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K. S. James*

The Historical Nature of Demographic Transition in Kerala: Estimates of Vital Rates Using Parish Records

Introduction

IT IS evident from several studies that demographic transition in Kerala is more historical than contemporary phenomenon. Fertility decline in Kerala had taken place even before the intensification of family planning programme (Nair, 1974). The onset of mortality decline in the state is even traced back to the beginning of the present century and attributed to adequate provision of health services, favourable climatological conditions and scattered pattern of settlement arresting the spread of epidemics (Panikar and Soman, 1984; Bhat and Rajan, 1990). However, these facts have not been examined empirically. Most of the studies on Kerala's demographic transition are based on recent data sets, which by their very nature do not give a proper insight into the exact point of the onset and historical nature of transition. Hence, to pinpoint the timing of the onset of demographic transition, it is necessary to concentrate to the transition process of Kerala in a historical perspective.

In this respect, Parish registers which were kept for religious purpose in the parishes of Christian community become a good source of information to understand the past population dynamics. Parish records provide us with annual series of data on baptisms, burials and marriages which are considered to be the same as births, deaths and marriages. Kerala has, indeed a substantial portion of the population as Christian (nearly 20 per cent), which gives enough confidence to utilize these records for an understanding of the past population dynamics. Though historical investigation through parish records

*Associate Fellow, Centre for Economic and Social Studies, Tvizamiah Observatory Campus, Begum Peth, Hyderabad- 500016.

has been prominent in Western European countries, it has been rare in Kerala's case.[1] However, for a better understanding of demographic transition process, the European countries extensively utilized the parish records. These studies have provided useful insights into the demographic and economic history of this region (Hajinal, 1965; Wrigley and Schofield, 1981).

One of the serious handicaps of parish records is the absence of information on the population at risk. The available information from the parishes includes the number of births, deaths by age and marriages. Hence, transformation of these vital events into vital rates becomes an important task. As there are no direct ways of converting vital events into vital rates in the absence of population at risk, it has to be undertaken through some indirect techniques. This paper makes an attempt in this direction. A statistical technique is devised to estimate population at risk given a series of birth and deaths.

Later the reliability of such population estimates is validated in comparison with census records of Travancore area of Kerala.[2] The available information in the census records includes the age structure of the population. The estimation of vital rates from the available age structure of the population is attempted. A comparison of the estimated birth rates and death rates using parish and census records is done towards the end.

The data are collected from five parishes of Syrian Catholics churches in and around Palai, Kottayam district of Kerala.[3] Parish records give information on total number of births and deaths in each year over the period 1911-1980. Although the baptism (births) data is available in most of the study parishes from the second half of the nineteenth century, information about burial (deaths) is confined only to the twentieth century. Hence the estimation of vital rates is possible only for the twentieth century.

I. Method of Estimating Vital Rates from Parish Records

There have been many attempts to estimate fertility and mortality rates using parish records of Western countries. One of the pioneering attempts to analyze and understand the parish records to the fullest extent as a source of demographic data was made in

1. An attempt to understand the age at marriage of males and females of Kerala was made by Krishnan (1977) utilising family records kept at the St. Mary's Church, Changanacherry. Another study was done using the parish records of Trivandrum Archdiocese for the last hundred years to understand the demographic scenario of the Latin Catholics in Kerala (Rajan, Bhat and Dyson, 1993).
2. Kerala state was formed in 1956 with the amalgamation of majority of Malayalam speaking areas of two princely states Travancore and Cochin (a tiny state situated between Travancore and Malabar) and the Malabar districts of Madras Presidency. As the parish records collected for this study are from old Travancore region, the census records are also analysed only from Travancore area.
3. Syrian Catholics in Kerala is a traditional Christian community the origin of which goes back to the beginning of Christian era through the efforts of St. Thomas. They claimed a superior lineage and hence subsequent conversion into this community was not encouraged.

'family reconstitution' studies (Henry, 1965). However, this method is too time consuming and laborious and the inability to capture proper characteristics of some members makes it difficult to trace out the genealogies of many families for generations (Wrigley and Schofield, 1981). A technique called 'inverse projection' is developed to estimate vital rates from a series of births and deaths with only information on initial age structure (Lee, 1974, 1985, 1993). Another method called 'back projection' has been developed in a larger study undertaken by the Historical demography group at Cambridge by utilizing data from nearly 404 parishes of England (Wrigley and Schofield, 1981). Recently efforts have been made to estimate the size and structure of the population through generalized population technique (Oeppen, 1993, 1993a). However, all these techniques require an age structure and population size at some point in time.

