Regional Patterns of Fertility in Nepal

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Nepal is characterized by distinct physiographic and ethnic diversities which present challenges and opportunities for its development. In this vein, regional level perspectives are important to understand existing disparities. This paper focuses on regional patterns of fertility and its implications. The objective is to examine w*here* significant change in fertility has taken place and to examine its association with selected socioeconomic factors. The emphasis on space (i.e., region) as the unit of analysis is guided by the conviction that "geography matters." This approach is similar to other areal-level analyses in which countries, districts or communities are used as the unit of analysis as distinct from those analyses that use individual persons or households as the unit of analysis. Areal-level analysis complements individual-level analysis.

Data and Methodology

Using data from two population censuses taken 20 years apart, 1971 and 1991, I examine two related measures of fertility: the child-woman ratio (CWR) and the change in the proportion of children and women in the population between the two census periods. Both are period measures of fertility. The CWR is simply a ratio of the number of children, 0 to 4 years of age, to the number of women in the reproductive age group, 15-49, at a fixed point in time. This ratio is

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based on age-sex structure of the census population and is, therefore, a crude measure. However, the measure is especially useful in planning for social provisions (i.e., schooling and child health interventions). The ratio may also be thought of as a measure of "effective" of fertility because children who die early in life are excluded (Misra, 1995).

I have chosen the CWR as a measure of fertility for three main reasons. First, in a situation in which the vital registration system is nonfunctional and comparable estimates from sample surveys are unavailable, the census based CWR is a convenient fertility measure for cross-sectional analysis at the sub-regional or district levels (see also, Jones 1990). Second, data reporting in the census is along geopolitical administrative boundaries. Given this, comparisons at the regional or district level for different points in time are possible. Third, the CWR is a simple measure with minimal data requirements.

The other fertility measure used in this analysis is the proportion of children (0-4 years) and of women (15-49) in the total population. I use this to assess the direction of change in the fertility level by considering changes in mortality and the age structure as well as improvements in age reporting.

I have also used cluster analysis to discern regional patterns and changes. Background factors included in the cluster analysis are: overall percentage literate (for ages 6 and over), percentage of women literate among women of reproductive age (15-49), infant mortality rate (per 1,000 births), and percentage of women of reproductive age currently using contraception. Literacy data are taken from the 1991 census (CBS, 1993); infant mortality data are based on the 10 percent sample of 1991 census data as reported by Thapa (1996); and contraceptive prevalence data are based on the 1991 national survey (MOH, 1993). The selection of these factors is somewhat arbitrary. The cluster analysis uses the 75 districts (as of 1991) as the unit of analysis.

The quality of census data is an important issue. Some amount of undercounting has been found in both censuses. Indirect estimates have placed the undercounting at four percent in the 1991 census (CBS, 1994b). Similar independent estimates of under or overcounting are not available for the 1971 census, although some reports speculate that undercounting of children 0-4 years of age is higher than four percent (CBS, 1987). In the 1991 census, quality in the content and coverage has improved (Karki, 1995). The population enumerator ratio is roughly comparable in both censuses i.e., 963:1 in 1991 and 925:1 in 1971. Likewise, the sex ratio is normal and both censuses follow the usual

pattern of decrease with an increase in age. The United Nations age-sex accuracy index value is also roughly comparable in both censuses, although the 1991 census is on the border line between "inaccurate" and "highly inaccurate" (Karki, 1995).

The two prevalent regionalization schemes in Nepal are *ecological* which divides the country into Mountain, Hill and Terai and *developmental* which divides the country into Eastern, Central, Western, Mid-western and Far-western regions. While the first scheme overlooks east-west variation, the latter overlooks north-south variation. I take intraregional differences and data availability into consideration and use 15 regions in the analysis of regional fertility patterns; I refer to these as ecodevelopment regions. These cross-classifications strategies have been adapted for national surveys also (e.g., MOH, 1997).

Results

Child-Woman Ratio

The 1971 census (CBS, 1975) recorded a total of 1,634,110 children from 0 to 4 years of age and 2,784,761 women of reproductive age (15-49). The CWR was 0.587 or 587 children per 1,000 women. According to the 1991 census (CBS, 1994a), there were 2,707,352 children and 4,403,624 women of respective ages. Thus, the child-woman ratio was 0.615 or 615 children per 1,000 women. The 1991 ratio is almost five percent higher than the 1971 ratio.

