University of the Philippines
SCHOOL OF ECONOMICS

Discussion Paper 7807 August 1978

THE EFFECTS OF SOCIO ECONOMIC-DEMOGRAPHIC FACTORS AND FAMILY PLANNING PROGRAMS ON FERTILITY IN THIRD WORLD COUNTRIES*

by

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*Based on parts of a thesis submitted to the Operations Research Interdepartmental Program of the Massachusetts Institute of Technology in partial fulfillment of the requirements of the degree of Master of Science.

ABSTRACT

The controversial disagreement between the Third World and the developed countries as exhibited in the World Population Conference of 1974 in Bucharest focused on whether population control is best achieved through concentration on socio-economic development or on intensive family planning programs.

This study tries to discover the effects of socio-economic conditions as well as some crude family planning measures on fertility through factor and regression analyses on data from Third World countries. These methods, however, can only ascertain the existence and magnitudes of correlative relationships and cannot imply causal effects.

The analysis indicated that socio-economic and demographic conditions do have very strong and statistically significant relationships with fertility. Furthermore, family planning program measures also seem to have significantly strong correlation with economic growth, education and population density.

Family planning measures fail to show sufficiently significant relations with fertility. This is most probably due to the crudeness of data used in this study as well as the lack of sophistication and experience in family planning of most Third World countries.

This supports the case of the importance of socio-economic conditions in population control. However the lag between development and fertility must be determined before development can be recommended as a solution to the population problem.

It is safe to suggest that both developmental and family programs be adopted. Further studies - preferably at the micro level - need be made to determine the amount of concentration on each. But family planning programs should be considered inseparable from the socio-economic and demographic situations.

Chapter I

PLANNING A STUDY ON DETERMINANTS OF FERTILITY

The World Population Conference at Bucharest in 1974 drew to the limelight the growing resentment of the Third World against the developed countries' insistent demand that population control be a prime target for development. Particularly in the late sixties and early seventies, policies guiding aids for development in developed countries as well as international agencies were concentrated on population control programs. The general feeling of the Third World countries during the Conference was that there was need for a redistribution of wealth.

Encouraged by the astounding success of the OPEC nations, Third World countries joined together and reiterated the establishment of a New International Economic Order which has been indicated in the Sixth Special Session of the U.N. General Assembly in May 1974. The main gist of this document is to demand a net transfer of wealth from developed to developing countries by raising the prices of the latters' basic raw commodity exports and by providing for a more "equitable relationship" between prices paid by countries for imports and prices received for exports.

The discussion brought also to the forefront the controversy as to whether the population program should be given

more concentration than social and economic development programs. It is therefore the purpose of this paper to try to show if existing data for developing countries show any relationship between economic social conditions and fertility as well as between family planning program effectiveness measures and fertility. It is equally important to find out the strength of these relationships in order to assess the importance of both factors in population control.

Most econometric analyses on determinants of fertility point to some clear relationship between socio-economic-demographic variables and fertility. They also point to certain pitfalls that we should avoid. These are:

1. Regression, especially standardized regression coefficients, should be supplied together with their significance tests in order to assess the degree and level of relationships.
2. The problem of multicollinearity should be considered very carefully.
3. Inasmuch as overpopulation and/or rapid population growth are considered mainly as problems of developing countries, we should, as much as possible, restrict the data to these countries to avoid strong

effects of developed countries which are operating at a different level.

4. Qualitative and judgmental data will be avoided as much as possible.

On the opposite side of the picture, there have also been studies - mostly through simulation models - on the effects of population growth on eco-socio-welfare conditions. Most of the findings suggest a rather long lag on these effects, but suggest that it is a big and primary impact.

It is hypothesized that a reduction in fertility increases the material wealth of the country at a much faster pace than a constant fertility.

There has been little work done, however, in the area using contemporary data to justify this relationship. Therefore in our data analysis, we would like to find this (long-term) effect of popualtion growth particularly on the welfare of the people, for after all, this is the main purpose of all population control programmes.

The objectives of this paper can be summarized as:

1. a) To see how economic and social conditions relate to fertility and to what degree.

b) To see how family planning measures relate to fertility and to what degree.

