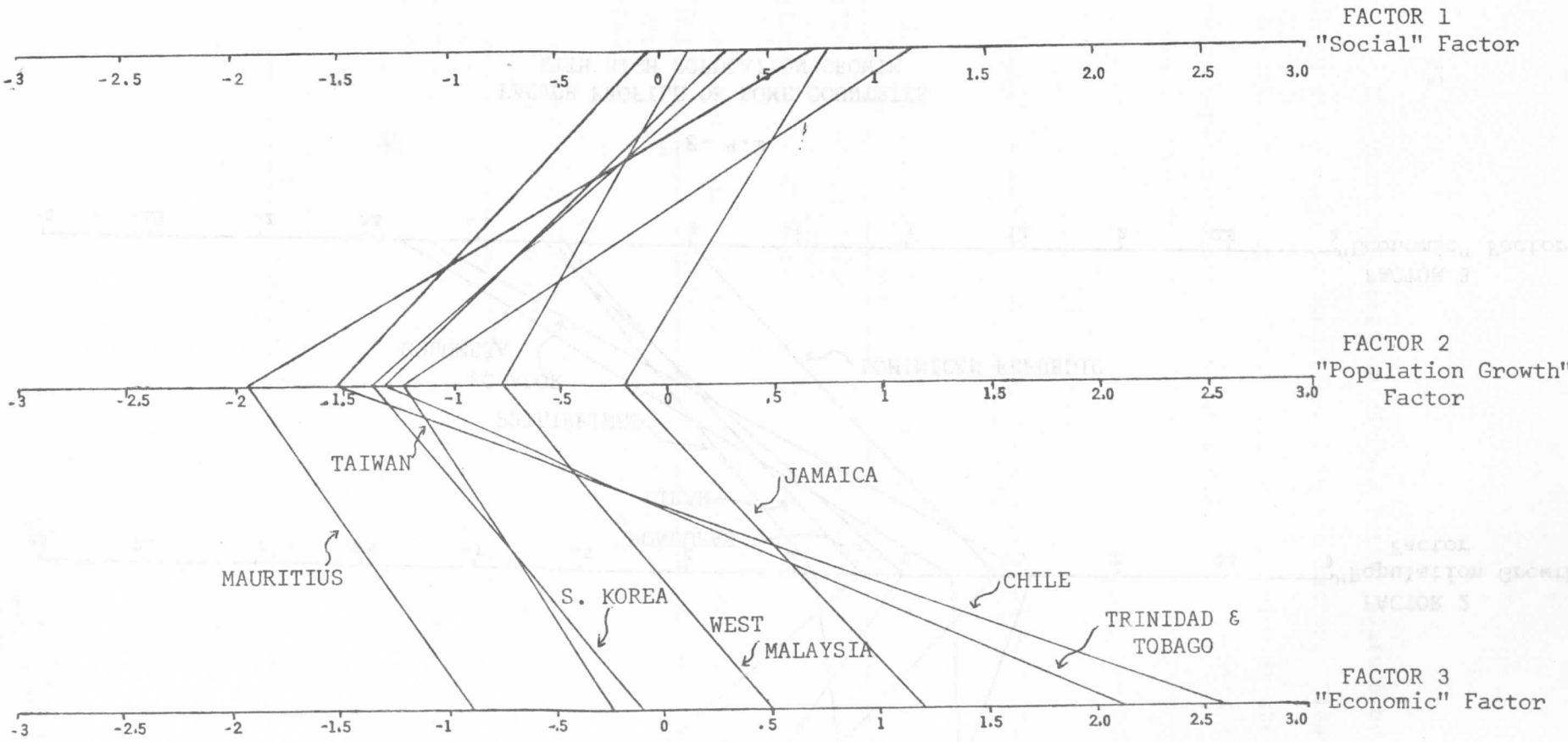

Fig. 4.1

FACTOR PROFILE OF SOME COUNTRIES
WITH LOW POPULATION GROWTH

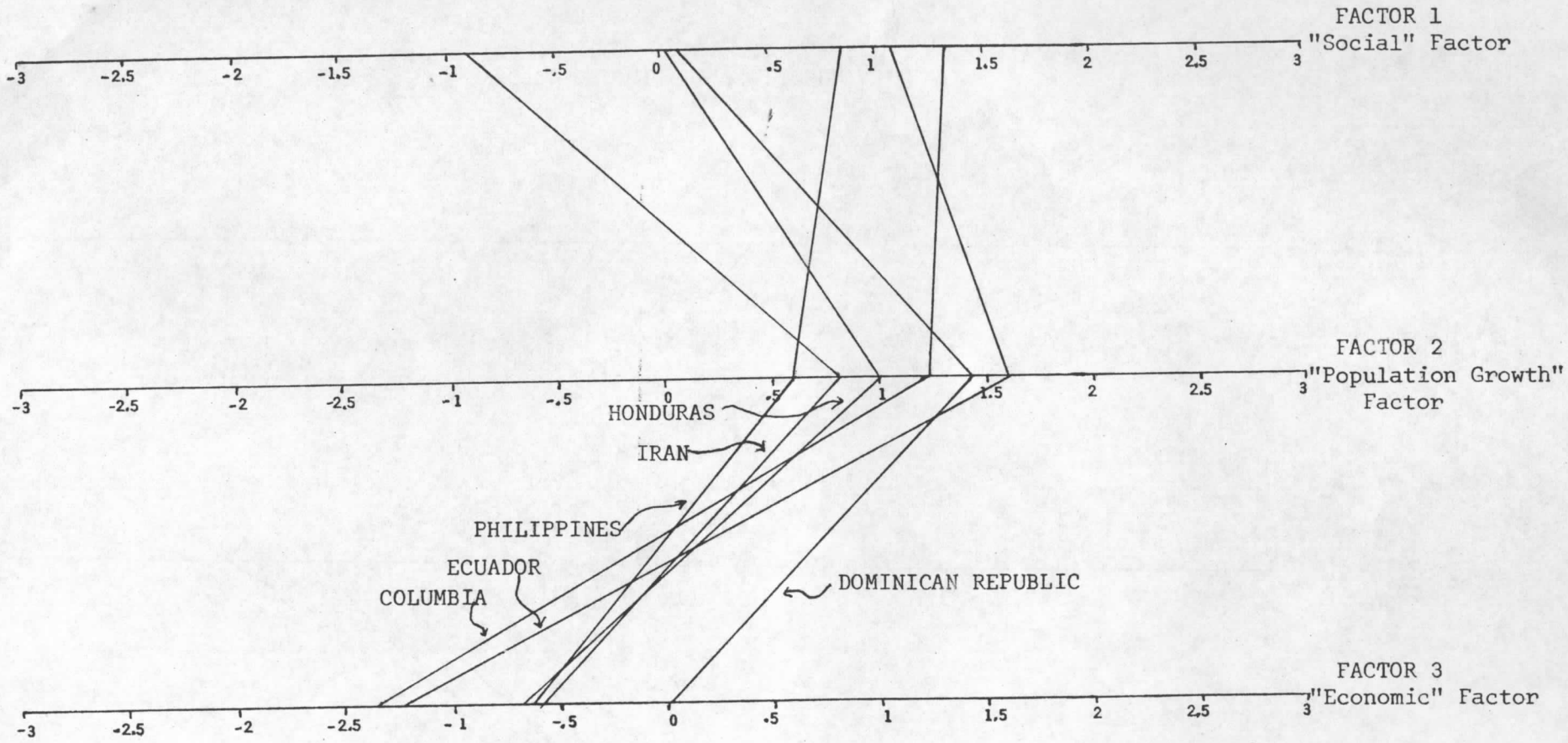

Fig. 4.2

FACTOR PROFILE OF SOME COUNTRIES
WITH HIGH POPULATION GROWTH

The Quartimax Rotation gives a better picture by combining socio-economic conditions into one factor. Classifying the countries according to Table 4.1, we can arrive at the following types of countries in Table 4.2.

