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ON SPECIFICATION OF MARRIAGE CURVES IN INDIA (*)

INTRODUCTION

Nuptiality is one of the important components of fertility and population growth in almost all societies and particularly so in the developing countries of today. Average age at marriage and the rates at which different populations marry are some of the important indices of the age curves of nuptiality. Though nuptiality has long been recognised as an important component of population growth, it is only recently that analytical studies are being conducted on the age patterns of marriage of different populations. Some excellent mathematical investigations on the age structures of nuptiality have been undertaken (Coale, 1971; Coale and Mc Neil, 1972), but majority of the studies are based on indices like the mean or the median ages at marriage, the marriage rates and the nuptiality tables. One of the main obstacles to a rigorous statistical investigation of the age curves of nuptiality, particularly in developing societies, seems to be the lack of necessary data on marriage in these countries. The only information available is the age distribution of population by marital status as recorded in the national censuses at intervals of 10 years. Registration data are either non-existent, or if they exist, they are not reliable. An attempt has been made in this paper to study the age patterns of marriage more thoroughly for Indian males and females by studying the different moments of the age distribution of marriage. The basic data have been taken from the age distribution of population by marital status in the Census of India (1971). Nuptiality curves have been studied for all the States and by rural-urban breakdown. Even admitting that the specification of the nuptiality curves by different moments as calculated from the proportions single has got its limitations, it is believed the method will be reasonably accurate and will give deeper insight into the age structure of nuptiality in India. The methodology has been explained in the following section.

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METHODOLOGY

The following symbols have been used in this paper. It is assumed that marriages are all first marriages. The method is based on an extension of Hajnal's original method of calculation of singulate mean age at marriage from census data on proportions single (Hajnal, 1953).

$S(a)$ = proportion single at exact age a

$S(a, a + 5)$ = proportion single in the 5-year age group $(a, a + 5)$

$dS(a) = S(a + da) - S(a)$

$\mu'_n = n$ -th moment of the age distribution of marriage about origin i.e., about $a = 0$

$\mu_n = n$ -th moment about the mean of the distribution

α and β are the lower and the upper limits of age at marriage

$$\mu'_n = \int_{\alpha}^{\beta} a^n dS(a) / \int_{\alpha}^{\beta} dS(a).$$

In the absence of any knowledge about the form of the age-specific nuptiality curve i.e. $S(a)$, it is not possible to find out an exact expression for μ'_n . As such numerical method has been used for finding out an expression for μ'_n . The limits of age range of marriage have been set as 10 and 50 for both sexes ($\alpha = 10$, $\beta = 50$).

The numerator of μ'_n can be approximated as:

$$\begin{aligned} \int_{10}^{50} a^n dS(a) &= [a^n S(a)]_{10}^{50} - \int_{10}^{50} na^{n-1} S(a) da = \\ &= [50^n S(50) - 10^n] - \sum_{x=2}^9 \left[\int_{5x}^{5x+5} na^{n-1} S(a) da \right] = \quad (\because S(10) = 1) \\ &= [50^n S(50) - 10^n] - \sum_{x=2}^9 [S(5x, 5x + 5) \int_{5x}^{5x+5} na^{n-1} da] = \\ &\quad \text{(applying Mean Value Theorem of Integral Calculus)} \\ &= [50^n S(50) - 10^n] - \sum_{x=2}^9 [(5x + 5)^n - (5x)^n] [S(5x, 5x + 5)] \end{aligned}$$

Thus, finally we arrive at

$$\mu'_n = \frac{[10^n - 50^n S(50)] + \sum_{x=2}^9 [(5x+5)^n - (5x)^n] [S(5x, 5x+5)]}{1 - S(50)}$$

$S(50)$ has been approximated as: $S(50) = \frac{S(45, 50) + S(50, 55)}{2}$

RESULTS

Below are presented tables showing the mean, the standard deviation and the standardised measures of skewness and kurtosis for the age specific nuptiality curves in India. For ready reference see Kendall and Stuart (1961).

