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THE IMPACT OF EXPECTED CHILD SURVIVAL ON HUSBANDS' AND WIVES' DESIRED FERTILITY IN MALAYSIA: A LOG-LINEAR PROBABILITY MODEL

by

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Abstract: In a regime of high mortality, parents may have a greater number of births than their desired family size as an insurance against the possibility of losses in the future, at a time when fecundity loss or health hazards would make further births inadvisable or impossible. The log-linear probability model and data from the Malaysian Family Life Survey are used to explore this relationship quantitatively. The results suggest that perceived child survival probabilities affect husband's desired fertility significantly, in the expected direction, but have no impact on the wife's desire for further births. Important husband-wife differentials in the response of desired fertility to changes in other variables are also uncovered.

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Introduction

The literature on child mortality-fertility linkages distinguishes between two types of reactions to child mortality: replacement and hoarding. Replacement is the response of fertility to experienced mortality: the death of a child elicits a desire to have another birth. Several recent investigations have quantified the magnitude of this effect (see articles in Preston 1978; Lehrer 1983). Hoarding is the response of fertility to expected mortality. In a regime of high mortality, parents may have a greater number of births than their desired surviving family size as an insurance against the possibility of losses in the future, at a time when health hazards or fecundity loss would make further births inadvisable or impossible. To the extent that couples prefer to err on the side of having too many, rather than too few, surviving children, a reduction in child mortality could have, by altering parents' perceptions of child survival probabilities, a significant negative impact on fertility. While the importance of this effect has been emphasized at the theoretical level by several authors, among them Preston (1972) and Ben Porath (1978), data limitations have presented a major obstacle to empirical analyses. The Malaysian Family Life Survey (MFLS), a survey conducted by the Rand Corporation in 1976-1977, provides an opportunity to explore this relationship quantitatively.

The MFLS is a very rich survey. It contains detailed pregnancy and contraceptive histories, as well as abundant socioeconomic and demographic data for about 1,200 ever-married women less than 50 years of age residing in Peninsular Malaysia.[1] Included in the pregnancy histories is information on the date of each birth and whether each child is alive as of the survey date. Desired future fertility is also documented. Very important for the purposes of the present study, the following question was included in the survey: "Nowadays, if a woman gives birth to ten children, how many will grow up to be 20 years old?" Answers to this question, which range from 3 to 10, provide a measure of each respondent's subjective evaluation of child survival probabilities.

Evidence is starting to accumulate that husbands and wives may differ in their preferences for the sex of offspring, in their reproductive goals, and in other dimensions of fertility behavior (Coombs 1977; Coombs and Fernandez 1978; Pebley, Delgado and Brineman 1980). A valuable feature of the MFLS is that several questions, including the one cited above and others related to desires for further children in the future, were addressed to both husbands and wives. The present study incorporates both sets of answers into the analysis.

The hoarding hypothesis suggests that parents who expect a small fraction of children to survive would be more likely to desire further births than their counterparts with more optimistic expectations. A preliminary analysis of the data, shown in Table 1, provides some confirmation for this theory. SURVH represents the husband's answer to the question cited above, values of 8 or lower being classified as "LOW"; higher values being classified as "HIGH".[2] H equals 1 if the husband states a desire to have further children and is 0 otherwise. SURVW and W are similarly defined for wives.

The crosstabulations in Table 1 suggest that there is an association in the expected direction between perceived child survival probabilities and desired future fertility. Examination of husbands' responses in families of parity 3 or less shows that while 77.8 percent of husbands with low child survival expectations desire further children, only 59.5 percent of husbands with high child survival expectations want more births. Similar results are uncovered for husbands in families of parity 4 or larger, and for wives in families of parity 3 or less. While the results for wives in larger households point in the same direction, the differences in expected fertility between the LOW and HIGH categories are very small and statistically insignificant at all conventional levels.

The remainder of this article examines these relationships more carefully. First, to the extent that child survival expectations are correlated with experienced mortality (those parents who have lost one or more children having lower estimated survival probabilities), the results in Table 1 could simply reflect a replacement strategy. Thus, a statistical analysis that holds constant experienced mortality, as well as other control variables, is necessary. Second, H and W are jointly dependent variables; husbands' and wives' fertility desires are simultaneously determined and they interact with each other; the empirical analysis should take this into account. The log-linear probability model satisfies these two requirements. The Appendix contains a brief description of this technique.

Section A presents the results obtained using the log-linear probability model. These estimates confirm that the perceived child survival probability has a significant influence on the husband's desired fertility, but no impact on the wife's desire to have further births. A quantitative estimate of the effect on husband's desired fertility is presented. It is also found that several other economic and demographic variables affect husband's and wife's desired fertility differently. The implications of these findings are discussed in Section B.