Table 4.2

Classification of Countries by Socio-Economic-Conditions and Population Growth Rate

Good Socio-Econ. Conditions	Low Population Growth
Chile	Trinidad & Tobago
S. Korea	Jamaica
Taiwan	

Average Socio-Econ. Conditions	Low Population Growth
Mauritius	
W. Malaysia	
Sri Lanka	

Low Socio-Econ. Conditions	High Population Growth
India	
Nepal	

Low Socio-Econ. Conditions	Average Population Conditions
Laos	Ghana
Nigeria	Uganda

High Socio-Econ. Conditions	High Population Growth
Costa Rica	
Venezuela	
Panama	

Average Socio Econ. Conditions	Above Average or High Population Growth
Columbia	Honduras
Dominican Rep.	Philippines
Ecuador	Thailand
El Salvador	

Average - Socio Econ. Conditions	Average Pop. Growth
Tunisia	
Turkey	

Low Socio-Econ. Conditions	High Population Growth
Iran	
Kenya	

This shows the quite varied situations in the Third World. It must be noted, however, that for countries with low or average economic-socio conditions and exhibiting low or average population growth, all (except for India) have very high birth rates. Population growth rate is modified due to high mortality. Thus we see a clear relationship between socio-economic conditions and fertility.

III. Preliminary Regression Analyses

One thing that is clear in both the correlation and factor analyses is that there exists a high multicollinearity among the socio-economic variables. This may cause difficulty in trying to find the separate "effects" of these variables on birth rates. It may thus be interesting to find out the relationships among socio-economic-demographic variables as well as family planning measures.

The high multicollinearity among variables is again shown by preliminary regression analyses on potential predictors of birth rate. In doing this preliminary analyses we assume a certain heirarchy among the variables. We assume that the demographic and the economic variables (population density, GNP per capita, and urbanization ratio) have a higher priority as predictors on the social variables. That is, it is assumed, for example, that GNP per capita, and urbanization ratio affect school

enrollment and life expectancy, rather than vice-versa. Furthermore, long-run population growth from '60-'71 was used as a predictor to discover if the effect of population growth on the depletion of resources can be caught on certain welfare indicators such as ratio of total population to number of physicians net food supply per capita, dependency ratio. Again without showing the various regression tables, here are some results of the preliminary study.

1. Urbanization ratio is significantly explained by GNP per capita (significant at 1%) and population density (significant at 5%).

2. Newspaper circulation per 1000 inhabitants can be explained by urbanization ratio (significant at 1%) and population density (significant at 2 1/2%).

3. School enrollment rate can be explained significantly (at 1%) by urbanization ratio.

4. Ratio of population to physicians can be explained significantly (at 1%) by school enrollment rate.

5. Both food supply per capita and per capita energy consumption can be explained significantly (at 1%) by GNP per capita.

6. Life expectancy can be explained significantly (at 1%) by the school enrollment rate.

7. Acceptors' rate in family planning programs is significantly explained by GNP growth rate (at more than 1%) and school enrollment rate (at more than 2 1/2%).

8. Years in family planning of a country is significantly explained (up to 2.5%) by population density.

9. No significantly relationship was found between long-run population growth and socio-welfare indicators.

The most relevant observation here is no. 7 and no. 8 which shows the strong relationship between acceptance rate on one hand and GNP growth rate and school enrollment rate on the other; and years of family planning program on one hand and population density on the other. This results are reproduced in Table 4.3 and Table 4.4.

