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Is fertility level in less developed rapidly growing regions really influenced by literacy rate and age at marriage? A case of Punjab, Pakistan

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ABSTRACT

Fertility is the most fundamental aspect of human life that assures continuation of the human society and determines size of population of any area at any given time. Because of its enormous impact on population augmentation and socio-economic attributes of the society, need for the study of fertility cannot be overlooked specifically for a heavily populated and rapidly growing region like Punjab Province of Pakistan. Fertility in this developing region is determined by a complex interplay of many factors. Among them, literacy rate and age at marriage are believed to be the most imperative determinants of fertility. The study in point, besides measuring the fertility rate in Punjab at district level, investigates the interaction that exists between literacy, age at marriage and fertility. To probe the dynamic relationship between these variables, census data of 34 districts of Punjab have been used. Quantitative analysis made by using Computer software SPSS revealed a clear cut inverse relationship between literacy ratio and fertility and between age at marriage and fertility. Literacy ratio and age at marriage showed strong positive association with each other. This suggests that there is a strong interaction between literacy, age at marriage and fertility. The impact of literacy on fertility is, however, multifarious. An increase in literacy ratio may bring a change in the perception level of the people and their attitude towards the family size. It may also cause a rise in age at marriage that in turn exert depressing impact on fertility by reducing exposed fertile span of fecund females. The study thus suggests, specifically for those working on to constraint fertility that they should focus more to increase literacy rate and age at marriage if they truly want to influence fertility. The current study is aimed at investigating the impact of literacy rate and age at marriage on fertility at district level in Punjab.

KEY WORDS**:** Fertility, Literacy rate, Singulate mean age at marriage (SMAM), and Punjab.

Introduction

Beginning from menarche the biological process of reproduction is repeatable until menopause. Depending upon geographic conditions and many other factors, the age at puberty varies from region to region and between sexes. However, the

role of age at puberty alone in fertility without exposure to sexual union (marriage) is zilch. Fertility is influenced by biological factors affecting fecundity. Commencing at puberty it tends to decline with the advancement of age. For females it ceases at menopause. During this reproductive span, women are capable of bearing more than 15 children but national averages never reach this level because socio-economic and demographic factors limit the number of children women have (Population Reference Bureau, 2004). Due to marked spatial variations in these factors, fertility rate of different regions highly varies. Most of the less developed regions like that of Punjab, are attributed with high fertility and facing a lot of pressure in meeting the resource and other needs of the people. Continuous large population increment each year, keeps on diluting the gains of economic improvement while making sustainable development more difficult. This is why the study of fertility levels and determinants, especially for such regions, may prove useful if given due consideration.

Fertility occurs through three phases namely sexual union, conception and gestation (Davis and Blake, 1956). These phases are necessary if a baby is to be born alive. In Islamic societies like Punjab, socially sanctioned child bearing is limited only to married women. Marriage of a female at or after menarche is the starting point of her reproductive span and disruption of marriage or menopause, (whatever is earlier), is the end point of her reproductive period. Within the reproductive span, fecund woman produces at a rate inversely related to the average duration of the birth interval. A high fertility is associated with short birth intervals and low fertility is associated with long birth intervals. Such biological and behavioral factors which are nearest to the event of fertility and through which environmental, social and economic variables affect fertility are known as proximate determinants of fertility (Bongaarts and Potter, 1983). In the absence of these determinants, human fertility may reach at a theoretical maximum of total fecundity which on an average is 15.3 births per woman. Davis and Blake (1956) were the first to identify a set of eleven such determinants to which they named as intermediate fertility variables. Their classification, however, did not get wide acceptance because it was not easily incorporated in the fertility analysis. Bongaarts (1978) reclassified this set into seven factors including marriage pattern, contraceptive use, induced abortion, lactation or postpartum infecundability, spontaneous abortion, frequency of coitus and sterility. But after various studies he realized that some of these factors are more relevant than others in determining the magnitude of fertility change. He than reduced this list to only four variables to explain fertility. These include the proportion of women of childbearing age who are married, the proportion of women using contraception, the proportion of women of childbearing age who currently are unable to conceive a child usually because of postpartum infecundity from breastfeeding, and induced abortion, accounting for up to 96% of fertility change in some populations (Bongaars, 1982-1987). The importance of each of these factors varies spatially depending upon the cultural and economic situation. For example, the role of abortion as a determinant

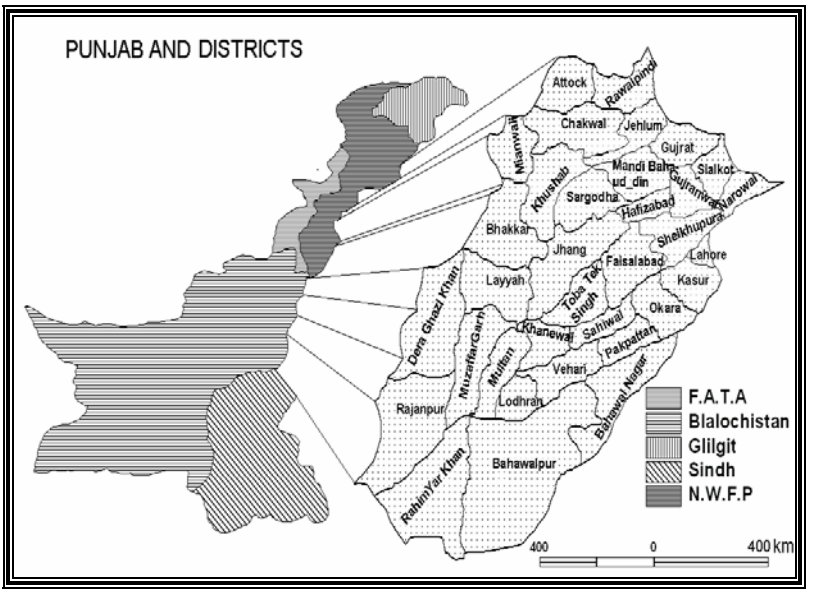
of fertility in Islamic societies like Punjab is considered to be zilch. However, in quantitative studies of fertility, these variables are usually not used.

As has already been mentioned, fertility is affected by a number of interrelated factors. It depends partially upon personal attitudes and aspirations that in turn are influenced by intelligence and education. Economic circumstances and government policies too influence fertility. It also varies by geographic region and environment, rural-urban residence, religion, caste, occupation, social and economic status of the people. Notestein (1953) had rationalized the decline in fertility by declining mortality rates, increasing education levels and independence of females. He emphasized that high infant and child mortality rates constitute an important reason for having many children. In Pakistan, one out of seven children dies before reaching the age of one year (NIPS, 2005). Accordingly, the parents here may feel the need to have many children. This is particularly true for male children. (Davis, 1963) added postponement of marriages, increase in the proportion of single population and migration to the main factors affecting fertility rates. Some demographers argued cultural milieu of the society as the main contributing factor (Coale, 1973:53-73). Watkins (1986) pointed out that the areas that share common language and culture have comparable performance in fertility rates. Bogue considers marital status, educational attainment, urban and rural residence, region of residence, occupation and income of husband, occupation of employed women, use of contraceptives and attitude towards the size of family as more important determinants of fertility (as cited in Sinha and Zacharia, 1986). Hakim (2000) revealed that demographic, socio-economic and regional factors affect fertility. He concluded that female education and age at marriage are the main determinants of fertility. Ahmed (2002) reinforced the influence of female education and infant mortality rates on fertility levels. In Punjab too, fertility is determined by a complex interplay of many such factors. However, the role of literacy and age at marriage is believed to be playing more significant role. In numerous other areas of the world also, an increase in female literacy rate has been reported one of the most significant factors in aiding fertility decline. Such as, The Sri Lankan total fertility rate (TFR) has been reduced to 2.1 with the enhancement of female literacy rate (Bhatti et al, 2003:161-182).

Location and extent of the region

Punjab is located at the north-western edge of the geologic Indian plate in South Asia. It extends from 27.66º to 34.02º north latitudes and from 69.33º to 75.33º east longitudes. It extends over an area of 205,345 sq. km that constitutes 25.8 % of the country's land mass (PCO, 2001). In the north, it is bounded by NWFP and federal capital Islamabad, in the north-east by Azad Jammu & Kashmir, in the east and south by India, in the south-west by Sindh and in the west by Balochistan and NWFP (map 1).

Map 1: Location of Punjab and its Districts



Methodology

Data used for this study has been computed mainly from 1998 census of Pakistan which is the latest census held in Pakistan up till now. Provincial and district census reports of Punjab provided the data. Pakistan population data sheet of 2001 also helped in this regard (NIPS, 2001). The authenticity of results is, therefore, linked with the accuracy of census data. For the processing of data, various demographic and statistical techniques were applied. To calculate fertility levels, following fertility measures were employed:

1. Child Women Ratio (CWR) = Total number of children of age 0-4 years × 1000 / Total female population of age15-49 years.
2. Age Specific Fertility Rate (ASFR) = Total live births in a year to women in specified age group × 1000 / Total number of women in that specified age group.
3. Total Fertility Rate (TFR) = Σ ASFRs × 5 / 1000.