2. To see how population growth relates to socio-economic welfare indicators and to what degree.

Chapter II

CHOICE OF TECHNIQUE FOR ANALYSIS

The major problem to be encountered in this analysis would be the lack of methodology to ascertain causal relationships among variables.

Given a spcific set of data one can only guess that a certain group of variables can "predict" some "dependent variable" whether their relationship is causal or not. These econometric-regression methods are probably the best means available to study relationships between demographic and socio-economic as well as family planning factors. We shall employ them and perhaps make some causal inference or assumption from the "evidence" that we can derive.

The statistical approach to study fertility can be done from either of two points of view. First is the time-series technique. Here, we can study some geographic unit or units over a period of time and determine the variations in the dependent variable associated with changes in the assumed predictors. To achieve general validity, the analysis will have to be done repeatedly for many countries over a long period of time.

The main difficulty with this technique is simply the insufficiency and unreliability of year-to-year data. Birth rate,

for example, cannot be predicted yearly. The widely used estimate of birth rate from the census of a country is not quite useful since this is taken only every ten years and also contains gross inaccuracies. Surveys often yield unproductive results in terms of catching short-term changes in birth rates inasmuch as sample sizes and confidence intervals (expected to be quite large) are usually not given. The National Demographic Survey of the Philippines for 1968 as compared to that for 1973 seems to show no change in birth rate although many family planning program experts of the country believe that birth rate have been successfully brought down. The unfortunate thing is that no checks can be derived at from the survey figures unless confidence intervals for the estimate are explicitly given.

Furthermore time-series data inevitably lacks variation and heterogeneity of data which will tend to give a lack of general validity to the results.

Alternatively, one can study a number of geographic units at the same point in time. The influence of socio-economic development on fertility and vice-versa can be inferred at in some "average" manner. As Irma Adelman explains it:

> "One advantage of this approach is that the greater range of variation in characteristics among countries [or among geographic units within a country] and the

> lesser degree of interaction among the explanatory variables permit a much more accurate determination of regression coefficients than does time-series analysis."[1/]

One big disadvantage with the method, however, is that it assumes that all countries (at least Third World countries) of different economic and social history and environment, would respond to certain circumstances in exactly the same fashion. This is a very dangerous assumption inasmuch as traditions, attitudes, and socio-cultural values differ widely among countries. Fortunately, this assumption can be partially tested. For if the assumption is totally untrue, then our regression models would yield low correlation coefficients, high standard errors, and low significance for the regression coefficients.

An in-country "cross-sectional" study of various municipalities, provinces or regions also runs into the same problem as time-series. Third World countries are particularly deficient in recording such data or are deficient in recording them with sufficient accuracy and reliability. "A Study of Input-Output Relationships in the Philippines Family Planning Program" by the Commission on Population of the Philippines

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[1/] Irma Adelman, "An Econometric Analysis of Population Growth," American Economic Review, 1963, pp. 35.

produced insignificant results primarily, as suspected by the researchers, because both economic, social and family planning data were quite inaccurate to begin with.

Because of the lack of data for time series and in-country cross-sectional analysis, plus the fact that sufficient variation and heterogeneity of the observations will be assured, cross-sectional analysis of different Third World countries will be the tool for our analysis. But we shall always keep in mind its main limitations - particularly that of its lack to determine causation at the assumption of homogeneity of response of various dissimilar countries.

Chapter III

COLLECTION OF DATA

The most important thing to decide on at this present stage of our analysis is what variables to use and how to measure them. The main difficulties are first, an insufficiency of data for one particular year (many data, especially those for socio-welfare measures are of "the latest available year"); second, the inaccuracy and unreliability of the data - such as errors in measurement and lack of standard definitions of terms such as "urban," "literacy," etc.

But even with these problems we need not feel that we have reached a deadend. The first difficulty is rather softened by the fact that from the 60's up to the present, general knowledge dictates that there are very few countries that have changed drastically in their socio-economic-demographic characteristics in a span of, say, a decade. This can be tested in our analysis: if our coefficients turn out to be quite significant, then we can say there is evidence to prove this.

The second difficulty also is not insurmountable due to the fact that although measures may be inaccurate, the degree or level of the country's state regarding a specific variable is usually intact. Countries with high and rapid economic development

would show larger GNP per capita and GNP growth rates than others; those with better social conditions would exhibit higher literacy rates, higher life expectancies, etc. So hopefully, errors in measurements, if the sample size is large enough, would balance out, or if not, at least some sort of trend of relationships may be detected.