IV. General Summary

Overall, the correlation, factor and preliminary regression analyses point to the following important conclusions:

1. There is a very high multicollinearity among potential predictors of birth rate.

2. The varimax factor analysis shows that the "social" measures (mainly literacy measures and mortality measures) have an

Table 4.3

Relationships Among Potential Predictors of Birth Rate

Dependent Variable: PERACCP

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANCE
GNPGRT	.72911	.50065	.24723	8.696896	**
SCHENR	.07820	.43560	.03169	6.088803	*1/2
(constant)	-1.76372				

Multiple R = .66935 Adjusted R Square = .40557

R-Squared = .44803 Standard Error = 3.18142

F = 10.55192 (**)

**significant at 1%
*1/2 significant at 2 1/2%
*significant at 5%

Table 4.4

Relationships Among Potential Predictors of Birth Rate

DEPENDENT VARIABLE: YRSFMPL

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANCE
POPDEN	0.1485	.47530	.00539	7.588	$*\frac{1}{2}$
(constant)	5.82979				

Multiple R = .47530 Adjusted R Square = .22591

R Square = .22591 Standard Error = 3.3754

$F = 7.587\ (*\frac{1}{2})$

aspect unaccountable by the economic variables. It is speculated that it is these variables that can catch some sort of income distribution and degree of poverty in the countries. This may account for the fact that school enrollment is a better predictor of life expectancy than the more expected health (population per physician) and nutrition (food supply per capita) measures. It is also important to note that it is these variables that are most strongly correlated with birth rate.

3. GNP growth rate and school enrollment rate are both significant in determining more than 40% of the variance in the acceptance rate of family planning programs. This is one of the most important results obtained in this study (which we shall return to in a later chapter) indicating a strong relationship between family planning output and economic and social development. Furthermore population density seems to have some strong relationship with years in family planning.

4. Equally important is the fact that long-run population growth fails to show any relationship with socio-welfare indicators.

With these preliminary and important analyses done, we now are ready to try to discover the relationship of birth rate with the various socio-economic-demographic and family planning variables.

CHAPTER V

BIRTH RATE, SOCIO-ECONOMIC-DEMOGRAPHIC VARIABLES AND FAMILY PLANNING

The main relationships we want to discover can be summarized in the following model:

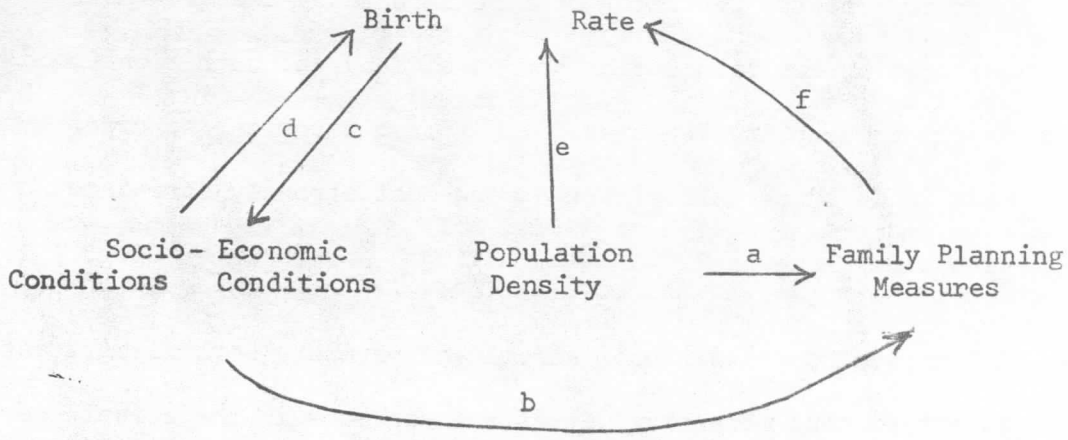

Fig. 5.1

We have already made some discoveries on the paths labeled a, b and c. Population density has some relationship with years in family planning (Table 4.4) while GNP growth rate and school enrollment are highly significant predictors of acceptor's rate (Table 4.3). Furthermore there was no significant relationship found between population growth during the period 1960-1971 and some socio-economic-welfare indicators.

Now we need to find the significant predictors of birth rate as represented by the paths d, e and f.

