for husband's and wife's educational levels has an explained sum of squares of 746.789. A test for the difference between the additive model and that which allows for a separate effect of every combination of husband's and wife's education is given by

$$F = \{ (747.25 - 746.789) / (4) \} / \{ (1514.924) / (2663) \} = 0.203,$$

which does not even approach significance. One cannot, therefore, reject the hypothesis that the net influences of husband's and wife's education on fertility, after adjusting for other correlates of fertility, are additive. This statistical conclusion is consonant

Table 3. Mean Number of Additional Children Wanted by Education of Husband and Education of Wife, for Japanese Women of Childbearing Age, 1981

Education of Wife	Education of Husband			
	Total	Primary	Secondary	Some Junior College or More
	Mean Number of Additional Children Wanted			
Total	<u>0.337</u>	<u>0.194</u>	<u>0.341</u>	<u>0.478</u>
Primary	<u>0.153</u>	0.135	0.167	0.345
Secondary	<u>0.351</u>	0.368	0.348	0.351
Some Junior College or More	<u>0.615</u>	0.250	0.664	0.611
	Expected Means from Additive Model			
Total	..	..	..	..
Primary	..	0.142	0.173	0.180
Secondary	..	0.323	0.353	0.360
Some Junior College or More	..	0.580	0.611	0.618
	Actual Minus Expected Means			
Total	..	..	..	..
Primary	..	-0.007	-0.006	0.165
Secondary	..	0.045	-0.005	-0.009
Some Junior College or More	..	-0.330	0.053	-0.007
	Frequencies			
Total	<u>2572</u>	<u>670</u>	<u>1252</u>	<u>650</u>
Primary	<u>769</u>	495	245	29
Secondary	<u>1359</u>	163	894	302
Some Junior College or More	<u>444</u>	12	113	319

disappear since it is the educational groups with the fewest children who desire to have the most more.

Although there are some exceptions, notably for women who attended secondary school, the means in the upper panel of Table 3 are generally consistent with the view that education of husband and education of wife exert independent influences over the number of additional children desired. A model specifying additive effects of

husband's and wife's education is treated separately and those found when an additive model is imposed on the data. The discrepancies between the two sets of means never amount to as much as one-tenth of a child and the largest discrepancies are observed at the extremes where husband's and wife's educational levels are inconsonant and very few cases are involved.

As was the case with the gross means, one might also inquire, given that the effects of husband's and wife's educational levels are additive, whether or not they are equal as well. However, pursuing that hypothesis is ill-advised until one first determines if either husband's or wife's education has any statistically significant effect at all once the controls are introduced. The residual sum of squares from the model incorporating the controls and the additive effects of both husband's and wife's educations is 1515.385. The same model has an associated explained sum of squares of 746.789, as noted above. A parallel model which includes only the additive effect of husband's education has an explained sum of squares of 746.358. Thus, a test of the unique effect of wife's education, adjusting for the controls and husband's education has an explained sum of squares of 746.358. Thus, a test of the unique effect of wife's education, adjusting for the controls and husband's education, is given by

$$F = [(746.789 - 746.358)/(2)]/[(1515.385)/(2667)] = 0.379,$$

which is not significant. One cannot, therefore, reject the hypothesis that wife's education contributes nothing to the variance in the number of children ever born once husband's education and the control variables are taken into account. Stated otherwise, there are no net differentials in marital fertility in contemporary Japan with respect to wife's education.

Evaluation of the unique contribution of husband's education to the variance in the number of children ever born proceeds in the same fashion. We find that a model incorporating the control factors and the additive effect of wife's education has an explained sum of squares of 743.293. The contribution of husband's education is then evaluated by considering

$$F = [(746.789 - 743.293)/(2)]/[(1515.385)/(2667)] = 3.08,$$

which is significant at approximately the .05 level with 2 degrees of freedom in the numerator and more than one thousand in the denominator. Thus, one cannot reject the hypothesis that there are net differentials in the number of children ever born with respect to husband's schooling, even after controlling for a variety of socioeconomic and demographic correlates of fertility.