Because of "latest-year-available" restrictions, it was decided that data will be as close to the period 1965-1974 as possible since this is where the available data are centered on. Our socio-economic-demographic data are based mostly on UN data and in the annual "Population and Family Planning Programs: A Textbook" published by the Population Council (these data in turn are also based very much on UN data). For family planning measures we will use "Family Planning Programs: World Review 1974", again published by the Population Council.

The cases comprising our observations are restricted primarily by information on family planning measures, 39 developing countries, which have sufficient information on acceptance rates and years in family planning as published by the Population Council, were chosen for the analysis. Their data appear on Appendix A. Ten of these countries (Egypt, Gambia, Guatamela, Indonesia, Mexico, Morocco, Nicaragua, Puerto Rico, Singapore and South Vietnam) were used as saved data and were not included in the subsequent correla-

tion, factor and regression analyses. The results of these analyses will be tested on these saved data for verification. Only ten were chosen since it was deemed that to use more would reduce the sample size of the fitted data and therefore worsen the confidence interval of our estimates. The saved data consists of 3 countries from Africa, 4 from Latin America and the Carribean and 3 from Asia.

We believe that although the countries are not many, they do provide a varied and general enough set of data covering most Third World regions. There is of course the question of whether a country is underdeveloped or not. We use the general definition of the Population Council that the Third World is made up of countries in Asia (except for Japan and Israel), Latin America and the Carribean and Africa. We believe there will be no contention as to the "Third Worldness" of the countries chosen except perhaps for Puerto Rico (which has a very high GNP per capita of $1830 but has an urbanization ratio of only 48%).

Table 3.1 gives a summary of the variables that were considered in this study.

Table 3.1

Definition of Variables and Sources:

1. BTHRT = Birth rate, number of births per 1000 population for 1971.
   Source: Table 4, "Population and Family Planning Program: A Factbook" Reports on Population/Family Planning, Sept. 1973.

2. FERWMN = Percent of population made up of women aged 15-44.
   Source: Table 4, "Population and Family Planning Program: A Factbook" Reports on Population/Family Planning, Sept. 1973.

3. DECBR = percent decline in birth rate from 1968 to 1974.
   Source: Birth Rate 1968: Table 3, "Population and Family Planning Program: A Factbook," Reports on Population/Family Planning, Sept. 1973. Birth Rate 1974: Table 4, "Family Planning Programs World Review 1974" Studies in Family Planning, Aug. 1975.

4. GNPPCAP = GNP per capita at market prices, 1971.
   Source: World Bank Atlas, 1973, IBRD, Washington D.C.

5. GNPGRT = Average GNP growth rate, 1965-1971.
   Source: World Bank Atlas, 1973, IBRD, Washington D.C.

6. PERURB = Urbanization ratio, ratio of inhabitants living in urban areas to total population, 1970.
   Source: Table 3, "Population and Family Planning Program: A Factbook" Reports on Popualtion/Family Planning, Dec. 1974.

7. PERCAPEN = Per capita energy consumption (in kilograms of coal equivalent).
   Source: Table 140, Statistical Yearbook, 1972, UN, NY, 1973.

8. LITRT = Literacy rate, percent of popualtion that can "read and write".
   Source: Table 6.8, Handbook of International Trade and Development Statistics, Supplement 1973, UN, NY, 1974.

9. SCHENR = School enrollment rate, percent of children of eligible age in primary and secondary schools.
   Source: Table 6.8, Handbook of International Trade and Development Statistics, Supplement 1973, UN, NY, 1974.

Table 3.1 (cont'd.)

10. NEWSCIRC = daily general-interest newspaper circulation per 1000 inhabitants, 1971 unless otherwise indicated.
Source: Table 11.1, Unesco Statistical Yearbook, 1973, UNESCO, Paris, 1974.

11. DTHRT = death rate, number of deaths per 1000 population for 1971
Source: Table 4, "Population and Family Planning Programs: A Factbook," Reports on Population/Family Planning, Sept. 1973.

12. LIFEXP = average life expectative at birth, years indicated.
Source: Appendix D of Chapter Two, Meadows et al., Dynamics of Growth in a Finite World, Wright-Allen Press, 1974 pp. 178-184.