We propose here to estimate the initial size and structure of population from available series of births and deaths without any information on population size and structure at any point of time.

This method is primarily based on two assumptions. Firstly, it assumes the study population to be closed to migration. However, this seems to be a strong assumption in case of a parish population which is often prone to migration between parishes given the narrow boundary of parishes in Kerala. Therefore, illustration of some preliminary estimates of migration between parishes will be attempted later. The second assumption relates to the initial stable age structure.[4]

The Twin Information from Parish Records

The parish data provide two vital pieces of information that are utilized for estimating age structure of the population: (1) Infant mortality rate and (2) Birth-death ratio. An examination of the quality of this data undisputedly proved its reliability to undertake demographic analysis (Rajan and James, forthcoming). The available burial data from the parish has the information on the age of each buried. This data is employed for estimating the Infant Mortality Rate from the parish records. The infant mortality rate, in turn, can be used to estimate the expectation of life at birth assuming an age pattern of mortality. Here the age pattern of mortality from the West model of Coale and Demeny is utilized for the estimation of expectation of life at birth (Coale and Demeny, 1983).

Locating Age Structure

Based on the two terms, expectation of life at birth and birth-death ratio, an appropriate age structure can be identified from the model stable population for any

4. Stable age structure assumes that the proportion of persons at each age group will remain constant if the population is subjected to constant birth and death rate over a long period.

specific period. This age distribution is located through a process of multiple interpolation first between birth-death ratio at different levels and later at different levels of expectation of life at birth.

Generation of Population Size

Having located the age 'structure using birth-death ratio and expectation of life at birth, it is even possible to estimate the population size for a particular base year directly. The age structure selected from the stable population also gives information on number of births. Hence the population size can be estimated as the ratio of parish births to stable population births multiplied by the located age structure.

This procedure would, however, end up in some error. This is because fertility levels could be different between the located stable age structure and parish population. Hence the next attempt is to find out the fertility level for the parish population for a base year.

This has been carried out with the help of a projection. Assuming that the net migration is zero the customary projection demands information on base age structure and estimates of fertility and mortality parameters. The age structure is already gauged from the model stable population.[5] The mortality parameter chosen for the projection is the expectation of life at birth corresponding to the infant mortality rate estimated from the parish. The fertility parameter (Total Fertility Rate (TFR)) is determined through a trial and error method. For the initial period, a particular level of TFR is chosen when birth-death ratio obtained from projection equals that of available from the parish data. This projection also gives the number of births for the base period. As the parish data also gives the number of births for the same period the population size is estimated as the ratio of parish births to projected births multiplied by the age structure.

Having computed the initial size and structure of population from the parish, the same for the subsequent years can be estimated through backward or forward projections. The survival ratio for the projection is located from the model life table using the information on the estimated expectation of life at birth from parish for different periods.[6] However, the population in (0-4) age group is not obtainable in case of forward projection method. Suppose that the forward projection is carried out from t to $t + 5$ period. The total number of births that has occurred during this five-year period is

5. Since the sex ratio of stable population is 100, suitable adjustments are needed to make the structure favourable to females. The sex ratio of stable population is defined as the ratio of female birth rate to male birth rate multiplied by sex ratio at birth. The corresponding birth and death rate for male and female age structure is available from the model stable population. Therefore based on the above formula the sex ratio of the stable population is estimated considering a sex ratio at birth of 104. Thereafter the estimated figure is prorated with the male age structure (United Nations, 1967).
6. The survival ratio corresponding to the expectation of life at birth has been observed from the model life table.

obtainable from the parish. Also parish data gives information on the total number of deaths between 0-4 age group during this five-year period. Therefore the subtraction of the 0-4 age group deaths from the total number of birth during the five-year period, gives the 0-4 age group population in $t + 5$ period. In the case of backward projection, however, a similar problem is posed in estimating the population in open-ended age group. Because each time one moves back in time the final open-ended age group should be reverse survived. Here it is done through dividing the open-ended age group with the corresponding ratio of *"T* value from the model life table.

The Estimation of Net **Migration**

Initially it is assumed that the population under study is closed to migration. Nonetheless, a crude estimate of the migration component can be obtained on completion of this estimation procedure. Having obtained the population size considering two different base years e.g. $t, t + i$ and assuming them to be accurate, we can estimate the quantum of migration during the period 'i'. Considering a constant migration rate during the same period the estimation of net migration can be obtained through a balancing equation.

