DETECTION OF ERRORS IN MATERNITY HISTORY DATA

By

ATEF M. KHALIFA HODA M. RASHAD DAAD M. FOUAD

Maternity history data, for Less Developed Countries, are usually affected by several kinds of errors. These errors may lead to a considerable bias, especially in the analysis of trend . Thus, beforeany analysis of the data, it is essential to check the reliability of recording and to assess the degree and direction of bias likely to affect the estimates.

Several procedures are already available. One of the most commonly used is the well known procedure P/F ratio developed by Brass (Brass, 1975).

It is proved that successive application of the P/F ratio in periods preceding the survey could differentiate not only between the effect of typical errors affecting the data and the impact of fertility change, but also the ability to differentiate between the effect of each kind of error.

A. TYPES OF ERRORS AFFECTING MATERNITY HISTORY DATA.

A type of error that may happen is the definition of the Cohort of mothers, for example mothers aged 32 in the age group 30-34 may state themselves as in the age group 25-29, This means that the Cohort of mothers aged 25-29 increases in number of mothers and also the Cohort aged 30-34 will be affected by this movement.

Another widely recognized possible error is that the total number of children ever born may be under estimated . Mothers in old age have strong tendency to omit births due to the effect of memory of longer interval and larger number of births, and also for social reasons ; children who moved away or died, female births may be more often omitted.

* Prof.of Demographic Institute of Statistical Studies and Research,Cairo Univ.

** Lecturer of Demography, Institute of Statistical Studies and Research,Cairo Univ ISSR

** *Based on a Master Thesis.submited to The Department of Population and Biostatistics, I.S.S.R. Cairo Univ.

It is clear that the underestimate of fertility in the earlier periods resulting from omission must be followed by increasing fertility when compared by recent periods. This may be due to the false decline in fertility affecting these data in the earlier periods.

- Another type of error occurs in moving births belonging to a specific period of time to another period, such that, when asking mothers in a special age group about their births in a year (12 months) before survey. Births may be allocated an average to a shorter or longer interval than they actually took place. This distortion called reference size error is assumed to be the same for all age groups of women, so its effect on fertility analysis is straight and the effect on fertility level depends upon whether this reference size error was shorter or longer.

- The more complicated type of misplacement error always happen when the error of reference is related to the age of mother. Brass (1975) discusses a tendency for older women to exaggerate the interval since births took place, placing them further back in time than they actually occured. This error causes an over-estimation of the level of fertility for the earliest periods preceding the survey and implies a change in the age pattern due to a false decline in fertility in young age groups for more recent Cohorts.

- Another equally plausible type of error which introduces an apposite bias is discussed by Potter (1975). In an attempt to provide explanation of timing distortions he presents a model in which the allocation of the time of birth of the nth child is affected by the reported time of birth of the $(n-1)^{th}$ child and the interval between births as well as the number of years before the survey that the event occured. Specifically, Potter considers

that is a tendency to bring earlier events closer to the date of interview and to exaggerate the length of interval between births. He also assumed that very recent events are correctly reported. In fact the results of this model is an under-estimation of the level of fertility corresponding to the most distant periods preceding the survey (shorter reference error not necessarily equal for all ages and all orders of births), while the most recent period rates are nearly correct and those corresponding to the period before the most recent are exaggerated. Evidently, Patter's is model leads to a false conclusion of a decline in fertility in the most recent period.

B. SUCCESSIVE APPLICATION OF P/F RATIO METHOD

The successive application of P/F ratio means applying this procedure during some number of years preceding the survey. In order to calculate the estimated number of the children ever born (P_i) corresponding to mothers aged 15-19 in (0-1) year before the survey we have to realize the formula $\frac{1}{5}$ ($P_{15,\ldots,19} + P_{14,\ldots18} + P_{13,\ldots,17} + P_{12,\ldots16} + P_{11,\ldots15}$ during 0-1,1-,2-,3-,4-5 years preceding the survey). In order to get the corresponding number to mothers aged 15-19 in 1-2 years before the survey we have to reduce the number of the children ever born belonging to mothers aged 15-19 in 0-1 year before the survey by the value $5(P_{15,\ldots,19}$ in 0-1 year before the survey) and so on.

The values of F can be calculated by the formula

$$F = \sum_{j=0}^{i=1} f_j + w_i f_i$$

where F, is the cumulative number of the children ever born,

f_i, denotes the age specific fertility rates of women currently in age group i in a specific period.

w_i, denotes the multiplying factors presented by (Brass, Rashad, 1980) when:

$f_o = 0$,

f_1 = Age specific fertility rates for ages 14.5 to 19. ,

f_2 = For ages 19.5 to 24.5

and when

f_o = 0,

f_2 = Age specific fertility rates for ages 13.5-18.5

f_3 = For ages 18.5 - 23.5

and when

f_o = 0,

f_2 = Age specific fertility rates for ages 12.5 - 17.5

f_3 = For ages 17.5 - 22.5

C. EFFECT OF FERTILITY CHANGE ON THE BEHAVIOUR OF P/F RATIOS.

1. Applying The P/F Ratio Method Under the Assumption of Constant Fertility.

Table (1) presented the detailed single years age specific fertility rates and assumed to be constant during 35 years preceding the survey.

Table (1) single years age specific fertility rates under the assumption of constant fertility.

Age	age specific fertility rates	Age	A.S.F.R
15	.098	32	.140
16	.125	33	.134
17	.142	34	.127
18	.153	35	.120
19	.161	36	.112
20	.166	37	.104
21	.170	38	.097
22	.172	39	.089
23	.173	40	.080
24	.172	41	.072
25	.171	42	.063
26	.168	43	.055
27	.165	44	.046
28	.161	45	.037
29	.157	46	.029
30	.152	47	.021
31	.146	48	.013
		49	.005

Table (2) presents the values of the P/F ratios in 5 years average up to the end of different years preceding the survey under the assumption of constant fertility

Table (2) the values of P/F ratios up to the end of 3 years preceding the survey under the assumption of constant fertility

Age	0-1	1-2	2-3
15-19	.935	.873	.835
20-	1.000	1.000	1.009
25-	.995	.997	.998
30-	.993	.995	.995
35-	.992	.993	.994
40-	.990	.990	.991
45-	.993	.990	.988

One can observe that all values presented in table (2) are nearly closed to the unity , this is not only the values results from applying the method in 0-1 year before the survey but also the values resulted form applying the method successively in different years preceding the survey. Also it is obvious that these results are logcally acceptable and reveal higher degree of accuracy in applying the method.