Between 1971 and 1991, all five ecodevelopment regions in the Mountain ecological region showed an increase in the child-woman ratio (Table 1). The Mid-west, Far-west and Central regions showed greater percentage increases than the Eastern and Western subregions. Part of these increases may have been due to improvements in the quality of the data, primarily in the coverage of children, as well as in improvements in child mortality. The entry of large numbers of women into childbearing ages may also have increased these ratios. However, determining the amount of change in the ratio due to this transition is beyond the scope of this paper. Nevertheless, the fact that the amount of change in four out of five subregions ranges from 13 to 21 percent may be an indication of an increase in fertility in the Mountain ecological region.

Table 1 Child-woman ratio, 1971 and 1991

Ecodevelopment Regions	Child-woman Ratio		Change (1971-1991)	
	1971	1991	Absolute	Percent
Eastern Mountain (EM)	0.551	0.620	0.069	12.5
Central Mountain (CM)	0.543	0.626	0.082	15.1
Western Mountain (WM)	0.442	0.476	0.034	7.6
Mid-western Mountain (MWM)	0.553	0.655	0.102	18.5
Far-western Mountain (FWM)	0.530	0.642	0.113	21.2
Mountain (all)	0.541	0.632	0.091	16.7
Eastern Hill (EH)	0.584	0.627	0.043	7.4
Central Hill (CH)	0.590	0.551	- 0.039	-6.6
Western Hill (WH)	0.557	0.610	0.053	9.5
Mid-western Hill (MWH)	0.606	0.699	0.092	15.2
Far-western Hill (FWH)	0.522	0.656	0.134	25.6
Hill (all)	0.575	0.610	0.035	6.1
Eastern Terai (ET)	0.645	0.558	- 0.086	-13.4
Central Terai (CT)	0.594	0.621	0.027	4.6
Western Terai (WT)	0.553	0.628	0.075	13.5
Mid-western Terai (MWT)	0.680	0.681	0.000	0
Far-western Terai (FWT)	0.702	0.731	0.030	4.2
Terai (all)	0.616	0.617	0.001	0
Nepal	0.587	0.615	0.028	4.8

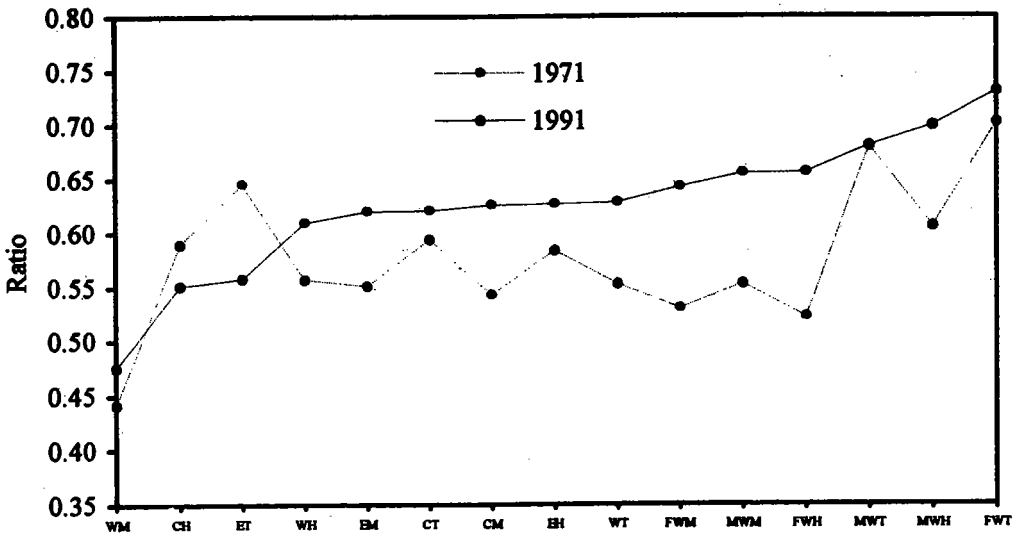
The subregions in the Hill ecological region present a somewhat mixed scenario. The Central Hill revealed a clear decline with the CWR, decreasing from 0.590 in 1971 to 0.551 in 1991. On the other hand, the Far-western Hill showed a clear increase in the CWR from 0.522 to 0.656, approximately 26 percent. The Mid-western Hill showed an increase of 15 percent.

Within the Terai ecological region, the Eastern Terai showed a decline of 13 percent. On the other hand, the Western Terai region showed a 14 percent increase in the ratio. The changes in the remaining areas (i.e., Central Terai, Mid-western Terai and Far-western Terai) were not large.

