

**FERTILITY TRENDS AS ESTIMATED FROM CIVIL
REGISTRATION DATA: AN APPLICATION
OF A NEW METHOD***

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The civil registration system in the Philippines, like that of most developing countries, is incomplete in the coverage of vital events. As a result vital rates based on direct use of the civil registration data do not provide adequate information on levels and trends of fertility in the Philippines. Recently, however, Brass¹ (1975) has developed an analytical technique for the analysis of defective birth data from the civil registration systems. In brief, the technique requires tabulation of registered births by birth order and age of mother and population by age of mother. Using these data fertility rates by birth order and age of mother are computed. The cumulative first birth order rate (F_1), cumulated up to age 49, is compared with an independent estimate usually from census data of proportion of women of completed fertility with at least one child (P_{1+}). The ratio P_{1+}/F_1 provides an estimate of the correction factor for adjusting the first births for incomplete coverage. The correction factor determined for first births is then assumed to apply to all births and total fertility rates and age specific fertility rates are adjusted accordingly. In essence the basic assumption here is that relative coverage for all births is the same as for the first births. A method for checking this assumption and adjusting where needed is also suggested by Brass. It is based on the computation of F_j values where F_j is

*This research was carried out during Dr. Orense's brief stay in Chapel Hill at the invitation of POPLABS of the University of North Carolina. The authors are grateful to the POPLABS staff for their technical assistance in the preparation of this paper.

¹Brass, William, 1975, *Methods for Estimating Fertility and Mortality from Limited and Defective Data*, Occasional Publication, International Program for Population Statistics, University of North Carolina at Chapel Hill.

obtained by adding the age parity specific birth rates for the j^{th} birth order. The relative values of F_j are compared with a standard set of F_j^* selected to be approximately appropriate for the level of fertility of the population for providing evidence on the variations in under-reporting of births by birth order. The values for Standard Set are usually derived from data on family sizes of women with completed fertility (i.e. women 40-44 or 45-49 years old) from censuses or surveys by computing proportion of women with j or more births.

The purposes of the present paper are:

(1) to apply this method to the data from the civil registration system of the Philippines in order to estimate levels and trends in fertility and

(2) to evaluate the estimates by making comparisons with alternative estimates based on surveys and censuses reported in the literature.

Data and Estimation of Fertility Parameters

The birth data for 1960 to 1974 were collected by the civil registration systems of the Philippines and published by age of mother and birth order in the *Vital Statistics Report*, National Census Statistics Office, National Economic and Development Authority, Republic of the Philippines. A small number of these births are not classified by age of mother, birth order or both. In this study these births were proportionally allocated in three steps with respect to birth order, age of mother, and cells, independently; i.e., by always considering the proportions of the known data (not adjusted values). Thus, three adjustments for unknown category births are added to the original births with known characteristics.

The number of women in each age group 15-19, 20-24, . . . 45-49 for the intercensal period was obtained by interpolation using exponential formula between the 1960 and 1970 female population counts. For 1971 to 1974 the female population values were obtained from the National Census and Statistics Office,

Age and Sex Population Projections for the Philippines, UNFPA-NCSO, Population Research Project, Monograph No.2.

The percentage standard fertility distribution by parity was obtained from the age group 45-49 using data of ever-married women by number of children born alive from Table IV-1, *National Summary of the 1970 Census of Population and Housing*, Philippines.

One of Brass' techniques uses $P_{1+} \cdot F/F_1$ as an estimate of the total fertility rate, where P_{1+} is the proportion of women in the age group 45-49 having at least one birth. This value comes out as .8783 for 1970 using the population census. F is the total observed fertility and F_1 is the fertility for first birth. The expression $P_{1+} \cdot F/F_1$, accurately estimates the total fertility rate whatever the understatement of F and F_1 , provided the under-registration of all births is the same as for first births and that the age pattern of first births has remained unchanged over time.

Example:

From a table of birth rates classified by age of mother and birth order as illustrated below the row and column totals were obtained. The new totals provide information on age specific fertility rates and column totals the age cumulative specific birth order rates.

Age	1960 Birth Order			10+	Total
	1	2	.		
15-19	.0209	.0067	.	0.000	.0295
20-24	.0476	.0583	.	0.0002	.1523
.
.
45-49	.008	.0010	.	0.0038	.01175
$F_j = (\text{Total} \times 5)$	0.5630	0.5771	.	0.2091	3.2749(F)
$F_j (\%)$	17.19	17.62	.	6.38	

The fertility rates $F_j (\%)$ classified by birth order were plotted against the standard distribution, F^* .

