PROSPECTS OF LONG-RANGE POPULATION GROWTH AND SOME RELATED CHARACTERISTICS IN EGYPT

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I. Introduction

The objective of planned development processes can be stated as the attainment of the highest level of welfare possible for members of the society. Thus, development efforts are devoted to the welfare of the human being ; but, they are also designed and carried out by members of the society, individually and as elements of societal institutions. Accordingly, effective development processes must aim at maximising the contribution of the human resources of the society to collective welfare.

Egypt's endowment of natural resources is rather limited except for the human element. This relative abundance of human resources has been considered by some as nothing but a liability. This position resulted in a compulsive desire on the part of some of the intellectual and decision-making elites to reduce population growth rates through planned reduction in fertility rates. The vehicle through which this objective was to be attained was an official family planning program that was started in 1966.

While reduction in the population growth rates may reinforce development efforts, Egyptian and international experience in the fields of planning for development and family planning programs point out the following conclusions :

a) Fertility level is the outcome of social behaviour that is determined by the socio-economic conditions of the society. Thus, excluding coercion, a substantial reduction in fertility rates, e.g. to the level currently observed in developed countries, cannot be achieved in the absence of socio-economic conditions that are consistent with this level of fertility. In Egypt, attaining socio-economic conditions consistent with low levels of fertility requires profound socio-economic change that can only be attempted through societal efforts in integrated development.

This position was formalized in the National Population and Family Planning Policy, NPFPP, adopted in 1973[1] as the basis for population planning in the ten-year period 1973-1982.

b) Even a substantial reduction in fertility rates within a short period of time would not, in itself, solve Egypt's population problems, in the sense that there would still be some population aspects that reflect negatively on the welfare of the society, e.g. high dependency burdens, poor spatial distribution and other population characteristics that are inconsistent wth high levels of productive efficiency. These problems are interrelated and, again, can be handled only in a long-range program of societal development.

Recognition of the two points given above resulted in the realization of the fallacy of separating the so-called population problem in Egypt from the overall problems of underdevelopment. In the sense that establishing and reinforcing population characteristics that reflect positively on the level of welfare cannot be achieved independently of the overall development efforts of the society. Further, it is now acknowledged in Egyptian planning circles, that the country's human resources can become, if properly developed, into an efficient productive energy, its most treasured resource. This could be achieved through a long-term human resource development strategy that constitutes an integral component of the long-term national development strategy.

It is from this vantage point that this paper attempts to investigate the prospects of long-range population growth and its implications for the age structure especially in terms of the dependency burden of the population.

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(1) The Supreme Council for Population and Family Planning, The National Population and Family Planning Policy. Cairo, October 1973.

II. Current Population Growth Targets

Egypt, like many other less developed countries, has been perceived to suffer from a population problem characterised by the, once popular, label, of "population explosion". In the sixties, the solution prescribed for this problem was family planning programs. As indicated in the introduction, the definition of the problem in this manner as well as the resultng identification of the solution suffered from a basic conceptual deficiency : namely, the isolation of a societal phenomenon from its overall socio-economic context. We are not to discuss this issue here, but are interested only in its reflections on population growth targets set by the NPFPP.

In 1966, the target set for the Egyptian Family Planning Program was a reduction of one point per thousand in the crude birth rate, CBR, per year. The NPFPP adopted the same target for the period 1973-1982, setting a targetted CBR of 24 thousand in 1982.

The determination of population policy targets in terms of reductions in CBR reflects an inappropriate uni-dimensional definition of the population problem, and a sense of urgency enhanced by the fallacious belief in the possibility of implementing drastic reductions in the CBR through family planning programs.

It is informative in this regard to briefly delineate the behaviour of CBR in Egypt since 1966. The CBR declined from 41.2 per thousand in 1966 to 34.1 per thousand in 1972, the latest year for which final birth rates are available. Thus, the average annual decline in the CBR over the time period. (1966-1972) was larger than the targetted one point per thousand. Clearly, this decline cannot be attributed entirely to the family planning program, mostly because of the exceptional military and economic conditions the country has been going through since 1967[1].

