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Stover's Augmented Proximate Determinants of Fertility: A Regional Analysis In Pakistan

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Abstract

The significant drop in fertility levels is a recognized fact in Pakistan, however; regional disparities are yet observed, that is conditioned to ruling unequal growth of regions and its consequence in local demographic condition. The current study emphasizes regional appraisal of direct determinants of fertility reduction, as a means for the quality understanding of the projected population problems. Stover augmented model (1998) is being employed to analyze the effects of sexual activity, contraception, induced abortion, post-partum infertility, and secondary sterility on different fertility levels, using three data sets of Pakistan Demographic and Health Surveys, 1990-91, 2006-07 and 2012-13. In the early '90s, secondary sterility showed higher inhibiting effects but afterward; its value increased gradually, putting lesser weight on fertility levels. Sexual activity and post-partum infertility came out as other highly contributing factors whereas, contraception and induced abortion; though increased over time comparatively showed less influence on fertility drop. The study suggests that in prevailing orthodoxy Muslim society; free dialogues on women's reproductive health and family planning should be supported via government movement. Furthermore; for directing and promoting population cut spouses should give the confidence to go for sterilization after reaching the preferred family size.

Keywords: *Total Fertility Rate, Proximate determinants of fertility, Stover's augmented fertility model (1998), Regional disparities, Pakistan*

JEL Classification*: J10, J11, J12, J13*

INTRODUCTION

Fertility can be defined in various ways; in medical terminology, it describes as a capability of a woman to conceive and have children, the capability to get pregnant through regular sexual

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activity (Medicine Net.com, 2010). Demographers define fertility as an output of reproduction instead of the capability to have children. Sometimes, terms of fertility, fecundity, and fecundability are often used mutually in demographic studies. Fecundity is the physiological ability of women to have children that appears normally, during menarche (beginning of menstruation cycle) and menopause (ending of menstruation cycle). Fecundability is a possibility to conceive that depends upon the pattern of intercourse and the precautionary conduct of pregnancy (Frank, 2008). Fertility has been thought for many years, the main essential determinant of demographic transition, even though during modern timings, there was an extensive propensity to reduce its levels, yet obvious regional dissimilarities exist; the latter has related to improving the demographic change and eventually asymmetric socio-economic progress, which is widespread in Pakistan. The abovementioned asymmetric fertility levels are also due to the diverse techniques of reproduction control, a theme which has provoked the understanding of the current study, intended to highlight the aspects that condition the geographic disparities of this essential determinant of demographic change. In the 1990s, Pakistan's rank was 9th amongst the heavily populated countries, with a total population of 106.070 million which increased to 182.1 million in 2013 to 201.066 million in 2018 the 6th Global Rank (Worldometers, 2018). Paying consideration to the ascribed subject, the regions; for example, Islamabad, where high socio-economic and demographic progress is noticed, fertility levels are lower (3 children per woman) and larger contraceptive prevalence (59.4%), a somewhat lower condition in other regions, mainly in Balochistan (19.5%). Sexuality plays an exceptional role in appearing fertility levels at younger ages, while, induced abortion exercise contributes to reducing fertility, largely in Islamabad, on contrary to postpartum infertility, which has comparatively more significance for Khyber-Pakhtunkhwa and Sindh regions (PDHS, 2012-13). To support the presented declarations, there are determinants of the so-called Proximate determinants of fertility (PDs); we attempted to study how contraception, sexual activity, post-partum infertility (lactation) along with induced abortion affect women's fertility regulation, to let evaluating the factors, conditioned on fertility levels, among all considered regions. The development of the stated study is very appealing, as it provides efficient and consistent fundamentals regarding the conditioners of demographics that cause variations in fertility levels. For attaining the aforesaid statements, subsequent objectives are set: firstly, studying how sexual activity, contraception use, postpartum in fecundability along with induced abortion has controlled the sign of fertility level, presently. Secondly, evaluating, the determinants which condition fertility levels in different regions, with a diverse degree of development in the demographic change. Thirdly, apply in Pakistan and its regions, in line through a transformation that has been happening inside them, the latest methodology of PDs of fertility.

LITERATURE REVIEW

Dynamics of fertility and the mainly broad propensity of the drop in its levels have been enlightened through diverse theories, the theory of demographic transition (González et al. , 2007) is discernible, and it suggests relating fertility decline with the modernized procedure, conditioner of the change in the social prospect of women and regulation of ideal family size. More broadly, fertility drop has been acknowledged in Pakistan in a slow manner (Sathar and Casterline, 1998). Nevertheless, by the uneven pace at countrywide, according to some social, economic, cultural, and environmental uniqueness of diverse demographical clusters, living in various regions, a propensity which harmonizes by the statement of assumed theory; even so,

it is multifaceted to specify how socio-economic along with environmental factors, convincing regional dissimilarities between the fertility levels. For transcending these restrictions, it is required to examine through other factors through which growth workout its effect on each PD.

