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Estimates of Birth Intervals in Pakistan, with and without the WFS Restrictions

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Almost all the World Fertility Surveys (WFS), and those repeating a similar pattern of pregnancy history data collection, like the Population, Labour Force, and Migration Survey (PLM) carried out in Pakistan in 1979-80, covered information on proximate determinants for the last closed and open birth intervals. This paper, based on the PLM data, discusses the methodological issue of data collection. The types of restriction used have often been doubted as they have produced biased estimates of contraceptive use and duration of breast-feeding, which are important in the estimation of birth interval and in the ultimate estimation of the structures of the relationship predicting fertility. The representativeness of the last closed and open birth intervals is limited if these are probed deeper in the time before survey, as the proportion of births gets quite small. It is inappropriate to estimate proximate determinants on fertility data that do not provide information on all the births. Therefore, an attempt has been made to estimate contraceptive use and breast-feeding with and without the WFS restrictions. The logit model has been used with a dichotomous variable, 'whether the next live birth occurs or not', on proximate determinants and other socio-economic variables to estimate the amount of biasedness. The results reveal that there appears to be a higher proportion of unbiased estimates if they are derived through the unrestricted sample; and these results are in conformity with the results found elsewhere. The biasedness of the restricted samples also affects the studies aimed at observing the relationship between the predictor and the dependent variables.

INTRODUCTION

In 1975 a large number of countries participated in the World Fertility Survey (WFS) programme, in which a detailed information on maternity history was collected with a view to assessing the fertility and family planning-related behaviour of women. In a majority of the cases, the information on breastfeeding and contraception was obtained for only the last closed and open intervals.[1] Such a restriction on fertility histories has raised many doubts about the possibility of the sample selection bias in the results. A number of researchers have used the WFS data for examining the effect of breastfeeding and use of contraception on the

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[1]The "open birth interval" is the birth interval begun at the birth of the last (i.e., the youngest) child and terminated by the interview. Another birth may occur after the interview and hence the term "the last closed birth interval" is the interval terminated by the last child.

length of birth intervals [Jain and Bongaarts (1981); Smith (1985)]. They have acknowledged that due to the restriction of the sample to the last closed and open intervals, there is a potential bias in the results. This requires measures to minimise such biases in fertility estimates. It is, therefore, of significance to examine the magnitude of such biases in the case of Pakistan–to see what impact it has on the estimates of birth intervals and fertility.

This leads us to the two main questions of this study: The first is: To what extent does the selection of the last closed and open intervals affect the estimates of the levels of contraceptive use and breastfeeding duration? The second is: Does the selectivity bias in data collection on the last closed and open intervals affect the pattern of relationships between these intermediate variables of fertility and other crucial socio-economic variables?

THE DATA

The data for this paper have been obtained from the Fertility Module of the Population, Labour Force, and Migration Survey (PLM) conducted in Pakistan in 1979-80. In this survey, the Pakistan Fertility Survey (PFS) questionnaire was repeated and information was collected on maternity history, fertility, and family planning. An important difference between the two surveys was that the number of observations in the PLM was twice the size of that of the PFS, and contained detailed information on reproductive histories of 9416 currently married women selected from about 11,000 households. Information was gathered in the survey for each child (a total of 38,746 in the survey) that the respondent had borne, including their sex, date of birth, and age of death. In case the exact dates of birth or death of any child were not given, they were taken as inferred by taking into account all the other information probed and provided by the mother, such as her age at marriage and the ages of all other children. The survey also collected information on duration of breastfeeding for every child, use of contraception for each birth interval, and any other occurrence such as miscarriage or abortion.

METHODOLOGICAL ISSUES AND PROCEDURES

The use of the last closed and open birth intervals in a selective fashion can best be examined by taking cohorts of birth intervals begun in various years preceding the survey year. All birth intervals originated in the 12 month-period before the survey date would be represented since such recent ones would have started by the last or next to the last birth. However, these intervals do not provide any information pertaining to birth spacing practices because a large number of them would not be closed so soon by another birth. The representativeness of the last or next to the last births is affected as one moves back in time, because many of those women

would have started their fertility earlier; this is particularly true in high fertility situations like that of Pakistan.