2. Applying The P/F Ratio Method Under The Assumption of Fertility Decline.

Data presented in table (3) represents the complete birth history under the assumption of fertility decline.

Total fertility rates in this table declined from 7.000 in 35 years preceding the date of survey to be 4.000 at the date of the survey.

Table(3)Single years age specific fertility rates under the assumption of fertility decline

Age	0-1	1-	2-	3-	4-	5-	6-	7-
15	.00009	.00009	.00009	.00009	.00009	.00009	.00009	.0000
16	.004	.004	.004	.004	.004	.004	.004	.004
17	.032	.032	.032	.032	.032	.032	.032	.032
18	.062	.062	.062	.062	.062	.062	.062	.062
19	.107	.107	.107	.107	.107	.107	.107	.107
20	.151	.151	.151	.151	.151	.151	.151	.152
21	.189	.189	.190	.190	.190	.190	.190	.190
22	.223	.223	.224	.224	.225	.225	.226	.226
23	.252	.252	.253	.253	.254	.255	.256	.257
24	.274	.275	.276	.277	.278	.280	.281	.282
25	.269	.271	.273	.274	.276	.277	.279	.280
26	.265	.267	.269	.271	.273	.274	.276	.278
27	.256	.258	.260	.263	.265	.268	.270	.272
28	.247	.249	.252	.255	.257	.260	.263	.266
29	.235	.238	.241	.244	.247	.250	.254	.257
30	.215	.218	.222	.225	.228	.232	.235	.239
31	.196	.199	.202	.206	.210	.214	.217	.221
32	.178	.182	.186	.189	.191	.197	.200	.204
33	.161	.165	.169	.172	.176	.180	.184	.188
34	.147	.150	.154	.157	.161	.165	.168	.171
35	.131	.135	.138	.142	.146	.149	.153	.157
36	.117	.120	.124	.127	.131	.135	.138	.142
37	.104	.107	.110	.113	.117	.120	.124	.128
38	.091	.094	.097	.100	.103	.107	.110	.114
39	.078	.081	.084	.086	.089	.093	.096	.099
40	.064	.067	.069	.072	.074	.077	.080	.083
41	.050	.052	.054	.056	.058	.061	.063	.065
42	.038	.039	.041	.042	.044	.046	.048	.050
43	.026	.028	.029	.030	.031	.033	.034	
44	.017	.018	.019	.020	.020	.021		
45	.010	.011	.011	.012	.012			
46	.006	.006	.006	.007				
47	.004	.004	.004	.004				
48	.002	.002	.002	.002				
49	.0004	.0004	.0004	.0004				
T.F.R	4.203							

8-	9-	10-	11-	12-	13-	14-	15-	16-	17
.00009	.00009	.00009	.00009	.00009	.00009	.00009	.00009	.00009	.0[illegible]004
.004	.004	.004	.004	.004	.004	.004.	.004	.004	.004
.032	.032	.032	.032	.032	.032	.032	.032	.032	.032
.062	.062	.062	.062	.062	.062	.062	.062	.062	.062
.107	.107	.107	.107	.107	.107	.107	.107	.107	.107
.152	.152	.152	.152	.152	.152	.152	.152	.152	.152
.191	.191	.191	.191	.191	.191	.191	.192	.192	.192
.226	.227	.227	.227	.228	.228	.229	.229	.229	.230
.257	.258	.259	.260	.260	.261	.262	.263	.263	.264
.283	.285	.286	.287	.288	.289	.291	.292	.293	.294
.282	.284	.286	.287	.289	.290	.292	.294	.295	.297
.280	.282	.284	.286	.289	.291	.293	.295	.297	.299
.275	.277	.280	.282	.285	.287	.290	.292	.295	.296
.268	.271	.274	.277	.280	.283	.286	.289	.292	.295
.260	.263	.267	.270	.273	.277	.280	.284	.[illegible]88	.291
.243	.246	.250	.254	.257	.261	.265	.269	.273	.277
.225	.229	.233	.237	.241	.245	.249	.254	.258	.262
.209	.213	.217	.221	.225	.230	.234	.239	.243	.24-
.192	.196	.200	.205	.210	.214	.219	.224	.229	
.177	.181	.186	.190	.195	.200	.204	.209		
.162	.166	.170	.174	.179	.184	.188			
.146	.150	.155	.159	.164	.168				
.132	.135	.140	.144	148					
.117	.121	.125	.129						
.102	.106	.110							
.086	.089								
.068									

18-	19-	20-	21-	22-	23-	24-	25-	26-	27-
.00009	.00009	.00009	.00009	.00009	.00009	.00009	.00009	.00009	.0000
.004	.004	.004	.004	.004	.004	.004	.004	.004	.004
.032	.032	.032	.032	.032	.032	.032	.032	.032	.032
.062	.062	.062	.062	.062	.062	.062	.062	.062	.062
.107	.107	.107	.107	.107	.107	.107	.107	.107	.107
.152	.152	.152	.152	.152	.152	.152	.152	.152	.152
.192	.192	.192	.193	.193	.193	.193	.193	.193	.193
.230	.231	.231	.231	.232	.232	.233	.233	.233	.234
.265	.266	.266	.267	.268	.269	.269	.270	.271	
.296	.297	.298	.300	.301	.302.	.303	.305		
.299	.300	.302	.304	.305	.307	.307	.		
.301	.303	.305	.308	.310	.312				
.300	.303	.306	.308	.311					
.298	.301	.305	.308						
.295	.299	.307							
.281	.285								
.267									

28-	29-	30-	31-	32-	33-	34-35
.00009	.00009	.00009	.00009	.00009	.00009	.00009
.004	.004	.004	.004.	.004	.004	
.032	.032	.032	.032	.032		
.062	.062	.062	.062			
.107	.107	.107				
.152	.152					
.193						

Table (4) presents the values of the P/F under the assumption of fertility decline.