Figure 1 provides a summary of the CWR in 1971 and in 1991. (I have plotted the regions ranging from low to high ratios based on the 1991 data.) Of particular interest is the case of the Central Hill and the Eastern Terai where the CWR is considerably lower in 1991 than in 1971. The implication I draw is a clear decline in overall fertility.

Similarly, the case of the Mid-western Terai, in which no change is observed, is also interesting. The subregions with wider gaps include the Central Mountain, the Far-western Mountain, the Mid-western Mountain, the Far-western Hill, and the Mid-western Hill. Among these, the Far-western Mountain, the Far-western Hill and the Mid-western Hill ecodevelopment regions stand out as regions with a possibile rise in fertility.

Figure 1 Child-woman ratio (CWR) by ecodevelopment regions, 1971 and 1991



WM = Western Mountain, CH = Central Hill, ET = Eastern Terai, WH = Western Hill, EM = Eastern Mountain, CT = Central Terai, CM = Central Mountain, EH = Eastern Hill, WT = Western Terai, FWM = Far-western Mountain, MWM = Mid-western Mountain, FWH = Far-western Hill, MWT = Mid-western Terai, MWH = Mid-western Hill, FWT = Far-western Terai.

Note: The regions are listed according to the values (low to high) based on the 1991 data.

The change in the age structure, especially the number and proportion of women entering childbearing years, affects the CWR. It is, therefore, important to analyze changes in the proportion of children and women in the total population between the two census periods.

Changes in the Proportion of Children (0-4 years of age) and Women of Childbearing Age

In 1971, the proportion of children (0-4) in the total population was 0.141 ranging from 0.111 to 0.161 in the different ecodevelopment regions (Table 2). The highest proportion was recorded in the Far-western Terai and the lowest in the Western Mountain. In 1991 the proportion of children in the total population was 0.146, ranging from 0.111 to 0.166. The Western Mountain recorded the lowest proportion. Several subregions recorded an increase in the proportion of the children; specifically the Far-western Hill, the Far-western Mountain and the Mid-western Mountain showed larger proportional increases than other ecodevelopment regions.

Table 2 Changes in the proportion of children (0-4) and of women (15-49), 1971 and 1991

Ecodevelopment Regions	Proportion of Children in the Total Population			Proportion of Women in the Total Population		
	1971	1991	Change	1971	1991	Change
EM	0.131	0.145	0.015	0.237	0.235	-0.002
CM	0.132	0.144	0.012	0.243	0.231	-0.013
WM	0.111	0.111	-0.001	0.252	0.233	-0.019
MWM	0.139	0.160	0.021	0.251	0.245	-0.007
FWM	0.133	0.157	0.025	0.251	0.245	-0.006
Mountain	0.132	0.150	0.018	0.245	0.238	-0.007
EH	0.138	0.148	0.010	0.236	0.235	-0.001
CH	0.140	0.133	-0.007	0.238	0.242	0.004
WH	0.137	0.150	0.013	0.247	0.246	-0.001
MWH	0.149	0.166	0.017	0.246	0.238	-0.009
FWH	0.134	0.160	0.026	0.257	0.245	-0.012
Hill	0.140	0.147	0.008	0.243	0.242	-0.001
ET	0.148	0.135	-0.013	0.230	0.242	0.012
CT	0.144	0.145	0.001	0.243	0.234	-0.009
WT	0.134	0.145	0.012	0.242	0.231	-0.010
MWT	0.159	0.157	-0.002	0.233	0.230	-0.003
FWT	0.161	0.166	0.005	0.230	0.227	-0.003
Terai	0.146	0.145	-0.001	0.237	0.235	-0.002
Nepal	0.141	0.146	0.005	0.241	0.238	-0.003

EM = Eastern Mountain, CM = Central Mountain, WM = Western Mountain, MWM = Mid-western Mountain, FWM = Far-western Mountain, EH = Eastern Hill, CH = Central Hill, WH = Western Hill, MWH = Mid-western Hill, FWH = Far-western Hill, ET = Eastern Terai, CT = Central Terai, WT = Western Terai, MWT = Mid-western Terai, FWT = Far -western Terai.

Between 1971 and 1991 the proportion of children increased in four of the five ecodevelopment regions in the Mountain ecological region; only in the Western Mountain did the proportion remain about the same. In the Hill ecological region, almost all the ecodevelopment regions (the exception being the Central Hill) recorded an increase in the proportion of children. In the Terai ecological region, the Eastern Terai showed a large decline in the proportion of children. On the other hand, the Western Terai recorded an increase by about the same proportion. The changes in the remaining three regions were minimal.