Amongst the classical researchers, Davis and Blake (1956), proposed a theoretical representation of different variables that worked directly upon fertility levels. In any society, the fertility level is directly affected through a set of some variables, the intermediate variable. They grouped them into three key categories; intercourse, conception, and gestation variables, and recognized a mechanism through which some socio-economic, cultural, and human behaviour co-operate (indirect) with the biological (direct) determinants of fertility. Though, the framework did not present a proper mechanism for quantitative analysis. As a requisite precursor to examining the intermediate variables that acquire a pertinent position in the regulation of fertility are seen in Bongaarts (1978) work, where, differences in the levels of fertility, attributed to marriage, contraceptive practice, induced abortion along with postpartum infertility (amenorrhea) and sterility are enlightened. In the Bongaarts criterion, each factor contributes inhibiting effects (both at major and minor scale) on fertility, thus, this could be lesser as compared to its possible level, in relation to how a woman acts beside her reproductive existence previous to these four factors. If a woman remained on having sexual association throughout her fertile phase, never practiced contraceptives, never exposed to pregnancy plus never gone through amenorrhea, she would has total fertility of 13 to 17 or a hypothetical mean value (15.2 children) set by Bongaarts (1978) or 20 by Stover (1998), however; as these determinants emerged in a larger or smaller extent in woman, fertility level, truly examined has differences. Bongaarts (1978) proposed factors have obtained a few modifications, regulating them in harmony with the framework wherever they will be exercised. This model has proved better at discerning inter-population variation, thus, simple to use with aggregate data and did very well in recognizing the constituents of fertility differentials. Bongaarts and Potter (1983) used data sets of 41 developed and developing countries; found that 96% of disparities infertility can be expounded by five main PDs. They suggested an age-specific version of PD, broadly practiced infertility analysis due to its flexibility for assessing the quantitative effect of PDs. Bongaart's primary formulation (1978) has been extensively used (APPRC, 1998; Jolly and Gribble, 1993; Cleland and Chidambaram, 1981, Casterline, 1983; Kalule-Sabiti, 1984) and broadly defended (Hobcraft and Little, 1984; Palloni, 1984; Stover 1998). Bongaarts immense power is its simple application through generally existing data to decompose the contribution of every intermediate variable chosen on the current fertility levels over time and across regions. However, a few weak points of the model have been recognized and documented (Wood, 1994; Reinis, 1992; Stover, 1998). Earlier research work ascribed the decline in fertility primarily due to the increased contraceptives practice, postpartum in fecundability, and late or non-marriage (NCPD, 1989; Cross, et al., 1991; Brass and Jolly, 1993; Macrae, et al. 2001; Blacker, 2002). De Bruijn (2006) elucidated that proximate determinant either affects the exposure to intercourse or the exposure to conception, gestation, and healthy childbirth. This resulted in a simple as well as an influential model which is used for analyzing the fertility changes over time. From the Bongaarts original model (1978), Stover (1998) has supplemented fundamentals building modifications to that model, which are well thought-out in this study. Awes (2014) also measured that Stover's model of fertility has been used in hundreds of analyses therefore influencing significantly the collection and reporting of data which is correlated to fertility. The model is also used in many demographic studies for recognizing, classifying, and analyzing the

key factors responsible for fertility changes all over the world.

DATA AND EMPIRICAL METHODOLOGY

The study applied Stover's augmented fertility model (1998), using three data sets of Pakistan Demographic and Health Surveys (PDHS) 1990-91, 2006-07, and 2012-13. Quantitative indices are computed first for rural and urban residences, separately and then further classified into the regions of Sindh, Punjab, Khyber-Pakhtunkhwa, Balochistan, Gilgit Baltistan, and Islamabad. For attaining better clearness in examining how women control their fertility in the considered regions, manners of every intermediate variable that conditioned distinction among fertility levels, are examined ahead.

Measurement of Proximate Determinants of Fertility

Sheikh (2019) explained the proposed Bongaarts model (1978), TFR is expressed as the product of five principal PDs of fertility i.e. marriage, contraception, induced abortion, postpartum Infecundability, and primary sterility. Based on these five indices, following the multiplicative model of fertility is expressed as;

$$TFR=C_m \times C_c \times C_a \times C_i \times C_p \times TF \ldots (A)$$

Where;

TFR	*Bongaarts Total Fertility Rate*
C_m	*Marriage*
C_c	*Contraception*
C_a	*Induced abortion*
C_i	*Post-partum Infecundability*
C_p	*Primary Sterility*
TF	*Total Fecundity*

All indices can obtain the values between 0 and 1. If no fertility inhibiting effect of a known proximate variable is determined, the index takes the value equals to 1 and when the fertility inhibiting effect is completed; the index takes the value 0. Hence, closer the index to 1, the inhibiting effect of fertility would be smaller. TF is the natural capability of a woman to reproduce and Fecundity Rate represents mean the number of children anticipated by a woman. Therefore, TF is a hypothetical value of TFR among women where every inhibiting effect of PDs is missing. So, $C_m = C_c = C_a = C_i = C_p = 1$

Stover (1998) recommended modifications in the Bongaarts model by considering the indices of sexual activity, contraception, induced abortion, post-partum infertility, and secondary sterility. After modification of all indices, Stover's augmented model of TFR is now written as;

$$TFR^*=C_x^* \times C_c^* \times C_a^* \times C_i^* \times C_s^* \times PF \ldots (B)$$

Where;

*TFR**	*Stover's Total Fertility Rate*
C_x^*	*Augmented Sexual Activity Index*
C_c^*	*Augmented Contraceptive use Index*

C_a^* *Augmented Induced Abortion Index*
C_i^* *Augmented Post-partum Infertility Index*
C_s^* *Augmented Secondary Sterility Index*
PF *Potential Fecundity*

PF measures the fertility in a population if all women were fertile until the end of menstruation, while, TF captures the population, where specific sterility is measured by sterility. According to TFR* model, PF is defined as TFR for women who are sexually active and fecund for the entire period and who never breastfed, experience postpartum abstinence never practiced any contraception. The other way to estimate PF is to start with actual fertility and remove the effects of all PDs.

Augmented Index of Sexual Activity (C_x^*)

Stover argued that the index of sexual activity represents women's percentage, remained sexually active in the last four weeks and who are not now sexually active but are presently pregnant or abstaining postpartum (Postpartum abstinence is the escaping of sexual association between spouses after childbirth) should be used in place of the proportion of married women. So, C_x^* can be as follows;

$$C_x^*=S\ldots(1)$$

Where;

S Percentage of sexually active women, who remained sexually active in the last 4 weeks/ pregnant or abstaining postpartum

Augmented Index of Contraception (C_c^*)

Reinis (1992) and Stover (1998) strongly argued the hypothesis that only fertile/fecund women use contraceptives. They also argued about women who reached the age of 45-49 years already enter into the phase of natural infecundity that might lead to the overlapping between contraception and infecundity. Bongaarts and Potter (1983) recognized the dilemma that several women, at older motherhood, practicing sterilization, and other lasting methods of birth control are expected to be infecund. This dilemma of infecund women being sterilized, resolved by including the sterility index (C_s^*) to Stover's model. Hence, a modification is made to remove all sterile/infecund women from the contraception index, these women are now incorporated in (C_s^*). Therefore, when the index of (C_s^*) is included in the model (B), sterility correction factor of 1.08 is no more required. The augmented index of contraception (C_s^*)can now be calculated as;

$$C_c^*=1-u^*e\ldots(2)$$

If the calculated value is 1, indicates the complete lack of contraception and 0 when every fecund woman uses effectual contraception technique.

Augmented Index of Induced Abortion (C_a^*)

Stover proposed another modification to the abortion index by multiplying 'u' to 'e' so that the percentage of women prevented by contraceptive technology can be calculated as follows;

$$C_a^* = \frac{TFR}{TFR+0.4(1+u\times e)\times TAR} \quad \ldots (3)$$

If the calculated value of C_a^* equals 1 represents a lack of induced abortions and 0 symbolizes every childbirth is aborted.

