# Pitfalls in Benefit-Cost Analysis of Birth Prevention

Harvey Leibenstein

*Population Studies*, Vol. 23, No. 2. (Jul., 1969), pp. 161-170.

Stable URL:
http://links.jstor.org/sici?sici=0032-4728%28196907%2923%3A2%3C161%3APIBAOB%3E2.0.CO%3B2-U

*Population Studies* is currently published by Population Investigation Committee.

# Pitfalls in Benefit-Cost Analysis of Birth Prevention

HARVEY LEIBENSTEIN

## I

C. P. Snow,[1] in considering the reasons why scientific judgments are frequently distorted, makes the telling point that ' most of all, the self-deceiving factor seems to be a set of euphorias. The euphoria of gadgets . . .' The euphoria of gadgets is an ever-present factor in the area of population problems. At least two types of gadgetry are involved: the gadgetry of birth control devices, and in this particular case, the intellectual gadgetry of the benefit–cost analysis. While I believe that the euphoria associated with such gadgets frequently leads to results and expectations that are way out of line with reality, nevertheless this paper should not be taken as an argument against the desirability of birth control programmes. It is limited to the pitfalls inherent in a specific type of intellectual gadgetry.

The use of benefit–cost analyses on a variety of social and economic issues has become popular. It is only natural for economists to apply this approach to family planning programmes. The basic notions are simple and, on the surface, appear to be exceedingly persuasive. However, I hope to show that the analysis has some biases in favour of unduly favourable results for birth prevention or birth control programmes. In part, this is due to faulty economic logic of some aspects of the analysis; and in part to unsophisticated assumptions made by some of the practitioners of this particular art form.

The basic aim is to compute the benefit–cost ratio, or the difference between benefits and costs of a prevented birth.[2] It is normally assumed that the prevented birth is one which would have become a marginal worker in the economy. The benefit of birth prevention is the sum of the amounts that would be consumed over his or her lifetime, had the person been born. The cost is the sum of the contributions to the national product that the person would have made. A discounting procedure is used to calculate both the benefit stream and the cost stream. The reason is simply that consumption in the future is not worth the same as it would be in the present. If it existed in the present it could be invested to yield earnings into the future. It also reflects, at least in part,

[1] *Science and Government* (Cambridge, Mass., 1961), p. 68.

[2] I attempt in this section to present a strong, albeit simple, case for the benefit–cost analysis consistent with the writings of Dr. Stephen Enke and his followers. While I do not 'buy' this approach, I believe that the profession is indebted to Enke for pushing it since in the course of the debate over this approach more valid criteria for evaluating population limitation programmes are likely to result. Cf. S. Enke, 'The economics of government payments to limit population', *Economic Development and Cultural Change*, July 1960; Paul Demeny, 'The economics of government payments . . . A comment', *Economic Development and Cultural Change*, July 1961; and, Anne O. Kreuger and Larry Sjaastad, 'Some limitations of Enke's economics of population', *Economic Development and Cultural Change*, July 1962. I have gained a great deal from reading the unpublished Ph.D. dissertation of a former student of mine, F. G. Zaidan, *Benefits and Costs of Population Control with Special Reference to the U.A.R.* (Harvard University, 1967).

the time preference of the present over the future. Hence, all future sums of a stream of benefits or costs are discounted to obtain their present values.

Symbolically, the following simple formula indicates the method behind the basic computation:

$$\sum_t \frac{B_t - C_t}{(1+r)^t} - P \gtreqless 0$$

where $P$ is the cost of preventing a birth through a family planning programme. $B_t$ is the benefit derived from a prevented birth for year $t$, i.e. it refers to the age of the person if the birth had not been prevented. In essence, this is the consumption saved in year $t$ by having prevented the birth. $r$ is the rate of discount. $C_t$ is the contribution to output that is foregone by the fact that the birth had been prevented during year $t$.

It is useful to separate the formula into three segments.

$$\sum_{t=0}^{t=12} \frac{B_t}{(1+r)^t} + \sum_{t=13}^{t=60} \frac{B_t - C_t}{(1+r)^t} + \sum_{t=61}^{t=65} \frac{B_t}{(1+r)^t} - P \gtreqless 0.$$

The first is for ages 0 to 12: the second for ages 13 to 60, and the third for ages 60 and over. In the first segment there are only benefits since a person does not work before age 12; hence, there is no output foregone. The second segment includes both benefits and costs during the working years of the individual. The third segment once again includes only benefits. If, in the second segment, the person produces less than he consumes, then there must be a positive benefit from birth prevention.