To examine the representativeness of the last closed and open intervals in various time-periods preceding the survey, Figure 1 shows the percentage of births in each year that began in the last closed or open birth interval. As we can see, the proportion of births is quite small, the longer is the period before the survey. However, the proportion of births becomes quite substantial five years prior to the date of the survey, because all those women who began their birth intervals during the past five years are also included. It is evident from Figure 1 that the last closed or open birth intervals reach far back in time. As the figure shows, about 14 percent of these intervals were initiated 10 years before the survey year, whereas 9 percent of women had their last closed and open birth intervals about 19 years before the

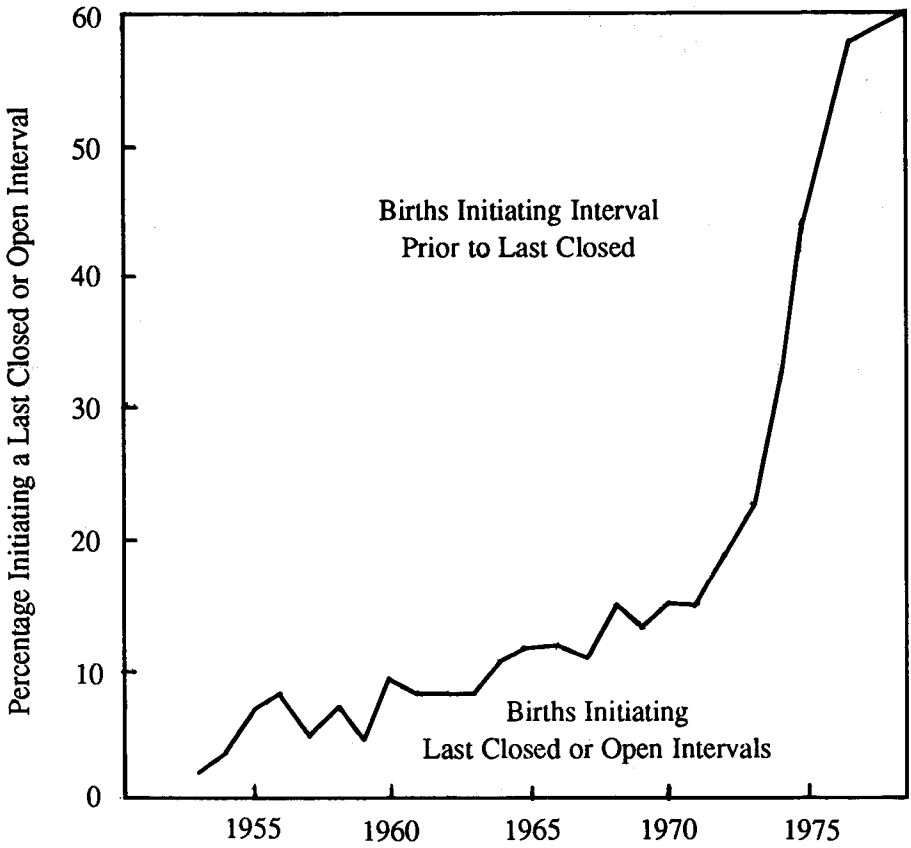

Fig. 1. Percentage of Births in Each Year that Initiated a Last Closed or Open Interval: 1979 PLM Survey.

survey year. Therefore, it would not be appropriate to base estimates of current breastfeeding or contraception on data for all births with restrictions of the last closed and open birth intervals. This has also been proved in some earlier studies [Akin *et al.* (1981); Palloni (1984) and Pebley *et al.* (1986)].

After examining the sources of bias in the number of births due to birth interval restrictions, we shall proceed to examine the variations in fertility by selected background variables–to see the extent to which such restrictions bias the results regarding the structure of the relationship between the predictor variables and fertility. These variables include contraception, abortion, breastfeeding, and infant mortality as intermediate variables and age, education, residence, and the number of sons as socio-economic variables. Son-preference variable is of particular interest because some studies suggest that women who do not have at least one son may intentionally curtail breastfeeding in order to hasten the birth of the next child [Bumpass *et al.* (1982); Rindfuss *et al.* (1982)].

Our dependent variable, "whether the next live birth occurs or not", is a dichotomous one and takes discrete values 1 if a live birth occurs and 0 otherwise. The use of the ordinary least square (OLS) method in such circumstances is inappropriate not only because of the problems associated with heteroscedasticity but also because there is nothing to constrain the dependent variable to the unit interval. The most commonly used methods to examine the behaviour of binary dependent variables by regression analysis are: (i) the Linear Probability (LP) Model, (ii) the Probit (P) Model, and (iii) the Logit (L) Model. These models differ from each other in terms of the different cumulative distribution function assumed in the regression relationship.[2] As the conditional probability interpretation of the L-model is not always fully satisfied, the non-linear functional form–e.g., the probit and the logit models–is preferred. In the case of binary variable, however, because the normal and logistic distribution are very close to each other except at the tails, the estimates obtained using the probit and the logit forms are likely to be close. The methodology adopted in this study was developed by Rindfuss, Bumpass and Palmore (1987) to estimate the biases in birth intervals. They chose the logit model to measure the amount of biases arising from the introduction of the restrictions in the WFS methodology of data collection on the contraceptive use and breastfeeding practices almost in all the 42 participating countries. In this paper also, the logit model has been applied to estimate our model. [Rindfuss, Bumpass and Palmore (1987)]. A brief description of the logistic regression is followed by the discussion of results. If y is the binary dependent variable and Xs are explanatory variables, then the logistic model, for instance x_1 and x_2 implies that the probability of success

