

M. Naseem Iqbal Farooqui

Factors Affecting Rural Fertility in Pakistan

Introduction

THE historical decline of fertility in the countries of Europe and North America has generally been attributed to a complex of factors related to the process of modernization, economic development and industrialization. Due to the overlapping nature of urbanization, improved level of education, social mobility and declining mortality, agreement is lacking among the social scientists as to the relative importance of each of these underlying factors and their modes of action. Increasing attention has been given in the recent past to the increasing cost of rearing children as a factor affecting fertility decline. Leibenstein [1] who was the first to conceptualize an economic theory of fertility, noted the utilities and costs of children in terms of income effects, survival effects and the effects due to changes in occupational distribution. Becker [2] applying the concepts of consumer preferences or tastes, choose between alternative combinations of commodities. The economic variables influencing that choice are a budget constraint (income) and the relative prices of commodities. Children are seen as commodities providing income in terms of psychic satisfaction. The demand for children can be interpreted as a demand for a particular kind of consumer durable. The quality of children in Becker's model is measured by the amount of money spent on them. Becker's model was, however, modified by Easterline [3] who suggested modifications of the concepts of income and emphasized the influence of sociological factors acting as constraints on economic factors. He proposed a more complex treatment that would take account of differing attitudes among various socio-economic groups. Following Leibenstein [1], high fertility in the rural areas of the developing world including Pakistan can be attri-

buted to benefits derived by parents from children as productive agents and as a source of security in emergencies and in old age. On the average, according to this view, the benefits to parents from having births are relatively greater and the costs relatively lower. The main source of family income in rural areas is that of the adult male head of household. A change in the income of the head of household may have a variety of effects on his desires for having children. Women's cash contribution to family income comes from wage work outside the home. In order to devote her time to children, a woman foregoes opportunity to earn additional income or undertakes other activities. The "opportunity cost" of children is, according to economic theory, the most important part of the total cost of rearing children. Thus female labour force participation is directly competitive with high fertility. In agricultural societies, few women work outside their homes for wages but instead work as unpaid family workers on family farms. The benefits and costs of children in these surroundings are assumed to be assessed by parents within an institutional context defined by such things as laws of inheritance, land tenure systems, opportunities for migration, marriage customs as well as the degree of uncertainty in their life. Studies conducted in various parts of the world depicting the effect of rural socio-economic development on rural fertility are numerous yet for present purposes only studies conducted in developing countries undergoing rapid socio-economic changes are being reviewed here in the following paragraph.

Kocher [4] hypothesized that if increased agricultural production is widely diffused so that rural incomes rise in a fairly egalitarian manner, a set of processes will be activated leading to improved living conditions and a more modern life style for most of the rural population. He observed the simultaneous trends of declining fertility, advancing agricultural productivity, and increasingly egalitarian rural income distribution in Taiwan, Japan, and South Korea. The author also illustrated the cases of dominating influence on fertility of the impact of inegalitarian agricultural development. Lee and Sun [5] while reviewing the Taiwanese development experience argue that in the first stage of agricultural development in a society with rapid population growth, the new techniques and innovations introduced are those which are labour intensive in character so that the extra labour force in rural areas could be absorbed and labour productivity improved. They also suggest that modernization raises aspirations of rural families for consumer's goods and children's education, factors to pressure families to minimize family size. In addition, adoption of modern agricultural techniques facilitates adoption of family planning. Mueller [6] by drawing upon the experiences in Japan, Taiwan and Indian Punjab, traces socio-economic, economic-demographic and purely economic pathways whereby agricultural change has both fertility raising and fertility reducing effect. She concludes that the curbing of population growth through increased child survival, made possible by better nutrition, health and sanitation services, is likely to be marginal. In her

view the introduction of high yielding seeds could provide strong economic incentive for the farmers to purchase modern farm inputs in greatly increased quantities and that rising income may inspire the farmers to invest in education of children. Thus raising consumption aspiration along with investment in children should lead farm families to be more conscious of the economic burden of having many children. In another study Mueller [7] while conducting an economic study of the value of children in agrarian families with the help of an aggregated life cycle model based on consumption and production profiles of age and sex categories of children, finds that the notion that farmers in developing countries benefit from large families loses plausibility. She, therefore, concludes that agricultural development enhances marginal utility of children, increases their economic value, and diminishes restraints of higher parity families. Yet in another study Mueller [8], by analysing island-wide sample survey data of 675 Taiwanese farmers, concludes that since the economic benefits of children are undergoing a weakening trend, the impact of this transformation upon fertility is negligible and of unclear direction. The author cautions that these findings may be unique to Taiwan since agricultural development there has been broadbased, evolutionary, and supported by infrastructure development that helps spread of consumption aspiration from urban to rural areas. Mueller and Cohn [9] with the help of a 1969 island-wide random sample survey of 2,100 couples used fixed measures of income and three measures of fertility to investigate the income-fertility relationship. The data, however, failed to show the expected positive relation between income and fertility possibly owing to the fact that the data had not taken into account the effect of child costs upon fertility decisions.

Having reviewed the relevant literature, the object of the present study is to identify those factors, among the broad socio-economic framework, which could possibly be responsible for bringing about a sustained reduction in the rural fertility level in Pakistan. It is however, clear that the population growth rate [35] in Pakistan is looming large (around 3 percent per annum during 1972-81) in a society where most of the benefits of socio-economic development are eaten up by the rising population under the influence of near constant fertility and moderately declining mortality. The attention of both the policy makers and the social scientists in Pakistan will have to be focused, in future, on the rural masses and their environment because it is here that the real solution of economic welfare of the whole society is to be sought. Apart from introduction, this study is divided into six main parts namely data source, methodology, an overview of agricultural development, results, conclusion and policy implication. The review of agricultural development is being undertaken here with a view to educate the readers about the history and the problems of agricultural development in Pakistan. All these, in the opinion of the author, are likely to help the readers in understanding the implication of population growth and agricultural development in Pakistan.