As a very brief introduction it may be mentioned that the mean of the distribution is the 'Singulate Mean Age at Marriage' as is extensively used in the demographic literature and is due to John Hajnal (1953). The standard deviation gives an idea about the variability of the age specific marriage curves. A simple measure of skewness is γ_1 . This is not bounded either to the left or to the right and can theoretically vary between $-\infty$ to $+\infty$. The skewness shows the extent to which the distribution is centered around the mean, negative numbers imply that the distributions are skewed to the left and positive numbers imply that they are skewed to the right. β_2 has been taken as a measure of kurtosis. Theoretically it can vary between 1 and ∞ . The normal distribution is taken as a standard against which any distribution can be compared as regards its kurtosis. Any distribution with $\beta_2 = 3$ has the same peakedness as that of a normal distribution while it may be considered to be less or more peaked than the normal distribution according as β_2 is less than or greater than 3. Though as statistical tools they are all elementary and standard routine measures, the author is not aware of any detailed study in the field of demography, particularly in the field of nuptiality, where the latter three measures, namely the standard deviation, the skewness and the kurtosis, have been used for describing the age specific nuptiality curve of a population. To that extent, it is believed, the presentation of the tables showing the four moments of the distribution and a detailed discussion on the patterns of the nuptiality curves as depicted by these moments, will be rewarding. Looking at the moments of the age distribution of marriage (rural-urban combined) it is observed that there is substantial variation in the moments of different orders over the States for both males and females. While the first moment, viz., the mean age at marriage, ranges from 19.3 to 27.5 years for males and from 15.0 to 23.8 years for females, the standard deviation is observed to vary from 4.6 to 7.1 years for males and from 3.7 to 6.1 years for females. The mean and the variability for the male marriage curves are both higher than the corresponding statistics for the female marriage curves for almost all the States in India. Further the States showing relatively larger values for means and standard deviations for the male marriage

TABLE 1

Moments of the age distribution of marriage in India: 1971 census synthetic cohort

COMBINED

States	Male			Female				
	Mean	S.D.	Skewness (γ_1)	Kurtosis (β_2)	Mean	S.D.	Skewness (γ_1)	Kurtosis (β_2)
Andhra Pradesh	22.74	5.03	.58	5.11	16.23	3.86	1.13	8.42
Assam	25.66	5.56	.79	4.37	18.69	4.25	1.64	9.11
Bihar	19.87	5.69	.76	4.49	15.30	3.89	.96	6.09
Gujarat	22.23	5.18	.73	5.04	18.44	3.90	.89	7.29
Haryana	20.52	5.24	.69	4.81	16.64	3.96	.51	4.51
Himachal Pradesh	23.09	5.34	.77	5.51	17.78	3.84	.66	4.38
Jammu and Kashmir	23.62	5.93	.84	4.68	17.76	3.87	.85	6.26
Kerala	26.78	5.15	.83	4.31	21.04	4.74	1.26	7.03
Madhya Pradesh	19.27	5.90	.75	4.53	15.01	4.03	1.30	8.89
Maharashtra	23.61	5.21	.61	4.87	17.55	4.27	1.12	7.07
Manipur	26.24	5.67	.65	3.99	22.42	6.06	.91	4.22
Meghalaya	25.33	5.97	.86	4.57	20.07	5.04	1.14	5.90
Mysore	25.09	5.22	.56	4.98	17.82	4.32	.99	6.47
Nagaland	27.53	6.27	.64	3.63	23.77	6.13	1.08	4.70
Orissa	22.66	4.65	.72	5.28	17.32	3.69	1.43	9.42
Punjab	23.34	4.79	.56	3.93	20.06	3.84	.60	5.76
Rajasthan	19.51	5.68	.42	3.53	15.09	3.86	.60	4.34
Sikkim	25.50	7.10	.55	3.53	21.79	6.14	1.29	5.60
Tamil Nadu	25.98	4.89	.95	5.34	19.38	3.75	.88	6.22
Tripura	25.19	5.23	.51	3.90	18.35	4.33	1.05	5.98
Uttar Pradesh	19.34	6.19	.79	4.35	15.44	4.03	.98	6.68
West Bengal	24.49	5.94	.63	4.35	17.98	4.81	1.50	7.08
India	22.39	6.02	.36	3.80	17.18	4.48	.94	6.27

(Table 1 contd)

Table 1 (continued)

