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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

Economics Department Working Paper No. 11

THE FOREGONE BENEFITS AND COSTS OF A PREVENTED BIRTH: CONCEPTUAL PROBLEMS AND AN APPLICATION TO THE U.A.R.

January 23, 1968

This paper was completed by Mr. Zaidan before joining the service of the Bank. It is issued for the information of staff members in this form because it deals with a subject of considerable interest to the Bank. This draft has been submitted for publication and it is expected that the final version will be reissued by the Harvard Center for Population Studies, who supported the research on which the paper is based. The paper is not to be quoted without the author's permission.

Applied Quantitative Research Division

Prepared by: George C. Zaidan

THE FOREGONE BENEFITS AND COSTS OF A PREVENTED BIRTH: Conceptual Problems and an Application to the U.A.R.*

Introduction:

1. Among the chief problems that many underdeveloped countries face today, is the "problem of overpopulation." As a result of the large drop in death rates following World War II, the rate of population growth has accelerated to an extent which seriously imperils the success of many efforts at economic development. Since the manipulation of death rates cannot be considered a policy variable, various studies have tried to investigate the effect of a lower fertility on economic development. Attempts to quantify this relationship have taken two forms. The first is that of Coale and Hoover,[1/] who use various assumptions which enable them to trace the path of per capita income with and without a reduction in fertility.

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* This paper is an abbreviated version of part of my unpublished Ph.D. dissertation, "Benefits and Costs of Population Control with Special Reference to the U.A.R. (Egypt), "Harvard University, 1967. (Henceforth this source is referred to as BCPC). It is Contribution No. 37 from the Harvard Center for Population Studies. I wish to thank Professor H. Leibenstein for many helpful comments. This research was supported with a grant from the Harvard Center for Population Studies, for which grateful acknowledgment is made.

1/ A.J. Coale and E.M. Hoover, Population Growth and Economic Development in Low Income Countries, Princeton University Press, 1958.

The second, introduced by Enke,[1/] is to treat investment in population control as any other economic project, and to work out a benefit-cost analysis of such an investment. Very briefly, the essence of this approach is to work out the consumption and productivity streams of an unborn child, and - after appropriate discounting - to subtract the latter from the former to get the net economic benefits of preventing a birth. These benefits are measured in terms of the income stream that becomes available to the economy as a whole, as a result of preventing one birth. Taking this approach as our starting point, the object of this paper is (a) to refine and extend this analysis, both by working out the upper and lower limits of the above benefits, as well as trying to include additional effects that are capable of being quantified, and (b) to explicitly analyze the assumptions and hence limitations of such a procedure. To this end, we can conveniently break down the discussion of this paper into three separate parts. The first is a description of the various effects and their combination in a benefit-cost criterion. The second considers the conceptual problems arising out of the application of such a criterion, and the third applies our framework to the case of the U.A.R., in order to get an estimate of the various magnitudes involved.

1/ S. Enke, "The Gains to India from Population Control: Some Money Measures and Incentive Schemes," The Review of Economics and Statistics, Vol. XLII, No. 2, May 1960, pp. 175-181, and also "The Economics of Government Payments to Limit Population," Economic Development and Cultural Change, Vol. VIII, No. 4, July 1960, pp. 339-348. The conceptual framework is also outlined in Economics for Development, Prentice-Hall Inc., 1963, Chapter 20 and in "The Economic Aspect of Slowing Population Growth, "Economic Journal, Vol. LXXVI, March 1966.

I - The Benefit -Cost Criterion:

2. The effect of preventing a specified number of births can affect per capita income through several possible paths. First, and almost by definition the per capita income is increased because the unborn child would have added nothing to production, whereas he would have been a consumer. Thus, the same national output is divided among a smaller population. This is so in the short-run[1] when the size of the labor force is unaffected by what is happening to fertility. In a longer perspective, however, the unborn child would have joined the labor force, so that output is smaller in the lower fertility case. This reduction is measured by the marginal product of labor. Thus the net benefits of this initial effect can be measured by the difference between the consumption stream and productivity stream of an unborn child.

3. Second, as a result of the initial increase in per capita income, either consumption per worker and/or savings per worker will rise. This in turn will increase the rate of growth of income. Hence, not only is the same national output being divided among fewer people, but also the national output itself may be larger, as a result of a lower fertility. Let us look at how this can occur.

4. First it can occur through the wage productivity effect, which has been analyzed by H. Leibenstein.[2] The basis of this effect is that the increased food consumption resulting from the initial increase

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1/ The "short-run" is defined here as the length of time between birth and the average age at which persons enter the labor force.

2/ H. Leibenstein, Economic Backwardness and Economic Growth, New York, 1957, Ch. 6, pp. 62-69.

in per capita income will lead to an increased supply of effort resulting in a greater output. The strength of the relationship between increased income per capita and greater output depends on the following intervening links: It depends on (i) the marginal propensity to consume food, (ii) the resulting increased calorie intake, (iii) the increased supply of effort, (iv) the marginal product of effort.

5. The greater the magnitude of relationships (i) through (iv), the greater the magnitude of the wage productivity effect. In the context of underdeveloped countries, the existence of such an effect implies that (i) the per capita consumption is below the minimum calorie requirements and (ii) that the marginal product of effort is not zero. Even when this effect is present, one must allow for the fact that it is only the consumption of workers that adds to output. Thus one must only take into account the proportion of the initial increase in income that goes to members of the labor force, and only in those periods of the year where there is no seasonal unemployment.

6. Next, turning to the savings effect, we note that the total output may be larger because of changes in savings patterns resulting from the initial increase in income. Here it is worth noting that the relevant changes are those that occur in savings per worker and not savings per head. (Since, in the short-run the size of the labor force is constant, requiring more savings per worker is the same as requiring larger total savings). Because the population is smaller in the low

fertility case, a higher savings per head need not imply more capital per worker.[1/] It is the latter which is necessary to secure a higher rate of growth of output. Thus, in the short-run what is necessary are larger total savings, and not merely more savings per head whereas in the long-run - when the labor force is smaller in the low fertility case - even the same total savings result in more capital per worker and which is beneficial.

1/ Here it is worth noting the difference between the wage productivity and the savings effect. In the former if the marginal propensity to consume (out of the increased per capita income) is the same as the average one, then there will still be an increase in output, because workers will be getting more food per head. With the savings effect, however, a marginal propensity to save (out of the increased per capita income) that is equal to the average one, will only lead to an increase in savings per head, but not to an increase in savings per worker. Hence, there are no benefits of increased output. The latter arise only if, and to the extent that, the marginal propensity to save exceeds the average one. The reason for this difference is that all capital is used by the labor force, whereas it consumes only part of total consumption. This means that in order to increase capital per worker, total savings must increase, (which in turn means that marginal savings must exceed average ones), whereas it is not necessary for total consumption to increase, in order to raise consumption per head. The latter can occur by switching food from the "non-labor" force to the labor force. In the case of a prevented birth, this would occur because part of the consumption that the unborn child would have used up, is diverted to the labor force. Hence, food intake per worker is increased, even with the same total consumption.

7. Combining the above three effects[1] we shall measure the net foregone benefits of a prevented birth by applying the following formula:

$$\sum_{i}^{\bar{i}} \frac{y_i}{(1+r)^i} + \text{f.k.h.} \frac{\bar{i}\, y_i}{(1+r)^{\bar{i}}} + r(s-S) \sum_{i} \sum_{j} \frac{y_i}{(1+r)^j} + r \sum_{i} \sum_{j} \frac{x_i}{(1+r)^j}$$

$$i \neq j \qquad\qquad i \neq j$$

where $y_i = (c_i - mp_i)(1-q_i)$ and where the summation extends to the end of our time horizon.

8. In this expression the symbols have the following meanings:

c_i = annual foregone consumption of the unborn child between ages i and (i + 1).

mp_i = annual foregone production (the marginal product of labor) of the unborn child between ages i and (i + 1).

q_i = probability of death between ages i and (i + 1). "1 - q_i" is therefore, the probability of survival.

y_i = is, therefore, the net income stream of an unborn child, allowance being made for the possibility that that unborn child may have died at various ages.

1/ One other effect which we do not consider is the possibility that different fertility patterns will affect the capital-output ratio. The argument here is that a reallocation of resources away from sectors with a high capital-output ratio (such as housing) will lead to a faster rate of growth of output. The reason for not considering such an effect is threefold: First, only a small proportion of total investment can be thought of as being linked to population. Second, even here the relationship is not clear. Housing for instance is related to urbanization as well as changes in family size, and the relationship between the latter two and a reduction in fertility is not direct. Finally, even if there is a reallocation of investment, the time lag is so long that even moderate discounting would make this effect quantitatively negligible.

f = marginal propensity to consume food by the labor force in periods of the year when there is no seasonal unemployment.

k = a constant that converts expenditures on food into an extra supply of effort via increased calorie intake.

h = the marginal product of effort.

x_i = the cost of education between ages i and (i + 1).

r = discount factor = marginal product of capital.

S = propensity to save before the reduction in fertility.

s = propensity to save out of the increased per capita income.

8. This expression is the net income stream made available to the economy as a result of preventing one birth. Its first term is the net discounted consumption stream minus productivity stream of an unborn child, which is our first effect. The second term is the wage-productivity effect, whereas the last two terms are the savings effect for individuals and the government respectively. The reason for making a distinction between both, is that different assumptions may be justified in each case. For individuals there is very little information as regards the relationship between demographic trends and savings behavior.[1/]

1/ The theoretical relationships between savings behavior and the rate of the population growth have been analyzed by P. Demeny in "Demographic Aspects of Saving, Investment, Employment and Productivity", Paper No. 460, United Nations World Population Conference, Belgrade, 1965. The discussion is inconclusive and there are no empirical studies at the micro-level of the relationship between family size and savings in less developed countries. However, some unpublished work shows that the dependency burden is an important explanatory variable in accounting for differences in gross domestic savings among a large sample of developed and less developed countries.

9. To return to our expression, it is seen that each of its terms correspond to one of our effects. It may be helpful to see the interaction of these effects with the aid of a diagram. In Part I of Figure One the increased consumption per head resulting from the prevention of a specified number of births, is measured on the vertical axis while the increased savings per worker is measured on the horizontal axis. In Part II we show the effect of the increased consumption per head on the increased income per head during the current period--i.e. income per head today. This curve subsumes many relationships behind it, that have already been mentioned. In particular the following leakages account for the fact that it exhibits diminishing returns: (1) Only part of the increased consumption per head results in increased food intake per head. (2) Not all of the increased food intake per head goes to people who are in the labor force. (3) Because of seasonal unemployment in agriculture the increased food intake during some parts of the year does not result in an increased supply of effort. (4) Because of diminishing returns to factor equal increases in the supply of effort lead to less than proportional increases in output. In Part III, assuming all savings are invested, the increased capital per worker is plotted against the increased income per head that it is likely to generate in <u>all</u> future time periods. Here, too, diminishing returns to capital are shown. Finally in Part IV we see the alternatives that are possible between income today or in the future, and time preference will determine what proportion of the increased income is saved and what proportion is consumed. Enlarging Part IV we can think of O_2 as the point at which the economy would have been if there had been no reduction in fertility.

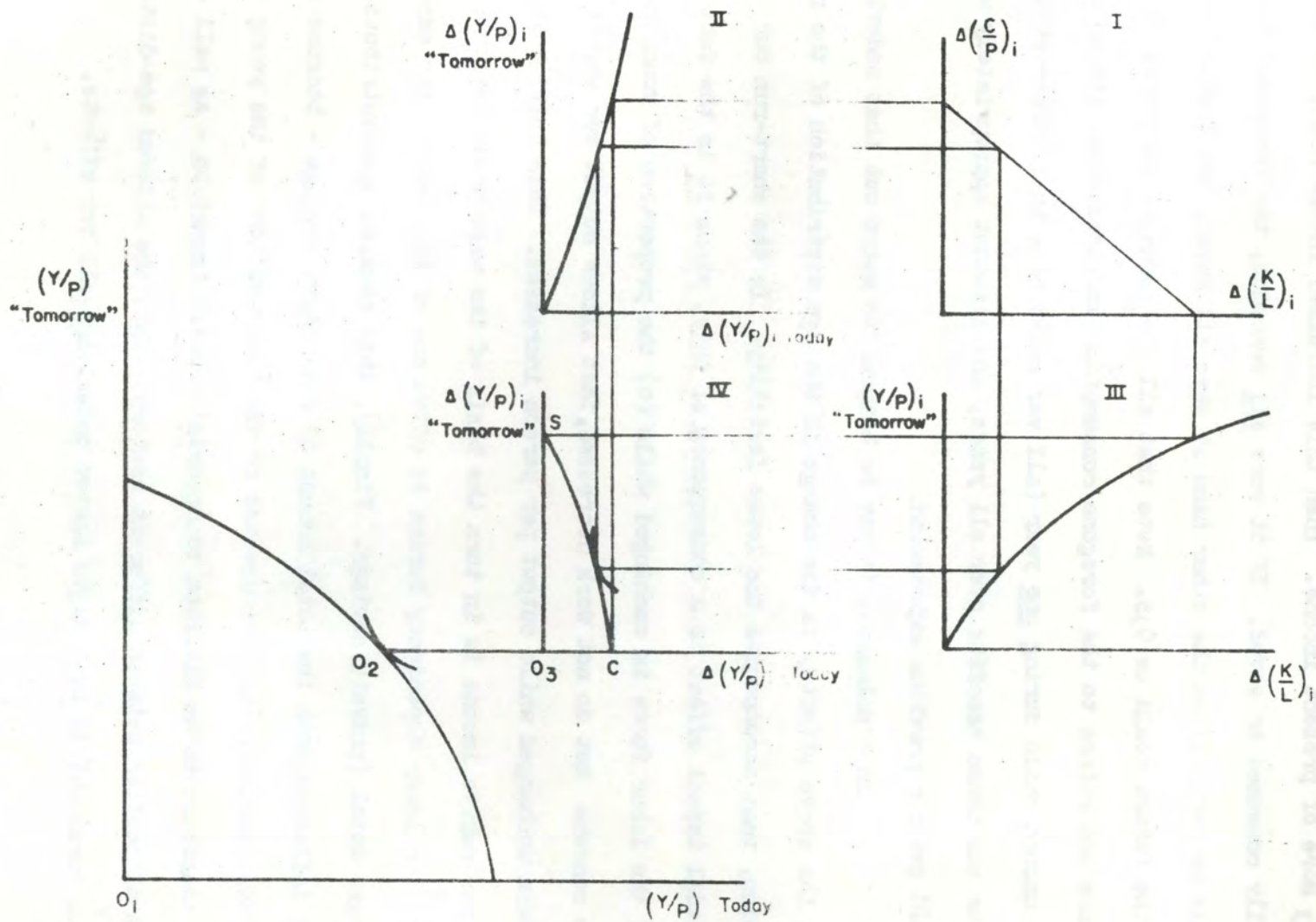
II
$\Delta(Y/P)_i$ "Tomorrow"
I
$\Delta\left(\frac{C}{P}\right)_i$
$\Delta\left(\frac{K}{L}\right)_i$
$\Delta(Y/P)_i$ Today
IV
$\Delta(Y/P)_i$ "Tomorrow"
S
III
$(Y/P)_i$ "Tomorrow"
(Y/P) "Tomorrow"
O_2
O_3
C
$\Delta(Y/P)_i$ Today
$\Delta\left(\frac{K}{L}\right)_i$
O_1
(Y/P) Today

FIGURE 1

The initial increase in per capita income can be thought of as providing O_2O_3 more of present income. Then this increased income could be either wholly consumed or saved. If it were <u>all</u> consumed, the increased income would be O_3C. If on the other hand it were all saved, the income increase in the future would be O_3S. Note that all the sequence portrayed in figure one refers to the foregone consumption and production stream of the unborn child during <u>one</u> year (all variables have an i subscript). If we sum these benefits over all years, and discount appropriately we would get our previous expression.

10. In conclusion, it may be helpful to point out that underlying all the above effects, is the change in the age distribution of the population, that accompanies the lower fertility. In the short-run our initial impact effect is a consequence of this, since it is the fact that (a) the labor force is unchanged while (b) the proportion of young people who consume but do not work decreases, that allows output per worker to remain unchanged while output per person increases. This initial increase in per capita income is in turn the basis of the wage productivity effect. Also the lower dependency burden is often one of the reasons for expecting larger total (private) savings. Finally, this changed age-distribution may influence both the total amount of government savings - because it allows resources that are devoted to the "consumption" of the young such as education to be diverted to material capital formation - as well as its allocation between different sectors. Thus the altered age-distribution turns out to be a major factor underlying all our effects.

II - The Applicability of our Criterion:

11. Before proceeding to apply our framework to the case of the U.A.R., it is well to discuss explicitly the assumptions, and hence limitations of the criterion developed above. At the outset, three points are worth emphasizing. The first is that our criterion views children exclusively as investment goods - no account being taken of the satisfaction of the parents derived from the "consumption " of their children. In an overpopulated and underdeveloped country, it can safely be assumed that the "social welfare function" - as opposed to the individual one-should not pay attention to such aspects. This brings us to the second point which is related, but distinct from, the above. This is that the returns from investment are viewed exclusively from the point of view of the country rather than the family.1/ The discrepancies between both approaches can be large. For instance, from the point of view of the family, the two main returns from "investing" in a child are (a) the earnings of the child, once he starts to work, and (b) the child as a source of old-age security. As far as (a) goes, what an individual is paid may be very different from the marginal product

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1/ For an analysis of the child as a consumption good, see G. Becker, "An Economic Analysis of Fertility", in Demographic and Economic Change in Developed Countries, Universities - National Bureau of Economic Research, Princeton, New Jersey, Princeton University Press, 1960. For an analysis of the child from the point of view of the family see H. Leibenstein, Economic Backwardness and Economic Growth, New York, 1957, Chapter 10, pp. 161-165.

of labor - which is his contribution to society. As far as (b) goes, preventing a birth may increase rather than diminish old-age security, from the point of view of society. This is so because a lower fertility reduces the proportion of dependents to the labor force.[1/] This means that the former (both the older groups and the "unprevented" or remaining young ones) can get more expenditure per head in the form of old-age security in the low fertility case.

12. The third point is that the benefits of our criterion assume that the birth is permanently prevented. If it is delayed, the benefits would be smaller depending on the form of the delay. This point is worth making because the benefits computed according to our criterion are often compared with the costs of a family planning program and the latter ones are found to be relatively insignificant. However, this comparison is legitimate only if the birth is permanently prevented. If it is merely delayed (as for instance if the initial acceptors in a family planning program are middle class urban women, who have not yet had the number of children they desire), then the costs of a family planning

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1/ For a general treatment of the determinants of the age distribution see A.J. Coale, "The Effects of Changes in Mortality and Fertility on Age Composition," Milbank Memorial Fund Quarterly, January 1956.

program are unchanged, but the net foregone benefits may be greatly affected, depending on the form of the delay.[1/]

13. Having cleared these points, there remains one disturbing aspect about our criterion which should be cleared up. This is that there is a built-in bias in our criterion that ensures that benefits will always exceed costs. This is as it should be for the case of the overpopulated and underdeveloped countries of today, but what is troubling is that this should also be the case for both (a) the developed countries of today and (b) those same countries in their early period of industrialization in the nineteenth century. In the latter case, our criterion would have shown large benefits from population control, whereas the subsequent development of these countries shows their economic growth to have been highly successful, partly <u>because</u> of the stimulating effects of

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1/ As a simple but unrealistic example, consider a woman who in the absence of a family planning program had a child every three years. Assume that she joins the program for one year, drops out, and then immediately has a child. As a result of this, there is a four year gap between her latest births. If it is further assumed that her next child follows after two years and that all following births are unaltered, then all that has happened is that the birth has been delayed for one year. The foregone benefits are the income stream of the unborn child minus the income stream of the born one. The absolute magnitude of both streams is the same, but discounting introduces a difference and determines the benefit. Other forms of delay can be imagined in which women do not catch up on lost time, but simply go on to have the same children over a longer total span of time. Here the benefits would be larger because several children are delayed. In general, the influence of discounting is such, that even "minor" forms of delay, result in benefits that are quantitatively larger than the government expenditures required to prevent one birth.

population growth. True, we have no way of checking whether these rates of population growth were "optimal," but at the very least they did not appear to hinder economic development. Under the circumstances, there appears to be an inconsistency between our criterion and the observed historical experience. It is this that has lead us to spell out the reasons and implications of the bias in our criterion. To this we now turn.

14. The large positive bias in expression (1)[1/] arises because the initial effect is always large and positive (as a consequence of this the wage-productivity and/or savings effects are also positive and further add to the benefits). This is due to three reasons.[2/] The first is that the average consumption is being compared with marginal product. In the long-run, average consumption and average production are identical. However, whereas an unborn child consumes, through his lifetime, as much as the average person, his marginal output falls short of the average.

1/ In the following paragraphs, and as was pointed out above, the child is viewed exclusively as an investment good. If the consumption aspects were also allowed for, and assuming that children are a joy to their parents, we would have to include the satisfaction that parents would have derived from their children, as well as the satisfaction of the latter from "being alive," to the cost side of preventing a birth. In practice, this presents insuperable problems of putting a subjective value on human life, as well as interpersonal and intertemporal comparisons of utility. In principle, however, this point may reduce the positive bias in our criterion.

2/ Besides these, S. Enke lists other (minor) reasons for this bias. See, "The Economic Aspects..." op. cit., footnote to p. 56.

Insofar as the difference between the average and marginal output is a measure of the extent of the pressure on limited resources, this source of bias is legitimate. If it were the only source of bias, it would not lead to the inconsistencies noted at the end of the previous paragraph. However, there are two other reasons for a large positive bias. The first is that the consumption and productivity streams are discounted. Since consumption starts immediately after birth, whereas production is delayed for at least ten to fifteen years, even moderate discounting greatly exaggerates the difference between the present value of both streams. The second is that throughout, consumption is treated as a cost - and, hence, the foregone consumption of the unborn child as a benefit. In general, it is not clear why this should be so, although it is certainly legitimate in some instances. Let us then look at the implications of (a) discounting and (b) treating foregone consumption as a benefit.

15. The discount rate that is used is meant to reflect both the time preference of society, as well as the productivity of capital. The existence of a preference for the present as given by Bohm-Bawerk is in terms of (i) the shortness of life, (ii) the deficiency of the imagination and (iii) limited willpower. Of these three, we may assume that the last two are not present in the farsighted leaders of a society - i.e. that, if at all present, they are limited to the "private" rather than social time preference. As for the first reason, its presence depends essentially on what exactly we mean by "society." If we take this to mean the individuals that compose it, then the first reason is a valid

basis for time-preference. On the other hand, if we view society as an abstract entity that never dies - although the individuals that compose it do - then even the first basis of time-preference is invalid. This may explain to some extent the paradox outlined above. From the point of view of the persons living in the nineteenth century in countries that subsequently experienced rapid economic growth, it may have been valid to advocate a policy of population limitation. Viewing the matter from the present, however, and looking at a certain country as an abstract entity, it is doubtful whether we could endorse such a policy. Thus our criterion does not lead to inconsistencies so long as it is remembered that the benefits that are being considered are those accruing to the people that are living at the time the policy recommendation is made. Taking this point a step further, we can say that by specifying which age group within a population we are particularly interested in, will determine the length of our time horizon. For instance, if our time horizon extends to the average expectation of life at birth, then our net benefits are those that accrue to children being born today. Those who are older will reap only part of those benefits. Alternatively, if we take the time horizon to be, say only ten years, then those benefits accrue to all those who have a remaining expectation of life, exceeding ten years. We may, therefore, conclude, that the use of a (high) discount rate implies that we are considering the benefits for people alive today, rather than for society in an abstract sense, and that the length of the time horizon implicitly determines which age group we have in mind.

16. Turning next to the treatment of foregone consumption as a benefit, it is to be noted that this is by no means obvious or necessary. Indeed, there are various circumstances in which consumption could be assumed to exert a stimulating effect on economic growth. The crucial point is whether and to what extent insufficient demand constitutes a bottleneck on economic growth. If insufficient demand is a serious bottleneck, then population growth may be beneficial by stimulating consumption. This stimulating mechanism can take one of three forms. Faster population growth leads to a larger total consumption (even with no changes in per capita consumption), which by allowing the full exploitation of economies of scale, may make the introduction of certain industries profitable. Second, by leading to a faster rate of growth of total consumption, faster population growth can, via the acceleration mechanism, lead to a faster rate of growth of output. Finally, differentials in the rate of growth may have beneficial effects on consumption. This latter argument is that of Kuznets,[1/] and it can be summarized as follows: because the differential rate of population growth both as between urban and rural areas, and as between the higher and lower income groups, has moved historically in an opposite direction to the growth in economic opportunities, economic growth, when it had succeeded, was accompanied by a tremendous geographical and social mobility. A migrant into the cities is likely to consume a higher proportion of his income than his counterpart in the country because of the different values

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1/ S. Kuznets, "Population Growth and Aggregate Output," in Demographic and Economic Change in Developed Countries, Universities National Bureau of Economic Research, Princeton University Press, 1960.

prevailing in urban areas. He is also likely to respond and switch more quickly to the new and expanding industries. Both factors have a stimulating effect on economic growth.

17. In the light of the foregoing we may ask in what cases insufficient demand is a bottleneck to economic growth. Taking the case of the developed countries of today first, we observe that by looking at the various theories of growth that are an outgrowth of the Keynesian framework (Harrod-Domar and their offshoots) we see aggregate demand occupying a central position. Here we would argue that the opportunity to invest is an important bottleneck. Modern corporations have huge amounts of capital at their disposal in the form of undistributed profits. Alternatively they are able to raise all the capital they require if the investment opportunity is there. This is so from a long-term point of view even though they may experience temporary difficulties of financing in times of credit restriction. They also have the necessary skilled manpower and the managerial abilities of organization, so that their chief problem is one of finding an outlet for their products rather than satisfying a pre-existing demand.[1/] In this creation of demand, population growth is an important stimulating factor, although less so than at the time A. Hansen was developing his stagnation thesis.[2/] This is because of the increasing rate of technological progress during the postwar

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1/ This is the thesis of J.K. Galbraith, The Affluent Society, New York, 1958. See especially Chapter XI, on "The Dependence Effect."

2/ A. Hansen, "Economic Progress and Declining Population Growth," American Economic Review, Vol. XXIX, No. 1, Part 1, March, 1935.

period. Without wishing to assign a particular weight to the population factor, the point that the faster rate of growth of consumption associated with a faster rate of population growth has both cost and benefit elements which are not readily separable remains valid.

18. Next taking the case of underdeveloped countries of the nineteenth century and comparing them with those of today, we observe that they differ in one fundamental respect. The best summary of this difference is in a paper by H. Wallich.[1/] Very briefly put, the thesis is that in the development of the advanced countries of today the driving force was the entrepreneur, the process was innovation and the goal was the enrichment of the entrepreneur. This picture, which is portrayed in Schumpeter's theory of economic development, no longer reflects the situation as it is today. Instead the impetus comes from the government, the process is imitation and the goal is the higher living standard of the masses. The former mechanism is production or supply oriented, the latter is demand or consumption oriented. Production and consumption are, of course, interdependent and each has a place in both outlooks, but there is nevertheless a genuine difference of where the impetus originates. In the former case the problem is to ensure that what is produced is sold. In the latter case consumption is present (and most would say "overpresent" pointing to the efforts of underdeveloped countries today to curb their excessive consumption) and it is a question of

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1/ H. Wallich, "Some Notes Towards a Theory of Derived Development," Paper reproduced in The Economics of Underdevelopment, New York, Oxford University Press, 1963, edited by A.N. Agarwala and S.P. Singh.

breaking through another bottleneck. What this other bottleneck is, is immaterial from our point of view. Whether it is the low levels of capital formation (savings) according to Nurkse,[1/] the small share of profits in national income--all savings coming only from profits--as in the theory of Lewis[2/] or the "inability to invest" as developed by Hirschman,[3/] or finally any of a multitude of other reasons, insufficient demand is never the culprit.