Data Source

Data for deep analytical studies of family formation is limited in Pakistan. However, in the present paper macro level data from population and agricultural censuses has been utilized. The necessity of utilizing macro-level rather than micro-level data arises from two facts. The first one is the non-availability of relevant micro-level data and the second is the ability of macro-level or community level variables to capture some of the important variations in the fertility behaviour which could otherwise not be possible by the utilization of the relevant micro-level variables. Moreover, for the purposes of formulating national population policy inclusion of both micro-level and macro-level data in a given socio-economic framework is highly desirable. Apart from the consideration of a host of socio-economic and demographic variables likely to be associated with rural fertility decline, the one that needs some extra attention is some sort of index of agricultural production or farm income. Since analysis of the inter-relationship between fertility and agricultural production should involve observations over time, data constraint in respect of population and agricultural time series has limited the scope of this study to a cross-sectional interaction of socio-economic and demographic variables.

The data for this study pertain to the whole of Pakistan excepting the Agencies, Added and special areas of Frontier regions. The unit of observation is district which is the third administrative layer after the province and division. Data on socio-economic and demographic characteristics of the district population has been obtained from the 1961 population census [11]. Incidentally 1961 census was the only census¹ which provided sufficient data on the rural characteristics of all the 45 districts of Pakistan. The relevant data on major crops at the district level for the period 1954-65 [14] are available in published form and so are the relevant prices of major crops for each year from published figures [22]. The major crops included in the present study for deriving an index of farm income are wheat, rice, barley, maize, jawar, bajra, grain, tobacco, sugarcane and mustard.

1. The first population census in Pakistan was undertaken in 1951, the second in 1961, the third in 1972 and the fourth in 1981. Since the first census in 1951 [10] was undertaken only three years after partition, much detailed information on demographic, social and economic characteristics of the population had to be foregone for the sake of brevity. The 1961 population census [11] was much better in quality and covered more characteristics of the population under study. Moreover, relevant data from the 1972 census of population [12] could not be made possible at district level on account of census organization's policy of collecting the relevant data in sample survey rather than from a big count. The results of the 1981 population census [35] are not likely to be available for some time to come.

Methodology

Ordinarily, agricultural production includes the output of all crops, including vegetables and fruits, as well as output of allied activities like poultry, dairy, fishery, forestry etc. However, this study is confined to crops output, which on the average accounted for about four-fifths of total agricultural production. Output of all allied activities, likely to be significant in some district, is committed here because direct measurement of output from these sources, especially at the district level, could not be obtained.

The next step after the selection of crops is to choose a set of price weights for different crops in order to aggregate them to a single magnitude. The decision in this regard is dependent on the use to which the data is to be put. Since the purpose here is to measure changes in the real disposable income of the farmers, the price at which a farmer sells his output would have to be deflated by the price index of the commodities he purchases. To do this requires data on the market surplus, the seasonal and spatial variation in prices, quantities sold in different markets and seasons as well as changes in the relative price and quantities of the commodities purchased by the farmer. Since the data on all other variables are not available, the set of wholesale prices for major crops both at provincial and district level have been used. A substantial part of the produce is often sold during harvest season, but the proportion varies according to the holding capacity of the farmer. Thus, there is still a case for using the farm harvest price. Unfortunately, the farm harvest prices were not available, therefore, recourse had to be taken to the selection of whole-sale prices which were available for all major crops.

In order to investigate the relationship between rural income and fertility, an additive linear model of family formation in rural sector is postulated. The model is fitted to the observed data through the:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + E$$

by application of ordinary least square technique [15]. Step by step technique of Multiple Regression Analysis has been employed with a view to assess the contribution of each independent variable to fertility. The list of variables included in the model alongwith their description is given as under:

Y = Surviving fertility

X_1 = Farm Income

X_2 = School enrolment

X_3 = Female education

X_4 = Male education

X_5 = Female economic activity

X_6 = Female marriage rate

X_7 = Female age at marriage

X_8 = Population in agriculture

The three indices of surviving fertility are measured as child-woman ratios: (1) the ratio of the number of children less than 5 years of age per thousand women of child-bearing age (15-49); (2) the ratio of children 5 to 9 years of age per thousand women of child-bearing age; and (3) the sum of these two ratios. This synthetic measure of surviving fertility varies less across districts than the actual birth rate since birth and death rates are positively correlated. It will, however, correspond approximately to both the long run size of surviving family in the district and the secular rate of natural increase. The educational variable is measured in two ways: school attendance of children i.e. percent of children 5-14 years of age attending school and educational attainment of adults i.e. percent of males 15 years and over and percent of females 15 years and over who had completed 6 or more grades at the time of census. Since child as well as adult schooling are thought to add in various ways to the costs of rearing children and diminish some of their short run utility, these two measures of schooling are included as separate variables.

Since child's participation in labour force is not reported in the census³, it is assumed that the frequency of child's participation in labour force is inversely related to child's school attendance. Women's opportunity cost is measured as the percent of women 12 years and over engaged in non-agricultural activity. Population in agriculture consists of the proportion of persons of both sexes aged 12 years and over engaged in agriculture. Percent of married females aged 10 years and over is taken as the index of female nuptiality. Since age at marriage of rural females was not reported in the population census of Pakistan, the same was estimated for each district by applying Hajnal's technique [16] on proportion single by age of females in five years age groups. Lastly, in order to arrive at the aggregate output of all major crops included in the study, the five year moving average of crop productions and their price centered at 1961 were calculated and their product cumulated for each district. The aggregate output of all major crops in rupee value divided by the number of male agricultural workers yielded an index of output per male worker in each district.