RURAL

States	Male			Female				
	Mean	S.D.	Skewness (γ_1)	Kurtosis (β_2)	Mean	S.D.	Skewness (γ_1)	Kurtosis (β_2)
Andhra Pradesh	22.28	5.00	.59	5.10	15.79	3.60	1.01	8.46
Assam	25.45	5.47	.85	4.56	18.58	4.22	1.78	9.64
Bihar	19.50	5.61	.84	4.74	15.10	3.82	1.02	6.57
Gujarat	21.46	5.14	.94	5.86	17.91	3.65	.73	7.41
Haryana	19.78	5.02	.85	5.57	16.02	3.55	.84	8.89
Himachal Pradesh	22.86	5.30	.75	5.27	17.48	3.72	.66	4.57
Jammu and Kashmir	23.11	5.98	.94	4.89	17.14	3.62	.94	7.07
Kerala	26.54	5.10	.85	4.37	20.96	4.73	1.32	7.41
Madhya Pradesh	18.40	5.69	.99	5.50	14.46	3.74	1.49	11.30
Maharashtra	22.47	4.86	.76	5.98	16.57	3.69	1.08	8.08
Madipur	26.19	5.65	.67	4.05	22.46	6.34	.78	4.02
Meghalaya	24.74	5.78	.98	5.25	19.77	4.97	1.23	6.23
Mysore	24.53	5.21	.62	5.16	17.26	4.00	.92	6.76
Nagaland	28.32	6.02	.64	3.82	24.19	6.08	1.05	4.61
Orissa	22.42	4.62	.78	5.32	17.24	3.66	1.41	9.25
Punjab	22.93	4.85	.86	5.12	19.84	3.76	.58	5.78
Rajasthan	19.00	5.68	.51	3.49	14.72	3.64	.51	3.98
Sikkim	25.83	7.30	.45	3.05	21.98	6.22	1.22	5.27
Tamil Nadu	25.64	4.90	1.00	5.43	19.32	3.55	.75	6.08
Tripura	24.75	5.11	.54	4.01	17.95	4.10	1.03	5.94
Uttar Pradesh	18.61	6.02	.95	4.88	14.89	3.79	1.06	8.19
West Bengal	23.60	5.69	.72	4.77	17.22	4.51	1.87	9.31
India	21.64	5.95	.44	3.88	16.63	4.28	.98	6.77

(Table 1 contd)

Table 1 (continued)

States	Male			Female				
	Mean	S.D.	Skewness (γ_1)	Kurtosis (β_2)	Mean	S.D.	Skewness (γ_1)	Kurtosis (β_2)
Andhra Pradesh	24.28	4.83	.79	5.60	17.78	4.28	1.34	8.26
Assam	27.10	5.99	.38	3.57	19.93	4.89	.97	5.76
Bihar	22.42	5.41	.45	3.96	17.07	4.16	.91	6.15
Gujarat	23.80	4.92	.60	4.61	19.66	4.14	1.08	7.05
Haryana	23.31	5.06	.49	4.74	19.22	4.47	.83	5.13
Himachal Pradesh	24.68	4.64	.45	4.37	20.20	4.33	.71	4.49
Jammu and Kashmir	25.51	5.55	.87	5.01	19.98	4.06	.78	6.50
Kerala	27.84	5.23	.78	4.26	21.40	4.76	.96	5.44
Madhya Pradesh	22.73	5.36	.38	4.08	17.50	4.27	.88	6.18
Maharashtra	25.17	5.24	.52	4.12	19.46	5.59	1.08	6.53
Manipur	26.84	6.27	.72	3.55	21.65	5.00	.98	5.48
Meghalaya	27.81	6.40	.47	3.11	21.54	5.25	.81	5.01
Mysore	26.43	5.04	.55	4.80	19.33	4.72	1.05	6.04
Nagaland	24.96	6.53	.70	3.57	19.51	4.92	1.96	10.90
Orissa	24.48	4.39	.50	4.29	18.08	3.81	1.53	10.26
Punjab	24.47	4.86	.59	4.83	20.72	3.92	.52	4.82
Rajasthan	21.36	5.14	.21	3.96	16.68	4.28	.74	5.20
Sikkim	23.76	5.37	.45	3.56	20.05	5.64	2.51	12.59
Tamil Nadu	26.65	4.82	.88	5.26	20.09	4.14	1.12	6.80
Tripura	28.40	5.27	.20	2.69	21.06	4.92	.84	5.22
Uttar Pradesh	22.89	5.74	.72	4.63	18.36	4.45	.92	6.04
West Bengal	26.48	6.01	.56	4.02	20.20	4.96	1.00	5.92
India	24.73	5.56	.48	4.25	19.15	4.58	.90	5.93

URBAN

curves exhibit, in general, larger values for these statistics for the female curves as well. This is corroborated by strong positive correlations between the male and the female statistics ($r = .87$ for mean and $.64$ for S.D.). The relationship is not, however, established when marriage curves for the two sexes are studied separately for rural and urban. This is of course what is expected because the age specific marriage curve for an urban population cannot be taken as a true reflection of the marriage propensity of the same population because of strong age-sex-marriage selective migration and the disturbed age structure of the urban population.

