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What Can Proximate Determinants of Fertility Tells Us about the Fertility Transition of Pakistan?

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Abstract

Population planning program of countries neighboring Pakistan for example, Iran, Sri Lanka, Bangladesh are started about the same time as that in Pakistan and there has been a considerable reduction in fertility in these countries. During the past five decades Pakistan experienced a slow pace change in fertility—total fertility rate has declined from eight children per woman in the early 1960s to only four by the end of 2000s. Pakistani fertility particularly at regional levels received less attention in previous research. This paper attempts to explore the role of main proximate determinants of fertility proposed by Bongaarts to analyse the fertility transition in Pakistan since 1990s. Using the cross-sectional data from the 1990, 2006 and 2012 Pakistan Demographic and Health Survey, and 2000-01 Pakistan Reproductive Health and Family Planning Survey, the classical Bongaarts model is applied here and the analysis is extended to analyse the regional variation. The results indicate that timing of marriage and contraceptive use are crucial determinants associated with fertility reduction in Pakistan. By following the Bongaarts criteria of fertility transition, it can be concluded that Pakistan has entered in the early third phase of fertility transition. Specifically urban areas of Pakistan, two provinces Punjab and Baluchistan are ahead in fertility transition compared to other regions. The results of the analysis highlight various areas for program intervention and policy development in Pakistan.

Keywords: Bongaarts model, family planning, Pakistan.

1. Introduction

Pakistan ranks sixth among the most populous countries of the world (184.8 million) with a total fertility rate (TFR) of 4.0 *(Population Reference Bureau, 2012)*. During the past five decades, Pakistan has experienced a slow-paced change in the level and pattern of fertility. The total fertility rate has declined from eight children per woman in the early

1960s to only four by the end of 2000s (Figure 1). It is well established fact that changes in fertility are interplay of two key dimensions. The first dimension covers the family planning (FP) provision and services, so called supply side factors. Slow programme implementation, unstable political support, inadequate administrative supervision and frequent changes in the programme strategies are reported to be the key reasons of unsatisfactory performance of the supply side input. The second dimension involves understanding reproductive needs and contraceptive use behaviour of the population. This dimension can be designated as demand side factors. This study aims to contribute to an understanding of trends and differentials in Pakistani fertility focusing on the demand side dimensions (non-programme factors) to bridge the gap in the previous research.To best understand the fertility transition of Pakistan, proximate determinants models of fertility is the need of the study—in particular, what is the contribution of the proximate determinants to understand the fertility decline dilemma of Pakistan.

2. Population Planning in Pakistan: A Review

Population planning in Pakistan has a long history. With the end of nearly 60 years of population planning inputs, very slow acceleration of fertility transition in Pakistan is identified. Since 1960s key policy and strategy shifts for population planning program in Pakistan have been shown in Figure 1. In 1953, the FP association was formed in Lahore (West Pakistan), financially supported by the Government. It was a non-government organization (NGO) who started to work entirely on its own basis. In 1954, another FP association was founded in Dacca (East Pakistan). In 1959, the Economic Committee of the Government approved the first pilot project of FP. Hence, one FP pilot project was launched in Dacca (1961). This pilot project was the outcome of agreement between Ministry of Health, Labor and Social Welfare of Pakistan and Population Council of New York (Clark et al., 1964). At the same time another FP pilot project was also started in West Pakistan, in Lulliani (a rural place located near Lahore) (Kantner, 1964). The Staff from the Health Education Division, University of California in collaboration with University of Dacca assisted the FP project in Dacca, and staff from John Hopkins School of Hygiene and Public Health (Department of Maternal and Child Health) in collaboration with the University of Punjab assisted the pilot project at Lulliani to enhance and develop the national FP program in Pakistan. The FP project in Dacca was in an urban settlement; later on, its rural counterpart was come into existence at Commila (Kotwali thana: thana is synonym of District, it is a term used for administrative unit in East Pakistan) in conjunction with the Pakistan Academy for Rural Development. Details of the Commila FP programme in terms of place, costs, staff, research design and FP material supplies can be found in Khan (Khan, 1964).

The formal country wide official version of Pakistan FP programme was started on 1 July 1965 during the third five-year plan of the country. By the end of the first year (July 1966), the FP programme was fully operational in 33 districts (10 in East Pakistan and 23 in West Pakistan). More explicit details of this first major Government FP programme can be viewed in (Adil, Hardee, & Sadik, 1968), however, by mid-1968 the Government FP programme exceeded the anticipated coverage in terms of the provision of FP services to tribal areas of Pakistan— ‘Dirstate’, ‘Khyber Agency’, ‘Khurram Agency’ in West Pakistan and ‘Chittagong Hill Tract district’ in East Pakistan (Bean & Bhatti, 1969). The first three years of the Pakistan FP programme (1965-68) is reckoned to have been a period of remarkable investment in population control. The mid-term evaluation of the

1965 Pakistan FP programme had suggested a series consisted of nine recommendations for improvement (United Nations Advisory Mission Report, 1969). These nine recommendations for improving the national FP programme of Pakistan were: administration and organization, the methods of birth control, FP services, the motivation and promotion of the FP, the follow up of the contraceptive users, the training of the personnel involve in the FP, the FP research and evaluation, supplies and transport of the FP material and the work plan for donor agencies.