The first and second points in 1960 (see Chart No. 1) deviate from the linear trend; this situation indicates that the first and second order births were registered with a higher degree of coverage than subsequent births. Hence, an adjustment of the first and second points is necessary before the expression for total fertility rate could be used. Therefore, a regression line excluding first and second points was fitted by least squares method. The new values for first and second points were obtained from this regression line. These new values were used to correct F_1 and F_2 and accordingly total fertility rate was adjusted. For example for 1960, the adjusted value of the first point is $\frac{15.12}{17.19} \times .5630 = .4952$ where 15.12 is an estimate of the F_1 (%) based on the regression line and 17.19 is the unadjusted first-order fertility in percent and .5630 is five times the sum of the first order birth rates. The second point is similarly adjusted. The total fertility rate, 3.2749, is reduced to 3.0905 because of the new values of the first and second points. Hence, the estimate for the total fertility rate for 1960 is $.8733 \times \frac{3.0905}{.4952} = 5.45$. The percent coverage of birth registration is estimated as the ratio of the reported to the estimated TFR, $3.2749/5.45 = .60$ or 60 percent.

Most of the graphs of the percent observed cumulative fertility by birth order, when plotted against the standard fertility distribution from the 1970 census, show a linear trend except the first point representing the first birth order. In 1960 and 1961, point 2 is also far from the straight line. Therefore, for 1960 and 1961 both first and second points were not used in the fitting of the straight line. There are only two years, 1962 and 1964, where no point (except, of course, the point representing birth orders 10 and over which was not considered in any regressions) deviated much from the regression lines. For other years, only the point corresponding to first birth order was disregarded when regression lines were obtained.

The percentage distribution of total fertility by birth order is given for the years 1960, 1961, . . . 1974 in Table 1. The standard distribution based on information on children ever born to ever-married women in the 1970 census is also given in the same table.

OBSERVED
F (%)

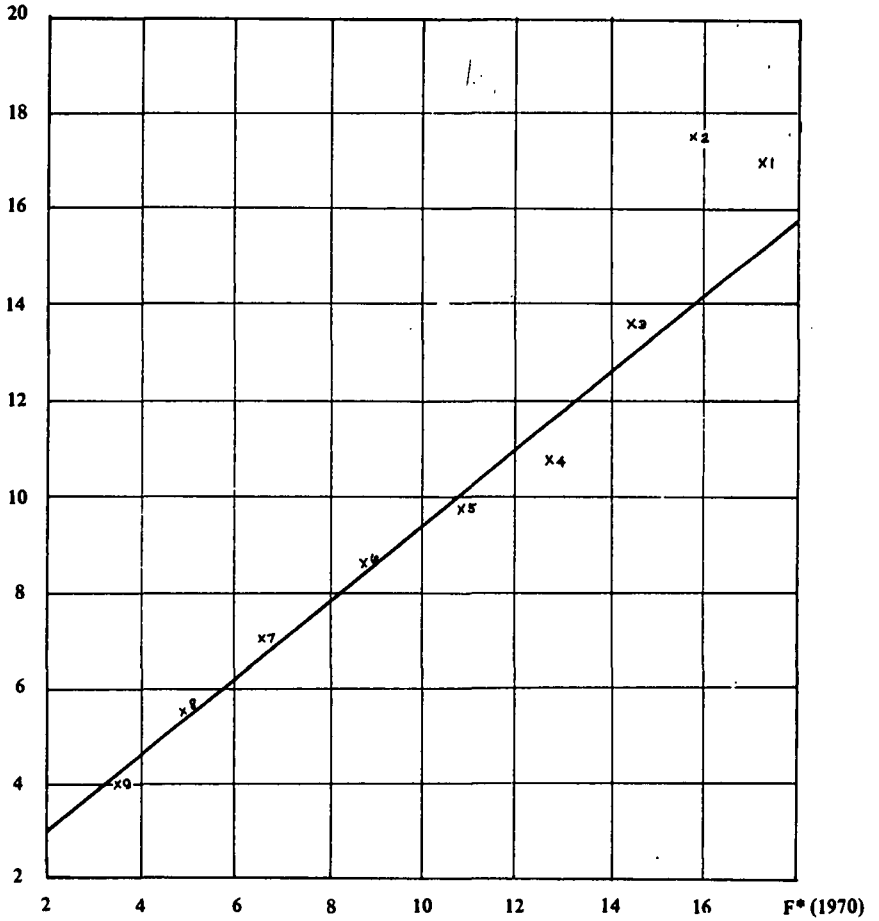


CHART 1: LINEAR TREND OF FERTILITY RATES (%), 1960

NOTE:

PTS 1 AND 2 DISREGARDED IN FITTING THE REGRESSION.