19. We may, therefore, conclude that in both the case of the developed countries of today and these same countries in their early phase of industrialization, consumption had a different role than in that of most underdeveloped countries today. In the former cases, consumption - through the mechanisms outlined above - had stimulating, as well as braking effects, and it is impossible to disentangle the two. In such cases it is illegitimate to treat foregone consumption exclusi ely as a cost. This is yet another reason which resolves the paradox between our criterion and observed historical experience. Thus, even if we were looking exclusively at the interests of the people then living in countries about to embark on industrialization (i.e. even if we were discounting), it may have been of no benefit to them to have a policy of population limitation. We cannot say for sure, for it is impossible to

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1/ R. Nurkse, Problems of Capital Formation in Underdeveloped Countries, Oxford University Press, New York, 1961, pp. 57-70.

2/ A. Lewis, "Economic Development with Unlimited Supplies of Labor," The Manchester School of Economic and Social Studies, 23, May 1955, pp. 153-160; and The Theory of Economic Growth, Homewood, Illinois, 1955, pp. 225-244.

3/ A.O. Hirschman, The Strategy of Economic Development, Yale University Press, 1958, pp. 33-38.

disentangle the stimulating from the retarding effects of consumption. However, the major point of this whole analysis serves to emphasize that the applicability of our criterion is limited only to those situations in which insufficient demand is not an impediment to economic growth.

III - A Case Study of the U.A.R.:

20. The application of formula (1) requires information which can sometimes be obtained from the relevant data, and also some assumptions that must be made when the necessary data is unavailable. In the latter case, the net benefits will largely depend on these assumptions. For instance, no perfect capital market exists, and assuming social time-preference to lie between 10% and 15%, we made calculations for these two extremes. As far as the other assumptions go, these differ for each of our effects. Let us briefly look at them and their implications for the magnitude of the net benefits.

A. The Initial Effect:

21. The information that is required here is the consumption and marginal product of the average person at every age, together with the probability of survival to various ages. The latter can be deduced from vital and census statistics, which though inaccurate, do not greatly affect the final net benefits. Let us, therefore, concentrate on the former.

22. On the consumption side two problems arise. The first is the definition of "consumption." In his study for India, Enke defines this as GNP minus gross capital formation. This is the standard definition in the national accounts, but as a measure of benefits of an unborn

child, it can be criticized on three grounds: (1) that a lot of what is consumption is really investment from the point of view of economic growth. Examples of this are expenditures on education, health and other investment in human capital. (2) There is an element of grossness in consumption. Some government expenditures (such as maintaining law and order) as well as the higher costs of urban living resulting from greater concentration rather than because the goods are different from their counterpart in the country - both these forms of expenditures can be regarded as intermediate goods rather than final output. (3) Finally, some consumption expenditures are made independently of the rate of population growth and are, therefore, non-marginal. An example of this is defense expenditures. Adjusting for <u>some</u> of the above factors has a sizable effect, since for the U.A.R. it would reduce average consumption by about 25%. It can be argued that such a figure is a better measure of benefits because increased intermediate goods, as well as more (human) capital formation, does not increase the present welfare of the reduced population. However, increased (human) capital formation does increase the productivity of the labor force, but we have (a) no measure of this increase, and (b) the benefits accrue so far into the future that any discounting makes them negligible. Hence, it can plausibly be argued that the second definition - or an intermediate one - is more plausible. Our calculations take both definitions into account as possible upper and lower limits of the benefits.

23. The second problem on the consumption side concerns the allocation of this consumption figure to different age groups. No data is available for this. Enke assumed that persons aged 35 consume 13 to

14 times as much as children in their first year.[1] By looking at actual studies in developed countries[2] (for a "typical" middle class family), or alternately by looking at food requirements and assuming that actual expenditures at different ages are made in proportion to the requirements of these ages, we arrived at a different conclusion. In both the latter cases the ratio of children's consumption to adults varied by a ratio of between 1:2 and 1:2.5. Since the future is heavily discounted, adopting our ratios substantially increases the benefits, as we shall see below.

24. Turning next to the production side, we were confronted with exactly analogous problems as on the consumption side. The determination of the marginal product of labor is a question which has received a lot of attention in the literature, but on which no agreement has emerged. Opinions range from a zero marginal product - usually based on either actual experiments[3] or a calculation of labor requirements which are shown to be well below the actual number of laborers[4] - to a marginal product not substantially different from the wage-rate - based on the

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1/ See his calculations for India, in "The Gains to India...," op.cit.

2/ See A. Sauvy, Theorie Generale de la Population, Paris, 1952, Vol. 1, Ch. 23, and references therein. In particular see L.I. Dublin and A.J. Lotka, The Money Value of a Man, New York, 1930, Ch. 4, for the estimate of the actual expenditures of a "typical" middle class family in the U.S.

3/ Such as W. Cleland's study ("Egypt's Population Problem," L'Egypte Contemporaire , January 1937), which estimates that 3/5 of Egypt's rural population is redundant.

4/ Such as the study by M.R. El Ghonemy, "Resource Use and Income in Egyptian Agriculture before and after the Land Reform, with particular reference to Economic Development," unpublished Ph.D. dissertation, North Carolina State College, 1953. The conclusion here is that 50% of the agricultural labor force is redundant.

fitting of production functions to the data,[1] on the observation that the hypothesis of zero marginal productivity is inconsistent with profit maximization, and on the analysis of the geographical, seasonal, and male vs. female and child wage differentials.[2] Since the debate on this issue is far from settled,[3] and although our inclination in this debate is that a lot of labor is redundant,[4] we have taken for purposes of calculation the national marginal product to be equal to the agricultural wage-rate, in order to ensure that our net benefits may be regarded as a minimal figure.

1/ See for instance M.M. El Imam, 'The Production Function for Egyptian Agriculture, 1913-55, "Institute of National Planning, Memo. No. 259, Cairo, 1962, and H. Kcheir el Dine, "The Cotton Production Function and its Relation to Technical Progress and Disguised Unemployment," Institute of National Planning, Memo. No. 370, Cairo, 1963.

2/ B. Hansen, "Marginal Productivity Wage Theory and Subsistence Wage Theory in Egyptian Agriculture," Journal of Development Studies, July 1964.

3/ For the latest word in this controversy see R. Mabro, "Industrial Growth, Agricultural Underemployment and the Lewis model: The Egyptian Case: 1937-1965, "Journal of Development Studies, July 1967. The author argues that considerable surplus labor exists in small farms, while none exists in large ones. This is the result of regional immobility, and explains the fact that seasonal wage variations may exist together with a labor surplus.

4/ This redendancy does not necessarily mean that if part of the labor force were suddenly withdrawn output would not be reduced, but rather that if we compare two situations, one with constant fertility and the other with declining fertility (and hence a slower rate of population growth), then the "withdrawals" from the labor force in the latter case (actually the slower ratesof addition to the labor force), which are very gradual, can be accommodated by adjustments that would leave total output unaltered in both situations. It is worth noting that the concept of marginal product as it is discussed in the literature - namely, as a (i) sudden withdrawal of labor, with (ii) all other factors remaining constant - is not strictly relevant to our case of comparing a high with a low fertility situation. In this case rather than sudden withdrawals there is a gradual transition which allows the adjustments necessary to leave total output unchanged.

25. From the previous discussion it will be seen that taking maximum and minimum values for the level of consumption (marginal productivity), the allocation of the consumption (production)[1] stream to different ages and the discount rate gives eight different possible consumption (production)streams. Table I summarizes the result of these eight different benefit streams.[2] It also gives the same eight possibilities for the year 1947 - only mortality having changed between 1947 and 1960. From this table we notice that the benefits of a prevented birth vary from 4.5 to 1.2 times the per capita income---i.e. when all factors are allowed to vary at the same time the difference between the maximum and minimum varies by a factor of nearly 4. But before it is concluded that this measure suffers from a great degree of imprecision, it should be pointed out that it is unlikely that we would want, in any particular situation, to vary all the factors at once. What particular ones we would want to vary would depend on the use we would want to make of our figure and in this context it is well to distinguish between two possible uses.

26. First we may wish to compare the value of a prevented birth in one year with that value in another year, to get an indication of how far the situation has improved or deteriorated. In this case we would use the same definition of the level of consumption (production), and the

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1/ As far as the allocation of the marginal product to different age gr ups goes, we arbitrarily assumed that children start work at age 10, and that the productivity of children aged 10-14 and 15-19 was one-third and two-thirds, respectively, of those aged 20 and over. By contrast Enke's figures (S. Enke, Economics for Development, op. cit., Ch. 20) vary by a factor of 7 between ages 10 and 35.

2/ This is the result of applying formula (1) to the eight different streams. The method is set out clearly in S. Enke, "The Gains to India from Population Control," lac. cit.

TABLE I. THE INITIAL IMPACT EFFECT

	10%							15%						
	(1)	(2)	(3)	(4) =(1) minus (3)	(5) =(2) minus (3)	(6) =(4) div. by 58	(7) =(5) by div. by 58	(1)	(2)	(3)	(4) =(1) minus (3)	(5) =(2) minus (3)	(6) =(4) div.by 58	(7) =(5) div.by 58
PRESENT MORTALITY (1960)														
1. Our Consumption and Productivity Stream	351	281	91	260	189	4.5	3.3	206	165	31	175	134	3.0	2.3
2. Enke's Consumption and Productivity Stream	278	222	79	198	143	3.4	2.5	136	109	24	112	85	1.9	1.5
PAST MORTALITY (1947)														
3. Our Consumption and Productivity Stream	294	235	71	223	164	3.9	2.8	175	140	25	151	116	2.6	1.9
4. Enke's Consumption and Productivity Stream	223	179	61	162	118	2.8	2.0	113	90	19	94	71	1.6	1.2

Column 1: Discounted Consumption Stream. Consumption defined according to standard procedures.
Column 2: Discounted Consumption Stream. Our revised definition of consumption.
Column 3: Discounted Productivity Stream.
Column 4: Net benefits according to first definition of consumption.
Column 5: Net benefits according to second definition of consumption. Figures in cols. 1 to 5 are in Egyptian pounds.
Column 6: Net benefits (first definition) as a proportion of per capita income (=58 Eg.P.).
Column 7: Net benefits (second definition) as a proportion of per capita income.

same method of allocation between different age groups in both years. In addition we would use the same discount factor, so that the main variable in such a comparison would be the different number of survivors in the various age brackets. For instance, comparing the year 1947 with 1960 we could say that the effect of reduced mortality has been to increase the net value of a prevented birth by something between 15% and 25%. We may further argue that this is an underestimate if we believe that either (a) the productivity of labor has declined between both dates because population has been growing faster than other resources, and/or (b) a higher rate of interest should be used in 1960 than in 1947, because with a greater international demonstration effect and more government propaganda leading to a rising level of expectation of the masses, time preference for the present has increased. Thus although (a) and (b) cannot be measured, it can be concluded that as a minimum the value of preventing a birth has substantially increased, which makes a population program correspondingly more urgent now.

27. Alternately we may wish to compare investment in population control with investment in other projects. In this case we would be using the same interest rate to discount the benefits and costs of both a prevented birth and of other projects.[1/] Hence we would allow only for

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1/ If we do not want to take into account the scale of the alternative investment choices we can take the ratio of benefits to costs. But if the scale does matter then we have to specify a size for the population control program, and multiply the difference between benefits and costs of one prevented birth by the number of prevented births, before comparing this figure with that of alternative investment opportunities.

a change in our concept of consumption and the allocation of both consumption and production to different age groups. Here the range between maximum and minimum values of a prevented birth would vary by a factor of 2. (4.5/2.5 for a 10% discount rate and 3.0/1.5 for a 15% rate). Given the uncertainty about the future, the difficulty of calculating shadow prices and many other difficulties that beset the evaluation of returns on industrial projects our range of variability does not seem to be, by comparison, excessive.

The Wage Productivity Effect:

28. By referring back to the second term of expression (1), it will be seen that the benefits to be derived via the wage-productivity effect are a proportion of the initial effect. This proportion depends on (1) the marginal propensity to consume food, (2) the proportion of that food consumption that goes to members of the labor force, (3) the proportion of the year for which this labor force is employed, (4) the increased calorie intake resulting from higher per capita food consumption, (5) the increased supply of effort due to a higher calorie consumption, and finally (6) the marginal product of effort. Various upper and lower bound estimates can be made for each of these factors. Items (1) to (3) need not detain us here, for their variability is not very large. As far as items (4) to (6) go, we note the following: In (4) we assume that calories increase in proportion to the increased expenditure on food. This implies that diets remain unchanged, which for (a) marginal changes, and (b) low levels of income (implying diets that are restricted to one or two staples) is realistic. In addition, it is implicitly assumed that malnutrition exists. Calorie requirements depend on various factors

such as age, sex, weight temperature and especially work. Although these requirements are periodically revised, if we assume an eight hour day of agricultural work, then they all point to an average well above that of 2500, which is the present daily average consumption of the U.A.R.[1/] Because of the large calorie requirement for basic metabolism, small increases in calorie intake lead to large increases in the supply of effort. Estimates vary widely, from 100 to 200 extra calories [1/] required to produce the equivalent of an extra hour's work. Together with total extra number of calories consumed, this allows us to determine the total number of extra hours of work. This does not mean that workers actually work more hours, but that during the same workday, they produce - in terms of effort - the equivalent of more hours of work. It remains to convert this increased supply of effort into an increased output. Here "the marginal product of effort of the equivalent of an hour's work," is calculated by assuming the marginal product of labor to be equal

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1/ For instance, taking the requirements (for a full eight hour working day), listed in H. Correa, The Economics of Human Resources, (Contributions to Economic Analysis, 34), Amsterdam, 1963, Table IV, p. 36, for each of the agricultural, industrial and service sectors, and weighting these requirements by the corresponding proportions in the U.A.R. gives a nation-wide requirement of 3150 daily calories. By contrast the actual consumption is 2500. See, also S. Shehata, "Co-operative Efforts and Food Consumption in the U.A.R.," L'Egypte Contemporaire, January 1964. The author mentions the figure of 3000, as the minimum calorie requirement for the U.A.R.

2/ We may mention the following three sources: (a) H. Leibenstein, Economic Backwardness...op. cit., and references therein, where the conclusion is that 100 extra colonies are required to produce the equivalent of an hour's work, (b) S. Shehata, op. cit., who gives 1700 calories required for basic metabolism and 3000 as the minimum for an eight hour day. This implies that around 150 calories are required per hour, and (c) H. Correa, op. cit., Ch. 4, from which we deduced a figure of around 200.

to the wage-rate. (=35 Eg.P. per year). In addition, it was assumed that at present the labor force worked the equivalent (in terms of effort) of a four-hour day. This was deduced from the fact that the average daily calorie consumption was 2500 calories and that at this level of calorie intake, one is working at 50% of full capacity in both the agricultural and industrial sectors.[1/] A four-hour day gives 1200 hours per year (assuming 300 working days). Dividing this figure by the yearly wage-rate, gives an approximation to the marginal product of the equivalent of an hour's effort (found to be 0.03 Eg.P. in our case). Thus, we have all the required information, and on this basis it turns out that the wage-productivity effect varies between 4.5% and 18% of the initial effect,[2/] with 8% being a "likely" or reasonable value.

29. Before proceeding, it may be worth pointing out that the above calculations are marginal in the sense that large increases in the supply of effort may affect (and lower) the marginal product of effort, and also in the sense that after income has increased to a certain level, there is no longer any malnutrition. In the latter case the wage-productivity effect would no longer hold, whereas in the former it may be reduced. On the other hand, we may note that not only is the total number of calories important, but also their distribution among proteins,

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1/ H. Correa, op. cit., Table IV-2-3, p. 36.

2/ The initial effect which we are referring to is that defined on the assumption that consumption is defined as GNP minus gross capital formation (i.e. as a proportion of Col. 4 of Table 1). It is a higher proportion of the minimum definition of consumption (Table 1, Col. 5). Similar comments apply below, in our discussion of both private and government savings as a proportion of the initial effect.

carbohydrates and fats. The present diet of the U.A.R. is far from balanced,[1/] so that even after daily consumption reaches the minimum requirement level, there is still room for increases in productivity. A final comment is that the productivity of the labor force can improve because of increased consumption of other factors besides food. In particular, improvements in health could have tremendous effects,[2/] but we have not included these.

C- Increases in Private Savings:

30. As a matter of arithmetic, the magnitude of the savings effect as a proportion of the initial increase in income depends on, and is in fact equivalent to the assumed marginal propensity to save. In other words, a propensity to save of n% leads to an increase in benefits equivalent to n% of the initial effect. Thus, if all the income were saved, the benefits would be doubled. The interesting question is whether

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1/ S. Shehata, "Co-operative Effects and Food Consumption in the U.A.R.," op. cit. In the U.A.R. carbohydrates (grains) account for 80% of the diet, while fats and proteins account for 20%. By contrast the ideal balance is 50%, 35% and 12% respectively. This may be an explanation for the results obtained by W. Galenson and G. Pyatt, (The Quality of Labor and Economic Development in Certain Countries, International Labor Office, Geneva, 1964), who found that both in the case of developed (who were well above the minimum requirements) and underdeveloped ones, the quantitatively largest and statistically most significant factor explaining the rate of growth of labor productivity was calories per head (twelve quality improvement factors were tested altogether).

2/ H. Correa, op. cit., pp. 43-47, calculates that for Egypt the slack in output due to deficient health is larger than that arising from undernutrition. Correa's estimate of the former is biased downward because he only takes account of illnesses that result in death while a lot of the loss in output results from chronic illnesses that reduce vitality, but do not lead to death (e.g. bilharzia).

total savings will in fact increase. In theory the interrelationships between population growth and savings behavior are complex and no empirical studies are available of the influence of family size on actual savings. On a speculative basis we would argue that unless there were positive government efforts to mobilize this saving, no increases should be expected. This argument is based on a point made by S. Kuznets[1/] which is that if the only problem in economic growth was to curb consumption, then this could be achieved very easily. Calculations show[2/] that a (linear) increase in savings proportions from 9% to 15% of national income over a ten-year period, and with no reduction in fertility, can be achieved by a decrease in the absolute level of consumption by an average of 1.2% of GNP in the first seven years (and by a maximum of 2.2% of GNP in any one year). After this initial period, saving proportions are increased by foregoing some increases in the absolute level of consumption. Put in these terms, the increase in savings proportions can be achieved at a remarkably low sacrifice.

31. It is, of course, true that if fertility were reduced, then no reduction in the absolute level of consumption would be necessary to raise savings proportions. But the difference between both cases seems so small that it would be unwise to believe that a fall in fertility would automatically raise total savings. Rather, it seems that the causes which make the raising of saving proportions so difficult even when fertility is not reduced, would also be present in the case of a fertility reduction.

1/ S. Kuznets, "Demographic Aspects..." op. cit.
2/ See Table IV, p. 75 in BCPC, op. cit.

These will differ from case to case, but perhaps a common basis is the consumption oriented form of economic development today. The demands of the population for higher living standards today (enhanced by propaganda and an international demonstration effect) may be an explanation for the vain efforts of many governments at curbing consumption. If this explanation is correct, it would be wrong to infer that a reduction in fertility will stimulate savings, unless it can be shown how fertility reduction will affect these underlying factors. It may be that the desire for smaller families is the result of a desire for more consumption (this is often the basis of the propaganda of many family planning programs), in which case no larger savings can be expected. We may then conclude as follows. In order to be conservative, we have argued that it is preferable not to expect any benefits from the savings side. However, the magnitude of this effect shows the large potential benefits that can be expected if government policies of taxation etc., are successful in mobilizing the released income resulting from lower fertility.

D - Government Savings:

32. As noted in section one, the only assumed increase in government savings as a result of a reduced fertility are the increased savings resulting from the reduced expenditure on primary education. This is so because the government is committed to universal primary education so that - assuming the marginal costs of education are the same as the average ones - a reduction in fertility may reduce such expenditures. The further assumption is made that these expenditures will be invested rather than directed to government consumption. This assumes a high priority on the part of the government for development. In addition

several other benefits can be expected which we have not taken into account. These arise because either fewer persons will be educated on other levels than primary education (if educational policy is determined by a given proportion of students in each age-group) and the sums of money thus saved may also be invested, and/or because a higher proportion of persons will be educated (if educational policy is formulated in terms of a fixed sum of money) with a resulting improvement in the quality of the labor force. The existence of such benefits that we will not take into account, may counteract the fact that some of the reduced expenditures on primary education may end up in increased government consumption.

33. With all the above provisos in mind, we find that the magnitude of this effect is substantial. It amounts from 14% to 19% of the initial effect which in terms of the income stream generated per prevented birth is equal to about two thirds the per capita income.

Conclusions:

34. We may conclude as follows: the magnitude of the initial effect of permanently preventing one birth was found to give rise to a net income stream equal to somewhere between 2.5 and 4.5 times the present per capita income when a 10% discount rate was used and to between 1.5 and 3.0 times per capita income when a 15% discount rate was used. To this effect we can add the wage productivity effect and the effect of increased government saving. These amount to somewhere between

18.5% to 37%[1/] of the initial effect. This is a minimum, for other possible benefits include: (1) The increase in private savings, which can be sizable (as large as the initial effect if all increases in per capita income are saved), but not likely without positive government policy.

35. (2) The possible increase in government savings as a result of reduced expenditures on forms of education other than primary, and for the improvement in the quality of the labor force because of more education per head.

36. (3) The improvement in the quality of the labor force because of larger expenditures on health, per head, by both the private and government sector.

37. Finally we re-emphasize the limitations of this calculation. First these benefits are the result of looking at the child exclusively as (a) an investment good and (b) from the point of view of society. Second, the "benefit for society" is simply defined as the sum of the benefits accruing to the people that are alive today. More precisely, our calculations refer to the benefits of persons born today since our time-horizon was of the same length as the average expectation of life at birth. Older sections of the population would reap only part of those benefits. Third, the treatment of consumption exclusively as a cost is

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1/ As previously noted, this percentage refers to the income stream computed on the basis of the maximum definition of consumption (Col. 5, Table 1). Since both effects are defined in absolute terms, they amount to a larger proportion (23% to 46%) of the lower estimate of consumption.

based on the premise that the development of the U.A.R. is of the consumption-oriented type, and that whatever the obstacles to growth, insufficient consumption is not one of them. Finally, these benefits are those of permanently preventing a birth. A delayed birth would have led to only a part of these benefits, this proportion depending on both the exact form of the delay and the discount rate that is being used.

shown in the table the proportion that is "wasted" is less than 5 per cent. Another point worth noting is that this proportion is not related to the density of the population in a given country. This is especially worth emphasizing in view of the fact that in the popular image, density is often associated with the gravity of a population problem. Columbia, for instance, has large tracts of vacant and fertile lands but nevertheless it has to invest 14 per cent of its national income in order to absorb the increase in its population. Alternatively, one notes that a country such as Pakistan has less of a "population problem." This seems to run counter to the popular image which associates the population problem with the teeming millions of Asia. It is not that this image is mistaken but that it does not follow from this particular criterion.

An alternative criterion might be the absolute size (and not the proportion) of investments that go into absorbing population increase. This may be of interest to donors of aid, who may be more concerned with this absolute rather than relative size. Thus countries with large populations would come on top of the list, as can be seen in Table 5.

TABLE 4. PROPORTION OF GNP THAT HAS TO BE INVESTED IN ORDER TO KEEP PER CAPITA INCOME AT A CONSTANT LEVEL IN VARIOUS COUNTRIES.

Over 10%	Colombia, India, Morocco, Brazil, Ghana, Tunisia
7.5–10%	Malaysia, Peru, the United Arab Republic, Thailand, Mexico, Philippines, Turkey
5–7.5%	The Sudan, Pakistan, Nigeria, Indonesia, South Korea, Chile, Ethiopia
Less than 5%	United States, Norway, France, Sweden, Denmark, Finland, West Germany, Italy, the United Kingdom, Belgium, Austria, Greece, Portugal

Note: Population growth figures are for 1967. The incremental capital-output ratio is for the period 1960-65. Countries included are those which had the necessary data, and they are classified in descending order.

TABLE 5. ABSOLUTE AMOUNT OF RESOURCES PER YEAR THAT ARE ABSORBED BY POPULATION GROWTH IN SOME LESS DEVELOPED COUNTRIES.
(Figures are in million US$ at 1964 prices)

India	5070
Brazil	2060
Mexico	1510
Colombia	720
Pakistan	680
Turkey	580
Philippines	380
Peru	340
Thailand	300
Malaysia, Morocco	250
Ghana	180
Tunisia, the Sudan	90

Note: The investment proportions required to keep per capita income at a constant level are those of Table 4. The GDP estimates are for 1966 at 1964 prices.

The previous various criteria of what constitutes a population problem emphasize that there are different ways of looking at the same phenomenon; depending on the way we look at this phenomenon, a different classification is obtained. However, more important than the particular classification one chooses is the point that by historical standards the problem is urgent in all less developed countries. Furthermore, as death rates in these countries fall further, the problem is likely to increase, the more so among countries whose problem is at present "mild." For these reasons, it may be more relevant to emphasize the much larger difference between developed and less developed countries, rather than the differences among the latter group.

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Population Growth and Economic Development

In discussing the advantages that economic development derives when human fertility is reduced, the author shows that while some commonly held beliefs about these are correct, others are out of touch with modern expert thinking.

George C. Zaidan

IT TOOK THE WORLD over 18 centuries to increase its population from a quarter to one billion persons. Today one billion persons are being added every 15 years, and the world population is growing at a rate that is 30 times as high as the average rate of growth between the first century A.D. and 1650. In less developed countries that rate is 40 times as high.

Why are these rates so high? What are their economic implications? What are the prospects of a deceleration? These are large and important questions which need to be taken one at a time; in this article I am concerned only with the second.

In attempting to indicate what we know today about population and economic development, there is one important preliminary point. Many people have been alarmed by the population explosion and some writers have made forecasts of impending famine. However, although the population of the world today is larger than ever, the standard of living of a large proportion of mankind is also much higher than at any time in recorded human history. Equally, looking into the future, it appears that the potential for economic growth is far greater than the potential for population growth. For instance, new strains of wheat, rice, and other foods have been discovered that could increase yields by two to five times over short periods of time. In contrast, the world population would only double over 35 years or so. Of course to exploit this potential would require large accompanying social changes, but the potential is there and it is immense.

But while the potential for economic growth is larger than the potential for population growth, this is not strictly relevant to the question that is being considered here. The crux of the matter is not whether the world can adjust to the present high rates of population growth but rather how much better the prospects for development would be if these high rates could be reduced. Here there are some impressive statistics. A representative sample of less developed countries [1] shows that over 65 per cent of total investments are devoted to maintaining the level of per capita income at a constant level, whereas the corresponding figure for a sample of developed countries [2] was less than 25 per cent. To reduce this gap, a developing country can either increase its national income and/or reduce its population. In terms of the resources required to achieve a given increase in living standards, these will be many times lower if they are used to reduce fertility than in any alternative investment. This is ultimately the basis of the need for population control. Furthermore, the total costs of such a program are a small proportion of the total expenditures on development (3 per cent as a maximum), so that investment in population control can never hope to replace expenditures on economic development, but is rather a complement to the latter.

The Economic-Demographic Model

Since death rates can be expected to decline further, and since emigration can rarely be influenced to a significant extent, economists have looked with particular interest at the effect of reduced fertility on economic development. More particularly the question was put: how would a linear reduction of 50 per cent in the birth rate over a period of 25 years (and constant thereafter) affect the standard of living in a developing country? The first model of this sort was applied to India [3] (and Mexico) but several other studies have been carried out since, and they have all confirmed the numerical magnitude observed in the first study. Before discussing the results of this study it may be instructive to spell out why it is that large benefits have been observed. Chart I attempts to reproduce in

TABLE 1: PROJECTIONS OF THE POPULATION OF A TYPICAL LESS DEVELOPED COUNTRY.