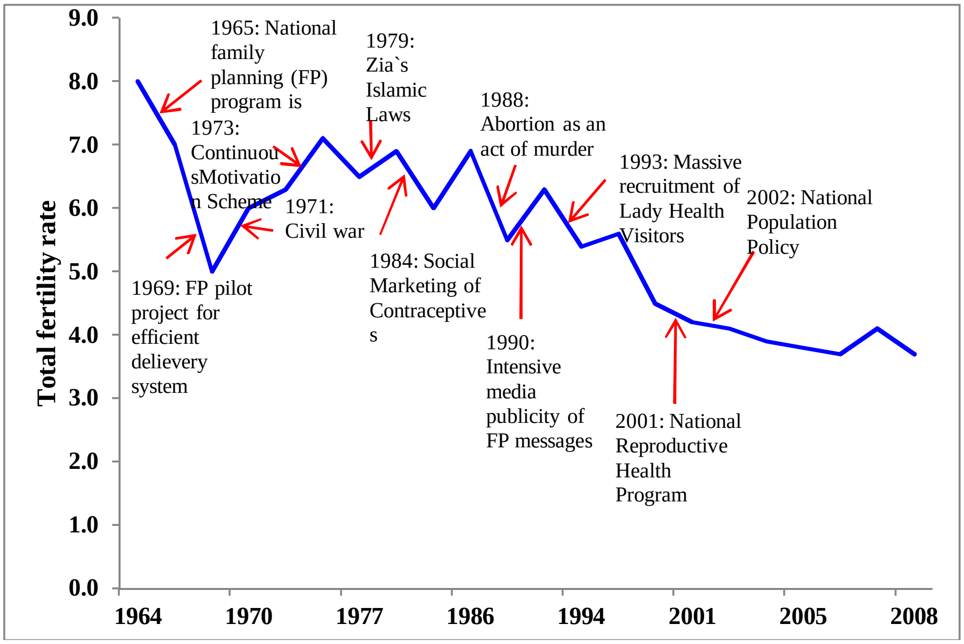

Figure 1: Population Policy and Period Total Fertility Rate (TFR) In Pakistan Since 1960s.

However, after a substantial investment in FP in the country, the following most relevant question needed an answer: had the Pakistan in FP programme promoted a decline in fertility, indeed, had fertility transition started in Pakistan? To answer this question in the first instance, reliable studies were required to allow observation and evaluation of change if any in fertility. Some micro level studies had been conducted to observe the impact of the FP programme (Khan & Choldin, 1965; Roberts et al., 1965; J. Stoeckel & Choudhury, 1969; J. E. Stoeckel & Choudhury, 1967). The reliable inferences concerning the impact of the FP programme from these micro level attempts were hard to derive. At macro level, globally, a similar kind of answer was the need of time, particularly in those countries who had initiated the FP programmes in late 1950s. Consequently the World Fertility Survey (WFS) was launched for the evaluation of the impact of FP inputs. After the separation of East Pakistan in 1971, the political and administrative setup of the country was changed. However, by the mid-1975, the Government of Pakistan had infused a new population planning programme—expanded population planning programme. As a part of WFS, the Pakistan Fertility Survey (PFS) was conducted in 1975. The preliminary findings of PFS answered the fertility change question of Pakistan like this: "unwanted fertility is high while the contraceptive access and practice is minimal in Pakistan”, ("World Fertility Survey, Pakistan: Unwanted Fertility High, Contraceptive Knowledge and Practice Low," 1977; "World Fertility Survey, Pakistan: Unwanted Fertility is High While Contraceptive Access and Practice are Minimal," 1977) (p. 16 and 230 respectively). Other than PFS data, the fertility behavior was assessed using the Population, Labor Force, and Migration Survey (PLM) in 1979. The analysis suggested no change in reproductive behavior of Pakistani women in the seventies (Sathar & Irfan, 1984; Shah, Pullum, & Irfan, 1986). In other words, twenty years of enthusiastic FP effort had not succeeded (Robinson, 1978). This had indicated an unwillingness of population of Pakistan to use birth control services. Rather this unwillingness would be understood through research and evaluation, indeed the Government of Pakistan infused a new Population Welfare Planning Plan (1980-83) in the fifth five year planning programme of the country. The Population welfare planning plan like earlier FP programmes in Pakistan viewed with pros and cons (Lieberman, 1982; Robinson, 1987). During the late 1980s, the issue of whether there was a real fertility decline in Pakistan remained the interesting puzzle for researchers (Afzal, Kayani, & Mohammad, 1993; Afzal & Kiani, 1995; Retherford, Mirza, Irfan, & Alam, 1987)?