Augmented Index of Post-partum Infertility (C_i^*)

One more modification has been carried out by dividing the women who are in their reproductive period into two groups; women who breastfed and never breastfed their children, respectively. The augmented index of post-partum infertility C_i^* has calculated as C_i^1 and C_i^2 representing the women who breastfed and never breastfed their children, respectively, and estimates areas;

$$C_i^1 = \frac{20}{18.5 + i^1} \quad \ldots.(4)$$

$$C_i^2 = \frac{20}{18.5 + i^2} \quad \ldots.(5)$$

Here, i^1 and i^2 are the mean duration of postpartum amenorrhea of women who have breastfed and never breastfed their children, respectively. Let ψ be the percentage of women who breastfed their children and $(1-\psi)$ be the percentage of women who never breastfed their children. Thus, (C_i^*) can be represented as;

$$C_i^* = \psi^* C_i^1 + (1- \psi^*) C_i^2 \ldots (6)$$

Augmented Index of Secondary Sterility (C_s^*)

Stover's modification has been performed by considering the women (aged 45-49) without births are regarded as sterile. In this method, all women whose age is less than 45 and not having any birth are excluded or they are not considered as sterile unless they reach up to age 45 years. The C_s^* being anticipated using data on women's proportion gave no births during the past 5 years and on no account of any contraceptive method. This percentage is then measured as 'f' and the index can be calculated as;

$$C_s^* = 1-f \ldots (7)$$

$$f = f_1 + f_2$$

f_1 = Proportion of women (aged 45-49), gave no live birth during the past 5 years

f_2 = Proportion of women (aged 45-49), never practiced some contraceptive method

ndex C_s^* expresses the total effect of infecundity upon fertility and the value 0 shows when all sexually active women are infecund and value 1 (no fertility inhibiting effect) if all sexually active women found fertile/fecund.

RESULTS AND DISCUSSIONS

Descriptive Statistics

The referred propensity to fertility drop, for the entire nation, is apparent for all measured regions, though; decline paces and fertility levels have obvious dissimilarities. The rural woman carries on having children, somewhat more than four, generally, as compared to urban women. The significance of each PD in elucidating the decrease in observed fertility levels depends upon delineation amid these determinants to the degree upon which fertility levels respond to them. The detailed descriptive statistics of all variables and percentage distribution with reference to the mean number of children per woman by some regions and residence are given in Table 1. The estimated fertility remained significantly higher in rural regions (4.23 to 3.84 births) compared to urban areas (4.04 to 3.55 births). The perseverance of a difference in the number of children between urban and rural women is perhaps owing to aspects linked with urbanization, for example, advanced level of education, the elevated position of women, easy and enhanced access to reproductive health-related programs, and family planning knowledge and services as well as older aged marriages. Among all regions, fertility had remarkably declined over time, though differences are relatively small; Punjab (4.05 to 3.52 children), Sindh (4.33 to 3.63 births), Khyber Pakhtunkhwa (4.15 to 3.69 children), Balochistan (3.98 to 4.16 births), Gilgit Baltistan (4.22 children) and Islamabad (3.12 children). Figure 1 signified that fertility remained highest in Balochistan Province (least developed region) and lowest in Sindh, Punjab, and Islamabad (highly developed regions).

Table 1: Descriptive statistics and Mean number of children by residence and regions in Pakistan, 1990-2013

Variables	1990-91				2006-07				2012-13			
Fertility	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
Pakistan	*4.14*	*2.951*	*0*	*16*	*3.90*	*2.883*	*0*	*16*	*3.71*	*2.740*	*0*	*19*
Place of Residence												
Rural	*4.23*	*2.976*	*0*	*16*	*3.98*	*2.989*	*0*	*16*	*3.84*	*2.830*	*0*	*19*
Urban	*4.04*	*2.925*	*0*	*16*	*3.77*	*2.700*	*0*	*15*	*3.55*	*2.625*	*0*	*16*
Regions												
Sindh	*4.33*	*3.005*	*0*	*16*	*3.90*	*2.988*	*0*	*16*	*3.63*	*2.843*	*0*	*16*
Punjab	*4.05*	*2.898*	*0*	*13*	*3.82*	*2.747*	*0*	*15*	*3.52*	*2.622*	*0*	*16*
Khyber Pakhtunkhwa	*4.15*	*2.977*	*0*	*16*	*4.09*	*2.967*	*0*	*15*	*3.69*	*2.646*	*0*	*13*
Balochistan	*3.98*	*2.914*	*0*	*15*	*3.84*	*2.972*	*0*	*16*	*4.16*	*3.033*	*0*	*19*
Gilgit Baltistan	---	---	---	---	---	---	---	---	*4.22*	*2.853*	*0*	*15*
Islamabad	---	---	---	---	---	---	---	---	*3.12*	*2.038*	*0*	*11*
Total	**6611**				**10023**				**13558**			

Source: PDHS data (2012-13)