That is $P_{t+1} = P_t + (B_t - D_t) + (I_M - 0_m)$

Where P is the population, B is the births, D is the deaths, I_m is the in migration, O_m is the out migration and t is the time. With the availability of population size at two points and births and death during the same period the net migration can be estimated.

Reliability Test

In order to examine the soundness of the proposed method, it is replicated on a hypothetical stable population. Initially, an age distribution from the stable population with level 13 and GRR 2.0 has been selected. Suitable adjustment in the age distribution is made to arrive at an overall sex ratio favourable to females. Thus the initial population size was 19836. However, for the time being it is assumed that the size of the population is unknown. The total number of births and deaths for the same age structure was 615 and 353 respectively yielding a birth-death ratio of 1.74. In the subsequent projection with the same level of expectation of life at birth (47.082 for males and 50 for females) and the given age structure, a TFR of 4.1 has given a total of 632 births and 362 deaths, which gave identical birth-death ratio (1.74). The population then estimated turned out to be 19302 as against the initial population size of 19836. Hence, with an allowance of three per cent error in the estimated population size, the suggested method may be considered robust.

Application of the Methodology in the Case of Parish Data

Although baptism data is available for all the five parishes even from last century, the burial data for three parishes started only from 1931 onwards. For the other two parishes, however, data were available from 1910 and 1916 respectively. The population estimates are possible only for the period when information on both number of births and deaths are available. The basic inputs data such as the infant mortality rate, corresponding expectation of life at birth from West model life table and the birth-death ratio of the parishes are given in the Table 1.

TABLE 1: INFANT MORTALITY RATE, CORRESPONDING EXPECTATION OF LIFE AT BIRTH FROM MODEL LIFE TABLES (WEST MODEL) AND BIRTH-DEATH RATIO FOR ALL THE PARISHES

Year	*Infant Mortality Rate*		*Expectation of life at birth*		*Birth-death ratio*		
	Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Total*
1911-15	161.18	121.00	43.74	49.59	2.29	2.32	2.30
1916-20	202.53	141.65	37.99	45.87	1.45	1.49	1.47
1921-25	97.56	88.17	54.42	56.24	2.82	2.75	2.78
1926-30	116.04	98.21	51.11	54.12	2.70	2.76	2.73
1931-35	138.76	115.90	47.31	50.57	2.48	2.38	2.43
1936-40	105.39	90.43	53.00	55.75	2.74	2.53	2.63
1941-45	107.24	105.51	52.67	52.61	2.13	2.09	2.11
1946-50	115.88	97.68	51.14	54.23	2.82	2.86	2.84
1951-55	92.58	60.78	55.36	62.44	4.04	4.18	4.11
1956-60	72.00	70.29	59.49	60.20	3.65	3.82	3.73
1961-65	60.81	54.70	61.78	63.93	4.44	4.47	4.45
1966-70	52.01	35.69	63.71	68.81	4.88	5.26	5.06
1971-75	36.97	31.63	67.10	69.88	4.80	5.53	5.14
1976-80	31.67	10,97	68.40	76.73	4.24	4.96	4.56

Note: Information for the period 1911-15 is based on one parish and for 1916 to 1930 is based on two parishes. One parish is omitted from the data for the year 1946-50. For all other periods data from all the five parishes are combined.

For estimating population size any base period can be chosen. However, since the entire exercise starts on the assumption of a stable age structure, the selected base year should preferably be the one before the onset of fertility transition and in the case of Kerala, perhaps, any year before 1950 might be desirable. Further in order to estimate migration between the periods, it is desirable to select different base periods. The base periods selected include 1921-25,1926-30, 1931-35,1936-40 and 1946-50. For all these base years, the initial age structure is determined through multiple interpolation from the Coale and Demeny West model stable population using expectation of life at birth

and birth-death ratio (Coale and Demeny, 1983). This located age structure corresponding to each base year is then used in the projection exercise. TFR for the projection is fixed in such a way that the birth-death ratio obtained from parish matches that from the projection result. Table 2 presents information on the level of TFR that equals birth-death ratio from projection and parish records, projected number of births for the base periods and the actual births from the parish for the same period.

TABLE 2: TOTAL FERTILITY RATE AND NUMBER OF BIRTHS FROM THE PROJECTION AND PARISH FOR ALL THE BASE YEARS

Base period	*TFR*	*Projected births*	*Total Births from parish*
1921-25	4.8	3720	916
1926-30	5. 2	4040	1146
1931-35	5.2	4040	3251
1936-40	4.6	3560	3146
1946-50	5.3	4120	3655

Note: 1921-25 and 1926-30 data are based on two parishes.