TABLE 1: PERCENTAGE DISTRIBUTION OF TOTAL FERTILITY BY BIRTH ORDER FROM CIVIL REGISTRATION DATA AND STANDARD DISTRIBUTION FROM THE 1970 POPULATION CENSUS

Birth Order	Civil Registration Data														1970	
	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	Census Standard Distribution
1	17.19	16.60	16.24	19.73	15.40	17.25	20.71	20.83	19.98	21.97	20.31	21.20	23.10	22.37	24.55	17.28
2	17.62	17.68	16.68	14.80	13.52	12.84	12.23	12.88	13.27	13.43	14.09	14.69	15.27	14.96	15.87	15.94
3	13.51	11.71	13.49	12.60	12.62	12.25	12.04	11.14	12.27	12.07	12.42	12.49	12.67	12.50	13.04	14.43
4	10.67	11.19	12.26	11.28	11.58	11.38	11.44	11.67	11.23	10.88	11.08	10.93	10.94	10.69	10.87	12.71
5	9.72	9.67	10.79	10.03	10.56	10.33	10.32	10.62	9.82	9.56	9.62	9.41	9.27	9.03	9.00	10.80
6	8.46	8.56	9.84	8.17	8.95	9.19	9.17	8.45	8.69	8.35	8.35	8.09	7.83	7.59	7.62	8.75
7	6.93	7.06	7.64	6.74	7.71	7.43	7.80	7.15	7.19	6.93	6.93	6.68	6.31	6.14	6.00	6.63
8	5.47	5.85	5.44	5.33	6.03	6.14	6.39	7.10	5.70	5.54	5.53	5.35	4.88	4.78	4.37	4.93
9	4.03	4.16	3.92	4.03	4.68	4.66	4.96	4.51	4.19	4.12	4.17	4.00	3.59	3.44	3.45	3.43
10 and over	6.38	7.53	3.77	7.28	8.95	8.53	4.95	5.66	7.66	7.15	7.48	7.16	6.14	8.50	5.37	5.10

Table 2 gives the reported and adjusted total fertility adjusted as illustrated above and percent coverage of birth registration for the years 1960 through 1974.

The same computations of total fertility were also done using three-year average birth rates in order to achieve more stability in the rates by aggregating the data. The percentage distributions of the observed total fertility by birth order for the three-year periods beginning 1960-62 through 1972-74 are given in Table 3, and the reported and adjusted total fertility rates in Table 4.

TABLE 2. REPORTED AND ADJUSTED TOTAL FERTILITY RATES AND COVERAGE RATES PHILIPPINE REGISTRATION SYSTEM, 1960-74

Year	Total Fertility Rate		Percent Coverage of Birth Registration $\frac{(2)}{(3)} \times 100$
	Reported	Adjusted	
(1)	(2)	(3)	(4)
1960	3.27	5.48	60
1961	3.28	5.80	57
1962	3.77	5.41	70
1963	3.71	5.46	68
1964	3.82	5.70	67
1965	3.69	5.99	62
1966	3.71	5.93	63
1967	3.68	5.91	62
1968	3.84	5.79	66
1969	3.92	5.70	69
1970	3.90	5.65	69
1971	3.71	5.49	68
1972	3.57	5.26	68
1973	3.74	5.38	70
1974	3.66	5.04	73

TABLE 3. PERCENTAGE DISTRIBUTION OF TOTAL FERTILITY BY BIRTH ORDER FROM 3-YEAR AVERAGE REGISTRATION DATA AND A STANDARD DISTRIBUTION FROM 1970 POPULATION CENSUS

Birth Order	1960-62	1963-65	1966-68	1969-71	1972-74	1970 Census
						Standard Distribution
1	16.65	17.42	20.49	21.19	23.36	17.28
2	17.29	13.70	12.81	14.11	15.37	15.94
3	12.91	12.49	11.83	12.35	12.70	14.43
4	11.43	11.42	11.44	10.97	10.83	12.71
5	10.10	10.31	10.24	9.53	9.09	10.80
6	9.01	8.78	8.77	8.25	7.67	8.75
7	7.24	7.31	7.37	6.83	6.14	6.63
8	5.58	5.84	6.38	5.46	4.69	4.93
9	4.03	4.46	4.54	4.08	3.49	3.43
10	5.76	8.27	6.13	7.24	6.68	5.10