In the 1980s methodologically more reliable surveys called Demographic Health Surveys (DHS) were came into practice. As a part of the DHS series, the first Population and Demographic Health Survey (PDHS) were held in Pakistan in 1990-91. The long-awaited decline in fertility was reported in early 1990s from the findings of 1990-91 PDHS (Klitsch, 1993). This was the first evidence of onset of fertility transition in Pakistan, however, the fertility decline was still under debate due to issues of data quality (Curtis & Arnold, 1994; Sathar, 1993). In the meanwhile, some studies were conducted in major urban areas to observe the fertility decline. One such study was conducted in urban settings of Karachi which showed a fertility decline in a well-educated community of the city (Hagen, Fikree, Sherali, & Hoodbhoy, 1999). Finally, after the release of preliminary findings from the 1998 Census jointly with other empirical evidence, demographers speculated with a good degree of confidence the onset of fertility transition in Pakistan (Ali & Zahid, 1998; Moore, 1998; Sathar & Casterline, 1998). Different factors were said to be responsible for the slow paced fertility transition: a rise in the female age at marriage, a decline in breastfeeding, rise of the Pakistani female education, urbanization, an increase in the poverty level, rise in the mass media exposure, and the small increase in contraceptive prevalence (Ali & Hussain, 2001; Soomro, 2000). Other than these factors documented above, the Government of Pakistan incorporated the ‘Reproductive health’ services in the national FP programme to understand the insight factors of slow pace fertility transition. The reproductive health issues of both men including the concern of sexually transmitted diseases and women including the maternal mortality concerns brought a new dimension in population research of Pakistan (Mahmood & Durre-e-Nayab, 2000).

Pakistan has one of the oldest FP programme in the world. Fluctuating political support and frequent changes in programme strategies has made it less fruitful. At present, fertility has declined to four children per woman (TFR = 4.0) and the Government plan is for it to reach below replacement level by year 2020. However, at the same time researchers cautioned about the stalled in the fertility transition of Pakistan (Sathar, 2007).

Previous research have found a profound gap in particular after 1990s in terms of understanding the role of proximate determinants in the fertility transition of Pakistan, however, some studies address the issue at national level of fertility transition in Pakistan (Aziz, 1994; Nasir, Akthar, & Tahir, 2009; Soomro, 2000). The present study aims to contribute to a better understanding of the contribution of the proximate determinants of fertility decline to the changes in fertility in Pakistan since 1990s. The analysis is extended to understand the variation of proximate determinants among seven geographic regions—place of residence (rural and urban) with four provinces (Punjab, Sindh, NWFP and Baluchistan), and at national level.

2. Model and Methods

The proximate determinant model of fertility proposed by John Bongaarts is based on the scheme first introduced by Davis and Blake (Bongaarts, 1978; Bongaarts & Potter, 1983; Davis & Blake, 1956). The standard model measures the impact of four main determinants (called proximate determinants) on fertility through a set of quantitative indexes.

Typically a woman's fertility is the outcome of her three step mileage.

First step is: she should be sexually active (normally in the age of 15) and involve in intercourse (presumably held under union ship in many societies). Bongaarts identified this step as one of his first determinant of fertility and had given a name to this exposure: 'the proportion of women married'. The proportion of women married (a measure of exposure to intercourse) is referred as 'the index of marriage(C_m)' and symbolically it is presented through the following expression:

$$C_m = \frac{\sum_{x=a}^{b} m(x)g(x)}{\sum_{x=a}^{b} g(x)}$$

$$C_m = \frac{TFR}{TMFR} \qquad \boxed{(1)}$$

C_m is the weighted average of the age-specific proportions of married women; where in equation (1), $m(x)$ is the proportion of currently married women aged x years, $g(x)$ is the age specific marital fertility rate $[g(x)]$ can be computed by dividing the age specific fertility rates (ASFR) by the proportion of women that is currently married at each age x; a is the lower biological limit (normally 15 years), b is the upper biological limit or reproductive age (normally 49 years).

Pakistan is a society in which it can be gently assumed that sexual activity would take place within marriage for validity of the formula presented in equation (1). In the expression for (C_m) shown in equation (1), the $TMFR$ stands for the total marital fertility rate. However, the index C_m can take values between '0' and '1' inclusive. A particular value of marriage index (C_m) say 0.8 for example; indicates that fertility is reduced as a result of 20% women being not sexually active throughout the entire reproductive period and therefore gives the proportion by which TFR is smaller than TMFR. Hence the extreme values of marriage index can easily be interpreted and understood: a value of 1 indicates that there is no effect in lowering fertility because all women of reproductive age are married, and a value of '0' indicates that fertility is completely protected with the complete absence of marriage. For any society the extreme values of index (0,1) are quite impractical, however, the values between '0' and '1' are readily available and varies from one society to another.

Second step is: intercourse (first step) leads to conception (second step), this stage or state of conception could be controlled by using contraception. Bongaarts identified this step as second or next key proximate determinant of fertility and had given a name to this exposure: 'contraceptive use' including abstinence and sterilization. Contraceptive use (a measure of exposure to contraception) is referred as 'the index of contraception(C_c)' and symbolically it is presented with the following expression:

$$C_c = 1 - 1.08\, u\, e \qquad (2)$$

Where 'u' (prevalence of current contraceptive use among married women) is the proportion of married women currently using contraception, and 'e' is the average method-use effectiveness (the proportionate reduction in the monthly probability of conception due to contraception). The value of 'e' is estimated using the weighted average of the method-specific use-effectiveness, (say for any method 'm') 'e_m', by the proportion of the women using a given method, u_m, by using the following expression:

$$e = \frac{\sum e_m u_m}{u_m} \qquad (3)$$

Further, average use method effectiveness could be estimated using the following expression shown in equation (4). The expression is suggested by Bongaarts and Potter and has been used by researchers for application purposes (Bongaarts & Potter, 1983; Islam, Yadava, & Alam, 2005; Nasir et al., 2009).

$$e_m = 1 - \left({}^{f_m}/_{f_n}\right) \qquad (4)$$

Where f_m in equation (4) indicates the mth contraceptive method failure rate and f_n is the natural infertility. The constant 1.08 (sterility correction factor) in equation (2) is an adjustment for the fact that non-sterile women do not use contraception if they believe that they are sterile (Bongaarts & Potter, 1983). Since estimates of contraceptive effectiveness are rarely available, the values measuring the method specific use-effectiveness have been taken from the Bongaarts and Potter (1983, p. 84): 1.0 for female sterilization, 0.9 for pill, 0.95 for IUD, 0.99 for injectable, 0.99 for implants, 0.9 for condoms (modern methods); 0.7 for withdrawal, 0.8 for abstinence and 0.3 for other traditional methods. These values of use-effectiveness have been used for computing the index of contraception in this study.