Although husband's education exerts a statistically significant influence over a couple's fertility behavior, its impact is substantively quite modest. The gross variance in children ever born associated with husband's education amounts to less than three percent of the total. The unique variance left to husband's education, once wife's education and the control variables are introduced, comes to just  $(746.789 - 743.293)/(746.789 + 1515.385) = .0015$  or about one-tenth of one percent of the total variance. If there was any doubt before, this calculation surely leaves no question that educational differentials in fertility have all but disappeared in contemporary Japanese society.

#### IV. Education and Future Fertility

While the educations of husbands and wives may exert little influence over actual childbearing, education may still be a potent factor in the formation and ultimate fulfillment of future fertility expectations. Women were asked in the 16th Mainichi Survey of Fertility and Family Planning to state the number of additional children they wanted. Table 3 shows the means on this variable by education of husband and education of wife. (The number of cases is somewhat less in Table 3 than in the previous tables owing to the further exclusion of women who did not report the number of additional children they wanted, as well as those unable to have any further children.) As can be seen by inspecting the gross means reported in the upper panel of Table 3, the association between future fertility desires and the education of either husband or wife is just the opposite of the gross association observed between education and children ever born. Better educated women and women with better educated husbands want more, rather than fewer children than poorly educated women and women with poorly educated husbands. If women were to fulfill these desires, even the gross educational differential in fertility would largely

husband's and wife's educational levels on the number of additional children wanted (= A) is given by

$$\hat{A} = 0.618 - .438(EW_1) - .258(EW_2) - .037(EH_1) - .007(EH_2),$$

(.033)
(.050)
(.040)
(.046)
(.036)

where the standard errors of the coefficients are reported in parentheses beneath their estimated values. Despite the impression one obtains from inspecting the upper panel of Table 3, this regression reveals no impact of husband's education upon the number of additional children the wife desires. Neither of the coefficients of the dummy variables for husband's education is as large as its standard error, indicating that the number of additional children desired by women whose husbands attended primary or secondary school is no less than the number desired by women whose husbands reached junior college or beyond. Furthermore, the difference between the two coefficients of the dummy variables for husband's education is not significant, so there is no statistically detectable difference between the number of additional children desired by women whose husbands went to primary school and those whose husbands went to secondary school.

Although no additive effect of husband's education upon the number of additional children wanted can be detected statistically, it is still possible that there is interaction of the influence of wife's education with husband's educational level. The second panel of Table 3 shows, for couples with varying educational backgrounds, the mean number of additional children wanted if the data were described by an additive model. The third panel of the table gives the differences between the actual means and those expected under the additive model. With two exceptions, the discrepancies between the actual and expected means are negligible. However, women who themselves have high educational levels, but who have husbands who reached only primary school want fewer children than they are expected to desire under the additive model. Conversely, women who reached primary school, but whose husbands attained junior college and beyond want somewhat more children than expected under an additive model of the effects of husband's and wife's educational levels. These disparities are considerable, especially in light of the fact that women in the aggregate desire only about one-third of an additional

child on the average. They are also consistent with the view that women whose husbands have educational backgrounds widely different from their own form their wishes in much the same way as fertility behavior is molded in the general population, i.e., the women with poor educational backgrounds want more children than those with better educational backgrounds. This applies, however, only in the instances of women whose husbands have very different educational backgrounds from their own.

Although the discrepancies noted in the third panel of Table 3 are large, they are observed only for the two smallest groups of women. Where the number of cases is substantial, the additive model fits quite well. A poor fit at the extremes in a couple of small groups does not necessarily lead to the rejection of the model. We observe, for example, that the between mean sum of squares in the upper panel of Table 3 is 63.655, while the within group sum of squares is 1119.412. The sum of squares explained by the additive model is 60.808, so a test for interaction is given by

$$F = [(63.655 - 60.808)/(4)]/[(1119.412)/(2563)] = 1.63,$$

which is not significant at the .10 level. Consequently, there is neither any statistical evidence that husband's education has an additive influence on wife's desired number of additional children nor any evidence that it interacts with the effect of wife's education on future fertility desires. In forming their ideas about additional children, women appear to be influenced by their own, but not by their husband's education.