The output per male worker in agriculture has been used in this study as a proxy for farm income. Female wage workers in agriculture, being few, are

3. Only children 10-14 are classified as workers at the district level but their numbers for the rural part of the district are not reported.

excluded from the calculations. Moreover, it is assumed that, in rural areas, the income of the male head is the deciding factor, since women are either engaged in household duties or work outside their homes as unpaid family workers. Factors affecting the farm income are numerous and depend on the pattern of land utilization, the prevailing system of land tenure, government subsidies, prevailing socio-economic conditions, irrigation facilities as well weather conditions.

An Overview of Agricultural Development in Pakistan

It would be worthwhile to mention briefly in passing the rural structure of Pakistan Society. During the Moghal rule, before 1857, the system of land ownership in the India subcontinent was Feudal in nature⁴. The British, after 1857, appointed intermediaries whose job was to collect revenues from the peasants. In return they were entitled to a certain percentage of produce. These intermediaries were in most cases either the local chiefs who had helped the Britishers gain control of the sub-continent or persons useful in maintaining local support for the British occupancy. These intermediaries became so powerful that they acquired the rights of land distribution, control of rents to the tenants while at the same time having no responsibility for the safety of the tenants. Apart from these intermediate revenue collectors who become landlords, there also emerged a class of money lenders who by virtue of charging very high rates from peasants and small landholders, accumulated good fortune and status among the rural masses. In the absence of any deliberate birth control practice and due to nearly universal marriage, family size increased steadily contributing to ever greater land fragmentation. According to 1960 agricultural census of Pakistan [13], 49 percent of all farms in Pakistan were of less than half an acre, 43 percent were between one half acre to 25 acres whereas only 8 percent had sizes of 25 acres or more. Immediately after landlords,⁵ who occupy the most prestigious position in Pakistan society, comes the class of small landholders followed by tenants and those engaged in non-agricultural occupations. The least prestigious of all groups are landless agricultural labourers.

After the creation of Pakistan, individual provinces enacted land tenancy reforms with a view to changing the existing agrarian structure in the country

4. Under this system the farmers were required to give a part of their produce to local chiefs in return for their claims to land ownership and safety from external aggression. The farmers could not, however, affect any transfer of land.

5. Since a majority of the populace lives in rural areas where land is the primary source of livelihood, landlords are able to exert considerable influence over their areas both politically and economically. Most of the representation in national and provincial assemblies in Pakistan usually consisted of big landlords.

[17]. According to available evidence⁶ [18, 19] land reforms measures were most successful in North West Frontier Province and in East Pakistan (now Bangladesh) where large landlords were less common and land reform legislation was enacted soon after partition. The first big attempt in the direction of land reform came with the promulgation of the land reform law in January 1959 under Martial Law Regulation No. 64. The law put the ceiling on individual ownership of 500 acres of irrigated land or 1,000 acres of non-irrigated land along with restriction on sub-division of existing holdings. The excess land to be realized was to be distributed among the tenants at subsidized prices. Myrdal [20] argues that since provincial governments were delegated the responsibility for consolidating the small holdings, it remained under discussion for a long time in the provincial assembly, thus permitting the large landlords to distribute land to members of their own family. Another land reform law [21] promulgated under Martial Law Regulation No. 115 in March 1972 declared that no individual can under any circumstances own or possess land in excess of 150 acres of irrigated land or 300 acres unirrigated, or a combination of irrigated and unirrigated land, the aggregate of which exceeds the equivalent of 150 acres of irrigated land. There were many sub-classes in the Law regarding confiscation without payment, redistribution of excess land among active cultivators etc. Although there is no reliable figure for resumable area under the new law, it is certain that declarations filed with the land commission do not present a true picture, as large owners have concealed or illegally transferred vast amounts of land [21].

Agriculture occupies the most important place in the economic history of Pakistan. This can be seen by the fact that the share of agriculture to gross domestic product in 1949-50 amounted to about 59 percent [22]. Nearly two-thirds of the GDP consists of food grains which include wheat, rice and maize, wheat being the staple food for the majority of population. The agricultural region of Pakistan lies in the Indus plain and is irrigated by a well established system of canals diverted from the river Indus and its tributaries. Besides weather, which plays a very significant part in the overall production of both total food and non-food crops, irrigation by tubewell has also achieved significant importance in the recent past. The production of wheat, the principal food crop, increased from 3.25 million tons in 1947-48 to 3.8 million tons in 1949-50, after which it started to decline and reached a very low of 3.1 million tons [22] at the start of the first five year plan in 1954-55. The production of wheat again increased from 3.1 million tons in 1954-55 to 4.4 million tons in 1964-65. 1965-66 witnessed serious droughts in Pakistan coupled with low discharge of water in the canals. The 1965 war with India further added to the already

6. The big landlords in the provinces of Sind and Punjab were so powerful that almost nothing was done in these provinces to enforce the tenancy acts.

aggravated situation. The 1966-67 crops year was the record best for wheat production in history with wheat reaching to 6.8 million tons [23] in 1967-68, exceeding the production targets set forth by the government [23]. Although the area for total food crops grew by 5.9 million acres and that for total principal crops by 7.5 million acres during the period 1949-50 to 1966-67, the availability of food grains per capita did not change from its 1949-50 level of 15 ounces per day [23]. There is increasing evidence that planners in Pakistan had always underestimated the size as well as the growth of population [24], in which case the level of food grain per capita in the country should be much lower than its 1949-50 level inspite of the fact that the government has been importing heavily food grains under PL-480 from U. S.