Step three is: intercourse (first step) leads to conception (second step), and conception is followed by gestation and parturition. The state of gestation and parturition could face the abortion. Bongaarts identified this step as third proximate determinant of fertility and had given a name to this exposure: 'induced abortion'. Induced abortion (a measure of exposure to parturition) is referred as 'the index of abortion(C_a)' and symbolically it is presented with the following expression:

$$C_a = \frac{TFR}{TFR + 0.4\,(1 + u) \times TAR} \qquad (5)$$

Where TAR is the total abortion rate and equal to the average number of induced abortions per woman at the end of reproductive period, the term $0.4\,(1 + u)$ is an estimate of the births averted by a single abortion. A modification of this index is suggested by Stover (Stover, 1998), and according to him u should be multiplied by e to describe the proportion of women protected by contraception and equation (5) by incorporating Stover's modification would be

$$C_{à} = \frac{TFR}{TFR + 0.4\,(1 + u \times e) \times TAR} \qquad (6)$$

Where e indicates the average use effectiveness of contraception and details are given above equation (5) to (6). Finally, after having birth, a woman is in the state of post-partum (the period when woman adjust physically to the process of childbearing or conception). Bongaarts identified this stage as the fourth proximate determinant of fertility and had given a name to this exposure: 'post-partum infecundability' or 'duration of post-partum amenorrhea'. The index of post-partum infecundability (C_i) is presented with the following expression:

$$C_i = \frac{20}{18.5 + i} \qquad (7)$$

Where i (measured in months) is the average duration of postpartum infecundability caused by breastfeeding or postpartum abstinence. The value of i can be estimated using the following equation:

$$i = 1.753\,\mathrm{Exp}\,(0.1396 \times B - 0.001872 \times B^2) \qquad (8)$$

Where B is the mean or median duration of breastfeeding in months (Bongaarts & Potter, 1983).

Based on these four indexes, Bongaarts suggested the following multiplicative model of proximate determinants of fertility:

$$TFR = C_m \times C_c \times C_a \times C_i \times TF \qquad (9)$$

Where TF in equation (9) is the woman's biological capacity to produce called average potential fertility or total fecundity. The theoretical maximum fertility of a woman is 35 births, not counting multiple births. This theoretical maximum is based on the maximum reproductive life span of age 15 to 50 years in the absence of all biological and behavioral constraints. If the constraints waiting time to conception, risk of intrauterine mortality and onset of permanent sterility are taken into account, the average potential fertility is about 15.3 children per woman (range between 13 and 17) with minor variations in human sub-populations (Bongaarts & Potter, 1983). The proximate determinant model shown in equation (9) assumes that each of the determinants has an independent inhibiting effect on fertility.

With the standard version of proximate determinant model of fertility depicts in equation (9), it is argued that the model is good at discerning inter population variations and has been widely used by researchers. Nevertheless some weaknesses of the model have been identified (Reinis, 1992; Stover, 1998).

3. Data

Two main sources of data have been used: Pakistan Demographic Health Survey (PDHS) and Population Reproductive Health and Family Planning Survey (hereafter 1990 PDHS, 2000 PRHFPS, 2006 PDHS and 2012 PDHS). Both surveys are coordinated by National Institute of Population Studies (NIPS), Islamabad, Pakistan (Hakeem, Sultan, & din, 2001; National Institute of Population Studies [Pakistan] and Macro International Inc, 1992, 2008). Surveys are nationally representative surveys in scope and have covered the four provinces (Punjab, Sind, NWFP and Baluchistan) of the country. The sample for each survey was drawn from the National Master Sample Frame prepared and maintained by Federal Bureau of Statistics (FBS) (currently Pakistan Bureau of Statistics), Islamabad, and Pakistan. The ever-married woman was the target for interview. Eligible women (PDHS-1990: ever-married 15-49; PRHFPS-2000: ever-married 15-49; PDHS-2006: ever-married 12-49) were identified using short questionnaire of each survey. However, the sample sizes (based on long household questionnaires) for successfully completed interviews in three surveys are shown in Table 1.