The results displayed in Table 3 demand adjustment for socio-economic and demographic factors if one desires to isolate the net impact of education upon the desire for additional children. One such adjustment is displayed in Table 4, where we have simultaneously controlled via dummy variable regression analysis for (1) farm occupation, (2) urban experience prior to marriage, (3) patrilocality of residence before marriage, (4) wife's work experience prior to marriage, (5) type of marriage, (6) desired number of children, (7) duration of marriage, and (8) number of children ever born. Except for the number of children ever born, these are the same variables we controlled when studying actual fertility in the previous sections.

Table 4. Adjusted Mean Number of Additional Children Wanted by Education of Husband and Education of Wife, Controlling for Children Ever Born and Other Social Factors, for Japanese Women of Childbearing Age, 1981

Education of Wife	Education of Husband			
	Total	Primary	Secondary	Some Junior College or More
	Adjusted Mean Number of Additional Children Wanted			
Total	<u>0.337</u>	<u>0.361</u>	<u>0.322</u>	<u>0.343</u>
Primary	<u>0.344</u>	0.369	0.295	0.334
Secondary	<u>0.310</u>	0.344	0.311	0.288
Some Junior College or More	<u>0.409</u>	0.270	0.463	0.395
	Adjusted Means Expected from Additive Model			
Total	..	..	..	..
Primary	..	0.360	0.316	0.292
Secondary	..	0.354	0.310	0.286
Some Junior College or More	..	0.469	0.425	0.401
	Difference of Adjusted Means from Additive Model			
Total	..	..	..	..
Primary	..	0.009	-0.021	0.042
Secondary	..	-0.010	0.001	0.002
Some Junior College or More	..	-0.199	0.038	-0.006
	Frequencies			
Total	<u>2572</u>	<u>670</u>	<u>1252</u>	<u>650</u>
Primary	<u>769</u>	495	245	29
Secondary	<u>1359</u>	163	894	302
Some Junior College or More	<u>444</u>	12	113	319

The addition of children ever born to the set of controls was dictated by the fact that it is a potent determinant of the desire for additional children. The zero order correlation between children ever born and number of additional children wanted is itself about -.5. Thus, in the aggregate, the more children a woman has in hand, the

fewer additional ones she wants.

Comparison of the adjusted means in the upper panel of Table 4 with the unadjusted means in the upper panel of Table 3 reveals that the modest educational differentials in prospective fertility are almost completely eliminated upon introduction of the control variables. For example, the unadjusted difference in the number of additional children wanted by women who attended primary school and those who advanced to junior college or beyond comes to  $(.615) - (.153) = .462$ , or nearly half a child. After adjustment, the difference comes to just  $(.409) - (.344) = .065$ , or about one-twentieth of a child. The controls account, then, in some sense for  $(100)[(.462) - (.065)] / (.462) = 85.9$  percent of the gross differential in number of additional children wanted by wife's education.

Although the differentials in the number of additional children wanted by education of husband and education of wife are severely attenuated by the introduction of the control variables, they nonetheless remain significant in the statistical sense. The sum of squares explained by a model which incorporates the controls and additive effects for both husband's and wife's education comes to 611.504 or 51.7 percent of the total sum of squares. The residual sum of squares from this model amounts to 571.563. A model which incorporates the controls and only effects for wife's education has an explained sum of squares of 610.547, thus yielding a test for the unique contribution of husband's education of

$$F = [(611.504 - 610.547)/(2)] / [(571.563)/(2554)] = 2.14,$$

which approaches but does not reach significance at the .10 level. However, if we examine the model in which both husband's and wife's education are included, we find that the coefficient of the dummy variable for husbands who attended primary school ( $= .0680$ ) is more than twice as large as its standard error, while that for husbands who reached the secondary level ( $= .0238$ ) is roughly the same order of magnitude as its standard error ( $= .0258$ ). Pooling the two variables in the analysis of variance for the unique effect of husband's education yields an insignificant result, though the data are consistent with the hypothesis that women whose husbands attended only primary school desire somewhat more additional children than those whose

husbands advanced to junior college and beyond. Evidently, this effect is not substantively large, even though it is statistically significant.