Chapter 4 as a whole testifies to the high multicollinear aspect of the problem. This points to the extreme difficulty in trying to separate the various effects of these variables on birth rate. With this in mind and remembering the previous factor analysis that was done, we decided to do another common factor analysis (employing again both varimax and quartimax rotations) on a smaller scale on the socio-economic-demographic variables that we want to predict birth rate. The variables are so chosen so as not to include family planning program measures in order to distinguish the two effects (socio-economic-demographic and family planning variables). Birth rate too was not included. The results of the factor analysis are shown in Table 5.1. This is quite similar to the previous factor analysis done. Factor 1 corresponds to socio-welfare (socio-economic in the quartimax rotation analysis), factor 2 corresponds to population density and dependency ratio measure (Note that the sign of correlation of the two variables with the factor is of opposite directions which means that, as in the previous factor analysis, dependency ratio is more a measure of population growth while population density is a better measure of depletion of resources). Factor 3 corresponds to an economic dimension (again distinct only in the varimax rotation) and factor 4 corresponds to some noises. Note that the explained variance of GNP growth rate is very low and so it does not correlate highly with any factor. This shows its strong independence

from the other socio-economic-demographic factors.

Regressing birth rates on the factors gotten from the analysis plus GNP growth rate as well as on years in family planning and acceptance rate, we get the results on Table 5.2. Table 5.2.A gives us the regression employing factor scores of the varimax rotation analysis and Table 5.2.B of the quartimax rotation analysis. Note that factor 1 and factor 2 are highly significant in both cases.

In the stepwise regression of Table 5.2 (and most other regression in this analysis) only predictors with F ratios of greater than 2 was brought into the problem. All others that do not satisfy this requirement are shown together with their statistics.

Looking at the table, it seems very clear that socio-welfare conditions and popualtion density have very high significance (in both rotations) as predictors of birth rate. Employing the quartimax rotated factors in Table 5.1.B that combine socio-economic variables into one factor (factor 1) seem to predict slightly better than when we separate two effects.

Furthermore in Table 5.1.A the "social" factor 1 has a much stronger relationship with birth rate than the "economic" one (though both are significant at 1%) even if the correlation of the

Table 5.1

Factor Analysis Tables for Potential Predictors of Birthrate

Variables	Communality
DTHRT	0.92391
DEPRAT	0.60053
POPDEN	0.88166
PERURB	0.73603
PERCAPEN	0.71862
LITRT	0.92103
NEWSCIRC	0.73712
POPPHY	0.79542
LIFEXP	0.90135
GNPPCAP	0.99759
GANPGRT	0.12214
SCHENR	0.87276
FDPCAP	0.71172
INFMORT	0.83460
Total Common Variance excluding GNPGRT *	0.8179

Varimax Rotated Factor Matrix

	Factor 1	Factor 2	Factor 3	Factor 4
DTHRT	-0.78145	-0.36445	-0.33721	-0.25829
DEPRAT	-0.19779	-0.72436	-0.09544	0.16615
POPDEN	0.15049	0.88331	-0.08657	0.26696
PERURB	0.38138	0.10994	0.65734	0.38261
PERCAPEN	0.19461	0.06972	0.82039	0.05340
LITRT	0.79168	0.25178	0.47947	0.03138
NEWSCIRC	0.44537	0.39490	0.57533	0.22763
POPPHY	-0.68377	0.11016	-0.16019	-0.53858
LIFEXP	0.79441	0.20944	0.40929	0.24263
GNPPCAP	0.31382	-0.09073	0.93930	0.09265
GNPGRT	0.09361	0.02872	0.04515	0.33243
SCHENR	0.78156	0.17930	0.37971	0.29256
FDPCAP	0.40907	-0.01104	0.73765	0.01137
INFMORT	-0.78802	-0.26536	-0.36350	-0.10524

*GNPGRT was excluded because it has little correlation with the rest of the variables.

Table 5.1 (cont'd.)