A. Empirical Results

Discussion of Estimated Model

The objective of the present section is to ascertain empirically, for the case of Malaysia, whether husbands' and wives' perceived child survival probabilities have the expected impact on desired future fertility and, if so, to quantify the importance of this effect. In light of the fact that the wish to have at least one child is almost universal in Malaysia, couples with no children as of the interview date are excluded from the analysis. Also excluded are households in which the mother is over 40 and cases with missing information on husband's and wife's desired fertility.

Rather than taking the entire life cycle of the married couple as the time frame of reference, we follow Turchi (1975), Cramer (1980), and others in assuming that husbands and wives make their fertility decisions in a

sequential manner. Attention is focused on H and W, the husband's and wife's desires to have further births, as functions of the current stock of children, SURVH and SURVW, and several other control variables.[3]

The first set of estimates is reported in Table 2. The figures under "H" measure the impact of the various exogenous variables on the probability that H equals 1, i.e., that the husband desires to have additional children. If an exogenous variable, say x, has a positive sign in the H column, this means that, other factors held constant, a rise in x increases the odds that H will equal 1 (see Appendix). The figures under "W" are the corresponding estimates for wives. The interaction term captures the influence of husband's desired fertility on the wife's and vice versa.

Aside from child mortality variables, several other covariates are included in the analysis as controls, the choice being guided in general by results from previous studies. After a brief discussion of the coefficients associated with these control variables, as well as the interaction and constant terms, attention is focused on what is the primary concern here, the perceived child survival-probability effects.

As expected, the interaction term is positive and highly significant; the fertility desires of husbands and wives are positively associated. Other factors held constant, if the husband desires more children, this makes it more likely that the wife will desire more children, and vice-versa. Interestingly, the constant term is larger, and significantly so, for husbands than for wives. Ceteris paribus, husbands have preferences for larger family sizes than wives. Perhaps this reflects the fact that mothers and fathers share the benefits associated with children equally, but mothers bear more of the costs. Along the same lines, note that the coefficients associated with the parity dummy variables are larger in absolute magnitude for W than for H (Parity = 1 or 2 is the base). The presence of four or five children in the household depresses mothers' future fertility desires more than fathers', and the same is true for the presence of six or more children in the family. Again, the differences are significant statistically.[4]

Reflecting a biological phenomenon, wife's age has a significantly negative coefficient. The older the wife, the less likely are husband and wife to desire further births.

The importance of the sex composition of children for a couple's future fertility behavior has been emphasized by Welch (1974) among others. Thus, the proportion of surviving children who are boys is included in the model. The expected negative impact of this variable on desired future fertility is confirmed only for fathers. Son preference does not seem to be prevalent among women.

Following a common procedure in the literature, husband's and wife's education, measured in years of schooling, are included as rough proxies for the husband's permanent income and the value of female time, respectively. Mixed results have emerged from previous studies. Estimates of the effects

of husband's education on fertility range from significantly negative to significantly positive numbers. (See the literature review by Schultz 1974.) With regard to the wife's education, the standard a priori expectation is that it should have a negative effect on fertility, women with high potential wages desiring few children. Positive signs associated with variables measuring the value of female time have emerged, however, in some studies using data from developing countries (McCabe and Rosenzweig 1976; see also Butz' (1976) discussion). This result is to be expected if close substitutes for mother's time in child care are available or if income-earning activities are compatible with child-rearing activities.

The present results show an insignificant impact of female education on desired future fertility. For male education, our results are in agreement with previous discrepancies in the literature: we have both a negative and a positive sign; the former for wives, the latter for husbands. Significance in both cases is low.

Several other proxies for the household's permanent income and the value of female time could be used. Table 3 presents one such possibility. An index of house quality, ranging from 1 to 18, is included instead of husband's education, and two dummy variables controlling for female income-earning activities are included instead of wife's education.[5] "Paid employee" equals 1 if the wife is a full-time or part-time paid employee as of the survey date. "Other income-earning activity" equals 1 if she is self employed, a worker in family business, an employer (paying wages to others) or if she engages in the production of home goods and services for sale. These activities are likely to be more compatible with the rearing of children than work as a paid employee. No income-earning activities on the part of the mother constitutes the base. All other control variables are included in the model, but the coefficients are not reported since they are very similar to those shown in Table 2. The results indicate that the house quality index has no effect on desired fertility. Interestingly, "Other income-earning activity" has a strong positive effect on husband's desired fertility but no effect on wives' fertility desires. Because wife's schooling is more likely to be exogenous to desired fertility behavior than income earning activities at the time of the survey, our preferences are in favor of the model in Table 2.