As pointed out by Griffin [25], the strategy for economic development in Pakistan has been to channel resources away from agricultural population in favour of urban class. According to the third five year plan [26], the transfer of savings from the agricultural sector had been achieved through the compulsory procurement of food grains at low prices so as to subsidize the cost of living of urban industrial workers. Generous tax concessions were given to industries whereas a lack of similar incentives existed for commercial agricultural investment. The government's measures had the effect of reducing per capita income and consumption in rural areas relative to the rate of growth of GNP per capita [25]. The rural income per capita declined from 1949 to 1965 due to the fact that it was mostly in agricultural sector that consumption was restrained and a surplus generated [25]. Moreover, the level of food consumption in rural areas could have been lower as income had been sharply redistributed to the urban areas. Because of this expansion of urban industrial sector, the share of agriculture of GDP declined from about 60 percent in 1949-50 to about 44.7 percent in 1970-71. Also the contribution of crops, both major and minor, to GDP also declined from 42.2 percent in 1949-50 to 32.3 percent in 1970-71 [22].

With a view to raise the output per acre as well as the income of the rural masses, a large scale development programme, as part of the village agricultural and industrial development programme⁷, was launched in Pakistan [18]. The overall purpose of these programmes was to enhance the quality of village life through social activities, to create a spirit of self-help and cooperation among villagers and increase community services including basic schooling and medical aid. The programme failed to uplift the economic life of the rural community. The reasons for the failure of the programme were, among others, lack of funds, lack of cooperation among village aid programme and other government departments, inefficient training of village workers, difficulties in recruiting voluntary

7. Apart from the small projects under village aid programme large rural development programmes such as the Indus basin Irrigation project and rural Electrification scheme were also undertaken by the government.

labour for special projects and non-cooperation among villages. Moreover, the services of extension staff were hardly utilized by the cultivators. Also inadequate and low quality of seeds were distributed to them. The prices of fertilizers were so high that about two-thirds of the cultivators were not in a position to use them [18]. This programme was later on abolished by the government during 1960.

The reasons for the stagnant condition of agriculture during the first plan period have already been cited. The GDP in agriculture grew at an annual growth rate of 1.3 percent⁸ during 1950-55 with annual growth rate of GDP in manufacturing being 9.1 during this period [27]. The largest growth rate (23.7) during this period was evident in large scale manufacturing industry indicating thereby transfer of resources from agriculture to industry. The condition of agriculture growth remained almost stagnant as before even during the first plan period (1955-60). However, all sectors of the economy in this period were either stagnant or experienced a substantial decline in growth rate, the sector most adversely affected being large scale manufacturing. The growth rate of total GDP declined to its record low of 2.4 percent per annum whereas gross per capita income did not show any variation even during the first plan period. The second five year plan launched in 1960 gave top priority to agriculture and education [2]. Unlike the first five year plan [28], the targets for the second five year plan were either met or exceeded. The GDP during this period increased at an annual compound growth rate of 6.8 percent with remarkable growth occurring in all sectors of the economy [22]. The growth in agriculture output during 1960-69 occurred due to the institution of price support for agricultural produce, lowering of high export taxes on farm produce and abolition of compulsory sale to the government [27]. These policies had the beneficial effect of giving incentive to changing cropping pattern of commercial farming in the country [27]. There were improvements in agricultural extension services and tremendous increase in the use of fertilizers owing to the improvement in the distribution channels [21].

Results

In the following paragraphs, the effect of various socio-economic and demographic variables including income on fertility in a rural setting is examined using the household model presented in earlier part of this paper. The interaction of surviving fertility with selected socio-economic variables of the rural population at aggregate district level is picturized through the use of a set of regression equations. Tables 2 through 4 present the regression equations generated through the application of three sets of fertility indices. For simpli-

8. Calculated from statistics given in [23].

city only one of the three fertility indices is utilized at a time. Table 2 presents regression equations with dependent variable child-woman ratio 0-9. Only results of this table are analysed here. However, regression equations in Tables 3 and 4 are also provided with dependent variables child-woman ratios 0-4 and 5-9. Reader is warned against drawing any conclusion from these two tables simply because age 0-4 is highly deficient in coverage in 1961 census and age 5-9 is on the contrary over-reported in the 1961 census. The artificial and irregular variations of child-woman ratios 0-4 and 5-9 in Tables 3 and 4 are likely to bias the results of these tables. However, dependent variable with child-woman ratio 0-9 is expected to eliminate the coverage error inherent in ages 0-4 and 5-9. Relevant bivariate relationships among all the variables are presented in Table 1 whereas means and standard deviations of all the relevant variables are given in Table 5.

It may be observed from Table 1 that the zero order correlation coefficient between farm income and fertility is negative and statistically significant. Moreover, the association between farm income and school enrolment and between farm income and male education in rural areas is positive and significant (Table 1); yet the association of farm income with female education is positive but statistically insignificant. The positive association of farm income with school enrolment shows that as income of rural families rise they tend more and more to send their children to school. Positive association between male education and income signifies the earning capacity of male education. The probable reason for weak correlation between farm income and female education may be the limited role played by women in rural agricultural society of Pakistan, where their major role⁹ is inside the home. Positive but insignificant effect of income on female economic activity also lends support to the above reasoning. It may be noted that where farm income is higher, female age at marriage is also higher (Table 1) but female marriage rate is lower, with coefficient of correlation between farm income and female marriage rate being not significant. Also rising age at marriage shows depressing effect on fertility and female marriage rate but positive effect on female economic activity, school enrolment and adult education. The coefficients of correlation are found to be statistically significant in all cases (Table 1). This shows that all the associations of bivariate nature are in the expected direction.

Since bivariate correlation analysis can explain only the direct relationship between two variables without, however, taking into account the effect of other

9. The insignificant role of rural women outside agriculture can be attributed to their very low education level and also to the institution of purdah among rural families in general. However, the coefficient of correlation between female education and female economic activity is, as usual, positive and statistically significant (Table 1). This shows that women with education have the potential of securing jobs outside home in the non-agricultural sector of the economy.