Table (4) applying the P/F ratio method up to the end of years before the survey under the assumption of fertility decline

Age	0-1	1-2	2-3
15-19	1.095	1.077	1.000
20-	.989	.975	.956
25-	1.020	1.021	1.015
30-	1.035	1.032	1.026
35-	1.069	1.060	1.051
40-	1.126	1.113	1.099
45-49	1.226	1.209	1.192

One can observe from data presented in Table 4 that:

- All the values of the P/F ratios are in general more than the unity.

- Successive applications to the P/F ratios reveal a direction of increasing affect on these ratios at the time of the direction of fertility decline

- Also, examining the values of the P/F in each year before the date of survey show a systematic increase with age of mothers.

D. EFFECT OF ERRORS ON THE BEHAVIOUR OF THE P/F . RATIOS.

1. Effect Of Event Misplacement Error On P/F Ratios Under The Assumption Of Constant fertility.

Table (5) presents the P/F ratios up to the end of different years preceding the survey when the data have been subjected by event misplacement, under the assumption of constant fertility Potter (1975).

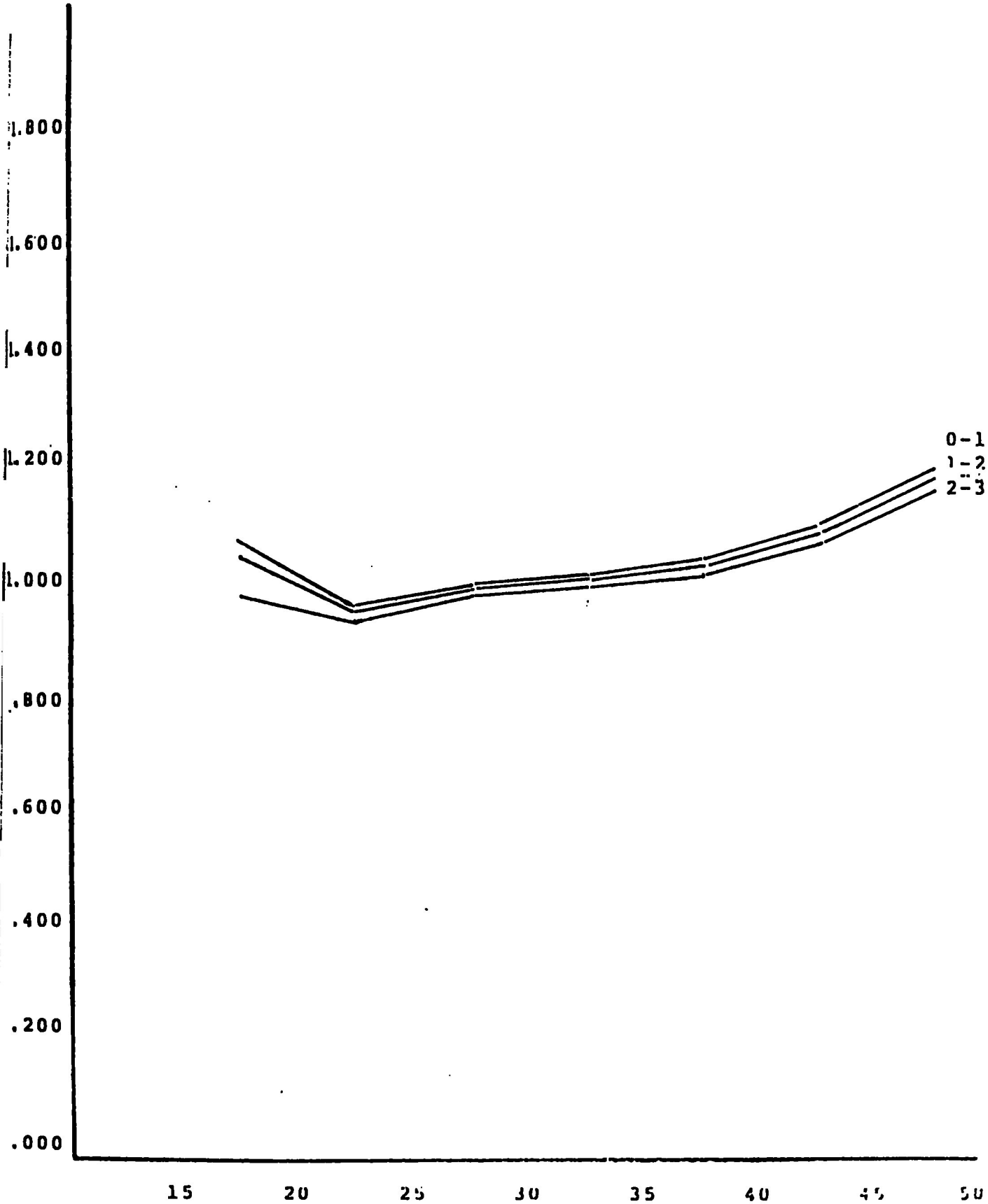

Fig (1) Effect of fertility decline on the P/F ratios.

Table (5) The values of P/F ratios
up to the end of 3 years before the survey.

Age	0-1	1-2	2-3
15-	2.064	2.007	1.124
20-	1.381	1.271	1.177
25-	1.188	1.120	1.056
30-	1.111	1.068	1.030
35-	1.068	1.043	1.021
40-	1.043	1.026	1.013
45-	1.020	1.015	1.014

It is obvious from data presented in table (5) that the values of P/F ratios in the recent years are $>$ 1.0 mean while these values in the earliear years have a decreasing tendecny and expected to be $<$ 1.0. The behaviour of the P/F has a small decreasing trend specially if the value corresponds the the first age group is neglected.

2. Effect of Omission On The P/F Ratios Under The Assumption Of Constant Fertility.

Table (6) presents the values of P/F ratios when the data are affected by omission we assumed that mothers aged 40-44 tend to omit 15% from their earlier births in the time of survey,and mothers aged 45-49 tend to omit 20% from their earlier births. It is clear that this type of omission only affect the number of the children ever born (P_i).