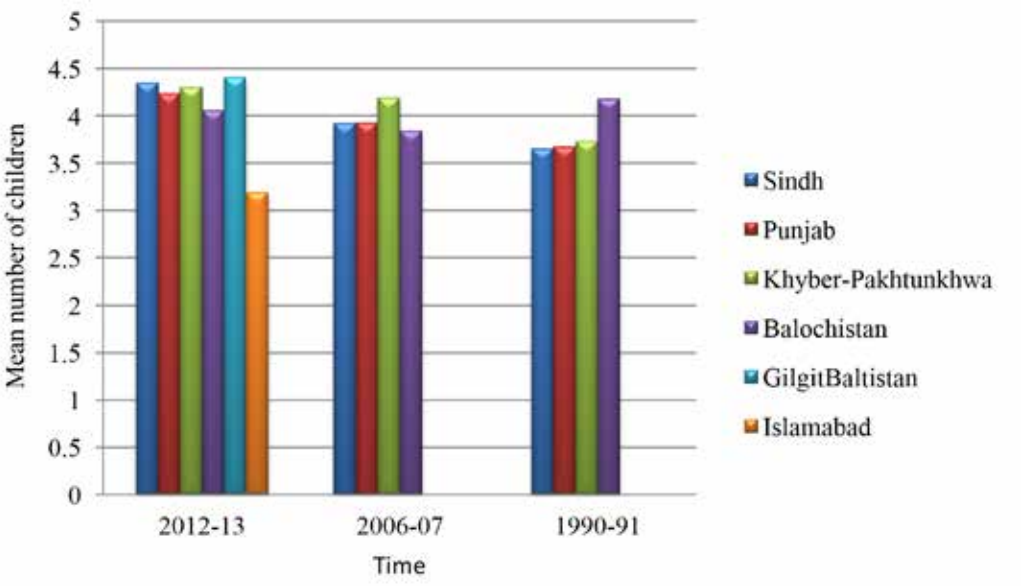

Figure 1: Mean number of children by different regions of Pakistan, 1990-2013

Nuptiality or Sexual Activity

Nuptiality or marriage rate is thought to be an intricate phenomenon. It depends upon some demographic aspects, cultural and community significance as well as the prospect of different clusters of people (Ojeda, 1993). It has been measured to influence the levels of fertility; therefore, the marital status, age at the first union, additionally; to the determination of husband and wife's interaction, is associated with the sexual activity index of demographic change. In Pakistan, ceremonial marriage still has the most significant role in starting the family unit. Being married, both legally and religiously, are general, which turns out to be more obvious as the woman becomes older. Table 2 shows that at the regional level, no considerable dissimilarities about the common behavior formally differentiated. Among women (age cohorts of 15-19, 20-34), it is worth observing the greater percentage of women who are previously in a stable association with spouses (married women, currently living with spouses) than married women, currently living somewhere else, this designates the incidence of a prototype of early marriages or nuptiality in more customary societies using a smaller degree of development (PDHS, 2012-13). The initial beginning of nuptials or unions is linked to bigger revelation to pregnancy hazard, therefore, larger fertility. The young age at first marriage happens in almost all regions, above 19 years of median age at first marriage, and in contrast, in Islamabad, the woman starts conjugal relationships about three years afterward (Table 3). Generally, new modes of cohabitation are starting to emerge; therefore, there are additional nativities of exterior traditional unions. It is thought that sexual activity earlier than matrimony or agreed to monger is becoming extensive and it is happening all over the world, economic reformation, and social disparities' circumstance, which involves being taken into description while carrying out such estimation (García and Rojas, 2002). In connection to the aforesaid, the commencement of first cohabitation (sexual interaction) occurs considerably at younger ages as compared to first marriage, which is mainly disreputable in the Islamabad region where the time gap between age at the first cohabitation and first marriage is 1.7 years.

Table 2: Percentage distribution of married women with different age cohorts and couple's relationships

Geographic Stratums	Women's age cohorts (years)	Married women	Couple relationship	No couple relationship
	15-19	*4.3*	*4.2*	*5.4*
Pakistan	*20-34*	*54.2*	*53.3*	*61.6*
	35-49	*41.5*	*42.5*	*33.0*
Place of Residence				
	15-19	*3.5*	*3.4*	*4.7*
Urban	*20-34*	*52.0*	*51.3*	*60.7*
	35-49	*44.5*	*45.3*	*34.5*
	15-19	*5.0*	*4.9*	*5.6*
Rural	*20-34*	*56.2*	*55.1*	*62.0*
	35-49	*38.8*	*39.9*	*32.3*
Regions				
	15-19	*3.9*	*3.6*	*5.3*
Punjab	*20-34*	*54.9*	*53.1*	*65.7*
	35-49	*41.2*	*43.3*	*29.0*
	15-19	*4.6*	*4.5*	*5.9*
Sindh	*20-34*	*54.9*	*54.7*	*58.1*
	35-49	*40.5*	*40.8*	*36.0*
	15-19	*5.7*	*5.8*	*5.4*
Khyber Pakhtunkhwa	*20-34*	*52.8*	*51.5*	*57.0*
	35-49	*41.5*	*42.6*	*37.5*
	15-19	*3.6*	*3.5*	*13.0*
Balochistan	*20-34*	*57.6*	*57.7*	*47.8*
	35-49	*38.8*	*38.8*	*39.1*
	15-19	*1.7*	*1.9*	---
Islamabad	*20-34*	*50.1*	*48.5*	*69.8*
	35-49	*48.2*	*49.6*	*30.2*
	15-19	*4.9*	*4.8*	*5.8*
Gilgit Baltistan	*20-34*	*51.8*	*49.9*	*65.9*
	35-49	*43.3*	*45.3*	*28.3*

Source: PDHS data (2012-13)

For other regions, the starting of sexual activity leads one year and six months to marriage. In this way, sexual activity has to turn out to be a significant determinant in pregnancy disclosure and discussed fertility levels. While applying the preferred technique to proximate determinants, it is likely to happen that the reducing effect of sexual activity on fertility diminishes; which understands all-woman infertile ages, at the level where single women would be sexually active, thus, it is probable to believe that the adjustment offered by Stover presents in a more accurate model to compute the revelation to pregnancy hazard.

Table 3: The mean and median age of women (25-49 years) at first marriage and first cohabitation (sexual interaction)

Geographic Stratums	Mean age at first marriage	Median age at first marriage	Median age at first cohabitation
Pakistan	*18.85*	*19.5*	*18.0*
Place of Residence			
Urban	*19.41*	*20.7*	*19.0*
Rural	*18.36*	*18.8*	*18.0*
Regions			
Punjab	*19.51*	*20.0*	*19.0*
Sindh	*18.79*	*18.8*	*18.0*
Khyber Pakhtunkhwa	*18.49*	*18.9*	*18.0*
Balochistan	*18.15*	*18.5*	*18.0*
Islamabad	*20.84*	*22.7*	*21.0*
Gilgit Baltistan	*17.31*	*17.7*	*17.0*

Source: PDHS data (2012-13)

Table 4: Percent distribution of married women, who found sexually active throughout the last four weeks

Geographic Stratums	Timing of last sexual intercourse (%)
Pakistan	*70.1*
Place of Residence	
Urban	*72.3*
Rural	*68.9*
Regions	
Punjab	*65.7*
Sindh	*78.2*
Khyber Pakhtunkhwa	*70.0*
Balochistan	*83.5*
Islamabad	*76.1*
Gilgit Baltistan	*72.7*

Source: PDHS data (2012-13)

Table 4 represents the percentage of married women, remained sexually active (last four weeks) displayed no steady prototype with the period of the marital union, till it starts decreasing between those married twenty or elder years. Nationwide, it can be noticed that around 70% of women have the most recent sexual intercourse during the last month. Statistics also reveal a distinction of 3 percent (72.3% versus 68.9%) between urban and rural women who are sexually active throughout the last 4 weeks. Great differences concerning the last sexual activity (duration) are also observed amongst all regions. The percentage of women, found sexually active, varied from 65.7% in Punjab to 83.5% in Balochistan due to early marriages (18 years).