From fertility levels measured by these yardsticks, CWR and TFR were related with literacy and age at marriage. The data was summarized in the form of tables, treated statistically and presented graphically. A number of computer software programs were available for performing statistical analysis but SPSS was preferred.

Singulate mean age at marriage was also used as a variable of fertility which is an estimate of the mean number of years lived by a cohort of women (15-49

years) before their first marriage (Newell, 1988: 97). (Hijnal; 1953: 115-136) introduced this technique. It has been calculated in the following way:

$$SMAM = \frac{(a + b) - d}{100 - c}$$

Where: a = the years of singleness by 100% women to age 15 = 100 × 15 = 1500

b = the years of singleness from 15–50 = (Σ 15 – 19 + ---------- 45 – 49)×5

c = the percentage of women still single at age 50 = $\frac{45 - 49\ 50 - 54}{2}$

d = the years of singleness to age 50 by those not marrying = 50 × c

Following steps involve in calculating SMAM:

1. Sum of the percentage of 15 to 49 age never married multiply by 5.
2. Add 1500 with sum of percent (result of 1 plus 1500).
3. Average of the percentage of ages 45 – 49 and 50 – 54 and divide by 2.
4. Multiply the result of 3 by 50.
5. Subtract the result of 4 from 2 (2 minus 4).
6. Subtract the result of 3 from 100 (100 minus 3).
7. Divide the result of 5 by result of 6 (5/6).

Table 4 of the 1998 census reports provided the data for total population, total female population and female population of age 15-49 years, number of females in specific age group and total number of children age 0-4 years. Table 29 supplied data for the total number of children born alive and ever married women of age 15-49 years. Table 33 contained data for total number of live births in a year, total female live births in a year, total ever married females of age 15-49 years, total number of live births during last 12 months to women in specified age group. SMAM means age at marriage was computed from table 6 and LR from table 11 of the 1998 provincial and district census reports of Punjab. Correlation between fertility and its variables was computed by using computer software Statistical Package for Social Sciences (SPSS).

Population growth

The population of Punjab is highly complex and many faceted group of people that has been subjected to continuous changes more due to vital rates and less due to migration. Since the start of the second half of previous century, sustained high fertility resulted in momentous growth and rise in the size of its population. In terms of population number, the province is manifested with a large size even larger than most countries. It is almost equal to Philippines, 1.2 times larger than Thailand or Turkey, four times larger than Sri Lanka or Australia and 19 times larger than New Zealand. The account of population growth tells that excellent arable lands due to high agricultural yields have been the fastest growing region of the Punjab as well as of the country. Growth of population started to gear up in 1920s onwards with the extension of large scale irrigation facilities that attracted people from other areas also. Over the 50 years period from 1901 to the time of the

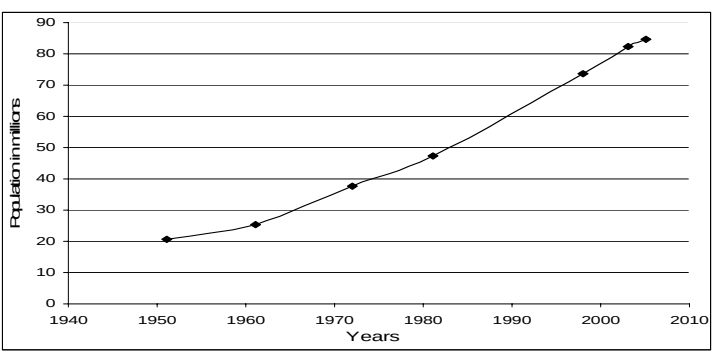
first census of Pakistan, the average rate of population growth in Punjab remained around 1.4% per annum (Slade, 1951) and thereafter increase occurred at an explosive rate of over 2% (table 1). Its population has increased by 2.3 times from 20.55 million in 1951 to 47.29 million in 1981 just in a period of 30 years. From 1951 to 1998 it increased by 3.6 times to reach 73.62 million in less than half a century time span. Then it reached to 84.81 million in 2005 (NIPS, 2005) showing over 4 fold increase between 1951 and 2005. Fig 1 further clarifies the story of rapid population growth. The current estimated population of Punjab is in the neighborhood of 90 million which means that since first census after independence, it increased by about 4.4 times within a time span of just 57 years. Estimates for future indicate that it may reach to 96.15 million in 2015 and 109.86 million in 2025 (NIPS, 2005).

Table 1:
Population growth, density and proportion of urban population

Census year	**1951**	**1961**	**1972**	**1981**	**1998**	**2003 ***	**2005****
Population in millions	20.54	25.46	37.61	47.29	73.62	82.48	84.81
Density (persons/sq. km)	100	124	183	230	358.5	402	413
Percent of country's total	60.9	59.4	57.6	56.1	55.6	55.5	55.3
Intercensal annual growth rate	-	2.18	3.40	2.74	2.63	2.30	1.9
Percent urban population	17.3	21.5	24.4	27.6	31.2	-	-
Growth rate of urban pop.	-	5.34	4.53	4.24	3.4	-	-
Growth rate of rural pop.	-	1.66	3.06	2.23	2.32	-	-

Source: Provincial Census Reports (PCRs) of Punjab. *Estimated population based on 1998 census population and reduced growth rate of 2.30. **NIPS estimates 2005.

Fig 1: Population growth trend in Punjab, data from table 1



It is evident from table 1 that population of Punjab didn't grow at a uniform rate and has been subjected to marked fluctuations. The highest growth rate (3.4) was noticed for the intercensal period of 1961 and 1972. The rise in growth rate between 1951 and 1972 could be attributed to a decline in mortality due to

improvement in medical facilities, sustained fertility at high level and inflow of migrants. While slow downward trend in growth rate from 1972 to 1981 (2.75%) and 1981 to 1998 (2.63%) could be attributed to slow paced modest fall in fertility. Though, its share in the country's population has been found decreasing in all the censuses (overall decrease from 1951 to 1998 was 5.25% points) but in terms of population number and density, Punjab still ranks highest amongst the provinces. Its population is about 2.4 times larger than the population of Sindh, more than 4 times larger than the population of NWFP and more than 11 times larger than the population of Baluchistan. The recent growth rate suggesting a sizeable addition to the population every year not only dilutes the results of development efforts but also creates unsustainable level of demand for resources which are already scarce to cater the needs of people. Therefore, Punjab faces a formidable challenge of tackling the issues of economic development, reduction in unemployment, improving the living conditions of population and poverty reduction. If the current pace of growth continues, the population of province is likely to become double within next 30 years (as law of 70 tells, that is 70 divided by growth rate (2.63) = population doubling time).

The Population Welfare Department of the Government of Punjab, in its 9th population welfare plan, 1998-2003 had planned to reduce the population growth rate by 0.1% in each of the five plan years to bring it down to 2.1% by the mid 2003. To indicate, whether the target was achieved or not, the plan evaluation is not available. However, according to this department, the increment in population over the five plan years between 1998 and 2003 was 9.75 million persons. By adding this figure to their mid year estimated baseline population of 77.5 million in 1998, the total population of the province in mid 2003 stands at 87.3 million. While based on the assumption of continued growth rate of 2.63% to the 1998 census population of 73.62 million, results in addition of 10.2 million by the year 2003 and 15.49 million individuals by the year 2006. If we apply the reduced growth rate of 2.30% on census population to estimate the population of 2003 and 2006, it gives the addition of 8.86 and 13.54 million individuals and a total population of about 82.49 million (Naeem, 2003: 31). This rate of growth gives an addition of 13.54 million in the census population of 1998 and a total population of about 87.16 million in 2006. The estimates prepared by NIPS for the years 2005, 2010 and 2020 give the population of province 84.81, 89.11 and 103.25 millions respectively (NIPS, 2005). However, the growth rate of population has been reported to reduce to 1.9% (Economic Survey of Pakistan, 2004-05).

The pattern of population growth in rural and urban areas also differed greatly since the first census of 1951 to the last census of 1998. Though, proportion of urban population has increased from 17.3% in 1951 to 31.2% in 1998 but likewise overall average annual growth rate, the rate of urban population growth is also receding (table 1). During the intercensal period of 1951-61, the average annual rate of population growth in urban areas was 5.34% (Naeem, 2003: 32) which reduced to 4.5% during the intercensal period of 1961-72 and remained over 4% in

the subsequent census of 1981. Then it declined further to 3.4% in 1998 (1998 PCR of Punjab, 2001: 114). In rural areas, population growth rate increased significantly from 1.66% during 1951-61 to 3.06 % during 1961-72 and then showed slight decline in 1981 and 1998 (table 1).