Provisional figures for 1973 yield a CBR of 35.4 per thousand, over one point per thousand higher than the 1972 rate. While pre-

(1) Bindary, A., Population Planning in Egypt : An Attempt at Conceptualization. **International Journal of Health Services,** Volume 3. No. 4, 1973.

liminary evidence is that the CBR reverted in 1974 to about the 1972 level, another rise in the birth rate is expected starting 1975 in response to the easing up of military tension after the October 1973 war[1].

Ths brief survey tends to indicate that the CBR targets of the NPFPP are probably too optimistic for the period of the policy and definitely cannot be extended to another ten-year period. This is mostly due to the effect of the age structure as we shall see later on.

However, in general, the crude birth rate should not be the sole criterion for target setting, in a wide-scope population policy. For while the CBR is a valid measure of natality[2] it is not a pure measure of fertility[3]. As such it is not sensitive to fertility changes. But, more importantly, restriction of target-setting criteria to the CBR results in ignoring other demographic characteristics of paramount importance especially in the long-term, like the age structure of the population.

The age structure of a human population is probably its most important demographic characteristic. It summarizes the entire demographic history of the population, for it is the result of all fertility, mortality and migration conditions experienced by the society for as long as the age of the oldest living individual, and may be longer. In the absence of external migration, the age structure is determined solely by natural increase. In addition, the relative weights of various segments of the age span have demographic, social and economic implications of utmost importance.[4] Accordingly, no long-term population policy could afford to neglect the age structure of the population.

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(1) Fergany, N., Sample Estimates of Crude Birth and Death Rates in Rural and Urban Areas of Egypt for 1973 and 1974. PFPB, Cairo 1975.

(2) The overall relative frequency of the production of children in the society.

(3) Among other things, it is strongly affected by the age-structure.

(4) UN, **The Determinants and Consequences of Population Trends**, Volume I, New York, 1973, pp. 262-292.

III. Design of the Investigation

The investigation undertaken here consists of carrying out a set of projections for the population of Egypt by age and sex for the time period (1970-2110), starting with an adjusted age-sex structure for 1970[1], under a set of 21 assumptions on future age-specific mortality using the shorter- Pasta Package[2]. Using a large number of fertility assumptions and only one mortality assumption reflects the facts that mortality has already reached a reasonably low level in Egypt, while fertility is still moderately high and that future mortality patterns are easier to predict than future fertility patterns.

The projections are carried out under the assumption of no external migration. This reflects the present evaluation of the limited prospect of large scale emigration effectively relieving population pressure in Egypt, or significantly affecting the future of long-range population growth in the country.

The time span of the investigation, 1970-2110, extends far beyond the time-range of present long-term planning horizon in Egypt, the year 2000. This is a reflection of the slow but ponderous nature of demographic changes. These changes are characterised by an in-built momentum, most potently stored in the age-structure, that is almost impossible to abate. Thus a realistic evaluation of the consequences of fertility and mortality trends in the next twenty-five years has to take into consideration their effects on shaping the age-structure for decades to come.

The age-sex specific mortality assumption was fashioned using the "South" family of the Coale-Demeny model life table[3]

(1) Taken from : Valaoras, V.G. et al ; **Population Analysis for Egypt (1935-1970)**; Cairo Demographic Center, Cairo 1972, p. 17.

(2) Shorter, F., and Pasta, D. ; **Computational Methods for Population Projections**; The Population Council, New York; 1974.

(3) Coale, A.J. and Demeny, R. ; **Regional Model Life Tables and Stable populations** ; Princeton University Press, Princeton, 1966.

starting with level 15, i.e. a life expectancy at birth for females of 55 years, in the five-year period (1970-1975), and assuming a uniform gain in life expectancy of five years every ten-year period until it reaches level 24, i.e. a life expectancy at birth for females of 77.5 years, in the five-year period (2015-2019) and all subsequent five-year intervals.