Contraception

In Pakistan, the contraceptive practice became speedily widespread after the 1990s, when

Population Welfare Division granted a position as a developed department, generally, due to changes in population policies and family planning programs. In the middle of 1950, the Family Planning Association of Pakistan and accompanied voluntary organizations initiated the family planning activities and were widened through the health infrastructure between 1960 and 1965. An autonomous family planning division was found in the public sector during 1965-1970 which was followed by a "continuous motivation system", occupying male and female workers at the union council level. From 1983 to 1988, the role of nongovernmental organizations (NGOs) was institutionalized under an NGO coordinating council, and field activities were planned in the provincial framework. In 1992, the NGO coordinating council put back by National Trust for Population Welfare to reinforce the involvement and taking part in different activities of population welfare. The Village-based Family Planning Worker Program was initiated in 1993 by the Ministry of Population Welfare for boosting program exposure in rural areas. During the period of 2001-2011, a provisional population sector perspective plan was developed to increase family planning exposure and better quality services, dropping infant and maternal mortality rates (MOPW, 2002). In 2010, the Ministry of Population Welfare was decentralized and every task for applying population program activities was shifted to provinces. This has controlled its extensive exercise and set motive, why contraceptives are believed to be one of the key determinants in expedited fertility drop. The commonness of current contraceptive exercise among married women is extensively used and helpful measure for the achievement of family planning programs. Family planning refers to the conscious attempt made by married couples for controlling the number of children through the use of contraceptive methods. Generally, the class of contraceptive methods used also influences the decrease in fertility levels. Any modern methods include female and male sterilization, male condoms, pills, injectable, implants, Intra-Uterine Devices, Lactation Amenorrhea Method, Standard Days Method, and emergency contraception whereas, any traditional methods comprise of rhythm, withdrawal, and folk. Among modern methods, male condoms (8.8%) and female sterilization (8.7%) are used frequently; whereas, withdrawal is the most trendy and accepted (8.5%) traditional method. Trends of contraception methods showed that traditional methods are comparatively narrowly practices, nationwide, as compared to other methods. Table 5 shows that the practice of any contraception method increased from 11.8% to 35.4%, modern methods increased by 9% to 26.1%, and use of traditional methods increased by 2.8% to 9.3%, over the measured period. Urban women are more probable to exercise any contraceptive methods (25.7% to 44.8%) than women in rural areas (5.8% to 30.7%). Urban women practiced nearly 18.7% to 32% more modern methods to control fertility than rural women (4.8% to 23.1%). The traditional methods are also common among urban women i.e. 7.1% to 12.8% than rural women i.e. 1% to 7.6%. The disparities among all regions for using contraception are also obvious. Punjab showed a high percentage about 13% to 40.7, 9.8% to 29%, and 3.2% to 11.7% followed by Khyber Pakhtunkhwa around 8.6% to 28.1%, 7.6% to 19.5%, and 1% to 8.6% of any contraceptives, modern methods and any traditional methods, respectively. Women in Islamabad showed the maximum use of contraception i.e. 59.4%, whilst, women in Balochistan stood for the lowest level of family planning i.e. 19.5% due to prevailing orthodoxy male dominated society.

Induced Abortion

In Pakistan, abortion is unlawful except for medical causes or when the existence of the mother is at risk. Therefore, it is complex to collect precise information regarding the level of induced abortion. PDHS deals with quite a lot of questions regarding miscarriage, abortions,

and stillbirths to count pregnancies which had not ended within live births. Therefore, it is not easy to collect correct information regarding induced abortion. Additionally, induced abortions might be under-reported due to various reasons, including censure by religion (Islam). In such ways, the exercise of circumlocutory techniques to analyze the frequency of this practice becomes crucial, as abortion considerably works as an important determinant of fertility. During1990s, induced abortions have shown negligible impact but afterward; its weight increased steadily on fertility decline. In general, variations in induced abortions are rather small apart from that high percentage of miscarriages take place in Balochistan from 3.3% to 15.2% whereas, Islamabad (3.5%) and Punjab (2.4%) showed high percentages of abortions overtime period (Table 6).

Breastfeeding and post-partum Infecundability

Factors, decrease the risk of another pregnancy, after childbirth are breastfeeding, amenorrhea, and postpartum abstinence; these factors influence the woman's postpartum infertility phase. Breastfeeding infamously reduces the possibility of women's ovulation, particularly after childbirth, intending that amenorrhea may continue till breastfeeding ends. It also offers natural contraception for expanding the postpartum amenorrhea; therefore, ensuring space between births.

Table 5: Percentage distribution of contraception use by different methods

Geographic Stratums	Any method	Any Modern method	Any Traditional method	Not Currently using
Pakistan				
1990-91	*11.8*	*9.0*	*2.8*	*88.2*
2006-07	*29.6*	*21.7*	*7.9*	*70.4*
2012-13	*35.4*	*26.1*	*8.2*	*64.6*
Place of Residence				
Urban				
1990-91	*25.7*	*18.7*	*7.1*	*74.3*
2006-07	*41.1*	*29.9*	*11.2*	*58.9*
2012-13	*44.8*	*32.0*	*12.8*	*55.2*
Rural				
1990-91	*5.8*	*4.8*	*1.0*	*94.2*
2006-07	*23.9*	*17.7*	*6.2*	*76.1*
2012-13	*30.7*	*23.1*	*7.6*	*69.3*
Regions				
Punjab				
1990-91	*13.0*	*9.8*	*3.2*	*87.0*
2006-07	*33.2*	*23.1*	*10.1*	*66.8*
2012-13	*40.7*	*29.0*	*11.7*	*59.3*
Sindh				
1990-91	*12.4*	*9.1*	*3.4*	*87.6*
2006-07	*26.7*	*22.0*	*4.7*	*73.3*
2012-13	*29.5*	*24.5*	*5.0*	*70.5*

Khyber Pakhtunkhwa				
1990-91	*8.6*	*7.6*	*1.0*	*91.4*
2006-07	*24.9*	*18.7*	*6.2*	*75.1*
2012-13	*28.1*	*19.5*	*8.6*	*71.9*
Balochistan				
1990-91	*2.0*	*1.7*	*0.3*	*98.0*
2006-07	*14.4*	*13.4*	*1.0*	*85.6*
2012-13	*19.5*	*16. 3*	*3.1*	*80.5*
Islamabad				
2012-13	*59.4*	*44.1*	*15.4*	*40.6*
Gilgit Baltistan				
2012-13	*33.6*	*28. 2*	*5.4*	*66.4*