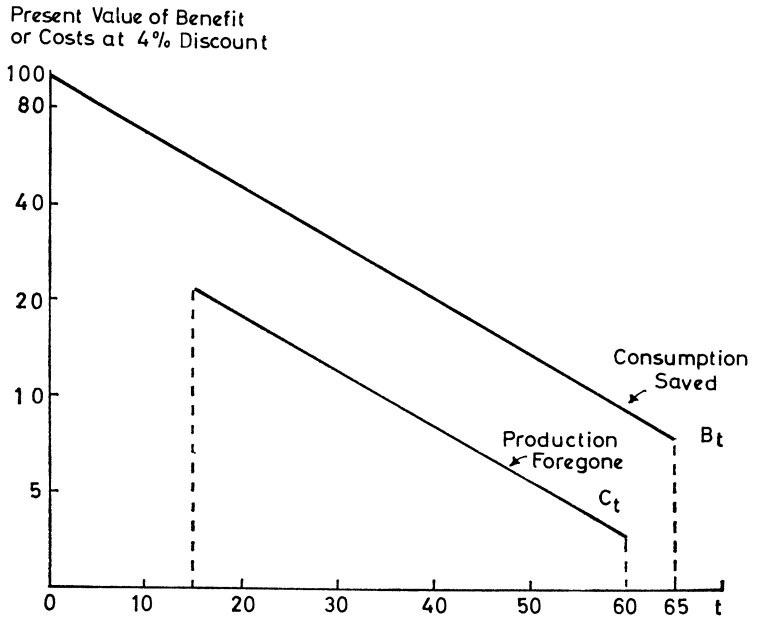
Now we could make some simple assumptions about the nature of the benefits and the costs and see that the benefits will outweigh the costs by a considerable margin in almost all instances. The usual assumption is that people consume more or less in proportion to their income per person but produce less than that, since production is determined by the value of their marginal product. To see this let us think of a 'sexless' labour unit made up of, say, one male and 0·4 of a female, if the ratio of male to female labour participation were on the average 1 : 0·4. We visualize the representative unit as passing through two stages: a consumption stage in the early years and a production-and-consumption stage in later years (we could ignore the retirement stage for present purposes). Now consumption will approximate income or output per worker (i.e. output divided by the number of labour units). But if we remove one labour unit we reduce production by less than output per worker since non-labour inputs are not affected, i.e. capital and land remain the same. Professor Theodore Schultz[3] and others have estimated that the marginal product of labour is likely to be only 0·3 of the average product. Some have even argued that in densely populated underdeveloped countries it might be close to zero. In any event, if we look at our formula, since the costs which represent the *production foregone* (i.e. marginal product of labour) by a prevent d birth are less than the benefits, that is the consumption saved (i.e. approximately equal to output per worker), then the end result must be that the benefits are considerably greater than the costs. This will be accentuated by the discounting procedure, since the benefits start immediately but the costs occur 13 years later and hence in comparison to the benefits they are discounted to a

[3] T. W. Schultz, *Transforming Traditional Agriculture* (New Haven, 1966), pp. 63–70.

greater extent and have a lower present value. Thus, just on the basis of such simple and apparently reasonable assumptions we are likely to get very favourable results in terms of the ratio of benefits to costs for birth prevention.

While we could make a number of adjustments in the interest of greater accuracy for (1) mortality rates at various ages, and (2) for unemployment rates at various ages, these would only increase the benefit-to-cost ratio. Even if we make consumption a function of age this does not change the basic nature of the outcome, since by the time a labour unit is employed it is likely to be a full consumer. In fact, as long as we stick to this basic formulation and its assumptions, the outcome is *almost* a foregone conclusion if the cost of the birth prevention programme is assumed to be small, as is usually the case.

The basic logic of these arguments is depicted in the graph below in which both consumption per 'worker' and production foregone are indicated on the same logarithmic scale. It is clearly shown in the graph that the present value of the benefits of consumption saved per labour unit will be greater than the production foregone.




We assume in our illustration that consumption saved (i.e. the benefits each year) is constant each year at a level of 100. Since the production foregone is a fraction of that, we assume that it is at a level of 40 each year for those years during which the representative worker is in the labour force. Each point on the line $B_t$ represents the present value of the benefits for the year in question. Similarly each point on the line $C_t$ represents the present value of the production lost by a prevented 'birth' for the year in question. The slope of each line is indicative of the discount rate employed. Since the sum of the benefits is the area under the line $B_t$ and the sum of the costs is the area under the line $C_t$ it is readily apparent that the benefits will far outweigh the costs.