For instance, with a TFR of 4.8 during 1921-25, the projected birth-death ratio becomes 2.78, same as that of the parish birth-death ratio. Similarly, the number of projected births for the same period amounts to 3720. Since the observed number of births during 1921 -25 period is 916, the structure and size of the population for 916 births are estimated as the ratio of parish births to projected births multiplied by the age structure (916/3720* age structure used for projection). In the same way the age structure and size of the population for all base years discussed above are being estimated. The estimation of population for other years is carried out by forward or backward projection with the help of survival rates from the model life table corresponding to the parish expectation of life at birth.

The estimated population considering different base year periods is given in Table 3. As the information on base years 1921-25 and 1926-30 are based on two parishes, population estimates for subsequent years are also based on these two parishes only.

It is discernable from the table that there is very little variation in the population estimates based on 1931-35 and 1936-40 as the base years. Further the differences in the estimated population with the two base years (1921 -25 and 1926-30) for two parishes are also minimal. On the other hand, the estimated population corresponding to the base year 1946-50 is somewhat different from the other two base years. One of the probable reasons for such discrepancy in the estimated figures might be due to the out-migration of the peasants that occurred in Travancore during and after depression (Tharakan, 1976). The overall pattern of the growth of population is one of a sharp increase from 1946-50 to 1966-70. The period before 1946-50 and 1966-70 experienced a slow growth of population. On the whole, a steady increase in the population growth is noticeable.

TABLE 3: ESTIMATED POPULATION BASED ON DIFFERENT BASE YEARS ALL THE PARISHES

Year	*Base Year 1921-25*			*Base*	*Year 1926-30*		*Base*	*Year 1931-35*		*Base*	*Year 1936-40*		*Base*	*Year 1946-50*	
	Male	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*	*Male*	*Female*	*Total*
1911-15	2165	2167	4332	2114	2170	4285									
1916-20	2382	2387	4769	2360	2417	4777									
1921-25	2579	2604	5183	2590	2670	5260									
1926-30	2942	2960	5903	2954	3014	5968									
1931-35	3276	3297	6573	3295	3355	6650	7802	8505	16307	7724	8509	16233	6690	6542	13232
1936-40	3584	3607	7191	3608	3669	7277	8769	9363	18132	8602	9299	17901	7429	7353	14782
1941-45	3892	3945	7837	3921	4008	7929	9666	10200	19866	9471	10150	19622	8380	8369	16749
1946-50	4240	4362	8602	4273	4425	8698	10820	11284	22104	10602	11243	21845	9451	9451	18902
1951-55	4700	4880	9580	4735	4944	9679	12223	12577	24800	11986	12464	24450	10896	10871	21767
1956-60	5111	5352	10463	5147	5416	10563	13457	13838	27294	13207	13686	26893	12177	12237	24414
1961-65	5528	5808	11336	5564	5870	11434	14744	15007	29751	14484	14832	29316	13515	13528	27043
1966-70	5947	6187	12134	5983	6245	12228	15972	16106	32078	15708	15916	31624	14804	14743	29548
1971-75	6164	6457	12621	6198	6512	12710	16905	17120	34025	16641	16923	33564	15810	15871	31681
1976-80	6313	6682	12995	6343	6732	13075	17641	17812	35454	17381	17613	34994	16623	16680	33304

Note: The estimates of population for all the years using the base years 1921-25 and 1926-30 includes only two parishes.

Estimation of Net Migration

Assuming the population estimates corresponding to different base years to be accurate, one can approximate the extent of net migration in terms of the balancing equation. The estimated population size based on 1931-35 is 16307 and 1946-50 is 18901. So the difference in the population size during the two periods may comprise of the difference in the number of births and deaths during the said period and the quantum of net migration. Since the birth minus death during this time period is 5446, the net migration can be estimated as (-2852), In the same way between 1936-40 and 1946-50 the calculated net migration is (-2532).

Estimation of Vital Rates

Once the population size is at hand, estimates of vital rates become simpler. The estimates of CBR and CDR for different time periods are given in Table 4.