TABLE 1—MATRIX OF ZERO ORDER CORRELATION FOR THE RURAL DISTRICTS OF PAKISTAN

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1. Child woman ratio 0-4	1.000	1.0									
2. Child woman ratio 5-9	0.822**	1.000									
3. Child woman ratio 0-9	0.914**	0.905**	1.000								
4. Farm income	-0.252*	-0.407**	-0.338*	1.000							
5. School enrolment	-0.546**	-0.612**	-0.617**	0.393**	1.000						
6. Female education	-0.439**	-0.477**	-0.481**	0.066	0.661**	1.000					
7. Male education	-0.443	-0.554**	-0.504**	0.337*	0.891**	0.815**	1.000				
8. Female's economic activity	-0.320*	-0.287*	0.340*	0.118	0.505**	0.349**	0.401**	1.000			
9. Female marriage rate	0.234	0.216	0.256*	-0.162	-0.286*	-0.213	-0.232	-0.199	1.000		
10. Age at marriage	-0.342*	-0.329*	-0.416**	0.414**	0.426**	0.332*	0.446**	0.260*	-0.487*	1.000	
11. Population in Agriculture	0.129	0.137	0.139	0.064	0.257*	0.531**	-0.388**	-0.198	0.415**	-0.569*	1.000

*Significant at $P = 0.05$ **Significant at $P = 0.01$

TABLE 2—STEP BY STEP REGRESSION OF INDEPENDENT VARIABLES ON FERTILITY : RURAL PAKISTAN
(Dependent Variable is Child-woman Ratio 0-9)

Constant	Farm Income	School Enrolment	Female Education	Male Education	Female's Economic Activity	Female Age Marriage Rate	Age at Marriage	Population in Agriculture	R ²	Contribution to R ²
1754	-0.1809* (2.447)								0.1141**	0.1141
1846	-0.0605 (0.863)	-13.749** (4.365)							0.3905**	0.2764
1851	-0.0832 (1.141)	-10.4228* (2.394)	-16.3607 (1.104)						0.4081**	0.0176
1774	-0.1177 (1.650)	-21.0304** (3.325)	-45.9161* (2.366)	15.3351* (2.226)					0.4734**	0.0653
1774	-0.1178 (1.627)	-21.0050** (3.030)	-45.8944* (2.320)	15.3234* (2.163)	-0.1547 (0.010)				0.4734**	0.0000
1711	-0.1153 (1.568)	-20.6326** (2.909)	-45.1136* (2.241)	15.0543* (2.089)	0.1522 (0.009)	0.8799 (0.348)			0.4750**	0.0016
2130	-0.0861 (1.122)	-21.5461** (3.043)	-44.9113* (2.246)	16.5425* (2.280)	2.1441 (0.131)	-0.6175 (0.202)	-20.9731 (1.241)		0.4960*	0.0210
2558	-0.0471 (0.598)	-19.3145** (2.736)	-56.7978** (2.722)	15.9531* (2.386)	1.5583 (0.098)	0.3558 (0.1313)	-37.808 (1.942)	-5.7554 (1.634)	0.5309**	0.0349

*Significant at $P = 0.05$

**Significant at $P = 0.01$

Note : Figures in parentheses indicate the t -values associated with regression coefficient.

TABLE 3—STEP BY STEP REGRESSION OF INDEPENDENT VARIABLES ON FERTILITY : RURAL PAKISTAN
(Dependent Variable is Child-woman Ratio 0-4)

Constant	Independent Variables								R ²	Contribution to R ²
	Farm Income	School Enrolment	Female Education	Male Education	Female's Economic Activity	Female Marriage Rate	Age at Marriage	Population in Agriculture		
859	-0.0751+ (1.709)								0.637**	0.0637
906	-0.0446 (0.317)	-0.528** (3.762)							0.2997*	0.2360
908	-0.0247 (0.057)	-5.3842* (2.066)	-8.2653 (0.093)						0.3142**	0.0145
868	-0.0429 (0.992)	-10.982** (2.566)	-23.8630* (2.0268)	8.0929+ (1.935)					0.3730**	0.0587
869	-0.0433 (0.985)	-10.791* (2.566)	-23.6999+ (1.974)	8.0052 (1.863)	1.1632 (0.119)				0.3732**	0.0002
832	-0.0418 (0.937)	-10.5694* (2.456)	-23.2351+ (0.902)	7.8511+ (1.794)	0.9805 (0.098)	0.5236 (0.342)			0.3751**	0.0019
1004	-0.0298 (0.633)	-10.9448* (2.519)	-23.1521+ (1.887)	8.4565+ (1.898)	-0.1621 (0.016)	-0.0915 (0.0536)	-8.6166 (0.831)		0.3866*	0.0115
1213	-0.1072 (0.218)	-9.8517* (2.245)	-28.9740* (2.234)	8.1870* (1.849)	-0.4490 (0.045)	0.3901 (0.225)	-16.8626 (1.393)	-2.890 (1.288)	0.4136**	0.0210

*Significant at $P = 0.05$

**Significant at $P = 0.01$

+Significant at $P = 0.10$

Note : Figures in parentheses indicate the t -value associated with the regression coefficient.

TABLE 4—STEP BY STEP REGRESSION OF INDEPENDENT VARIABLES ON FERTILITY : RURAL PAKISTAN
(Dependent Variable is Child-woman Ratio 5-9)