Fertility assumptions consisted of two components : the level of total fertility as expressed by the gross reproduction rate, GRR, or the total fertility rate, TFR(2), and the relative age distribution of fertility, for it is well known that the latter changes with the former.

The GRR for 1970 was taken as the starting point for the assumptions on the level of total fertility. Relating the reported number of births by age of mother(3) to the corresponding number of females in the initial age structure resulted in a GRR of 2.8. Allowing for an extent of underregistration of births of 6%(4) inflated the GRR to about 3.0. It was assumed that all fertility decline that is to take place will occur in the thirty-five year period (1970-2005), therefore age-specific fertility rates will remain constant at the values of the five-year period (2000-2005). Three "final" values for the GRR at the year 2005 : 1.50, 1.25 and 1.00, were taken and the level of total fertility was assumed to decline uniformly from the initial level of 3.0 in 1970 to the final value in 2005 in order to determine the level of total fertility for every five-year period in the interval (1970-2005)(5). To pro-

(1) Available evidence indicates that the initial mortality level may be slightly higher than reality. The life expectancy at birth for both sexes in the five-year period (1960-1965) is estimated at 50 years. See : Fergany, N., A Reconstruction of Some Aspects of the Demographic History of Egypt in the Twentieth Century, DPA, AUC, Cairo 1975. However, it was preferred to be conservative with regard to the mortality assumption.

(2) Assuming a sex ratio at birth of 105 males per 100 females, TFR = 2.05 × GBR.

(3) Source : Collection of Vital Statistics for ARE, 1930-1970, CAPMAS, Cairo, Feb., 1973, table 22.

(4) See : Fergany, N., Op. cit.

(5) Naturally, one would not expect fertility decline to be so regular in reality, but this is the simplest and safest assumption to make.

vide for a wider variety of total fertility levels and the time at which fertility ceases to decline, seven assumptions were devised within each set such that in the ith assumption, total fertility is stabilized at the level of the ith five-year period, i=1,2, . . ., 7.

The following table summarizes the resulting twenty-one fertility assumptions. The table gives the GRR level at which fertility ceases to decline and the order of the five-year period at which this level is reached.

Assumption	Final Total Fertility Level for Set		
(Period)	I	II	III
1	2.89	2.87	2.84
2	2.68	2.62	2.55
3	2.47	2.37	2.26
4	2.26	2.12	1.97
5	2.05	1.87	1.68
76	1.84	1.62	1.41
7	1.63	1.37	1.13

Hypothetical future relative age distributions of fertility were arrived at through a study of the parameters of age distributions of fertility in Egypt in the time period (1945-1970) in conjunction with the Coale - Trussell model fertlity schedules[1]. Coale and Trussell model fertility schedules are functions of three pa-

(1) Coale, A.J. and James Trussell, T. ; Model Fertility Schedules : Variations in the Age Structure of Childbearing in Human Populations ; **Population Index**, Vol. 40, No. 2, April 1974; pp. 185-284.

rameters : the mean, the standard deviation and a measure of the ratio of frequency of child-bearing in the age group (15-19) to the next five-year age group. Values of these three parameters were calculated from Egyptian data for the period (1945-1970), linearly extrapolated, and the resulting values reconciled with the ranges of these parameters available in the collection of model fertility schedules. The matching was not perfect. Some of the extrapolated combinations of the three parameters were not available in the collection of model schedules. In this case, the closest member of the collection was chosen. We ended up with four relative age distributions of total fertility, the first to apply to the first total level and each of the other three to apply to two consecutive total levels, within each set of seven fertility assumptions. The following table gives the relative distributions.

Age Group	Relative Fertility Distribution for Levels			
	(1)	(2,3)	(4,5)	(6,7)
15—19	0.059	0.051	0.024	0.010
20—24	0.228	0.176	0.134	0.090
25—29	0.239	0.232	0.239	0.228
30—34	0.212	0.232	0.262	0.290
35—39	0.167	0.193	0.218	0.248
40—44	0.084	0.100	0.108	0.119
45—49	0.012	0.015	0.015	0.016

IV. Criteria for Decision

Similar studies have started from the premise that population should stabilize at a rate of growth equal to zero, i.e. reach stationarity(1). While this may be a desirable objective in a developed country it may not be necessarily so in a developing country like Egypt.