13. INFMORT = number of infant deaths per 1000 births, latest available year.
Source: Table 3, "Family Planning Programs: World Review, 1974," Studies in Family Planning, Aug. 1975.

14. POPPHY = ratio of total population to number of physicians, years indicated.
Source: Table 202, Statistical Yearbook, 1972, UN, NY, 1973
Table 197, Statistical Yearbook, 1973, UN, NY, 1974
Table 203, Statistical Yearbook, 1974, UN, NY, 1973

15. FDPCAP = net food supply per capita, in vegetable calories per person per day as defined in text, years indicated.
Source: Table 160, Statistical Yearbook, 1971, UN, NY, 1972.
Table 162, Statistical Yearbook, 1972, UN, NY, 1973.

16. POPDEN = Population density (Population/sq. mi.)., 1971.
Source: Table 3, "Population and Family Planning Programs: A Factbook," Reports on Population/Family Planning, Dec. 1974.

17. DEPRAT = dependency ratio, number of persons below 15 and over 64 divided by number of persons aged 15 to 64.
Source: 1) Table 4, "Population and Family Planning Programs: A Factbook," Reports on Population/Family Planning, Dec. 1972.
2) Table 4, "Population and Family Planning Programs: A Factbook," Reports on Population/Family Planning, Sept. 1973.
3) Table 3, "Population and Family Planning Programs: A Factbook," Reports on Population/Family Planning, Dec. 1974.

18. LPOPGT = long-run population growth - average population growth during the period 1960-1971.
Source: World Bank Atlas, 1973, IBRD, Washington, D.C.

Table 3.1 (cont'd.)

19. PERACCP = number of acceptors of family planning as percentage of total married women, aged 15-44. Average for 1972 and 1974.
Source: Table 3, "Family Planning Programs: World Review of 1974" Studies in Family Planning. Aug. 1975.

20. YRSFMPL = number of years since a particular government of a country has adopted a national family planning program, as of 1974.
Source: Table 3, "Family Planning Programs: World Review 1974" Studies in Family Planning, Aug. 1975.

21. POPGRT = BTHRT - DTHRT

Chapter IV

PRELIMINARY ANALYSES

I. Correlation Analysis

From the data that was gathered, it was decided that some graphs be done on important variables. It was found that linear relationships exist particularly between birth rate and the other socio-economic-demographic variables. On thing was noted, however, in the graph plotting birth rate against population density, Hongkong is a very far outlyer - far enough probably to blur a lot of the relationships where population density is involved. It was thus decided that most of the regressions - those where population density is an important factor - will exclude Hongkong.

The first logical step is to perform correlation analysis to see pairwise relationships among the variables. Without showing the rather large correlation matrix, we present here some initial observations:

1) There exists high correlation among measures of mortality - death rate, life expectancy and infant mortality - and measures of literacy - literacy rate and school enrollment rate - and between these two groups.

2) There exists high correlation between GNP per capita and both per capita energy consumption and food supply per capita.

3) Most important is the fact that birth rate, death rate and life expectancy are all quite highly interrelated, which points to an early indication of some relationship between birth rate and general socio-economic conditions.

4) Equally as interesting also is that although acceptance rate is not highly correlated with the other variables, its highest correlation is surprisingly that with GNP growth rate, followed by the more expected school enrollment rate.

5) Years in family planning and acceptor's rate have a low correlation coefficient of .3+. This could be accounted for by the fact that the two do not have to be highly correlated. The former is more of a long-run measure, the latter is more of a short-run and may be temporary measure.

6) Decline in birth rate from 1968 to 1974 seems to have, with respect to the other variables, some relationships with socio-economic conditions particularly literacy rate, school enrollment rate, GNP per capita and per capita energy consumption.

7) The primary lack of strong correlation is between population growth (whether long-run, 1960-1971 or that of 1971) and

welfare indicators such as GNP per capita, GNP growth rate, food per capita, population per physician, literacy rate and school enrollment rate.

II. Factor Analysis

From the correlation matrix, factor analysis was done in order to find a basic structure in the interrelationships of the variables. The factor analysis used assumes that each variable can be explained by some common factors it shares with other variables as well as a unique element which do not contribute to any relationships (the so-called common factor analysis as opposed to principal-component factor analysis).