Residence in an urban area is expected to depress fertility, since the costs associated with raising children are usually higher, and the benefits lower, than in rural areas. Only husbands behave in accordance to the theory; the coefficient associated with area of residence is insignificant for wives. Ethnicity plays an important role, as evidenced by the coefficients associated with "Chinese" and "Indian" (Malays, together with a very small number of individuals of other races, constitute the base).

According to the replacement hypothesis, the death of a child is expected to have a positive impact on fertility. Evidence of significant replacement effects with these data, using actual spacing variables as opposed to desired future fertility variables, is reported in Lehrer (1983). Weaker effects

emerge from the present analysis. The dummy variable DEATH equals 1 if at least one child died and is 0 otherwise. The two coefficients associated with DEATH are positive, as expected, but significance is low. The t-ratio is 0.14 in the H column and 1.2 in the W column.[6]

Holding constant actual child deaths in the family and the control variables discussed above, do parents' perceptions of child survival probabilities affect desired fertility? The results indicate that the husband's perceptions have no influence on W, and the wife's perceptions have no influence on H. This is perhaps not surprising, since we are holding each spouse's own perceptions constant. Do own perceptions have an influence? The answer is yes for fathers, no for mothers. Husband's child survival expectations (SURVH) have a strong negative effect on husband's desired fertility (H). But SURVW has no influence on W.

The strength of the impact of SURVH on H may be assessed by examining the estimated probabilities in Table 4 for specified values of SURVH. An increase in SURVH from 8.8, its mean value, to 9 would lower the estimated probability of husbands' desiring further births from 0.4652 to 0.4530. An increase in SURVH to 10 would lower the estimated probability to 0.3950.

Differentials by Race

A number of studies have uncovered major differences in the economic and demographic behavior of the various racial groups in Malaysia (e.g., see Butz and DaVanzo 1978b; Kusnic and DaVanzo 1980). While sub-dividing our sample according to race results in small sample sizes and relatively large standard errors, some tentative conclusions may be drawn from an analysis of the two larger groups, Malays and Chinese. The estimates are reported in Table 5.

Actual child loss and expected child survival probabilities play a more important role among Malays than among Chinese. The observed differences in significance may be due to the fact that mortality levels are substantially lower among Chinese and hence there is relatively little variability in the mortality variables for this racial group.

With regard to the control variables, among Malays there is a remarkable difference between husband's and wife's preferences for the sex of children. The proportion of surviving children who are boys has a negative effect on husband's desired future fertility but a positive effect on wife's desired future fertility. This finding lends support to the study by Coombs and Fernandez on husband-wife agreement about reproductive goals in Malaysia (1978). Interestingly, husband's and wife's years of schooling also affect H and W in opposite directions. Less disagreement in the coefficients for H and W is found among the Chinese.

B. Discussion

The major conclusion from this study is that, for the case of Malaysia, the perceived child survival probability affects husband's desired fertility significantly in the expected direction but has no influence on the wife's desire for future births.

This research has tentatively answered one question and raised some new ones. Not only have we found that expected child survival probabilities affect husband's and wife's desired fertility differently, our analysis has also uncovered important husband-wife differences in the response of desired fertility to changes in other variables, ranging from experienced child loss to female income-earning activities and to residence in urban versus rural areas.

Two implications follow. First, the standard microeconomic model which assumes a common utility function and a common set of prices for husband and wife needs to be revised. Some research on this topic is already in progress (Thomson 1982; Cymrot and Seiver 1982). The present findings underscore the need for further efforts in this direction. Reasons why the utility functions may differ need to be explored. To what extent does the structure of costs and rewards derived from children, male and female, differ for husbands and wives? Second, our results suggest that an important item in the agenda for further research is an analysis of the linkages between each spouse's fertility desires and contraceptive behavior. Unless it may be shown that wife's fertility desires are more likely to be translated into actual fertility behavior than husband's desires, the widespread practice of addressing fertility surveys to wives only should be reconsidered.