Source: PDHS data (1990-91, 2006-07 and 2012-13)

Table 6: Percentage distribution of pregnancy terminations

Geographic Stratums	2006-07			2012-13		
	Stillbirth	**Miscarriage**	**Abortion**	**Stillbirth**	**Miscarriage**	**Abortion**
Pakistan	*2.8*	*8.1*	*1.5*	*2.8*	*12.0*	*1.7*
Place of Residence						
Urban	*3.7*	*8.9*	*1.5*	*1.9*	*12.6*	*2.4*
Rural	*2.2*	*7.7*	*1.6*	*3.2*	*11.8*	*1.4*
Regions						
Punjab	*2.6*	*8.4*	*1.5*	*2.7*	*11.3*	*2.4*
Sindh	*3.8*	*8.4*	*1.5*	*3.0*	*13.3*	*0.7*
Khyber Pakhtunkhwa	*2.6*	*7.6*	*2.1*	*2.3*	*11.8*	*1.1*
Balochistan	*0.9*	*3.3*	*0.9*	*3.7*	*15.2*	*0.2*
Islamabad	*--*	*---*	*---*	*1.5*	*14.5*	*3.5*
Gilgit Baltistan	*---*	*---*	*---*	*0.7*	*9.3*	*0.7*

Source: PDHS data (2006-07 and 2012-13)

In accord with the later, it may be conditioned that length of lactation is linked to pregnancy exposure, space between pregnancy, and level of fertility, as this could influence the repression of women's reproductive cycle, in a manner that breastfeeding span and amenorrhea affect postpartum infertility that could have larger effect compared to sexual abstinence. Table 7 displays the calculated lengths of breastfeeding and related estimated postpartum amenorrhea. A slight decreasing trend is observed in both durations including breastfeeding and postpartum amenorrhea from 1990-2013. Median duration of breastfeeding is decreased almost 19.9 to 18.65 months, whereas, estimated duration of postpartum amenorrhea also decreased from13.28 to 12.21 months. This decrease is reported due to the increased use of infant formula milk other than breast milk in Pakistan. Children, belonging to rural areas and Khyber Pakhtunkhwa showed somewhat higher median duration of breastfeeding (about 21.0 and 19.6) and (23.0

and 21) months, respectively.

Sterility/Infertility

Natural infertility rises with women's age with the delay of primary maternity. It is lowest amongst younger women, providing lifetime standard proportion of infertile women when almost every woman is exposing to conception throughout her reproductive phase. When considering infertility of women, this has to be influencing the fertility levels to a smaller degree, because women younger than 35 years, only a few of them found infertile. As women grow up elder, the percentage of infertility increases speedily, until it influences, since predicted, the majority of women at the ending of measured fertile time (Bongaarts, 1984). Nevertheless, Ericksen and Brunnette (1996) discovered that a few African women who have reported they being infecund for the preceding five years were in that situation for the short term. However; it is relatively complex to assess sterility or involuntary childlessness (lower ability to conceive) due to the lack of data on secondary infertility. Most women and men, after adopting assisted reproductive technologies i.e. contraception, also prefer voluntarily childless for various reasons (Priskorn, 2012).

Table 7: Median duration of breastfeeding and estimated duration of postpartum amenorrhea

Geographic Stratums	1990-91		2006-07		2012-13	
	Median Duration of Breastfeeding	Estimated Duration of Postpartum Amenorrhea	Median Duration of Breastfeeding	Estimated Duration of Postpartum Amenorrhea	Median Duration of Breastfeeding	Estimated Duration of Postpartum Amenorrhea
Pakistan	*19.9*	*13.28*	*18.9*	*12.43*	*18.65*	*12.21*
Place of Residence						
Urban	*14.8*	*9.10*	*18.0*	*11.67*	*18.20*	*11.83*
Rural	*21.0*	*14.22*	*19.4*	*12.85*	*19.60*	*13.02*
Regions						
Punjab	*18.0*	*11.67*	*17.9*	*11.58*	*17.50*	*11.25*
Sindh	*22.8*	*15.76*	*20.3*	*13.62*	*20.60*	*13.88*
Khyber Pakhtunkhwa	*23.0*	*15.93*	*21.5*	*14.65*	*21.00*	*14.22*
Balochistan	*22.0*	*15.08*	*20.7*	*13.96*	*19.60*	*13.02*
Islamabad	---	---	---	---	*14.50*	*8.88*
Gilgit Baltistan	---	---	---	---	*20.10*	*13.45*

Source: PDHS data (1990-91, 2006-07 and 2012-13)

Fertility Inhibiting Effects of Proximate Determinants

Regional Fertility Differences

By glancing at the estimated values, the contribution of each index signified a proportionate decline in estimated Augmented Total Fertility Rate (TFR*) for the measured period of 1991 to 2013 (figure 2). Table 8 reports the calculated index values and inhibiting effect (percentage reduction) of each PD on fertility decline by Augmented Stover's Model of fertility, over time. The calculated values of TFR* were found 5.4, 4.1, and 3.8 children per woman in 1991, 2007,

and 2013, respectively at the national level while, fertility differentials between residences, rural women reported one child more, than urban women. Fertility decreased for rural women (5.58, 4.5 to 4.2) whereas, 4.9, 3.3 to 3.2 children per woman for urban women. High fertility among rural women maybe because they want larger families for assuring some households and farm assistance plus economic security in their older age while urban women try to cut their fecundity due to the high cost associated with children's nurturing and development. During the 1990s, fertility was found smallest in Sindh (5.12) and maximum in Balochistan (5.84 live births per woman) whereas, Sindh and Khyber Pakhtunkhwa showed higher (4.3), and Punjab showed lower number of children (3.9) in 2007. Fertility was found lowest in Islamabad and higher in the underprivileged areas of Balochistan i.e. 3 and 4.2 children, respectively during 2012-13.