This is basically due to the fact that population policy in developed countries at present have a limited range of prospects

(1) See for example, Frejka, T.; **Future of Population Growth : Alternative Paths to Equilibrium**; John Wiley and Sons; New York, 1973.

with regard to population growth targets, while population policies in less developed countries have a much wider span of discretion, especially if integrated into overall development policies. In other words, the viable options for population policies in developed countries are rather limited and stationarity seems to be the most desirable(1). While stationarity of the population of less-developed countries would be also desirable from the point of view of the developed world, a less developed country can legitimately entertain the following question : Is stationarity the optimum population growth prospect ? or would it be stability at some rate of growth higher than zero(2) ? Asking this question naturally leads to another, what should be the criteria for decision?

We have alluded earlier to the significance of the demographic and socio-economic implications of the age-structure. The socio-economic repercussions of the age-structure are determined by the relative weights of various age contingents, which have far-reaching bearings on aspects of consumption, savings, production and social welfare in general(3). It is customary to divide the human age span into three groups : less than fifteen years of age, fifteen to less than 65 years of age, and 65 years of age and above. The three groups correspond to the stages of childhood, adulthood (or working age), and old age respectively.

The various socio-economic implications of the age-structure are usually quantitatively summarized in the index known as the dependency ratio, which relates the population in the first and third age contingents to the number of individuals in the second.

However, the dependency ratio is not a sensitive index of changes in the dependency burden resulting from changes in the

(1) Some European countries are alarmed by the prospects of imminent population decline.

(2) For obvious reasons we have excluded stability at a negative rate of growth as an undesirable prospect. We have also excluded the rather bizarre scenario calling for a drastic reduction of growth rates to a negative level that would continue for a period of time until a moderate population size is reached and then stability at a higher rate of growth would be attempted. If such a scenario can be at all achieved it would have negative socio-economic repercussions.

(3) U.N., **Op. Cit.** pp. 288-292.

age structure due to the equal treatment it accords to childhood dependency and old age dependency. This is unacceptable for two reasons. First, the social cost of providing for a dependent child may be different from that for an aged dependent. Second, and probably more important, the cost of providing for a child, unlike that incurred by supporting an old age person, can be thought of as an investment that would yield a stream of returns in the future.

This insensitivity of the dependency ratio is particularly misleading in assessing the effect of aging of a population(1) where the ratio of child to aged dependents varies significantly. It is known that in the absence of migration, a history of decline in the rate of natural increase from high to low, or zero level results in considerable aging of the population. This process results in a reduction in the proportion of children in the population and an increase in the proportion of old individuals. While the dependency ratio may not change significantly, the socio-economic implications of changes in the relative size of its two constituent components is far-reaching. Accordingly, a refined analysis of the socio-economic implications of changes in the age structure during the aging of a human population should give different treatment to the childhood dependency ratio from the old age dependency ratio(2).

Studies of the cost of supporting a child dependant relative to the cost of providing for an old dependant yield estimates of old age dependants costing 1.5 to 2.0 times as much as a child dependant.(3) If, in addition, we take into consideration the productive potential of children to the society, and the other undesirable effects of "old" populations(4). One may safely assume that the dependency burden of one unit of old age dependency is at least twice as heavy as one unit of childhood dependency. Accord-

(1) A human population is said to "age" or "grow older" if the proportion of individuals defined as "old" in the population increases.

(2) Childhood dependency ratio (CHDR) = Population ($<$ 15) / Population (15-64) Old age dependency ratio (OADR) = Population (65+)/ Population (15-64).

(3) U.N., **op. cit.** p. 289.