Constant	Independent variables							R ²	Contribution to R ²	
	Farm Income	Enrolment	Female Education	Male Education	Female's Economic Activity	Age at Marriage	Population in Agriculture			
894	-0.1183** (2.926)							0.1661**	0.1661	
940	-0.0573 (1.528)	-6.9685** (4.157)						0.4075*	0.2415	
943	-0.0716+ (1.847)	-4.8714* (2.105)	-10.3141 (1.309)					0.4313**	0.0238	
925	-0.0795+ (2.001)	-7.3211* (2.076)	-17.1396 (1.583)	3.5415 (0.921)				0.4431**	0.0118	
923	-0.0796+ (1.959)	-7.6375+ (1.977)	-17.4096 (1.579)	3.6866 (0.933)	1.9253 (0.2141)			0.4438**	0.0006	
912	-0.0786+ (1.915)	-7.5709+ (1.912)	-17.2699 (1.536)	3.6385 (0.904)	1.9803 (0.217)	0.1574 (0.111)		0.4440**	0.0002	
916	-0.0783+ (1.792)	-7.5795+ (1.879)	-17.2680 (1.516)	3.6526 (0.883)	1.9916 (0.215)	0.1432 (0.090)	-0.1985 (0.206)	0.4440**	0.0000	
1023	-0.0685 (1.4851)	-7.0204+ (1.695)	-20.2463 (1.654)	3.5049 (0.841)	1.8523 (0.198)	0.3898 (0.238)	-4.4169 (0.386)	-1.4421 (0.698)	0.4514**	0.0074

*Significant at $P = 0.05$

**Significant at $P = 0.01$

+Significant at $P = 0.10$

Note : Figures in parentheses indicate the t -values associated with regression coefficient.

TABLE 5—MEANS AND STANDARD DEVIATIONS OF RELEVANT VARIABLES FOR RURAL PAKISTAN

<i>Name of the Variable</i>	<i>Mean</i>	<i>Standard Deviation</i>
1. Child-woman ratio 0-4	817.8	89.02
2. Child-woman ratio 5-9	828.8	86.82
3. Child-woman ratio 0-9	1654.0	160.10
4. Farm income	551.26	229.00
5. School enrolment	11.54	6.658
6. Female Education	1.859	1.803
7. Male Education	17.840	8.046
8. Female Economic Activity	2.028	1.363
9. Female Marriage Rate	67.6	7.87
10. Age at marriage	18.4	1.23
11. Population in agriculture	39.09	8.103

variables, recourse has therefore been made to a more complete representation of the model at the aggregate level. Ordinary least square regression analysis is utilized here to study the effect of various socio-economic variables on fertility. Table 2 presents a set of equations where the effect of socio-economic variables on fertility (child-woman ratio 0-9) is picturized through the use of multivariate analysis. In the present study, the predictive power of the relationship in the regression model is less important than the significance and size of the regression coefficient involved. It may be stated that the coefficient of multiple correlation (R) is significant¹⁰ at each stage of step regression in Table 2. The model on the whole explains about 53 percent inter-district variation¹¹ in surviving fertility in rural Pakistan. As is evident from the table, income explains¹² about 11

10. The significance of R indicates the appropriateness of the model in the present case.

11. The models generated by taking fertility measures child-woman ratios 0-4 and 5-9 and presented in Table 3 and 4 explain on the whole about 41 and 45 percent interdistrict variation in surviving fertility in rural Pakistan.

12. Income in the models of Tables 3 and 4 explains about 6 and 17 percent variation in fertility respectively.

percent of the inter-district variation in surviving fertility whereas¹³ income, school enrolment, female education and male education taken together contribute about 47 percent of the variation in surviving fertility. Contribution of female's economic activity and the marriage rate to total variance is almost negligible¹⁴ and proportion of population in agriculture contributes about 3.5 percent of the variance in fertility.

As regards the contribution of each independent variable to the total variation in fertility, the last column of Table 2 shows that about half¹⁵ of the explained variation (0.2764 out of 0.5309) in fertility is explained by school enrolment alone. Income explains only half as much (11 percent) as school enrolment; together these two variables account for 39 percent of total variance or nearly three-fourth of explained variation.

As indicated by equation one Table 2, the direct effect¹⁶ of income on fertility is negative and significant at 5 percent coefficient level. However, in the presence of education, the income effect, though still retaining its depressing effect on fertility, loses its statistical significance. The negative sign of the regression coefficient for income, however, predominates even when all variables of the model have been taken into account. The regression coefficients for education¹⁷ are strong and statistically significant. Thus even when the income effect is controlled, education has a separate effect on fertility. The most powerful coefficient is the one for school enrolment, suggesting that, other things being equal, a rising tendency to send children to school imposes opportunity costs on parents which are competitive with bearing and raising children. Since fertility and education are negatively associated (Table 1), it is reasonable to interpret these results in terms of the fertility effect even though the child-woman ratio is affected by both fertility and mortality. Female education, when controlled for income, male education, and other variables, tends to exert separate and distinct effects on fertility. The coefficient of female education is as strong

13. The joint contribution of income, school enrolment and adult education in Table 3 is about 37 percent, whereas the contribution of the same variables in Table 4 is about 44 percent. As opposed to the model of Table 2, these low contributions are the result of low contribution of income and school enrolment.

14. This does not change appreciably even if the dependent variables are modified as in Table 3 and 4.

15. The contribution of explained variance of school enrolment in the other two models is somewhat more than 50 percent of the total.

16. The direct effect of income on fertility is negative in the other two models but the regression coefficient for income is statistically weak in model 4. Income, however, maintains its negative effect throughout.

17. In model 3 the regression coefficients of school enrolment and female education are negative and statistically significant, whereas that of male education are positive and statistically weak. On the other hand in model 4 only the coefficient of school enrolment is significant. Otherwise, that of male and female education are statistically not significant.

as that of school enrolment in our model. The positive sign of male education reflects the effect of interaction among school enrolment, female education, male education and fertility. The coefficients of Pearsonian correlation between school enrolment and male and female education are 0.8907 and 0.6608 respectively, and that between male and female education the correlation coefficient is 0.8155 (Table 1). All these correlation coefficients are statistically significant at one percent confidence level. Moreover, the correlation coefficients between education variables and surviving fertility are also significant at one percent confidence level. The regression coefficient of male education also indicates that, even when income of male head of household and female education are held constant, male education has direct effect on the number of surviving children.