Age Group ↓ Year →		10	20	30	40	50	60
Projection A							
0-14	434 (*43.4*)	616 (*44.7*)	870 (*45.1*)	1,261 (*45.7*)	1,840 (*46.3*)	2,655 (*46.3*)	3,848 (*46.4*)
15-64	534 (*53.4*)	718 (*52.1*)	996 (*51.6*)	1,406 (*51.0*)	2,003 (*50.4*)	2,901 (*50.6*)	4,204 (*50.7*)
65-over	32 (*3.2*)	43 (*3.1*)	65 (*3.4*)	90 (*3.3*)	132 (*3.3*)	180 (*3.1*)	245 (*3.0*)
Total	1,000	1,377	1,931	2,757	3,975	5,736	8,297
Projection B							
0-14	434 (*43.4*)	567 (*42.7*)	637 (*37.8*)	676 (*32.9*)	783 (*31.5*)	901 (*30.5*)	994 (*29.1*)
15-64	534 (*53.4*)	718 (*54.1*)	985 (*58.4*)	1,287 (*62.7*)	1,573 (*63.2*)	1,869 (*63.4*)	2,181 (*63.8*)
65-over	32 (*3.2*)	43 (*3.2*)	65 (*3.9*)	90 (*4.4*)	132 (*5.3*)	180 (*6.1*)	245 (*7.2*)
Total	1,000	1,328	1,687	2,053	2,488	2,950	3,420

Projection A—fertility remains unchanged. Projection B—the birth rate is lowered by 50 per cent over a period of twenty five years and constant thereafter. In both cases mortality is constantly improving. Figures are in thousands (initial population=1 million). Figures in brackets are percentages.

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[2] The United States, Canada, Australia, and 16 West European countries.

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simplified form the mechanism through which this model operates. As can be seen from the Chart, there are three different paths through which a reduction in birth rates affect the rate of growth of per capita income. The first occurs because the reduction in fertility leads to a smaller total population. Table 1 shows differences in the total population (and its age distribution) with and without a reduction in fertility. In both examples a similar reduction in mortality is assumed, and the initial population is assumed to be one million.

The result of this smaller population is that the national income is shared by fewer persons. The national income itself is not reduced and may well be increased in the short run, since the reduction in fertility does not damage the productive capacity of the economy; this depends on the accumulation of capital, the quantity and quality of the labor force, technology, and the amount of natural resources. The reduction in fertility is assumed to have no effect on any of these "factors of production" except the accumulation of capital and the quantity of the labor force. The first effect is positive and immediate in the sense that the savings potential of an economy increases with reduced fertility, whereas the second is negative but occurs with a time lag of 15 years or so, since the quantity of the labor force would be smaller than otherwise. These two other effects, depicted in Chart I, are discussed at some length below.

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The third path is via the growth of the labor force. Here, it is important to make a distinction between the short term (defined as the time between birth and the average age at which persons enter the labor force, or about 15 years) and the long term. In the short term a reduction in fertility has no effect on the size of the labor force, since all the persons who will be entering the labor force over the next 15 years or so have already been born today. In the long term, however, there is a negative effect, in that the labor force would be smaller than otherwise. The impact of this on the economy will depend on the particular country that is being studied: in conditions of "surplus labor" or economies where unemployment is high, such a reduction will not affect the national income of an economy, at least initially. Elsewhere the negative effect will be more substantial and immediate.

TABLE 2. INCOME PER EQUIVALENT ADULT CONSUMER[1] WITH FERTILITY REDUCED, AS A PROPORTION OF INCOME PER CONSUMER WITH SUSTAINED FERTILITY.

Years =	0	10	20	30	40	50	60
	100	103	114	141	163	186	209

[1] By this measure the total population is weighted by the number of infants in it, and converted to a number of "equivalent adult consumers." The assumptions made are that a child's consumption is 0.5 that of a male adult, and that an adult female consumes 0.9 times the consumption of an adult male.

Combining these three effects, we can see how a reduction in fertility affects favorably the standard of living. On the one hand there are fewer people; on the other, total output is larger in the short run under conditions of reduced fertility. After a period of 15 years, there is some doubt as to whether total income would be larger than otherwise, since this depends on the relative magnitude of the second positive effect, as compared to the last negative effect.

Such then is the mechanism of the model. The results derived from it are striking. Table 2 shows that the standard of living in a country which reduced its fertility would be 40 per cent higher [5] than otherwise at the end of 30 years, and over twice as high at the end of 60 years.

[4] N.H. Leff, "Population Growth and Savings Potential," unpublished preliminary report of the Office of Program Coordination, U.S. Agency for International Development.

[5] It may be important to note that the whole measurement of these economic benefits is from the standpoint of a country. At the family level the calculus of benefits and costs of an additional child may be very different. This is a crucial distinction in considering policies designed to reduce fertility.

Some Other Implications of Population Growth

Though the model outlined above shows the major economic benefits of reduced fertility, it omits some important effects, most of which would increase the observed benefits. These effects are omitted because they pose difficult problems of measurement,[6] but they may be no less important than the effects that have already been discussed. Some of these omitted effects which are shown through dotted lines in Chart I are particularly interesting.

> The age structure of a population is determined primarily by the birth rate. Thus less developed countries—with birth rates of 40 per 1000 or more—typically have a proportion of children (aged 15 years or less) of 40–45 per cent of the total population, whereas in developed countries—with birth rates below 20 per 1000—the corresponding proportion is about 25 per cent. The death rate also has an effect on the age structure, but the quantitative effect is small. This can be seen intuitively, because a decrease in death rates leads to more people surviving at *all* ages. If the death rate in all ages is reduced by the same percentage amount, then the age structure remains unchanged. Hence it is not the size of the decline in the death rate that influences the age structure, but its differential impact in different age groups. Usually the proportionate decline is larger among young infants, so that a decline in the death rate is associated with a younger age structure. By contrast a decline in birth rates always leads to a much more marked and older age structure, since it is only the numbers of young people that is reduced.

A reduction in fertility would, through better nutrition, health, and education, affect positively the quality of the labor force. This would in turn lead to a larger total income than otherwise. There are two reasons why nutrition and health would improve. On the one hand the total population would be smaller, while on the other, total income and hence total expenditure on food consumption and health may be larger. For both these reasons, each member of the labor force would be better nourished and healthier. Total expenditures on education may be larger and, after some time lag (the time between the start of the reduction in fertility and the age of entry to schools) the school age population would be smaller. Eventually, as a higher proportion of educated persons entered the labor force, the labor force would be more skilled.

A second set of relationships that have been omitted concern the impact of economic development itself on the rate of population growth. The rise in per capita incomes encompasses vast changes (such as education, urbanization, and the employment of women) that reinforce the initial decline in fertility. At the same time a faster rate of economic development may accelerate the decline in mortality. But again this decline in mortality, which is concentrated among young children, sometimes leads to a decline in fertility, as parents perceive that a larger number of their children survive to the adult ages.

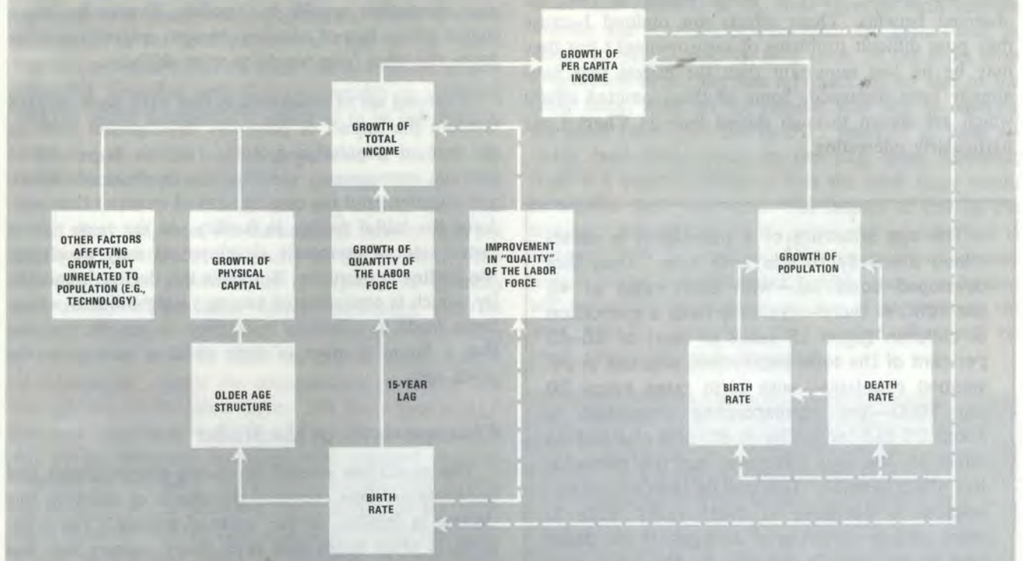
Characteristics of the Model

The model has several interesting characteristics and implications. One concerns the effects of delaying this decline in fertility, or the "costs of waiting." The argument is often heard that since every country that has become highly developed has experienced a reduction in fertility of 50 per cent or more, public policy should be directed at accelerating economic development to the maximum possible extent, and fertility decline will take care of itself. While it is true that all countries that are today highly developed have experienced at least a 50 per cent decline in their fertility, it is not clear *when* such a decline "normally" starts. A leading authority estimates that for many less developed countries of today with low per capita incomes, it would require 30 to 60 years for these countries to reach a level of industrialization where an "autonomous" decline in fertility would set in. The costs of such a delay would be large. Table 3 shows the ratio of income per consumer in a population where the decline starts immediately to one in which there is a 30-year delay (in both, fertility is assumed to be halved over 25 years, and is constant thereafter). It is seen that to wait for an automatic decline in fertility is to forego the relative gains shown in Table 3. These gains rise to 63 per cent after 50 years, and then settle to 40 per cent, which is the gain previously noted at the end of 30 years.

Another characteristic of the model is that for at least 15 years, and possibly for a much longer period of time (especially in those countries that suffer from "surplus labor"), total income would be larger under conditions of reduced fertility. This point is particularly relevant with respect to two arguments that are often

[6] In his latest book, *Asian Drama*, G. Myrdal is critical of these omissions and of the Coale-Hoover approach in general. His criticisms, however, are directed at the accuracy of the model, and in particular the narrow range of its results. But Myrdal accepts the conclusions that the economic effects of a fertility reduction are "favorable . . . and that these effects are very considerable and cumulative, gaining momentum over the years" (Page 1467).

CHART I: THE RELATIONSHIP BETWEEN THE BIRTH RATE AND PER CAPITA INCOMES



made for having a larger population. The first argument is that a larger population is beneficial because it leads to a larger total consumption. This larger market allows the economy of a country to exploit to the maximum the economies of scale of this larger market. There are at least two reasons why this argument is unconvincing. First, it holds only in a closed economy that has no trade. Once trade is possible, then specialization would permit the exploitation of some of these economies. Second, the argument confuses demand based on "need" —which would be larger with a bigger population— with demand backed by purchasing power. Since total income would be larger with reduced fertility for at least 15 years and possibly longer, demand in the sense of the *ability* to purchase a larger total amount of goods would be greater with reduced fertility.

A second argument that is made for a larger population is that of military power—that country A cannot afford to limit its population while country B, across the border, is growing at such a rapid pace. The previous discussion suggests several reasons why such an argument is untenable. First, a program of fertility reduction would not affect the growth of the persons eligible for military service for a long period of time— between the onset of the decline in fertility and the average age of conscription, say 15 years or more. Even after this period it is worth noting the large absolute increases that occur under conditions of reduced fertility. Table 1 shows that the 15-64 age bracket would be 240 per cent higher at the end of 30 years, even if fertility is halved. Second, military power is not only a matter of numbers, but especially of the quality of the people and the armaments at their disposal. A population in which fertility was being reduced would be healthier, better fed, and better educated. In addition, because of the larger total income in the short run, it would be able to afford more military equipment at the same level of sacrifice (where "sacrifice" is defined to be a given proportion of the national income going into defense expenditures).

Benefits Independent of Economic and Demographic Conditions

A third characteristic of the model is that the magnitude of the benefits is determined by the rapidity of the decline in fertility and—a striking fact—is not affected to a significant extent by the initial economic and demographic conditions prevailing in a given country. Thus the model was worked out with the detailed data for both India and Mexico and in spite of the different conditions (Mexico has higher fertility, lower mortality, and a higher per capita income than India), the results were essentially the same. Subsequent applications to other countries have tended to confirm this.

TABLE 3. INCOME PER CONSUMER, WITH IMMEDIATELY REDUCED FERTILITY AS A PROPORTION OF INCOME PER CONSUMER WITH FERTILITY REDUCTION STARTING AFTER 30 YEARS.

Years =	0	10	20	30	40	50	60	100
	100	103	114	141	158	163	149	141

The fact that these models are applicable to all countries may be a source of some puzzlement in view of the variety of conditions prevailing in the less developed world. This feature is best explained because of the fact that benefits are measured in terms of *relative* rates of growth of per capita income, together with the fact that the main source of benefits in the short run arise because the production that unborn children would otherwise have consumed is available for distribution among the "remaining" population. For instance, assume two countries A and B with per capita incomes of $100 and $400, respectively. Now assume the reduction in fertility reduces family size from eight to six persons. Then in both countries the relative gain of the family in per capita income [7] is the same—33 per cent. If the rate of growth of per capita income would have been zero in the absence of a reduction of fertility, then country A's per capita income would have been $133 and country B's $533.

A Zero Birth Rate?

Another characteristic of the model occasionally prompts nonspecialists to pursue the *reductio ad absurdum* and to ask whether, since the greater the reduction in fertility, the larger the benefits this implies, a zero birth rate would in some sense be economically "the best"? This question is theoretical for at least the next decade or two, since the halving of the birthrate over such a period would represent a considerable achievement. The answer to it then depends on what we mean by "economically the best." If we are looking at the rate of growth of per capita income as our sole measure of welfare, then the answer would be yes. If we look at total income then in the short run the answer would still be yes, though a time eventually comes when this is no longer so. Finally, an important point to make is that all the argument is in terms of trying to achieve the largest growth of national income—either in total or per capita terms. However, the measurement of national income does not include the joy that parents get from having children. It is difficult to see how this can be measured, but beyond a point there is obviously a clash between individual and social welfare. Both for this reason and because of the fact that few would be prepared to accept per capita income as the only measure to be maximized, a point will be reached beyond which a further reduction in the birthrate is no longer desirable. However, it seems to me that as long as the gap between developed and developing countries is increasing, it is legitimate to look at per capita income as the main measure to be maximized and to attach only minor importance to other factors. Translated into policy terms, this means that developing countries might aim at bringing down their birthrates approximately to the level prevailing in developed countries as quickly as possible provided this remains an economically efficient proposition. Beyond this point there may be room for arguing over the desirability of further declines, but this is not a question over which one needs to worry in the near future.

[7] In terms of income "per equivalent adult consumer," the gain would be smaller since a family of six would have a smaller proportion of children.

What is a "Population Problem"?

Another implication of the fact that the benefits are more or less the same for all countries is that it can be argued that it is equally urgent to start a population policy in all countries. This would indeed be so if our criterion for adopting a population policy was based solely on the relative percentage increases in per capita income that would result from such policy.

Although this is one possible criterion, several other alternatives are possible. One possibility would

be the extent to which an economy has to invest (as a proportion of its income) in order to keep per capita income at a constant level. This would give a measure of the resources that are "wasted" to absorb the growth of population. Table 4 gives these figures for some 33 countries. Something that stands out from this table is that for all developed countries that are

women through improving their education; introducing sex education and the concepts of benefits of smaller family size throughout the total educational system; and accelerating the provision of health services, especially in the M.C.H. area, in order to cut down the high rate of infant mortality (estimated by Shah and Worth at 208/1000) so that the time lag in the feedback mechanism regarding children's survival will be shortened.

Finally, only if the leadership becomes fully aware of the total implications of population change will they be motivated to treat this problem from all of its aspects. Once this awareness is developed, then and only then will Nepal be able to move ahead in implementing policies that will indeed affect its population's reproductive behavior, thus affecting the general fertility level.

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Studies in Family Planning

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Population Growth and Economic Development

IN THE following paper George C. Zaidan of the Economics Department of the International Bank for Reconstruction and Development discusses the economic implications of different rates of population growth and some commonly held misconceptions about them. This is a slightly expanded version of a paper that first appeared in the March 1969 issue of Finance and Development, *a quarterly publication of the World Bank and the International Monetary Fund.*

IT TOOK the world over 18 centuries to increase its population from a quarter of a billion persons to one billion persons. Today one billion persons are being added every 15 years, and the world population is growing at a rate that is 30 times as high as the average rate of growth between the first century A.D. and 1650. In less developed countries that rate is 40 times as high.

Why are these rates so high? What are their economic implications? What are the prospects of a deceleration? These are large and important questions which need to be taken one at a time; in this article I am concerned only with the second.

In attempting to indicate what we know today about population and economic development, there is one important preliminary point. Many people have been alarmed by the population explosion and some writers have made forecasts of impending famine. However, although the population of the world today is larger than ever, the standard of living of a large proportion of mankind is also much higher than at any time in recorded human history. Equally, looking into the future, it appears that the potential for economic growth is far greater than the potential for population growth. For instance, new strains of wheat, rice, and other foods have been discovered that could increase yields by two to five times over short periods of time. In contrast, the world population would only double over 35 years or so. Of course to exploit this potential would require large accompanying social changes, but the potential is there, and it is immense.

But while the potential for economic growth is larger than the potential for population growth, this is not strictly relevant to the question that is being considered here. The crux of the matter is not whether the world can adjust to the present high rates of population growth but rather how much better the prospects for development would be if these high rates could be reduced. Here there are some impressive statistics. A representative sample of less developed countries[1] shows that over 65 per cent of total investments are devoted to maintaining per capita income at a constant level, whereas the corresponding figure for a sample of developed countries[2] was less than 25 per cent. To reduce this gap, a developing country can either increase its national income and/or reduce its population. In terms of the resources required to achieve a given increase in living standards, these will be many times lower if they are used to reduce fertility than in any alternative investment. This is ultimately the basis of the need for population control. Furthermore, the total costs of such a program are a small proportion of the total expenditures on development (3 per cent as a maximum), so that investment in population control can never hope to replace expenditures on economic development, but is rather a complement to the latter.

[1] The sample included the following 22 developing countries: Brazil, Chile, Colombia, Ethiopia, Ghana, India, Indonesia, Kenya, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Peru, the Philippines, South Korea, the Sudan, Thailand, Tunisia, Turkey, Uganda, and the United Arab Republic.

[2] The United States, Canada, Australia, and 16 West European countries.

The Economic-Demographic Model

Since death rates can be expected to decline further, and since emigration can rarely be influenced to a significant extent, economists have looked with particular interest at the effect of reduced fertility on economic development. More particularly the question was put: how would a linear reduction of 50 per cent in the birth rate over a period of 25 years (and constant thereafter) affect the standard of living in a developing country?

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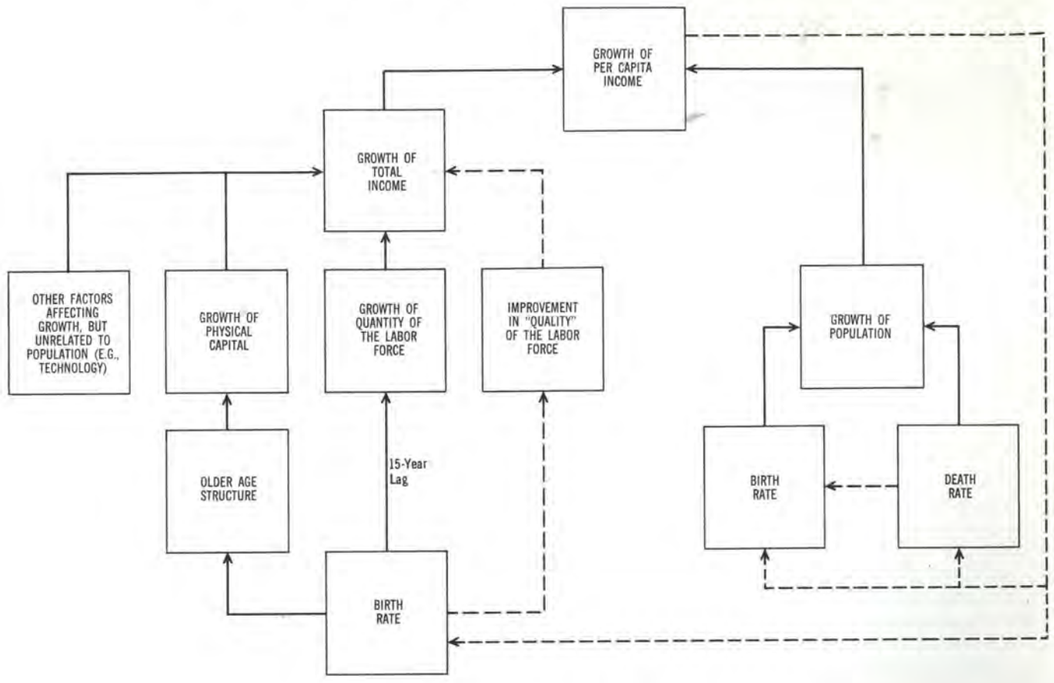
FIGURE 1. *The Relationship Between the Birth Rate and Per Capita Incomes*



The first model of this sort was applied to India[3] (and Mexico), but several other studies have been carried out since, and they have all confirmed the numerical magnitude observed in the first study. Before discussing the results of this study, it may be instructive to spell out why it is that large benefits have been observed.

Figure 1 attempts to reproduce in simplified form the mechanism through which this model operates. As can be seen from the Figure, there are three different paths through which a reduction in birth rates affects the rate of growth of per capita income. The first occurs because the reduction in fertility leads to a smaller total population. Table 1 shows differences in the total population (and its age distribution) with and without a reduction in fertility. In both examples a similar reduction in mortality is assumed, and the initial population is assumed to be one million.

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TABLE 1. *Projections of the Population of a Typical Less Developed Country*

Age Group	Time in Years 0	10	20	30	40	50	60
Projection A							
0-14	434 *(43.4)*	616 *(44.7)*	870 *(45.1)*	1,261 *(45.7)*	1,840 *(46.3)*	2,655 *(46.3)*	3,848 *(46.4)*
15-64	534 *(53.4)*	718 *(52.1)*	996 *(51.6)*	1,406 *(51.0)*	2,003 *(50.4)*	2,901 *(50.6)*	4,204 *(50.7)*
65-over	32 *(3.2)*	43 *(3.1)*	65 *(3.4)*	90 *(3.3)*	132 *(3.3)*	180 *(3.1)*	245 *(3.0)*
Total	1,000	1,377	1,931	2,757	3,975	5,736	8,297
Projection B							
0-14	434 *(43.4)*	567 *(42.7)*	637 *(37.8)*	676 *(32.9)*	783 *(31.5)*	901 *(30.5)*	994 *(29.1)*
15-64	534 *(53.4)*	718 *(54.1)*	985 *(58.4)*	1,287 *(62.7)*	1,573 *(63.2)*	1,869 *(63.4)*	2,181 *(63.8)*
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Total	1,000	1,328	1,687	2,053	2,488	2,950	3,420

Projection A—fertility remains unchanged. Projection B—the birth rate is lowered by 50 per cent over a period of twenty-five years and is constant thereafter. In both cases mortality is constantly improving. Figures are in thousands. Initial population is 1 million. Figures in brackets are percentages.

TABLE 2. *Index of Income per Equivalent Adult Consumer[1] with Reduced Fertility,[2] Based on Income per Consumer with Sustained Fertility[3] = 100*

	Time in Years 0	10	20	30	40	50	60
Index	100	103	114	141	163	186	209

1 By this measure the total population is weighted by the number of infants in it, and converted to a number of "equivalent adult consumers." The assumptions made are that a child's consumption is 0.5 that of a male adult, and that an adult female consumes 0.9 times the consumption of an adult male.
2 As in Projection B, Table 1.
3 As in Projection A, Table 1.

The result of this smaller population is that the national income is shared by fewer persons. The national income itself is not reduced and may well be increased in the short run, since the reduction in fertility does not damage the productive capacity of the economy; this depends on the accumulation of capital, the quantity and quality of the labor force, technology, and the amount of natural resources. The reduction in fertility is assumed to have no effect on any of these "factors of production" except the accumulation of capital and quantity of the labor force. The first effect is positive and immediate in the sense that the savings potential of an economy increases with reduced fertility, whereas the second is negative but occurs with a time lag of 15 years or so, since the quantity of the labor force would be smaller than otherwise. These two other effects, depicted in Figure 1, are discussed at some length below.

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Some Other Implications of Population Growth

Though the model outlined above shows the major economic benefits of reduced fertility, it omits some important effects, most of which would increase the observed benefits. These effects are omitted because they pose difficult problems of measurement,[7] but they may be no less important than the effects that have already been discussed. Some of these omitted effects, which are shown

[4] The age structure of a population is determined primarily by the birth rate. Thus less developed countries—with birth rates of 40 per 1000 or more—typically have a proportion of children (aged 15 years or less) of 40–45 per cent of the total population, whereas in developed countries—with birth rates below 20 per 1000—the corresponding proportion is about 25 per cent. The death rate also has an effect on the age structure, but the quantitative effect is small. This can be seen intuitively, because a decrease in death rates leads to more people surviving at *all* ages. If the death rate in all ages is reduced by the same percentage amount, then the age structure remains unchanged. Hence it is not the size of the decline in the death rate that influences the age structure, but its differential impact in different age groups. Usually the proportionate decline is larger among young infants, so that a decline in the death rate is associated with a younger age structure. By contrast, a decline in birth rates always leads to a much more marked and older age structure, since it is only the number of young people that is reduced.

[5] N.H. Leff, "Population Growth and Savings Potential," unpublished preliminary report of the Office of Program Coordination, U.S. Agency for International Development.

[6] It may be important to note that the whole measurement of these economic benefits is from the standpoint of a country. At the family level the calculus of benefits and costs of an additional child may be very different. This is a crucial distinction in considering policies designed to reduce fertility.

[7] In his latest book, *Asian Drama*, G. Myrdal is critical of these omissions and of the Coale-Hoover approach in general. His criticisms, however, are directed at the accuracy of the model, and in particular the narrow range of its results. But Myrdal accepts the conclusions that the economic effects of a fertility reduction are "favorable . . . and that these effects are very considerable and cumulative, gaining momentum over the years" (page 1467).

through dotted lines in Figure 1, are particularly interesting.

A reduction in fertility would, through better nutrition, health, and education, affect positively the quality of the labor force. This would in turn lead to a larger total income than otherwise. There are two reasons why nutrition and health would improve. On the one hand, the total population would be smaller, while on the other, total income and hence total expenditure on food consumption and health may be larger. For both these reasons, each member of the labor force would be better nourished and healthier. Total expenditures on education may be larger and, after some time lag (the time between the start of the reduction in fertility and the age of entry to schools), the school age population would be smaller. Eventually, as a higher proportion of educated persons entered the labor force, the labor force would be more skilled.

A second set of relationships that have been omitted concerns the impact of economic development itself on the rate of population growth. The rise in per capita incomes encompasses vast changes (such as education, urbanization, and the employment of women) that reinforce the initial decline in fertility. At the same time a faster rate of economic development may accelerate the decline in mortality. But again this decline in mortality, which is concentrated among young children, sometimes leads to a decline in fertility, as parents perceive that a larger number of their children survive to the adult ages.

Characteristics of the Model

The model has several interesting characteristics and implications. One concerns the effects of delaying this decline in fertility, or the "costs of waiting." The argument is often heard that since every country that has become highly developed has experienced a reduction in fertility of 50 per cent or more, public policy should be directed at accelerating economic development to the maximum possible extent, and fertility decline will take care of itself. While it is true that all countries that are today highly developed have experienced at least a 50 per cent decline in their fertility, it is not clear *when* such a decline "normally" starts. A leading authority estimates that for many less developed countries of today with low per capita incomes, it would require 30 to 60 years for these countries to reach a level of industrialization where an "autonomous" decline in fertility would set in. The costs of such a delay would be large. Table 3 shows the ratio of income per consumer in a population where the decline starts immediately to one in which there is a 30-year delay. (In both, fertility is assumed to be halved over 25 years, and is constant thereafter.) It is seen that to wait for an automatic decline in fertility is to forego the relative gains shown in Table 3. These gains rise to 63 per cent after 50 years, and then settle to 40 per cent, which is the gain previously noted at the end of 30 years.