Evaluation of the unique contribution of wife's education to the number of additional children wanted is straightforward. A model which incorporates the control variables plus the effects of husband's education yields an explained sum of squares of 608.005. The unique contribution of wife's education to the number of additional children wanted is thus statistically assessed by

$$F = [(611.504 - 608.005)/(2)]/[(571.563)/(2554)] = 7.82,$$

which is significant by any conventional standard. We may conclude, therefore, that the relationship between wife's education and number of additional children wanted cannot be explained away completely by the control factors considered herein.

The foregoing analysis reveals that both husband's and wife's educational levels continue to exert an influence, albeit small, over the number of additional children wanted after controlling for a plethora of social and demographic variables. As can be seen from the second panel of Table 4, these net effects are, however, contradictory. The mean number of additional children wanted which are expected from a model incorporating only the additive effects of husband's and wife's education are reported in this panel of the table. The figures reveal that, under this additive model, the additional number of children wanted increases as wife's educational level rises, but decreases as husband's educational level advances. Thus, the contrary net impacts of husband's and wife's education tend to cancel each other out, leaving the number of additional children wanted virtually undifferentiated by the total educational resources of a family once the control variables have been taken into account.

The third panel of Table 4 shows the discrepancy between the adjusted mean levels of number of additional children wanted under a model specifying additive effects of husband's and wife's education and a model which does not impose this constraint upon the effects of the educations of spouses. By and large, the additive model fits the data quite well, though women with husbands who attended only primary school who have themselves advanced to the junior college level or

beyond desire about one-fifth of an additional child less than would be expected under an additive model. There are, however, very few women in this group and this discrepancy alone proves insufficient to reject the fit of the additive model to the data at hand. A test for the significance of the interaction between husband's and wife's education, after introducing the control factors, is given by comparing the sums of squares explained in models which do and do not specify an additive influence of husband's and wife's educations. A model, including the control variables, which allows each combination of husband's and wife's educational levels to have their own level of number of additional children wanted is associated with an explained sum of squares of 612.369. The residual sum of squares from this model comes to 570.698. The alternative model, constraining the impacts of husband's and wife's education to be additive, while still incorporating the control variables, produces an explained sum of squares of 611.504. A test for the interaction of husband's and wife's education, with the control factors present, is, therefore, given by

$$F = [(612.369 - 611.504)/(4)]/[(570.698)/(2550)] = 0.97,$$

which is insignificant by any conventional criterion. We cannot, therefore, reject the hypothesis that the influences of husband's and wife's educations upon prospective fertility are additive. Their effects do, however, tend to cancel one another, since prospective fertility decreases with husband's education and increases with that of wives.

#### V. The Changing Impact of Education on Fertility

The analyses developed in this paper reveal that educational differentials in numbers of children ever born and numbers of additional children wanted are insubstantial. This is especially so after the gross differentials by husband's and wife's education are adjusted for a variety of socioeconomic and demographic factors known to be correlated with fertility behavior. Once these controls are introduced, wife's education has no direct impact upon the number of children ever born, but there remains a slight inverse, albeit statis-

tically significant relationship between the number of children ever born and husband's educational background. Because this net differential amounts to about one-tenth of a child, for all practical purposes differential fertility has all but disappeared among currently married women of childbearing age in contemporary Japan.

The situation with respect to the number of additional children wanted is not very different from that with respect to the actual number of children ever born. There are small, but statistically significant effects of husband's and wife's education. However, once the controls are introduced, these net differentials amount to only about one-tenth of an additional child. Furthermore, the impacts of husband's and wife's education on the number of additional children are contrary to one another, with wife's education exhibiting a net positive and husband's education a net negative relationship with prospective fertility. Thus, even if women acted out their stated desires for additional children, no large educational differentials in actual fertility would materialize.