Quartimax Rotated Factor Matrix

	Factor 1	Factor 2	Factor 3	Factor 4
DTHRT	-0.90535	0.25048	0.18434	-0.08681
DEPRAT	-0.28431	0.68519	-0.00952	0.22390
POPDEN	0.25031	-0.87225	-0.07802	0.22821
PERURB	0.77282	0.02566	0.29468	0.22645
PERCAPEN	0.65413	0.07755	0.52562	-0.09190
LITRT	0.93520	-0.11690	-0.09544	-0.15378
NEWSCIRC	0.78584	-0.26460	0.21155	0.06927
POPPHY	-0.71006	-0.18290	0.29512	-0.41313
LIFEXP	0.93139	-0.08540	-0.14996	0.06386
GNPPCAP	0.79949	0.26297	0.53148	-0.08226
GNPGRT	0.16869	-0.01309	-0.01186	0.30557
SCHENR	0.90943	-0.06114	-0.16633	0.11957
FDPCAP	0.74977	0.15786	0.32003	-0.14907
INFMORT	-0.88070	0.14895	0.18041	0.06499

Table 5.2.A

Regression Birth Rate on Varimax Factors, GNP Growth Rate and Family Planning Measures

Dependent Variable: BTHRT

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANCE
FACTOR 1	-5.09799	-.55905	1.03219	24.394	**
FACTOR 2	-4.03476	-.44536	.92334	19.095	**
FACTOR 3	-2.76581	-.32274	.87160	10.070	**
YRSFMPL	-.47443	-.20489	.26120	3.299	
(Constant)	43.52884				

Multiple R = .87357 Adjusted R Square = .73351

R Square = .76312 Standard Error = 4.5969

F = 18.52403 (**)

Variables not in the Equation

VARIABLE	BETA IF IN	PARTIAL	TOLERANCE	F
GNPGRT	.00804	.01613	.95401	.006
PERACCP	-.07625	-.12830	.67058	.368

Recall:

FACTOR 1 = "SOCIO" VARIABLES

FACTOR 2 = POPULATION DNESITY

FACTOR 3 = "ECO" VARIABLES

Table 5.2.B

Regressing Birth Rate on Quartimax Factors,
GNP Growth Rate and Family Planning Measures

Dependent Variable: BTHRT

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANC
FACTOR 1	-5.7263	-.65322	.83853	46.635	**
FACTOR 2*	4.36442	.48217	.95334	20.958	**
YRSFMPL	--.40910	-.17668	.24452	2.799	
(Constant)	43.04583				

Multiple R = .88418 Adjusted R = .764

R Square = .78177 Standard Error = 4.319

F = 28.65811 (**)

Variables not in Equation

VARIABLE	BETA IF IN	PARTIAL	TOLERANCE	F
GNPGRT	.04853	.10078	.94132	.236
PERACCP	-.04308	-.07435	.65004	.128
FACTOR 3	-.02395	-.05068	.97691	.059

Recall: FACTOR 1 = "SOCIO-ECO" VARIABLES
FACTOR 2 = POPULATION DENSITY
FACTOR 3 = SLIGHTLY CORRELATED TO "ECO" VARIABLES

*Note: FACTOR 2 is negatively correlated to Population Density in Quartimax Factor Matrix, so relationship is in the right direction.

"economic" variables with factor 3. This means that the "social" measures - notably mortality and literacy measures - are more significant in predicting birth rate.

Years in family planning's relationship with birth rate is not significant but it seems to be approaching the 5% level. Acceptance rate and GNP growth rate have very low significance and cannot be used as predictors. So looking back at Fig. 5.1, we see significant results in paths represented by d and e while that of f is not conclusively significant. The path d is significant for both socio-and economic conditions when the two factors are separated, and even more so when the two are combined into one measure. Next, regression analysis was done using variables that load highly on the factors from the factor analysis as well as family program measures. The best regression is the one employing mortality measures to represent factor 1.