Literacy situation in the region

Fertility behavior of a population is affected by human development whereas literacy and education are key variables of the development. Both of these are used as the foremost indicators of the level of socio-economic and cultural development. A low level of literacy, poor enrolment and smaller proportion of educated persons reflect low level of development, poor educational facilities and strong influence of traditional social values which keep the parents away from educating their children. The literacy in Punjab has increased to nearly two folds during the intercensal period from 27.4% in 1981 to 46.6% in 1998. At the time of 1998 census, among the total literates, 99.2% were formal and only 0.8% were non-formal literates (Naeem, 2003: 51). It is noticeable that literacy ratio (LR) in Punjab, like many other less developed areas, is highly variable by gender as well as by rural urban areas. It is exceptionally higher for males than females and also for urban than rural areas (table 2). The literacy profile of females has been quite depressing as compared to males. In 1981, the female LR was less than half (16.8%) of the male LR (36.8%). It is worth noting that the LR for males has increased from 36.8% in 1981 to 57.2% in 1998 showing an increase of 20.4 percentage points during intercensal period. Whilst for females it has increased from 16.8% in 1981 to 35.1% in 1998 showing more than double increment but in terms of percentage points, it is only 18.3. It seems that norms of traditional society, lack of finances and inadequate educational facilities have hampered education particularly for females in the past which in turn has been a possible major cause of high fertility because a negative relationship is expected between literacy and fertility levels. Similarly, rural-urban differentials in literacy are also noticeable. Table 2 indicates that in the rural areas of Punjab, LR has shown an increment of 18 percentage points from 1981 to 1998 which is just less than double, the LR recorded in 1981. Though LR for rural females has increased more than 2.6 times during this period but in terms of percentage points, the increment for females (15.4%) is less than that for males (20.8%). In urban areas, the LR has increased from 46.7% in 1981 to 64.5% in 1998 showing an increment of 17.8 percentage points.

Table 2

Literacy Ratio and Functional Literacy in Punjab by Sex and Rural-Urban Areas

Areas	1981			1998			1998 Functional literacy*		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
All	27.4	36.8	16.8	46.6	57.2	35.1	37.4	46.5	27.4
Rural	20.0	29.6	9.4	38.0	50.4	24.8	28.9	55.9	17.8
Urban	46.7	55.2	36.7	64.5	70.9	57.2	54.8	60.1	38.4

Source: 1981 & 1998 Provincial Census Reports of Punjab and *Naeem, 2003: 53

Though LR in Punjab is slightly higher than national level (44% in 1998 and 26.2% in 1981) yet it is considerably low compared to that in developed world and even in many less developed Asian countries like Sri Lanka, Bangladesh and India. In rural areas, literacy situation is even worse where male literacy is 38.0% and female literacy is 24.8%. Generally, literacy level in Punjab is associated with urbanization and access to educational facilities. Thus, it is low in districts with smaller proportion of population living in urban areas and in districts with limited educational facilities like Rajanpur, D. G. Khan, Muzaffargarh, Layyah etc. Many reasons for low LR can be enlisted. The absence of sincere effort and embedded prejudice against education among some people has gravely damaged the real progress in this field. Some people still hold the view that education is unimportant and it spoils the children who could be more usefully employed as earning members in agricultural or manufacturing activities. Such thinking is further supported by the landlords who have strong hold on the peasant population working for them (Khan, 2002). What is more, for various social, economic and other reasons, many parents prefer to educate their children, particularly females, in the institutions nearer to their homes. Although in most of the districts of Punjab, primary schools are available at convenient distances but lack of facilities for the education beyond primary level, reduces the interest of people in educating their children. Many of them avoid and some times can not afford, sending their children in high schools, colleges and universities located far away from their areas. Far away location of institutions makes the education more expensive for people and consequently many of them circumvent educating their children. In terms of absolute numbers, the illiterates have increased from 23.94 million in 1981 to 27.74 million in 1998. This needs special attention of the planners because besides other maladies, illiteracy possibly can keep fertility at high levels and its eradication may cause change in fertility behavior.

Functional literacy has also been computed for the population aged 10 years and above which is considerably low. UNESCO committee of experts on literacy has defined functional literacy as equivalent of primary or elementary level of education in quantitative terms. (Mehmood, 2003: 255-83) has applied the criterion of the attainment of primary level education to obtain comparable

functional literacy rate for Pakistan. By applying the same method on 1998 census data of Punjab, low overall functional literacy rate (37.4%) revealed which is relatively higher for males than females and for urban areas than rural area (table 2). However, awareness about the importance of education among the people is increasing which is evident from the comparison of 1981 and 1998 census data on LR. This is particularly notable in case of urban areas.

Besides, analysis of the age and gender specific literacy rather than aggregate literacy is helpful in examining the changes in different age cohorts of both sexes that reflect the picture of those becoming literate over a span of life. Age specific LR indicates that proportion of literates is higher in younger age cohorts than older ones which have past school age with few chances to enhance literacy status. Tables 3a & 3b present the proportion of literates in different age groups by gender and rural-urban areas for 1981 & 1998 respectively. The concentration of literates is higher in the age groups of 10-24 years with maximum in age group 15-19 in almost all the cases and then it decreases sharply in the next age groups. The decrease in LR with age indicates a reduction in retention rates and a higher proportion of drop outs in higher education. Generally, the female LR is lower in all age groups but the difference starts increasing from age group 20-24 and becomes higher and higher with age. This age group also corresponds to the period of university and college education. The start of increase in gap in LR of males and females from this age group is associated with inadequate opportunities for females in acquiring higher education and stopping education after marriage (Saeed, 1986: 127-46). Almost similar pattern of differentials in age specific LR has been observed for rural and urban areas. However, it is evident from the tables that sizeable changes have occurred in literacy rates for both sexes and also for rural and urban areas during recent decades. For instance, in age group 10-14, it has risen from 27.99% to 58.62% between 1981 and 1998, for both sexes of all areas indicating more than doubling of literacy level among the youngest population. This acceleration in literacy reflects the situation of two different cohorts becoming literate at different points in time that are reflective of the rise in schooling among younger age groups (Mahmood, 2003: 264).

Table 3a:
Age Specific Literacy Ratio in Punjab by Gender and Rural-Urban Areas (1981)

Age Groups	**All Areas**			**Rural Areas**			**Urban Areas**		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
10-14	27.99	33.98	21.03	21.60	29.17	12.70	44.48	46.66	42.03
15-19	39.06	49.04	27.96	30.31	42.67	16.70	59.25	63.50	54.41
20-24	37.42	49.25	24.69	27.76	40.79	14.33	58.60	66.68	49.08
25-29	32.16	44.28	18.82	23.12	35.34	10.06	53.93	64.75	41.11

30-34	28.02	40.51	14.94	19.70	31.44	7.77	49.24	62.47	34.27
35-39	25.73	38.72	12.62	17.70	29.62	5.92	46.03	60.89	30.21
40-44	22.17	34.46	9.88	15.04	25.82	4.72	41.14	55.70	24.79
45-49	20.27	31.14	8.34	13.85	23.32	3.79	37.85	51.36	21.63
50-54	18.02	25.78	8.31	12.91	19.39	4.98	33.22	44.04	18.74
55-59	17.24	27.51	5.64	11.93	20.46	2.58	33.43	47.83	15.60
60+	12.73	18.64	4.50	9.50	14.31	2.82	24.32	34.00	10.58
10+	27.42	36.82	16.18	20.01	29.56	9.38	46.72	55.23	36.72

Source: 1981 Provincial Census Report of Punjab.