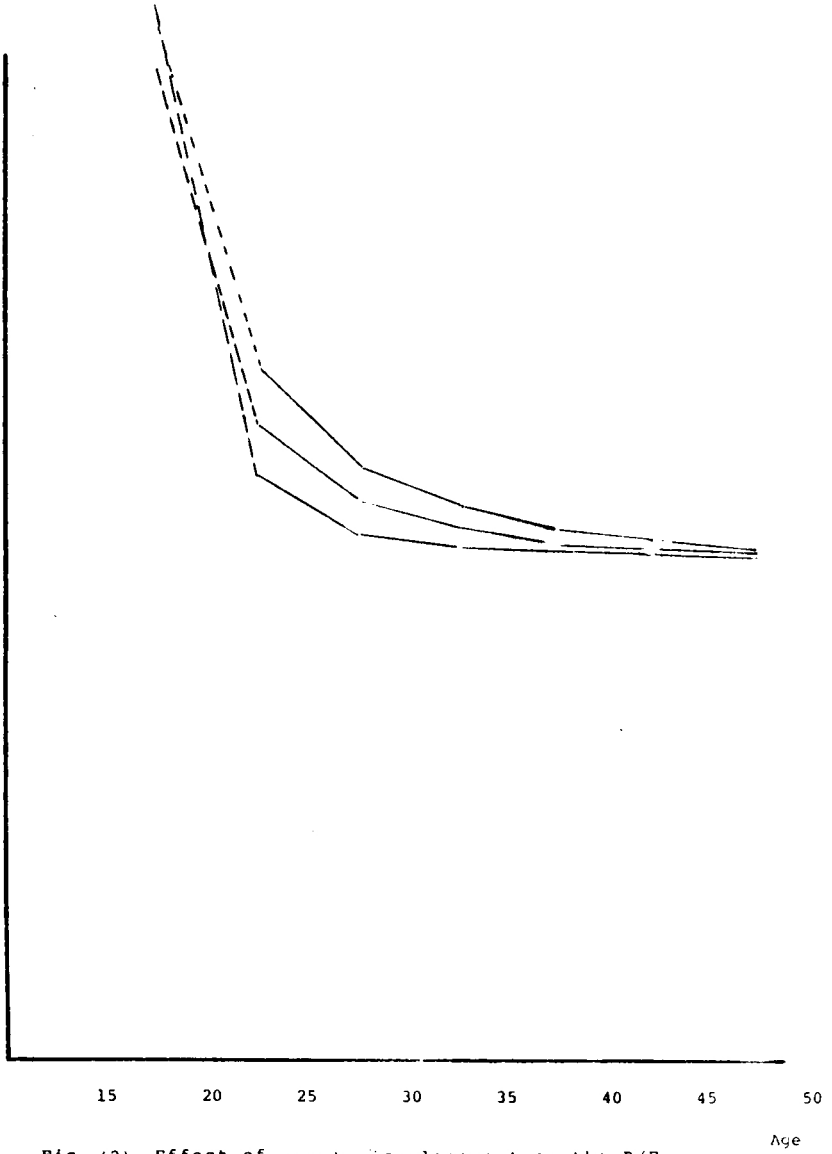

Fig (2) Effect of event missplacement on the P/F ratios under the assumption of constant fertility.

Table (6) The values of P/F ratios up to 3 years preceding the survey when the data are subjected to omission, constant fertility.

Age	0-	1-	2-
15-19	.935	.873	.835
20-	1.000	1.000	1.009
25-	.995	.996	.998
30-	.993	.995	.995
35-	.992	.993	.993
40-	.840	.841	.843
45-49	.795	.792	.791

It is obvious that there is a decreasing trend affecting the behaviour of the P/F ratios in each year preceding the survey.

3. Effect of Reference Size Error On The P/F Ratios Under The Assumption Of Constant Fertility.

Table (7) presents the values of P/F ratios when the data are affected by shorter reference size error such that data during one year before the survey are understated by 20% . This under statement have all been allocated to births occuring between one and two years preceding the survey.

Table (7):The values of P/F ratios up to the end of 2 years before the survey when the data subjected to reference size error, constant fertility.

Age	0-	1-
15-19	1.164	.755
20-	1.250	.840
25-	1.243	.833
30-	1.240	.831
35-	1.239	.829
40-	1.236	.825

It is clear that the P/F ratios in the recent year are all greater than unity and less than that in the earlier year, also