[2]For detailed discussion on each of these models, see Kmenta (1986, Ch. 11), Goldfeld and Quandt (1972, Ch. 4), and Maddala (1983, Ch. 2).

(y-hat), which, in our case, is the probability of having a live birth, can be written as,

$$\hat{y} = \frac{1}{[1 + exp^{-}(\alpha + \beta_1 x_1 + \beta_2 x_2)]} \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

and with no live birth,

$$1 - \hat{y} = 1 - \frac{1}{[1 + exp^{-}(\alpha + \beta_1 x_1 + \beta_2 x_2)]} \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

The odds of an event to occur in the logistic function will be,

$$\left(\frac{\hat{y}}{1 - \hat{y}}\right) = \frac{1}{exp^{-}(\alpha + \beta_1 x_1 + \beta_2 x_2)} = exp^{\alpha + \beta_1 x_1 + \beta_2 x_2} \quad \ldots \quad \ldots \quad (3)$$

Therefore, the odds of an event ($x_1 = 1$) for having a live birth with the odds of having no birth ($x_1 = 0$) will be,

$$Odds\ Ratio = \frac{exp^{\alpha + \beta_1 x_1 + \beta_2 x_2}}{exp^{\alpha + 0 + \beta_2 x_2}} = exp^{\beta_1} \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

To linearise the odds of an event, we take natural logarithm,

$$ln\ odds = ln\left(\frac{\hat{y}}{1 - \hat{y}}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

The 95 percent confidence limits of the estimated odds ratio (OR).

$$ln\ \hat{OR} \pm 1.96\ SE\ (ln\ \hat{OR}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

The estimation of y_i values obtained through the logistic function provide the required properties of the estimation of the probabilities because this function is the one that increases with the increasing values of,

$$\alpha + \Sigma\, \beta_i x_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

and the estimated probabilities are within the range of zero and unity. If we substi-

tute the range of plus and minus infinity for Equation 7 in Equation 1, we get,

$$\text{if } \alpha + \sum \beta_i x_i = +\infty$$

$$\text{then } \hat{y} = \frac{1}{1 + exp^{-\infty}} = \frac{1}{1+0} = 1$$

$$\text{if } \alpha + \sum \beta_i x_i = -\infty$$

$$\text{then } \hat{y} = \frac{1}{1 + exp^{\infty}} = 0$$

$$\text{if } \alpha + \beta_i x_i = 0$$

$$\text{then } \hat{y} = \frac{1}{1 + exp^{-0}} = \frac{1}{1+1} = \frac{1}{2} \quad \ldots \quad \ldots \quad (8)$$

This shows that if the exponent of e is positive and very large, the probability is close to the unity; and if it is negative and small, then it is close to zero.

The analytical procedure uses the birth interval covering the period from 2 to 12 years before the survey. In order to further see whether there was any systematic variation associated with the decreasing selectivity, we used three different durations of birth intervals that began 2–6 years, 2–5 years, and 2–4 years preceding the survey.[3] These sets of intervals, while providing a large enough sample, not only permit stable estimates of the coefficients but are also expected to minimise the selection biases associated with the fertility histories of currently married women. The intervals that began 2 years before the interview are not included in the analysis because women falling within these intervals would not have had sufficient time to have these intervals closed. The procedure adopted divides the birth interval into four segments, and within each segment a logistic regression is used, in which the dependent variable is, "whether the next live birth occurs or not". In order to capture a stable pattern of birth intervals, we have examined the 2, 3, and 4–8 birth orders separately.