TABLE 4. REPORTED AND ADJUSTED TOTAL FERTILITY RATES FOR 3-YEAR PERIODS FROM 1960 TO 1974 PHILIPPINE CIVIL REGISTRATION DATA

Period	Total Fertility Rate		Percent Coverage of Birth Registration
	Reported	Adjusted	$\frac{(2)}{(3)} \times 100$
(1)	(2)	(3)	(4)
1960-62	3.45	5.51	63
1963-65	3.74	5.80	64
1966-68	3.74	5.84	64
1969-71	3.87	5.58	69
1972-74	3.66	5.22	70

Graphs of the fertility (%) by birth order for the five periods versus the standard distribution are given in Chart No. 2.

The adjusted age specific fertility rates for 1960-62, . . . 1972-74 are given in Table 5 and the corresponding percentage distributions in Table 6. An illustration for computing adjusted age specific fertility rates for 1960-62 follows:

Age	1960-62 Birth Order			Total
	1	2	3 and above	
15-19	.0220	.0081	.0026	.0327
20-24	.0487	.0613	.0540	.1640
.
.
45-49	.0006	.0007	.0089	.0102
F_j (observed)	.5738	.5959	2.2775	3.4472
F_j^f (adjusted value from regression)	.5249	.4887	2.2775	3.2911
$F_j^e = \frac{P_{1+}}{F_1} \times F_j^f$				
(corrected for coverage)	.8783	.8177	3.8109	<u>5.507</u>
Adjustment factors for $F_j = F_j^e / F_j$	1.5307	1.3723	1.6733	1.5975

The adjusted fertility rate for each age group in Table 5 is the weighted average of the reported birth rates by birth order using the adjustment factors as weights.

The crude and adjusted crude birth rates for 1960 to 1974 are presented in Table 7. An adjusted crude birth rate was obtained by adjusting the crude birth rate for the estimated percent coverage.

OBSERVED
F (%)