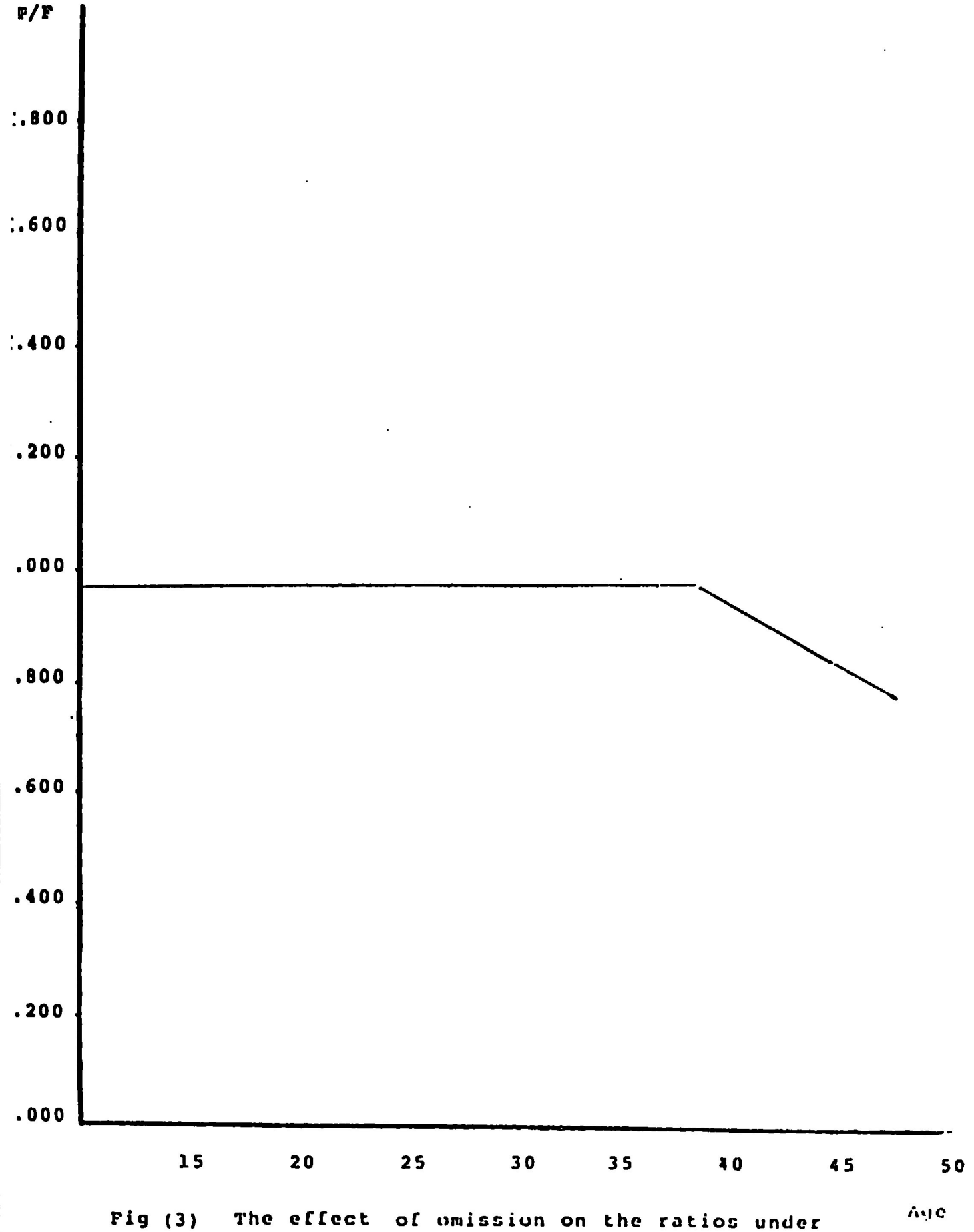

Fig (3) The effect of omission on the ratios under the assumption of constant fertility.

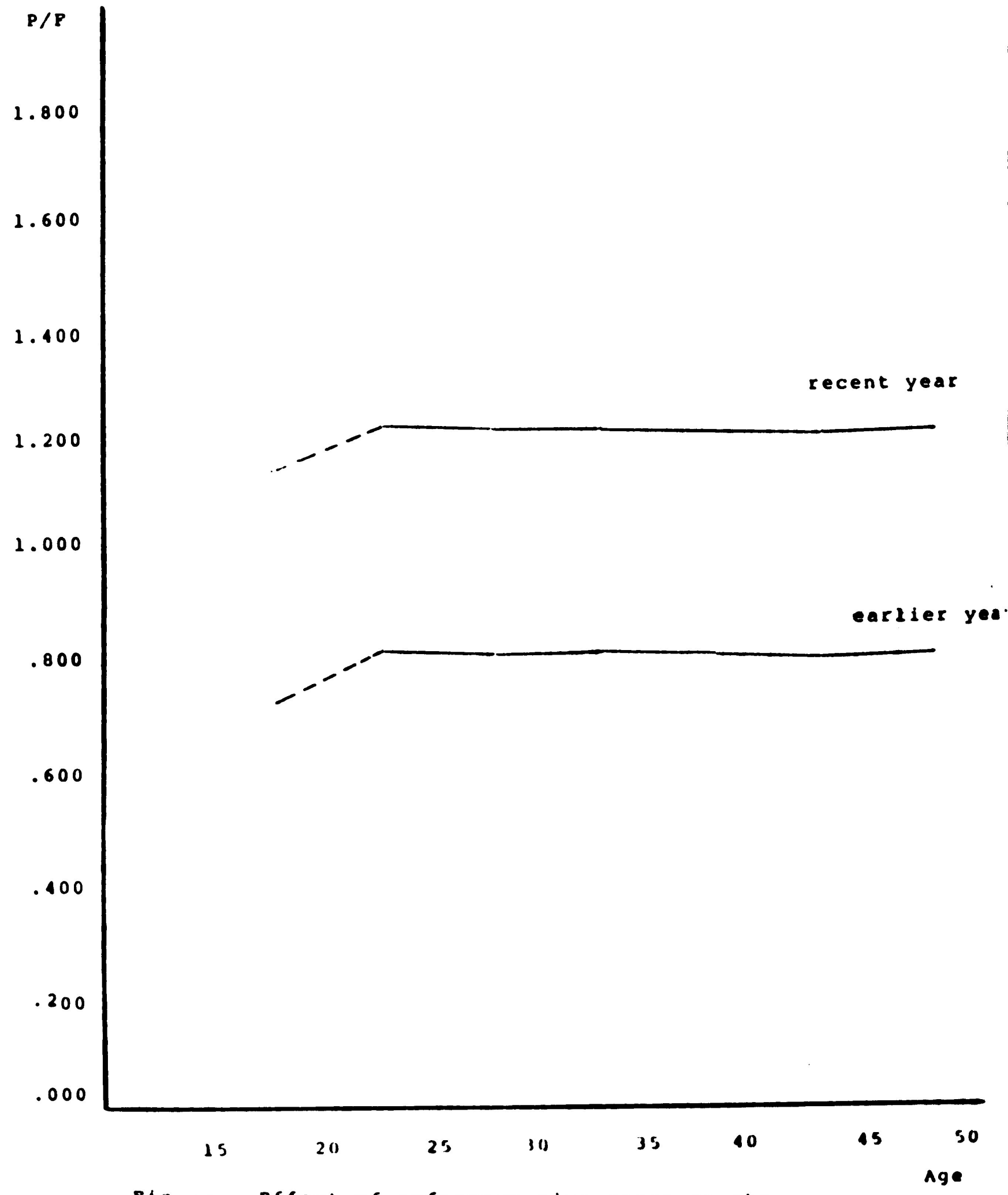

Fig (4) Effect of reference size error on the behaviour of the P/F ratios under the assumption of constant fertility.

the behaviour of the P/F ratio shows no trend specially if the values of P/F corresponding to mothers in the first age group are neglected because of its lower degree of accuracy.

Effect of Omission And Reference Size Error On The P/F Ratios Under The Assumption Of Constant Fertility.

Table (8) The values of P/F ratios when the data are affected by omission and reference size error, constant fertility.

Age	0-	1-
15-19	1.164	.755
20-	1.250	.840
25-	1.243	.833
30-	1.240	.831
35-	1.239	.829
40-	.989	.660
45-49	.869	.578

It is clear that the values of the P/F ratios in the recent year are all greater than unity except the last two age groups, the correspond ing values in the earlier year are all less than unity. Also it is obvious that there is a decreasing trend affecting the data.

5. Effect of Omission On P/F Ratios Under The Assumption of Fertility decline.

Table (9) presents the effect of omission on the behaviour of the P/F ratios under the assumption of fertility decline.