(4) For a discussion of the effects of aging of human populations see. **Ibid.** pp. 289-292, 236, 441, 444.

ingly, we propose to construct an index of dependency burden as follows :

$$IDB = (CHDR+a.\ OADR)/(1+a)$$

where a $\geqslant$ 2. Clearly conclusions drawn using this index depend on the value of the parameter a. Unfortunately, available information is not sufficient to arrive at a good estimate of a. Here we all use the conservative value a. = 2.

V. Conclusions

Table (1) gives the population size in 2010 and stable characteristics implied by the various fertility assumptions considered. As expected, we observe that a lower ultimate rate of natural increase is related to a lower childhood dependency ratio and a higher old age dependency ratio. We also observe the following :

1. The impact of the age-structure on demographic characteristic of the population is strongly reflected on crude vital rates. A lower stable rate of natural increase, i.e. an "older" population, is reflected in a higher CDR at the same level of age-specific mortality rates, it reaches 12 per thousand for assumption 7 of set III. Also, because of the young initial age-structure and high initial fertility, the CBR remains relatively high even for the most ambitious scenario of fertility decline included here, assumption 7 of set III(1).

2. A lower ultimate rate of natural increase is associated with a lower total dependency ratio. However, the index of dependency burden, IDB, decreases with declines in the rate of natural increase to reach its lowest level when the NIR is approximately in the internal 1.0% — 1.5%, see Figure (1). We note that this shape of the relationship between IDB and NIR depends on the value of the parameter a. Values of a larger than 2.0 would cause the curve to reverse its direction at larger values of NIR.

(1) Actually, according to this assumption, the CBR does not go below the 20 per thousand mark until after the year 2000.

SET III

Fertillity Assumption	Population in Millions	Vital Rates Per thousand CBR	CDR	NIR	Percentage Age Distribution <15	15—64	65+	Dependency Indices % CHDR	OADR	TDR	IDB
1	3 135	39	4	35	43.6	52.2	4.2	83.5	8.1	91.6	33.2
2	1 735	34	5	29	40.1	54.5	5.4	73.5	9.8	83.3	31.0
3	999	30	6	24	36.4	56.7	6.9	64.3	12.1	76.4	29.5
4	609	72	6	21	33.3	58.4	8.4	57.1	14.3	71.4	28.6
5	354	23	8	15	29.4	60.1	10.5	49.0	17.5	66.5	28.0
6	202	19	10	9	25.1	61.5	13.3	40.9	21.7	62.6	28.1
7	112	14	12	2	20.6	62.3	17.2	33.0	27.7	61.7	29.5