At the beginning of this essay, we speculated that socio-economic differentials in fertility themselves evolve over the course of the demographic transition. There is some evidence that the negligible educational differentials in fertility which can be observed in contemporary Japan are themselves of fairly recent vintage. There are three independent pieces of evidence which suggest that educational differentials in fertility were wider in the recent past than they are in contemporary Japan.

At five year intervals between 1950 and 1970, Ohbuchi (1976) studied ecological regressions of age specific birth rates across Japanese prefectures. Every regression included as predictor variables (1) the ratio of nonprimary to total employment, (2) monthly total cash earnings per employee, (3) infant mortality, (4) the number of tatami per person, and (5) the ratio of students continuing on to senior high school to total graduates of junior high school. The regressions were estimated in log form, so that the regression coefficients are indicators of the elasticities of fertility with respect to the independent variables. The elasticities of the birth rate with respect to the measure of educational standard are displayed in Table 5 for each five year age group in each year.

Across Japanese prefectures, the ratio of students continuing on

Table 5. Elasticity of Birth Rate with Respect to Education Standard by Age Group of Women, Japan, 1950-1970

Age Group of Women	Year of Observation				
	1950	1955	1960	1965	1970
	Elasticity of Birth Rate with Respect to Educational Standard				
15-19	+ .220	+ .027	- .659	-1.294	-3.070
20-24	-.005	- .098	- .208	- .700	-1.148
25-29	-.187	- .323	- .334	- .248	- .060
30-34	-.378	- .617	- .726	- .494	+ .098
35-39	-.607	- .969	- .958	- .749	- .366
40-44	-.792	-1.474	-1.176	-1.117	- .902
45-49	-.980	- .853	-1.000	+ .173	- .370

Source: Ohbuchi, Hiroshi. 1976. "Demographic Transition in the Process of Japanese Industrialization," in Japanese Industrialization and Its Social Consequences, edited by Hugh Patrick, University of California Press. pp. 352-356.

to senior high school from junior high school is generally inversely related to aggregate age specific birth rates. Thus, the evidence in Table 5 is consistent with the view that rising educational standards are conducive to lower levels of fertility. The elasticities of the birth rate with respect to this measure of educational standard do, however, appear to be changing. Intercohort comparisons can be effected by reading across each row of Table 5. Excepting the cohorts reaching ages 15-19 and ages 20-24 in each year, the elasticities of the birth rate with respect to the measure of educational standards tend to rise through the 1950s and then decline through the 1960s. This pattern is consistent with the hypothesis that the inverse relationship between education and fertility tends to build up as the demographic transition gets under way, but to disappear as the transition draws to its conclusion.

Intracohort comparisons can be made in Table 5 by reading down the diagonals from the upper left to the lower right hand portions of the table. If these intracohort comparisons are taken at their face value, there is a tendency for the elasticity of the birth rate with

respect to the measure of educational standards to rise initially as a cohort enters the prime years of childbearing and, then to dwindle off as the reproductive period of a cohort draws to an end. The only important exception to this generalization is the experience of the cohort of 1926-1930, which was aged 20-24 in 1950. In this cohort, the elasticity of the birth rate with respect to the indicator of education rises in each successive five year period. This cohort is, however, the one which would have moved through its own reproductive cycle almost in lockstep with the ongoing and rapid decline in Japanese fertility after the Second World War. This is the period in which one might expect socioeconomic differentials in fertility to peak out.

The ecological regressions studied by Ohbuchi and reviewed above refer, of course, to current rather than completed fertility. The patterns observed in Table 5 reflect the responsiveness of fertility at each stage in the life cycle of successive cohorts to their surrounding educational environment. Individual level data on completed fertility by husband's and wife's educational level have been assembled by Hashimoto (1974) for selected years between 1940 and 1967. These data are presented in Table 6.

As can be seen by inspection of the table, the educational differential observed in completed fertility in 1940 amounts to about one child when husband's education is taken as the predictor variable and to less than that when wife's education is investigated. The educational differential widens to well over one child by 1952, but dwindles thereafter. By 1967, the educational differential in completed fertility by either wife's or husband's education is substantially less than one child. Thus, the data assembled by Hashimoto reinforce those of Ohbuchi. The educational differential in fertility has clearly been changing in Japan. The limited data available suggests it widened in the early 1950s, but then went into a gradual decline to its present negligible level.