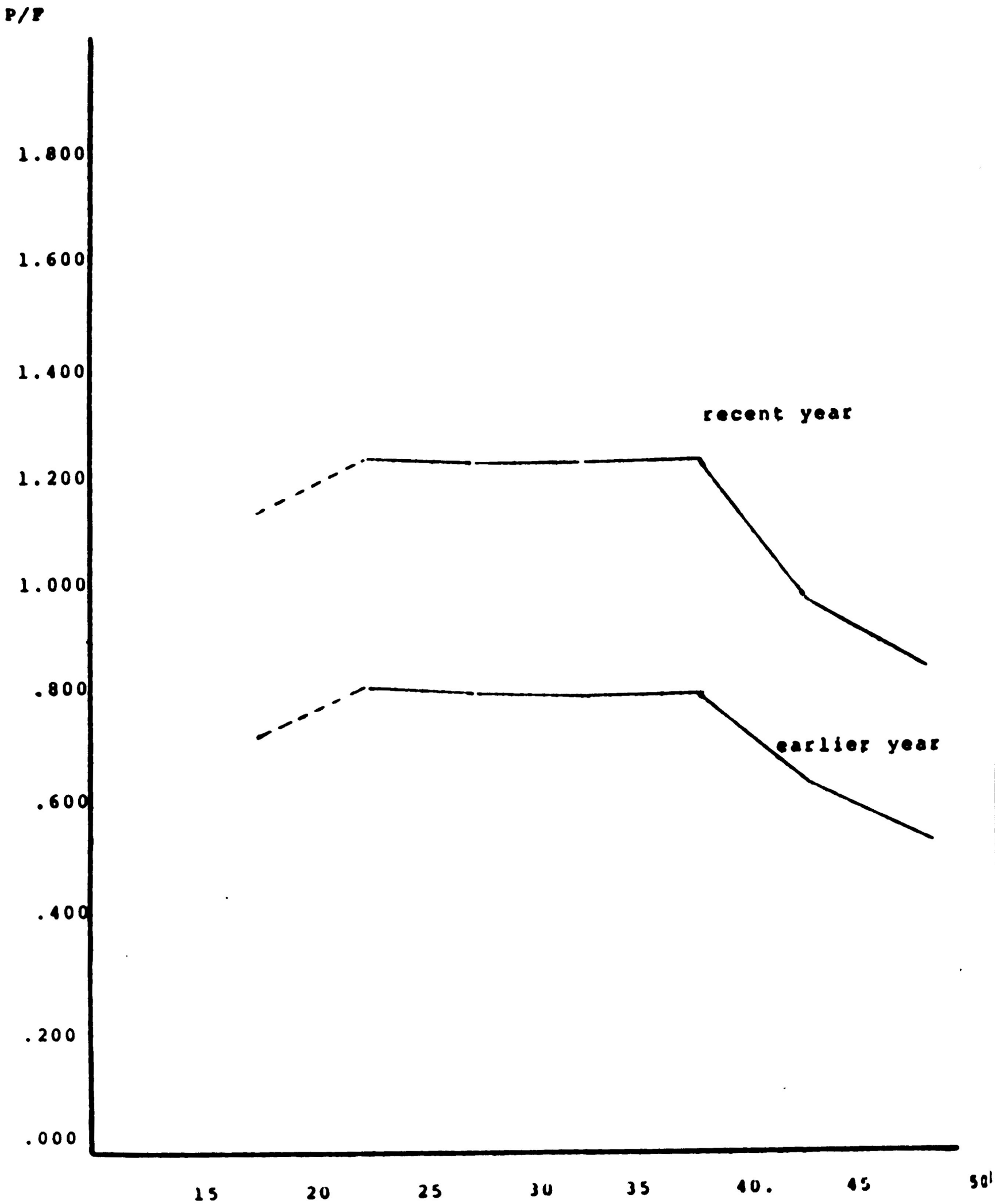

Fig (5) Effect of reference size error and omission on the behaviour of the P/F ratios under the assumption of constant fertility.

Table (9) Applying the P/F ratio method up to the end of 2 years before the survey when the data affected by omission.

Age	0-	1-
15-19	1.095	1.077
20-	.989	.975
25-	1.020	1.021
30-	1.035	1.032
35-	1.069	1.060
40-	.901	.891
45-49	.858	.846

It is clear that the behaviour of the P/F ratio shows an increasing trend affecting both the recent and the earlier years, and this increase suddenly decreases with the last two age groups of mothers.

5. Effect of Reference Size Error On P/F Ratios Under The Assumption Fertility Decline.

Table(10) The values of P/F ratios when the data are affected by reference size error up the end of 2 years before the survey,fertility decline.

Age	0-	1-
15-19	1.353	.947
20-	1.236	.825
25-	1.275	.853
30-	1.295	.861
35-	1.338	.885
40-	1.409	.929
45-49	1.539	1.010