Note that life expectancy and death rate load very highly not only in the "social" factor 1 of the varimax rotated matrix but also in the combined "socio-economic" factor 1 of the quartimax rotated matrix. Life expectancy and death rate individually were used as predictors as shown in Table 5.3.A and 5.3.B respectively. In both cases, population density joins the mortality measure as highly significant predictors of birth rate, with R Squares approaching the ones gotten when the hypothetical factors from the factor analysis were used.

The main difference between the two regressions is that years in family planning seem to be significant at 5% when life expectancy is used and then loses it when death rate is used.

In both regressions, GNP per capita - representing the "economic" factor 3 - fails to achieve relevantly high significance. This is most probably due to the collinearity of the economic variables with the social variables of life expectancy and death rate.

We claim that these mortality measures although "social" in nature are good indicators of general socio-economic conditions. This can be seen in Table 5.1 wherein these measures correlate almost perfectly with the combined "socio-economic" factor 1 of the quartimax rotated matrix. The correlations here are much higher than the correlation of the mortality measures with the more purely "social" factor 1 of the varimax rotated matrix.

Thus even if the economic indicators are not significant predictors in Table 5.3.A and 5.3.B we can safely say that their contribution to the relationship is largely contained in the mortality measures, life expectancy and death rate.

Percent of women in the fertile age group has a negative partial correlation with birth rate which is in the wrong direction of common sense.

Table 5.3.A

Regressing Birth Rate on Socio-Eco Variables
Life Expectancy Represents "Socio" Factor

Dependent Variable: BTHRT

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANCE
LIFEXP	-.56759	-.5759	.10879	27.219	**
POPDEN	-.02580	-.35657	.00908	8.079	**
YRSFMPL	-.57959	-.25031	.27375	4.483	*
(Constant)	79.09555				

Multiple R = .86496 Adjusted R Square = .72801
R Square = .74816 Standard Error = 4.64009

F = 23.76576 (**)

VARIABLES NOT IN EQUATION

VARIABLES	BETA IF IN	PARTIAL	TOLERANCE	F
PERURB	.41737	.27190	.10689	1.836
NEWSCIRC	-.12724	-.16529	.425	.646
SCHENR	-.06892	-.06308	.21099	.092
GNPPCAP	-.15342	-.21069	.47495	1.068
GNPGRT	.11792	.22609	.9586	1.239
POPPHY*	-.17606	-.23749	.45826	1.375
FDPCAP*	-.18718	-.27794	.55529	1.926
DEPRAT*	.44044	.64716	.54374	16.574
PERACCP	-.05621	-.09192	.67359	.196
FERWMN*	-.1202	-.21791	.82766	1.147

*Relationship in wrong direction.

Table 5.3.A (cont.)

SUMMARY OF STEPWISE REGRESSIONS

PREDICTORS	MULTIPLE R	R Square	(Adjusted R Square	R Square Change	Simple R	BETA
LIFEXP	.69906	.48869	(.48869)	.48869	-.69906	-.575
POPDEN	.83733	.70112	(.68962)	.21243	-.66832	-.356
YRSFMPL	.86496	.74816	(.72801)	.04704	-.42855	-.250

The tabel above gives the changes in Multiple R and R square as each predictor is introduced to the problem. Simple Pearson's correlation and the Beta values (when all predictors are in the equation) are also shown.

Table 5.3.B

Regressing Birth Rate on Socio-Eco Variables
Death Rate Represents "Socio" Factor

DEPENDENT VARIABLE: BTHRT

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANCE
DTHRT	.94519	.61873	.17216	30.142	**
POPDEN	-.02267	-.31329	.00902	6.310	*1/2
YRSFMPL	-.32109	-.13867	.26222	1.499	
(Constant)	32.57441				

Multiple R = .87279 Adjusted R Square = .7427
R Square = .76176 Standard Error = 4.51307

F = 25.57888 (**)

VARIABLES NOT IN EQUATION

VARIABLES	BETA IF IN	PARTIAL	TOLERANCE	F F
PERURB	-.09603	-.14495	.54285	1.494
NEWSCIRC	-.11489	-.15480	.43253	.565
SCHENR	-.04987	-.04946	.23435	.056
GNPPCAP	-.15926	-.23667	.52610	1.365
GNPGRT	.05804	.11632	.95692	.315
POPPHY*	-.23874	-.31931	.42620	2.611
FDPCAP*	-.18623	-.29267	.58842	2.155
DEPRAT*	.41013	.61356	.53321	13.886
PERACCP	-.05411	-.09133	.67878	.193
FERWMN*	-.13032	-.24226	.82333	1.434

*Relationship in wrong direction.