The estimated population, however, are based on different base years. The differences in the estimated population for the same period based on different base years could be attributed to the impact of migration. Hence, adjustment has to be made to account for the migration factor in estimating the birth rate so as to get an accurate estimate of the same. Therefore, the estimation of vital rates up to 1926-30 is carried out using the population figures available for two parishes based on 1921-25 based year. Estimates for the period 1926-30 also is based on 1926-30 base period for the two parishes. 1931-35 itself is the base year for that period and 1936-40 is the base year for 1936-40 and

TABLE 4: ESTIMATED BIRTH RATE AND DEATH RATE FOR DIFFERENT PERIODS

Years	*Birth Rate*	*Death Rate*
1911-15	39.98	-
1916-20	39.71	27.01
1921-25	35.34	12.69
1926-30	38.41	14.08
1931-35	39.87	16.40
1936-40	35.15	13.34
1941-45	30.66	14.56
1946-50	38.67	13.69
1951-55	38.79	9.45
1956-60	32.24	8.63
1961-65	28.40	6.37
1966-70	24.38	4.82
1971-75	19.89	3.87
1976-80	15.63	3.26

Note: 1911-15 estimate of birth rate is based on information from one parish and 1916-20 to 1926-30 birth rate and death rates are based on information from two parishes.

1941-45 periods. For all other periods the estimates are based on 1946-50 as the base year.

There was a high fertility regime until 1930s with a fluctuating CBR of above 35 per thousand population. The second phase of the fertility transition could be figured from 1930 to first half of 1950s when the fertility level continued to be high with some degree of fluctuation. However, in the third phase of the transition, the birth rate is on a fast decline. Since second half of 1950s, the birth rate of Syrian Catholics was on a fast decline and came down to the lowest level of 15.63 by 1976-80.

Death rate, on the other hand, was comparatively low and was on a steady decline since the 1920s except for two time periods. The quinquennia 1931-35 and 1941-45 have recorded a higher death rate than that of the earlier periods. This may certainly be attributed to the Economic Depression and the Second World War respectively, which created certain amount of scarcity in the state. During 1916-20 the death rate was abnormally high. This was the period of First World War and the attack of influenza for the country, the effect of which would have created hardships to the people of the state. By 1976-80, death rate among the Syrian Catholics reached a nadir of less than 4.

Assessment of Reliability

The reliability of the population estimates and its corresponding vital rates can always be adjudged by comparing them with existing alternative source of data. As mentioned earlier, the size of population is not available for the past years. On the other hand, the directory published by the diocese recently contains information on the population of each parish. The directory for the year 1980 showed a total population of 31658 for all the parishes together. The estimated population considering 1945-50 as base year for 1975-80 was 33304. It shows only a marginal difference between the estimated and the actual figure. This difference may be attributed to the migration after the base year 1946-50 since the estimation of migration after the base year of 1945-50 is not possible through this method.

Another way to assess the reliability of the estimated population is to compare the estimated vital rates with the available alternative sources. It should also be noted that there remains very little published information on vital rates of Kerala for the past periods.[7] The only estimate available on the past vital rates is through census. But, it does not provide quinquennial estimates of vital rates suitable for comparison with those obtained from parish data. Hence an attempt is made in the following section to obtain five yearly estimates of vital rates based on census data to make it comparable with the

7. Estimates of vital rates for Kerala using stable population methods show a birth rate of 59.2 and a death rate of 48.2 for 1901, which seems to be an overestimation which the authors themselves comment; (see Ramkumar and Gopinathan Nair, 1980).

parish estimates. This estimate also would help in identifying the difference in the demographic transition between Syrian Catholics and other population.

Since the vital rates computed from the census are meant primarily for quality check, it would have been appropriate to utilize census age distribution of Syrian Catholics. However, the age distribution is not available for the Syrian Catholic population from Travancore census. Two of the censuses give age distribution data of Syrian Christians in some broad age group. This data, in any case, will not help in estimating the quinquennial vital rates over a period of time.

2. Estimation of Vital Rates from Census Age Distribution

Due to the absence of any direct information on the vital rates in the past census, all estimates are to be made using age structure of the population. It definitely calls for an application of suitable indirect statistical technique to gauge details on the fertility and mortality levels.

There are a couple of techniques available to estimate birth rate and death rate from the census age distribution assuming the stability of age structure (United Nations, 1967, 1983). Many of these methods provide inter-censal estimates of birth rate and death rate. However, Reverse-Survival Methods and the Rele's Method could provide quinqennial estimates of fertility rates from census age distribution (Rele, 1967; United Nations, 1983). Both these methods, however, need some reliable estimates of mortality parameter. This can be gauged directly from stable population using census age distribution.