Table 1: Sample Sizes of Ever-Married Women in Pakistan Demographic and Health and Population Reproductive Health and Family Planning Surveys of Pakistan

Sample characteristics	PDHS	PRHFPS	PDHS	PDHS
	1990-91	**2000-01**	**2006-07**	**2012-13**
Total				
Eligible	6904	7411	10601	14569
Successfully interviewed	6611	6579	10023	13558
% successfully interviewed	95.8	88.8	94.5	93.1
Urban				
Eligible	3567	3200	4104	6964
Successfully interviewed	3384	2826	3830	6351
% successfully interviewed	94.9	88.3	93.3	91.2
Rural				
Eligible	3337	4211	6497	7605
Successfully interviewed	3227	3753	6193	7207
% successfully interviewed	96.7	89.1	95.3	94.8

PDHS: Pakistan Demographic and Health Survey
PRHFPS: Pakistan Reproductive Health and Family Planning Survey

4. Results Background Characteristics of the Study Sample

Table 2 shows the frequency and percentage distribution of respondents by their basic background characteristics (age is years, place and province of residence, respondent and her husband education level and respondent age at first marriage). More than three-fifths of the sampled women were aged between 20 and 39 years. Geographically, most of the population of Pakistan in rural resident—more than half of the sample is from rural areas of Pakistan particularly in 2006 and 2000 survey. Punjab is the most densely province of Pakistan. More than two-fifths of the women were from Punjab followed by Sindh and

NWFP. Baluchistan is the least populated province of Pakistan—least proportions of women were selected from Baluchistan. Vast majority of women was having no level of education. By looking at the individual categories of level of education across three surveys, less than 10 per cent of women were have higher education. In case of respondent's husband education, more than fifty per cent were having some level of education (either primary or secondary or higher). Maximum number of women get marry in (16-20) year age category; however average age at first marriage seems higher in 2006 (18.29 years) compared to 2000 or 1990 sample.

4.1 Proportion Married (C_m)

The marriage index is designed to represent the proportion by which TFR is smaller than the TMFR as a result of marital pattern (the effect of non-marriage in terms of a reduction in fertility per women). Table 3 shows the calculated index of marriage for seven geographic stratums. For total women, C_m equals 0.698, 0.66 and 0.624 in 1990, 2000 and 2006 respectively. The marriage pattern accounts that 30.2% (1990), 34% (2000), and 37.2% (2006) of women in their reproductive period are not sexually active (for not being married) to reduce the actual fertility levels. In addition, it shows a proportion of married reduced by 0.074 points during 1990 to 2006. The marriage pattern among urban women (Cm for 2006: 0.564) and those living in Punjab (Cm for 2006: 0.575) has the highest fertility reducing effect, accounting for 43.6% (urban) and 42.5% (Punjab) reduction in actual fertility levels. Notably, it is observed that marriage index shows declining trends for overall sample and across geographic regions since 1990s. There are two exceptions in two regions (Sindh and NWFP) to this finding. First, in case of Sindh, the marriage index (0.68) observed to be constant since 1990s; second, in case of NWFP, no decline is observed from 1990 (0.693) to 2000 (0.710), but after 2000 a substantial decline is observed.

4.2 Index of Contraception (C_c)

The index of contraception is designed to measure the effect of contraception to reduce the risk of conception (effect of contraception on marital fertility assuming induced abortion is absent). In terms of marital fertility rate, the index of contraception gives the proportion by which TMFR is smaller than total natural fertility (fertility in the absence of any deliberate birth control practice). However, the contraception index value depends on the current contraceptive prevalence rate and the average use effectiveness of the contraception. The results of both contraceptive prevalence (*U*) and its use-effectiveness (*e*) for the seven geographic stratums can be handed from the corresponding author. The index of contraception varies inversely with the contraceptive prevalence and use-effectiveness. If the contraceptive prevalence is completely absent then the index value would be 1. The calculated values of contraceptive index have been shown in Table 3. The calculated value of C_c for total population in 2006 (0.713) indicates that 29% of maximum potential fertility of married fecund women has been suppressed by contraceptive use. The contraceptive index across all seven geographic stratums shows a slow increase during the period 1990 to 2006. As expected, increase in urban areas is greatest than in rural areas. For instance, rural resident women in 2006 are 16 percentage points behind in contraceptive use than women living in urban areas. For the same case in 1990, this urban-rural difference is noted to be greatest (19%). Across provinces, the effect of contraceptive use in Punjab is the greatest, accounting for a 32% reduction of natural fertility relative to marital fertility in 2006.

Table 2: Percentage Distribution Of Selected Demographic And Socio-Economic Characteristics Of Study Sample, Pakistan

Characteristics	**2006-07**		**2000-01**		**1990-91**	
	PDHS		**PRHFPS**			**PDHS**
	N	**(%)**	**N**	**(%)**	**N**	**(%)**
Age (years)						
15-19	578	5.8	404	6.1	407	6.2
20-24	1560	15.6	1081	16.4	1064	16.1
25-29	2010	20.1	1410	21.4	1469	22.2
30-34	1716	17.1	1233	18.7	1200	18.2
35-39	1649	16.5	1036	15.7	1031	15.6
40-44	1282	12.8	883	13.4	820	12.4
45-49	1228	12.3	532	8.1	620	9.4
Total	10023	100.0	6579	100.0	6611	100.0
Place of residence						
Urban	3830	38.2	2826	43.0	3384	51.2
Rural	6193	61.8	3753	57.0	3227	48.8
Total	10023	100.0	6579	100.0	6611	100.0
Province of residence						
Punjab	4263	42.5	3015	45.8	2207	33.4
Sindh	2716	27.1	1791	27.2	1798	27.2
NWFP	1862	18.6	1167	17.7	1665	25.2
Baluchistan	1182	11.8	606	9.2	941	14.2
Total	10023	100.0	6579	100.0	6611	100.0
Education of respondent						
No	6665	66.5	4604	70.0	5055	76.5
Primary	1344	13.4	804	12.2	600	9.1
Secondary	1348	13.4	801	12.2	842	12.7
Higher	666	6.6	370	5.6	114	1.7
Total	10023	100.0	6579	100.0	6611	100.0
Husband education						
No	3675	36.7	2561	38.9	2999	45.4
Primary	1589	15.9	1013	15.4	1039	15.7
Secondary	3144	31.4	1929	29.3	2083	31.5
Higher	1615	16.1	1076	16.4	493	7.5
Total	10023	100.0	6579	100.0	6611	100.0
Age at first marriage (years)						
<=15	2588	25.8	1730	26.3	2116	32.0