Table 3b

Age Specific Literacy Ratio in Punjab by Gender and Rural-Urban Areas (1998)

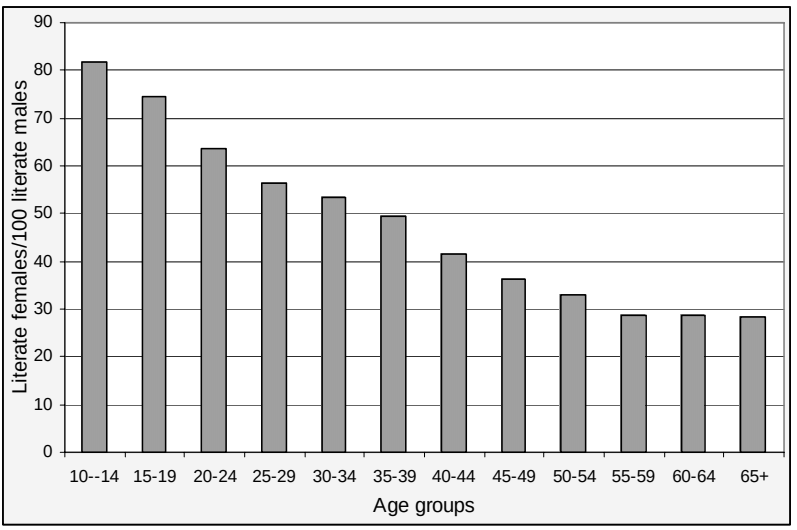
Age Groups	All Areas			Rural Areas			Urban Areas		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
10-14	58.62	64.23	52.44	51.37	59.53	42.30	73.99	74.35	73.59
15-19	61.94	70.70	52.68	54.52	67.04	41.32	76.34	77.79	74.80
20-24	54.97	67.22	42.68	46.06	61.94	30.71	72.47	77.06	67.52
25-29	47.55	60.46	34.23	37.74	53.04	22.70	66.94	74.14	58.76
30-34	43.36	55.88	29.79	33.54	47.71	18.85	62.52	70.87	52.66
35-39	42.42	55.73	27.62	32.27	47.17	16.27	61.35	70.95	49.94
40-44	38.48	53.84	22.43	28.45	44.79	12.15	58.12	70.44	44.03
45-49	33.33	48.39	17.61	23.96	39.02	8.78	53.68	67.67	37.91
50-54	29.61	43.36	14.30	21.39	34.63	6.81	48.45	62.96	31.82
55-59	27.58	41.06	11.79	20.12	32.74	5.56	45.32	60.35	27.04
60-64	21.38	31.94	9.21	15.16	24.55	4.40	37.49	50.91	21.81
65-69	19.94	29.58	8.37	14.06	22.48	4.04	35.38	47.92	19.95
70-74	16.53	24.30	6.96	11.85	18.43	3.80	30.33	41.44	16.41
75+	14.95	22.12	6.39	11.18	17.23	4.00	27.11	37.63	14.21
10+	46.56	57.20	35.10	37.95	50.40	24.78	64.48	70.94	57.23

Source: 1998 Provincial Census Report of Punjab.

The tables also depict that the levels of literacy have improved across all the age cohorts and gender gap has been reduced, particularly for younger age cohorts of 10-19 years of both the sexes and also for rural and urban areas. The urban females of 10-19 years have made remarkable progress, reaching the literacy level of above 73% making the gender gap in literacy almost negligible. The number of literate females per 100 males in age group 10-14 is the highest (81.6). It is about three times higher than the literate females per 100 males in age groups 60 years

and above (fig 2). In urban areas, the literate females in age group 10-14 are almost equal (99) to per 100 literate males (PCO, 2001).

Fig 2: Literate Females per Hundred Literate Males by Different Age Groups



Data source: Population Census Organization of Pakistan

Literacy status of the population of Punjab is also affected by the extent of children's enrolment in educational institutions. It is an accepted view that fertility tends to decline more rapidly where schooling is widespread and primary school enrolment is nearly universal. Schools and education related activities often help spread attitudes about the benefits of smaller families in the society. When overall education levels rise, social norms concerning childbearing can change. The costs of having children rise because not only the parents sometimes have to pay school fees for each child not they also lose potential labour that children could provide. It reveals from the analysis that literacy ratio, particularly among female population in the region is low that could be a possible reason of high fertility. An improvement in literacy rate and education is, therefore, likely to reduce fertility up to the desired level.

Results and discussion

Fertility Levels

Two representatives of fertility levels, total fertility rate (TFR) and child woman ratio (CWR) have been used in the analysis.

a) Total Fertility Rate

TFR is the most widely used summary measure of fertility, computed as the sum total of ASFRs. It is specifically useful for the purpose of comparisons because it takes into account the differences in age structure and its interpretation is simple (Weeks, 2008 & 1986). It is the average number of children that are expected to be born to a woman during her reproductive age span if she were to pass through all her reproductive years confirming to the age-specific fertility rates of a given year (Preston et al, 2001: 93-116; Haupt and Kane, 1980: 27-35; Shryock et al, 1976: 313-16). It tells the estimated average number of children that would be born to each woman if the current rates remained constant. TFR is considered to be the most important indicator of fertility because it answers as nearly as possible to the question; how many children, women are having now a days? The figure it gives, is hypothetical as it is based on age specific birth rates in one year only (Jones, 1990: 96-97). Though, it is calculated from period data (ASFRs) but technically is a cohort measure because it sums up in a single figure, the fertility of all women at a given point in time and tells that this is the total number of children, a woman would have if the fertility rate for a given year applied to her, throughout her childbearing span. It may also be termed as a synthetic cohort measure because in reality, no individual woman is very likely to pass through her reproductive age confirming to the age specific fertility rates of any single year (Weeks, 1986). These rates change and fluctuate from year to year, even if gradually. For instance, women who were aged 15-19 in 2005, may delay childbearing than women aged 15-19 in, say, 1992. They would lower the TFR a bit in 2005 and then raise it several years later when they start their child bearing. However, year to year fluctuations in the TFR may reflect changes in the timing of births rather than changes in the average number of births of women. Although TFR requires a lot of data yet it is advantageous over other measures because it is a single figure cohort measure and independent of age structure (Newell, 1988).

Table 4
Fertility Rate in Punjab

	All Areas			**Rural Areas**		**Urban Areas**		
Districts	TFR*	TFR	CWR	TFR	CWR	TFR	CWR	EDI**
Hafizabad	4.9	3.47	643.77	3.53	658.95	3.31	604.87	25
Khushab	4.3	4.63	571.05	4.36	575.68	5.43	557.44	53
Jehlum	3.8	3.17	535.40	3.35	552.57	2.66	488.44	62
Bhakkar	4.7	3.4	677.08	3.57	687.07	2.47	626.01	55
Mianwali	4.7	5.56	638.34	5.89	662.40	4.33	549.10	48
Chakwal	3.9	5.97	506.15	5.88	509.27	6.7	483.81	39
Rajanpur	5.7	3.63	892.60	3.67	920.31	2.28	742.21	58
Layyah	5.8	3.23	736.54	3.23	762.65	3.21	575.99	47
Mandi Bahauddin	4.2	2.41	594.06	3.34	607.65	3.15	522.88	43
Lodhran	5.1	3.60	744.83	3.63	752.05	4.04	703.36	58

Narowal	4.7	4.26	684.51	4.54	698.60	2.40	588.72	40
Attock	4.1	3.40	530.41	3.69	540.87	2.32	490.61	43
Pakpattan	4.7	3.0	657.50	4.30	673.16	4.04	568.77	54
T. T. Singh	4.6	5.57	596.27	5.81	609.67	4.57	541.04	42
D. G. Khan	5.5	4.72	874.20	4.89	922.56	3.84	615.71	58
Sahiwal	4.6	2.87	602.17	3.04	615.72	2.09	507.29	49
Gujrat	4.0	3.75	562.62	3.41	581.38	4.58	513.09	26
Bahawalnagar	4.8	4.97	657.08	4.83	666.978	3.76	616.32	43
Khanewal	5.0	4.09	649.69	4.39	663.57	2.75	587.37	51
Vehari	4.8	5.52	657.5	6.20	669.25	5.27	598.67	49
Okara	4.6	4.33	663.91	4.70	683.85	3.13	597.89	52
Kasur	5.0	5.83	734.52	5.24	769.36	4.81	625.11	53
Bahawalpur	5.0	3.67	693.52	3.69	724.04	3.62	516.12	60
Muzaffargarh	5.5	4.34	839.04	4.44	864.48	3.67	678.96	48
Sargodha	4.3	3.75	597.94	4.00	622.72	3.13	537.21	45
Sialkot	4.7	3.60	618.77	3.97	660.49	2.61	508.20	33
Jhang	4.4	4.8	628.99	5.21	646.53	3.55	573.78	53
Multan	5.0	3.93	655.19	4.34	734.05	3.42	555.07	48
R. Y. Khan	5.0	5.8	770.01	6.04	797.39	5.09	665.27	56
Sheikhupura	5.0	6.10	685.96	6.36	707.97	5.39	627.25	47
Rawalpindi	4.0	2.94	501.04	3.14	523.77	2.78	480.83	25
Gujranwala	4.9	2.9	638.70	4.44	700.38	3.72	582.04	37
Faisalabad	4.4	4.8	597.36	5.02	633.47	4.39	551.69	41
Lahore	4.4	2.74	535.25	3.84	731.29	2.54	498.91	15
Punjab	4.7	4.3	639.44	4.7	683.02	3.50	549.54	45.3

Data source: 1998 Provincial & District Census Reports of Punjab; and Pakistan Population Data Sheet 2001.

TFR= Total Fertility Rate, and CWR= Child Woman Ratio.

* TFR estimated by National Institute of Population Studies (NIPS), 2001, Islamabad.

**This index was used as a component of human deprivation measure in UNDP Human Development Report 1998. It is calculated as EDI = Illiterate aged 10 years and above + Children out of school (aged 5-9 years) x 100 / Total population i.e. EDI for Punjab = 27741240 + 5620340 X 100 / 73621290 = 43.5.