Another characteristic of the model is that for at least 15 years, and possibly for a much longer period of time (especially in those countries that suffer from "surplus labor"), total income would be larger under conditions of reduced fertility. This point is particularly relevant with respect to two arguments that are often made for having a larger population. The first argument is that a larger population is beneficial because it leads to a larger total consumption. This allows the economy of a country to exploit to the maximum the economies of scale of this larger market. There are at least two reasons why this argument is unconvincing. First, it holds only in a closed economy that has no trade. Once trade is possible, then specialization would permit the exploitation of some of these economies. Second, the argument confuses demand based on "need"—which would be larger with a bigger population —with demand backed by purchasing power. Since total income would be larger with reduced fertility for at least 15 years and possibly longer, demand in the sense of the *ability* to purchase a larger total amount of goods would be greater with reduced fertility.

A second argument that is made for a larger population is that of military power —that country A cannot afford to limit its population while country B, across the border, is growing at such a rapid pace. The previous discussion suggests several reasons why such an argument is untenable. First, a program of fertility reduction would not affect the growth of the persons eligible for military service for a long period of time—between the onset of the decline in fertility and the average age of conscription, say 15 years or more. Even after this period it is worth noting the large absolute increases that occur under conditions of reduced fertility. Table 1 shows that the 15–64 age bracket would be 240 per cent higher at the end of 30 years, even if fertility is halved. Second, military power is not only a matter of numbers, but especially of the quality of the people and the armaments at their disposal. A population in which fertility was being reduced would be healthier, better fed, and better educated. In addition, because of the larger total income in the short run, it would be able to afford more military equipment at the same level of sacrifice (where "sacrifice" is defined to be a given proportion of the national income going into defense expenditures).

Benefits Independent of Economic and Demographic Conditions

A third characteristic of the model is that the magnitude of the benefits is determined by the rapidity of the decline in fertility and—a striking fact—is not affected to a significant extent by the initial economic and demographic conditions prevailing in a given country. Thus the model was worked out with the detailed data for both India and Mexico and in spite of the different conditions (Mexico has higher fertility, lower mortality, and a higher per capita income than India), the results were essentially the same. Subsequent applications to other countries have tended to confirm this.

The fact that these models are applicable to all countries may be a source of some puzzlement in view of the variety of conditions prevailing in the less developed world. This feature is best explained because of the fact that benefits are measured in terms of *relative* rates of growth of per capita income, together with the fact that the main source of benefits in the short run arises because the production that unborn children would otherwise have consumed is available for distribution among the "remaining" population. For instance, assume two countries A and B with per capita incomes of $100 and $400, respectively. Now assume the reduction in fertility reduces family size from eight to six persons. Then in both countries the relative gain of the family in per capita income[8] is the same—33 per cent. If the rate of growth of per capita income would have been zero in the absence of a reduction of fertility, then country A's per capita income would have been $133 and country B's $533.

One final characteristic of this model may be worth noting. This is that the economic effects of an increase in the rate of population growth are not the same as the economic effects of reducing this rate. The asymmetry here arises because of the different source of growth in each case. The model being discussed here assumes that the deceleration in the rate of population growth occurs because of a reduction in fertility. By contrast, historically the acceleration in population growth rates has not occurred because of an increase in fertility, but because of falling death rates and/or immigration. The economic effects of these trends will differ depending on the particular circumstances of each case. For instance, if the source of acceleration is immigration, and the migrants are mostly skilled members of the labor force, then this acceleration in population might raise the per capita income. If the source of acceleration is the fall in death rates, then this will result in more people in both the working ages and the younger and older groups. The economic effects will then depend on the exact impact of the death rates on the age structure and the contribution of the additional workers to the economy.

Though these economic effects have not been measured quantitatively, one general comment that can be made is that if these economic effects are negative then their magnitude is likely to be lower than the economic benefits of an equivalent reduction in fertility. This is so because the impact of the death rate on the age structure is smaller than the effect of fertility, and also because the economic effects of population work themselves out through the changes in this age structure.

A Zero Birth Rate?

Another characteristic of the model occasionally prompts nonspecialists to pursue the *reductio ad absurdum* and to ask whether (since the greater the reduction in fertility, the larger the benefits this implies) a zero birth rate would not in some sense be economically "the best." This question is theoretical for at least the next decade or two, since the halving of the birth rate over such a period would represent a considerable achievement. The answer to it then depends on what we mean by "economically the best." If we are looking at the rate of growth of per capita income as our sole measure of welfare, then the answer would be yes. If we look at total income then in the short run the answer would still be yes, though a time eventually comes when this is no longer so. Finally, an important point to make is that all the argument is in terms of trying to achieve the largest growth of national income—either in total or per capita terms. However, the measurement of national income does not include the joy that parents get from having children. It is difficult to see how this can be measured, but beyond a point there is obviously a clash between individual and social welfare. Both for this reason and because of the fact that few would be prepared to accept per capita income as the only measure to be maximized, a point will be reached beyond which a further reduction in the birth rate is no longer desirable. However, it seems to me that as long as the gap between developed and developing countries is increasing, it is legitimate to look at per capita income as the main measure to be maximized and to attach only minor importance to other factors. Translated into policy terms, this means that developing countries might aim at bringing down their birth rates approximately to the level prevailing in developed countries as quickly as possible provided this remains an economically efficient proposition. Beyond this point there may be room for arguing over the desirability of further declines, but this is not a question over which one needs to worry in the near future.

What is a "Population Problem"?

Another implication of the fact that the benefits are more or less the same for all countries is that it can be argued that it is equally urgent to start a population policy in all countries. This would indeed be so if our criterion for adopting a population policy was based solely on the relative percentage increases in per capita income that would result from such policy.

Although this is one possible criterion, several other alternatives are possible. One possibility would be the extent to which an economy has to invest (as a proportion of its income) in order to keep per capita income at a constant level. This would give a measure of the resources that are "wasted" to absorb the growth of population. Table 4 gives these figures for some 33 countries. Something that stands out is that for all developed countries that are shown in the Table the proportion that is "wasted" is less than 5 per cent. Another point worth noting is that this proportion is not related to the density of the population in a given country. This is especially worth emphasizing in view of the fact that in the popular image, density is often associated with the gravity of a population problem. Colombia, for instance, has large tracts of vacant and fertile lands but

TABLE 3. *Index of Income per Consumer Given Immediate Fertility Reduction, Based on Fertility Reduction Starting after 30 Years = 100*

	Time in Years							
	0	10	20	30	40	50	60	100
Index	100	103	114	141	158	163	149	141

Note: In both declines, fertility is assumed to be halved over 25 years and is constant thereafter.

TABLE 4. *Proportion of GNP That Has to be Invested in Order to Keep Per Capita Income at a Constant Level in Various Countries*

Over 10%	Colombia, India, Morocco, Brazil, Ghana, Tunisia
7.5–10%	Malaysia, Peru, the United Arab Republic, Thailand, Mexico, Philippines, Turkey
5–7.5%	The Sudan, Pakistan, Nigeria, Indonesia, South Korea, Chile, Ethiopia
Less than 5%	United States, Norway, France, Sweden, Denmark, Finland, West Germany, Italy, the United Kingdom, Belgium, Austria, Greece, Portugal

Note: Population growth figures are for 1967. The incremental capital-output ratio is for the period 1960–65. Countries included are those that had the necessary data, and they are classified in descending order.

[8] In terms of income "per equivalent adult consumer," the gain would be smaller since a family of six would have a smaller proportion of children.

TABLE 5. *Absolute Amount of Resources per Year That are Absorbed by Population Growth in Some Less Developed Countries*

(Figures are in million US$ at 1964 prices)

India	5070
Brazil	2060
Mexico	1510
Colombia	720
Pakistan	680
Turkey	580
Philippines	380
Peru	340
Thailand	300
Malaysia, Morocco	250
Ghana	180
Tunisia, the Sudan	90

Note: The investment proportions required to keep per capita income at a constant level are those of Table 4. The GDP estimates are for 1966 at 1964 prices.

nevertheless has to invest 14 per cent of its national income in order to absorb the increase in its population. Alternatively, one notes that a country such as Pakistan has less of a "population problem." This seems to run counter to the popular image that associates the population problem with the teeming millions of Asia. It is not that this image is mistaken but that it does not follow from this particular criterion.

An alternative criterion might be the absolute size (and not the proportion) of investments that go into absorbing population increase. This may be of interest to donors of aid, who may be more concerned with this absolute rather than relative size. Thus countries with large populations would come on top of the list, as can be seen in Table 5.

The previous various criteria of what constitutes a population problem emphasize that there are different ways of looking at the same phenomenon. Depending on the way we look at this phenomenon, a different classification is obtained. However, more important than the particular classification one chooses is the point that by historical standards the problem is urgent in all less developed countries. Furthermore, as death rates in these countries fall further, the problem is likely to increase, the more so among countries whose problem is at present "mild." For these reasons, it may be more relevant to emphasize the much larger difference between developed and less developed countries, rather than the differences among the latter group.

Development Enquiry Service

The Organisation for Economic Cooperation and Development has authorized its Development Centre to undertake activities in the field of population as a pilot scheme to be appraised at the end of 1969.

Through its network of international contacts and the bank of experience available to it, the Development Enquiry Service of the Centre furnishes answers on programs of development to interested public and semi-public organizations and their experts and planners in developing countries.

Questions are invited and may focus on any particular aspect of the multi-disciplinary population spectrum, including research, family planning programs, information and training activities, international assistance, and so forth. Questions should be addressed to:

The Development Enquiry Service
O.E.C.D. Development Centre
91, boulevard Exelmans
Paris 16e, France

NEPAL: National Development, Population, and Family Planning

OVER THE YEARS we have presented in this bulletin reports on the demographic situation and the nature and scope of family planning programs in various countries. This is the first such report on Nepal. It was prepared by A. S. David, Visiting Associate Professor of Economics with the Carolina Population Center at the University of North Carolina, Chapel Hill. Dr. David, a former Ford Foundation Mid-Career Fellow in Population, served in Nepal with the Ford Foundation Economic Advisory Team to the Ministry of Economic Planning, His Majesty's Government, from 1963 to 1967, and again as a short-term advisor for two months in 1968. This study is based on a report to His Majesty's Government written by Dr. David in July 1968.

AN OVERVIEW

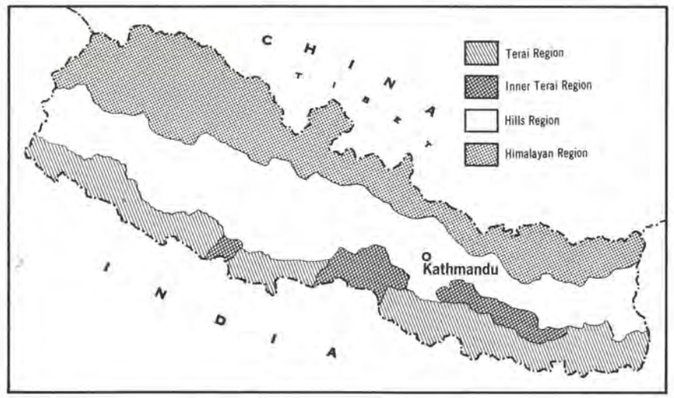
The year 1951 marks the date of Nepal's first step toward "modernization" after a century of total seclusion under the autocratic prime ministership of the Rana family. Since then Nepal has chosen to modernize via the planned economy route. This has led to the adoption and implementation of three periodic plans and their current involvement in the preparation of the *Fourth Plan*. It is very difficult to adequately quantify the degree and rate of change, even though rough estimates have been prepared to monitor changes in agricultural production, investments in private and public components of the various sectors of the economy, changes in price levels, etc. Improvements in levels of living of the average Nepali are difficult to come by even with the evident changes in the physical facilities such as transport, communication, schools and hospitals.

Nepal is strategically located between the two giants of Asia, China in the North and India in the South. It is a small kingdom, only about 100 miles wide and 500 miles long. Within this rectangular area elevation ranges from slightly above sea level in the southern plains to the highest point on earth, Mount Everest.

Geographically the kingdom is divided into four major regions: the Mountain Region consisting of the great Himalayan range; the Hill Region that extends from the first plains area in the South to the Mountain Region with elevations varying from less than a thousand feet to that of the Mountain Region; the Inner Terai, a low-land area south of the Hill Region and separated from the Terai plains by the narrow low hills; and the Outer Terai (commonly referred to as the Terai) plains which are an extension of the Gangetic Plains of Northern India. Topographically, the kingdom is divided into three major river basins: the Kosi in the East, the Gandak in the center and the Karnali in the West (see Figure 1).

Traditionally, mainly because of transport, communication, and social structure difficulties, the country of Nepal has not operated as an integrated whole. Communities and geographic areas existed in almost complete isolation from one another until about 1955 when Nepal attempted to bring about some degree of integration through the "planned" economy approach.[1] An overview of the total economy as reflected in the growth and composition of its Gross Domestic Product, as presented in Table 1, looks as follows:[2]

FIGURE 1. *Nepal*



1. The Gross Domestic Product, based on current prices, rose by about 41 per cent between 1962 and 1965 but only by 6 per cent when computed on the basis of 1962 price level, or an average of 2 per cent per year.[3]

2. The agricultural sector was the largest contributor to G.D.P., followed by manufacturing and trade.

3. The greatest increase (at constant prices) in sectoral contribution to G.D.P. was that of the services' sector, followed by transport, communication and power sector. Agriculture's contribution increased the least, by an average of 1 per cent per year.

POPULATION SIZE, COMPOSITION AND GROWTH RATES

Historical Note

Nepal reported its population size for the first time in 1911. The undertaking was a stock-taking endeavor rather than a census of population. It has since then reported its total population about every ten years. The first "modern and complete census" for Nepal, using internationally accepted concepts, was made in 1952 under the auspices of the Department of Statistics, which was established in 1950.[4]

[1] Nepal has completed two plan periods and is presently implementing its *Third Plan*, which covers the period 1965–70.

[2] In 1963, the first attempt was made to estimate the Gross Domestic Product in Nepal, using the 1961–62 agricultural sample survey conducted by the Central Bureau of Statistics —the first survey of its kind. In 1965 the process was repeated for 1964–65.

[3] 1962 and 1965 constitute the first and last year of the *Second Plan*. Computations of G.D.P. have been in accordance with recommended methods of the U. N. Only the industrial or institutional origin approach was used since the data needed for computation by the type of final expenditure or the distributive shares were not available. Thus no check on these estimates can be made.

[4] The central government actually directed the Department of Statistics to undertake the census in 1952 for the East and in 1953 for the

TABLE 1. *Gross Domestic Product (G.D.P.) in Current and Constant Prices by Major Components of the Economy: Nepal, 1961–62 and 1964–65*[a]

Component	G.D.P. at Current Prices (Million Rupees) 1961–62	1964–65	Per Cent Change	G.D.P. at 1961-62 Prices (Million Rupees) 1961–62	1964–65	Per Cent Change Total	Per Cent Change Annual Average
Agriculture and Forestry	2,393	3,443	44	2,393	2,465	3	1
Transport, Communication and Power	179	264	47	179	209	17	6
Manufacturing and Trade	1,027	1,257	22	1,027	1,119	9	3
Services	149	321	115	149	180	21	7
Total (in million Rs.)	3,748	5,285	41	3,748	3,973	6	2
Total (in million U. S. dollars)[b]	493	695	41	493	523	6	2

[a] In computing the G.D.P. at constant prices the 1961–62 price level is used.
[b] 100.00 U. S. $100 = Rs. 756. (Nepali currency henceforth referred to as N. C.)
Source: Ministry of Economic Planning, *The Economic Affairs Report*. His Majesty's Government of Nepal, Vol. III, No. 2 and unpublished estimates prepared by Ministry of Economic Planning regarding price increases.

Accepting the existing data as the best available, one notes that the population increased by 66 per cent in the 50 years between 1911 and 1961, or 1.3 per cent per year. This rate of increase inched upward so that during the early 1960's the average annual rate of increase was 2.0 per cent. Therefore, if the recent annual rate of increase of 2 per cent continued, the 1964–65 population would double in 35 years[5] (see Table 2). The population of Nepal is a young population—a characteristic of almost all the developing nations. Its dependency ratio in 1952–54 amounted to 77 per cent and increased to 81 per cent by 1961–62.[6] The labor force in 1961–62 accounted for only 46 per cent of the total population (see Table 3).

Implications for National Development

Assessment of total impact of population change on national development must, by definition, include the population variable as an endogenous (or dependent) variable in a system of interrelated variables that define the dimensions of development and change. Treatment of population as an endogenous variable requires the availability of data in quantity and quality far beyond what currently exists in Nepal. Furthermore, theoretical underpinning of demographic variables are glaringly lacking to the point of making it almost impossible to treat population endogenously. Therefore, population projections, covering the period 1970 to 1995, are made by adopting the U. N.'s component method.[7] Since vital rates are not available through vital registration, the following rates were estimated from the 1961–62 census, the 1963 Population Survey and UN Model Life Tables and used as the basis for the analysis:

(a) life expectancy at birth during the 1956–61 period was 37.5;[8]
(b) general fertility rate of 45 which corresponds to roughly a Sex Age Adjusted Birth Rate (SAABR) of 50;[9]
(c) migration is assumed to be negligible, thus not estimated for this study;[10]
(d) the base year population size and composition is the 1970 population. This population size is derived by projecting the adjusted 1961 population census of 9,829,000 to 1970—a total population of 11,377,000.[11]

Using the above methodology and estimates, the effects of population on per capita Gross Domestic Product, primary school enrollment and per capita food availability (cereal grains only) were then determined under the following two assumptions:[12] (1) no change in the present level of fertility while mortality continues to decline, and (2) decline in fertility within a twenty-five year period according to stated specific long-run fertility reduction pattern. The gains from controlling the population growth rate through reductions in fertility were then assessed.

Based on the existing demographic experiences of the population, and assuming further decline in mortality, population size is estimated to reach 22.75 million in 1995 (see Figure 2 and Table 4). This means that population annual growth rate will continue to increase for each five-year interval so that for the period 1990–1995 population annual growth rate will exceed the 3 per cent mark. The implications of such a rapid increase in population are indeed significant, especially when one realizes that the number of years required for a population to double will decrease significantly.[13]

Both population size and growth rate will be smaller if fertility begins to decline. The magnitude of population size and growth rate has been computed under ten different assumptions of fertility decline. The decline ranged from 5 per cent to 50 per cent and was assumed to be achieved through a 25 year period.[14] The net effect of a decline in fertility results not only in smaller population sizes but also in lower rates of growth, lower birth rates, and lower death rates.[15] Nevertheless, it must be stressed here that under the assumed demographic experiences, population growth rate is always positive and greater than unity. The lowest rate of growth would be achieved in 1990–1995 if fertility were assumed to decline by 50 per cent (see Figure 3).

The gains in fertility reduction cannot be measured unless they are estimated in the context of certain key variables that affect total national development.[16] For this study only three variables were considered: Gross Domestic Product, elementary school population (i.e., 5–11 years old), and food availability in terms of cereal grains. To measure the net gains I computed and compared each of the above variables on a per capita basis.

Population Growth and G.D.P.[17]

The base year estimate of G.D.P. placed it at 3,748 million Rupees.[18] With a population of 9.41 million, per capita G.D.P. would then be Rs. 398 or about $52.00. If population growth is not checked and G.D.P. were to grow as "sluggishly" as recorded during the early 1960's as is assumed in Figure 4, then per capita G.D.P. would decline throughout the projected periods, i.e., by 35 per cent over the 25 year period. A reduction in fertility by 50 per cent would slow down the rate of decline significantly.

On the other hand, if the *Third Plan* target of doubling G.D.P. by 1980 were to be achieved, the required rate of growth in G.D.P. for each five-year

TABLE 2. *Total Population and Its Average Annual Growth Rate: Nepal, 1911-65*

Year	Total Population (In Thousands)	Average Annual Growth Rate (Per Cent)
1911	5,639	
1920	5,574	−0.1
1930	5,533	−0.1
1941	6,284	1.2
1952–54	8,473	2.9[a]
1961–62	9,388	1.4
1964–65	9,951	2.0

[a] The jump in annual rate of growth from 1.2 to 2.9 per cent may be due to either one or both of the following:
(1) over-enumeration of population in 1952–54.
(2) under-enumeration of population in 1941.

Source: Ministry of Economic Planning, *The Economic Affairs Report*, His Majesty's Government of Nepal, Vol. III, No. 4, p. 15. The 1964-65 fiscal year projection is derived from: Ministry of Economic Planning, *The Third Plan*, His Majesty's Government of Nepal, p. 11.

TABLE 3. *Demographic Characteristics: Nepal, 1952–54 and 1961–62*

Census Year	Total Population (In Millions)	Population Structure 0–14	15–59	60 and over	Dependency Ratio
1952–54	8.4	3.3	4.0	0.4	77
(Per Cent of Total)	(100)	(39)	(56)	(5)	
1961–62	9.4	3.7	5.2	0.5	81
(Per Cent of Total)	(100)	(39)	(55)	(6)	

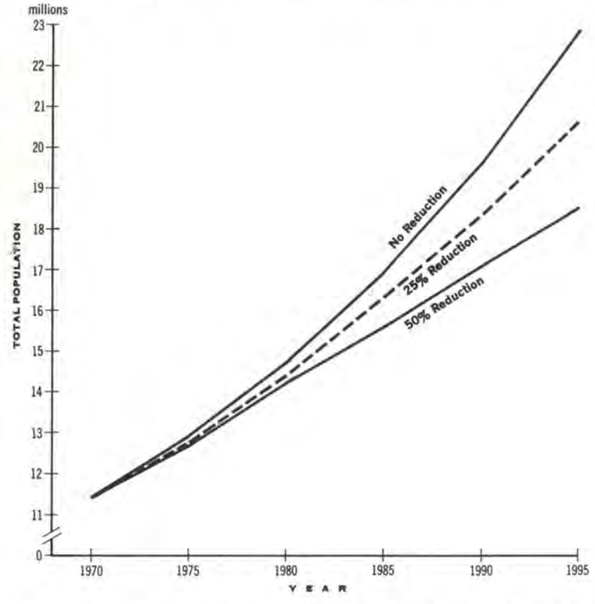
Source: Ministry of Economic Planning, *The Economic Affairs Report*, Vol. III, No. 4, p. 3, His Majesty's Government of Nepal, 1965.

TABLE 4. *Projected Total Population Size under Various Fertility Assumptions: Nepal, 1970–1995*

Fertility Reduction (Per Cent)[a]	Year 1970	1975	1980	1985	1990	1995
	(Population in millions)					
0	11.4	12.9	14.72	16.91	19.56	22.75
5	11.4	12.99	14.67	16.79	19.31	22.32
10	11.4	12.88	14.61	16.66	19.06	21.89
15	11.4	12.86	14.56	16.53	18.82	21.46
20	11.4	12.85	14.50	16.40	18.57	21.02
25	11.4	12.84	14.45	16.28	18.32	20.59
30	11.4	12.82	14.40	16.15	18.07	20.16
35	11.4	12.81	14.35	16.02	17.82	19.73
40	11.4	12.80	14.29	15.89	17.58	19.31
45	11.4	12.78	14.24	15.76	17.33	18.88
50	11.4	12.77	14.19	15.64	17.08	18.45

[a] The reduction in fertility is assumed to be achieved in 25 years; i.e., each annual decline is 1/25 compounded annually.

FIGURE 2. *Projected Total Population Size under Various Fertility Assumptions: Nepal, 1970–1995*



West. The endeavor was gigantic for Nepal in terms of manpower use. Two-hundred supervisors were trained in Kathmandu who were then given charge of 1,957 centers located all over the country. The supervisors selected, and trained, and supervised 17,000 enumerators. About 19 tons of census schedule forms and publicity materials had to be transported out of Kathmandu to the various parts of the country. Tabulation of the 8 million individual slips had to be done by hand without any office equipment. The latter operation lasted for over two years. Furthermore, vital registration of deaths and births is yet to be undertaken for Nepal. The only survey that recorded birth and death estimates was done by HMG in collaboration with the University of Hawaii in 1965–66. Some unsuccessful official attempts were made to establish vital registration in Nepal during the past year.

[5] This is about the same as what India and Indonesia experienced in the 1950's. However, where population and G.N.P. for 1965 are related and compared within the ECAFE Region, Nepal ranks at the bottom of the scale along with Laos and Afghanistan. (See Simon Kuznets, "Growth and Structure of National Product, Countries in the ECAFE Region, 1950–1961," *World Bank Atlas*, 1967 edition.)

[6] This, in a way, reflects the reduction in infant mortality due to improved health services.

[7] "Methods for Population Projections by Sex and Age," Manual III, United Nations, Population Studies, ST/SOA/Series A. 1956.

[8] Central Bureau of Statistics population projection estimates as reproduced in an unpublished paper prepared for the Planning Commission, Nepal, 1968.

[9] This rate was estimated and used by H. N. Thakur, Nepal's Population Projection 1961–1975, Nepal 1965. The recent C.B.S. population projections, however, use a SAABR of 40. I have accepted Thakur's estimates and have used them throughout my analysis.

[10] Migration patterns tend to show seasonal variations due to the agricultural practices, but since no clear indication of the magnitude of the net effect is available, it has, in all projections, been assumed to be near zero.

[11] The result of my projection is almost identical to Thakur's "low mortality" projection for 1970 (11,377,000 vs. 11,380,000). Thakur and Krotki have recently reevaluated the 1961 Census results and adjusted the total 1961 population to 9,829,000 in Harsha N. Thakur and Karol J. Krotki, "Estimates of Population Size and Growth from the 1952–54 and 1961 Censuses of the Kingdom of Nepal," paper presented at the Annual Meeting of the Population Association of America, Boston, April 1968.

[12] The results presented here are as reliable as the basic assumptions and the adequacy of the data permitted. Modifications should be made as soon as additional data and experiences are gained.

[13] For example, it will take 28 years for the population to double if the average annual rate of growth is 2.5 per cent, but will diminish to 23 years when population growth rate increases to 3.0 per cent per year.

[14] The pattern of reduction in fertility in the 25 years was assumed to be such that 1/25 of the specified reduction would occur in the first year, 2/25 in the second, and so on, until the total reduction is achieved by the 25th year.

[15] The decline in the rate of increase of population size will not, however, occur until fertility is at least reduced by 20 per cent. It can, therefore, be said that the higher the decline in fertility, the earlier will the decline in growth rate begin.

[16] The term "national development" is used here to stress the fact that development is more than economic development. It encompasses, among others, economic, social, political, and psychological change.

[17] Time series estimates of the rate of growth of Gross Domestic Product are lacking, thus the analysis necessitated the determination of gains in per capita G.D.P. by assuming various rates of annual growth in each of the periods under study.

[18] No reliable estimates of size and/or change in G.D.P. for Nepal have been produced. The first attempt was based on the 1961–62 Agricultural Census and some crude indicators of other sectors of the economy. The above estimate has been used most extensively and as such will be used as the base year estimate for our analysis. (See for example B. B. Thapa, *Planning for the Development of Nepal*, 1967, Table 8.)