Identification of stable population with *CIS* and growth rate for Travancore

Modern Census operations began in Travancore since the year 1875. From 1881, the decadal census enumeration had started. Therefore, the estimation of vital rates is possible from 1881. According to the census reports of Travancore, migration does not play any major role in the state till 1941 and the state is characterised by marginal net inflow of persons till that time. Thereafter the trend reversed and a substantial amount of out-migration is recorded. This might lead to incorrect estimates of vital rates after 1940. The rate of natural increase computed by subtracting rate of net migration from the inter-censal growth rate is utilized for the estimation of vital rates from 1941-51 decade.

Assuming population being closed to migration, two consecutive census age distributions will help in estimating the census survival rates. These census survival rates serve as a clue to locate the mortality pattern of the study population from the model life table (United Nations, 1967). But the handicap of this approach is the defective age structure due to serious age misreporting and under-enumeration in Indian censuses. One way to overcome this problem is to smooth the census age distribution through a suitable

smoothing procedure. The reliability of the estimates then will depend on the chosen method of smoothing (United Nations, 1967).

In such a circumstance, an alternative approach is to choose an estimate based on cumulated age structure which is believed to be least affected by age misreporting and heaping (United Nations, 1967). The choice of cumulated proportion of age structure (Cx) reduces the effect of age heaping and age rnisreporting because of the cumulation from age zero to age *x*. Further, it is stated that

> for South Asian populations, *C15* for both sexes combined may be a good choice as the age distribution parameter to which a stable population is fitted, since it appears that the tendency for males to be transferred downward across age 15 is balanced, to some extent, by a tendency of females to be transferred in the other direction (United Nations, 1983).

This method, therefore, is utilized for the estimation of vital rates and mortality parameter. Another accompanying parameter required for the estimation of vital rate is the inter-censal growth rate or natural increase. For a given pair of *C15* and inter-censal growth rate or rate of natural increase, multiple interpolation is carried out on the model stable population of West model to gauge information on mortality parameter (Coale and Demeny, 1983). It should be noted that the model life table as well as the model stable population refers only to males and females separately. However, *CIS* refers to both sexes together. It is argued that the mortality pattern embodied in the female life tables is an adequate representation of the mortality pattern prevalent in the whole population (both sex combined) (United Nations, 1983).

Table 5 presents the input information such as inter-censal growth rate or natural increase and *C15* and the estimated expectation of life at birth, birth rate and death rate using model stable age distribution from 1881 onwards. The estimates of vital rates from 1951 onwards used the inter-censal natural increase adjusted for migration while between 1881-1941, the inter-censal growth has been utilized for estimating the vital rates (Bhat and Rajan, 1990).

The estimated trend in birth rate confirms that the fertility transition of the state is of a recent origin. Also a strict declining trend in birth rate is noticed after 1961. A birth rate of over 40 is recorded in almost all the decades preceding the 1961 except the 1941-50 decade. A decline in the birth rate during 1941-50 might be the effect of scarcity which prevailed in the state due to the Second World War and the consequent suffering of the masses. The estimated death rate shows a nearly declining trend except in certain periods. This confirms the hypothesis that the decline in the death rate in Kerala had originated even prior to the 20th century (Bhat and Rajan, 1990). The death rate has recorded a substantial increase during 1931-40 and 1951-60 decades compared to the previous decade.

TABLE 5: ESTIMATES OF EXPECTATION OF LIFE AT BIRTH AND VITAL RATES USING STABLE POPULATION *(CIS)* APPROACH

Census Years	*Annual G.R/N.I*	*CIS*	*%*	*B.R*	*D.R*
1875-1881	.0078	.3987	22.50	54.09	46.29
1881-1891	.0063	.3624	27.70	42.85	36.54
1891-1901	.0143	.3815	37.00	40.45	26.16
1901-1911	.0150	.3915	35.50	42.64	27.64
1911-1921	.0156	.3957	35.50	43.32	27.72
1921-1931	.0241	.4255	45.00	43.45	19.34
1931-1941	.0175	.4105	34.00	46.51	29.50
1941-1951	.0216	.3929	51.14	37.87	15.33
1951-1961	.0241	.4263	44.63	43.70	19.61
1961-1971	.0247	.4026	56.75	36.69	11.99
1971-1981	.0197	.3498	65.43	28.85	9.15

Note: Growth Rate (G.R) is estimated for the period 1875-81 to 1931-41 and Natural Increase (N.I) is given for the period 1941-51 to 1971-81. e_0 = expectation of life at birth, B.R = Birth rate and D.R = Death rate.