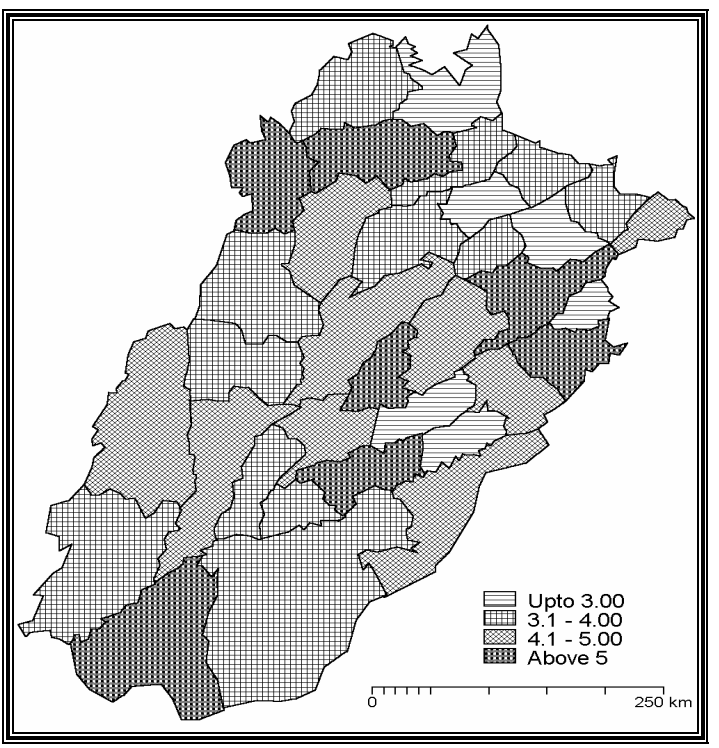
Table 4 presents the TFR for Punjab and districts and also for rural and urban areas. It is evident from the table that TFR for the province computed from census data is 4.3. It is slightly lower than the national TFR (4.5), calculated from 1998 census data (Feeney and Alam, 2003: 73-87). It varies from 4.7 in rural areas to 3.5 in urban areas, showing a difference of 1.2 births per woman. Thus it clearly supports the proposition that fertility tends to be lower in urban and higher in rural populations and there is an inverse relationship between the degree of urbanization

and fertility. The TFR for the Punjab computed by NIPS is 4.7 and for the districts, it varies from as high as 5.7 in Rajanpur to as low as 3.8 in Jehlum (table 4).

Table 5
Grouping of the Districts by Total Fertility Rate

Category	TFR	No. of Districts	Names of Districts
1	Up to 3.00	06	Mandi Bahuddin, Pakpattan, Sahiwal, Rawalpindi, Gujranwala, Lahore
2	3.1-4.00	12	Hafizabad, Jehlum, Bhakkar, Rajanpur, Layyah, Lodhran, Attock, Gujrat, Bahawalpur, Sargodha, Sialkot, Multan
3	4.1-5.00	09	Khushab, Narowal, D.G. Khan, Bahawalnagar, Khanewal, Okara, Muzaffargarh, Jhang, Faisalabad
4	Above 5.00	07	Mianwali, Chakwal, T. T. Singh, Vehari, Kasur, R. Y. Khan, Sheikhupura

Map 2
Total Fertility Rate in Punjab as Computed From 1998 District Census Reports



Among the rural areas of the districts, the highest TFR (6.36) has been found again in Sheikhupura whereas lowest (3.04) in Sahiwal (table 4). As regards urban areas of the

districts, the highest TFR (6.7) is found in Chakwal and lowest (2.09) again in Sahiwal (table 4). On the basis of TFR, the districts of Punjab have been grouped into five categories (table 5) and results have been displayed on the map 2.

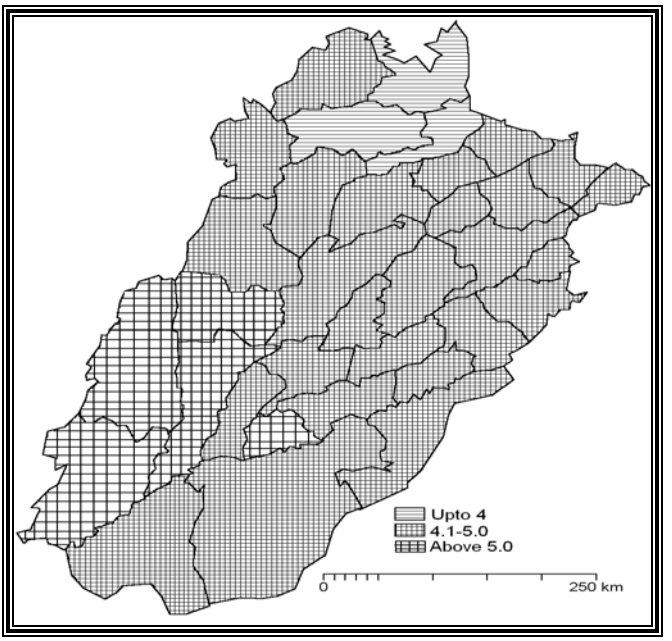
A mention must be made at this point that according to TFR estimated by NIPS (table 4), only in three districts, Chakwal, Jehlum and Rawalpindi, it is 4.0 and below most of the districts (26) fall in to the category in which fertility ranges from 4.1 to 5.0. In five districts, Rajanpur, Layyah, Lodhran, D. G. Khan and Muzaffargarh, TFR is above five (table 6 & map 3). In fifteen districts, TFR exceeds the provincial level of 4.7; in five districts, it is equivalent to the provincial level, and in fourteen districts, it remains below provincial level.

The difference between TFR computed from census data for current study and TFR estimated by NIPS may be because of the difference in calculation methods employed and adequacy of the data used for this purpose. However, both results indicate that TFR is relatively higher in socio-economically less developed districts. National institute of population studies (NIPS) has recorded the lowest TFR for Rawalpindi, Jehlum and Chakwal where most of the people are engaged in government jobs, specifically their large proportion is employed in Pakistan armed forces. Literacy rate in these districts is also relatively higher. Conversely the highest TFR has been recorded in Rajanpur, Layyah, Lodhran, D. G. Khan and Muzaffargarh which are socio-economically less developed. In these districts, literacy rate is relatively low and most of the people are engaged in agricultural activities. This may be an indication of the trueness that socio-economic conditions play significant part in determining the fertility behaviour of the people.

Table 6
Grouping of the Districts by Total Fertility Rate Estimated by NIPS

Category	TFR	No. of Districts	Names of Districts
1	Up to 4.00	03	Chakwal, Jehlum and Rawalpindi
2	4.1-5.00	26	Mandi Bahuddin, Pakpattan, Sahiwal, Gujranwala, Lahore, Hafizabad, Bhakkar, Attock, Gujrat, Bahawalpur, Sargodha, Sialkot, Multan, Khushab, Narowal, Bahawalnagar, Khanewal, Okara, Jhang, Faisalabad, Mianwali, T. T. Singh, Vehari, Kasur, R. Y. Khan, Sheikhupura
3	Above 5.00	05	Rajanpur, Layyah, Lodhran, D. G. Khan and Muzaffargarh

Map 3: Total fertility rate in Punjab as estimated by NIPS



b) Child Woman Ratio

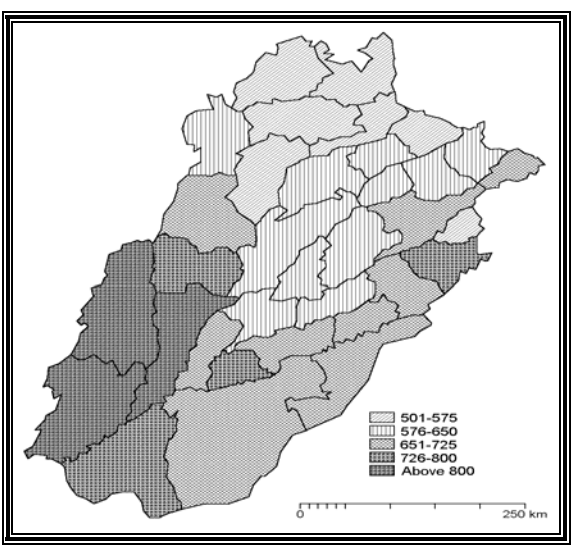
A much simpler summary measure of fertility that is useful for sub-national projections is CWR (Shrivastava, 1994). It is commonly calculated from census data for comparison purposes. The index is calculated as the number of children aged 0-4 years per 1000 women of child bearing age in a given year (Weeks, 1986; Barclay, 1958). This tool has been specially designed to furnish a useful measure of fertility when detailed data on births are lacking. It serves well as a relative measure to compare the fertility performance of the population of different sections and areas, such as the districts of Punjab. It is also widely used in population geography for micro level spatial studies (Jones, 1990: 96-97). Its great operational advantage is that the basic data is available from census age tables. It is also considered good to compare the fertility performance of different sections of same population. The higher index value indicates the higher level of fertility and vice versa. Nevertheless, it can be affected by the under enumeration of infants, by infant and childhood mortality rates and by age distribution of women within the childbearing span. Because the results are derived from the group of survivors of the preceding 5 years instead of actual births, so unavoidably include the effects of infant and childhood mortality that occur during this period. In less developed areas where mortality component (infant and child mortality) is significant, CWR may under estimate the fertility levels. Thus differences between populations of the districts in child mortality may cause complications for fertility comparisons.