FIGURE 3. *Average Annual Growth Rate of Population, by Five-Year Intervals, under Various Fertility Assumptions: Nepal, 1970–1995*

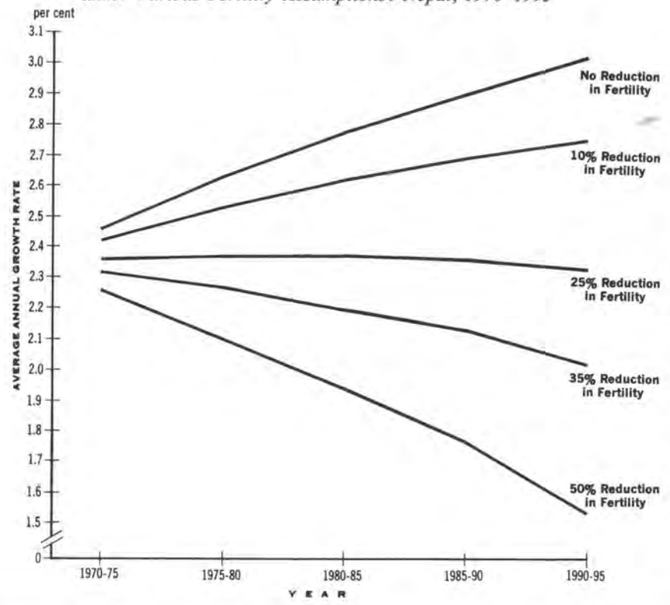
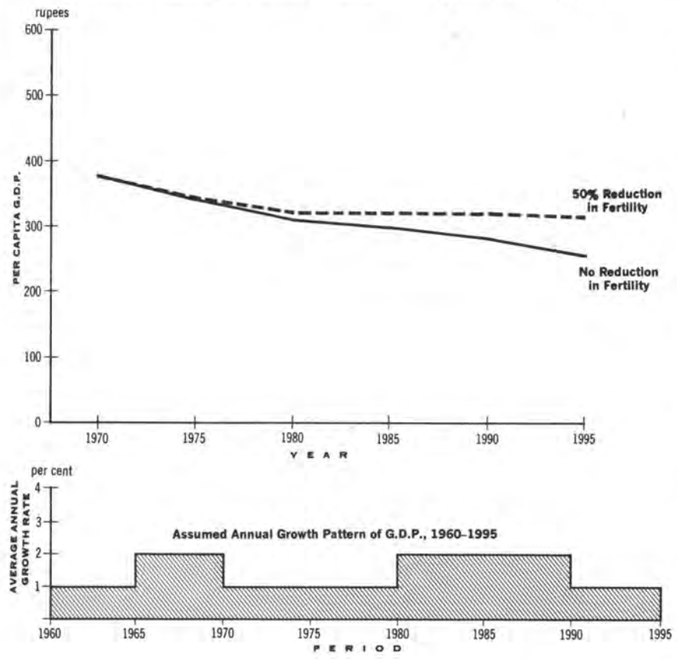


FIGURE 4. *Per Capita Gross Domestic Product (G.D.P.) under Various Assumed Growth Rates and Fertility Reductions: Nepal, 1970–1995*



interval would have to be 2, 4, 5, and 6.7 per cent. I have categorized this rate as "vigorous" and assumed it to continue over the remainder of our period of study and then assessed the changes in per capita G.D.P. (see Figure 5).

The significant conclusions to be drawn from the above analysis are: (a) when the per cent annual rate of growth of G.D.P. falls below that of population growth, then the *per capita* G.D.P. declines over time. However, the rate of decline is greater when the fertility level is assumed to remain constant; and (b) even with an assumed decline in fertility, per capita G.D.P. does not increase significantly until the latter years of the projected period. This latter conclusion implies that *the faster the country can drop the fertility of its population, the greater will be the benefits* as measured by gains in per capita G.D.P.

Population Growth and Elementary School Enrollment

His Majesty's Government, by adopting the "Karachi Plan" (as revised in the "Tokyo Plan"), has pledged to provide free and compulsory schooling to all of its elementary school age population (5–11 years old) by 1980. The *Third Plan* includes provision for 40 per cent of the same. At this rate of expansion, coupled with the growth in population aged 5–11, the quality of education will be seriously hampered since the teacher training programs will not be capable of meeting the needs of such expanding numbers.

A fast growing population means an increasing percentage of elementary school population. As Figure 6 shows, the proportion of the 5–11 year olds will increase with increases in population. This means that the actual numbers will multiply rapidly. A decline in fertility, however, would result in a reduction of the relative size of the elementary school age population. For example, primary school age population would expand from its 1970 level of 2,120,400 to 4,470,000 (i.e., by 111 per cent) by 1995 if population growth rate were unchecked, whereas it will grow by only 39 per cent, or one-third, if population growth rates were reduced by 50 per cent (see Figure 6).

The implications of the above facts are obvious. If, under the existing rates of population growth, Nepal is facing serious difficulties in educating its young population, how then can the educational system be capable of meeting the needs of a faster rate of growth of population?[19]

Population Growth and Cereal Grain Availability[20]

His Majesty's Government, in its agricultural targets for the *Third Plan*, aimed at increasing cereal grain production by an average annual rate of growth of 3 per cent. If cereal grain production increased at the assumed 3 per cent growth rate, given the 1964–65 estimated 1.9 million metric tons of cereal grain,[21] per capita food availability would increase very little, i.e., by about 5 per cent, if population growth rate were unchecked. However, per capita cereal grain availability would increase by 29 per cent if population growth rate were checked by reducing fertility level by 50 per cent in 25 years (see Figure 7).

Based on assumptions such as the above and the accompanying analysis one concludes:[22]

1. When the annual per cent growth in cereal grain production increases faster than that of population, the per capita food availability increases.

2. Assuming per capita consumption to remain constant, increases in per capita food availability would result in increases of exportable cereal grain, thus improving the nation's export bill.

3. Under all assumed rates of fertility decline, the gains in per capita cereal grain availability increase with time. Thus, as was the case with per capita G.D.P., the faster the rate of decline in fertility, the greater the gains in per capita cereal grain availability. This conclusion has tremendous social, economic, and political implications.

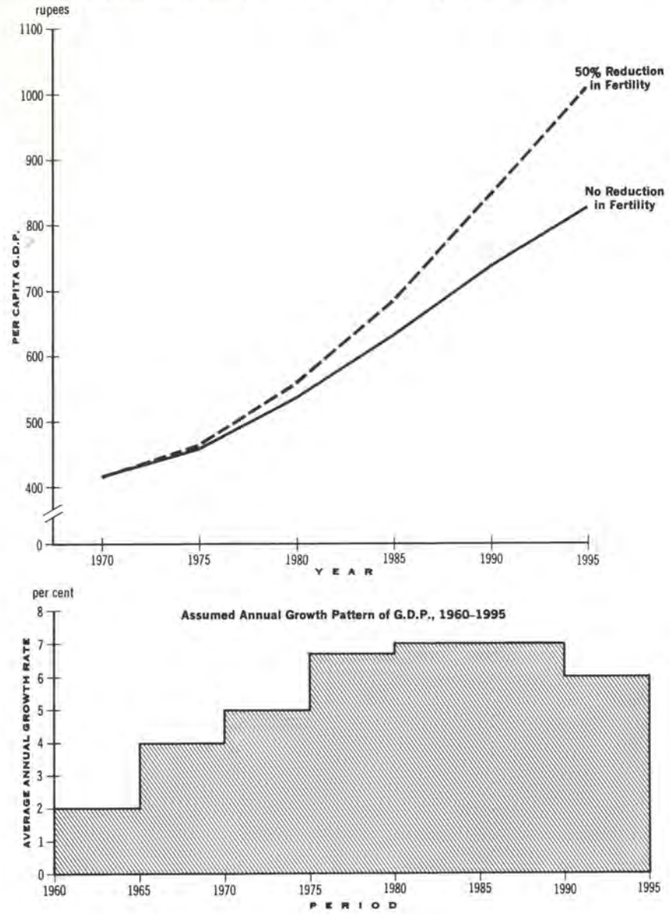
[19] This problem has emerged over the past years and found expression in the tremendous wastage in the potential efficiency of Nepal's investments in education. (See A. S. David, "Planning for the Educational System in Nepal" in *Economic Affairs Report*, HMG of Nepal, 1967.)

[20] Food production and its subsequent demand depends on so many factors that an attempt to project adequately both the supply and demand becomes very difficult at this stage. The discussion is in the context of cereal grain only, i.e., rice, corn, wheat, and millet, because of the availability of some production estimates of such crops, and because plan targets are mainly set in terms of increases in cereal grain.

[21] *The Food Problem in Nepal: Its Magnitude and Requirements for Solution*, His Majesty's Government, 1967, Table 20, p. 49.

[22] I have deliberately excluded from this summary any discussion related to the problems that emerge as a result of the disparity between the geographic distribution of population and cereal grain production in Nepal.

FIGURE 5. *Per Capita Gross Domestic Product (G.D.P.) under Various Assumed Growth Rates and Fertility Reduction: Nepal, 1970–1995*



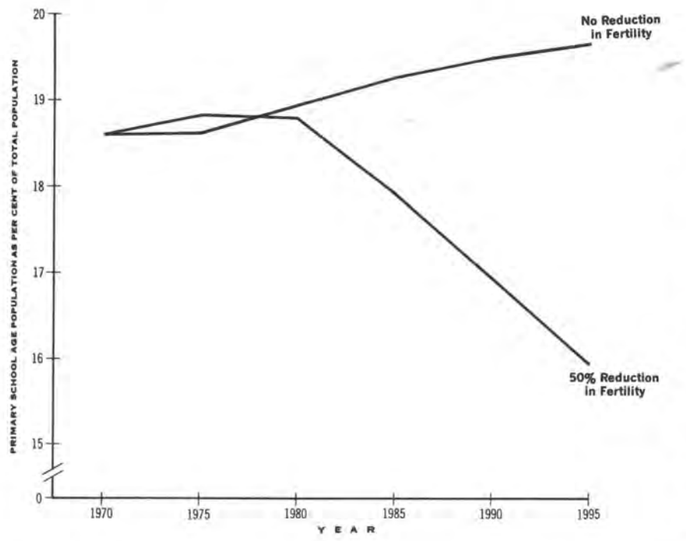
WHAT CAN BE DONE ABOUT THE POPULATION PROBLEM?

The magnitude of benefits derived from slowing the rate of growth of population depends to a great extent on the methods and magnitude of resources, both manpower and financial, that can be allocated to population programs. Furthermore, the rate at which an effective and efficient organization can be formed will definitely affect the magnitude of the program, its implementation and, therefore, the benefits derived. If *nothing* is done, which is an alternative available to policy makers, then all of the potential benefits of slowing down population growth will be lost. If some positive measures are taken, then the question that must be answered is how to organize for an effective program and set meaningful goals. Heretofore, many within His Majesty's Government and elsewhere have contended that implementation of a family planning program could meet the growing demands for slowing population growth rates. In the following paragraphs I argue that efforts in addition to the existing ones must be undertaken if Nepal wants to *effectively* manage its population growth rate.

Family Planning in Nepal

Family planning activities got under way in Nepal as early as 1958 when a voluntary family planning association was

FIGURE 6. *Primary School Age Population as a Per Cent of the Total Population under Various Fertility Levels: Nepal, 1970–1995*



established. The voluntary association provided only educational and motivational material with the main hope of generating both social and leadership support. The association did not, however, provide any clinical family planning services. By the beginning of the *Third Plan*, i.e., 1965, His Majesty's Government took a positive step by including in its health program, on an experimental basis, plans to offer family planning services in Kathmandu Valley. The responsibilities of implementing the experimental plans rested with the Maternal and Child Health Section of the Directorate of Health. The total allocated five-year budget was only Rs. 1,000,000 or Rs. 20,000 per year, (U.S. $2,632). Furthermore, His Majesty was among the original twelve heads of state who signed the Declaration on Population presented to the Secretary-General of the United Nations on Human Rights Day in 1966.

TABLE 5. *Expenditure for Family Planning Relative to Expenditure for Health and Development: His Majesty's Government of Nepal, 1965–1970*

	N.R. (Million)	U.S. Dollars[a] (Thousand)	As Per Cent of Health Plan	As Per Cent of Total Public Sector Plan
Family Planning allocated[b]				
1965–70	1	13	0.083	0.005
Health Sector Plan				
1965–70	120	15,789		6.9
Public Sector Plan				
1965–70	1,740	228,943		
Family Planning actual and proposed				
1965–66	.02	2.632		
1966–67	.10	13.158		
1967–68	.20	26.316		
1968–69 (budgeted)[c]	2.20	220.000		
1969–70 (estimated)[c]	3.00	330.000		
Total (Actual, 1965–70)	5.52	562.106	4.6	0.3

[a] U. S. $1 = N.R. 7.60.
[b] The allocated expenditures for family planning in the budget have been far exceeded by the actual expenditures, as a consequence of U. S. AID's involvement.
[c] U. S. $1 = N.R. 10. The N.R. was devalued.
Source: His Majesty's Government of Nepal, Ministry of Health.

The program, to the surprise and delight of many, moved rather quickly from the experimentation stage to the implementation of an expanding program. By September of 1966 six clinics in Kathmandu Valley were started, and training of physicians in IUD insertions was being conducted. In 1967, the M.C.H. Family Planning Section expanded its manpower, paramedical training activities, and its provision of services inside and outside Kathmandu Valley. Furthermore, a phased three-year program was launched in which the family planning services were to be offered at M.C.H. clinics while conventional methods, such as condoms, foam tablets, and jelly, were to be channeled through non-medical centers as well. The budget allocated for fiscal year 1967–68, was Rs.2,000,000 (or two times the total budget initially allocated for the five-year period of the *Third Plan*). The program continued to expand to the point that the 1968–69 budget allocation rose to about Rs. 22,000,000 (see Table 5).

Concurrent with the expansion of the official governmental program, the Family Planning Association began to expand its activities by opening a clinic in Kathmandu and acquiring the services of physicians to perform sterilizations and insert IUDs. A mobile unit was organized to perform sterilizations. Although the Association's efforts have expanded, they still provide a very small number of services. The International Planned Parenthood Federation is actively supporting the Association in its expansionary efforts.

The official total achievements to date include:

(a) the opening of 27 clinics, 12 in Kathmandu Valley and 15 in the outlying districts;
(b) the insertion of 4,097 IUDs;
(c) the performing of 801 vasectomies (including those performed by physicians of the Family Planning Association);
(d) the distribution of 969 cycles of oral pills and 87,795 condoms;
(e) the education of the "target population" through posters, radio, pamphlets and word of mouth; and
(f) the hiring of a statistician to head the evaluation component of the program.

Although the numerical achievements to date are impressive, one cannot really determine the impact of the program on the overall stated objective of "limiting population growth rate." No evaluation or proper follow-up has been undertaken. Thus, if the program is to become effective, it is imperative that the proper follow-up and evaluation of activities be greatly strengthened. All that is presently reported is the number of contraceptives offered, even though clinic records are kept on clients.

During my short stay I worked with the evaluation and education officers to tabulate the clinic records in order to identify the characteristics of the population being served in Kathmandu Valley. Preliminary results obtained from 9 of the 12 clinics in Kathmandu Valley revealed the following:

1. About 1611 women obtained IUDs while about 300 women received oral contraceptive pills.

2. Of those receiving the IUDS:

(a) 65 per cent were classed as completely illiterate while 28 per cent had received only primary education.
(b) About one-third of the total came from the farming class while another third came from the service class, i.e., their husbands worked either in an office or within His Majesty's Government (usually such positions are relatively low in the hierarchical structures).
(c) About 57 per cent of the clients were between the ages of 25 and 34. Only 1 per cent were in the 15–19 year old age group. This means that although the Nepali women marry young and begin to have children at a relatively young age (i.e., 18 years old as reported by Shah and Worth[23]), they do not seek family planning services until they have had some children. This may indicate that family planning is sought for family limitation and not spacing.[24]
(d) About 90 per cent of the total IUD clients sought family planning services after obtaining information from either friends or the clinic staff. This observation has tremendous implications as to the area of future concentration. Improving the quality of services will result in greater client satisfaction which, in turn, means greater spread of information.

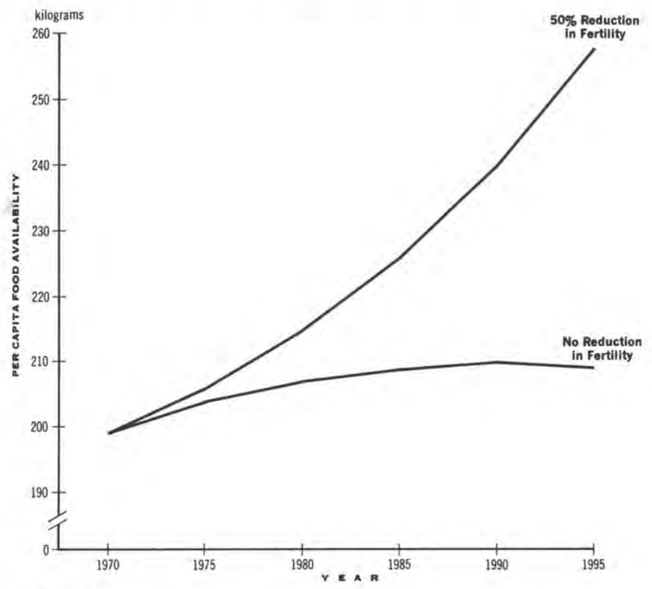
3. Information on clients receiving the oral contraceptive pills revealed the following:

(a) Although a small per cent of the clients had more education than those who received the IUD, nevertheless, the majority, i.e., about 64 per cent, were illiterate and 27 per cent did not have more than a primary education.
(b) The distribution of clients according to the occupation of the husbands was similar to clients serviced with IUDs. Most were either in the services sector or farmers.
(c) The age distribution of oral contraceptive users tended to be younger. It is difficult, without proper follow-up on use and pregnancy detection, to make concrete conclusions regarding use of this contraceptive method—whether it is taken for spacing or for family limitation.
(d) As was the case with IUD clients, the

[23] Narayan Shah, and Robert Worth, *Report of the National Health Survey of 1965–66*, a preliminary draft, Nepal, September 1967.

[24] Shah and Worth found that the mean age of final pregnancy is 36.6 years.

FIGURE 7. *Annual Per Capita Cereal Grain Availability under the Third Plan's Assumed Rates of Growth of Cereal Grain Production and Selected Fertility Levels: Nepal, 1970–1995*



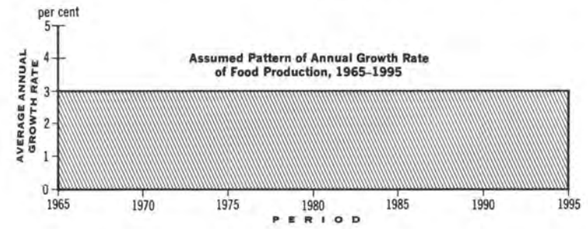
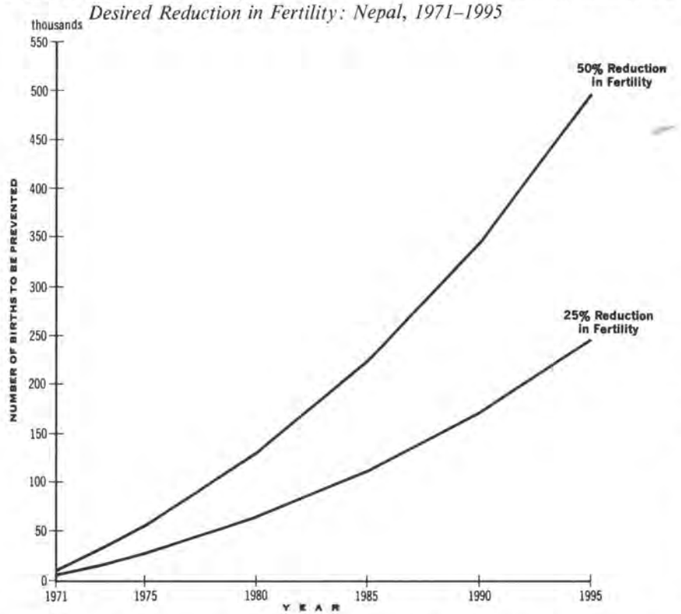


FIGURE 8. *Annual Number of Births to be Prevented in Order to Achieve the Desired Reduction in Fertility: Nepal, 1971–1995*



majority of the oral contraceptive users was referred to the clinic by either friends or clinic staff members (95 per cent). However, the referrals made by the clinic staff were much higher for oral pills than for IUDs (44 vs. 27 per cent). This difference may be due to the existing clinical practice of having the client who has or had any problem with the IUD take up the pills.

Adequacy of the Family Planning Program

His Majesty's Government adopted family planning in order to control its rate of population growth. The desired rate of growth was set and then the number of births to be prevented determined. Based on the number of births to be prevented, and some assumed rate of contraceptive effectiveness, the targets were then translated into contraceptive equivalents. This procedure is rational and sound. However, its rationality hinges on the ability to properly follow up the participants, to check whether or not the assumed rates of contraceptive effectiveness are correct and, finally to arrive at a measure (maybe through sampling of population) of the changes in birth rate and/or fertility level.

None of the needed follow-up steps have been taken. Therefore, one cannot conclusively state that since the targeted numbers of contraceptives have been distributed, the target effect on birth rate has been achieved. Furthermore, it is shown in the preceding pages that although the Government's efforts have been significant, they have not been sufficient. It appears that the magnitude of the problem and the range of the programs needed to meet such problems have not been realized. Let me briefly explain.

Policy makers and planners must realize the full implications of attempts to achieve their population goals by translating their births-to-be-prevented targets into program magnitudes.[25] The magnitudes of needed programs vary with the degree of desired reduction in the general fertility level. Although the first section of this paper deals mostly with the benefits derived from reducing fertility by 50 per cent over the 25-year period, I shall use the 25 per cent reduction target as an example here and carry it through to determine the needed contraceptive mixes. I had computed the contraceptive mixes for every chosen level of fertility decline that was discussed in the first section.[26] Any objective below a 25 per cent decline in fertility will reduce the size of the program significantly and any objective above 25 per cent will increase it significantly. (It must be remembered, however, that even if the fertility level were to be reduced by 25 per cent, the average annual rate of growth of population would still be about 2.5 per cent until 1990–1995, a level which would cause population to double in 28 years.)

A 25 per cent decline in fertility in 25 years means that:

1. The annual number of births to be prevented will increase from a low of about 5,000 in 1970 to a high of about 250,000 (see Figure 8).

2. The annual number of contraceptive users will vary with the combination and effectiveness of each contraceptive method. For example, assuming that the target decline in fertility were to be achieved by using only one of the following methods, the annual number of couples needed would be:

(a) for sterilization alone, assuming the contraceptive equivalence at 0.4 births prevented per year per sterilization, the number of *new sterilizations* will go up from a low of 13,000 in 1970 to a high of 41,000 in 1995;

(b) for the IUD alone, assuming the contraceptive equivalence of 0.36 births prevented per year per one woman-year of IUD use, the number of total IUD wearers enjoying protection in that year, irrespective of the year of insertion, ranges from a low of about 15,000 in 1970 to a high of about 100,000 by 1995;[27]

(c) for condoms alone, assuming the contraceptive equivalence of 0.24 births per one man-year of continued use, man-year condom use will range from a low of 20,000 in 1970 to a high of 1,004,000 by 1995;

(d) when a combination of contraceptive methods is used, the number of each contraceptive used will depend on the contraceptive mix. For example, if the objective of reducing fertility by 25 per cent is to be achieved by preventing 50 per cent through use of IUDs, 25 per cent through sterilization, and 25 per cent through condoms, then the range of each contraceptive will increase annually so that[28] (see Figure 9):

(i) the number of IUDs increases from a low of 7,000 in 1970 to a high of 345,000 by 1995;

(ii) sterilization increases from a low of 3,200 in 1970 to a high of 10,200 by 1995;

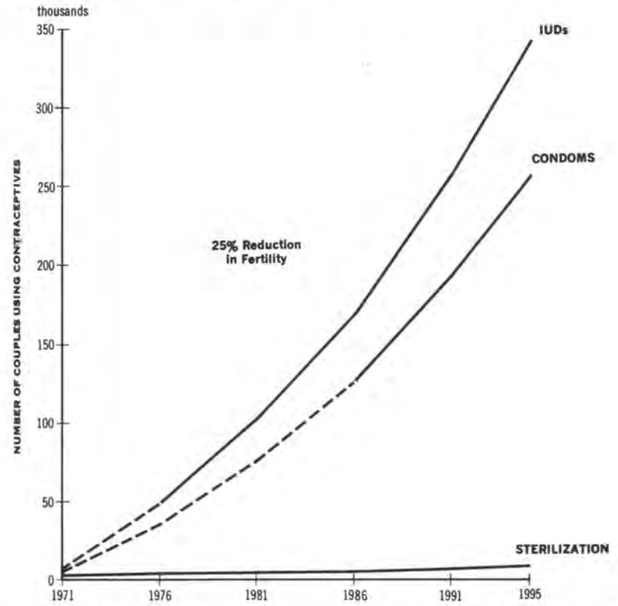
(iii) man-year condom use increases from a low of 5,000 in 1970 to a high of 259,000 by 1995.

[25] The magnitude of the program is defined here in terms of the number of couples that must be serviced with one or more of the known and acceptable contraceptive methods. This is estimated by first determining the number of births to be prevented under each of the assumed rates of fertility reduction over the 25-year period. Then contraceptive equivalents can be computed for any "desirable" combination of contraceptive methods, given the contraceptive effectiveness of each method.

[26] The tables I prepared were intended for ready reference to be used by planners in determining the size of program needed to achieve any of the desired levels of fertility reduction, under the stated assumptions. If any one of the assumptions needed to be changed or modified, a new set of tables would have been computed.

[27] The actual additional number of IUDs to be inserted depends on the length of protection, i.e., the longer the women wear the IUD effectively, the fewer will the annual number of new insertions have to be. For this reason, again, proper follow-up and evaluation are crucial to the program.

FIGURE 9. *Annual Contraceptive Mix Required to Achieve Desired Decline in Fertility: Nepal, 1971–1995*[1]



1 Contraceptive Mix includes 25 per cent condoms, 25 per cent sterilizations and 50 per cent IUDs.

[28] Other contraceptive mixes have been assumed and computed for each level of fertility reduction over the 25-year period. All that the planner needs to know is the desired contraceptive mix and the reduction in fertility; then he can refer to the appropriate table and read off the annual number of couples needed each year to use each contraceptive method. Again the usefulness of these tables is as good as the assumptions made and needs, therefore, to be changed any time any one or more of the assumptions is changed.

CONCLUSION

His Majesty's Government will need to strengthen its family planning program tremendously if it is to achieve the desired objective of fertility reduction through the avenues of family planning alone. No matter whether the target reductions in fertility can be achieved through family planning alone or not, still the family planning program needs to be structured on the following points:

1. The need for built-in organizational flexibility in order to meet the changing demands of a potentially rapidly growing program.

2. The need to increase social support for family planning and population planning. This support must come from within His Majesty's Government as well as from the total Nepalese society.

3. The need for providing adequate financial support with its disbursement made flexible enough to effect the needed program objectives.

4. The need for closer coordination and involvement of the Nepal Family Planning Association in developing the needed social support through increased educational efforts.

5. The best available persons must be identified and their services solicited for this program. To accomplish this, some of the rigidities of the Public Service Commission regulations must be waived. The present leadership must actively recruit its additional manpower needs from among the young graduates in the various fields that apply to effective family planning program implementation. It must never be forgotten that the program plans are as good as the ability of the organization to implement them. Implementation depends solely on individual competence, motivation and willingness to see the program implemented. For this reason one cannot overemphasize the need for recruiting and developing the best possible cadre of personnel. Salaries, and the ability to meet hiring regulations, should never become the main obstacles to effective program implementation.

Population planning is indeed very complex. This complexity stems from the basic fact that changing an individual's norms with regard to family size is tied up with the whole realm of social, psychological, economic and ethical values of that individual. To change such values one needs both to offer contraceptive services upon request and to use whatever tools and measures are available to influence the decision-making process of the individual. The major task is to convince individuals that by limiting their births, advantages will accrue to them individually, as well as to their society. Bridging this transition from individual actions to societal concern will require an attack on all fronts of a very complex problem.

His Majesty's Government must approach this problem from more than its family planning aspect and seriously consider the benefits of changing some of its social legislation that influences individuals' behavior with respect to family size. Such changes might include: raising the age at marriage; changing the income tax structure so that deductions will be allowed to those who remain single and higher rates imposed on those who marry and have children (especially more than two); increasing potential employment of

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A FRAMEWORK FOR THE ANALYSIS OF THE EFFECT OF FERTILITY DECLINE ON EDUCATION EXPENDITURES*

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** The views expressed in this paper are those of the author and not necessarily those of IBRD.