As a first step, the estimates were obtained based on the intervals that began 2–12 years before the survey and without WFS restrictions; and estimates were obtained for this interval again after imposing the WFS restrictions. Further, we also estimated the birth intervals that began 2–6 years, 2–5 years, and 2–4 years

[3]A smaller number of cases may affect the results obtained because of the well-known relationship between the sample size and the sampling variability associated with estimated coefficients.

preceding the survey with and without the WFS restrictions. These results were then compared with the estimates of our model. For this approach, we generate a large number of logistic regression estimates such as:

3 sets of birth order intervals (2, 3, and 4–8);
4 sets of segments (months 17–22, 23–28, 29–34, 35–40);
4 sets of time periods (2–12, 2–6, 2–5, 2–4 years preceding the interview); and
2 sets of restrictions (imposing or not imposing the WFS restrictions).
This yields 96 logistic regression runs.[4]

Using the original results as the basis for comparison, that is, the estimates based on the intervals begun at 2–12 years before the interview and without the WFS restriction, we establish a confidence interval around the betas from this unrestricted model. We then examine the corresponding betas from the other models to see whether they fall within this interval or not. If they do, we accept the hypothesis that the results from the two sets of universes are identical. If they do not, we reject the null hypothesis and conclude that the results are different. For the interpretation of the results, the signs of the coefficients and the direction of the change are also examined.

RESULTS AND DISCUSSION

The results of the basic analysis are summarised in Tables 1 and 2 in the text, while the estimates for each explanatory variable are presented in Appendix Tables A-1 – A-3.

Since the duration of breastfeeding and contraceptive use are considered to be important determinants of birth intervals, it is of interest to examine the biases they produce in fertility estimates. Table 1 provides the percentage of betas falling within the confidence intervals for these two variables.

In Table 1, for the no-restriction model in the period 2–4 years before the survey, 75 percent of the betas fell within the confidence interval with breastfeeding as explanatory variable, and 92 percent for contraceptive use. When we restrict the fertility history to the last closed and open birth intervals, only 25 percent and 50 percent of the betas fall within the confidence interval for the two variables separately.

However, when the period preceding the survey is 2–6 years, 58 percent estimates are biased for breastfeeding as compared to 100 percent with no restriction, and 67 percent for contraception as against 92 percent with restriction.

[4]Detailed results from these runs are presented in the Appendix Tables A-1, A-2, and A-3.

Table 1

Percentage of βs Falling within the Confidence Limits for βs in the 2–12-Year Unrestricted Model, by Type of Restriction, Type of Variable, and Number of Years Preceding the PLM Survey 1979

Type of Variable and Restriction	Number of Years Preceding Survey			
	2–12	2–6	2–5	2–4
Contraceptive Use				
WFS Restriction	83	67	58	25
No Restriction	100	92	100	92
Breastfeeding				
WFS Restriction	92	58	50	50
No Restriction	100	100	100	75

Table 2

Percentage of βs Falling within the Confidence Limits for βs in the 2–12-Year Unrestricted Model, by Type of Restriction, Type of Variable, and Number of Years Preceding the PLM Survey 1979

Type of Variable and Restriction	Number of Years Preceding the Survey			
	2–12	2–6	2–5	2–4
Intermediate Variables				
WFS Restriction	82	57	46	28
No Restriction	100	95	95	80
Socio-economic Variables				
WFS Restriction	70	48	47	25
No Restriction	100	95	87	80
All Variables				
WFS Restriction	75	52	47	26
No Restriction	100	95	90	80

This confirms the earlier findings that the longer the duration of the period before the survey, the higher is the proportion of the unbiased estimates falling within the confidence intervals; and that the magnitude of biased results is higher in the restricted than in the unrestricted sample. We may then say that from a biased restricted sample of births, we get biased results, and the relationship between the

predictor and the dependent variables would not depict the true picture. It would not be meaningful, therefore, to make the estimates of breastfeeding duration and contraceptive use for all births under the WFS restriction.

Table 2 summarises the results obtained from the betas falling within the confidence limits for betas in the 2–12 years of the unrestricted model, by type of restriction and different background variables. Taking the socio-economic and intermediate variables separately as well as combined in the four time-periods under study, we can see from Table 2 that the longer the period preceding the interview with unrestricted sample, the higher is the proportion of unbiased results. In this table, for all variables in the unrestricted sample, 95 percent of the betas fall within the confidence interval for the period preceding the survey of 2–6 years, as compared to 87 percent for 2–5 years, and 80 percent for the 2–4 years period preceding the survey. But when we restrict the fertility history to the last closed and open birth intervals, only 26 to 52 percent of the betas fall within the confidence intervals under different time-periods before the survey. When we look at the results separately for socio-economic and intermediate variables, we find that the proportion of unbiased estimates is higher for proximate variables. For example, for the period preceding the survey of 2–6 years, 57 percent of the betas fall within the confidence intervals for proximate variables as compared to 48 percent for socio-economic variables. This may mean that the socio-economic variables have a higher potential for biased estimates than the intermediate variables. This may be so because the intermediate variables are strongly related with the fertility outcome. We may then infer that the coefficients for the restricted sample are substantially different from those of the unrestricted (complete) samples. This difference is larger when the longer time-periods preceding the survey are observed.

