Comparison Period Fertility in 2001 and 2011

Bijaya Mani Devkota
Lecturer
Central Department of Population Studies (CDPS)

Received: November,18, 2018 Revised: March, 16, 2019 Accepted: March, 21, 2019

Abstract

Indirect demographic techniques have proven to be useful tools in the developing world, as their application to census and survey data has greatly expanded knowledge of the demographic situation in data deficient countries (Brass, 1996). The different techniques are based on specific assumptions and robustness of available data thus deserves caution in application. Failure to adhere to these methodological specifications results in generation of more errors (Feeney, 1996). The impetus of this paper is to assess the applicability of various methods in estimating recent fertility levels in Nepal.

It obtains optimal fertility estimates, the research undertook extensive data assessment, and corrections where possible, of individual variables employed hypothetical inter survey cohort method. In line with previous studies, the magnitude and pattern of the hypothetical inter survey method represented strong evidence of fertility decline in Nepal. This evidence rendered the Hypothetical inter-survey cohort appropriate for estimation of the fertility level in the country for the period. The study undertook and presented detailed data evaluation and adjustments, adhering to the Arriaga method and changing P/F ratio methodological assumptions. Hence, serious prudence should be taken during data collection and processing in order to minimise the magnitude of the errors. Hypothetical inter -survey cohort also support estimation of TFR values is 3.171 in between 2001-2011.

Keywords: Fertility, P/F ratio, Hypothetical inter-survey, Indirect techniques, TFR

Introduction

Nepal is among the poorest countries in the world and the quality of its demographic data is no different either. Data that is meager and defective limits understanding of population dynamics in the country. The controversy arising from fertility estimates in many developing countries is mainly due to the poor data quality. For instance, fertility decline in Nepal has been tested and tried with different studies coming up with contradictory conclusions national census data. Similar debates on fertility levels are going on in develop countries data as well. Erroneous information also produces inaccurate population development forecasts and planning as decisions based on the results could be compromised. As a result, indirect estimation of demographic parameters has proven to be very useful in the developing world, as its application to census and survey data has greatly expanded knowledge of the demographic situation in these often data deficient countries (Brass, 1996).

Fertility is an important demographic variable that is inextricably linked to socio-economic development, and affects the health and wellbeing of a population. Thus it is imperative to accurately estimate levels and trends of fertility. In general, the procedures take in to account data collected in a census or survey about women by age their children ever born and their children born during the year prior, to census or survey data. Methods, were developed earlier

1940's by Grab ill (1941) mortar (1949), Henry (1970) and Arriaga's and Anderson (1975). This technique devised several years ago (Arriaga,1983) consist of comparing average numbers of children ever born to obtain a set of age specific fertility rates. Failure to report events increases with the duration of recall lapse where women might fail to report their children because they are not living with them, or they are too young to be recognized as individuals worth reporting on, or they have died (Potter, 1977). For instance, although the 2001 Population Census Analytical Report deemed the census data cannot give total information of fertility data. So we use cenuses data for estimation and projection of the fertility levels. Moreover, the accuracy of fertility measurement depends on the age structure of the women, the shape of the age-specific fertility curve and the age range of the women under consideration (Brass, 1964). The poor data quality warrants the use of indirect estimation of demographic parameters in Nepal. Various demographic techniques for estimation of fertility have been developed to compensate incomplete and defective data.

Tribute has been paid to William Brass in this regard and as he is referred to as the "intellectual father of indirect estimation" (Coale and Trussell, 1996.The objective is to take into account the most probable sources of errors and minimize their influence on the estimated parameters. Based on the analysis of models and plausible hypotheses, indirect demographic techniques introduce some degree of order and consistency into what would have otherwise been an amalgam of errors (UN, 1983).