SUMMARY

This paper presents a framework for the analysis of the effect that family planning programs have on freeing resources from the educational sector. The educational targets of a government, whether the cost savings are reinvested or consumed, how far the community provides resources for education, whether acceptors are women who are limiting or spacing their births, and changes in social, economic and demographic conditions that are related to fertility--all these are questions that have to be implicitly or explicitly faced, when the magnitude of the effect of family planning programs is estimated. After reviewing the problems raised by these questions, the paper presents a framework for the analysis of current and capital resources freed. This framework could be used with local data of Latin American countries, and presented to policy makers, as one of the factors to be considered in formulating population policies.

I. INTRODUCTION

1. There is considerable ambivalence towards the population problem in Latin America. Action in this field has been initiated by private groups, in particular, the medical profession. Awareness of this problem has been mainly the result of the deleterious consequences to health of present demographic trends. Family planning programs have been seen as an answer to the high rates of induced abortion and associated high risks of maternal mortality. More recently, there has been an increasing awareness of this problem by several governments. The population problem is seen to be not only a health problem but also one that has serious economic implications. In particular, the implication of demographic trends for the achievement of abitious educational goals is receiving attention. This paper sets out a simple framework for the analysis of such implications. With data for a particular country, the effect of a

family planning program on educational expenditures can be estimated. The costs of such a program can then be compared with the resources freed in the educational sector as a result of family planning efforts.

2. It should be emphasized that these exercises are descriptive rather than prescriptive. They present policy-makers with the cost of alternative options, but do not by themselves show the desirability of a particular alternative. The decision of a government to adopt a given population policy will depend on fundamental political, ethical and social considerations. At the same time, policy-makers should be aware of the economic dimensions of the problem. The role of the economist is to present these economic implications to policy-makers as one of the considerations to be weighed in the formulation of a population policy.

II. METHODOLOGICAL PROBLEMS

3. A reduction in fertility leads in time to a smaller number of children entering the school ages and this in turn means that a community is required to spend less on education than otherwise. This statement seems simple and straightforward enough, but in cases where a quantitative analysis of the problem is attempted, several questions arise. The way these questions are resolved will affect the size of the economic magnitudes, but will not normally affect the conclusion that resources freed from the educational sector will be large in relation to the costs of family planning efforts. The following are some of the more important questions that arise in specific application.

4. Q1: What level of education would have been provided to children who are not born as a result of the provision of family planning services?

This question shows that some assumption on educational policy is

necessary to estimate economic implications. In the case of primary education, this is increasingly being considered to be a basic human right for all, and hence a government's policy usually aims at achieving universal primary education as early as possible. In such instances, the resources freed from primary education are equivalent to the full cost of seeing a child through primary school.

5. In some cases, the goal of universal primary education is replaced by more specific targets in terms of educating a given proportion of the relevant age group by a given year. If, for example, the target is to educate 80% of children in the 6-11 age group by 1975, then four out of five children who are not born would have received such education. The resources freed are then estimated at 80% of the costs of primary education.

6. In the case of secondary and higher education, targets are also often determined in terms of educating a given proportion of the relevant age group by a particular year. In such cases, the freed resources are proportional to these targets. If the target is to reach 50% of the relevant age group, then each child not born will free resources to the extent of 50% of the cost of a secondary education.

7. Another possibility is that a government has no explicit or implicit educational target. In this instance, a minimum assumption is that existing proportions of the relevant age group will be maintained in schools. Alternatively the trends in education in countries of similar levels of development can be used as a measure of the "implicit" target of the country under investigation. Most countries have in fact achieved

considerable progress in this field.[1/]

8. Q2: What happens to the resources freed from the educational sector?

These resources can be consumed or invested. In the first case, they can be diverted to areas other than education or they can be used to educate a larger proportion of the relevant age group than otherwise. If these resources are wholly consumed then the economic benefits are equivalent to the resources that are freed. If, however, these resources are invested, then the national income would be larger than otherwise. In this case, the economic benefits of reduced fertility would exceed the cost saved on education to the extent that the national income has increased. The same analysis applies in cases where the resources are diverted to areas which are classified as consumption in the standard national accounts, but which may also be viewed as a form of investment. Such is the case of the educational sector itself. If the resources freed from education are reinvested in education so that a larger proportion of the relevant age groups are educated, then, in turn, the labor force will be more skilled than otherwise. The increased productivity of

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1/ G. Jones, "Effect of Population Change on the Attainment of Education Goals in Developing Countries", in published paper prepared for the National Academy of Sciences Study of the Consequences of Population Change and their implications for National and International Policies, Woods Hole, July, 1969. See Table 1, P2. of this paper which shows the increase in enrollment ratios from 1950 to 1965 for developing countries.

The labor force will result in a national income that is larger than otherwise.[1/] The framework provided here includes as a measure of economic benefits only the resources freed; these can be regarded as a minimum estimate of the benefits.

9. Q3: Should the educational costs be the public costs born by the government or should they also include the contribution of the community (for example, student fees, school transportation costs, and the imputed value of buildings which are built by the community)?

In principle the costs should be inclusive of private contributions. The accepted economic measure of welfare is the national income of a country rather than the government budget. Ultimately the resources freed from education by the public sector will be spent on the population at large, who is the ultimate beneficiary. Hence, private costs that become directly available to the population should not be excluded. However, it may be useful in some cases to separate the public and private costs. Governments may be particularly interested in the impact of a program on the public sector.

10. Q4: Can the extent of annual reduction in fertility resulting from a family planning program be estimated with precision?

Though several studies[2/] have attempted to do this, there are still important unresolved difficulties. While rough estimates which are sufficient for most purposes can be made with the use of existing methods

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1/ Economists, in particular G.S. Becker and T. Schultz, have attempted to estimate the returns of investment in education. See for example, G.S. Becker, "Human Capital: Theoretical and Empirical Analysis with Special Reference to Education", National Bureau of Economic Research, New York, 1964; and T.W. Schultz, "Investment in Human Capital," American Economic Review, March 1961. The methods used by both authors are open to some objections but they do show that these returns can be substantial.

2/ For example, see R. G. Potter, "Estimating Births Averted in a Family Planning Program," a paper presented to Fertility and Family Planning: A World View Conference, University of Michigan, November 1967; and P.W. Mauldin, "Births Averted by Family Planning Programs", Studies in Family Planning, No. 33, August 1968, pp. 1-7.

no precision can yet be claimed on behalf of these methods. Two major difficulties[1/] are the following:

11. (a) To determine whether births are permanently averted or merely "delayed."

A woman who becomes an acceptor in a family planning program can do so for one of several reasons. Either she wishes to have no more children or she wishes to space her children but plans to have the same total number of children that she would have had, had she not become an acceptor; or she wishes to have a fewer total number of children and greater spacing between them. To calculate accurately the economic effects of reduced fertility, it is necessary to know the time sequence of births in the absence of a family planning program. By definition such a time sequence is not available. Therefore, indirect evidence and judgment have to be used. A question to an acceptor on whether she is limiting or spacing her births is helpful. In the former case, comparison with the fertility pattern of "similar" women with respect to age, education, parity, and other characteristics related to fertility, gives an indication of how many births are permanently averted. However, an indication that a given acceptor is spacing will not be sufficient to show (1) the extent and form of the delay that is involved, and (2) whether the acceptor plans to have the same total number of children than otherwise. The following example may highlight some of the problems.

1/ One problem not mentioned here is that of determining the exact year in which the reduction in fertility occurs. The lag between the time a woman accepts family planning services and the time a birth is averted varies between roughly one and three years. Studies measuring the number of averted births have not tackled the problem of how to estimate this lag. This is not a serious difficulty if the year for which cost savings are estimated is not taken as being only approximate. Cost savings could be aggregated for a five-year period, for example, as a way of partially overcoming this difficulty.

Assume that the time sequence of births in the absence of the practice of contraception and with this practice is known. In the first case, assume that a child is born every year, whereas in the second, one child is born every two years. In both cases the total number of births is assumed to be three. This sequence can be illustrated as follows:

Year	1	2	3	4	5
No Family Planning	B1	B2	B3		
With Family Planning	B1		B2		B3

How does this sequence differ from the case where one child is <u>permanently</u> averted as in the following sequence:

Year	1	2	3
No Family Planning	B1	B2	B3
With Family Planning	B1		B2

Assume that the cost of educating a child is 100 units per year and that primary education runs from ages 6 to 12. Then total educational costs would be as follows in the case of a delayed birth:

Year	5	6	7	8	9	10	11	12	
No Family Planning	0	100	200	300	300	300	300	300	0
With Family Planning	0	100	100	200	200	300	300	300	0
Difference or cost savings in primary education	0	0	100	100	100	0	0	0	0

In the case of a permanently averted birth total educational costs would be as follows:

Year	5	6	7	8	9	10	11	12	
No Family Planning	0	100	200	300	300	300	300	300	0
With Family Planning	0	100	100	200	200	200	200	200	0
Difference or cost savings in primary education	0	0	100	100	100	100	100	100	0

Comparing both cases, it is seen that in the case of a permanently averted birth, the cost savings are twice as large. This extreme example is meant to illustrate how difficult it is to derive exact estimates of economic benefits rather than to be a realistic reflection of these benefits in a particular situation. In some programs acceptors are asked whether they are limiting their births or spaing. Typically one-half will be limiting. Of the remainder who are spacing, there will be some who are also limiting. Thus, while it is important to show that it is unrealistic to aim for a precise estimate of averted births and hence of economic benefits, it is equally important to note that there is a strong presumption that any realistic adjustment to estimates that are made on the assumption that all births are permanently averted, would not alter the conclusion shown in these estimates, namely that the economic effects are substantial.

12. (b) To determine the extent to which the reduction in fertility results from the family planning program rather than from changes in socio-economic conditions unrelated to program efforts.

It can be argued that many women were practicing contraception prior to the introduction of a family planning program and that others would have

started to practice contraception even without a program as a result of changes in socio-economic conditions. Sometimes initial acceptors are middle-class women in urban areas who "switch" from private contraception to public or who would have started to practice contraception even in the absence of an official family planning program. How is this to be measured and how is the net reduction in fertility (i.e., that solely due to program efforts) to be estimated? Directly, it is impossible to estimate this, since no data is available on "what would have happened in the absence of a program." Indirectly, this can be done in several ways. One possibility is to study the characteristics of acceptors. In national programs, where the majority of acceptors come from rural areas and/or the lowest socio-economic and educational echelons, this is prima facie evidence that the effect of the program is substantial. Another possibility is the use of multiple regression analysis in which fertility differentials are related to two groups of factors: those contributed by the program (such as the number of man-hours of field work) and those related to fertility but not due to the program, such as changes in educational levels, infant mortality, the employment of women, etc. The data for such an analysis will only rarely be available. The one case where such an analysis was made[1/] shows that most of the variation in fertility levels can be accounted for by program inputs. In conclusion then, the existence of factors other than a family planning program, affecting fertility trends, will blur the precision with which estimates of the effect of a program on fertility reduction can be made. However, in the case of national

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1/ R. Freedman and John Y. Takeshita, Family Planning in Taiwan: Tradition and Change, Princeton University Press, 1969.

programs extending over several years a simple analysis may give a rough indication of the impact of the program. In such cases an estimate of the extent of the annual reduction in fertility, while not precise, can still serve as an adequate basis from which measures of the economic implications of such reductions can be estimated.

III. THE MEASUREMENT OF COST SAVINGS

13. A. Current Costs

The following steps are involved in calculating the cost savings in education. They are shown schematically in Table 1.

(i) Direct Costs

Given the size of the reduction in fertility, the number of children who would have been in school in various grades and at various years can be derived. This can be estimated by allowing for the probability that children not born would have (a) survived to the age of admission to schools; (b) been enrolled in school; and (c) remained in school in various grades rather than dropped out. The number of births averted thus has to be multiplied by the survivorship ratio (approximately one minus infant mortality), by the projected enrollment ratio and by the survival ratio in school or one minus the attrition rate in various grades. Given the number of children that would have been in school, the cost savings can be estimated by multiplication with the recurrent costs of maintaining one child in school. The key to Table 1 shows the steps that are involved.

14. (ii) Indirect Costs

The number of children who would have been in school would have required a given number of additional teachers, depending on the projected teacher/student ratio. In the case of primary education, these teachers would have had to be trained prior to the age at which children would have entered school. The cost of primary teacher training has therefore to be added to the direct cost savings. In addition, the costs of preparing a teacher to enter primary teacher training schools, (i.e., the costs of a primary education) has to be included. This will, in turn, require additional teachers. The cycle can be repeated indefinitely, but it converges very rapidly. In Table 1 only the first "round" is shown. A similar reasoning applies to the case of secondary education.

15. Table 1 shows in detail these steps for the educational costs of births averted in the first year. Educational costs for other years would be entered in the triangle below the diagonal in the Table. The triangle above the diagonal would consist of zeros. When the results are summed across rows, total cost savings on an annual basis are derived. It is possible to refine the scheme shown by allowing for changes in the quality of education, for example, by assuming that costs, enrollment ratios, and teacher-student ratios are all changing with time. For simplicity, these have been considered as constant in the Table.

TABLE 1: SCHEMATIC ILLUSTRATION FOR ESTIMATING CURRENT COST SAVINGS IN EDUCATION

Year	Number of births averted	Age that averted births would have had: 0-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, . . . t	Total Savings
n	X_1	Education costs of births averted in year n	S_n
n+1	X_2		S_{n+1}
n+2	X_3		S_{n+2}
.	.		S_{n+3}
.	.		.
.	.		.
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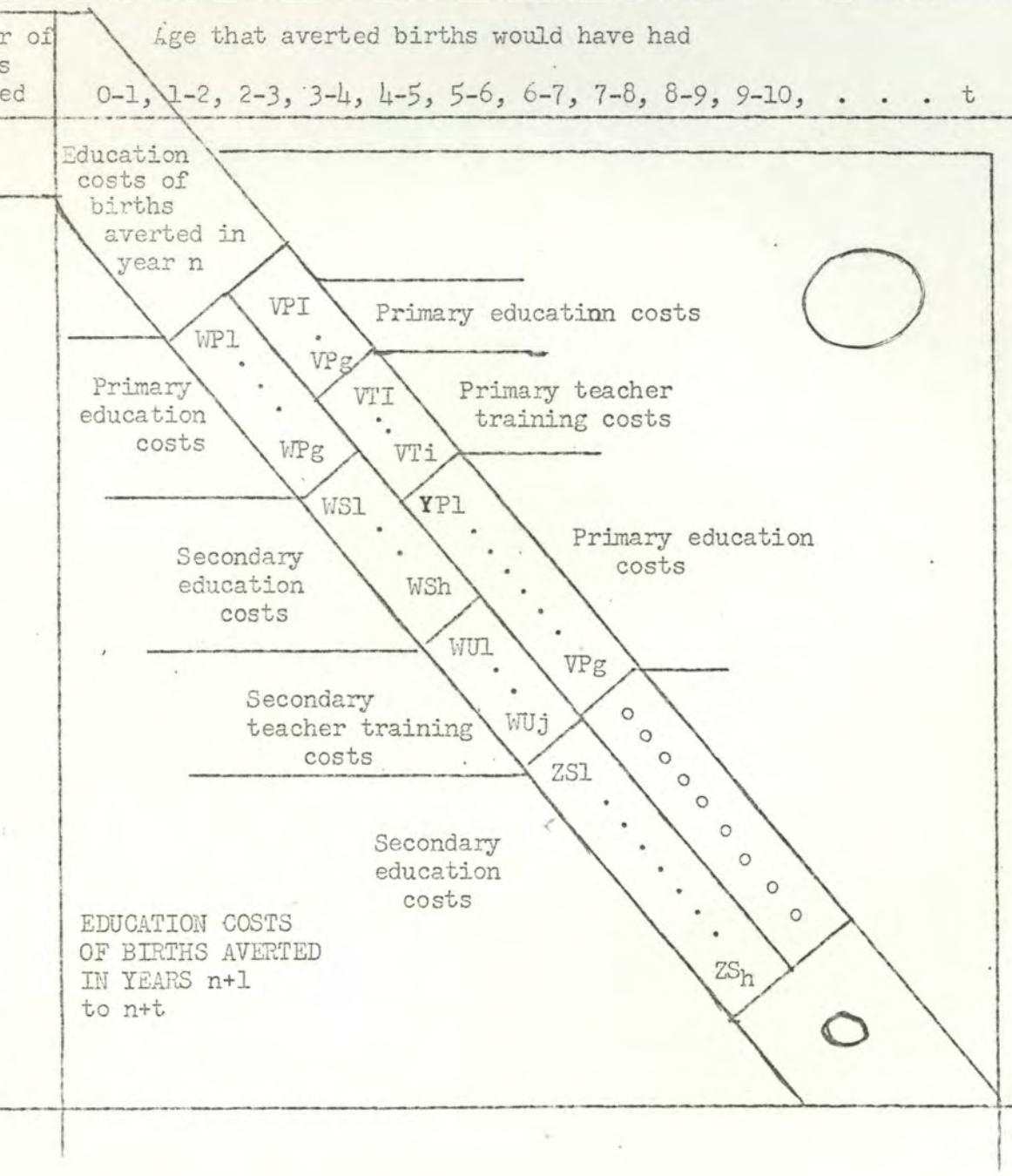
.	.		.
n+t	X_t		S_{n+t}
			Total savings from year n to n+t



KEY TO TABLE 1

Y = Additional number of primary school students who would have been in school in the absence of the family planning program or the number of places saved by the program.
Z = Additional number of secondary school students who would have been in school in the absence of the family planning program.
V = Number of additional primary school teachers needed to teach Y pupils.
W = Number of additional secondary school teachers needed to teach Z pupils.
P = Cost per student per year in primary education.
S = Cost per student per year in secondary education.
T = Cost per student per year in primary teacher training.
U = Cost per student per year in secondary teacher training.

g = Number of years of primary education.
h = Number of years of secondary education.
i = Number of years of primary teacher training education.
j = Number of years of secondary teacher training education.

NOTES

(A) Relationships between variables are as follows:

1. $Y = E.(1 - I_p).X$

   where E = Enrollment ratio in primary education; and
   I_p = Probability of death between birth and age of admission to primary school.

2. $Z = F.(1 - I_s).X$

   where F = Enrollment Ratio in secondary education; and
   I_s = Probability of death between birth and age of entry in secondary school.

3. V = Q.Y, where Q = Student-teacher ratio in primary education.
4. W = R.Z, where R = Student-teacher ratio in secondary education.

(B) It is possible to refine the analysis by making all costs (P, S, T, U), student-teacher ratios (Q, R), and enrollment ratios (E, F) all functions of time.

16. B. Capital Costs

Savings in capital costs with respect to primary education is illustrated in Table 2, but the same procedure applies to capital expenditure on secondary education, as well as primary and secondary teacher training schools.

Table 2: Savings on Capital Expenditures in Primary Education

Year	(1) No. of Averted Births	(2) No. in Primary School	(3) Annual Increment of Number of Children in Primary Schools	(4) No. of New Classrooms Required in Each Year	(5) Construction Costs Saved
n	X_1				
n+1	X_2				
.					
.					
.					
n+R-1	.	Y_1	Y_1	Y_1/C	$\overline{\underline{Y_1/C}}.L$
	.	Y_2	$Y_2 - Y_1$	$(Y_2-Y_1)/C$	$\overline{\underline{(Y_2- Y_1).L/C}}$
	.	.	$Y_3 - Y_2$	.	
	.	.	.	.	
n+R+p-1	.	Y_p	$Y_p - Y_{p-1}$	$(Y_p-Y_{p-1})/C$	$(Y_p -Y_{p-1}).L/C$
				Total Cost Savings =	$Y_p .L/C$

KEY = C = Classroom/pupil ratio
L = Cost of construction and equipment per classroom
R = Number of years between birth and primary school entrance age

17. These costs when added to those in Table 1 would give the total resources freed. They can be added in the year in which the averted births would have been enrolled in primary school. As in the case of current costs, allowance for improvements in quality can be made through increases in pupil-classroom ratios and in construction costs.

IV. CONCLUSION

18. This paper has presented a framework for the analysis of the implications of reducing fertility on educational expenditures. This framework could be applied to specific countries of Latin America using local data. In most cases, it will show that the resources freed from education are substantial in relation to the costs of family planning programs. This is suggested by rough computations that have already been done, and which approximate the approach outlined here. The results of these studies could then be presented to policy-makers for their consideration when population policies are being formulated.

From Demografia y Economia (Mexico, D.F.) 4, No. 2:227-47, 1970.

(Apparently a translation of Working Paper No. 11, January 23, 1968; Occasional Papers No. 12 - "The Costs and Benefits of Family Planning Programs" 1971 - states the author started this study in his doctoral dissertation in Economics (Harvard, 1967). "It has been considerably revised as a result of the author's subsequent experience in research and operational work within the Bank.")

LOS BENEFICIOS Y COSTOS DERIVADOS DE EVITAR UN NACIMIENTO:

Problemas conceptuales y una aplicación al caso de la R.A.U.*

GEORGE C. ZAIDAN **

INTRODUCCIÓN

ENTRE LOS PRINCIPALES problemas a que se enfrentan hoy en día muchos países subdesarrollados, se encuentra el "problema de la sobrepoblación". Como resultado de la disminución de las tasas de mortalidad después de la segunda Guerra Mundial, la tasa de crecimiento de la población se ha acelerado a un grado que pone en grave peligro el éxito de muchos esfuerzos por el desarrollo económico. En vista de que la manipulación de las tasas de mortalidad no puede ser considerada como una variable que sea objeto de una política a seguir, varios estudios han intentado investigar el efecto que tendría una reducción de la fecundidad sobre el desarrollo económico. Los intentos por cuantificar esta relación han tomado dos formas. La primera es la de Coale y Hoover,[1] quienes se valen de supuestos que les permiten seguir la trayectoria del ingreso *per capita* con y sin una reducción de la fecundidad. El segundo, introducido por Enke,[2] es tratar

* Este documento es una versión abreviada de parte de mi disertación doctoral, "Benefits and Costs of Population Control with Special Reference to the U.A.R. (Egypt)", Universidad Harvard, 1967. (Por tal razón me referiré a esta fuente como BCPC). Es la contribución No. 37 del Centro Harvard de Estudios de Población. Deseo agradecer al profesor H. Leibenstein varios comentarios de gran utilidad. Esta investigación fue patrocinada por un donativo del Centro Harvard de Estudios de Población, por lo cual doy mi agradecimiento. Este documento de trabajo es producto de una investigación en proceso. Se trabaja ahora en su actualización tomando en cuenta trabajos similares y las ideas ulteriores del autor sobre el tema. [La traducción al español es de A. García Rocha.]

** El autor es funcionario del Banco Internacional de Reconstrucción y Fomento. Las conclusiones y los puntos de vista que expresa en este trabajo no tienen representación oficial.

[1] A. J. Coale y E. M. Hoover, *Population Growth and Economic Development in Low Income Countries*, Princeton University Press, 1958. (Hay traducción al español.)

[2] S. Enke, "The Gains to India from Population Control: Some Money Measures and Incentive Schemes", *The Review of Economics and Statistics*, Vol. XLII, mayo de 1960, y también "The Economics of Government Payments to Limit Population", *Economic Development and Cultural Change*, Vol. VIII, Núm. 4, julio de 1960, pp. 339-349. El esquema conceptual es desarrollado también por Enke en *Economics for Development*, Prentice Hall Inc., 1963. Cap. 20, y en "The Economic Aspect of Slowing Population Growth", *Economic Journal*, Vol. LXXVI, marzo de 1966.

las inversiones en el control de la población como cualquier otro proyecto económico, y derivar un análisis de costo/beneficio de tal inversión. En forma muy breve, la esencia de este enfoque consiste en trabajar con las corrientes o flujos de consumo y productividad de un niño no nacido y —después de los descuentos apropiados— restar la segunda de la primera para obtener los beneficios económicos netos de evitar un nacimiento. Estos beneficios se miden en términos de la corriente de ingreso que queda disponible a la economía, considerada globalmente, como resultado de evitar el nacimiento. Tomando este enfoque como nuestro punto de partida, el objeto de este trabajo es: *a*) refinar y ampliar el análisis, trabajando tanto con el límite superior como con el inferior de los beneficios mencionados, así como tratar de incluir efectos adicionales que puedan ser cuantificados, y *b*) analizar explícitamente los supuestos y por lo tanto las limitaciones de tal procedimiento. Para esto, podemos dividir este trabajo en tres partes. La primera es una descripción de los distintos efectos y su combinación bajo un criterio de costo/beneficio. La segunda considera los problemas conceptuales que surgen de la aplicación de tal criterio, y la tercera consiste en la aplicación de nuestro esquema al caso de la RAU, para así obtener una estimación de las distintas magnitudes involucradas.

I. El criterio costo/beneficio

El efecto de evitar el nacimiento de un número especificado de niños puede afectar el ingreso *per capita* en varias formas posibles. Primero, y casi por definición, el ingreso *per capita* crece porque el niño que no ha nacido no habría agregado nada a la producción, mientras que hubiera sido un consumidor. Así, el mismo producto nacional queda dividido entre una población más pequeña. Esto es así a corto plazo[3] cuando el tamaño de la fuerza de trabajo no es afectado por lo que acontece con la fecundidad. Sin embargo, en perspectivas más largas, el niño no nacido se habría incorporado a la fuerza de trabajo, de modo que el producto resulta menor en el caso de fecundidad menor. Esta reducción se mide por el producto marginal del trabajo. De este modo, los beneficios netos de este efecto inicial pueden ser medidos por la diferencia entre la corriente de consumo y la de productividad de un niño que no ha nacido.

Segundo, como resultado del aumento inicial del ingreso *per capita*, se elevarán el consumo por trabajador y/o el ahorro por trabajador. Esto a su vez aumentará la tasa de crecimiento del ingreso. Por lo tanto, no es solamente que el producto nacional se divide entre menos gente, sino que también el producto nacional en sí puede ser mayor, como resultado de una fecundidad menor. Veamos como puede suceder esto.

Lo anterior puede ocurrir a través del efecto productividad de los salarios, que ha sido analizado por H. Liebenstein.[4] La base de este

[3] El "corto plazo" se define aquí como el tiempo transcurrido entre el nacimiento y la edad media a la cual la persona se incorpora a la fuerza de trabajo.

[4] H. Leibenstein, *Economic Backwardness and Economic Growth*, Nueva York, 1957, Cap. 6, pp. 62-69.

efecto es que el consumo mayor de alimentos que resulta del aumento inicial del ingreso *per capita* conduce a un aumento de la cantidad de esfuerzo que a su vez resulta en un producto mayor. La solidez de la relación entre el ingreso *per capita* y el producto mayor depende de los siguientes vínculos implicados: *i*) de la propensión marginal a consumir alimentos, *ii*) de la mayor ingestión de calorías resultante, *iii*) del aumento del esfuerzo y *iv*) del producto marginal del esfuerzo.

Cuanto mayores sean las magnitudes de las relaciones *i*) a *iv*), mayor será la magnitud del efecto productividad del salario. En el contexto de los países subdesarrollados, la existencia de tal efecto implica *i*) que el consumo *per capita* está por debajo de los requerimientos mínimos de calorías y *ii*) que el producto marginal del esfuerzo no es cero. Aun cuando este efecto esté presente, se debe tomar en cuenta el hecho de que es sólo el consumo de los trabajadores el que aporta a la producción. Así, sólo debe tomarse en cuenta la proporción del aumento inicial del ingreso que se distribuye entre los miembros de la fuerza de trabajo, y sólo en aquellos períodos del año en los que no hay desempleo estacional.