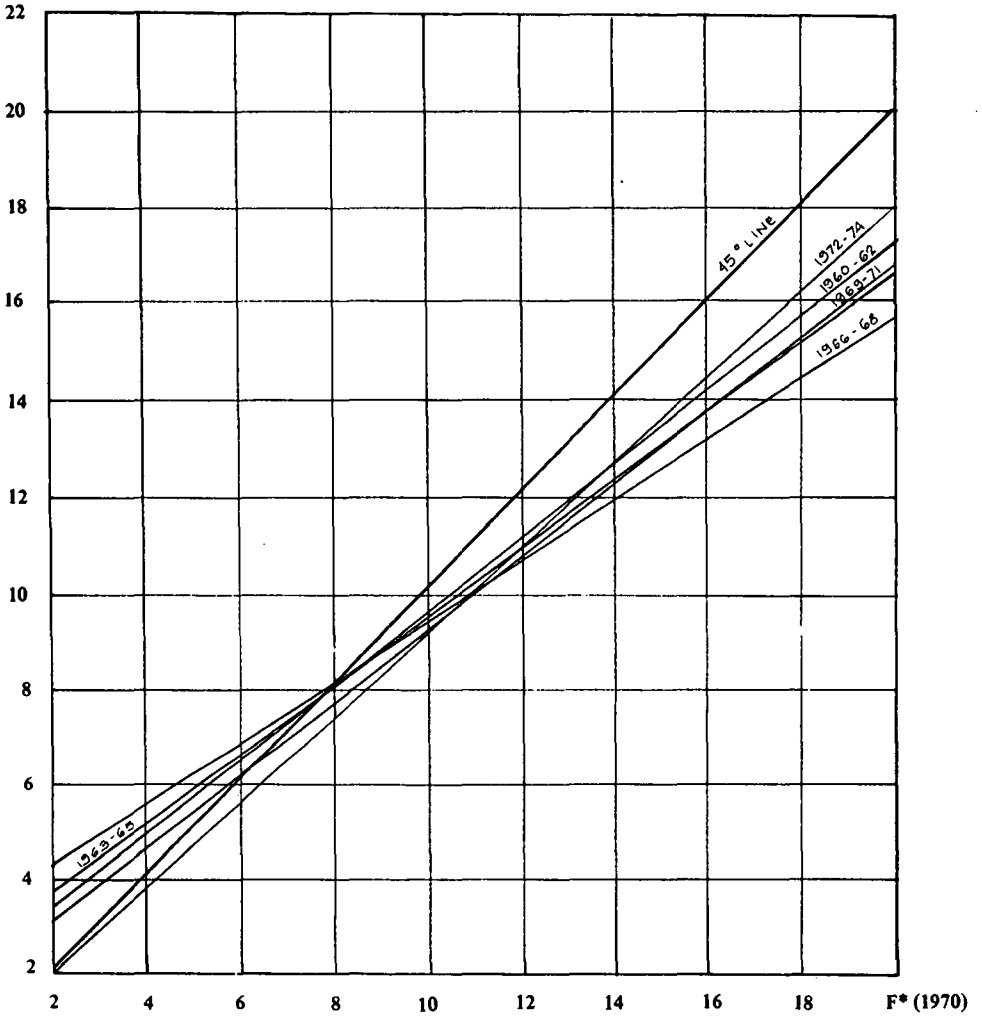


CHART 2: LINEAR TRENDS OF TOTAL FERTILITY BY BIRTH ORDER
1960 - 62 1972 - 74

TABLE 5. ADJUSTED AGE SPECIFIC FERTILITY RATES

Age	1960-62	1963-65	1966-68	1969-71	1972-74
15-19	.0491	.0563	.0455	.0433	.0450
20-24	.2490	.2345	.2083	.2181	.2095
25-29	.2845	.2989	.3152	.2922	.2621
30-34	.2430	.2725	.2804	.2619	.2384
35-39	.1747	.1936	.2115	.1966	.1892
40-44	.0844	.0867	.0906	.0876	.0818
45-49	.0168	.0168	.0175	.0172	.0183
Total	1.1015	1.1593	1.1690	1.1169	1.0443
TFR	5.5075	5.7965	5.8450	5.5846	5.2200

TABLE 6. PERCENT DISTRIBUTION OF ADJUSTED FERTILITY
BY AGE

Age	1960-62	1963-65	1966-68	1969-71	1972-74
15-19	4.46	4.86	3.89	3.88	4.31
20-24	22.60	20.23	17.82	19.53	20.06
25-29	25.83	25.78	26.96	26.16	25.10
30-34	22.06	23.50	23.99	23.44	22.83
35-39	15.86	16.70	18.09	17.60	18.12
40-44	7.66	7.48	7.75	7.84	7.83
45-49	1.53	1.45	1.50	1.54	1.75
	100.00	100.00	100.00	100.00	100.00

**TABLE 7. REPORTED AND ADJUSTED CRUDE BIRTH RATES,
PHILIPPINE CIVIL REGISTRATIONS SYSTEM, 1960-74**

Year	Reported ²	CBR ¹	Adjusted ^{a3}
1960	22.94		38.23
1961	22.95		40.26
1962	26.66		38.09
1963	26.27		38.69
1964	26.02		38.84
1965	25.03		40.37
1966	25.15		39.92
1967	24.92		40.19
1968	25.87		39.20
1969	24.46		38.35
1970	26.23		38.01
1971	25.43		37.40
1972	24.84		36.52
1973	26.15		37.36
1974	26.18		35.86

^aAdjusted by using the coverage rate in Table 2.

Total population in the denominator of these reported rates was obtained by using the interpolated female populations and sex ratios for the intercensal population. The rates may be slightly different from those published in official publications.

Discussion of Findings

In the following discussion, an attempt is made to evaluate the findings by making comparisons with alternative estimates prepared by other researchers.

From 1965 the TFR values given in Table 2 decrease from 5.99 to 5.04 in 1974. It does seem that the TFR values in the first five years are low and this condition might have been due to the

chosen standard distribution and the value of P_{1+} which were both based on the 1970 population census.

In Table 4, the adjusted total fertility rates for the three-year periods, 1960-62 through 1972-74 show the same trends as those obtained for individual years. The TFR values from 1963 to 1968 are more or less constant.