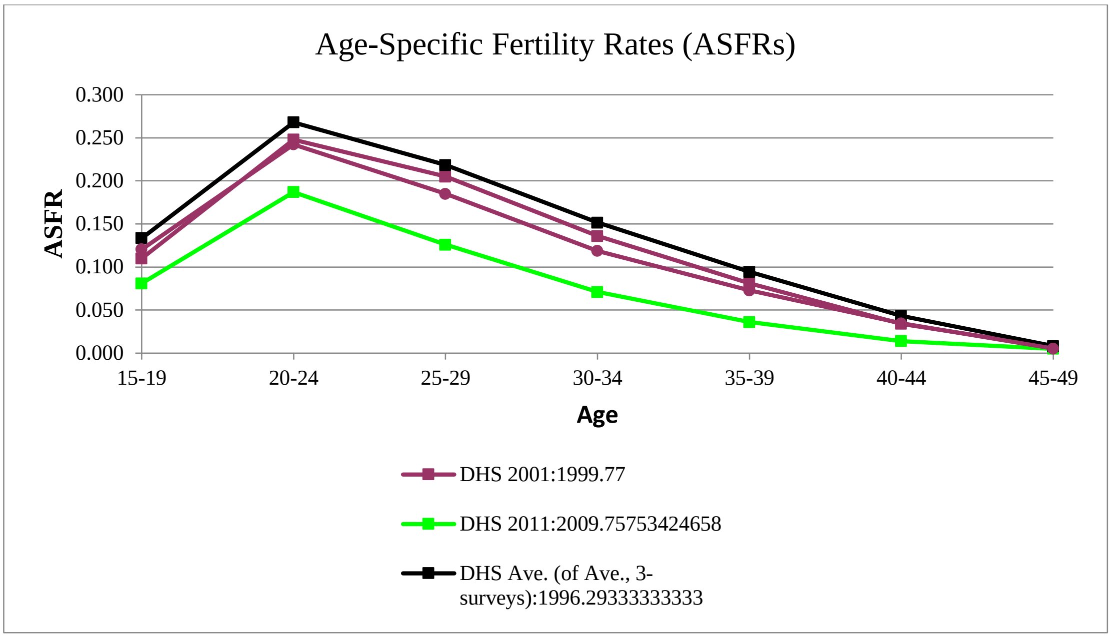
The demographic landscape of the SAARC region has seen unprecedented changes over the last 100 years. The population growth rate accelerated and India (which accounts for three-fourths of the region population) doubled its population between 1961 and 1991 and crossed one billion marks in 2001. India, Pakistan and Bangladesh are respectively the second, seventh and ninth most populous countries of the world. The highest fertility rate (TFR) 5.4 in Afghanistan and lowest fertility rate (TFR)2.1 which reached the replacement level in Sri Lanka world population data and NDHS give same TFR 2.6 in Nepal which is medium change of fertility in SAARC countries.

Trends of Fertility in 2001 to 2011

The total fertility rate for Nepal for the three years preceding the 2006 NDHS survey is 3.1 births per woman. As expected, fertility is considerably higher in rural areas (3.3 births per woman) than urban areas (2.1 births per woman), where fertility is at replacement level. The urban-rural difference in fertility is more pronounced for women in the age group 20-24 (168 births per 1,000 women in urban areas versus 248 births per 1,000 women in rural areas).

The overall age pattern of fertility as reflected in the ASFRs indicates that childbearing begins early. Fertility is low among adolescents and increases to a peak of 234 births per 1,000 among women age 20-24 and declines thereafter.

Figure 1: Trends of Fertility in NDHS 2001 to 2011



Numerators for ASFRs are calculated by identifying live births that occurred in the three-year period preceding the survey classified according to the age of the mother (in five-year age groups) at the time of the child's birth. The TFR for the three years preceding the 2011 NDHS is 2.6 births per woman. Fertility is considerably higher in rural areas (2.8 births per woman) than in urban areas (1.6 births per woman), where fertility is below replacement level.

Objectives of the Study

In order to achieve this, the study pursued the following specific objectives:

- To estimate the fertility levels 2001 to 2011 in Nepal.

Methods

The P/F ratio method was originally developed by William Brass and subsequently refined by a number of demographers. The method is a procedure for comparison of period fertility rates with reported average parities (Brass, 1964). The ratio of lifetime fertility to cumulative fertility, under a certain logical relationship and assumptions, is used to adjust levels of age patterns of fertility by the levels of fertility implied by the average parities of young women in order to obtain true estimates of recent fertility in a cohort (UN, 1983). This is in light of that, the total number of children ever born (CEB) to a group of women of a given age should give a record of their childbearing experience from the beginning of their reproductive life to current period. Thus, average parity is a measure of fertility experience of a cohort. This then translates that the P value of women at the end of child bearing should reflect the TFR of that cohort. Due to high levels of illiteracy (and probably ignorance of numbers) in less developed countries, there are often substantial omissions in the reported number of children ever born (CEB) to older women, but the reported numbers for younger women are generally more reliable (UN, 1983).