CONCLUSIONS

Collection of fertility data in the surveys with the restrictions discussed severely limits the number of birth intervals available for analysis and, thus, incorporate a selection bias which is reflected in the results. It is not appropriate to base estimates of proportions of women who practice contraception, or those who breastfeed, on data for births restricted to the last closed and open intervals because the number of births in the later periods preceding the survey is quite small.

These restrictions do bias estimates of the structure of relationships predicting fertility because our procedure only looks at the first 40 months of experience in the birth intervals. A procedure that incorporates the long tails of the birth interval distribution may obtain different results.

Estimates based on socio-economic variables have a higher potential for biased estimates than those based on intermediate variables, perhaps because the latter are more directly related with the fertility outcome.

Table A-1

Results (B_s) from Logistic Regression Analysis of the Determinants of Child Spacing in Pakistan (PLM Survey), by Type of Restriction: Second Birth Interval

Birth Interval Segment and Variable	Number of Years Preceding the Survey and Restriction Status										
	2–12 Years					2–6 Years		2–5 Years		2–4 Years	
	No Restriction				WFS Restriction	No Restriction	WFS Restriction	No Restriction	WFS Restriction	No Restriction	WFS Restriction
	Beta Confidence Interval										
Second Birth Interval, Segment 17–22											
EDUL	–.03687	–.24383	Thru	.17009	–.23361	.04185	.08881	.19625	–.18148	.20058	.05720
EDUH	.04998	–.13918	Thru	.23914	–.30129	.03197	.06581	.00439	–.24705	.16371	.80463
RES	.03707	–.06951	Thru	.14365	.11514	.12848	.07695	.08540	.17228	.07047	.09451
SON	.11903	.02171	Thru	.21635	.11762	.16975	–.02587	.25932	.07733	.20710	–.07292
AGE	–.00064	–.01398	Thru	.01270	–.01476	.01057	.00418	.00386	–.01915	.00282	.03480
CONT	.04524	–.19056	Thru	.28104	.08809	.01437	.19768	–.02104	.15319	–.04391	–.64479
ABOR	–.11191	–.28243	Thru	.05861	–.13282	–.14027	.01059	–.04832	.30661	.01477	.74007
BREF	–.01766	–.21086	Thru	.17554	.04943	–.09642	.33760	.06812	.07571	.12907	.28754
INF	.05866	–.12682	Thru	.24414	.12351	.06042	.04810	.12954	.14515	.14532	.30733
Second Birth Interval, Segment 23–28											
EDUL	.12254	–.06268	Thru	.30776	.20310	.21940	.73259	.24951	.70111	.30466	.63882
EDUH	–.03800	–.22608	Thru	.15008	–.01326	–.01143	–.16497	.00575	–.09582	.00225	.42254
RES	.03698	–.06394	Thru	.13790	–.14453	–.03030	–.35606	.01170	–.12354	–.00981	–.19032
SON	–.00284	–.09446	Thru	.08878	–.10220	.02254	–.03140	–.02196	–.02027	–.04274	.00912
AGE	.00031	–.01231	Thru	.01293	–.00626	–.00152	.01641	.00093	.02218	.00090	.02806

Continued –

Table A-1 – (*Continued*)