Appendix[7]

Consider H and W, the two binary, jointly dependent variables defined in the text. For simplicity, assume there is only one exogenous variable, x. Extension to the case of several exogenous variables is straightforward. The log-linear probability model for this double dichotomy case may be written as follows:

$$(1)\quad \log P[H=1,\ W=1] = \mu + \delta_1 + \alpha_1 x + \varepsilon_1 + \beta_1 x + \gamma_{11}$$

$$(2)\quad \log P[H=1,\ W=0] = \mu + \delta_1 + \alpha_1 x + \varepsilon_0 + \beta_0 x + \gamma_{10}$$

$$(3)\quad \log P[H=0,\ W=1] = \mu + \delta_0 + \alpha_0 x + \varepsilon_1 + \beta_1 x + \gamma_{01}$$

$$(4)\quad \log P[H=0,\ W=0] = \mu + \delta_0 + \alpha_0 x + \varepsilon_0 + \beta_0 x + \gamma_{00}$$

Imposing the identifying constraints

$$\alpha_0 = 0,\ \beta_0 = 0,\ \delta_0 = 0,\ \varepsilon_0 = 0,\ \gamma_{10} = 0,\ \gamma_{01} = 0,\ \text{and}\ \gamma_{00} = 0,$$

the model may be re-written as follows:

$$(5)\quad \log P[H=1,\ W=1] = \mu + \delta_1 + \alpha_1 x + \varepsilon_1 + \beta_1 x + \gamma_{11}$$

$$(6)\quad \log P[H=1,\ W=0] = \mu + \delta_1 + \alpha_1 x$$

$$(7)\quad \log P[H=0,\ W=1] = \mu + \varepsilon_1 + \beta_1 x$$

$$(8)\quad \log P[H=0,\ W=0] = \mu$$

From (5) and (6),

$$(9)\quad \log \frac{P[H=1,\ W=1]}{P[H=1,\ W=0]} = \beta_1 x + \gamma_{11} + \varepsilon_1$$

From (7) and (8),

$$(10)\quad \log \frac{P[H=0,\ W=1]}{P[H=0,\ W=0]} = \beta_1 x + \varepsilon_1$$

From (9) and (10),

$$(11)\quad \frac{\partial}{\partial x} \log \frac{P[H=1,\ W=1]}{P[H=1,\ W=0]} = \frac{\partial}{\partial x} \log \frac{P[H=0,\ W=1]}{P[H=0,\ W=0]} = \beta_1.$$

Thus, if β_1 is positive, this means that as x increases, the odds that W will equal 1 increase, holding H constant. If another exogenous variable, y, were introduced, a positive β_1 would indicate that as x rises, the odds that W will take the value 1 increase, H and y held constant.

Similarly, it may be shown that

$$(12)\quad \frac{\partial}{\partial x} \log \frac{P[H=1,\ W=0]}{P[H=0,\ W=0]} = \frac{\partial}{\partial x} \log \frac{P[H=1,\ W=1]}{P[H=0,\ W=1]} = \alpha 1.$$

An analogous interpretation applies to α.

Finally, from (5), (6), (7) and (8),

$$\log \frac{P[H=0,\ W=0]/P[H=0,\ W=1]}{P[H=1,\ W=0]/P[H=1,\ W=1]} = \gamma 11.$$

To see how this interaction term, $\gamma 11$, is interpreted, supposed H=0. Then the odds that W equals 0 are given by P[H=0, W=0]/P[H=0, W=1]. If H and W are independent, this ratio should be equal to P[H=1, W=0]/P[H=1, W=1]. Thus, departures of $\gamma 11$ from zero indicate an association between H and W.

NOTES

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1. For a detailed description of this data set, see Butz and DaVanzo (1978a).

2. The cutoff between the LOW and HIGH categories is somewhat arbitrary. Our choice of 8 is based on the fact that the averages of SURVH and SURVW are between 8 and 9.

3. Ideally, we would have liked to divide the sample into various groups according to parity and analyze each of them separately; however, sample size considerations did not permit this.

4. Calculation of the appropriate t-ratios, using information contained in the variance-covariance matrix for the estimated coefficients (not reported here), indicates that all the differences discussed in this paragraph are significant at the 5 percent level.

5. The house quality index is constructed on the basis of information on number of rooms in the household, material of outer walls, and availability of water, electricity, toilet facilities, and shower. A similar index is used by Butz and DaVanzo (1978b) in their analysis of contraception, breastfeeding and birthspacing behavior in Malaysia.

6. Interaction terms between DEATH and the parity dummy variables were included to allow for the possibility of differences in the strength of replacement behavior by parity. These were all insignificant and were dropped from the model.