The P/F Ratio Method for a Hypothetical Inter-Survey Cohort

Methodological Procedure

Step 1: Calculation of reported average parities from each survey P (i, j)

The average parities obtained from first survey are denoted by P (i, 1) and those from the second survey by P(i, 2). In both cases, they are computed by dividing the reported number of children ever born to women age group (i) by the total number of women in age group (i).

$$P\ (i,j) = \frac{CEB\ (i,j)}{W(i,j)}$$

CEB (i, j) = Number of CEB of age group 'i' in survey 'j'.

W (i, j) = Total number of women of age group 'i' in the j^{th} survey.

i = Age group of women 1 to 7. For 15-19,…

j = Number of survey or census 1 and 2, 1 for first surveys/censuses and 2 for second surveys/censuses.

First survey $P\ (i,1) = \frac{CEB\ (i,1)}{W(i,1)}$

Second survey $P\ (i,2) = \frac{CEB\ (i,2)}{W(i,2)}$

Where,

CEB (i, 1) = Reported number of CEB to women in age group (i) in the survey first.

W (i, 1) = Total number of women in age group (i) in survey first.

Similarly CEB (i, 2) = Reported number of CEB to women in age group (i) in second survey. W (i, 2) = Total number of women in age group (i) in second survey.

Step2: The average parities are depends upon the length of inter-survey interval

The parity increment between survey for corresponding cohort is equal to P (i + 1, 2) - P (i, 1) in Hypothetical cohort parities.

$\Delta P(i+1) = P(i+1,2) - P(i,1)$ for i = 1, ... 6

And $P\ (i,S) = \sum_{j=1}^{i} \Delta P\ (j)$

The parity increment ΔP (i + 1) for the youngest age group (i = 0) is taken as being directly equal to P (1, 2). If fertility is changing rapidly, this value of ΔP(1) will reflect period rates somewhat closer to second survey than to the mid - point of the interval, slightly over allowing therefore for change in fertility.

If the inter-survey interval is 10 years, then the survivors of the initial cohort of age group i in the first survey will be the women in age group (i + 2) in the second and hypothetical cohort parities are obtained by cumulating two parallel sequences of parity increments. For the youngest age groups, ΔP (1) is taken as being equal to P (1, 2) and ΔP(2) to P(2, 2). Parity increments are calculated.

$\Delta P\ (i+2) = P\ (i+2,2) - P\ (i,1)$ for i = 1, ... 5.

Hypothetical - cohort parities for even numbered age groups are obtained by summing the parity increments for even numbered age groups, whereas those for odd - numbered age groups are obtained by summing parity increments for odd - numbered age groups. Thus,

$P\ (2,S) = \Delta P\ (2) = P\ (2,2)$

$P\ (4,S) = \Delta P\ (2) + \Delta P\ (4)$

And P (6, S) = ΔP (2) + ΔP (4) +ΔP (6)

Where,

P (1, S) = ΔP (1) = P (1, 2)

P (3, S) =ΔP (1) +ΔP (3)

P (5, S) = ΔP (1) + ΔP (3) + ΔP (5)

And P (7, S) = ΔP (1) + ΔP (3) +ΔP (5) + ΔP (7).

Step 3: Calculation of age - specific fertility rates for inter - survey period f (i)

To calculate age-specific fertility rates for inter-survey period, first age-specific fertility rates for each survey year calculated by dividing the number of birth in the year preceding the survey to women of age group (i) by total women in that age in each survey.

$$f\ (i,\ 1) = \frac{B(i,\ 1)}{W(i,\ 1)}$$

$$f\ (i,\ 2) = \frac{B(i,\ 2)}{W(i,\ 2)}$$

Then the age specific fertility rates for inter-survey period are calculated as the average of observed of age-specific rates for two surveys.

$$f\ (i) = \frac{f(i,\ 1) + f(i,2)}{2}$$

Where, f (i, 1) = ASFRS for First survey

f (i, 2) = ASFRS for Second survey

Step 4: Calculation of cumulated fertility for hypothetical inter-survey cohort ϕ(i).

The calculation of cumulated fertility is denoted by ϕ(i).

$$\phi(i) = 5\sum_{j=f}^{i} f\ (j)$$

f (j) = inter-survey ASFR from younger age group up to the upper limit of the age group considered.