Coming to the other two moments, namely the skewness (γ_1) and the kurtosis (β_2), it can be noted that the marriage curves are skew to the right for both sexes for all the States in both rural and urban areas. This is indicated by a large positive value for the coefficient γ_1 . Moreover the skewness is substantially higher for females compared to males for all the States. The implication is that the marriage process starts at a very early age for both males and females (around age 10 for females and 15 for males) and continues at a greater pace leading to smaller value for the mean of the distribution. The longer tail of the distribution continues till around age 45 or 50 and marriage occurs at a much more slower rate after the mean of the distribution is reached. For females, "the tempo of marriage" (borrowing a term from A.J. Coale as used in his classic work on model nuptiality curves) is substantially higher compared to males, so that the mean of the distribution is attained much earlier in females. As the marriage process continues gradually at a lower pace till around age 45 or 50, a higher positive value for the skewness of the female marriage curve compared to males is attained. As for peakedness (β_2) of the distribution, it is quite clear that the marriage curves are always leptokurtic or sharply peaked compared to the Gaussian distribution. This again demonstrates that though the age range of marriage is theoretically taken as 10 to 50 years for both sexes, marriages are highly concentrated near-about the central value of the distribution making the curves sharply peaked. Further, the larger value for this statistic for females clearly demonstrates that concentration of marriage around the mean of the distribution is much higher for females compared to males. The correlations between the male and the female coefficients are, however, found to be insignificant with both skewness ($r = .15$) and kurtosis ($r = .27$).

Some interesting patterns in the age specific nuptiality curves of the States also emerge from the above analysis. It can be noted that while the States in the predominantly Hindi speaking belt — Bihar, Uttar Pradesh, Rajasthan and Madhya Pradesh occupy the lowest position bearing a very early marriage pattern, Kerala, Manipur, Meghalaya and Assam occupy a very high position bearing a relatively late marriage pattern for both sexes. Further, the States showing similar values as regards mean age at marriage have more or less the same standard deviations. With skewness and kurtosis, however no clear pattern is discernible. The pattern observed with the 1971 census synthetic cohort more or less follows that of the 1961 cohort (Malaker, 1978).

Regarding rural-urban differentials, for females the mean and the standard

deviation of age at marriage for the urban population are higher than the corresponding figures for the rural population. For males though the mean age at marriage for the urban population is higher than the mean age at marriage for their rural counterparts, no pattern is observed with the standard deviation.

CONCLUSION

The results of the above analysis can be briefly summarised as follows:

1. The mean and the standard deviation of age at marriage for males are respectively higher than the mean and the standard deviation of age at marriage for females for almost all the States.
2. The marriage curves are all positively skewed, the skewness for the female curves being substantially higher than the skewness for the male curves.
3. The marriage curves are highly leptokurtic, female curves being much more sharply peaked compared to male curves in almost all the States in India.
4. The mean and the standard deviation of age at marriage for males are highly correlated with the corresponding figures for females.
5. State-wise differentials are observed with respect to mean and standard deviation. With skewness and kurtosis, however, no such differential is established.

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SUMMARY

This paper attempts to specify the nature of the marriage curves in India by calculating the moments of the age distribution of marriage. The basic data used in this analysis are the age-sex specific proportions single in the census of India, 1971.

There are sharp regional variations in nuptiality. Marriage curves for both males and females are positively skewed, the skewness being substantially higher for females. Further, the curves are sharply peaked, more so in females than in males.

RIASSUNTO

In questo articolo l'A. si propone di precisare la natura delle curve di matrimonio in India attraverso il calcolo dei momenti delle distribuzioni dei matrimoni secondo l'età degli sposi. Sono stati utilizzati come dati di base in questa analisi le proporzioni di celibi e nubili per classi di età al censimento indiano del 1971.

Si osserva una netta variabilità regionale della nuzialità. Le curve di matrimonio, sia per gli uomini che per le donne, presentano una asimmetria positiva, assai più marcata per le donne. Inoltre, le curve presentano dei picchi, più netti per le donne che per gli uomini.

RESUME

Dans cet article l'A. essaie de spécifier la nature des courbes de nuptialité en Inde en calculant les moments de la distribution des mariages selon l'âge des époux. Les données de base de cette analyse sont constituées par les proportions des célibataires selon l'âge et le sexe d'après le recensement indien de 1971.

La nuptialité donne lieu à une dispersion régionale très nette. Les courbes présentent une asymétrie positive aussi bien pour les hommes que pour les femmes et l'asymétrie est beaucoup plus élevée chez les femmes. En outre, les courbes présentent un sommet très évident, surtout celles des femmes.