Amongst the districts, CWR highly varies i.e. between a minimum of 501.04 children per 1,000 women in Rawalpindi to a maximum of 892.60 children per 1,000 women in Rajanpur, showing a difference of 391.56 children. Almost similar trends are found in rural as well as in urban areas of the districts. Amongst the rural areas, the ratios vary from a minimum of 523.77 again in Rawalpindi to a maximum of 922.56 in D. G. Khan, indicating a variation of 398.79 children per 1,000 women (table 4). In urban areas, fertility ratios vary from a minimum of 480.83 in Rawalpindi to a maximum of 742.21 in Rajanpur, pointing to a difference of 261.38 children per 1,000 women. On the basis of CWR derived from 1998 census, the districts of the Punjab have been placed into five groups (table 7). Map 4 portrays the spatial pattern of CWR by using these groups.

Table7
Grouping of the Districts by Child Women Ratio

Category	CWR	No. of Districts	Names of Districts
1	501-575	07	Khushab, Jehum, Chakwal, Attock, Gujrat, Rawalpindi, Lahore
2	576-650	11	Hafizabad, Mianwali, Mandi Bahauddin, T. T. Singh, Sahiwal, Khanewal, Sargodha, Sialkot, Jhang, Gujranwala, Faisalabad
3	651-725	09	Bhakkar, Narowal, Pakpattan, Bahawalnagar, Vehari, Okara, Bahawalpur, Multan, Sheikhupura
4	726-800	04	Layyah, Lodhran, Kasur, R. Y. Khan
5	Above 800	03	Rajanpur, D. G. Khan, Muzaffargarh

Map 4: Child Woman Ratio in Punjab



Fertility Variables

Five variables for overall population and for each of the rural and urban sections of population have been used in quantitative analysis (table 8). These variables include male singulate, mean age at marriage; female singulate means age at marriage, literacy ratio for both sexes, male literacy ratio and female literacy ratio. These variables represent the age at marriage and literacy situation at the district level.

Table 8 depicts that literacy ratio (LR) and singulate mean age at marriage (SMAM) greatly vary from one district to another and among the sexes. LR ranges from a minimum of 20.7% in Rajanpur to a maximum of 70.4% in Rawalpindi which is amongst the four top ranking districts of Pakistan with regard to literacy rate. These districts are Karachi Central (76%), Karachi East (73.1%), Islamabad (72.4%) and Rawalpindi respectively. For males, it ranges from a minimum of 29.2% to a maximum of 81.2% again for the same districts respectively and for females from 11.3% in Rajanpur to 59.6% in Lahore. It is above 50% in 11 districts between 30% and 50% in 20 districts and below 30% in 3 districts. Most of the districts with LR of above 40%, are located in the northern and central parts of Punjab. Considerable, disparity in literacy levels of rural and urban areas of all the districts is a common attribute. Rawalpindi has the highest LR in rural areas and Lahore ranks second whereas Rajanpur has the lowest and Muzaffargarh second lowest LR in rural areas. As regards urban areas, Rawalpindi having the second largest proportion of urban population has the highest urban LR and Lahore having the largest proportion of urban population again ranks second. Lodhran has the lowest proportion of urban LR and Rajanpur has second lowest while both have the same proportion (14.5%) of urban population. However, LR in rural as well as urban areas of all the districts is continuously on rise (District Census Reports of Punjab, 1981 & 1998). The aggregate measure of literacy and its variations across districts can help in identifying the areas which require improvement and upgrading of education indicators.

Male SMAM also varies markedly from 23.5 in D. G. Khan to 27.9 in Rawalpindi for all areas, from 22.96 in D. G. Khan to 27.87 in Rawalpindi for rural areas and from 22.05 in Khanewal to 28.32 in Sahiwal for urban areas. Female SMAM varies from 19.3 in D. G. Khan and Rajanpur to 23.5 in Rawalpindi for all areas, from 18.67 in D. G. Khan to 27.22 in Khenewal for rural areas and from 21.57 in Rajanpur to 24.15 in Sahiwal for urban areas.

Table 8
Fertility Variables

Districts	All Areas					Rural Areas					Urban Areas				
	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5	V1	V2	V3	V4	V5
Hafizabad	26.7	22.4	40.7	62.3	28.7	26.5	22.2	35.5	47.5	22.3	27.2	22.9	54.7	63.1	45.5
Khushab	27.1	23.2	40.5	59.8	21.8	27.0	22.9	36.7	57.7	16.5	27.2	23.2	51.6	65.9	37.4
Jehlum	27.2	23.0	68.9	77.7	50.5	27.4	22.7	58.5	74.3	44.4	26.9	23.8	77.2	84.8	68.0
Bhakkar	26.4	22.3	34.2	49.7	17.6	26.2	22.1	30.1	46.2	12.9	27.2	23.0	55.1	67.6	41.5
Mianwali	26.5	22.4	42.8	63.8	22.1	26.1	22.1	38.8	60.9	17.3	27.7	23.5	57.1	73.5	39.9
Chakwal	27.4	23.3	56.7	73.4	42.1	27.3	22.5	54.7	72.4	39.5	27.6	23.3	70.7	79.8	61.8
Rajanpur	23.9	19.3	20.7	29.2	11.3	23.5	18.9	15.5	23.5	6.3	25.7	21.6	49.9	60.1	38.9
Layyah	25.7	19.5	38.7	53.0	23.4	25.3	21.5	34.9	49.9	18.9	27.7	23.7	62.4	72.6	51.5
Mandi Bahauddin	27.2	22.6	47.2	58.8	35.6	27.1	22.4	43.8	55.8	31.4	27.9	23.8	67.1	75.3	58.6
Lodhran	24.6	20.7	29.6	42.7	16.0	24.4	20.5	26.8	39.8	12.6	25.7	21.7	47.7	59.2	35.0
Narowal	26.3	22.5	52.7	65.6	39.8	26.1	22.3	50.5	64.2	36.9	27.2	23.7	67.5	75.4	59.3
Attock	27.2	22.3	49.3	67.0	32.0	27.1	22.1	43.6	62.7	25.9	27.5	22.9	69.4	80.8	56.3
Pakpattan	26.2	22.3	34.7	47.0	21.3	26.0	22.2	30.7	43.7	16.6	27.0	23.0	57.6	66.1	48.5
T. T. Singh	27.3	23.3	50.5	61.3	39.1	27.2	23.2	47.5	59.1	35.3	27.8	23.9	63.1	70.7	55.2
D. G. Khan	23.5	19.3	30.6	42.1	18.1	22.9	18.7	25.0	37.2	11.6	26.6	22.6	61.8	69.3	53.6
Sahiwal	27.5	23.3	43.9	54.7	32.3	27.3	23.2	39.4	51.4	26.6	28.3	24.1	65.8	70.9	60.1
Gujrat	26.9	22.8	62.2	73.0	51.6	26.9	22.5	57.9	70.2	46.6	26.8	23.6	72.8	79.3	65.4
Bahawalnagar	26.2	22.8	35.1	45.5	23.8	26.1	23.6	30.8	41.8	18.9	26.9	23.0	52.9	61.2	43.9
Khanewal	26.4	22.3	40.0	53.6	25.1	26.2	27.2	35.4	49.9	19.6	22.0	23.1	60.7	72.7	70.5
Vehari	26.2	22.2	36.8	49.4	23.2	26.0	21.8	32.9	46.1	18.6	27.1	23.1	56.7	66.1	46.5
Okara	25.9	22.1	37.8	49.2	25.0	25.9	21.9	31.3	43.1	18.4	26.2	22.8	58.7	68.2	47.3
Kasur	25.9	21.9	36.2	47.6	23.4	25.5	21.6	32.1	44.7	18.1	26.9	22.8	49.4	57.2	40.6
Bahawalpur	25.1	21.1	35.0	44.5	23.9	24.8	20.6	26.3	36.4	15.1	25.9	21.9	57.0	65.3	47.1
Muzaffargarh	23.6	19.5	28.4	41.0	14.8	23.1	19.2	24.1	36.9	10.0	25.9	21.9	55.5	64.8	44.9
Sargodha	26.9	22.5	46.3	59.2	32.7	26.6	22.0	39.1	53.7	23.7	27.8	23.5	64.2	72.3	55.3
Sialkot	26.6	22.9	58.9	65.9	51.5	26.3	22.5	53.8	61.9	45.5	27.3	23.7	72.3	75.9	68.2
Jhang	26.5	22.0	37.1	51.5	21.4	26.3	21.7	30.7	46.7	13.4	27.3	22.9	57.5	66.8	47.3
Multan	25.7	21.6	43.4	53.3	32.3	24.7	20.4	29.5	41.6	16.2	26.9	22.9	60.9	67.5	53.2
R. Y. Khan	25.0	20.9	33.1	43.4	21.8	24.7	20.5	26.9	37.9	14.9	26.2	22.3	57.0	64.9	48.4
Sheikhupura	26.3	22.2	43.8	53.3	33.3	26.1	22.0	38.8	49.3	27.2	26.8	22.8	57.6	64.3	50.1
Rawalpindi	27.9	23.5	70.4	81.2	59.2	27.9	22.2	63.9	79.9	49.0	27.9	23.8	76.0	82.2	68.8
Gujranwala	26.5	22.7	56.5	63.6	48.8	25.9	22.2	48.6	57.9	38.9	26.9	23.1	63.9	68.8	58.6
Faisalabad	26.6	23.0	52.0	61.0	42.2	27.2	22.7	42.5	53.8	30.3	27.4	23.4	64.2	69.8	57.9
Lahore	27.5	23.1	64.6	69.0	59.7	25.6	21.5	41.7	50.3	31.7	27.8	23.3	69.1	72.7	65.1
Punjab	26.4	22.5	46.6	57.2	35.1	25.9	21.8	37.9	50.4	24.8	27.3	23.2	46.7	70.9	57.2