TABLE 6: BIRTH RATE AND DEATH RATE OF KERALA BASED ON TWO METHODS OF ESTIMATE

Year	*Birth Rate*		*Death Rate*	
	r	*Stable*	*r*	*Stable*
1961	43.9	43.7	19.7	19.6
1971	37.1	36.7	12.2	12.0
1981	28.1	28.9	8.6	9.2

Notes: r = 'Variable r' method.
Stable = Estimated using model stable population.

An assessment of the quality estimates based on stable age distribution is made through comparing the estimated birth and death rate with other similar estimates. Nevertheless, accurate estimates of vital rates; are not available before 1951 for Travancore. On the other hand, there had been attempts to estimate birth rate and death rate for Kerala as a whole from 1951 onwards. The available estimate is utilised for comparison with the present sets of estimates.[8] The Table 6 presents the comparison of estimated birth rate and death rate by generalised stable population method and stable population approach.

The above comparison between the estimates of vital rates obtained does not exhibit any significant difference. In fact, 'variable r' approach was preferred against the model stable population because of the inherent assumptions of constant age pattern of mortality and accuracy in age structure of the population in the latter. The unexpected

8. Bhat has estimated vital rates using '/--variable' method which has advantages over stable population method of estimation (Bhat, 1987).

agreement of the two sets of estimates even in the latter period increase the confidence of using stable population assumption for the estimates of vital rates from parish records.

Rele's method of estimating the birth rate

The main advantage of Rele's method in estimating vital rates is that it gives quinquennial estimates of birth rate from the census age distribution. This procedure is based on the observed linear relationship between CWR (child-women ratio) and GRR and the curvilinear relationship of birth rate with CWR (Rele, 1987). This method uses population in ages 0-4 and 5-9 for the estimation of quinquennial birth rate. The 0-4 age group is utilized to estimate the birth rate during last five years from the census and 5-9 age group is utilized to estimate birth rale during 5-10 years preceding the census. The method necessitates information on mortality estimates for the period. The estimated expectation of life at birth using stable population technique is used for the same. A technique to overcome understatement and overstatement of population size in 0-4 and 5-9 age group with suitable weights has also been proposed (Rele, 1987). Thus the weights assigned are 0.3 and 0.7. According to Rele, the same weights are applicable in the case of individual states in India. The estimated figures based on the smoothed technique are presented in Table 7.

TABLE 7: QUINQUENNIAL ESTIMATES OF BIRTH RATE USING RELE's METHOD (SMOOTHED TECHNIQUE)

Period	*Birth Rate*	*Period*	*Birth Rate*
1871-1876	5289	1926-1931	43.28
1876-1881	46.68	1931-1936	4438
1881-1886	42.28	1936-1941	39.91
1886-1891	42.01	1941-1946	35.70
1891-1896	41.17	1946-1951	37.98
1896-1901	41.58	1951-1956	41.26
1901-1906	42.24	1956-1961	39.41
1906-1911	42.69	1961-1966	35.81
1911-1916	42.82	1966-1971	3234
1916-1921	40.88	1971-1976	29.40
1921-1926	40.26	1976-1981	26.68

Note Natural increase is used for estimating birth rate from the period 1936-41 onwards.

The Table 7 too reestablishes the onset of fertility transition in the state to be of recent origin. The declining trend in fertility is visible only from 1961 onwards. Before that there has been a very high fertility level which was generally over 30 except in a few quinquennia. Similar to the observation made from the parish data, the fertility transition can be observed in three stages. The first period can be identified as until the first half of the 1930s during which the state experienced a very high birth rate.

In the second phase the fertility showed more of a fluctuating nature terminating by the end of 1950s. A steady decline is observed thereafter.

3. Comparison of Vital Rates from Census and Parish Data: A Discussion

A comparison of the estimated vital rates based on parish data and the census age distribution is made towards examining the consistency of the two sets of estimates as well as the validity of parish population estimates. Obviously, a marginal difference in the birth rate obtained from parish records and that based on census age distribution is expected because of the differential rate of development between Christians (Syrian Catholics in particular) against Kerala as a whole even in historical times. Tables 8 and 9 gives the estimated birth rate and death rate from the parish data and from the census.

Owing to lack of estimates of quinquennial death rate from the census, a simple average of the two five year periods for the decades are used for the decadal death rate from the parish. Census estimates of birth rate and death rate until 1931-36 are based on growth rate, and thereafter, based on natural increase.