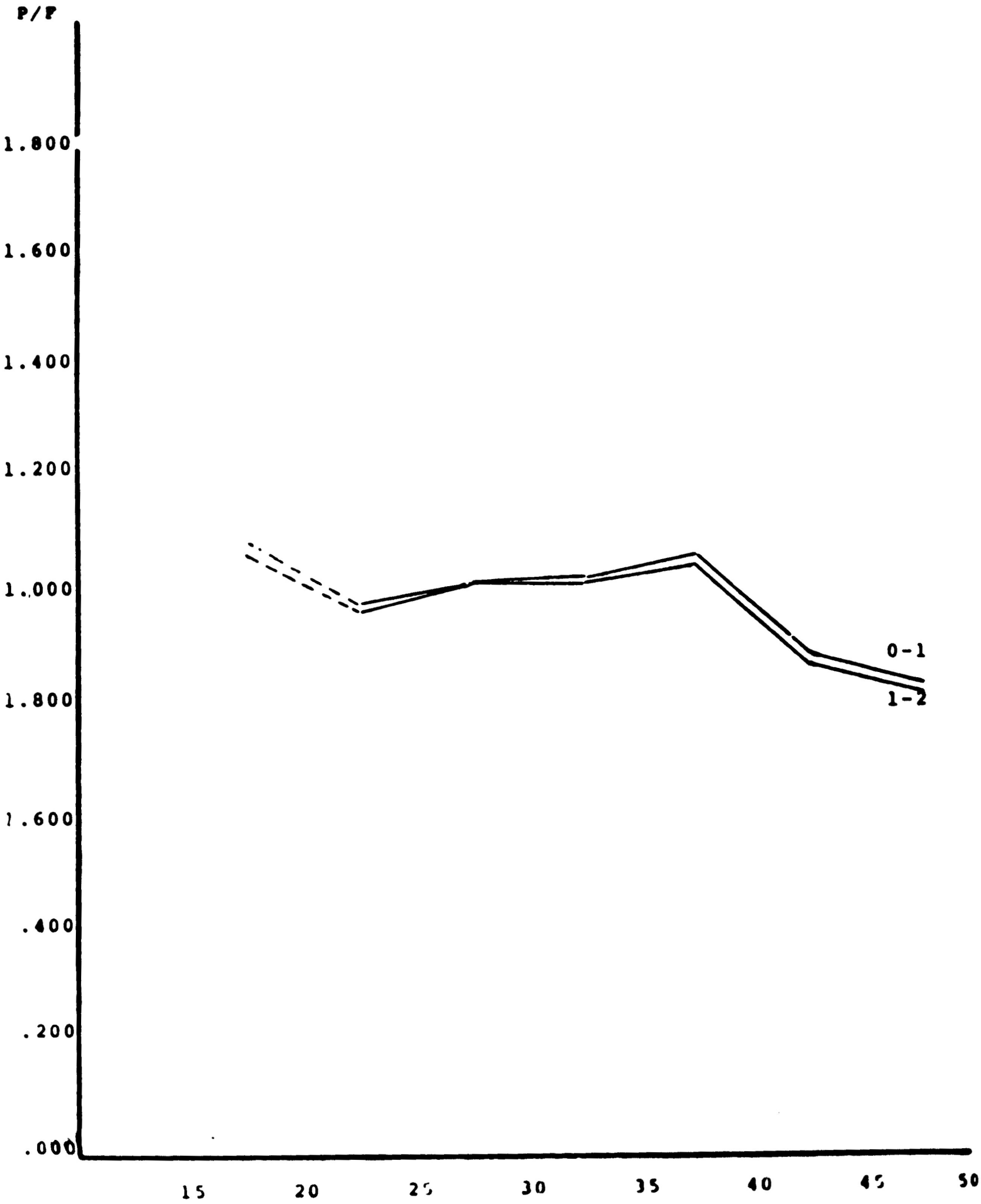

Fig (6) Effect of fertility decline and omission on the P/F ratios

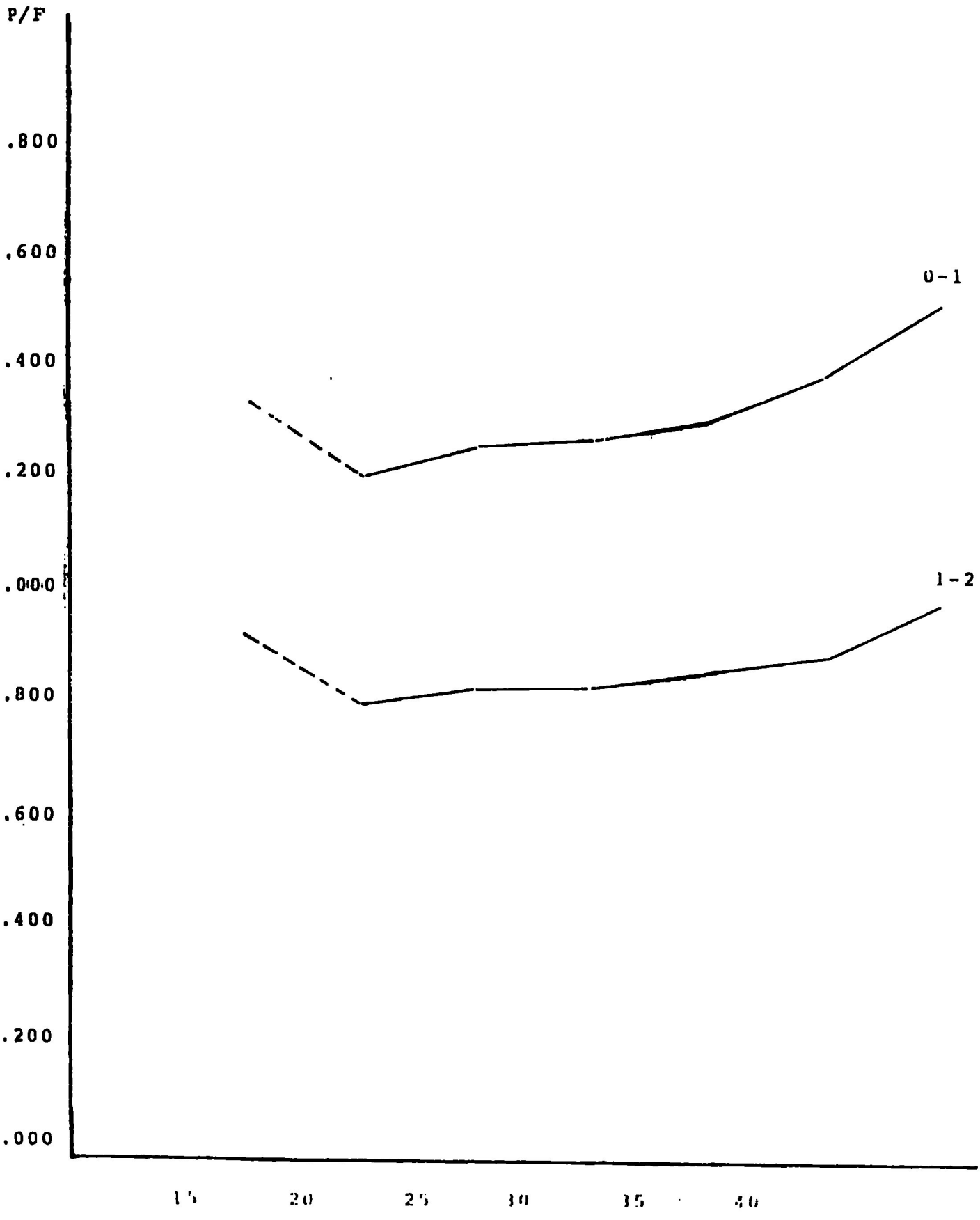

Fig (7) Effect of fertility decline and reference size error on the P/F ratios.