V1= Male singulate mean age at marriage, V2= Female singulate mean age at marriage, V3= Literacy ratio for both sexes, V4= Male literacy ratio, V5= Female literacy ratio.

Furthermore, the education deprivation index (EDI) which is believed to be a better indicator of the educational facilities as well as of the attitude of the people towards education (Naeem, 2003; UNDP, 1998), has also been computed from census data. It is below 30 in only 4 districts, between 30 and 50 in 19 districts, and at a very high level of 50 and above in 11 districts. It is highest in Jehlum, Bahawalpur, Rajanpur and Lodhran and lowest in Lahore (table 4). The higher index value indicates the lack of educational facilities and poor interest of people in education and vice versa. The index for the province as well as for the districts generally indicates a fairly high proportion of population, deprived of educational

opportunities. The general trend in the province is that the districts having high proportion of population, deprived of educational facilities show relatively higher rate of fertility (table 4) and there is a significant appositive relationship between EDI and fertility.

Relationship between Literacy, Age at Marriage and Fertility

Table 9 displays the minimum and maximum values, univariate descriptives like mean, median and standard deviations of fertility variables literacy and age at marriage. Correlation coefficients of these variables and fertility measured for all the rural and urban areas of the districts of Punjab are also given. The results show considerable spatial variations in the determinants of fertility. The large number of observations (34 districts), however, raised the test power giving significance to most of the correlations. All the variables have shown highly significant correlation with fertility. They appeared to be strongly associated with fertility at 1% level of significance ($p < 0.01$). The correlation matrix (table 10) shows that except male singulate mean age at marriage and literacy ratio that have shown weaker rapport, all other fertility variables are strongly correlated with each other also.

Table 9

Results of Univariate Descriptives and Pearson's Correlation Coefficients (N=34 districts)

Variables of fertility	Minimum	Maximum	Mean	Median	Std. Deviation	Correlation Coefficients	
						CWR	TFR
All Areas							
V1	23.50	27.90	26.25	26.45	1.10	-0.94**	-0.82**
V2	19.30	23.50	22.08	22.35	1.19	-0.89**	-0.83**
V3	20.70	70.40	44.10	41.75	11.98	-0.80**	-0.73**
V4	29.20	81.20	56.27	54.15	11.63	-0.86**	-0.78**
V5	11.30	59.70	31.34	26.90	13.02	-0.72**	-0.63**
Rural Areas							
V1	22.90	27.90	25.97	26.10	1.22	-0.88**	-
V2	18.70	27.20	21.93	22.10	1.49	-0.59**	-
V3	15.50	63.90	38.18	36.10	11.22	-0.66**	-
V4	23.50	79.90	51.42	49.90	12.29	-0.73**	-
V5	6.30	49.00	24.44	19.25	11.69	-0.55**	-
Urban Areas							
V1	22.0	28.3	26.92	27.15	1.09	-0.46**	-
V2	21.6	24.1	23.08	23.10	.64	-0.73**	-
V3	47.7	77.2	61.33	60.80	7.63	-0.80**	-
V4	57.2	84.8	69.85	69.05	6.71	-0.79**	-
V5	35.0	70.5	52.65	52.35	9.86	-0.69**	-

**Correlation is significant at 0.01 level. The correlation coefficient of CWR & TFR is 0.899.

V1= Male singulate mean age at marriage, V2= Female singulate mean age at marriage, V3= Literacy ratio for both sexes, V4= Male literacy ratio, V5= Female literacy ratio.

Table 10
Correlation Matrix of Fertility Variables

	All areas				Rural areas				Urban areas			
	V1	**V2**	**V3**	**V4**	**V1**	**V2**	**V3**	**V4**	**V1**	**V2**	**V3**	**V4**
V2	.92**				.73**				.53**			
V3	.76**	.71**			.76**	.48**			.33	.69**		
V4	.81**	.74**	.95**		.79**	.50**	.96**		.27	.68**	.93**	
V5	.68**	.66**	.97**	.86**	.68**	.41*	.97**	.87**	.03	.62**	.91**	.80**

*Correlation is significant at 0.05 level. **Correlation is significant at 0.01 level.

V1= Male singulate mean age at marriage, V2= Female singulate mean age at marriage, V3= Literacy ratio for both sexes, V4= Male literacy ratio, V5= Female literacy ratio.

Enormous variations are found in the literacy level of the districts of province. For example, literacy ratio of both sexes varies from 20.7 in Rajanpur to 70.4 in Rawalpindi for all areas, from 15.47 in Rajanpur to 63.94 in Rawalpindi for rural areas and from 47.66 in Lodhran to 77.21 in Jejlum. Having mean value 44.1, 38.20 & 61.33 and standard deviation 11.98, 11.23 & 7.63 for all the areas, rural and urban areas respectively, shows highly significant inverse correlation with fertility. Male LR varies from 29.2 again in Rajanpur to 81.20 in Rawalpindi for all areas from 23.55 in Rajanpur to 79.86 in Rawalpindi for rural areas and from 57.20 in Kasur to 84.85 in Jehlum for urban areas. Having mean value 56.27, 51.43 and 69.87 and standard deviation 11.63, 12.29 and 6.71 for all the rural and urban areas respectively, shows highly significant inverse correlation with fertility. Female LR varies from 11.3 in Rajanpur to 59.7 in Lahore (and 59.2 in Rawalpindi) for all areas from 6.26 in Rajanpur to 49.02 in Rawalpindi for rural areas and from 35.05 in Lodhran to 70.55 in Khanewal for urban areas. Having mean value 31.34, 24.44 and 52.66 and standard deviation 13.02, 11.70 and 9.86 for all areas, rural and urban respectively, shows highly significant inverse correlation with fertility.

Highly significant inverse correlation between LR and fertility indicates that fertility tends to decrease as LR increases. The analysis of data at the district level clearly indicates the negative impact of literacy on fertility. For example, overall LR and female LR as well is the highest, i.e., above 50 in Rawalpindi, Lahore, Jehlum, Gujrat and Sialkot districts (table 8) which show comparatively lower fertility rates and higher female SMAM. On the other hand, in those districts where female LR is the lowest (i.e., below 20 in Rajanpur, Muzaffargarh, Lodhran, Bhakkar and D. G. Khan), the fertility rate is the highest and female SMAM is the lowest among the districts of Punjab (Tables 4 & 8). In most of the districts, overall LR in general and female LR in particular, is very low. This can be attributed to the low status of women and low investment in the education of daughters that in turn results in low age marriages, early start of childbearing and

consequently high fertility. However, as a result of literacy encouraging policies of the government, currently more people are being enrolled in schools. This welcome trend is likely to affect health and fertility because literate women want smaller families and are more likely to use contraception than their illiterate counterparts. Furthermore, literate women are more cognizant about their family size, as compared to illiterates they have stronger desire to serve better life. In order to meet this aspiration, they tend to have smaller healthier families.

Literacy ratio influences fertility evidently through its impact on age at marriage. It causes the rise in SMAM and consequently, puts bearings on fertility. The societies like Punjab that are characterized by a low age at marriage exhibit high fertility, implying an inverse relationship between age at marriage and fertility. This factor of paramount importance operates, though the duration of exposed fecund period. Late female age at marriage implies delayed initiation of child bearing and there by reducing the overall duration of fecund period. Therefore, in the absence of other intervening factors, age at marriage, explains most of the variation in fertility. A marked positive relationship between literacy ratio and SMAM and a marked inverse relationship between SMAM and fertility is evident from the findings of the study. Therefore, a rise in literacy ratio may cause rise in SMAM and can contribute, of course, positively to the fertility transition.

