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Research Article

FORECASTING FEMALE NUPTIALITY OF RURAL POPULATION OF UTTAR PRADESH, INDIA: A TIME-SERIES APPROACH

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ABSTRACT

Nuptiality has a strong association with socio demographic and economical change in society. So, it has immense importance to study the female age at marriage in society. In rural India, mostly marriages take place at early ages. In this study, we forecast mean age at marriage for the period 2001 to 2020 based on the observed data 1931-2000. After checking the stationary of the data, it is found that ARIMA (1, 1, 1) best fitted to our data. It is observed that as time increases, mean age at marriage is also increasing. Same evidence is supported by the corresponding figure.

INTRODUCTION

A complicated individual phenomenon like marriage, with very strong familiar and social interlocks can be studied from different angles and at different levels. Numerous studies have found that the process of union formation happens in a systematic way. The pattern of marriage is undergoing some discernible changes throughout the world. It has played a major role in determining the growth rate of population through its linkage to marital fertility.

Historically changes in the Nuptiality pattern has played very significant role with respect to demographic transitions in many of the European countries (1). The experience of several less developed countries where population growth rate has recently slowed down also demonstrates this aspect (2,3).

The changes increases in respect of marriage age and age at consummation of the marriage and the resultant reduction in proportion of women remaining in married state are directly linked to fertility and thus determine the future trend of demographic transition. In India, major shifts have been observed in the age at marriage (4).

The analysis of experimental data that have been observed at different point in time leads to new and unique problems in statistical modeling and inference. The obvious correlation introduced by the sampling of adjacent points in time can severely restrict the applicability of the many conventional statistical methods traditionally dependent on the assumption that these adjacent observations are independent and identically distributed (4). The systematic approach by which one goes about answering the mathematical and statistical questions posed by these time correlations is commonly referred to as time series analysis.

In our view, the first step in any time series investigation always involves careful scrutiny of the recorded data plotted over time. This scrutiny often suggests the method of analysis as well as statistics that will be of use in summarizing the information in the data. Before looking more closely at the particular statistical methods, it is appropriate to mention that two separate, but not necessarily mutually exclusive, approaches to time series analysis exist, commonly identified as the time domain approach and the frequency domain approach.(5)

DATA AND METHODOLOGY

Study area: The study is conducted in the area of Rural Health Training Centre (RHTC), Department of Community Medicine, Rama University, Kanpur.

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Study participants: Study subjects are local residents of selected the village from RHTC area in Kanpur.

Inclusion criteria for subjects: Women, who were ever married and born in between 1931 to 2001, be included in the study. Since, time series should be continuous so discard observation belongs to year 1931:1946 and hence considers only data from 1947 and so on.

Exclusion criteria for subjects: The following category of women be excluded from study-

- Who are unmarried?
- Born before 1947 and after 2001.
- Who are unable to give their history because of mental illness, physical disability?
- Who were not signing the informed consent?

Ethical approval

The study has been approved by the Ethics Committees of Rama University, Kanpur. Informed consent in the local language will be taken from subjects during filling designed questionnaire, in written.

Questionnaire and tools for measurement

Subjects be interviewed with the help of pre-designed and pre tested schedule to elicit the information pertaining to socio-demographic characteristics such as religion, caste, type and size of family, educational level, age at consummation of the marriage, age at first pregnancy etc.

Sampling technique, Data Collection & Analysis method

A cross sectional study design is adopted for this study in a community area. In the first stage 30 clusters will be selected from 25 villages of Kanpur District, where cluster defines a village whose population is more than 2500. In each cluster we divide all eligible population into seven birth cohort and in each cohort we do complete enumeration by conducting house to house survey using designed questionnaire. The birth cohorts will be taken from 1930 to 2000 with decade difference. Data is analyzed by using $R_{3.1.1}$ package & SPSS 21.0 Version software. Following method is used for forecasting the nuptiality:

Time Series Analysis of Nuptiality Data

ARIMA stands for auto-regressive integrated moving average and is specified by these three order parameters: *(p, d, q)*. The process of fitting an ARIMA model is sometimes referred to as the Box-Jenkins method.(6)

An auto regressive (AR(p)) component is referring to the use of past values in the regression equation for the series *Y*. The auto-regressive parameter *p* specifies the number of lags used in the model. For example, AR(2) or, equivalently, ARIMA(2,0,0), is represented as

$$Y_t = c + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \epsilon_t$$

where φ_1, φ_2 are parameters for the model.