Augmented Index of Sexual Activity (C_x)*

The index values increased, in all regions, showing a lesser revelation to pregnancy hazards by high sexual activity that appeared to be weakened via new and useful contraception tools. The calculated values of C_x* increased from 0.60, 0.7 to 0.72, signifying about 39.5%, 30% and 27.9% reduction in fertility. The index shows more fertility inhibition effect among rural women (0.60, 0.67, and 0.70) than women of urban areas (0.67, 0.72, and 0.74) which contribute nearly 39.6%, 32.5%, and 29.1% in rural whereas, 32.3, 27.6 and 25.6% of fertility drop in urban regions over the estimated period. Across geographic regions, Khyber Pakhtunkhwa (0.62 and 0.68) showed the maximum and Punjab (0.65 and 0.72) reported the minimum fertility inhibiting effect during 1991 and 2007, even as, Punjab (0.67) reports the maximum whereas, Balochistan represents the minimum fertility inhibiting effects of C_x* (0.85), contributing by decreasing natural fertility up to 32.1% and 14.5%, respectively.

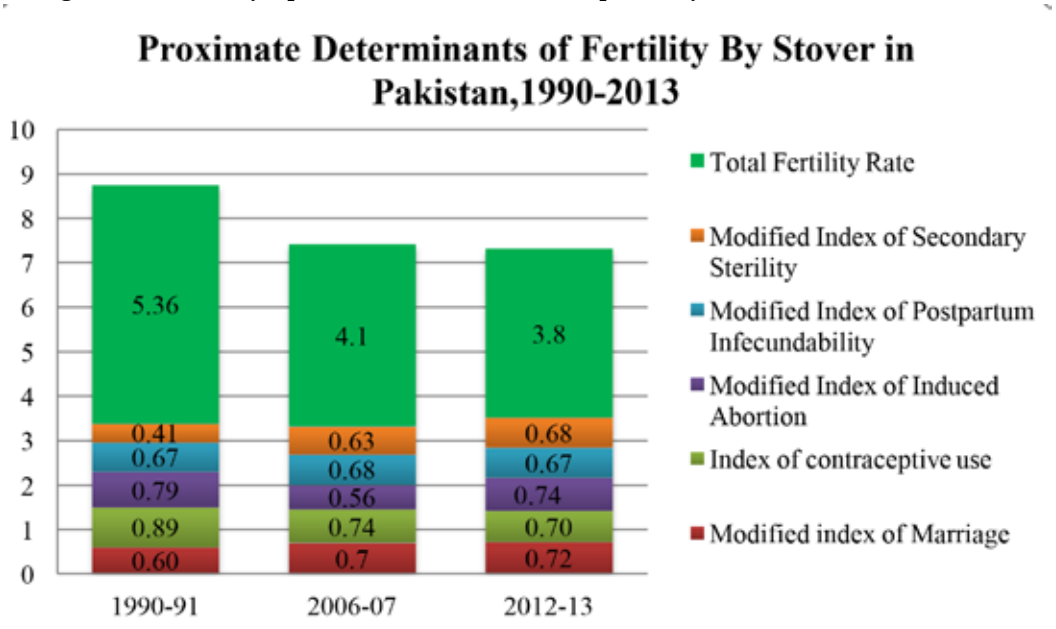

Figure 2: Fertility Inhibiting Effects of Proximate Determinants by Augmented Stover's Model in Pakistan, 1990-2013

Augmented Index of Contraception (C_c^*)

In a comparative study, Casterline, et al. (1983) documented a reverse relationship between fertility levels and contraceptive practice. Estimated values, accounted for a decrease in TFR* from (0.90) 9.4% to (0.72) 27.1%, over the measured time. Contraceptive use increased among urban married women (0.80 to 0.66) in the reproductive age from 19.9% to 33.3% than rural women (0.95-0.83). The statistics confirmed that contraceptive use is the significant means through which fertility decreased by more than 20%, in all regions and its impacts are more obvious in Punjab (0.89-0.69), Sindh (0.9-0.76), and Khyber Pakhtunkhwa (0.92-0.79), overtime period.

Augmented Index of Induced Abortion (C_a^*)

The estimated value of augmented induced abortion, now carrying, 'e', average method effectiveness uses of contraception by age and method, inhibiting effect of induced abortion decreased incredibly and then increased from 0.79 to 0.74, from 2007 to 2013. A similar trend of fertility reduction due to C_a^* is seen among sexually active rural and urban women. The inhibiting effect of C_a^* is relatively obvious among urban women i.e. 0.74 to 0.73 as compared to 0.79 to 0.74 for rural women that contributes approximately 26% to up to 27% (urban) while 21% to 26% (rural) reduction in fertility, over the period, respectively. All geographic regions showed a significant decline in fertility due to the increased use of contraceptives and induced abortion. Punjab (0.78) shows the minimum whereas; Sindh (0.83) and Balochistan (0.83) showed the maximum values of C_a^* during the 1990s. Balochistan (0.53) showed the least value (maximum fertility inhibitory effect by 47%) and Sindh (0.7) indicated the maximum (less contribution by 30% fertility reduction) during 2006-07. Islamabad (0.89) came out as the least contributory region (11%) and on the other hand, Balochistan (0.74) showed a high inhibitory effect on fertility reduction by 26% in 2012-13.

Augmented Index of Post-partum infertility (C_i^*)

The augmented index of post-partum infertility remained the highly contributing factor in decreasing fertility levels, over time. The index values of C_i^* at the national level are 0.67, 0.68, and 0.67 which shows that the duration of breastfeeding reduces natural fertility by 32.9% and 32%, respectively. The C_i^* shows more inhibiting effects of breastfeeding among rural women (0.65, 0.67, and 0.66) than urban women (0.73, 0.69, and 0.67) by dropping fertility up to 34.3%, 32.7%, and 34% in rural and at the same time as 26.9%, 30.8% and 32.4% in urban areas, respectively. Among regions, Punjab (0.69 and 0.69) showed comparatively less reduction in TFR* due to shorter duration of breastfeeding i.e. 30.4% and 30.6% throughout 1991 and 2007. Khyber Pakhtunkhwa (0.63, 0.64, and 0.64) showed the highest percentage due to a long period of breastfeeding and accounted for 36.9%, 35.1%, and 35.6% followed by Gilgit Baltistan (0.645) or 35.5% fertility reduction, during 2012-13.

Augmented Index of Secondary Sterility (C_s^*)

Stover's reformulation of the index value stands for the dominating effect on fertility decline because it uses all aspects of sterility i.e. infecundity and non-users of contraceptive. For the index, there is a small increase over time (0.41-0.68) causing less natural fecundity reduction from 58.4% to 31.7% over time. The index values increased over time in urban (0.45-0.72) as

well as in rural (0.37-0.64) areas. The higher index value leads to less fertility inhibiting effects on fertility reduction which is more profound among infertile rural women (62.3% to 35.5 %) as compared to urban (54.4% to 27.9%). The index values increased significantly across all other geographic regions, which is profound in Sindh (0.43-0.75), Khyber Pakhtunkhwa (0.30-0.69) followed by Balochistan (0.30-0.69) throughout the measured period.