En seguida, volviendo al efecto ahorro, notamos que la producción total puede ser mayor debido a cambios en los patrones de ahorro que son resultado del aumento inicial del ingreso. Vale la pena recalcar aquí que los cambios pertinentes son los que se presentan en el ahorro por trabajador y no en el ahorro *per capita*. (En vista de que a corto plazo el tamaño de la fuerza de trabajo es constante, requerir más ahorro por trabajador equivale a requerir mayor ahorro total.) Debido a que la población es menor cuando la fecundidad es menor, un ahorro *per capita* más elevado no implica necesariamente más capital por trabajador.[5] Es esto último lo que es necesario para asegurar una mayor tasa de crecimiento del producto. De este modo, a corto plazo, lo necesario es un ahorro total mayor y no simplemente mayor ahorro *per capita*, mientras que a largo plazo —cuando la fuerza de trabajo es menor en el caso de fecundidad baja— aun el mismo ahorro total resultaría en mayor capital por trabajador, lo cual es benéfico.

[5] Conviene hacer notar aquí la diferencia entre el efecto productividad de los salarios y el efecto ahorro. En el primero, si la propensión marginal a consumir (parte del aumento del ingreso *per capita*) es igual a su valor medio entonces habrá aún un aumento del producto, porque los trabajadores recibirán más alimentos por persona. Sin embargo, con el efecto ahorro, una propensión marginal al ahorro (del aumento de ingreso) que es igual a la propensión media sólo se traducirá en un aumento del ahorro por persona, pero *no* del ahorro por trabajador. Por lo tanto no hay beneficios de aumento de producto. Estos últimos surgen sólo si, y en el grado en que, la propensión marginal a ahorrar sea superior a la media. La razón de esta diferencia es que la fuerza de trabajo utiliza todo el capital, mientras que consume sólo parte de los bienes de consumo totales. Esto significa que para aumentar el capital por trabajador el ahorro total debe aumentar (lo cual a su vez quiere decir que los ahorros marginales deben exceder a los medios), mientras que no es necesario que aumente el consumo total para que se eleve el consumo *per capita*. Lo último puede ocurrir a causa de la transferencia de alimentos de la población desocupada a la fuerza de trabajo. En el caso de un nacimiento evitado, esto ocurriría debido a que parte del consumo que el niño no nacido habría usado lo efectuaría la fuerza de trabajo. Por lo tanto, el consumo de alimentos por trabajador es aumentado, aún con el mismo consumo total.

Combinando los tres efectos anteriores[6] mediremos los beneficios netos sacrificados al evitar un nacimiento aplicando la fórmula siguiente:

$$\sum_i \frac{y_i}{(1+r)^i} + f\,k\,h\,\frac{\sum_i y_i}{(1+r)^i} + r\,(s\text{-}S)\sum_{\substack{i \\ i \neq j}}\sum_j \frac{y_i}{(1+r)^j} + r\sum_{\substack{i \\ i \neq j}}\sum_j \frac{x_1}{(1+r)^j}$$

en la que $y_i = (c_i - mp_i)\,(1 - q_i)$ y la suma se efectúa hasta el final de nuestro horizonte de tiempo.

En esta expresión los símbolos tienen los significados siguientes:

c_i = consumo anual evitado del niño no nacido entre las edades i e $(i+1)$.
mp_i = producción anual evitada (producto marginal del trabajo) del niño no nacido entre las edades i e $(i+1)$.
q_i = probabilidad de morir entre las edades i e $(i+1)$. "$1 - q_i$" es por lo tanto, la probabilidad de sobrevivir.
y_i = es, por lo tanto, la corriente de ingreso neto de un niño no nacido, tomando en cuenta la posibilidad de que el niño no nacido haya muerto a distintas edades.
f = propensión marginal a consumir alimentos por parte de la fuerza de trabajo en períodos del año en los que no hay desempleo estacional.
k = constante que convierte el gasto en alimentos en un suministro adicional de esfuerzo vía al aumento de ingestión de calorías.
h = el producto marginal del esfuerzo.
x_i = el costo de la educación entre las edades i e $(i+1)$.
r = factor de descuento = producto marginal del capital.
S = propensión a ahorrar después de la reducción de la fecundidad.
s = propensión a ahorrar parte del aumento del ingreso *per capita*.

Esta expresión es la corriente de ingreso neto disponible en la economía como resultado de la prevención de un nacimiento. Su primer

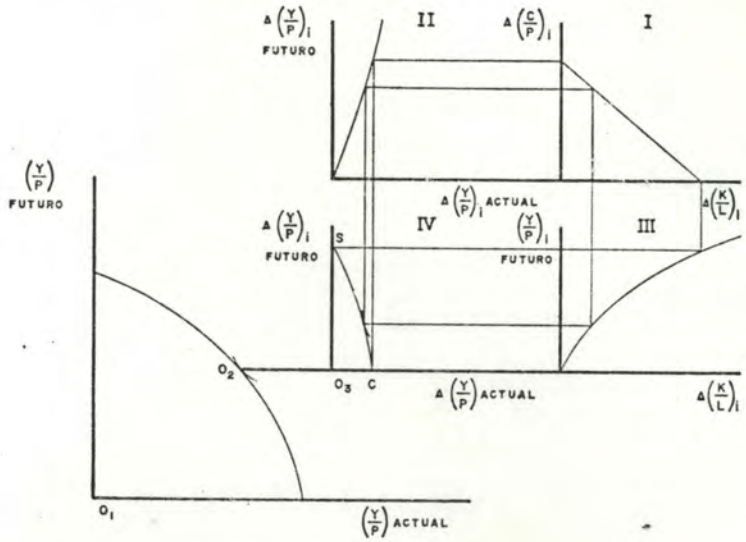
[6] Un efecto que no consideramos es la posibilidad de que patrones de fecundidad diferentes afecten la relación capital/producto. El argumento aquí es que la reubicación de recursos fuera de sectores con elevada relación capital/producto (como la vivienda) conducirá a una tasa mayor de crecimiento del producto. La razón para no considerar tal efecto es triple: primero, sólo una pequeña proporción de la inversión total puede considerarse ligada a la población. Segundo, aún aquí la relación no es muy clara. La vivienda, por ejemplo, está relacionada con la urbanización así como con los cambios en el tamaño de la familia, y la relación entre estas últimas dos y una reducción de la fecundidad no es directa. Finalmente, aun cuando haya reubicación de la inversión, el retardo de tiempo es tan largo que aún un descuento moderado haría este efecto cuantitativamente despreciable.

término es la corriente de consumo neto descontado, menos la corriente de productividad de un niño no nacido, que constituye nuestro primer efecto. El segundo término es el efecto productividad del salario, y los dos últimos son el efecto ahorro de los individuos y del gobierno respectivamente. La razón para distinguirlos es que puede justificarse la existencia de consumos diferentes en cada caso. Para los individuos existe muy poca información referente a la relación entre las tendencias demográficas y el comportamiento del ahorro.[7]

Volviendo a nuestra expresión, puede verse que cada uno de sus términos corresponde con cada uno de nuestros efectos. Puede ser util ver la interacción de estos efectos con la ayuda de un diagrama. En la parte I de la gráfica 1, sobre el eje vertical se mide el consumo *per capita* aumentado resultante de la prevención de un número especificado de nacimientos mientras que el aumento del ahorro se mide en el eje horizontal. En la parte II mostramos el efecto del consumo *per capita* aumentado sobre el ingreso *per capita* incrementado durante el período corriente —esto es, el ingreso *per capita* de hoy. Tras esta curva subyacen varias relaciones, que ya hemos mencionado. En particular las siguientes fugas dan cuenta de que exhibe beneficios decrecientes: *1*) Sólo una parte del consumo aumentado *per capita* resulta en un aumento de la ingestión de alimentos *per capita*. *2*) No todo el aumento del consumo de alimentos *per capita* lo efectúa gente que pertenece a la fuerza de trabajo. *3*) Debido al desempleo estacional en la agricultura, el aumento del consumo de alimentos durante algunas épocas del año no resulta en un aumento del esfuerzo. *4*) Debido a que los rendimientos de los factores son decrecientes, ante aumentos iguales de la oferta de esfuerzo se obtienen incrementos menos que proporcionales del producto. En la parte III, suponiendo que todos los ahorros son invertidos, el aumento del capital por trabajador aparece representado contra el aumento del ingreso *per capita* que posiblemente generará en *todos* los períodos futuros. También se muestran aquí los rendimientos decrecientes del capital. Finalmente, en la parte IV, vemos las alternativas que son posibles entre el ingreso actual o el futuro, y que la preferencia en el tiempo determinará la proporción del aumento de ingreso que es ahorrada y la que es consumida. Ampliando la parte IV podemos concebir 0_2 como el punto en el cual habría estado la economía de no haber reducción en la fecundidad. El aumento inicial del ingreso *per capita* puede ser considerado como un suministro adicional 0_20_3 al ingreso presente. Entonces este ingreso aumentado podría ser totalmente consumido o totalmente ahorrado. Si *todo* fuera consumido, el ingreso aumentado sería 0_3C. Si, por otra parte, todo fuera ahorrado, el au-

[7] La relación teórica entre el comportamiento del ahorro y la tasa de crecimiento de la población han sido analizadas por P. Demeny en "Demographic Aspects of Saving, Investment, Employment and Productivity", documento número 460, Conferencia de Población de las Naciones Unidas, Belgrado, 1965. La discusión no es concluyente y no hay estudios empíricos a nivel desagregado sobre la relación entre el tamaño de la familia y el ahorro en los países menos desarrollados. Sin embargo, algunos trabajos inéditos muestran que la carga de dependencia es una variable explicativa importante de las diferencias de ahorro interno bruto entre una gran muestra de países desarrollados y menos desarrollados.

mento de ingreso en lo futuro sería 0_3S. Nótese que toda la secuencia presentada en la gráfica 1 se refiere a la corriente evitada de ingreso y de consumo del niño no nacido durante un año (todas las variables tienen el subíndice *i*). Si sumamos estos beneficios sobre todos los años y descontamos en forma apropiada, obtenemos nuestra expresión inicial.



GRÁFICA 1

En conclusión, conviene señalar que bajo los efectos anteriores está el cambio de la distribución por edades de la población que acompaña a una fecundidad menor. A corto plazo nuestro efecto impacto inicial es una consecuencia de ello, ya que es el hecho de que *a*) la fuerza de trabajo permanezca inalterada mientras que *b*) disminuya la proporción de gente joven que consume pero no trabaja, lo que permite que el producto por trabajador no varíe mientras el producto por persona aumente. Este aumento inicial del ingreso *per capita* es a su vez la base del efecto productividad del salario. También, la menor carga de dependencia es con frecuencia una de las razones para esperar mayor ahorro total (privado). Por último, esta distribución por edades modificada puede influir en el monto total del ahorro público —debido a que permite que los recursos que son dedicados al "consumo" de los jóvenes, tales como la educación, sean dirigidos a la formación de capital material y a su ubicación entre los diferentes sectores. De este modo la distribución por edades alterada resulta ser un factor primordial subyacente a todos nuestros efectos.

II. La aplicabilidad de nuestro criterio

Antes de proceder a aplicar nuestro esquema al caso de la República Árabe Unida (RAU) conviene examinar explícitamente los supuestos y, por lo tanto, las limitaciones de los criterios desarrollados en la anterior. Desde luego deben recalcarse tres puntos. El primero es que nuestro criterio considera a los niños exclusivamente como bienes de inversión —sin tomar en cuenta la satisfacción que derivan los padres del "consumo" de sus hijos. En un país sobrepoblado y subdesarrollado, puede suponerse sin peligro que la "función de bienestar social" —en oposición a la individual— no debería tomar en cuenta tales aspectos. Esto nos trae al segundo punto que tiene relación con el anterior, aunque es distinto. Éste es que los beneficios de la inversión son vistos exclusivamente desde el punto de vista del país y no de la familia.[8] Las discrepancias entre ambos enfoques pueden ser grandes. Por ejemplo, desde el punto de vista de la familia, los dos beneficios principales de la "inversión" en un niño, son *a*) lo que gana el niño una vez que empieza a trabajar, y *b*) el niño como fuente de seguridad para la vejez. En lo que se refiere a *a*), lo que se paga a un individuo puede ser muy diferente del producto marginal de su trabajo —que es su contribución a la sociedad. En lo que concierne a *b*), la prevención de un nacimiento puede aumentar, en vez de disminuir, la seguridad en la vejez desde el punto de vista de la sociedad. Esto es así porque una fecundidad más baja reduce la proporción de dependientes de la fuerza de trabajo.[9] Ello significa que éstos últimos (tanto los grupos más viejos como los jóvenes restantes o "no evitados") pueden recibir más gasto *per capita* en la forma de seguridad para la vejez en el caso de una fecundidad menor.

El tercer punto es que los beneficios de nuestro criterio suponen que el nacimiento se previene en forma permanente. Si sólo se retarda, los beneficios serían menores según la forma del retardo. Este punto es digno de ser considerado porque los beneficios calculados de acuerdo con nuestro criterio son comparados a menudo con los costos de un programa de planificación familiar, y estos últimos son relativamente insignificantes. Sin embargo, esta comparación es legítima sólo si el nacimiento es evitado en forma permanente. Si sólo es retardado (como por ejemplo si los aceptantes iniciales de un programa de planificación familiar son mujeres urbanas de la clase media, que no han tenido el número de hijos que desean), entonces los costos de un programa de planificación familiar permanecen constantes, pero los beneficios netos sacrificados pueden verse seriamente afectados, según sea la forma del retardo.[10]

[8] Un análisis del niño como bien de consumo aparece en G. Becker, "An Economic Analysis of Fertility" en *Demographic and Economic Change in Developed Countries*, Universities-National Bureau of Economic Research, Princeton, Nueva Jersey, Princeton University Press, 1960. Un análisis del niño desde el punto de vista de la familia es el de H. Leibenstein, *Economic Backwardness and Economic Growth*, Nueva York, 1957, Cap. 10, pp. 161-165.

[9] Los interesados en un tratamiento general de los determinantes de la distribución por edades pueden ver A. J. Coale, "The Effects of Changes in Mortality and Fertility on Age Composition", *Milbank Memorial Fund Quaterly*, enero de 1956.

[10] Como ejemplo simple pero no realista, considérese una mujer que ante la ausencia de un programa de planificación familiar ha tenido un hijo cada tres

Una vez aclarados estos puntos, queda un aspecto preocupante que debe ser aclarado en relación con nuestro criterio. Este aspecto es que hay un sesgo inherente a nuestro criterio que asegura que los beneficios siempre serán mayores que los costos, como debe ser en el caso de los países sobrepoblados y subdesarrollados de la actualidad, pero lo que es discordante es que también debería ser el caso de *a*) los países desarrollados de la actualidad y *b*) estos mismos países durante sus primeros períodos de industrialización durante el siglo XIX. En este último caso, nuestro criterio habría mostrado grandes beneficios del control de la población, mientras que el desarrollo subsecuente de estos países muestra que su crecimiento económico ha tenido gran éxito, en parte *debido* a los efectos estimulantes del crecimiento de la población. Cierto que hasta ahora no tenemos manera de verificar si estas tasas de crecimiento de la población fueron "óptimas", pero al menos no parecen haber obstaculizado el desarrollo económico. Ante estas circunstancias, parece haber una incongruencia entre nuestro criterio y la experiencia histórica observada y esto es lo que nos ha llevado a desentrañar a continuación las razones e implicaciones del sesgo de nuestro criterio.

El gran sesgo positivo en la expresión (1)[11] se origina porque el efecto inicial es siempre mayor y positivo (como consecuencia de ello los efectos productividad del salario y/o los efectos ahorro son también positivos y se añaden a los beneficios). Esto se debe a tres razones.[12] La primera es que el consumo medio se compara con el producto marginal. A largo plazo, el consumo medio y la producción media son idénticos. Sin embargo, mientras a lo largo de su vida un hijo no nacido consume tanto como la persona promedio, su producto marginal es inferior al producto medio. Esta fuente de sesgo es legítima según el grado en que la diferencia entre el producto medio y el marginal sea una medida del grado de presión sobre los recursos

años. Supóngase que ella se incorpora al programa un año, lo deja y luego inmediatamente tiene un hijo. Como resultado de ello, hay un intervalo de cuatro años entre sus nacimientos más recientes. Si se supone además que su siguiente hijo se presenta después de dos años y que todos los nacimientos siguientes permanecen inalterados, entonces todo lo que ha sucedido es que el nacimiento ha sido demorado un año. Los beneficios sacrificados son la corriente de ingreso del hijo no nacido menos la corriente de ingreso del niño nacido. La magnitud absoluta de ambas corrientes es la misma, pero el descuento introduce una diferencia que determina el beneficio. Pueden concebirse otras formas de demora en las que las mujeres no recuperan el tiempo perdido, sino que simplemente proceden a tener los mismos hijos durante un período más largo. Aquí los beneficios serían mayores porque son varios los niños que son demorados. En general, la influencia del descuento es tal, que aún demoras muy leves resultan en beneficios que son cuantitativamente superiores a los gastos del gobierno en la prevención de un nacimiento.

[11] En los párrafos siguientes, y como fue señalado antes, el niño es visto exclusivamente como un bien de inversión. Si los aspectos de consumo fueran tomados también en cuenta, y suponiendo que los hijos son una alegría para sus padres, tendríamos que incluir también en el aspecto del costo de impedir un nacimiento la satisfacción de los últimos de "estar vivos", así como la de los padres de tenerlos. En la práctica, esto presenta los problemas insalvables de adjudicar un valor subjetivo a la vida humana, así como de comparaciones interpersonales e intertemporales de la utilidad. Sin embargo, en principio este punto puede reducir el sesgo positivo de nuestro criterio.

[12] Además de éstas, S. Enke enumera otras causas (menores) de este sesgo. Véase, "The Economic Aspects...", *loc. cit.*, nota al pie de la p. 56.

limitados. Si fuera la única fuente de sesgo, no conduciría a las inconsistencias anotadas al final del párrafo anterior. Sin embargo, hay otras dos razones de la existencia de un sesgo positivo. La primera es que las corrientes de consumo y productividad son descontadas. En vista de que el consumo empieza inmediatamente después del nacimiento, mientras que la producción se demora cuando menos diez o quince años, aún un descuento moderado exagera considerablemente la diferencia entre el valor presente de ambas corrientes. La segunda razón es que a todo lo largo, el consumo es tratado como un costo —y, por lo tanto, el consumo evitado del niño no nacido es tratado como un beneficio. En general, no está muy claro por qué debe ser así aunque en algunos casos es ciertamente legítimo. Veamos entonces las implicaciones de *a*) el descuento y *b*) de tratar el consumo evitado como un beneficio.

La tasa de descuento que se usa tiene la intención de reflejar la preferencia en el tiempo de la sociedad, así como la productividad del capital. La existencia de una preferencia por el presente en la forma expresada por Bohm-Bawerk es en términos de *i*) la duración corta de la vida, *ii*) la deficiencia de la imaginación y *iii*) la fuerza de voluntad limitada. De las tres, podemos suponer que las últimas dos no están presentes en los dirigentes que tengan visión a largo plazo de una sociedad —es decir que, si están presentes, se limitan a la preferencia en el tiempo "privada" más bien que a la social. En cuanto a la primera razón, su presencia depende esencialmente de lo que queremos decir exactamente por "sociedad". Si tomamos su significado en el sentido de los individuos que la constituyen, entonces la primera razón es una base válida para la preferencia en el tiempo. Por otra parte, si vemos a la sociedad como una entidad abstracta que nunca fallece —aunque los individuos que la componen lo hacen—, entonces aun la primera base de preferencia en el tiempo es inválida. Esto puede explicar en cierto grado la paradoja delineada antes. Desde el punto de vista de las personas que vivían en el siglo XIX en países que después han experimentado crecimiento económico elevado, pudo haber sido válido abogar por una política de limitación de la población. Viendo el asunto en el presente, sin embargo, y considerando a un cierto país como una entidad abstracta, es dudoso que pudiéramos respaldar tal política. De este modo nuestro criterio no conduce a incongruencias en tanto se recuerde que los beneficios bajo consideración son aquellos que estima la gente que vive en el momento en que se hace la recomendación política. Llevando este punto un paso más adelante, podemos decir que al especificar en *cuál* grupo de edad de la población estamos interesados, quedaría determinada la longitud de nuestro horizonte de tiempo. Por ejemplo, si nuestro horizonte de tiempo se extiende a la esperanza media de vida al nacer, entonces nuestros beneficios netos son los que corresponden a los niños que nacen en el presente. Los ya nacidos sólo perciben parte de esos beneficios. En forma alternativa, si tomamos el horizonte de, digamos, apenas diez años, entonces los beneficios los reciben *todos* aquellos que tienen una esperanza de vida restante superior a diez años. Podemos, por lo tanto, concluir que el uso de una tasa de descuento (elevada) implica que estamos considerando los bene-

ficios para la gente viva de hoy, y no los de la sociedad en un sentido abstracto, y que la longitud del horizonte de tiempo determina implícitamente qué grupo de edad tenemos en mente.

Pasando en seguida al tratamiento del consumo evitado como un beneficio, debe notarse que esto no es en manera alguna obvio o necesario. En verdad, hay varias circunstancias en las que podría suponerse que el consumo ejerce un efecto estimulante sobre el crecimiento económico. El punto crucial es el de si una demanda insuficiente constituye —y en caso de serlo, en qué medida— un nudo de estrangulamiento sobre el crecimiento económico. Si la demanda insuficiente es un estrangulamiento grave, entonces el crecimiento de la población podría ser benéfico al estimular el consumo. Este mecanismo estimulante puede tomar una de tres formas. El crecimiento más acelerado de la población conduce a un consumo total mayor (aun cuando no haya cambios en el consumo *per capita*), el cual, al permitir la explotación plena de las economías de escala, puede hacer redituable la introducción de ciertas industrias. Segundo, al conducir a una mayor tasa de crecimiento del consumo total, el crecimiento más rápido de la población puede, vía el mecanismo acelerador, conducir a una tasa mayor de crecimiento del producto. Este último argumento es el de Kuznets,[13] y puede resumirse como sigue: debido a que la tasa diferencial de crecimiento de la población tanto entre las áreas rurales y las urbanas, como entre los grupos de mayor y menor ingreso, se ha desplazado históricamente en una dirección opuesta al crecimiento de las oportunidades económicas, el crecimiento económico, cuando ha tenido éxito, ha venido acompañado de una tremenda movilidad geográfica y social. Un migrante a las ciudades probablemente consumirá una proporción mayor de su ingreso que su contraparte del campo debido a los valores diferentes prevalecientes en las áreas urbanas. También es probable que responda y se adapte con mayor rapidez a las industrias nuevas y en expansión. Ambos factores han tenido un efecto estimulante sobre el crecimiento económico.

A la luz de lo anterior podemos preguntar en qué casos la demanda insuficiente es un nudo de estrangulamiento para el crecimiento económico. Tomando primero el caso de los países desarrollados de la actualidad, observamos que al ver las distintas teorías del crecimiento que son una ampliación del esquema keynesiano (Harrod-Domar y sus seguidores) encontramos que la demanda agregada ocupa una posición central. A este respecto, podemos afirmar que la oportunidad de invertir es un estrangulamiento importante. Las grandes empresas modernas tienen enormes cantidades de capital a su disposición en la forma de ganancias no distribuidas. Por otro lado, son capaces de conseguir todo el capital que requieren si la oportunidad para invertir se presenta. Ésta es la situación desde un punto de vista a largo plazo, aun cuando dichas empresas puedan toparse con dificultades transitorias de financiamiento en tiempos de restricción del crédito. También cuentan con la fuerza de trabajo calificada que necesitan y con las capacidades empresariales de organización, de modo que su

[13] S. Kuznets, "Population Growth and Aggregate Output", en *Demographic and Economic Change in Developed Countries*, Universities-National Bureau of Economic Research, Princeton University Press, 1960.

problema principal es el de encontrar una salida a sus productos más bien que el de satisfacer una demanda pre-existente.[14] Al crearse esta demanda, el crecimiento de la población es un factor importante de estímulo, aunque en menor grado que cuando A. Hansen desarrolló su tesis sobre el estancamiento.[15] Esto se debe a la tasa creciente de progreso tecnológico durante el período de la posguerra. Sin querer asignar un peso particular al factor población, sigue siendo válido el argumento de que una mayor tasa de crecimiento del consumo asociada a una tasa de crecimiento mayor de la población tiene elementos de costo y beneficio que no son inmediatamente separables.

Al tomar en seguida el caso de los países subdesarrollados del siglo XIX y compararlos con los de hoy, observamos que difieren en un aspecto fundamental. El mejor resumen de esta diferencia es un escrito de H. Wallich.[16] En forma muy breve, su tesis es que en el desarrollo de los países avanzados de hoy la fuerza motriz fue el empresario, el proceso fue la innovación y la meta fue el enriquecimiento del empresario. El panorama, descrito por Schumpeter en su teoría del desarrollo económico, ya no refleja la situación de nuestros días. En su lugar, el impulso proviene del gobierno, el proceso es la imitación y la meta es un nivel de vida más alto para las masas. El primer mecanismo está orientado hacia la producción o la oferta, el segundo está orientado hacia la demanda o el consumo. La producción y el consumo son, desde luego, interdependientes y cada uno tiene su lugar en ambos enfoques, pero no obstante hay una diferencia genuina en el origen del impulso. En el primer caso el problema es asegurar que lo que se produzca sea vendido. En el último el consumo está presente (y la mayoría diría que "sobrerrepresentado", al señalar los esfuerzos de los países subdesarrollados de hoy por frenar su consumo excesivo) y es una cuestión de abrirse paso a través de otro estrangulamiento. Lo que éste signifique no interesa desde nuestro punto de vista. El que sea o no los bajos niveles de formación de capital (ahorro) de acuerdo con Nurkse;[17] la escasa participación de las ganancias en el ingreso nacional —todos los ahorros saldrían de las ganancias—, como en la teoría de Lewis;[18] o la "incapacidad para invertir" según Hirschamn,[19] o finalmente cualesquiera de una multitud de otras razones, la demanda insuficiente nunca es la culpable.

[14] Ésta es la tesis de J. K. Galbraith, *The Affluent Society*, Nueva York, 1958. Ver especialmente el cap. XI, "The Dependence Effect".

[15] A. Hansen, "Economic Progress and Declining Population Growth", *American Economic Review*, Vol. XXIX, Núm. 1, Parte 1, marzo de 1935.

[16] H. Wallich, "Some Notes Towards a Theory of Derived Development", documento reproducido en *The Economics of Underdevelopment*, Nueva York, Oxford University Press, 1963, volumen compilado por A. N. Agarwala y S. P. Singh.

[17] R. Nurske, *Problems of Capital Formation in Underdeveloped Countries*, Nueva York, Oxford University Press, 1961, pp. 57-70. (Hay traducción al español.)

[18] A. Lewis, "Economic Development with Unlimited Supplies of Labor", *The Manchester School of Economic and Social Studies*, 23, mayo de 1955, pp. 153-160; y *The Theory of Economic Growth*, Homewood, Illinois, 1955, pp. 225-244. (Hay traducción.)

[19] A. O. Hirschman, *The Strategy of Economic Development*, Yale University Press, 1958, pp. 33-38. (Hay traducción.)

Por lo tanto, podemos concluir que tanto en el caso de los países desarrollados de hoy como en estos mismos países durante su primera fase de industrialización, el consumo desempeñó un papel diferente al que tiene en la mayoría de los países subdesarrollados de la actualidad. En los primeros, el consumo —a través de los mecanismos delineados antes— tuvo efectos estimulantes así como de freno, que es imposible desentrañar. En tales casos no es legítimo tratar el consumo sacrificado exclusivamente como un costo. Hay aun otra razón que resuelve la paradoja entre nuestro criterio y la experiencia histórica observada. De este modo, aun cuando viéramos exclusivamente los intereses de la gente que vivía en países a punto de iniciar la industrialización (esto es, aun cuando efectuáramos el descuento), tener una política de limitación de la población podía no haber constituido un beneficio para ellos. No lo podemos afirmar con seguridad, porque es imposible desentrañar los efectos estimulantes de los retardatarios del consumo. Sin embargo, el punto principal de todo este análisis sirve para hacer hincapié en que la aplicabilidad de nuestro criterio se limita a aquellas situaciones en que la demanda insuficiente no es un impedimento al crecimiento económico.