The *d* represents the degree of differencing in the integrated **(*I(d)*)** component. Differencing a series involves simply subtracting its current and previous values *d* times. Often, differencing is used to stabilize the series when the stationarity assumption is not met, which we will discuss below.(7)

A moving average (MA(q)) component represents the error of the model as a combination of previous error terms e_t. The order *q* determines the number of terms to include in the model ARIMA models can be also specified through a seasonal structure. In this case, the model is specified by two sets of order parameters: *(p, d, q)* as described above and (P,D,Q_m) parameters describing the seasonal component of *m* periods.(8)

Modelling procedure

When fitting an ARIMA model to a set of time series data, the following procedure provides a useful general approach.(9,10)

1. Plot the data. Identify any unusual observations.
2. If necessary, transform the data (using a Box-Cox transformation) to stabilize the variance.
3. If the data are non-stationary: take first differences of the data until the data are stationary.
4. Examine the ACF/PACF: Is an AR(*p*) or MA(*q*) model appropriate?
5. Try your chosen model(s), and use the AICc to search for a better model.
6. Check the residuals from your chosen model by plotting the ACF of the residuals, and doing a portmanteau test of the residuals. If they do not look like white noise, try a modified model.
7. Once the residuals look like white noise, calculate forecasts.

The automated algorithm only takes care of steps 3–5. So even if you use it, you will still need to take care of the other steps yourself.

The process is summarized in the following Figure:

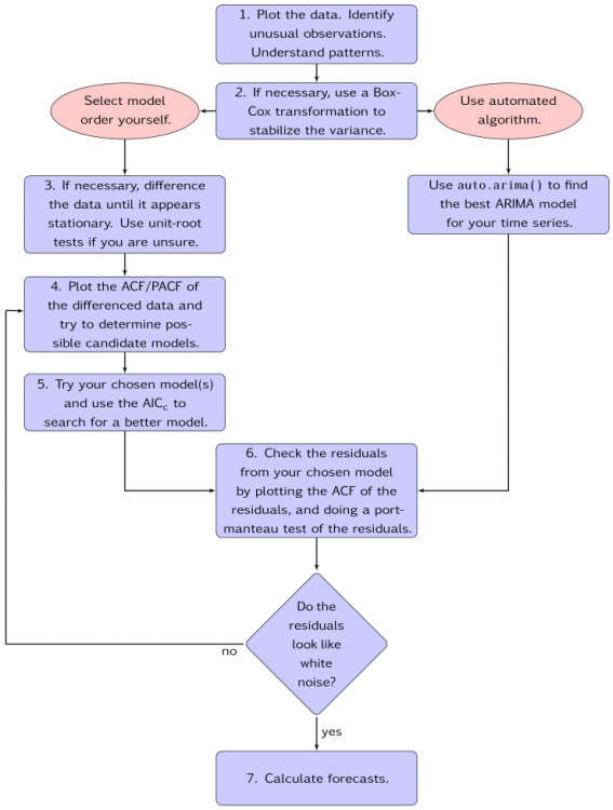


Table 1 Mean Age at Marriage for 1931-2000

Year	Mean Age at Marriage	Year	Mean Age at Marriage	Year	Mean Age at Marriage	Year	Mean Age at Marriage	Year	Mean Age at Marriage
1938	14.00	1957	15.03	1969	16.54	1981	18.07	1993	18.76
1944	14.00	1958	14.83	1970	15.91	1982	17.86	1994	18.42
1947	14.50	1959	15.16	1971	16.47	1983	17.70	1995	17.52
1948	12.00	1960	15.60	1972	16.10	1984	15.60	1996	19.31
1949	13.00	1961	15.47	1973	16.88	1985	16.75	1997	18.71
1950	12.00	1962	15.89	1974	16.60	1986	16.50	1998	18.50
1951	14.75	1963	16.52	1975	17.29	1988	17.86	1999	18.10
1952	14.21	1964	16.67	1976	16.63	1987	17.95	2000	19.23
1953	15.90	1965	16.58	1977	17.13	1989	18.95		
1954	15.50	1966	15.75	1978	16.93	1990	18.14		
1955	17.83	1967	15.20	1979	16.97	1991	17.24		
1956	16.46	1968	16.56	1980	17.43	1992	19.02		

RESULT AND DISCUSSION

To analyze our data first of all, we convert the raw data in the form of the Table 1. Since, time series data should be continuous with respect to all year, so while fitting an model we take the data from 1947 to 2000 and discard the information for the years 1937, 1944. After converting the data in the form of the table 1, we check stationarity of the data. We use R 3.4.0 software to fit a time series model to our data.