Male SMAM with mean values 26.25, 25.99 & 26.93, and standard deviation 1.10, 1.21 & 1.08 for all the rural and urban areas respectively show highly significant inverse correlation with fertility. It also shows highly significant positive correlation with the female SMAM and LR.

Female SMAM for all areas with mean, median and standard deviation values 22.08, 22.35 & 1.19 respectively, varies from 19.3 in D. G. Khan and Rajanpur to 23.5 in Rawalpindi. For rural areas with mean, median and standard deviation values 21.94, 22.13 & 1.49 respectively, it varies from 18.67 in D. G. Khan to 27.22 in Khanewal. For urban areas having mean, median and standard deviation values 23.09, 23.10 & 0.63 respectively, it varies from 21.57 in Rajanpur to 24.15 in Sahiwal. Highly significant inverse relationship of female SMAM with fertility is evident from the study. It shows highly significant negative correlation with EDI and highly significant positive correlation with LR. This type of relationship of SMAM with LR clearly points out that SMAM is lower among those who are mostly illiterate. Consequently, their fertility rate is also high. On the other hand, among literate, an economically comfortable populations SMAM is relatively higher affecting fertility inversely.

Furthermore, by examining district level data, it reveals that in the districts where female SMAM is lower, fertility rates are significantly high. For example, female SMAM is lowest for Rajanpur (19.3), Layyah (19.5), D.G. Khan (19.3) and Muzaffargarh (19.5) districts (table 8). In these districts, CWR is highest among the districts of Punjab which is 892.60, 736.54, 874.20 and 839.04 respectively (table 4). TFR is also highest in these districts which is 5.7, 5.8, 5.5 and 5.5

respectively, higher than national (4.8) and provincial (4.7) level (NIPS, 2001). All these districts are attributed to low level of literacy as well. On the other hand, in those districts where female SMAM is the highest, i.e., above 23 such as Khushab, Jehlum, Chakwal, T. T. Singh, Sahiwal, Rawalpindi, Faisalabad and Lahore (table 8), the CWR is the lowest i.e. below 600 (table 4). The highest female SMAM (23.5) and lowest CWR (501.04) have been recorded for Rawalpindi where literacy ratio is also highest among the districts of Punjab. TFR is also lowest in these districts (NIPS, Pakistan Population Data Sheet, 2001). Almost same trends prevail over the rural as well as urban areas of the region (table 4). The link between female literacy ratio and SMAM leads to the conclusion that SMAM can be raised by improving LR which in turn can contribute significantly in fertility reduction. Nonetheless, in the context of Punjab, an important associated factor for this to happen is the change in socio-cultural norms and without this most of the efforts to reduce fertility at micro level may prove worthless jumble.

To sum up, the study reveals that literacy, age at marriage and fertility are strongly associated to each other. In Punjab, where the society is believed to be male dominating, male LR and male SMAM are also strongly associated to fertility. This finding refutes the previously existing notion that only female LR and female SMAM are important as regards to fertility.

Conclusion

Punjab is one of the world's most densely populated and rapidly growing regions where fertility rate is also high. Many factors control the fertility rate and population growth process in the region. Literacy rate and age at marriage among them are the key factors. The study concludes that there is a clear cut inverse relationship between literacy ratio and fertility and between the age at marriage and fertility in Punjab. Besides female LR and SMAM, male LR and SMAM are also revealed important determinants of fertility in Punjab. Literacy ratio and age at marriage are positively associated with each other. This suggests that there is a strong interaction between literacy, age at marriage and fertility in the region. The impact of literacy on fertility, however, is multifarious and inverse. An increase in literacy ratio may cause a change in the perspicacity level of the people and their attitude towards the family size. It may also cause a rise in age at marriage that in turn may exert depressing impact on fertility by reducing exposed fertile span of fecund females. The study thus suggests, specifically for those working on to constraint fertility that they should focus more on increasing the literacy rate if they truly want to influence the fertility.

References

Ahmed, T. P. (2002). *Factors affecting fertility transition at district level, in Pakistan population stabilization prospects*, 2nd conference proceedings, 31st October- 2nd November 2002 Islamabad, Population Association of Pakistan, Islamabad.

Barclay, G. W. (1958). *Techniques of population analysis*, John Wiley and Sons Inc. New York.

Bhatti, A. F. et al. (2003). *Accelerating fertility transition in Pakistan: A benchmarking analysis for South Asia*, in Population research & policy development in Pakistan, 4th conference proceedings, 9-11 December 2003 Faisalabad, Population Association of Pakistan, Islamabad.

Bongaarts, J. (1987). *The proximate determinants of exceptionally high fertility*, PDR, 13(1),

Population Council, New York.

Bongaarts, J. (1982). *The fertility-inhibiting effects of the intermediate fertility variables*, Studies in family planning, 13(6 & 7), New York.

Bongaarts, J. (1978). *A framework for analyzing the proximate determinants of fertility*, Population and development review, Population Reference Bureau, New York, 4(1).

Bongaarts, J. & Potter, R. G. (1983). *Fertility, biology and behavior: An analysis of the proximate determinants*, Academic Press, New York.

Coale, A. J. (1973). *The demographic transition, in International population conference*, International union for the scientific study of population, Liege, 1 (1).

Davis, K. (1963). *The theory of change and response, in Modern demographic history*, Population index, 4 (29).

Davis, K., & Blake, J. (1956). *Social structure and fertility: An analytical framework*, Economic development and cultural change, 4 (4).

Feeny, G. & Alam, I. (2003). Fertility, population growth and accuracy of census data, *A chapter in Population of Pakistan: An analysis of 1998 population and housing census*, PIDE, Islamabad.

Govt. of Pakistan. (2005). *Economic survey 2004-05, Finance division*, Economic advisor's wing, Islamabad.

Hakim, A. (2000). *Fertility transition and differentials in Pakistan*, in Pakistan's population issues in the 21st century, Conference proceedings, 24-26 October, Karachi, Population Association of Pakistan, Islamabad.

Haupt, A. & Kane, T. T. (1980). *Population hand book*, International edition, Population reference bureau, Inc. Washington DC.

Hijnal, J. (1953). *Age at marriage and proportions marrying*, Population studies 7.

Jones, H. R. (1990). *Population geography*, Second edition, Paul Chapman publishing Ltd. London.

Khan, F. K. (2002). *Pakistan: Geography, economy and people*, Revised edition, Oxford university press, Karachi.

Mahmood, N. (2003). *Literacy and educational attainment in Pakistan*, A chapter in Population of Pakistan: An analysis of 1998 population and housing census, PIDE, Islamabad.

Naeem, J. (2003). *Socio-economic and demographic profile of Punjab*, PIDE, Islamabad.

Newell, C. (1988). *Methods and models in demography*, Belhaven Press, London.

NIPS (National Institute of Population Studies). (2005). *Population growth & its implications*, July 2005, Islamabad.

NIPS. (2001). *Pakistan population data sheet 2001*, Islamabad

Notestein, F. W. (1953). *Economic problems of population change*, Proceedings of the eighth international conference of agricultural economists, Oxford university press, New York.

Population Census Organization (PCO). (2001). *1998 Provincial census report of Punjab*, Islamabad.

Population Census Organization. (1998). *District census reports of Punjab*, Islamabad.
Population Reference Bureau. (2004). *Population bulletin*, (59)1, March 2004, Washington, DC.
Preston, S. H. et al (2001). *Demography-measuring and modeling population processes*, First edition, Blackwell publishers Ltd, Oxford, UK.
Saeed, M. (1986). *Literacy, enrolment and education*, A chapter in a population profile of Pakistan, PCO, Islamabad.
Shrivastava, O. S. (1994). *Demography and population studies*, Revised second edition, Vikas Publishing House Pvt. Ltd. New Delhi.
Shryock, H. S. et al (1976). *Studies in population: The methods and materials of demography*, condensed edition by Edward G. Stockwell, Academic press, Inc. New York.
Sinha, V. C. & Zacharia, E. (1986). *Elements of demography*, Allied publishers private Ltd. New Delhi.
Slade, E. H. (1951). *Census of Pakistan* Report and Table, (1).
Watkins, S. C. (1986). Conclusion, in Coale and Watkins, 1986, *The decline of fertility in Europe*, Princeton university press, Princeton.
Weeks, J. R. (2008). *Population: introduction to concepts and issues*, Tenth edition, Wadsworth publishing company, California.
Weeks, J. R. (1986). *Population: An introduction to concepts and issues*, Third edition, Wadsworth publishing company, California.

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