III. El estudio de un caso: la RAU

La aplicación de la fórmula (1) requiere información que puede, en ocasiones, ser obtenida de los datos pertinentes, y también algunos supuestos que deben hacerse cuando no se dispone de la información necesaria. En este último caso, los beneficios dependerán en gran medida de estos supuestos. Por ejemplo, no existe mercado de capital perfecto, y suponiendo que la preferencia social por el tiempo está entre 10 % y 15 %, hicimos cálculos para estos dos extremos. En lo que concierne a los otros supuestos, éstos difieren para cada uno de nuestros efectos. Veámoslos brevemente, así como sus implicaciones sobre la magnitud de los beneficios netos.

A. *El efecto inicial*

La información que se requiere aquí es el consumo y el producto marginal de la persona media en las distintas edades, junto con la probabilidad de supervivencia a las distintas edades. Estas últimas pueden deducirse de las estadísticas vitales y censales que, aunque inexactas, no afectan mucho los beneficios netos finales. Concentrémosnos, por ello, en lo primero.

Por el lado del consumo surgen dos problemas. El primero es la definición de "consumo". En su estudio de la India, Enke lo define como el producto nacional bruto menos la formación bruta de capital. Ésta es la definición acostumbrada en las cuentas nacionales, pero como medida de los beneficios de un niño no nacido puede ser criticada en tres aspectos: *1*) que gran parte de lo que es consumo en realidad es inversión desde el punto de vista del crecimiento económico; ejemplos de ello son los gastos en educación, salud y otras inversiones en capital humano. 2) Hay un elemento de ambigüedad en el consumo: algunos gastos públicos (tales como la conservación

de la ley y el orden), así como los costos más elevados de la vida urbana que resultan de la mayor concentración y no porque los bienes sean distintos de su contraparte rural —ambas formas de gasto pueden considerarse como bienes intermedios y no como producción final. 3) Por último, algunos gastos de consumo se hacen independientemente de la tasa de crecimiento de la población y son, por lo tanto, no marginales. Un ejemplo de esto son los gastos de defensa. Los ajustes de algunos de los factores anteriores tienen un efecto considerable ya que en el caso de la RAU se reduciría el consumo medio en alrededor de 25 %. Puede sostenerse que tal cifra mide mejor los beneficios ya que el mayor volumen de bienes intermedios, así como la mayor formación de capital (humano) no elevan el bienestar presente de la población reducida. Sin embargo, el aumento de la formación de capital (humano) aumenta la productividad de la fuerza de trabajo, pero *a)* no tenemos una medida de este aumento, y *b)* los beneficios resultan tan distantes en el futuro que cualquier descuento los hace despreciables. Por lo tanto, puede afirmarse que la segunda definición —o una intermedia— es más verosímil. Nuestros cálculos toman en cuenta ambas definiciones como posibles límites superior e inferior de los beneficios.

El segundo problema por el lado del consumo se refiere a la atribución de esta cifra de consumo a los distintos grupos de edad. No se dispone de información al respecto. Enke supuso que las personas de 35 años de edad consumen de 13 a 14 veces lo que consumen los niños en su primer año de vida.[20] Después de observar estudios reales de países desarrollados[21] (para una familia "típica" de la clase media), o bien al observar los requerimientos de alimentación y suponer que los gastos reales a las distintas edades se hacen en proporción a los requerimientos de estas edades, llegamos a una conclusión diferente. En los últimos dos casos el cociente del consumo de los niños entre el de adultos anduvo entre 1:2 y 1:2.5. En vista de que el futuro está seriamente descontado, la adopción de nuestros cocientes aumenta sustancialmente los beneficios, como veremos en seguida.

Volviendo al lado de la producción, nos enfrentamos a problemas exactamente análogos a los de la parte del consumo. La determinación del producto marginal del trabajo es una cuestión que ha recibido mucha atención en la literatura, pero sobre la cual no se ha llegado a ningún acuerdo. Las opiniones van desde cero producto marginal —de ordinario basadas en experimentos reales[22] o en un cálculo de los requerimientos de mano de obra que han mostrado estar muy por debajo del número real de trabajadores[23]— hasta un producto mar-

[20] Ver sus cálculos para la India, en "The Gains to India...", *loc. cit.*

[21] Ver A. Sauvy, *Theorie générale de la population*, París, 1952, Vol. 1, capítulo 23, y las referencias que contiene. (Hay traducción.) En especial véase L. I. Dublin y A. J. Lotka, *The Money Value of Man*, Nueva York, 1930, Cap. 4, respecto de la estimación de los gastos *reales* de una familia "típica" de la clase media en los Estados Unidos.

[22] Tal es el caso del estudio de W. Cleland ("Egypt's Population Problem", *L'Egypte Contemporaire*, enero de 1937), que estima que $^3/_5$ partes de la población rural de Egipto es redundante.

[23] Tal es el caso del estudio de M. R. El Ghonemy, "Resource Use and Income in Egyptian Agriculture Before and After the Land Reform, with Parti-

ginal no muy diferente de la tasa de salarios, con base en el ajuste de funciones de producción a la información[24] bajo la observación de que la hipótesis de cero productividad marginal es incongruente con la maximización de utilidades, y con base asimismo en el análisis de las diferencias de salarios geográficas, estacionales y femeninas-masculinas.[25] En vista de que el debate sobre este tema está muy lejos de haber sido resuelto,[26] y aunque nuestra inclinación en este debate es que gran cantidad de la fuerza de trabajo es redundante,[27] para propósitos de cálculo hemos tomado el producto marginal del trabajo igual a la tasa de salarios en la agricultura, para asegurar que nuestros beneficios netos sean considerados como una cifra mínima.

De la discusión anterior podrá verse que el tomar valores máximo y mínimo del nivel de consumo (productividad marginal), de la asignación de la corriente de consumo (producción)[28] a las diferentes edades y de la tasa de descuento, da ocho corrientes posibles de consumo (producción). El cuadro 1 resume el resultado de estas ocho corrientes distintas de beneficios.[29] También muestra las mismas ocho posibilidades para el año 1947 —sólo varió la mortalidad entre 1947 y

cular Reference to Economic Development", tesis doctoral inédita, North Carolina State College, 1953. La conclusión de este autor es que el 50 % de la fuerza de trabajo agrícola es redundante.

[24] Ver por ejemplo M. M. El Imam, "The Production Function for Egyptian Agriculture, 1913-55", Institute of National Planning, Memo. Núm. 259, El Cairo, 1962, y H. Kcheir el Dine, "The Cotton Production Function and its Relation to Technical Progress and Disguised Unemployment", Institute of National Planning, Memo. Núm. 370, El Cairo, 1963.

[25] B. Hansen, "Marginal Productivity Wage Theory and Subsistence Wage Theory in Egyptian Agriculture", *Journal of Development Studies*, julio de 1964.

[26] Respecto de lo más reciente sobre esta controversia ver R. Mabro, "Industrial Growth, Agricultural Underemployment and the Lewis Model: The Egyptian Case, 1937-1965", *Journal of Development Studies*, julio de 1967. El autor argumenta que existe excedente considerable de fuerza de trabajo en las pequeñas granjas, mientras que no existe ninguno en las grandes. Éste es el resultado de inmovilidad regional, y explica el hecho de que las variaciones estacionales de los salarios puedan coexistir con un excedente de fuerza de trabajo.

[27] Esta redundancia no significa necesariamente que si parte de la fuerza de trabajo fuera retirada de improviso el producto no se reduciría, sino más bien que si comparamos dos situaciones, una con fecundidad constante y la otra con fecundidad decreciente (y por lo tanto una menor tasa de crecimiento de la población), entonces los "retiros" de fuerza de trabajo en el segundo caso (en realidad las menores tasas de incorporación a la fuerza de trabajo), que son graduales, pueden ser acomodados mediante ajustes que dejarían el producto total inalterado en ambas situaciones. Vale la pena hacer notar que el concepto de producto marginal como se trata en la literatura —a saber, *i*) como un retiro intempestivo de fuerza de trabajo, con *ii*) todos los demás factores constantes— no tiene estricta relación con nuestro caso de comparación de una situación de alta fecundidad con una de baja. En este caso más que retiros intempestivos hay una transición gradual que permite que se efectúen los ajustes necesarios para dejar el producto total inalterado.

[28] En lo que concierne a la atribución del producto marginal a los diferentes grupos de edad, se supone en forma arbitraria que los niños empiezan a trabajar a los diez años, y que la productividad de los niños de las edades 10-14 y 15-19 es un tercio y dos tercios respectivamente, de la de las personas de 20 y más años. En contraste, las cifras de Enke (S. Enke, *Economics for Development*, *op. cit.*, Cap. 20) varían según un factor de 7 entre las edades de 10 y 35 años.

[29] Éste es el resultado de aplicar la fórmula (1) a las ocho corrientes diferentes. El método está establecido en forma muy clara por S. Enke en "The Gains to India from Population Control", *loc. cit.*

Cuadro 1

El efecto del impacto inicial

	10 %							15 %						
	(1)	(2)	(3)	(4) (1)-(3)	(5) (2)-(3)	(6) (4)/58	(7) (5)/58	(1)	(2)	(3)	(4) (1)-(3)	(5) (2)-(3)	(6) (4)/58	(7) (5)/58
Mortalidad presente (1960)														
Nuestra corriente de consumo y productividad	351	281	91	260	189	4.5	3.3	206	165	31	175	134	3.0	2.3
Corriente de consumo y productividad según Enke	278	222	79	198	143	3.4	2.5	136	109	24	112	85	1.9	1.5
Mortalidad pasada (1947)														
Nuestra corriente de consumo y productividad	294	235	71	223	164	3.9	2.8	175	140	25	151	116	2.6	1.9
Corriente de consumo y productividad según Enke	223	179	61	162	118	2.8	2.0	113	90	19	94	71	1.6	1.2

Columna 1: Corriente de consumo descontada. Consumo definido de acuerdo con los procedimientos estándar.
Columna 2: Corriente de consumo descontada. Nuestra definición de consumo revisada.
Columna 3: Corriente de productividad descontada.
Columna 4: Beneficios netos de acuerdo con la primera definición de consumo.
Columna 5: Beneficios netos de acuerdo a la segunda definición de consumo. Las cifras de las columnas 1 a 5 están dadas en libras egipcias.
Columna 6: Beneficios netos (primera definición) como proporción del ingreso *per capita* (=58 lbs. Eg.).
Columna 7: Beneficios netos (segunda definición) como proporción del ingreso *per capita*.

1960. En este cuadro observamos que los beneficios de un nacimiento evitado varían entre 4.5 a 1.2 veces el ingreso *per capita*— esto es, cuando se permite que todos los factores varíen a la vez la diferencia entre el máximo y el mínimo varía según un factor de casi 4. Pero antes de que se concluya que esta medida tiene un elevado grado de inexactitud, debe señalarse que es improbable que queramos, en cualquier situación, modificar todos los factores a la vez. Cuáles de ellos querríamos variar dependerá del uso que queramos hacer de nuestra cifra y en este contexto conviene distinguir dos usos posibles.

Primero podríamos querer comparar el valor de un nacimiento evitado en un año con el valor correspondiente a otro año, para obtener una indicación de qué tanto ha mejorado o se ha deteriorado la situación. En este caso usaríamos en ambos años la misma definición del nivel de consumo (producción), y el mismo método de asignación entre los distintos grupos de edad. Además usaríamos el mismo factor de descuento, de modo que la variable principal en tal comparación sería el número diferente de sobrevivientes en los distintos grupos de edad. Por ejemplo, al comparar el año de 1947 con el de 1969 podríamos decir que el efecto de la reducción de la mortalidad ha sido el de aumentar el valor neto de un nacimiento evitado en algo así como entre 15 % y 25 %. Podríamos además argumentar que esta es una subestimación si creemos que *a*) la productividad del trabajo ha disminuido entre ambas fechas porque la población ha estado creciendo más de prisa que otros recursos, y/o *b*) debería usarse una tasa mayor de interés en 1960 que en 1947, porque con un efecto demostración internacional mayor, y mayor propaganda del gobierno hacia la elevación de la esperanza de las masas, la preferencia por el tiempo presente se ha aumentado. De este modo aunque *a*) y *b*) no puedan ser medidos, puede concluirse que cuando menos el valor de evitar un nacimiento se ha aumentado sustancialmente, lo cual hace ahora más urgente un programa de población.

O bien podríamos querer comparar la inversión en control de la población con la inversión en otros proyectos. En este caso estaríamos usando la misma tasa de interés para descontar los beneficios y costos del nacimiento evitado y de otros proyectos.[30] Por lo tanto tomaríamos en cuenta solamente un cambio en nuestro concepto de consumo y la asignación de éste y la producción a los diferentes grupos de edad. Aquí el intervalo entre los valores máximo y mínimo de un nacimiento evitado variaría según un factor de 2. (4.5/2.5 a una tasa de descuento de 10 % y 3.0/1.5 a una tasa de 15 %). Dados la incertidumbre respecto al futuro, la dificultad para calcular precios virtuales y muchos otros obstáculos que dificultan la evaluación de los beneficios de los proyectos industriales, nuestro campo de variabilidad no parece ser excesivo, hablando en términos comparativos.

[30] Si no queremos tomar en cuenta la *escala* de posibilidades alternativas de inversión podemos tomar el *cociente* de beneficios y costos. Pero si la escala importa entonces tenemos que especificar el tamaño del programa de control de la población y multiplicar la *diferencia* entre beneficios y costos de un nacimiento evitado por el número de nacimientos evitados antes de comparar esta cifra con la de las oportunidades de inversión alternativas.

B. *El efecto productividad del salario*

Si recordamos el segundo término de la expresión (1), se verá que los beneficios que se derivarán vía el efecto productividad del salario son una proporción del efecto inicial. Esta proporción depende *1*) de la propensión marginal a consumir alimentos, *2*) de la proporción del consumo de alimentos que absorben los miembros de la fuerza de trabajo, *3*) de la proporción del año que permanece empleada la fuerza de trabajo, *4*) del aumento de la ingestión de calorías resultante de un mayor consumo *per capita* de alimentos, *5*) del mayor suministro de esfuerzo debido al mayor insumo de calorías, y, por último, *6*) del producto marginal del esfuerzo. Para cada uno de estos factores pueden estimarse varios límites superiores e inferiores. Los renglones del *1*) al *3*) no necesitan ser comentados, porque su variabilidad no es muy grande. En lo que concierne a los renglones del *4*) al *6*), notamos lo siguiente: en el *4*) suponemos que las calorías aumentan en proporción al aumento del gasto en alimentos. Esto implica que la dieta no se altera, lo cual es realista en el caso de *a*) cambios marginales y *b*) ante niveles bajos de ingreso (cuando la dieta se limita a uno o dos productos). Por añadidura, se supone implícitamente que existe desnutrición. Los requerimientos de calorías dependen de varios factores tales como la edad, el sexo, el peso, la temperatura y en especial el trabajo. Aunque dichos requerimientos son revisados periódicamente, si suponemos un horario de ocho horas en la agricultura, entonces todos ellos apuntan a un promedio muy por encima de 2 500, que es el consumo medio diario presente en la RAU.[31] En vista de los grandes requerimientos de calorías para el metabolismo básico, pequeños aumentos en la ingestión conducen a grandes aumentos en el suministro de esfuerzo. Las estimaciones varían ampliamente, de 100 a 200 calorías extras,[32] requeridas para producir el equivalente de una hora de trabajo extra. Al lado del número extra total de calorías consumidas, esto nos permite determinar el número total de horas adicionales trabajadas. Esto no significa que los trabajadores realmente trabajan más horas, sino que durante el mismo horario, producen en términos del esfuerzo el equivalente de más horas de trabajo. Falta convertir este suministro adicional de esfuerzo en producto adicional. Aquí "el producto marginal del esfuerzo equivalente al trabajo de una hora" se calculó suponiendo que el pro-

[31] Por ejemplo, hablando de los requerimientos (en un día completo de ocho horas) mencionados por H. Correa en *The Economics of Human Resources*, Amsterdan, 1963, cuadro IV, p. 36 para los sectores agrícola, industrial y de servicios, y ponderando estos requerimientos con las proporciones correspondientes en la RAU, resulta un requerimiento nacional global de 3150 calorías diarias, en contraste con el consumo actual de 2 500. Ver también S. Shehata, "Cooperative Efforts and Food Consumption in the RAU", *L'Egypte Contemporaire*, enero de 1964. El autor menciona una cifra de 3 000 como requisito mínimo de calorías de la RAU.

[32] Podemos mencionar las tres fuentes siguientes: *a*) H. Leibenstein, *Economic Backwardness... op. cit.*, y las referencias que contiene, donde se llega a la conclusión de que se requieren 100 calorías adicionales para producir el equivalente de una hora de trabajo; *b*) S. Shehata, *loc. cit.*, quien da 1 700 calorías como requisito para el metabolismo básico para un día de trabajo de ocho horas, lo que implica que se requieren alrededor de 150 calorías por hora; y *c*) H. Correa, *op. cit.*, Cap. 4, del cual dedujimos que la cifra es de alrededor de 200.

ducto marginal del trabajo es igual a la tasa de salarios (igual a 35 libras egipcias por año). Además, se ha supuesto que en el presente la fuerza de trabajo trabaja el equivalente (en términos de esfuerzo) de un día de cuatro horas. Esto fue deducido del hecho de que el consumo diario de calorías fue de 2 500 y de que a este nivel de ingestión de calorías, la persona trabaja al 50 % de su capacidad en los sectores industrial y agrícola.[33] Un día de cuatro horas da 1 200 horas por año (suponiendo que se trabajan 300 días). Dividiendo esta cifra entre la tasa anual de salarios, se obtiene una aproximación al producto marginal del equivalente de una hora de esfuerzo (que se encontró que era de 0.03 libras egipcias en nuestro caso). De este modo, tenemos toda la información que necesitamos, y sobre esta base resulta que el efecto productividad del salario varía entre 4.5 y 18 % del efecto inicial,[34] de modo que 8 % resulta ser un valor "probable" o razonable.

Antes de seguir, cabe señalar que los cálculos anteriores son marginales en el sentido de que aumentos grandes del suministro de esfuerzo pueden afectar (y disminuir) el producto marginal del esfuerzo, y también en el sentido de que después de que el ingreso ha aumentado a un cierto nivel, ya no existe desnutrición. En el último caso el efecto productividad del salario ya no sería válido, mientras que en el primero podría ser reducido. En cambio, podemos hacer notar que no sólo es importante el número total de calorías, sino también su distribución entre proteínas, hidratos de carbono y grasas. La dieta actual de la RAU dista mucho de ser equilibrada,[35] de modo que aun cuando el nivel de consumo diario alcance su nivel mínimo de requerimientos, habrá aún margen para los aumentos de la productividad. Un comentario final es que la productividad de la fuerza de trabajo puede mejorar debido al consumo de otros elementos distintos a los alimentos. En particular, la mejoría de la salud podría tener efectos tremendas,[36] pero no los hemos incluido.

[33] H. Correa, *op. cit.*, cuadro IV-2-3, p. 36.

[34] El efecto inicial al que nos referimos es aquel definido bajo el supuesto de que el consumo se define como el producto nacional bruto menos la formación bruta de capital (esto es, como una proporción de la columna 4 del cuadro 1). Esta representa una proporción elevada de la definición mínima de consumo (cuadro 1, columna 5). En nuestra discusión siguiente sobre ahorro público y privado como una proporción del efecto inicial son aplicables comentarios similares.

[35] S. Shehata, "Co-operative Effects and Food Consumption in the UAR", *loc. cit.* En la RAU los hidratos de carbono (granos) constituyen el 80 % de la dieta, mientras que las grasas y las proteínas el 20 %. En contraste, el balance ideal es 50, 35 y 12, respectivamente. Esto puede ser una explicación de los resultados obtenidos por W. Galenson y G. Pyatt (*The Quality of Labor and Economic Development in Certain Countries*. Organización Internacional del Trabajo, Ginebra, 1964), quien encontró que en el caso de los países desarrollados (que estaban todos por encima de los requerimientos mínimos) y los subdesarrollados, el factor cuantitativamente mayor y estadísticamente más significativo que explica la tasa de crecimiento de la productividad del trabajo son las calorías *per capita* (se probaron juntos doce factores de mejoramiento de la calidad).

[36] H. Correa, *op. cit.*, pp. 43-47, calcula que en Egipto la pérdida de producto debida a la salud deficiente es mayor que la que resulta de la desnutrición. La estimación que hace Correa de esta última contiene un sesgo en defecto debido a que sólo toma en cuenta las enfermedades que resultan en defunción mientras que gran parte de la pérdida de producto resulta de las enfermedades crónicas que reducen la vitalidad, pero que no conducen a la muerte (por ejemplo el bilharzia).

C. *Aumentos del ahorro privado*

En términos aritméticos, la magnitud del efecto ahorro como proporción del aumento inicial del ingreso depende de, y es de hecho equivalente a la propensión marginal al ahorro que haya sido supuesta. En otras palabras, una propensión al ahorro de n % conduce a un aumento de los beneficios equivalentes a n % del efecto inicial. De este modo, si todo el ingreso fuera ahorrado, los beneficios se duplicarían. La pregunta interesante es si de hecho el ahorro aumentará. En teoría las interrelaciones entre el crecimiento de la población y el comportamiento del ahorro son complejas y no existen estudios empírico sobre la influencia del tamaño de la familia en el ahorro real. Sobre una base especulativa diríamos que, a menos que hubiera esfuerzos positivos del gobierno para movilizar el ahorro, no sería de esperar aumento alguno. Este argumento se basa en un razonamiento de S. Kuznets[37] en el sentido de que si el único problema en el crecimiento económico fuera frenar el consumo, entonces esto podría lograrse muy fácilmente. Los cálculos muestran[38] que un aumento (lineal) de las proporciones de ahorro de 9 % a 15 % del ingreso nacional durante un período de diez años, y *sin reducción de la fecundidad*, puede ser logrado mediante una disminución del nivel absoluto del consumo a un promedio de 1.2 % del producto bruto nacional en los primeros 7 años (y a un máximo de 2.2 % del producto en cualquier año). Después de este período inicial, las proporciones de ahorro se incrementan al sacrificar algunos aumentos del nivel absoluto de consumo. Puesto en estos términos, el aumento de las proporciones de ahorro puede lograrse con un sacrificio notablemente bajo.

Es cierto, desde luego, que si la fecundidad se redujera, no sería necesaria ninguna reducción del nivel absoluto de consumo para elevar las proporciones de ahorro. Pero la diferencia entre ambos casos parece tan pequeña que sería poco sensato creer que un descenso de la fecundidad elevaría automáticamente el ahorro total. Más bien, parece que las causas que hacen tan difícil la elevación de las proporciones de ahorro, aun cuando no se reduzca la fecundidad, estarían presentes también en el caso de una reducción de ésta. Esto variará según el caso pero tal vez el común denominador es la forma de desarrollo de nuestros días orientado hacia el consumo. La demanda de la población por mayores niveles de vida (reforzadas por la propaganda y el efecto demostración internacional) pueden ser una explicación de los esfuerzos vanos de muchos gobiernos por frenar el consumo. Si esta explicación es correcta, sería equivocado inferir que una reducción de la fecundidad estimularía el ahorro a menos que pueda mostrarse como es que la reducción de la fecundidad afectará estos factores subyacentes. Puede ser que el deseo de tener familias más reducidas es el resultado del deseo de consumir más (ésta es a menudo la base de la propaganda de muchos programas de control familiar), caso en el cual no podrían esperarse mayores ahorros. Podemos luego concluir lo siguiente: para ser conservadores, hemos argumentado que es preferible no esperar ningún beneficio por el lado del

[37] S. Kuznets, "Demographic Aspects...", *op. cit.*
[38] Ver el cuadro IV, p. 75, en BCPC, *op. cit.*

ahorro. Sin embargo, la magnitud de este efecto muestra los grandes beneficios potenciales que pueden esperarse si las políticas del gobierno en lo fiscal, etc., tienen éxito en movilizar el ingreso liberado resultante de la fecundidad menor.

D. *Ahorro público*

Como se hizo notar en la sección 1, el único aumento supuesto en el ahorro público como un resultado de la reducción de la fecundidad es el aumento resultante de la reducción del gasto en educación primaria. Esto es así porque el gobierno tiene obligación de proporcionar educación primaria, de modo que suponiendo que los costos marginales de la educación son los mismos que los medios, una reducción de la fecundidad puede reducir tales gastos. El supuesto adicional que se hace es que estos gastos serán invertidos y no consumidos por el gobierno. Esto supone que el gobierno concede alta prioridad al desarrollo. Además, pueden esperarse varios otros beneficios que no han sido tomados en cuenta. Estos surgen ya sea porque menos personas se educarán en otros niveles que no sean los de educación primaria (si la política educativa está determinada por una proporción de estudiantes dada en cada grupo de edad) y las sumas de dinero ahorradas de este modo pueden ser también invertidas, y/o porque una mayor proporción de personas se educará (si la política educativa está formulada en términos de una cantidad fija de dinero) con una mejoría resultante de la calidad de la fuerza de trabajo. La existencia de tales beneficios, que no tomaremos en cuenta, puede contrarrestar el que parte de la reducción de los gastos en educación primaria pueda ir a parar al consumo público.

Con todo lo anterior, encontramos que la magnitud de este efecto es sustancial; constituye de 14 % a 19 % del efecto inicial, que en términos de la corriente de ingreso generada por cada nacimiento evitado es igual a cerca de dos tercios del ingreso *per capita*.

Conclusiones

Podemos concluir lo siguiente: se encontró que la magnitud del efecto inicial de evitar permanentemente un nacimiento da lugar a una corriente de ingreso igual a entre 2.5 y 4.5 veces el ingreso *per capita* presente cuando se usa una tasa de descuento de 10 %, y entre 1.5 y 3.0 veces el ingreso *per capita* cuando se usa una tasa de 15 %. A este efecto podemos añadir el efecto productividad del salario y el del aumento del ahorro público. Éstos llegan a ser entre 18.5 % y 37 % [39] del efecto inicial. Esto es un mínimo, porque otros beneficios posibles incluyen:

1) El aumento del ahorro privado, que puede ser importante (tanto como el efecto inicial si todos los aumentos del ingreso *per capita*

[39] Como se hizo notar antes, este porciento se refiere a la corriente de ingreso calculada con base en la definición máxima de consumo (columna 5, cuadro 1). Ya que ambos efectos están definidos en términos absolutos, alcanzan una elevada proporción (de 23 % a 46 %) de la estimación más baja del consumo.

son ahorrados), pero que no es probable sin una política pública positiva.

2) El aumento posible del ahorro público como resultado de la reducción de los gastos en formas de educación distintas a la primaria, y para el mejoramiento de la calidad de la fuerza de trabajo debido a mayor educación *per capita*.

3) La mejoría en la calidad de la fuerza de trabajo debido a los mayores gastos *per capita* en la atención de la salud, tanto por el sector público como el privado.

Por último, hacemos hincapié de nuevo en las limitaciones de este cálculo. Primero, estos beneficios son el resultado de considerar al niño como *a*) un bien de inversión y *b*) desde el punto de vista de la sociedad. Segundo, el "beneficio para la sociedad" se define simplemente como la suma de los beneficios de la gente que vive hoy. Más precisamente, nuestros cálculos se refieren a los beneficios de personas nacidas hoy, ya que nuestro horizonte de tiempo fue de la misma longitud que la esperanza media de vida al nacer. Los sectores más viejos de la población sólo reciben parte de esos beneficios. Tercero, el tratamiento del consumo exclusivamente como un costo se basa en la premisa de que el desarrollo de la RAU es del tipo orientado hacia el consumo, y que, sean cuales fueren los obstáculos al crecimiento, el consumo insuficiente no es uno de ellos. Finalmente, estos beneficios son los de evitar en forma permanente un nacimiento. Un nacimiento retardado conduciría sólo a parte de estos beneficios; esta proporción depende de la forma exacta del retardo y de la tasa de descuento que se utilice.