CON	–.12051	–.36301	Thru	.12199	.15913	–.21546	.05684	–.27278	.01060	–.20304	–.02244
ABOR	–.02222	–.17830	Thru	.13386	–.37895	–.03917	–.27125	–.05022	–.22212	.03288	–.51375
BREF	.45960	.29026	Thru	.62894	.34607	.47366	.27275	.48353	.75066	.35569	.29970
Second Birth Interval, Segment 29–34											
EDUL	–.08475	–.34319	Thru	.17369	.04405	–.34579	–.21372	–.48698	.01838	–.62131	–1.95668
EDUH	–.03332	–.27382	Thru	.20718	–.47383	.00809	–.43640	–.12329	–.51609	–.55116	–10.96304
RES	–.11554	–.24726	Thru	.01618	.14782	–.24060	.11793	–.25579	.16226	–.29631	.37155
SON	–.11198	–.22750	Thru	.00354	–.02897	–.25342	–.36138	–.32499	–.27021	–.24870	.08181
AGE	–.00253	–.01845	Thru	.01339	.00042	–.01144	.04581	–.01348	.05207	–.03232	.05100
CON	.25726	–.00792	Thru	.52244	.40696	.30230	.45799	.48711	.64638	.45497	8.35344
ABOR	–.05620	–.25886	Thru	.14646	–.22727	.04839	–.66436	.08788	–.20020	.18623	–2.43412
BREF	.08952	–.09270	Thru	.27174	.23764	–.06310	.12904	–.05375	.35146	.05708	3.21524
Second Birth Interval, Segment 35–40											
EDUL	–.05095	–.36633	Thru	.26443	.42393	–.09795	–3.50878	–.06645	–3.13128	–.09761	–7.01349
EDUH	–.07193	–.38929	Thru	.24543	.22635	–.07284	–.08870	.14913	.90281	.03629	–1.22388
RES	–.17575	–.33581	Thru	–.01569	–.27357	–.22150	–.46657	–.34917	–1.56729	–.55684	–2.92038
SON	–.08025	–.21767	Thru	.05717	–.18987	–.08695	–.35682	–.04201	–1.27055	–.19241	–1.15721
AGE	.00965	–.00869	Thru	.02799	.04330	.02073	.03420	.02343	.02848	.02861	–1.03175
CON	–.30750	–.78296	Thru	.16796	–.39747	–.36493	.21981	–.42629	.40631	.06950	4.15063
ABOR	–.04902	–.29490	Thru	.19686	.39866	.05634	.43237	.24027	.49833	.23263	.84011
BREF	.26486	.01680	Thru	.51292	.35721	.33735	3.66345	.24160	2.94542	.59792	2.53239

Table A-2

Results (B_s) from Logistic Regression Analysis of the Determinants of Child Spacing in Pakistan (PLM Survey), by Type of Restriction: Third Birth Interval

Birth Interval Segment and Variable	Number of Years Preceding the Survey and Restriction Status									
	2–12 Years					2–6 Years		2–5 Years		2–4 Years	
	No Restriction				WFS Restriction	No Restriction	WFS Restriction	No Restriction	WFS Restriction	No Restriction	WFS Restriction
	Beta Confidence Interval										
Third Birth Interval, Segment 17–22											
EDUL	–.03236	–.25928	Thru	.19456	.23004	–.11250	.45324	–.05705	1.26582	–.06904	2.70623
EDUH	–.12268	–.34150	Thru	.09614	.07192	–.23953	.33626	–.18694	.59357	–.20287	1.24085
RES	.04896	–.06210	Thru	.16002	–.16467	.03533	–.20527	.02427	.07632	–.03460	.70933
SON	–.03301	–.13555	Thru	.06953	–.20036	–.05042	–.31374	–.05801	–.11920	–.12597	–.45674
AGE	.00561	–.00829	Thru	.01951	.00166	.01515	–.01301	.01197	.01000	–.00772	–.01959
CON	.09161	–.13667	Thru	.31989	.24777	.28678	.22971	.24372	.02053	.30447	–.82374
ABOR	–.10597	–.27559	Thru	.06365	–.23455	–.06951	–.36878	–.18989	–.59862	–.28797	–.65059
BREF	.15126	–.08978	Thru	.39230	.27080	.18049	.09485	.18226	.18190	.51665	1.68516
INF	.20586	–.00402	Thru	.41574	.58767	.23164	.54265	.22633	.78696	.32498	2.15395
Third Birth Interval, Segment 23–28											
EDUL	.12230	–.07598	Thru	.32058	–.19725	.18957	–.40086	.14777	–.74531	.20088	–.72719
EDUH	.19136	.00822	Thru	.37450	–.06664	.28940	–.00061	.27694	–.11453	.40878	–.60298
RES	–.00657	–.10901	Thru	.09587	.07831	–.06045	–.06710	–.01662	–.07866	–.21434	–.41529
SON	.02796	–.06582	Thru	.12174	.26079	.06099	.25809	.09995	.29964	.22177	.53369
AGE	–.00087	–.01371	Thru	.01197	.00348	–.01428	–.00591	–.01476	–.01542	–.01438	–.01500

Continued –

Table A-2 – (*Continued*)