16-20	5010	50.0	3305	50.2	3036	45.9
20+	2425	24.2	1544	23.5	1459	22.1
Total	10023	100.0	6579	100.0	6611	100.0
Mean=	Mean=18.29		Mean=18.24		Mean=17.83	
Median= Median=17.00		Median=18.00		Median=18.00		
Mode= Mode=15	Mode=16			Mode=16		
Standard deviation (SD) =	SD=3.97		SD=3.97		SD=4.11	

PDHS: Pakistan Demographic and Health Survey
PRHFPS: Pakistan Reproductive Health and Family Planning Survey

Table 3: Proximate Determinants of Fertility Model, 1990-2006, Pakistan

Time Index Infecundability	**Marriage**		**Contraception**		**Abortion**	**Postpartum**	
	(C_m)	**(C_c)**		**(C_a)**	**(C_i)**	**TFR**	**TF**
Total							
1975*	0.785	0.955		1.000	0.642	7.4	15.4
1984**	0.779	0.917		1.000	0.647	7.1	16.7
1990	0.698	0.886		1.000	0.650	5.2	13.0
2000	0.660	0.738		0.994	0.654	4.8	15.3
2006	0.624	0.713		0.983	0.661	4.5	15.5
2012	0.617	0.686		0.970	0.642	3.7	14.0
Place of residence							
Urban							
1990	0.651	0.754		1.000	0.687	4.7	14.1
2000	0.599	0.619		0.991	0.678	4.0	15.9
2006	0.564	0.607		0.982	0.661	3.7	16.7
2012	0.559	0.619		0.964	0.656	3.2	15.1
Rural							
1990	0.749	0.943		1.000	0.611	5.8	13.5
2000	0.708	0.795		0.995	0.633	5.6	15.7
2006	0.665	0.768		0.988	0.661	5.0	15.1
2012	0.664	0.744		0.975	0.631	4.2	13.8

Region/province						
Punjab						
1990	0.682	0.876	1.000	0.645	5.2	13.4
2000	0.625	0.718	0.991	0.661	4.8	16.3
2006	0.575	0.681	0.981	0.672	4.2	16.1
2012	0.614	0.649	0.967	0.670	3.8	14.7
Sindh						
1990	0.689	0.882	1.000	0.672	5.4	13.2
2000	0.680	0.736	0.998	0.661	4.8	14.4
2006	0.682	0.738	0.983	0.677	5.1	15.1
2012	0.644	0.707	0.976	0.614	3.8	13.9
NWFP/Khyber						
1990	0.693	0.913	1.000	0.638	5.7	14.0
2000	0.710	0.772	0.9960.612		5.3	15.7
2006	0.635	0.763	0.983	0.631	4.5	14.9
2012	0.628	0.719	0.971	0.608	3.9	14.6
Baluchistan						
1990	0.737	0.913	1.000	0.643	5.5	12.8
2000	0.700	0.846	1.000	0.680	5.0	12.4
2006	0.648	0.855	0.993	0.641	4.4	12.5
2012	0.635	0.799	0.978	0.631	3.5	11.2

*(Bongaarts & Potter, 1983)
**(Aziz, 1994)
TFR: Total fertility rate (model estimate)
TF: Total fecundity rate

4.3 Index of abortion (C_a)

This index is designed to describe the fertility inhibiting effects of induced abortion. Total abortion rate (TA) and contraceptive prevalence rate are needed to compute the index of induced abortion (see Appendix A). In Pakistan, abortion is illegal except for medical reasons or when the life of mother is at risk. It is believed that induced abortion is practiced in the society of Pakistan; however, it is extremely difficult to get accurate information about the level of induced abortion. In the 2000-01 PRHFPS all ever-married women were asked whether they ever experienced a pregnancy, which ended in a miscarriage or an abortion? Those who responded positively were then asked about the total number of spontaneous and induced abortions. The information on induced abortion is utilized in this study to estimate the TA for the survey. In 2006-07 PDHS, several questions (for example miscarriage, abortion and stillbirth) about pregnancies have been asked that did not end in live births. The information on induced abortion from survey has been used to calculate the TA. There is no information available on induced abortion in the 1990-91 PDHS (index value assumed 1.0). It is further assumed that induced abortions might be under reported for a variety of reasons, disapproval by the religion for example.

The overall measure of the incidence of induced abortion is the TA, equal to the average number of induced abortions per woman at the end of the reproductive period if induced abortion rates remain at prevailing levels throughout the reproductive period (excluding abortions to women who are not married). Among all geographic stratums the calculated values for the index of induced abortion reaches a maximum of 0.998 in 2000 for Sindh and a minimum of 0.981 in 2006 for Punjab (Table 3). This range of abortion index provides almost negligible contribution to the reduction of fertility in Pakistan.