The following table shows the comparative values of TFR obtained from three sources:

Rates from Registration Data Using Brass Technique		Rates Derived from National Demographic Surveys of			Rates by UNFPA-NCSO		
		1968	1973				
	TFR	TFR		TFR		TFR	
-	-	1953-57	6.34	-	-	-	
-	-	1958-62	6.14	1958-62	6.64	-	
1960-62	5.51	-	-	-	-	-	
(1960-64	5.57)	-	-	-	-	1960-64	
1963-67	5.80	1963-67	5.69	1963-67	6.30	-	
(1965-69	5.86)	-	-	-	-	1965-69	
1968-72	5.58	-	-	1968-72	5.82	-	
(1970-74	5.36)	-	-	-	-	1970-74	
						5.34*	

*Low assumption

In the period 1960-64, the Brass technique gives an average TFR of 5.57 which is much lower than UNFPA-NCSO estimate of 6.79 and those of NDS 1968 and 1973 for 1958-62. In 1963-67, the NDS 1968 estimate of 5.69 is slightly lower than Brass estimate of 5.80. Both NDS 1968 and UNFPA-NCSO have higher estimates. In 1965-69 and 1970-74, the values from the different sources are reasonably close to each other.

Table 5 gives the adjusted age specific rates for 1960-62 through 1972-74, and Table 6 the corresponding percent distributions. The fertility rates for women over 25 years old gradually

TABLE 8: AGE SPECIFIC FERTILITY RATES DERIVED FROM REGISTRATION DATA USING BRASS TECHNIQUE, THE NATIONAL DEMOGRAPHIC SURVEYS OF 1968 AND 1973 AND UNFPA-NCSO

Rates by Data Using Brass Technique	Rates Derived from National Demographic Surveys							Rates by UNFPA-NCSO			
	AGE	60-62	63-68	53-57	1968 58-62	63-67	58-62	1973 63-67	68-72	60-64	65-69
15-19	.049	.051	.086	.060	.026	.084	.074	.056	.071	.059	.046
20-24	.249	.221	.263	.240	.186	.260	.254	.227	.336	.255	.219
25-29	.284	.307	.312	.301	.303	.313	.313	.302	.340	.340	.301
30-34	.243	.276	.278	.290	.262	.290	.281	.272	.282	.277	.241
35-39	.175	.203	.215	.208	.229	.211	.216	.199	.216	.222	.181
40-44	.084	.190	.092	.104	.112	.107	.101	.100	.093	.090	.069
45-49	.017	.017	.023	.025	.020	.027	.020	.022	.020	.019	.011

*Low assumption

decline from 1966 to 1974. There is no appreciable change in the fertility rates of younger women. The adjusted age specific rates from the Brass technique together with values derived from the 1968 and 1973 National Demographic Surveys and the UNFPA-NCSO are given in Table 8. A comparison of these values show moderate to slight differences.

TABLE 9: ESTIMATED CRUDE BIRTH RATES DERIVED FROM REGISTRATION DATA AND THE DUAL RECORD SYSTEMS IN SAMPLE REGISTRATION AREA

	Derived From Registration Data by Brass Technique	PHE	CRS	DUAL RECORD SYSTEM Dual Record Adjusted	
1971	37.40	33.64	24.65	37.91	41.86*
1972	36.52	33.86	27.98	35.30	35.82
1973	37.36	29.14	25.84	33.87	36.67
1974	35.86	—	—	—	—

PHE – Periodic Household Enumeration

CRS – Continuous Recording System

Adjusted – Using Chandra-Deming Method

Source: Tito A. Mijares, *Development and Maintenance of a Sample Vital Registrations System in the Philippines*, National Census and Statistics Office, undated, Tables Number 1, 5, 8 and 11.

CONCLUSION AND REMARK

Comparisons show that estimates in the early 60's from the Brass technique are low as compared to those from the NDS 1968 and 1973 and by UNFPA-NCSO. The estimates for the periods, late 60's and 70's, are plausible in relation to the alternative estimates.

The standard distribution from the 1970 Census in theory should be more suitable because women in the age group 45-49 in 1970 had more of their children born in the 60's rather than

70's. However, the percentage distribution of total fertility by birth order using 72-73 birth rates collected in some parts of Mindanao by Rev. Fr. Francis Madigan, S.J. and his group merely provides values which are similar to those obtained using the census standard set. This indicates that the standard distribution used probably is better suited for the recent years than the earlier years. This may be the reason for the lower levels of fertility estimates for early 60's.

Proportion of women in the age group 45-49, with one or more children (P_{1+}) obtained from the 1970 Census has been kept constant throughout the period for the analysis. This in fact might be changing. Therefore, there may be some bias due to this. Hence, one may investigate the use of: (1) alternative standard distribution from past censuses and recent surveys, and (2) alternative values of P_{1+} . A regional analysis of registration data using Brass method could also be done. Larger groupings e.g. Luzon, Visayas and Mindanao may provide more realistic estimates than the existing political regions because of the poorer civil registration coverage in some of the political regions.