Based on the direction of change in the proportions of children and of women between 1971 and 1991, three distinct groups of ecodevelopment regions may be classified. The Eastern Terai and the Central Hill are characterized by a decrease in the proportion of children and an increase in the proportion of women; the implication of this being a clear decline in fertility. The Mid-western Terai and the Western Mountain are characterized by a decrease in the proportions of both children and women. This may be indicative of a trend toward a decline in fertility. Finally, the remainder (11 of the 15) regions show an increase in the proportion of children and a decrease in the proportion of women. In seven of 11 of these regions, the increase in the proportion of children is greater than the decrease in the proportion of women.

An increase in the proportion of children ages 0-4 and a decrease in the proportion of women of childbearing age suggest the possibility of several underlying phenomena. First, the actual number of children born to women of childbearing age may have increased at the regional level despite the fact that various national surveys conducted over the past two decades have reported an overall decline in fertility (Retherford and Thapa, 1998). Second, the decrease in the proportion of women may be a reflection of a relative increase in the proportion of children. Third, the actual improvement in mortality, which disproportionately improves child survival rates, may have resulted in an increase in the proportion of children in the total population. These ratios may also reflect the decrease in infant mortality rates between 1971 and 1991. The Central Bureau of Statistics estimated that the infant mortality rate (per 1,000 live births) declined from 172 in 1971 to 97 in 1991 (CBS, 1987; Shrestha, 1995). Fourth, the improvement in data quality may have decreased the underreporting of children thereby increasing the proportion of children in the total population. There is, however, still the possibility of underreporting of children aged four

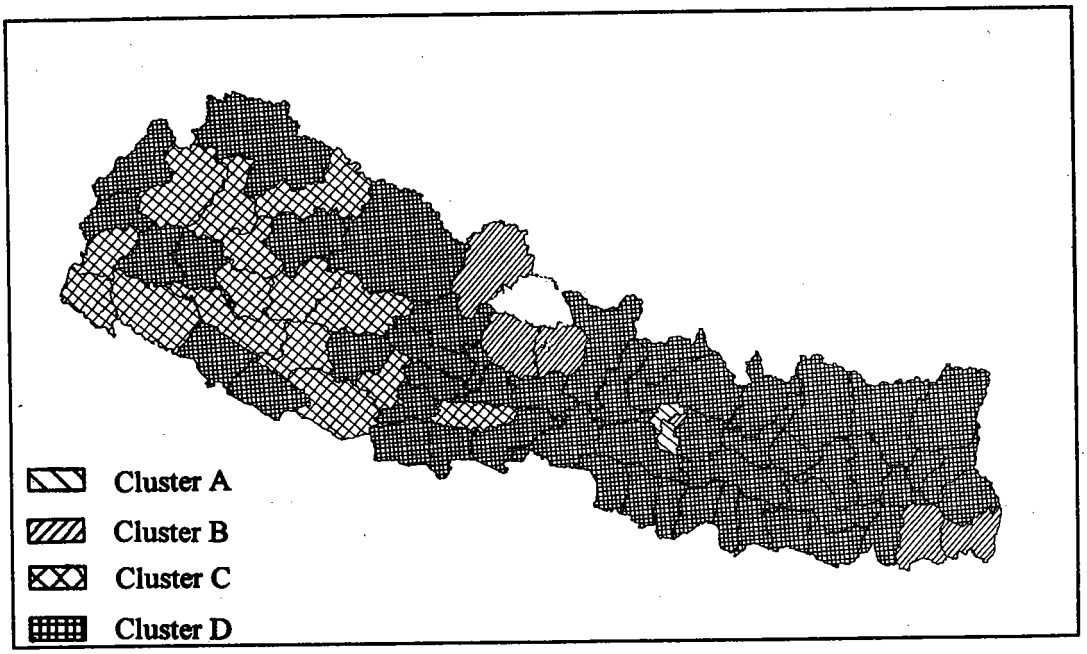
due to the widespread practice of digit preference in age reporting; many children aged four might have been recorded as being five years old.

Fertility Regimes Based on Cluster Analysis

Unlike the preceding analyses, I have used the district as the unit of analysis for the cluster analysis. By using the centroid method for hierarchical cluster (Aldenderfer and Blashfield, 1984), I classify districts with similar fertility (as measured by the proportion of children and of women) by their socioeconomic characteristics of the 75 districts. As mentioned earlier, the socioeconomic indicators used include overall literacy, infant mortality, literacy among women of childbearing age and contraceptive prevalence rates. Comparable data on infant mortality, contraceptive prevalence and literacy at the district level for both 1971 and 1991 were unavailable. Thus, the cluster analysis is limited to 1991 data.