CON	–.08940	–.30542	Thru	.12662	–.16016	–.19168	.02226	–.10554	.20395	–.44551	.44167
ABOR	.03960	–.10612	Thru	.18532	.07191	.05125	.05532	.03397	.14612	.13982	–.16707
BREF	–.06988	–.09576	Thru	.23552	–.09270	.06399	–.13447	.10121	–.10115	.03940	–.07659
Third Birth Interval, Segment 29–34											
EDUL	.03134	–.23000	Thru	.29270	.02699	.12167	.12368	.13809	.25918	–.09960	3.48253
EDUH	–.03911	–.29559	Thru	.21737	.10656	.01408	–.28167	.08715	–.12933	.07966	–.52914
RES	–.03587	–.16893	Thru	.09719	.02694	–.12505	.22194	–.17227	.03018	–.11456	–.10405
SON	–.00971	–.12973	Thru	.11031	.08628	.03932	.20597	–.04272	–.08007	–.06314	–.00416
AGE	.01123	–.00477	Thru	.02730	.02632	.00971	.00425	.00685	.00512	.01415	.01144
CON	.10385	–.16021	Thru	.36791	.06753	.00354	.21559	.04616	.21878	.05644	.41706
ABOR	–.02262	–.21638	Thru	.17114	–.04436	–.07186	–.13761	.01504	–.39108	.18612	–3.64784
BREF	.18956	–.04482	Thru	.42394	–.00051	.25214	–.04047	.22590	.00316	.50414	.10571
Third Birth Interval, Segment 35–40											
EDUL	–.52617	–.99173	Thru	–.06061	–.28888	–.46682	–.15112	–.90493	–2.75577	–.59889	–2.00684
EDUH	–.18539	–.51229	Thru	.14151	–.20378	–.17488	.15349	–.28279	–.04718	–.24020	.40737
RES	–.00684	–.15984	Thru	.14616	.25243	.06878	.37400	.11564	.67976	.04963	.17079
SON	–.07611	–.21761	Thru	.06539	–.28674	–.01167	–.08675	–.00399	.25716	–.01647	.16263
AGE	–.01533	–.03535	Thru	.00469	–.01650	–.00430	.04931	–.00864	.06054	–.00559	.04510
CON	–.09788	–.46414	Thru	.26838	–.50360	–.46416	–3.90963	–.27097	–3.56311	–.29730	–3.17319
ABOR	.06430	–.28298	Thru	.15438	.02623	.27889	.30090	.23860	.18407	.14297	–3.04474
BREF	.23128	–.05590	Thru	.51846	.43469	.38462	3.85588	.48385	3.66226	.34656	3.34312

Table A-3

Results (B_s) from Logistic Regression Analysis of the Determinants of Child Spacing in Pakistan (PLM Survey), by Type of Restriction: Fourth Through Eight Birth Interval

Birth Interval Segment and Variable	Number of Years Preceding the Survey and Restriction Status										
	2–12 Years					2–6 Years		2–5 Years		2–4 Years	
	No Restriction				WFS Restriction	No Restriction	WFS Restriction	No Restriction	WFS Restriction	No Restriction	WFS Restriction
	Beta Confidence Interval										
Fourth through Eight Birth Interval, Segment 17–22											
EDUL	–.08984	–.25228	Thru	.07260	–.06626	–.08794	–.10255	–.10952	–.01067	–.08241	.16237
EDUH	–.17538	–.33926	Thru	–.01150	–.26668	–.18405	–.20296	–.16404	–.12514	–.15662	–.20695
RES	.07820	.00622	Thru	.15018	.07995	.08278	.08331	.09733	.17117	.10155	.18440
SON	.05741	–.17697	Thru	.29179	.10567	.05028	.11328	.04728	.10797	.02521	.11398
AGE	.00021	–.00947	Thru	.00989	–.00598	.00153	.00394	.00224	–.00512	.00070	–.01227
CON	.05020	–.08706	Thru	.18746	.04126	.04853	.08932	.04707	.13372	.04351	.11171
ABOR	–.01431	–.11601	Thru	.08739	–.14617	.01458	–.16289	.01180	–.18733	–.00770	–.12239
BREF	–.05002	–.29476	Thru	.19472	.03396	–.03003	.03351	–.03489	.17540	–.04076	.03691
INF	.18662	–.11352	Thru	.25972	.22236	.19661	.11384	.18436	.18081	.18074	.10319
Fourth through Eight Birth Interval, Segment 23–28											
EDUL	–.13571	–.29735	Thru	.02593	–.19652	–.08945	–.00499	–.09527	–.02844	–.10139	.11054
EDUH	–.21757	–.38013	Thru	–.05501	–.16445	–.23072	.00965	–.25018	–.00758	–.22640	.16849
RES	.11018	.03792	Thru	.18244	.10308	.09180	–.01142	.10535	–.00412	.11287	–.02082
SON	.40394	.15908	Thru	.64880	.30471	.38645	.37594	.43113	.54526	.41750	.37214
AGE	–.00418	–.01388	Thru	.00552	–.00277	–.00367	–.00312	–.00375	–.00663	–.00513	–.00507
CON	.08458	–.05392	Thru	.22308	.03162	.08067	–.13328	.06166	–.13786	.03253	–.21101