7. This Appendix is based partly on Nerlove and Press (1973, 1976) and Kawasaki (1979).

Table 1: Desired Future Fertility by Child Survival Expectations

Controlling for Parity

(Column Percentages in Parentheses)

PANEL A: HUSBANDS

Parity = 1, 2 or 3

SURVH H	LOW	HIGH
0	26 (22.2)	81 (40.5)
1	91 (77.8)	119 (59.5)

X^2 = 10.2 p-value = 0.001

Parity = 4 or more

SURVH H	LOW	HIGH
0	80 (71.4)	132 (78.6)
1	32 (28 6)	36 (21.4)

X^2 = 1.86 p-value = 0.17

PANEL B: WIVES

Parity = 1, 2 or 3

SURVH W	LOW	HIGH
0	31 (23.5)	77 (32.6)
1	101 (76.5)	159 (67.4)

X^2 = 3.41 p-value = 0.06

Parity = 4 or more

SURVH W	LOW	HIGH
0	111 (79.3)	176 (80.4)
1	29 (20.7)	43 (19.6)

X^2 = 0.06 p-value = 0.80

Table 2: The Impact of Child Survival Expectations on Fertility
(t-ratios in parentheses)

	H	W
Interaction	1.949 (7.9)	
Constant	8.071 (6.6)	5.459 (4.5)
CONTROL VARIABLES		
Parity = 4 or 5	-0.5965 (2.0)	-1.363 (4.7)
Parity = 6 or more	-0.7456 (2.0)	-2.047 (5.3)
Wife's age	-0.1220 (4.9)	-0.09517 (3.8)
Proportion of surviving children who are boys	-1.081 (3.1)	0.2963 (0.83)
Husband's years of schooling	0.04026 (1.0)	-0.05953 (1.5)
Wife's years of schooling	-0.01003 (0.23)	0.03728 (0.84)
Urban area	-0.4505 (1.7)	0.1444 (0.54)
Chinese	0.1124 (0.41)	-0.8711 (3.1)
Indian	-1.349 (3.0)	-1.731 (3.9)
MORTALITY VARIABLES		
A child died (DEATH)	0.04652 (0.14)	0.4066 (1.2)
Husband's child survival expectations (SURVH)	-0.2239 (2.5)	0.03026 (0.33)
Wife's child survival expectations (SURVW)	-0.07276 (0.85)	-0.02590 (0.29)

Sample Size = 577

Table 3: Other Proxies for Household Income and Value of Female Time*

(t-ratios in parentheses)

	H	W
House quality index	0.005835 (0.14)	-0.02901 (0.73)
Paid employee	0.3358 (1.1)	0.2345 (0.75)
Other income-earning activities	0.7725 (2.7)	0.05577 (0.19)

*All variables in Table 2, except husband's and wife's years of schooling, are held constant.

Table 4: Estimates of P[H=1] for Specified Values of SURVH*

SURVH	P[H=1]
5	0.6817
7	0.5712
8	0.5123
8.8 (= mean value of SURVH)	0.4652
9	0.4530
10	0.3950

*All other exogenous variables are evaluated at their means.

Table 5: Differentials by Race

(t-ratios in parentheses)

	MALAY		CHINESE	
	H	W	H	W
Interaction	1.965 (5.9)		1.545 (3.5)	
Constant	7.720 (4.9)	3.160 (2.1)	1.313 (4.0)	10.49 (3.2)
CONTROL VARIABLES				
Parity = 4 or 5	0.08342 (0.21)	-1.407 (3.6)	-1.491 (2.8)	-1.509 (2.9)
Parity = 6 or more	-0.1017 (0.22)	-1.133 (4.8)	-2.168 (2.2)	-2.727 (2.3)
Wife's age	-0.1352 (4.1)	-0.03696 (1.1)	-0.1971 (3.7)	-0.1967 (3.8)
Proportion of surviving children who are boys	-1.005 (2.1)	0.7854 (1.6)	-1.635 (2.5)	-0.3793 (0.61)
Husband's years of schooling	0.1026 (1.8)	-0.1026 (1.7)	-0.06442 (0.97)	-0.05406 (0.82)
Wife's years of schooling	-.08987 (1.5)	0.06951 (1.1)	-0.03354 (0.46)	-0.1055 (0.14)
Urban area	-0.6218 (1.8)	0.07077 (0.20)	0.2841 (0.60)	-0.4167 (0.89)
MORTALITY VARIABLES				
A child died (DEATH)	0.08117 (0.21)	0.5695 (1.4)	-0.3170 (0.33)	-0.1055 (0.11)
Husband's child survival expectations (SURVH)	-0.1925 (1.9)	-0.007332 (0.068)	-0.2416 (1.1)	-0.07470 (0.34)
Wife's child survival expectations (SURVW)	0.04862 (0.48)	0.0001588 (0.002)	-0.2442 (1.0)	-0.2534 (1.1)
Sample size	293		220	

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