4.4 Postpartum Infecundability (C_i)

The index is designed to describe the effect of extended periods of postpartum infecundability caused by breastfeeding or postpartum abstinence and is the ratio of total natural fertility to total fecundity. The index value varies inversely with the average duration of postpartum infecundability denoted by 'i' in the index formula. Average duration of breastfeeding in months is needed to compute he value of 'i'. Because the practice of breastfeeding has an inhibitory effect on ovulation and thus increases the birth interval and reduces the natural marital fertility. The use of mean duration is preferred although some have used the median duration of breastfeeding for a variety of reasons. For example, DHS data produce distributions of duration of breastfeeding that are highly skewed. Consequently, the median duration have been observed to be shorter than the mean duration with a variation of 1.5 to 2 months and the other reason of preferring mean duration is based on the mathematical structuring (indexes are expressed as proportion) of the proximate determinant model indexes (Stover, 1998).

We used the mean duration of breastfeeding using the current status data. Mean duration of postpartum infecundability (MPPI) using the duration of breastfeeding have been calculated for the seven geographic entities and are shown in Appendix A. Among all geographic stratums the calculated values for the MPPI reaches a maximum of 14.22 months in 1990 for rural resident women and a minimum of 10.60 in 1990 for urban resident women. The gap in MPPI values since 1970s has not been significant. The MPPI values for period earlier than 1990s are 12.65 (for period 1975) and 12.41 (for period 1984) months which fall in the range between 10.60 and 14.22 months. The value of MPPI has not much changed in Pakistan since 1970s.

Table 3 presents the estimated values of index of postpartum infecundability across all regions. For total women, postpartum infecundability reduce the total fecundity rate by 34% (C_i=0.661) in 2006. For the period 1990 to 2006, a marginal increase in the index value (1.10 percentage point) is observed. Across all seven geographic stratums the greatest effect of postpartum infecundability is observed in case of rural resident women in 1990. The index value (0.611) shows that the total fecundity (physiological capacity to bear children) is suppressed by 39%. It is interesting to note that the postpartum infecundability index presents the same level in 2006 for total, urban and rural resident women (index value=0.661).

4.5 Role of Fertility Inhibiting Determinants

The contribution of the three main fertility inhibiting determinants (postpartum infecundability, marriage and contraception) is shown in Figure 2. The geographical pattern suggests that postpartum infecundability and marriage played the main role as fertility inhibiting factors however, practice of contraception over time turned out to be other key fertility inhibiting determinant in urban areas and Punjab during the second half of 1990s.

For example in case of urban women in 1990, the practice of contraception contributed to reduce the total fecundity (total fecundity rate of 13.0 children per Pakistani women) by 2.4 children per woman. The contribution of contraception increased significantly in the next 10 years, and in 2000 it contributed to decrease fertility from its theoretical maximum (TF=15.3) by more than 4 children per woman (4.2) (Figure 2 b). Then within the next 6 years (from 2000 to 2006), the contribution of contraception expressed in terms of percentage points reduces 33.2% of fertility levels in 2006 (contributes to decrease TF by 4.4 children per woman). Finally regarding urban areas it could be said that the fertility inhibiting effect of contraception in terms of children per woman (or percentage point) was doubled when compared to contribution observed in 1990.

5. Discussion: What is the Contribution of Proximate Determinants of Fertility in Pakistan?

Since the 1990s, Pakistani fertility has gradually started to decline. In late 1990s, the end of martial law regime under the cover of Islamic laws and the transition to democracy with a rigorous publicity of FP acted as a main initiator to the decline of Pakistani fertility. Applications of the Bongaarts model to the 1990 Pakistan Demographic and Health Survey

(PDHS), 2000 Pakistan Reproductive Health and Family Planning Survey and 2006 PDHS allowed examination of the changes influencing Pakistani women in the late 2000s to control their fertility. The fertility inhibiting effect of contraception (expressed in terms of number of children per woman) is more than double from one child per woman in 1990 to 2.7 in 2000. Clearly this was the end of democratic regime when General Mushraf had taken over the Government with a military action. The fertility inhibiting effect of marriage affected the outcome of fertility in Punjab and urban areas. In 1990, increase in age at first marriage contributed to reduce the TF (total fecundity rate of 13.4 children per woman) by 2.4 children per woman in Punjab. Within the next 16 years, the contribution of marriage decreased fertility from its theoretical maximum by 3.1 children per woman.