Conclusions and Recommendations

While contrasting the effects of different indices, estimated through Stover's augmented model, during the 1990s, secondary sterility was comparatively very low (below 0.5). The low index value shows the highest inhibiting effect on fertility but afterward; index values increased gradually in all regions. Generally, one would anticipate sterility to be decreasing due to better physical conditions and improved nutritional supplements amongst all Pakistani women except for women in Sindh. Among regions, sexual activity (postpartum abstinence) and post-partum infertility (prolonged lactation) are other highly contributing factors whereas the contraception and induced abortion though increased over time but relatively showed low effects on fertility decline from 1990-2013. Stover's indices are found more powerful in dropping total potential fertility which is interpreted into a higher value of PF contrasted to TF in the Bongaarts model. Based on results, the study suggests that in existing Muslim and orthodoxy society; open discussions on the issues of women's reproductive well-being and family planning should be encouraged via government support. Moreover; for supporting population control in Pakistan, spouses should give the self-confidence to go for sterilization once attaining the desired family size.

Table 8: Estimates and inhibiting effect (percentage reduction) of each proximate determinant of Fertility by Stover

Geographic Stratums	C_x*		C_c*		C_a*		C_i*		C_s*		PF	TFR* est.
	Index value	Effect	Index value	Effect	Index value	Effect	Index value	Effect	Index value	Effect		
Pakistan												
1990-91	*0.605*	*39.5*	*0.906*	*9.4*	*0.790*	*21.0*	*0.671*	*32.9*	*0.416*	*58.4*	*44.32*	*5.36*
2006-07	*0.700*	*30.0*	*0.851*	*14.9*	*0.560*	*44.0*	*0.680*	*32.0*	*0.635*	*36.5*	*31.44*	*4.10*
2012-13	*0.721*	*27.9*	*0.729*	*27.1*	*0.740*	*26.0*	*0.671*	*32.9*	*0.683*	*31.7*	*21.32*	*3.80*
Place of Residence												
Urban												
1990-91	*0.677*	*32.3*	*0.801*	*19.9*	*0.740*	*26.0*	*0.731*	*26.9*	*0.456*	*54.4*	*36.59*	*4.90*
2006-07	*0.724*	*27.6*	*0.791*	*20.9*	*0.520*	*48.0*	*0.692*	*30.8*	*0.711*	*28.9*	*25.79*	*3.30*
2012-13	*0.744*	*25.6*	*0.667*	*33.3*	*0.730*	*27.0*	*0.676*	*32.4*	*0.721*	*27.9*	*18.10*	*3.20*
Rural												
1990-91	*0.604*	*39.6*	*0.951*	*4.9*	*0.790*	*21.0*	*0.657*	*34.3*	*0.373*	*62.7*	*50.11*	*5.58*
2006-07	*0.675*	*32.5*	*0.882*	*11.8*	*0.560*	*44.0*	*0.673*	*32.7*	*0.586*	*41.4*	*37.22*	*4.50*
2012-13	*0.709*	*29.1*	*0.835*	*16.5*	*0.740*	*26.0*	*0.660*	*34.0*	*0.645*	*35.5*	*22.51*	*4.20*
Regions												
Punjab												
1990-91	*0.653*	*34.7*	*0.897*	*10.3*	*0.780*	*22.0*	*0.696*	*30.4*	*0.449*	*55.1*	*37.99*	*5.39*
2006-07	*0.721*	*27.9*	*0.839*	*16.1*	*0.650*	*35.0*	*0.694*	*30.6*	*0.628*	*37.2*	*25.42*	*3.90*
2012-13	*0.679*	*32.1*	*0.693*	*30.7*	*0.790*	*21.0*	*0.692*	*30.8*	*0.689*	*31.1*	*21.41*	*3.80*
Sindh												
1990-91	*0.648*	*35.2*	*0.906*	*9.4*	*0.830*	*17.0*	*0.643*	*35.7*	*0.408*	*59.2*	*39.75*	*5.12*
2006-07	*0.677*	*32.3*	*0.785*	*21.5*	*0.700*	*30.0*	*0.664*	*33.6*	*0.640*	*36.0*	*27.37*	*4.30*
2012-13	*0.799*	*20.1*	*0.760*	*24.0*	*0.760*	*24.0*	*0.646*	*35.4*	*0.412*	*58.8*	*31.71*	*3.90*

Geographic Stratums	C_x*		C_c*		C_a*		C_i*		C_s*		PF	TFR* est.
	Index value	Effect	Index value	Effect	Index value	Effect	Index value	Effect	Index value	Effect		
Khyber Pakhtunkhwa												
1990-91	*0.621*	*37.9*	*0.925*	*7.5*	*0.820*	*18.0*	*0.631*	*36.9*	*0.433*	*56.7*	*42.72*	*5.50*
2006-07	*0.686*	*31.4*	*0.846*	*15.4*	*0.670*	*33.0*	*0.649*	*35.1*	*0.677*	*32.3*	*26.27*	*4.30*
2012-13	*0.720*	*28.0*	*0.794*	*20.6*	*0.760*	*24.0*	*0.644*	*35.6*	*0.751*	*24.9*	*18.54*	*3.90*
Balochistan												
1990-91	*0.635*	*36.5*	*0.982*	*1.8*	*0.830*	*17.0*	*0.649*	*35.1*	*0.302*	*69.8*	*57.50*	*5.84*
2006-07	*0.705*	*29.5*	*0.918*	*8.2*	*0.530*	*47.0*	*0.658*	*34.2*	*0.604*	*39.6*	*31.73*	*4.10*
2012-13	*0.855*	*14.5*	*0.864*	*13.6*	*0.740*	*26.0*	*0.655*	*34.5*	*0.694*	*30.6*	*16.88*	*4.20*
Islamabad												
2012-13	*0.783*	*21.7*	*0.565*	*43.5*	*0.890*	*11.0*	*0.729*	*27.1*	*0.712*	*28.8*	*14.67*	*3.00*
Gilgit Baltistan												
2012-13	*0.748*	*25.2*	*0.718*	*28.2*	*0.800*	*20.0*	*0.645*	*35.5*	*0.843*	*15.7*	*16.27*	*3.80*

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