

STANDARD ERRORS OF AGE-SPECIFIC FERTILITY RATES

KUMUDINI DANDEKAR

In *Artha Vijnana*, in its issue of September, 1960 an article on graduation of fertility rates was published. In this article a third degree polynomial was fitted to the observed age specific fertility rates for 10 samples of women that were surveyed. Each sample consisted of about a thousand women and the third degree polynomial was found to give a satisfactory fit to the observed fertility rates. The procedure followed to get the fitted polynomials can be described briefly as under :

P_x was taken to be the age specific fertility rate at age x . If m_x out of n_x women at age x had a child during a specific year of enquiry the probability of the observed sample was given by

$$L = \prod_{x=0}^{n_x} C_{m_x}^{n_x} p_x^{m_x} q_x^{n_x - m_x}$$

where $q_x = 1 - p_x$

p_x was then put in the form $a + bx + cx^2 + dx^3$ and the values of the parameters a, b, c, d were obtained by the method of maximum likelihood which gave the following four equations.

$$\begin{aligned} \Sigma \frac{m_x}{P_x q_x} &= a \Sigma \frac{n_x}{P_x q_x} + b \Sigma \frac{n_x}{P_x q_x} x + c \Sigma \frac{n_x}{P_x q_x} x^2 + d \Sigma \frac{n_x}{P_x q_x} x^3 \\ \Sigma \frac{m_x}{P_x q_x} x &= a \Sigma \frac{n_x}{P_x q_x} x + b \Sigma \frac{n_x}{P_x q_x} x^2 + c \Sigma \frac{n_x}{P_x q_x} x^3 + d \Sigma \frac{n_x}{P_x q_x} x^4 \\ \Sigma \frac{m_x}{P_x q_x} x^2 &= a \Sigma \frac{n_x}{P_x q_x} x^2 + b \Sigma \frac{n_x}{P_x q_x} x^3 + c \Sigma \frac{n_x}{P_x q_x} x^4 + d \Sigma \frac{n_x}{P_x q_x} x^5 \\ \Sigma \frac{m_x}{P_x q_x} x^3 &= a \Sigma \frac{n_x}{P_x q_x} x^3 + b \Sigma \frac{n_x}{P_x q_x} x^4 + c \Sigma \frac{n_x}{P_x q_x} x^5 + d \Sigma \frac{n_x}{P_x q_x} x^6 \end{aligned}$$

The equations were solved by the method of successive approximation beginning with the observed values of p_x given by $\frac{m_x}{n_x}$.

The polynomial equations obtained for the 10 samples of women are presented in Table 1. In the present paper the standard errors of age specific fertility rates are obtained for the same samples of women. With the technique of fitting a third degree polynomial of the form $p_y = a + bx + cx^2 + dx^3$, by the above method it was possible to calculate the standard errors of the age specific fertility rates by calculating the variances and