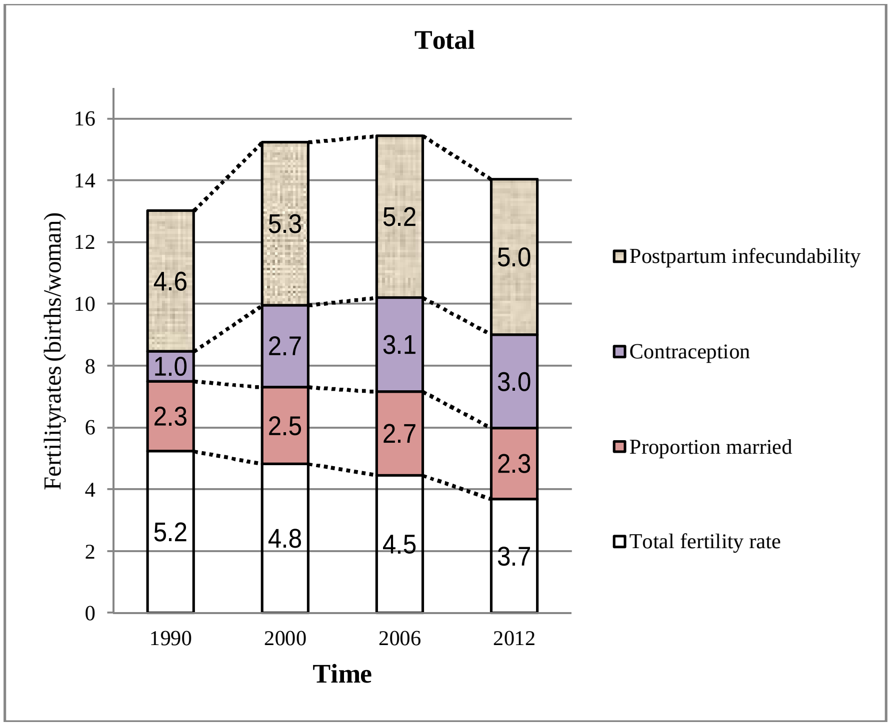

Figure 2: Changing Contribution of the Fertility-Inhibiting Determinants to the Pakistani Fertility Decline, 1990-2012

By combining contraception and marriage, it could be concluded that contraceptive practice is primarily responsible for the wide range of the levels of fertility within marriage in Pakistan. The results from this study provide evidence that from 1990 to 2000 Pakistani women increasingly used contraception to control their reproduction and to extent increase in age at first marriage as a primary fertility regulation method—a finding quite similar to some of the African countries (Sturlik & Vollmer, 2015). Another interesting conclusion could be drawn when comparing to previous periods: from 1974 to 1990, lactational infecundability has been found the most-significant fertility inhibiting effect. However, this effect attenuated from 1990 to 2006 (Aziz 1994). Our conclusion is consistent in case of Bangladesh (formerly part of Pakistan) till the early 1990s that the postpartum infecundability was observed to be the strongest fertility reducing factor .The influence of abortion in reducing fertility seems to be negligible. The Bongaarts model estimated TFR for period 1990 (5.2), 2000 (4.8), and 2006 (4.1) were marginally higher in 1990 survey (0.2 births per woman) and 2006 survey (0.4). It can be concluded that the difference between survey and estimated TFR could be attributed to induced abortion.

5.1 Quality of Abortion Data in Pakistan

Demographic surveys in Pakistan suffers in collecting the quality information on abortion because women are unlikely to report their abortion experiences when questioned directly in face-to-face interviews, particularly where the abortion is prohibited by law or because the safe abortion services are inaccessible or because the cost of induced abortion is not affordable. In addition, the quality of estimates using abortion statistics depends on the completeness of abortions reported and recorded. Selective omissions from the reproductive birth histories of women are potentially the serious data quality issues. For example, in 2006-07 Pakistan Demographic and Health Survey only 2 per cent of the sampled women had said they had an abortion. Therefore, by following the quality and quantity issue of abortion data at national scope in Pakistan, the contribution of abortion index taken with care.

Based on the TFR values using proximate determinants model Bongaarts and Potter (P.104) categorized the population into one of the four stages of transition (Bongaarts and Potter 1983). The first group with TFR greater than 6.0, indicates Phase 1, the second group with TFR value from 4.5 through 6 in phase II, phase III with TFR ranging from 3.0 to 4.5, and phase IV with TFR less than 3.0 children per woman. Based on the results estimated using Bongaarts and Potter`s criteria, this study confirms that: Pakistan has entered the early phase III of transition.

The proximate determinants model also allows a regional understanding of fertility transition in Pakistan. To understand the regional differentials in terms of fertility transition in Pakistan, regions are ranked from lowest to highest values of TFR in 2006 and 2012 and the information is presented in Table 4. The regional results show that none of the region has currently reached at the advance stage of transition, although urban, Punjab and Baluchistan are heading towards the phase III of transition in 2006. There is a clear change in 2012 that all six regions are in phase III of fertility transition of Pakistan.

Table 4: Stage of Fertility Transition in Different Regions of Pakistan, 2006-2012

Region	**Phase of transition**	
	2006	**2012**
Urban	III	III
Punjab	III	III
Baluchistan	III	III
NWFP	II	III
Rural	II	III
Sindh	II	III

The analysis presented in this paper suggests that attention to be given to two dimensions: contraceptive use and age at marriage. Lessons should be learnt from the previous strategies to lower the fertility levels in the form of set targets for the increase of contraceptive use in Pakistan actually has not motivated the mind of people. We recommend the indirect approaches to bridge this gap. For example, in formal education programs some portion of educational syllabus should include the introduction to contraception as well as information on sexually transmitted diseases. A similar kind of strategy was adopted in neighboring country of Pakistan namely, Iran where the fertility levels have tremendously reached at below replacement after the Islamic directive came in 1980s (Aghajanian 1994; Aghajanian and Merhyar 1999). Although, it is sometimes thought that devout Muslims have views oppose to the use of contraception, the opinions of Pakistani religious leaders on the support of their faith diverge widely (Nasir and Hinde 2011). A greater challenge is to motivate those leaders who have influence on the behaviors whom they lead.

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