SET II

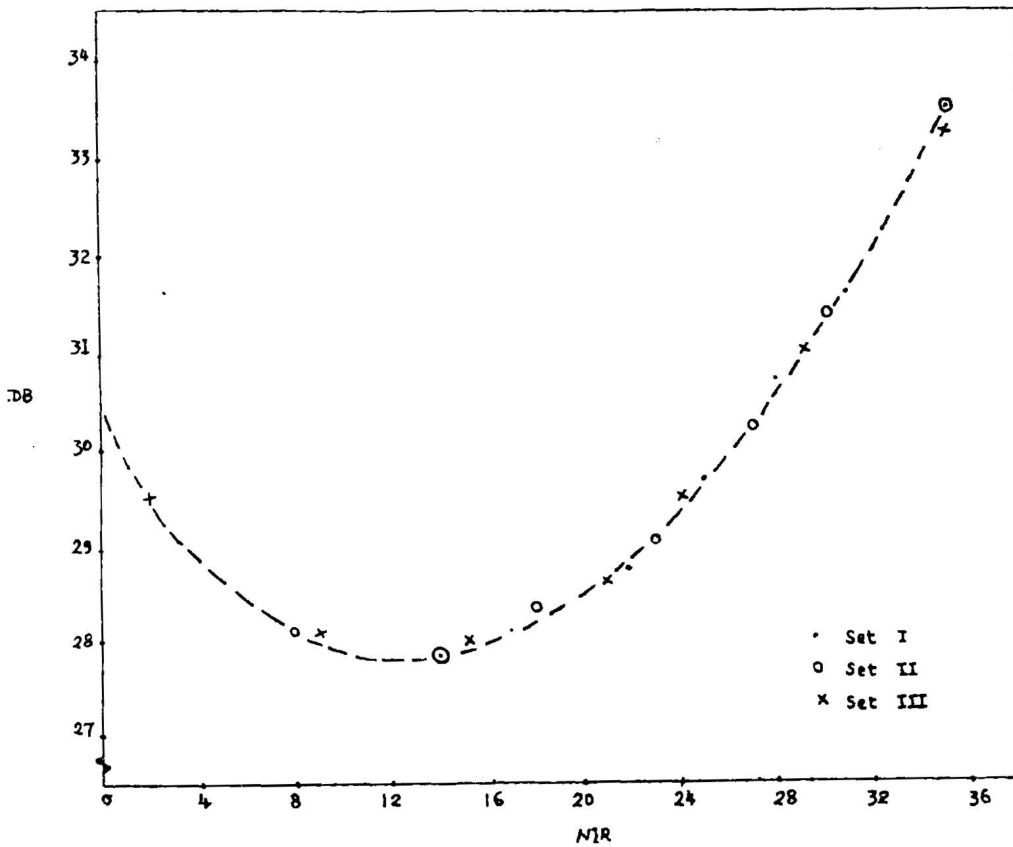
Fertillity Assumption	Population in Millions	Vital Rates Per thousand CHR	CDR	NIR	Percentage Age Distribution <15	15–64	65+	Dependency Indices % CHDR	OADR	TDR	IDB
1	3 290	39	4	35	43.9	52.0	4.2	84.4	8.1	92.5	33.5
2	1 944	35	5	30	40.8	54.1	5.1	75.4	9.4	84.8	31.4
3	1 306	32	5	27	38.3	55.7	6.1	68.8	11.0	79.8	30.2
4	786	29	6	23	34.9	57.5	7.6	60.7	13.2	73.9	29.0
5	516	25	7	18	31.9	59.0	9.1	54.1	15.4	69.5	28.3
6	315	22	8	14	28.2	60.6	11.2	46.5	18.5	65.0	27.8
7	198	18	10	8	24.5	61.7	13.8	39.7	22.4	62.1	28.1

TABLE I

Population Size, Vital Rates, Relative Age Distribution, and Dependency Indices, 2110

SET I

Fertility Assumption	Population in Millions	CBR	Vital Rates per thousand CBR	Vital Rates per thousand NIR	Percentage Age Distribtion <15	Percentage Age Distribtion 15–64	Percentage Age Distribtion 65+	Dependency Indices % CHDR	Dependency Indices % OADR	Dependency Indices % TDR	Dependency Indices % IDB
1	3 394	39	4	35	44.0	51.9	4.1	84.8	7.9	92.7	33.5
2	2 140	36	5	31	41.3	53.7	5.0	76.9	9.3	86.2	31.6
3	1 544	33	5	28	39.3	55.0	5.7	71.5	10.4	81.9	30.7
4	1 076	31	6	25	37.1	56.4	6.6	65.8	11.7	77.5	29.7
5	717	28	6	22	34.1	58.0	7.9	58.8	13.6	72.4	28.7
6	481	24	7	17	31.1	59.5	9.5	52.3	16.0	68.3	28.1
7	340	22	8	14	28.3	60.6	11.1	46.7	18.3	65.0	27.8


DB
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3. A lower stable rate of natural increase is, naturally, associated with a smaller population size at any future point in time. Thus, to select a preferred course of fertility decline on the basis of the resulting index of dependency burden, would raise the difficult choice between the combination of low IDB and large population size, and the combination of high IDB and small population size. Two combinations growth contrasting are the following : fertility assumption 6 of set II results in a stable IDB of 27.8 and a population size of 315 million at 2110[1], while fertility assumption 7 of set III results in a stable IDB of 29.5 and a population size of 112 million at 2110. See table (1).