TABLE 8: ESTIMATED BIRTH RATE USING PARISH DATA AND CENSUS AGE DISTRIBUTION OF TRAVANCORE

	Birth Rates	
Year	*Based on Parish data*	*Based on Census*
1911-15	39.98	42.82
1916-20	39.71	40.88
1921-25	35.34	40.26
1926-30	38.41	43.28
1931-35	39.87	44.38
1936-40	35.15	39.91
1941-45	30.66	35.70
1946-50	38.67	37.98
1951-55	38.79	41.26
1956-60	32.24	39.41
1961-65	28.40	35.81
1966-70	24.38	32.34
1971-75	19.89	29.40
1976-80	15.63	26.68

As seen in Tables 8 and 9 there is significant difference in the birth rate and death rate of Syrian Catholic population and that of Travancore or Kerala as a whole. Though the pattern of change remains similar for both the population, the magnitude of the rate is very different particularly during later period. The earlier decades exhibit very minor difference in birth rates for the two populations. The difference has widened from 1921-25 onwards though in the 40s and early 50s again there was a narrowing tendency. In

other words, there is a tendency of convergence between the birth rates of two groups during the periods of crisis indicating the effects of crisis being on all sections of the community in the case of Kerala. From the late 50s, the gap has substantially increased and the birth rate of Syrian Catholics came to a very low level by 1976-80 with that of Kerala remaining above 25.

TABLE 9: ESTIMATED DEATH RATE USING PARISH DATA AND CENSUS AGE DISTRIBUTION OF TRAVANCORE

Year	*Death Rates*	
	Based on Parish data	*Based on Census*
1911-21	27.01	27.72
1921-31	13.39	19.34
1931-41	14.84	29.50
1941-51	14.13	15.33
1951-61	9.04	19.61
1961-71	5.60	11.99
1971-81	3.65	9.15

The death rate also depicts almost a similar trend as that of the birth rates. It shows that except in the initial year, there is a difference in the death rate between Syrian Catholics and the entire Kerala population. Nevertheless, it needs a mention that during the crisis periods of 1940s the magnitude of difference came down substantially.

The difference between the estimated vital rates of the Syrian Catholic population and that of Kerala as a whole need not necessarily raise a suspicion on the quality of estimates based on parish data. It, otherwise, may be explained in terms of advantaged socio-economic conditions among the Syrian Catholics compared to the general population. At the macro level, many changes in the Syrian Catholic community in the socio-economic sphere had occurred much earlier than that of other communities. This would, in all probability, have brought about changes in their demographic behaviour as well, earlier than other communities.

However, it is quite astonishing to note that even with a substantial difference in the levels of fertility between Syrian Catholics and Kerala, the timing of the transition is similar for both these population. It is seen from Table 4 that the tendency towards a downward movement in the birth rate for both population starts around 1956-60 period. Since then, the magnitude of decline is substantially high among the Syrian Catholics than the Keralites.

Conclusions

This paper tries to estimate population at risk from an available annual series of births and deaths from the parish records. This is necessary as information on

population at risk is lacking from the parish records. Hence, for converting available vital events from the parish records into vital rates, information on population at risk is necessary.

The main advantage of this method is in terms of estimating the size and structure of population without the help of any initial age distribution at any point of time. The lone input for this exercise is limited to a series of births and deaths by age. This technique mainly employs stable population and model life table for the final estimates of population.

The estimated population from the parish using this method for the end year is near to the actual population count available from the parish for the end period, giving an added confidence in the precision of this method. Also the indirect estimates of vital rates from the census using stable population assumption are similar to the estimates of these rates obtained through advanced 'variable r' method available for the last three decades. Hence the inherent stable population assumption in the estimation of population at risk from parish records may not be far from reality.

The analysis suggest that the birth rate as well as the death rate of Syrian Catholics except in the initial periods and crisis times were substantially lower than the overall rates of Kerala. This gives an impression regarding the common impact of crisis on all sections of population in Travancore. The magnitude of difference in vital rates between Syrian Catholics and Kerala as a whole, however, widened in the latter part of the periods. Nevertheless the timing of the fertility transition seems to be more or less identical for both the population. The death rate was on a downward trend starting from the initial years except a marginal increase during the crisis periods for Syrian Catholics. This confirms the hypothesis advanced towards the timing of the decline in death rate in Kerala even in nineteenth century.

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