It is shown that the values of the P/F ratios in the recent year are all greater than unity, and less than unity in the earlier year , also one can observe that there is an increasing trend affecting the behaviour of the P/F in both the recent and the earlier year.

7. Effect of Reference Size Error, And Omission On P/F Ratios Under The Assumption Of Fertility Decline.

Table (11) The values of P/F ratios up to the end of 2 years preceding the survey , data are affected by reference error and omission,fertility decline

Age	0-	1-
15-19	1.353	.947
20-	1.236	.825
25-	1.275	.853
30-	1.295	.861
35-	1.338	.885
40-	1.128	.743
45-49	1.073	.706

It is clear that all the values of P/F ratios in the recent year are all > 1 but the increasing trend affecteing the behaviour of the P/F ratios suddenly decreased with the last two age groups.

In the earlier year we find that all the values of P/F are < 1, and the increasing trend is affecting the behaviour of the P/F ratios to decrease suddenly with the last two age groups.

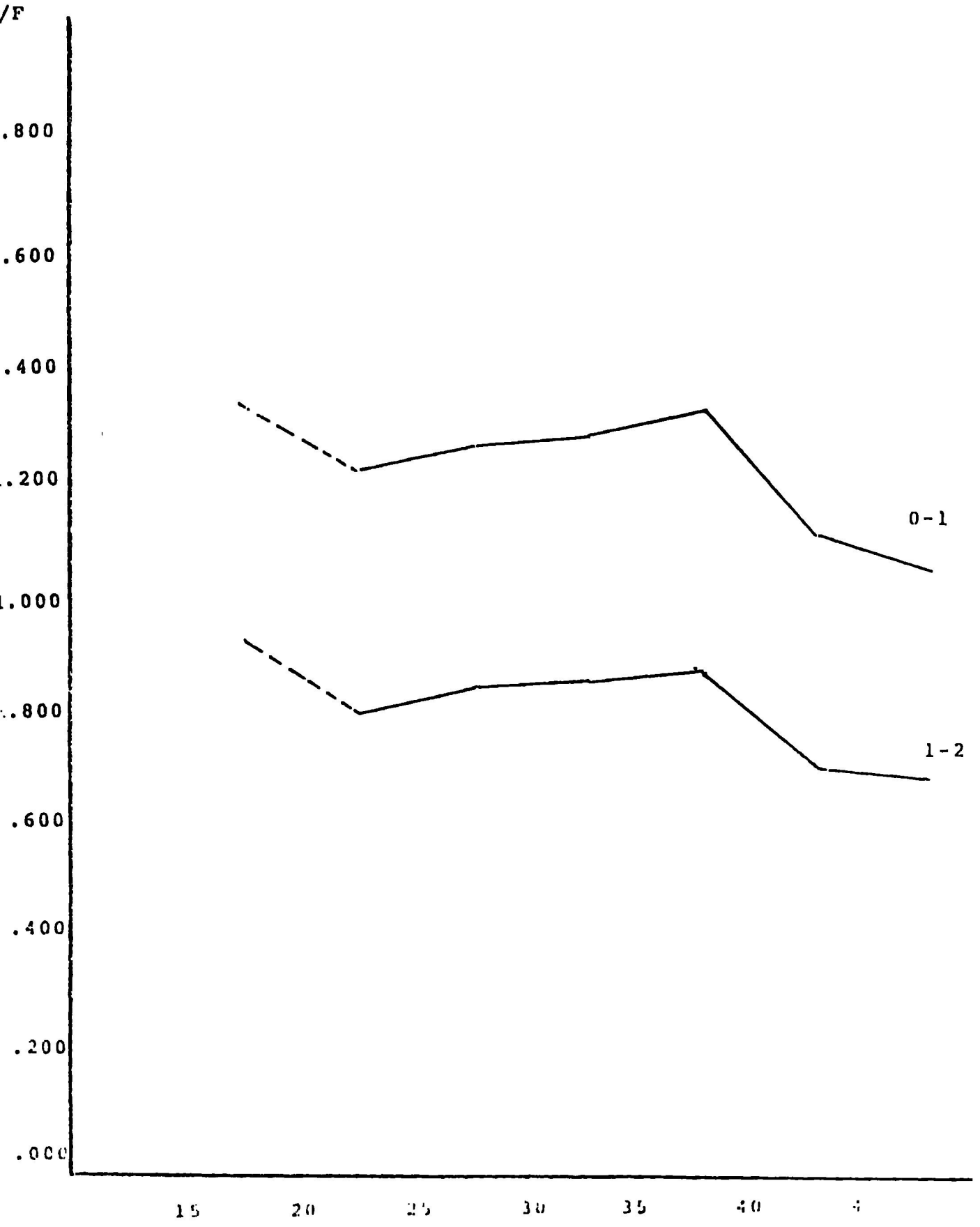

Fig (6) Effect of fertility decline, =reference
size error and omission. on the P/F ratio

E. CONCLUSIONS AND RESULTS

If the values of the P/F ratios in both the recent and earlier years are nearly close to the unity, and the behaviour of the P/F ratio shows no trend, this means that the fertility is constant and there is no error affecting the data, but if the behaviour of the P/F ratio shows an decreasing trend, this means that these data are affected by omission.

- If the values of the P/F ratios in the recent year are > 1, mean while these values in the earlier year are < 1, and the behaviour of the P/F ratio shows no trends, this means that these data are affected by reference size error. But if the behaviour of the P/F ratio shows decreasing trend, this means that these data are affected by both reference size error and omission.
- If the values of the P/F ratio are nearly close to the unity at young ages in both recent and earlier years, and > 1 corresponding to mothers at older ages, and if the behaviour of the P/F ratio shows an increasing trend, this means that these data are affected by fertility decline and this decline began in earlier periods, but if this increasing trend abruptly decreased, this means that these data are affected by both fertility decline and omission.
- If the values of the P/F ratios are > 1 in the recent year and < 1 in the earlier year , and if the behaviour of the P/F ratio shows an increasing trend, this means that these data are affected by fertility decline and reference size error, but if the behaviour of the P/F ratios abruptly decreased this means that these data are affected by fertility decline, reference size error, and omission.

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