ARIMA(1,1,1)

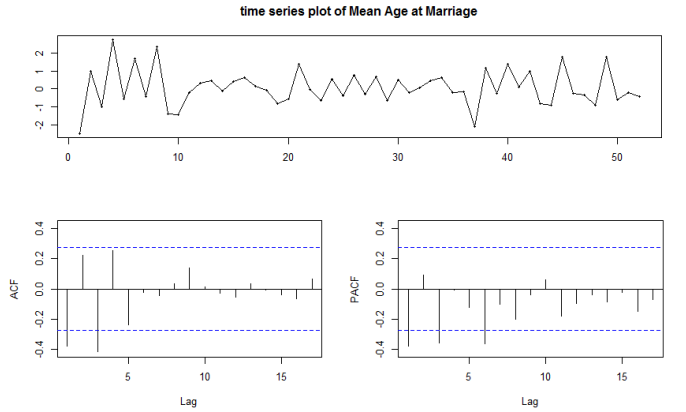
$$\Delta y_t = -0.86\Delta y_{t-1} + u_t - 0.61u_{t-1}$$

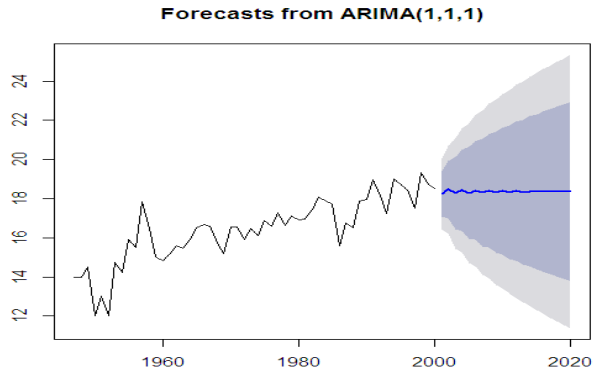
where,

$u_t \sim N(0, 0.6416)$ i.e. the error term is normally distributed with mean 0 and variance 0.6416.

Summary Table for Forecast value of Mean Age at Marriage for the years 2001 to 2010

Year	Forecast (Mean Age at Marriage)	Lower Limit (80%)	Upper Limit (80%)	Lower Limit (95%)	Upper Limit (95%)
2001	18.23195	17.05647	19.40744	16.43421	20.0297
2002	18.46176	16.99623	19.92729	16.22043	20.70309
2003	18.26474	16.41254	20.11694	15.43204	21.09744
2004	18.43365	16.36912	20.49818	15.27622	21.59108
2005	18.28884	15.949	20.62868	14.71036	21.86731
2006	18.41299	15.89179	20.93419	14.55715	22.26883
2007	18.30655	15.56455	21.04855	14.11302	22.50008
2008	18.3978	15.49301	21.3026	13.9553	22.84031
2009	18.31957	15.22707	21.41207	13.59	23.04914
2010	18.38664	15.14458	21.62871	13.42833	23.34496
2011	18.32914	14.92174	21.73654	13.11797	23.5403
2012	18.37844	14.83178	21.9251	12.95429	23.80258
2013	18.33617	14.64037	22.03197	12.68393	23.98841
2014	18.37241	14.5458	22.19902	12.52011	24.2247
2015	18.34134	14.37787	22.30481	12.27973	24.40295
2016	18.36798	14.28085	22.45511	12.11725	24.6187
2017	18.34514	14.13081	22.55947	11.89988	24.7904
2018	18.36472	14.03291	22.69653	11.73978	24.98965
2019	18.34794	13.89675	22.79912	11.54043	25.15544
2020	18.36232	13.79906	22.92559	11.38342	25.34123





CONCLUSION

The study of Nuptiality in any population is of immense importance due to its strong association with social, economic and demographic change in the population. In this paper Indian Nuptiality Patterns are captured through ARIMA model. This is the most popular model to forecast the trend. The age at entry into marriages is still quite low in Uttar Pradesh initially. Though the female age at marriage in UP has been rising slowly. As per result obtained by forecasting marriage age will reach around 25 in 2020.

References

1. Van de Wale(1972) Effects of late marriage Read from URL: www.womanpla.com
2. Das Gupta S *et al*. (2008) Knot ready: lessons from programs and policies to delay marriage for girls in India, paper presented at International Seminar on Changing Transitions to Marriage: Gender Implications for the Next Generation in Developing Countries, New Delhi, Sept. 10(6).
3. Das, N P and Devamoni Dey (1998). Female Age at Marriage in India: Trends and Determinants. Demography India, 27(6):91-115.
4. Pandey Ajay; Pandey Arvind: Analyzing Female Nuptiality Pattern at Micro Level: A Case of Uttar Pradesh. IASSI Quarterly. 1997. 16 (3&4).
5. Singh S & Samara R (1996) Early Marriage among women in developing countries. International Family perspectives 22(8-9): 148-157, 175.
6. Ruslana Dalinina. Introduction to Forecasting with ARIMA in R https://www.datascience.com/blog/introduction-to-forecasting-with-arima-in-r-learn-data-science-tutorials

7. Identifying the order of differencing in an ARIMA model. https://people.duke.edu/~rnau/411arim2.htm.
8. Summary of rules for identifying ARIMA models. https://people.duke.edu/~rnau/arimrule.htm.
9. ARIMA modelling in R. https://www.otexts.org/fpp/8/7
10. Coale, A (1971) Age patterns of marriage. Population Studies 25(11,16):193-214

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