ϕ(i) (i) = Cumulated ASFRs for a hypothetical inter-survey cohort.

Step 5: Estimation of average parity equivalent for the hypothetical inter-survey cohort F (i)

The average parity equivalent for hypothetical inter-survey cohort F (i).The average parity equivalent for hypothetical inter-survey cohort of age group (i) is estimated by inter-polarity of cumulated inter-survey age-specific fertility rates.

$$F\ (i) = \phi(i)\ \ (i - 1) + a\ (i)\ f\ (i) + b\ (i)\ f\ (i + 1) + c\ (i)\ \phi(i) \quad (7)$$

a (i), b(i), & c(i) are coefficients of constant

Step 6: Calculation of inter-survey age-specific fertility rates for conventional five year age group f + (i)

It is calculated by following relationship is

$$f^{+}\ (i) = [1 - w(i -1)]\ f(i) + w(i)\ f(i + 1)$$

Where $w(i) = x(i) + y(i)\,\frac{f(i+1)}{f(7)} + z(i)\,\frac{f(i+1)}{f(7)}$

X (i), y (i) and z (i) are constants for weighting factors.

Step 7: Calculation of adjusted inter-survey ASFRs for conventional five years' age group f*(i)

It is calculated by multiplying the inter-survey ASFRs Adjusted for congenital five-year age group by adjusted factor 'k'.

$f^*(i) = k \times f^+(i)$

Where k is selected from consistent $\frac{P(i, s)}{F(i)}$

Then, $TFR = 5 \times \sum_{i=1}^{7} f^*(i)$

If fertility has been changing, cumulated period fertility rates cannot be expected to equal lifetime fertility; and an adjustment factor calculated on the basis of the comparison of the two will reflect not only possible data errors but the effects of changes through time. Hence, its use for correction purposes the tend to obscure the effects of those changes.

The multiplying factor 'K' plays a significant role in Brass P/F ratio method in determining the TFR. In calculating the values of the factor 'K', according to the suggestion prescribed by Brass, it is important to select the value of the parameter 's'. But for actual population, it is not easy to get the value of 's' directly from the type of data generally collected. Alternatively, the mean age of fertility schedule 'm', which is equal to 's+13.2' in the model, or f1/ f2 may be used. These parameters are used as indicators for choosing the appropriate model to adjust the data from a real population. Generally, f1/ f2 is used as the parameter for selecting 'K' factor for the first three age groups and m is used to for selecting the 'K' factors for the later age groups. The ratio P2/ F2 or P3/ F3 is used as a correction factor for the adjusted ASFRs. In this study we used P2/ F2 as a correction factor. An increasing trend in P/F ratios by age of women may also suggest either that fertility has been decreasing or that the reported data on children ever born are distorted by progressively increasing omission of children as age of women increases. The estimates were calculated as the weighted number of births by age of mother for the three years preceding the survey date and divided by the woman years of exposure. The TFRs were then calculated as the sum of the ASFRs, all calculations have been performed using the SPSS syntax for fertility estimation already developed by the census program.

Results and Discussions

The results, obtained through Brass P/F ratio method, have been presented in the Table 1. The estimated P/F ratios obtained 2001 and census data set been shown in the table. As can be seen from the column, all of the P/F ratios are greater than unity. The P/F ratios increased consistently with age. An upward trend in P/F ratios with age increases indicates decrease in the level of fertility during the recent past and in the near future. The P/F ratio for the women aged 15-19 shows an erratic fluctuation when compared to those of the near age groups. This may be happened as a result of underreporting of births or for exclusion of births for that age group in data collection. The other causes may be slight upward shifting of age pattern of the women and underreporting of births for the reference period. The value of the P/F ratio for the women of the age group 20-24 is found to be 1.986, implying that the fertility level estimated on the basis of retrospective data on children ever born to this age group is 13% higher than that of indicated by current fertility rates. However, the adjusted ASFRs have been computed by multiplying the ASFRs by P2/ F2. During the period, the TGR in Nepal declined from 3.27

to 2.71 children per woman, and the total marital fertility rate declined from 4.45 to 2.61. The marital fertility declined in all age groups, however, the decline was more pronounced for women aged 25-29. The increase of contraceptive use rate was highest in this age group, which supports the findings. It is notable that, the overall use rate of any contraceptive method increased by 6.6% from 49.2% in 1996/97 to 55.8% in 2007.