Using both the quartimax rotation (that tries to make each variable load as high as possible on as few factors as possible) and the varimax rotation (that tries to make each factor load as high as possible on as few variables as possible), we get the results in Table 4.1 (Hongkong data was excluded).

The resulting factors can be interpreted as very good clustering of variables. There is a factor on population growth, factor 2, (correlated quite significantly with population growth for 1971, dependency ratio, birth rate, long-run population growth and popualtion density). Another on GNP growth rate (factor 4) and another on percentage fertile women (facotr 5).

Table 4.1

Explanation of Factor Analysis Tables
and Total Common Variance Explained

The first table gives the communality of each variable, which is the amount of variance of each variable explained by the hypothetical factors. The total common variance is the amount of variance of all the variables explained by the hypothetical factors.

The next tables are the varimax rotated factor matrix and the quartimax rotated factor matrix respectively. The matrix gives the correlation of each variable with each of the hypothetical factors.

Factor Analysis of All Variables

Variables	Communality
BTHRT	0.97943
DTHRT	0.94667
DEPRAT	0.84459
POPDEN	0.63584
PERURB	0.68705
PERCAPEN	0.76409
LITRT	0.91419
NEWSCIRC	0.69158
POPPHY	0.75206
LIFEXP	0.88259
POPGRT	0.91150
FERWMN	0.99583
LPOPGT	0.65935
GNPPCAP	0.99133
GNPGRT	0.88073
SCHENR	0.85708
FDPCAP	0.71762
INFMORT	0.85245
YRSFMPL	0.38192
PERACCP	0.68836
DECBR	0.64604
Total Common Variance	0.79430

Table 4.1 (cont.)

Varimax Rotated Factor Matrix
(Correlation of Factors with Variables)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
BTHRT	-0.56322	0.76236	-0.28137	-0.02512	0.03508
DTHRT	-0.89473	0.25740	-0.25246	-0.06501	0.10913
DEPRAT	-0.28325	0.78941	-0.02691	-0.02893	-0.37367
POPDEN	0.37839	-0.65992	-0.16940	0.10376	0.13303
PERURB	0.51561	-0.09478	0.58798	0.18204	-0.18250
PERCAPEN	0.24935	-0.10031	0.83025	0.00715	0.04990
LITRT	0.85318	-0.07620	0.40899	0.07232	0.08922
NEWSCIRC	0.61705	-0.27459	0.48153	0.05964	0.00006
POPPHY	-0.67530	-0.04099	-0.16289	-0.17146	0.48829
LIFEXP	0.85213	-0.09485	0.36150	0.11116	-0.06487
POPGRT	0.03183	0.93328	-0.18316	0.02025	-0.07433
FERWMN	-0.08890	-0.35900	0.02807	-0.12030	0.91858
LPOPGT	0.30645	0.67273	-0.13064	0.00986	-0.30936
GNPPCAP	0.37117	0.07801	0.91934	0.03138	-0.03623
GNPGRT	0.05742	-0.02158	0.04380	0.93253	-0.07369
SCHENR	0.81948	-0.13415	0.34575	0.18305	-0.12037
FDPCAP	0.44073	0.03564	0.71918	0.03361	0.06128
INFMORT	-0.87404	0.08729	-0.27735	-0.04158	-0.04717
YRSFMPL	0.08019	-0.57211	-0.11630	0.17840	-0.05314
PERACCP	0.43359	-0.33650	0.08289	0.60842	-0.09998
DECBR	0.42128	-0.49649	0.45595	-0.09131	-0.07632

Table 4.1 (cont.)