The most unusual phenomenon in our model is the appearance of a significant positive regression coefficient for male education. It is, however, in contradiction, to the usual finding of a significant and negative female education effect and weak and positive male education effect observed in other studies [29; 30; 31]. The positive effect of male education on fertility reflects in fact the earning capacity of male and the interpretation of this positive relation could, therefore, mean that as income rises so does fertility. The regression coefficient of female economic activity against fertility has a positive sign showing the effect of interaction, although its correlation with fertility is negative and statistically significant. The regression coefficient of population in agriculture against fertility has a negative sign. This is because both male and female workers have been lumped together, otherwise the male population in agriculture should in traditional society exert positive effect on fertility. Female marriage rate and female age at marriage both have the expected sign in relation to surviving fertility, but none adds significantly to overall relationship nor has a regression coefficient that is significantly different from zero.

Though there is a tendency for rural and agricultural regions to record higher fertility rates, it appears that these differences are largely accounted for by the education and income variables and that other variables do not seem to make any significant additional contribution to the explanation of inter-district variation in surviving fertility in rural Pakistan. In respect of female participation in economic activity in agricultural regions of Pakistan, it may be noted that only about one to two percent [11] of adult females participate in non-agricultural activities. These activities are usually confined to agriculturally oriented industries. It is, therefore, interesting to note that female economic activity explains the least (less than one percent) of the inter-district variation in surviving fertility in rural Pakistan. Moreover, the 't' ratios for the regression coefficients are also the lowest in the model. However, since women work mostly as

unpaid family workers¹⁸ on family farms, thus reducing the cost of rearing children, a positive association between unpaid family work and surviving fertility could be anticipated.

Less than one percent contribution of female marriage rate to inter-district variation in fertility is due to the universality of marriage institution in rural areas. Income does not seem to have significant effect on female marriage rate in rural areas. The coefficient of correlation between income and female marriage rate, though negative, is not statistically significant (Table 1). Evidence points to the fact that, in rural areas, daughters are married at an early age. One source [32] reports that 38 percent of village girls are married at the age of 12-14. When a dowry is expected, rising income is apt to be conducive to a greater frequency of marriage. Age at marriage in rural areas explains about two percent variation in fertility and the evidence points to the fact that age at marriage is still very low [32] in rural areas.

Conclusion

An empirical investigation of the household behaviour model analysed in this paper indicates that the rise in rural income of the farmers from agriculture has a depressing effect on rural fertility. However, no firm conclusion can be reached in this regard since our results are not statistically significant at the conventional confidence levels. It is evident, however, that income, through its effect on education, has a significant effect on fertility. School enrolment is the single most important determinant of fertility as measured here, both in terms of magnitude of effect and statistical significance. A unit increase in the percentage of children enrolled in school (Table 2), other things being equal, is associated with a decline of 20 units in the child-woman ratio. However, the enrolment ratio in Pakistan is very low (21.4 percent in 1965) [33] and the dropout rate is high, in fact, the retention rates [33] in Pakistan for primary level of education are the lowest in Asia. In view of the low school enrolment and high dropout rates, it seems that the programme of universal education as enunciated under the new educational policy [34] is likely to have significant effect on the overall fertility level in Pakistan.

Another variable which is an important determinant of family size in Pakistan is the education of female. Female education in terms of the size and significance of its coefficient of partial regression is the strongest variable next to school enrolment affecting family size in Pakistan. In view of the very low status of females in the rural agricultural society of Pakistan, it is highly unlikely that the enhancement of female education could become a reality in the near future.

18. Data on unpaid family workers in agriculture have not been available from the 1961 population census of Pakistan.

It is possible that more clearcut conclusions could be derived from studies which employ field survey data in which individuals and families are the units of observation rather than geographic aggregates. Such studies, moreover, would afford the opportunity to gather information on important intermediate variables which are crucial in the analysis of fertility and to measure fertility in more precise and complex manner than has been possible in this analysis.

Policy Implication

The results derived from the present study have direct relevance to policy making and provide food for thought for both the planners and policy makers in Pakistan. There is no denying to the fact that Pakistan is at the moment experiencing a population explosion which could be viewed as a byproduct of secular decline in mortality and a near constant fertility. The phenomenon of rapid population growth is, however, more evident in rural areas where about 74 percent [12] of Pakistan's population resides. This rural population has during the last two decades been showing growth rates much higher than those of urban population.¹⁹ Moreover, the national family planning programme launched in Pakistan in 1965 does not seem to bring any change in the attitudes of rural masses favouring a lower family size.²⁰ In view of the present state of demographic affairs prevalent in the rural sector of Pakistan, it is highly desirable that an effective population policy, as part of an overall economic policy, be instituted. In order to raise the agricultural productivity massive investment be made in infrastructural facilities such as water conservation system, irrigation, transportation, roads and markets. Government's inputs in credit, fertilizers, extension services and direct government investment in farming project should be increased. More important of all, highly effective land reforms be formulated so as to provide land to landless labourers and peasants. Farm loans should be provided to both the peasants and small-scale farmers. There is, however, evidence that in the past rural elite has benefitted from the farm loans. Effective rural development programmes along with increases in agricultural production is likely to bring a more equal distribution of income in future. Expansion of educational facilities to rural masses by way of opening up new schools should also serve as stimulus for bringing about a change in attitudes

19. Preliminary calculations with 1951-72 urban and rural growth rates of district population point to the fact that rural population, as compared to urban population, has during the last two decades been growing at much faster rate. The urban growth rates have remained either constant or are declining from their past levels.

20. Instead the family planning programme seems to have been favourable to rapid population growth in Pakistan. The programme seems to have some impact on urban population but in quantitative terms no statistics can be presented to prove the case in point.

towards life. Moreover, education would also bring about a change towards adoption of family planning programme in rural areas. All these measures as postulated by the present study have strong bearing on the ultimate attitude of rural population towards lower family size.