Table1: P/F Ratio Method for Hypothetical Inter-Survey Cohort

Age	2001P(i)	2011P(i)	Δ P(i)	P(i,s)	2001 f(i)	2011 f(i)
15-19	0.1542	0.0804	0.0804	0.0804	0.0305	0.0231
20-24	0.9695	0.7578	0.7578	0.7578	0.1087	0.0937
25-29	2.0594	1.7225	1.5683	1.6487	0.0917	0.0810
30-34	2.8704	2.4438	1.4744	2.2322	0.0600	0.0450
35-39	3.4417	2.9562	0.8968	2.5455	0.0380	0.0243
40-44	3.8207	3.3398	0.4694	2.7016	0.0197	0.0112
45-49	4.0370	3.5827	0.1410	2.6865	0.0076	0.0044
TFR						

Table 2: P/F Ratio Method for Hypothetical Inter-Survey Cohort

Age	f(i)	ϕ (i)	F(i)	K	f+	f*(i)
15-19	0.027	0.134	0.038	2.102	0.0345	0.06860
20-24	0.102	0.639	0.382	1.986	0.1037	0.20593
25-29	0.086	1.072	0.868	1.899	0.0828	0.16443
30-34	0.053	1.334	1.213	1.841	0.0497	0.09879
35-39	0.032	1.489	1.417	1.797	0.0297	0.05891
40-44	0.016	1.567	1.525	1.772	0.0143	0.02840
45-49	0.006	1.597	1.588	1.692	0.0047	0.00928
TFR						3.17190

Table 1 and 2 data are based on Hypothetical inter-survey cohort data method. These data were calculating the based on 2001 and 2011 census data. Changing reported average parities P (i, s) were calculate from 2001 and 2011 census reported average parities. Period ASFR f(i) was obtained from ASFR of 2001 and 2011 census ASFR datasheet. Then estimate parities equivalent of hypothetical inter-survey cohort were obtained interpolation of cumulative ASFR based on census 2001 and 2011 data. Adjustment factor was calculated with comparison between reported average parities and estimate parities equivalent. Adjusting values are similar to 20-25 and 25-30 age groups. Then calculate the adjusting value is 1.986 values with exact reference date September 2007. It is based on medium variant estimation, follows changing reported parities methods with help of manual X procedure in P (i, s)/F (i) ratios.

These ratios are reasonably consistent, except for the first, the value of which suggests the existence of less complete registration of births by very young mothers; part of this above-average omission affects the P /F ratio for the second age group through its dependence upon Δ (i). Since most of the P /F ratios are consistent, the way in which an adjustment factor is selected is not of great importance; the average of the ratios for age groups 20-29 is likely to be as satisfactory as any, so the adjusted fertility schedule, f *(i), for the period 2006-2011. The adjusting factor calculates is

K=1.986

Total fertility may be estimated either by summation of the f *(i) values and multiplying by five or by multiplying by K.

TFR=5(0.0686+0.2059+0.1644+0.0987+0.0589+0.0284+0.0092)
TFR= 3.171
In either case, the estimate of TFR obtained is 3.171 September 2007. K is an adjustment factor for registered births, so its reciprocal, 1 /K, is an estimate of the completeness of birth registration, with inter-censual birth rate may be estimated by summing total births registered during the years 2001-2011, multiplying the total by K, and dividing by the person-years lived by the entire population.

Conclusion

This paper has highlighted that violation of assumptions of estimating models distorts fertility estimates. In particular, evidence of changing fertility levels in Nepal renders the Arriaga's method inappropriate to use for estimation of recent fertility levels in the country. This research represents the hypothetical inter-survey faring better in indirectly estimating recent fertility levels in Nepal. Nevertheless, the inherent errors in the Nepal fertility data continue to compromise fertility estimates even when indirect techniques are employed. Whereas it is usually assumed that indirect techniques are robust to data errors, findings from this study suggest that these techniques are not as robust as they are assumed to be. While this research engaged in extensive data evaluation and adjustment, the current fertility estimates show that some of the inherent errors are not possible to eradicate at analysis level. Although, the changing P/F ratio. If the degree of data errors is enormous, then the techniques can also be sources of errors themselves (Fenney, 1996). Hence, serious prudence should be taken during data collection and processing in order to minimise the magnitude of the errors. Hypothetical inter -survey cohort also support estimation of TFR values is 3.171 in between 2001-2011.

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