Quartimax Rotated Factor Matrix
(Correlation of Factors with Variables)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
BTHRT	-0.69614	0.69919	0.02550	0.03901	0.06154
DTHRT	-0.93089	00.16987	0.21575	0.00344	0.06858
DEPRAT	-0.30600	0.79995	0.11655	0.01091	-0.31197
POPDEN	0.30285	-0.65076	-0.33016	0.07093	0.08118
PERURB	0.76483	-0.01484	0.26387	0.12550	-0.12840
PERCAPEN	0.62455	-0.04831	0.60000	-0.04493	0.09837
LITRT	0.94180	-0.00660	-0.06395	0.00358	0.15185
NEWSCIRC	0.79592	-0.20709	0.11829	-0.00340	0.03459
POPPHY	-0.70407	-0.14297	0.18023	-0.12854	0.43232
LIFEXP	-0.93283	-0.01227	-0.10124	0.04452	-0.00514
POPGRT	-0.13909	0.92569	-0.18049	0.05094	0.00881
FERWMN	-0.10124	-0.45299	0.05308	-0.12941	0.87225
LPOPGT	0.16223	0.71393	-0.26369	0.01676	-0.23134
GNPPCAP	0.76450	0.14955	0.61810	-0.02644	0.04202
GNPGRT	0.14517	-0.02682	0.01934	0.92445	-0.06288
SCHENR	0.90930	-0.05001	-0.09725	0.11795	-0.06620
FDPCAP	0.72491	0.09308	0.40822	-0.02133	0.12792
INFMORT	-0.89755	0.01727	0.18821	0.02285	-0.10298
YRSFMPL	0.08092	-0.56477	-0.13393	0.16335	-0.10855
PERACCP	0.49601	-0.30096	-0.13160	0.56987	-0.09842
DECBR	0.62858	-0.43105	0.19404	-0.14712	-0.07624

The first factor clearly relates to general social conditions inasmuch as death rate, literacy rate, life expectancy, school enrollment rate, infant mortality, newspaper circulation and population per physician load quite highly in this dimension.

The main difference between the quartimax and varimax rotations, however, is in the fact that the varimax rotated factor matrix seems to have separated the more economic dimension - factor 3 (correlated mainly with GNP per capita, per capita energy consumption, food supply per capita, and urbanization ratio) from that of general social conditions (death and infant mortality rates, literacy rate, life expectancy, school enrollment rate) - factor 1 described by variables mentioned previously. The quartimax rotated factor matrix, however, seems to have combined both socio-economic variables into one dimension (factor 1) and caught a small part of the economic dimension in another factor (factor 3).

This is a very good occurrence since employing these factors as predictors of birth rate might tell us something about the relationships of the latter variable on both the "social" and "economic" dimensions separately. Just looking at the varimax-rotated factor matrix now it seems birth rate is more correlated with the "social" factor 1 and has very slight correlation with the more "economic" factor 3. It is also clear that the correlation is much stronger in the combined "socio-economic" factor, in the

quartimax rotated factor matrix.

From both the first-order correlation matrix and the rotated factor matrices, birth rate's correlations with GNP growth rate and percentage fertile women seem to be quite low.

Other results that are quite important also are:

1. Acceptance rate has its highest correlation with the GNP growth rate dimension (factor 4).

2. Years in family planning has its highest correlation with the popualtion growth factor (factor 2).

3. Short-term decline in birth rate correlates more with "socio-economic factor 1 of the quartimax-rotated matrix, again supporting the relationship between fertility and socio-economic.

4. There does not seem to be any indication that population growth factors have any strong relationship with welfare and social indicators.

A simple profile of the factor scores of the different countries was done. Factor scores for both rotations are given in Appendix B.

Since the factor representing GNP growth rate and percentage fertile women clearly do not exhibit a regular pattern

in conjunction with the other factors, we shall concentrate on the first three factors.

In the Varimax Rotation factor scores, we can detect two types of countries. The first one are those with higher-than-average socio or economic factors and low population growth as shown in Fig. 4.1, and countries with high population growth as shown in Fig. 4.2. Note that the slopes of the curves in Fig. 4.1 and Fig. 4.2 are of opposite directions. Furthermore it seems in Fig. 4.2 that Latin American countries (which exhibit the highest population growth rate) have quite good "social" conditions but poor "economic" conditions. Inasmuch as the "social" factor correlates highly with mortality indices we can say that these countries are mainly characterized by a high fertility and low mortality giving impetus to a very rapid population growth. The more "advanced" countries in Fig. 4.1 are characterized by a low fertility and low mortality conditions.

The polarization of social and economic conditions, however, sometimes tend to blur the picture in the varimax rotation. Laos and Nigeria, for example, load oppositely on the "social" factor (factor 1) and on the "economic" factor (factor 3) in the varimax rotation. These inaccuracies make it difficult for us to make conclusions, especially for countries with low socio-economic conditions.