Continued –

Table A-3 – (*Continued*)

ABOR	–.03374	–.13502	Thru	.06754	–.13330	–.01626	–.14841	.00063	–.12869	.00700	–.16339
BREF	.08503	–.15887	Thru	.32893	.19631	.08439	.14602	.03868	.13346	.00115	.20771
Fourth through Eight Birth Interval, Segment 29–34											
EDUL	.08945	–.07301	Thru	.25191	.04451	.07152	.03118	.07757	–.02197	.05467	.07236
EDUH	–.10655	–.27535	Thru	.06225	.12077	–.14919	.14539	–.12256	.18734	–.16732	.25647
RES	.02324	–.04978	Thru	.09626	.00118	.03979	–.05579	.06004	–.12519	.04464	–.11598
SON	–.05820	–.29364	Thru	.17724	–.29276	–.10091	–.15213	–.07701	.05840	–.06696	.00219
AGE	–.00991	–.01983	Thru	.00001	–.00854	–.00651	–.00478	–.00612	–.01418	–.00613	.00110
CON	.02621	–.11307	Thru	.16549	.03196	.04177	.19251	.01727	.13437	.02043	–.17110
ABOR	–.07265	–.17687	Thru	.03157	–.04113	–.08189	–.00746	–.08357	.11252	–.06546	–.06911
BREF	.14134	–.11698	Thru	.39966	.04265	.21304	.04019	.21162	.20345	.19480	.06765
Fourth through Eight Birth Interval, Segment 35–40											
EDUL	.00383	–.17439	Thru	.18205	.00849	.03540	.05417	–.01452	–.12924	.02515	–.15590
EDUH	–.09826	–.28652	Thru	.09000	–.26574	–.13434	–.61876	–.15675	–.45551	–.18864	–.25587
RES	–.02845	–.10757	Thru	.05067	–.02162	–.04789	–.02226	–.05464	–.01168	–.06057	–.15226
SON	.05458	–.20938	Thru	.31854	1.32479	.03283	4.68733	.00489	4.70869	–.02365	4.64846
AGE	–.01968	–.03060	Thru	.00876	–.02108	–.01509	–.01011	–.01517	.00627	–.01335	–.01726
CON	.00843	–.14205	Thru	.16091	.01657	.00815	.04821	–.00480	–.08146	.03336	–.07104
ABOR	.00859	–.10281	Thru	.11999	.09078	–.03771	–.02919	–.07554	–.12491	–.06021	–.18220
BREF	.26659	–.04453	Thru	.57771	.67863	.20158	.87155	.23770	4.56014	.24652	4.43643

REFERENCES

Akin, J., R. Bilsborrow, D. Guilkey, D. Benoit, P. Cantrell M. Garenne and P. Levi (1981) The Determinants of Breast Feeding in Sri Lanka. *Demography* 18: 287–307.

Bumpass, L. L., R. R. Rindfuss, A. Palmore, M. Conception and B. M. Choe (1982) Intermediate Variables and Educational Differentials in Fertility in Korea and the Philippines. *Demography* 19: 241–260.

Goldfeld, S. M., and R. E. Quandt (1972) *Non-linear Methods in Econometrics.* Amsterdam: North-Holland Publishing Company.

Jain, A. K., and J. Bongaarts (1981) Breastfeeding: Patterns, Correlates, and Fertility Effects. *Studies in Family Planning* 12:3 79–99.

Kmenta, J. (1986) *Elements of Econometrics.* New York: Manillan.

Maddala, G. S. (1983) *Limited Dependent and Qualitative Variables in Econometrics.* Cambridge: Cambridge University Press.

Palloni, A. (1984) Assessing the Effects of Intermediate Variables on Birth Interval Specific Measures of Fertility. *Population Index* 50: 623–627.

Pebley, A. R., N. Goldman and M. K. Choe (1986) Evaluation of Contraceptive History Data in the Republic of Korea. *Studies in Family Planning* 17:1 22–35.

Rindfuss, R. R., L. L. Bumpass, J. A. Palmore and D. W. Han (1982) The Transformation of Korean Child Spacing Practices. *Population Studies* 36: 84–104.

Rindfuss, R. R., L. L. Bumpass and J. A. Palmore (1987) Analyzing Fertility Histories: Do Restrictions Bias Results? *Demography* 24: 113–122.

Smith, D. P. (1985) Breastfeeding, Contraception and Birth Intervals in Developing Countries. *Studies in Family Planning* 16:3 154–163.