The cluster analysis was performed using SPSSS/PC software (Norusis, 1992). Four clusters (I excluded Manang since it was an outlier) were identified; they are labeled as A, B, C and D. The clusters with their respective districts are shown in Map 1.

Map 1 Fertility Regimes Based on Cluster Analysis, 1991



Cluster A includes only two districts—Kathmandu and Lalitpur. The CWR in these two districts is the lowest and the values of the socioeconomic indicators are the highest. A large proportion of the population in these districts consists of migrants (although the exact percentage is difficult to ascertain). These two districts also rank first and second in terms of the human development index (for details, see Thapa, 1995). As shown in the analysis by Thapa (1995), the human development index (HDI) is itself strongly correlated with several other developmental variables in the 75 districts of the country. Clearly, a decline in fertility is closely associated with favorable socioeconomic conditions.

Cluster B includes six districts across four ecodevelopment regions. The districts include, Mustang (Western Mountain), Bhaktapur (Central Hill), Lamjung and Kaski (Western Hill) and Jhapa and Morang (Eastern Terai). Although they cover various ecodevelopment regions, their socioeconomic characteristics are only slightly lower than those of Cluster A. In none of these districts does the CWR exceed 540 per 1,000 women. In particular, the CWR has declined by more than 20 percent in Jhapa, Morang and Bhaktapur between 1971 and 1991. Overall, a relatively better socioeconomic condition is associated with a measurable decline in fertility in these areas.

Cluster C includes fifteen districts. This cluster can be considered a plateau of relatively high fertility. Districts in this cluster, which covers all three ecological regions but only the Mid and Far-west regions (with the exception of Palpa), consistently demonstrate very high CWRs and high infant mortality rates. Female literacy is very low and there is wide variation in contraceptive prevalence rates. Five of the 15 districts namely Mugu, Kalikot, Jajarkot, Bajura and Bajhang are among the districts with the lowest human development index. The HDI values in the remaining districts vary widely.

Cluster D includes the largest number of districts. Fifty-one of the 75 districts belong to this cluster; the districts represent all ecodevelopment regions. In most of these districts, the proportion of children has gone up and the proportion of women gone down. Summarizing their level of socioeconomic development is difficult; the HDI values vary considerably in the districts. It is this cluster where a clear sign of fertility decline is difficult to ascertain and the situation may be considered inconclusive.

Discussion and Conclusion

Assuming that there are no serious selectivity biases in the census data, the results presented here suggest a mixed pattern of fertility changes in the 15 ecodevelopment regions during the 20-year period, 1971-1991. Fertility has clearly declined in only two of the 15 regions—the Eastern Terai and the Central Hill. These regions are characterized by high levels of the human development index and other socioeconomic factors. These results are consistent with cross-national as well as country-specific studies which show that favorable socioeconomic conditions and family planning programs are strongly associated with reductions in fertility (e.g., Bulatao and Lee, 1983; Cutright, 1983; Mauldin, 1985; Rodrigues and Aravena, 1991; Singh and Casterline, 1985).

In fifteen districts—almost all of them in the Far and Mid-west regions—there is a plateau in the level of fertility. In this cluster the proportions of children and women are high but over the years the proportion of children has been increasing and the proportion of women has been decreasing. The influence of socioeconomic factors is minimal and these districts are characterized by relatively low human development indices. This suggests that there may not be a threshold level of socioeconomic conditions in these districts. Cross-national studies (e.g., Cutright, 1983; Mauldin, 1985) have found that a threshold level of socioeconomic conditions is a necessary precondition for fertility decline.

Increases in the child-woman ratio in certain areas may not be ruled out. Studies elsewhere have found that fertility increases may occur particularly if there is a lag in the increased use of contraception during the process of modernization (Dyson and Murphy, 1985 and 1986; Nag, 1980; Jones, 1990). Significant increases in the fertility levels with early modernization were reported in South America in the late 1940s and 1950s (Collver, 1965 cited in Jones, 1990) and in parts of Sub-Saharan Africa in the 1970s (Valentine and Revson, 1979; Romaniuk, 1980).

Some of the apparent differences and changes in the 15 ecodevelopment regions may be related to the quality of the data as well as to changes in mortality. No attempt has been made in this paper to analyze the relative role of each of these and other related factors. Nonetheless, the analysis presented here provides some insights for further research toward understanding fertility differentials at the regional level in Nepal.

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