The final piece of evidence concerning the shifting educational differentials in Japanese fertility is drawn from the 1981 Mainichi Survey of Fertility and Family Planning, the same data set which we utilized to analyze current educational differentials. Data on birth histories contained in this survey were tabulated in such a way as to obtain the number of children ever born to three cohorts of women at

Table 6. Number of Children Ever Born by Education of Husband and Education of Wife, for Couples at End of Reproductive Cycle, Japan, 1940-1967

Educational Level	Year of Observation			
	1940	1952	1962	1967
	Average Number of Children Ever Born			
Husband's Education				
Low	5.19	4.62	4.05	3.45
Middle	4.81	3.62	3.60	3.27
High	4.17	3.47	3.21	2.92
Wife's Education				
Low	5.19	4.57	4.04	3.48
Middle	4.39	3.58	3.47	3.14
High	4.74	3.13	3.09	2.69

Source: Hashimoto, Masanori. 1974. "Economics of Postwar Fertility in Japan: Differentials and Trends," *Journal of Political Economy*, Vol. 82, No. 2, Part II, March/April, pp. 239.

Notes: Educational levels are as follows: low, less than 10 years; middle, 10-12 years; high, 13 years or more.

For couples married more than 21 years.

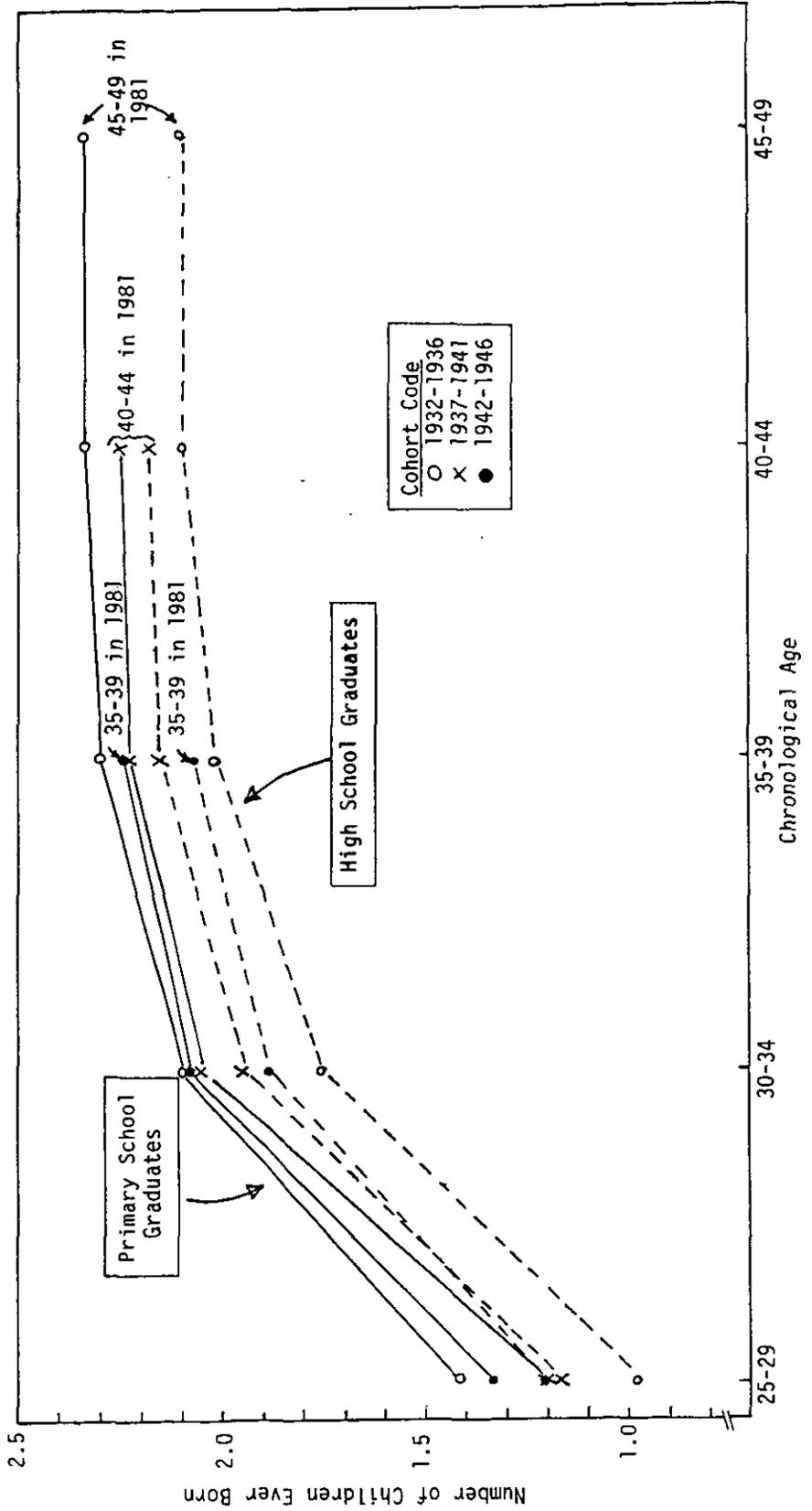
For couples with wife aged 45 or older.