Acknowledgement

The author is grateful to Dr. Abdul Razzaque Rukkanuddin, Director General, Population Division, Government of Pakistan, for useful comments on an earlier draft of this paper. For errors and omissions in the paper the author is solely responsible.

References

1. Leibenstein, H., 1977, *Economic Backwardness and Economic Growth*, John Wiley, New York.
2. Becker, G. S., 1960, An economic analysis of fertility. In : *Demographic and Economic Change in Developed Countries*, National Bureau of Economic Research.
3. Easterlin, R. A., 1969, Towards a socio-economic theory of fertility: Survey of recent research on economic factors in American fertility. In S. J. Behram *et al.* (eds.), *Fertility and Family Planning*, Ann Arbor, Michigan, 1969.
4. Kocher, James, E, 1973, *Rural Development, Income Distribution and Fertility*, the Population Council, New York.
5. Lee, T. A. and Sun, T. H., 1973, Agriculture, developments and population trends in Taiwan, paper presented on "Effects of Agricultural Change on Demographic Development in the Third World,". *International Population Conference*, Liege, Belgium, IUSSP.
6. Mueller, Eva, 1976, Value of children in agrarian societies. In : Ronald G. Ridker (ed.), *Population and Development : of the Search for Selective Intervention, for Resources for the Future*, Johns Hopkins University Press, Baltimore, 1976.
7. Mueller, Eva, 1975, "The Economic Value of Children in Peasant Agriculture", Paper presented at the Conference of Population Policy Sponsored by Resources for the Future, Washington, D. C., Mimeographed.
8. Mueller, Eva, "Agriculture Change and Fertility Change : The Case of Taiwan", Unpublished paper of the Population Studies Centre, University of Michigan, Ann Arbor, Mimeographed.
9. Mueller, Eva, and Richard, Cohan, 1974, "The Relationship of Income to Fertility Decisions in Taiwan", Taiwan Population Studies, Working paper No. 26, University of Michigan, Ann Arbor, Mimeographed.
10. Pakistan, *Census of Pakistan 1951*, Bulletin No. 4, Karachi, Office of the Census Commissioner.
11. Pakistan, Census Organization, *Census of Pakistan 1961*, Vol. 3, Karachi.
12. Pakistan, Census Organization, 1973, *Population Census of Pakistan 1972, Provisional Tables*, Census Bulletin No. 1, Islamabad.
13. Government of Pakistan, *1960 Pakistan Census of Agriculture*, Vol. II, West Pakistan, Agriculture Census Organization, Ministry of Agriculture and Works, Karachi.
14. Government of Pakistan, 1966, *Agriculture Statistics for West Pakistan*, West Pakistan Department of Agriculture, No. I.

15. Draper, N. R. and Smith H., 1966, *Applied Regression Analysis*, New York, Wiley.
16. Hajnal, John, 1953, Age at marriage and proportions marrying, *Population Studies*, 3.
17. Government of Pakistan, 1959, *Report of the Land Reforms Commission for West Pakistan*, Government of West Pakistan Press, Lahore.
18. Khan, A. H., 1973, *Land Reforms in Pakistan 1947-72, and Theory and Practice of Rural Works*, South Asia Series Occasional Paper No. 20, Asian Studies Center, Michigan State University.
19. Niazi, M. Shafi and Khawaja, M. H. 1961, *Land Reforms in Pakistan*, Government of Pakistan, Planning Commission, Agriculture Section.
20. Myrdal, Gunnar, 1968, *Asian Drama : An Inquiry into the Poverty of Nations—Vol. I to III*, New York, Partheon.
21. Herreing, Ronald and Ghaffar Chaudhary, M. 1974, The 1972 land reforms in Pakistan and their economic implications : A preliminary analysis, *Pakistan Development Review*, XIII.
22. Government of Pakistan, "25 Years of Pakistan in Statistics, 1947-1972", Ministry of Finance, Planning and Development, Central Statistical Office, Karachi, 1972.
23. Kanhart, F., 1970, *Agriculture and Related Industries in Pakistan : Prospects and Requirements until 1975*, Organization and Economic Cooperation for Development, Paris.
24. Bean, Lee L. and Bhatti, A. D., 1974, Pakistan population in the 1970's : Problems and prospects, *Journal of Asian and African Studies*.
25. Griffin, Keith B., 1965, Financing development plans in Pakistan, *Pakistan Development Review*, V.
26. Pakistan, Planning Commission, 1965, *Third Five Year Plan, 1965-70*, Rawalpindi, Government of Pakistan.
27. Pakistan, Planning Commission, 1960, *Second Five Year Plan, 1960-65*, Karachi, Government of Pakistan.
28. Pakistan, Planning Commission, 1960, *First Five Year Plan, 1955-60*, Karachi, Government of Pakistan.
29. Detray, Dennis N. 1972, *The Interaction between Parent's Investment in Children and Family Size : An Economic Analysis*, Rand Corporation, Santa Monica.
30. Ben-Porath, Yoram, 1970, *Fertility in Israel, An Economists' Interpretations: Differentials and Trends 1950-1970*, RM-5981-FF, The Rand Corporation, Santa Manica.
31. Detray, Dennis, 1970, *An Economic Analysis of Quantity-Quality Substitution in Household Fertility Decisions*, p-449, The Rand Corporation, Santa Monica.
32. Khan, Seemin Anwar and Faiz, Bilquees, 1976, The environment attitudes and activities of rural women : A case study of a village in Punjab, *Pakistan Development Review*, XV(3).
33. Government of Pakistan, 1970, *Education and Supply of Man-Power in Pakistan, 1965-1990*, Part II, Planning Division, Islamabad.
34. Korson, J. Henry, 1975, Bhutto's educational reform, *Journal of Asian and African Studies*, VIII(3-4).
35. Pakistan, Census Organization, *Population Census of Pakistan 1981, Provisional Tables*, Statistics Division, Government of Pakistan, Islamabad.