In comparing these two combinations it is instructive to take into consideration the following points :

a) When talking of the year 2110, no convincing argument could be made to support the contention that a smaller population size would be more desirable regardless of other population characteristics. Further, within the next 25 years, the differences between the population size implications of the two fertility assumptions under consideration are minimal. In fact, the population sizes implied are almost identical up to the year 2000.

b) Although the difference between the stable IDB implied by the two fertility assumptions is small in absolute value, it does represent a large relative difference if we take into consideration the range of variation of the index. Actually, the difference represents about 70% of the entire range of variation of the index if we take, as its maximum value, that implied by the results at stationarity (about 30.3, higher values of IBD, those corresponding to assumption 1 and 2 of the three sets, are associated with astronomically high population size).

(1) Assumption 7 of set I yields the same stable IDB value but at a slightly higher ultimate population size, see table (1).

Thus one may be inclined to prefer assumption 6 of set II over the rest of the assumptions included in this analysis as a scenario for desired fertility patterns in Egypt in the next twenty-five years.

However, restricting the analysis of the implications of fertility and mortality patterns to their ultimately stable effect at some future point in time, disregards the fact that demographic characteristics take a long time to stabilize. Consequently, investigation of the implications of demographic patterns during the process of stabilization, can be as important as implications attained at stability. An attempt was made to take into consideration the implications of various fertility assumptions used in the time period (1970-2110) by computing a cumulative index of IDB over that interval; the results are given in table (2),

Table (2)
Cumulative Value of the Index of Dependency Burden Over The Time Interval (1970-2010)

Fertility Assumption	SET I	II	III
1	10.56	10.50	10.46
2	10.01	9.90	9.77
3	9.66	9.49	9.24
4	9.31	9.05	8.87
5	8.97	8.75	8.55
6	8.64	8.51	8.40
7	8.52	8.42	8.46

Comparing the contents of tables (1) and (2) reveals some conflict between considerations of the stable situation and the situation during the process of stabilization. The fertility assumptions that result in the lowest stable IDB are not those leading to the lowest cumulative IDB in the time period (1970-2110). The following table brings out this conflict for the six fertility assumptions resulting in the lowest cumulative IDB.

Fertility Assumption	IDB Cumulative	2110	Stable Rate of Growth per thousand	Population Size in millions 2110
6,III	8.40	28.1	9	202
7,II	8.42	28.1	8	198
7,III	8.46	29.5	2	112
6,II	8.51	27.8	14	315
7,I	8.52	27.8	14	340
5,III	8.55	28.0	15	345

As indicated by the configuration of the table the six fertility assumptions included form four distinct groups according to the stable IDB value One may safely exclude assumption 7,III for having the highest stable IBD value among all 21 assumptions considered. This practically reduces the situation to comparing the two[1] groups { (6,III), (7,II) } and { (6,II), (7,I). }

Assumptions of the first set result in stable IDB values slightly higher than those of the second set, but compensate for this with lower cumulative IDB values. If we exclude the first two assumptions of the three sets from comparisons of cumulative IDB, as we did with respect to stable IDB, we find that the extent of relative difference between the two sets, is about the same on the two measures. Actually, the relative difference is slightly higher with respect to the cumulative Index.

However, the length of time period until the year 2110, may support giving a larger weight for differences on the cumulative index, which lead to the choice of the first set as the basis for determining desirable fertility pattern scenarios for Egypt up to the year 2000.

(1) The results of assumption (5, III are not much different from those of the group (6, II), (7, I).

ACKNOWLEDGEMENTS

The population projections that formed the basis of this study were carried out at the Computer Center of the American University in Cairo using a packaged program developed by F. Shorter and D. Pasta of the Population Council and installed on the AUC system by members of the staff of the Demographic Projections Analysis Project, DPA. AUC.

Mr. Mohamed Osman of DPA, Mrs, Denise Batani of the Social Research Center, AUC, Miss Mounira Hussein of the PFTB, and Miss Fatma El Zanaty of the Statistics Department, Cairo University contributed significantly to all phases of the work. Their efforts are gratefully acknowledged.