Table 5.3.B (cont.)

SUMMARY OF STEPWISE REGRESSION

PREDICTORS	MULTIPLER	R SQUARE	(Adjusted R Square)	R Square Change	Simple R	BETA
DTHRT	.79672	.63476	(.63476)	.63476	.79672	.61872
POPDEN	.86422	.74687	(.73714)	.11212	-.66832	-.31329
YRSPMPL	.87279	.76176	(.74270)	.01488	-.42855	-.13867

More fertile women should mean (ceteris paribus) more births. It seems the fact that the countries exhibit almost identical data on this variable (plus its insignificance and wrong direction of relationship in the regression) would tend to make this variable quite meaningless in this analysis.

Similarly, dependency ratio exhibits a significantly high positive partial correlation and Beta value with birth rate. It therefore seems that fertility has a very strong effect on dependency ratio rather than vice-versa. Because of this, dependency burden was not introduced into the equation for it may blur the relationship.

Population per physician and food per capita also exhibit wrong (negative) relationships with birth rate. We expect less birth rate when we have less people per doctor and also less births when we have less food for the people. The negative relationship with food per capita is probably its close positive relationship with socio-economic conditions which have negative correlations with birth rate. Anyway both coefficients for the two variables are insignificant to begin with.

Again, looking back at Fig. 5.1 we have confirmed the relationships between general socio-economic conditions (represented by life expectancy) and birth rate and between population density and birth rate.

There may be some slight relationship between years in family planning and birth rate, although it may be hard to separate it from population density. Recall that there exists a relationship between population density and years in family planning as mentioned in the previous chapter. It seems this relationship is operating here. This can be seen in Table 5.4 wherein years of family planning was significant on the second step, without population density as predictor, but loses it immediately after the latter is introduced in the third step.

Acceptance rate seems to be in a similar situation. In the stepwise regressions, acceptance rate never makes it significantly to the picture except when socio-economic conditions are not included. This is shown again in Table 5.4. At first acceptance rate was significant in the regression but once life expectancy is brought in, the statistical significance of acceptance rate quickly disappears. Inasmuch as acceptance rate correlates more with GNP growth rate than with its other significant predictor, school enrollment and inasmuch as GNP growth rate has little correlation with other socio-economic conditions (specifically life expectancy), we see that acceptance rate's relationship with birth rate must be quite on that aspect correlated with school enrollment.

Table 5.4

Stepwise Regressions Showing Inseparable Effects of Acceptance Rate and Socio-Eco Variables and of Years in Family Planning and Population Density

DEPENDENT VARIABLE: BTHRT

i) Predictors in the Equation on Step Number 1

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANCE
PERACCP	-.88648	-.43049	.35159	6.357	*1/2
YRSFMPL	-.66634	-.28777	.39535	2.841	
(Constant)	49.88656	-			

Multiple R = .59089 Adjusted R Square = .32412

R Square = .34915 Standard Error = 7.30862

F = 6.70578 (*1/2)

ii) Predictors in the Equation on Step Number 2

PREDICTORS	B	BETA	STD ERROR B	F	SIGNIFICANCE
PERACCP	-.20458	-.09935	.29184	.491	
YRSFMPL	-.89428	-.38621	.29110	9.437	**
LIFEXP	-.63797	-.64730	.13202	23.353	**
(Constant)	83.82368				

Multiple R = .81862 Adjusted R Square = .64374

R Square = .67013 Standard Error = 5.31044

F = 16.25215 (**)