For couples married more than 20 years.

successive five year intervals in their life histories. The cohorts of women were those aged 35-39, 40-44, and 45-49 in 1981, all groups which have essentially completed their reproductive experiences. Each cohort was subdivided by level of schooling into those who attended primary and those who attended secondary school. The small numbers of women in these cohorts who advanced beyond secondary school were excluded from the analysis.

The curves of cumulative number of children ever born for each educational group in each of the three cohorts are drawn in Figure 1. As can be seen from the figure, in each cohort, the differential between the number of children ever born among those attending primary

Figure 1. Cumulative Number of Children Ever Born Among Three Cohorts of Married Japanese Women, by Level of Education, as Observed from Birth Histories of Currently Married Women of Childbearing Age, 1981



and secondary school is well established by the time a cohort reaches ages 30-34. This differential persists, virtually unchanged, beyond ages 30-34 until the end of the reproductive life span. The educational differential in fertility in these cohorts is not, however, large, amounting to only about one-fifth of a child in the oldest cohort. However, the educational differentials in the two younger cohorts falls entirely within the range of that observed in the oldest cohort. These data suggest, then, as did the evidence previously surveyed, that the educational differential in Japanese fertility has been dwindling as the Japanese demographic transition draws to its conclusion.

## VI. Summary

We began this essay by speculating about the way socioeconomic differentials in fertility are likely to change over the course of the demographic transition, arguing that the inverse relationship between education and fertility emerges only after the transition is underway. We further postulated that this differential declines as the transition enters its final stages where fertility and mortality are once again adjusted to levels consonant with negligible or zero population growth. Multivariate analysis of 1981 data bearing upon number of children ever born and number of additional children wanted revealed that educational differentials in fertility in Japan have all but disappeared. Finally, a review of the data available for earlier years suggests that the educational differential in fertility was most likely expanding in the 1950s, before reversing itself in the 1960s and moving towards its present numerically small, albeit statistically significant level.

## References

- Hashimoto, Masanori. 1974. "Economics of Postwar Fertility in Japan: Differentials and Trends," Journal of Political Economy, Vol. 82, No. 2, Part II, March/April, pp. 170-194.
- Ohbuchi, Hiroshi. 1976. "Demographic Transition in the Process of Japanese Industrialization," pp. 329-361 in Hugh Patrick (ed.) Japanese Industrialization and Its Social Consequences. University of California Press.
- Population Problems Research Council, Mainichi Newspapers. 1978. Summary of Fourteenth National Survey on Family Planning. Tokyo, Japan.
- United Nations. 1973. The Determinants and Consequences of Population Trends, Vol. 1. New York: United Nations Publications.