II

We now turn to consider briefly the pitfalls inherent in the basic benefit–cost approach as it is usually applied.

(1) We note that there are some odd aspects to the benefit–cost type of argument. Since the rates of return to family planning programmes are likely to be very high[4] it seems likely that if these rates were applied to any normal planning model, that *all* of the investment funds available would be spent on the family planning programme.

Also high benefit–cost ratios appear to be true for any number of children per average family. That is, the argument holds not only for the birth prevention of the sixth or seventh child, but also works for the prevention of the first child. In addition, it is likely to be true for all countries except in those unusual cases where we know that there are very large increasing returns to labour. (It is difficult to think of any obvious cases.)

(2) If we impose the economists' very weak welfare criterion that an act is desirable if someone gains by it and no one loses, then the application of this criterion would frequently lead to a conclusion contrary to the benefit–cost analysis of birth prevention. For example, consider the case of a family deciding to have a third child. If the consumption of this third child is entirely composed by dividing household income by five rather than four, then no one outside the household is hurt by this decision; if the household prefers an additional child to the additional consumption per household member, there is a gain for the household in question. Clearly, the application of such welfare principles could apply in many instances in which the results of a benefit–cost analysis would show that 'benefits' were greater than the 'costs'.

There is a critical point involved here. Is avoiding consumption really to be construed as a benefit to an economy? In fact, consumption is usually viewed as the main purpose of economic behaviour. What the initial formulation essentially says is that no one should have children who do not pay for themselves in the sense that their consumption will be less than their contribution to the economy. We really cannot handle such ideas without initially having some social welfare criteria which include children as such, as well as the consumption goods, as part of the variables in our criterion. At present, no such generally accepted criterion exists. No one knows the appropriate substitutability between children and consumption goods – if this be viewed as a permissible way of looking at the problem.

It might be argued that the benefit–cost formula should only be applied to situations in which family planning activities are voluntary. However, we would still have to separate social and private gains. The mere fact that a birth is not wanted, does not make it socially undesirable without some initial criterion which leads to this conclusion. Is an unwanted birth in a one-child family *socially* undesirable? Also it is to be noted that those families which reduce their births gain in terms of consumption per family member in any event, but in addition they are subsidized by benefit–cost types of argument. There is in a sense a double gain involved and it is hard to see on

[4] Enke estimates that they would be one hundredfold the rate of return to other investments. See S. Enke 'The economic aspects of slowing population growth', *Economic Journal*, March 1966, p. 46.

what basis this is justified. If the provision of education or other indirect measures can change desired family size, then the problem remains of how to allocate resources between changing *desired* family size as against attempts to make it easier for or to induce people to achieve whatever their actual desired family size happens to be.

(3) In the usual benefit–cost analysis it is assumed that the prevented birth is of a person who, if born, would be a marginal worker. But we do not know what the incidence of family planning programmes is likely to be. It is quite possible that they might fall much more readily on those of middle-class origin who do not become marginal workers, as against those of working-class or peasant origin who might become marginal workers. In that case, one of the basic assumptions of the calculation does not hold.

Suppose that the impact of the family planning programme is mostly on middle-class families. Suppose that the number of children of middle-class families is reduced on the average from three to two per family, while those of lower-income families are not reduced and that their family size is twice as large. First, we note that the calculation of the cost foregone, being that of a marginal worker, would be incorrect. Secondly, it is quite possible that middle-class children over their lifetime produce in total more than they consume, and furthermore, that they provide almost all of the savings and other 'growth inputs' in the economy. In that case, the effect of the family planning programme would be to decrease savings per head and potentially decrease the rate of growth of the economy. This may counterbalance to a considerable extent the presumed benefits from prevented births.

(4) Recent research has shown that only a small proportion of growth is accounted for by standard inputs such as capital and labour. Most of the growth is provided by non-standard inputs (known as the 'residual') such as education, technical change, entrepreneurial activities, as well as other non-standard inputs which are not well understood. The 'residual' contribution to growth has been estimated to account for more than 50% of the growth in national income and frequently for as much as 90%.[5] To return to our previous example, where the family planning programme affects mostly 'non-marginal' births, it may very well be that the middle-class or other non-marginal births provide most of the 'residual' inputs and, as a consequence, provide the main factors that contribute to economic growth. Under these circumstances it is quite possible that the family planning programme may actually worsen the condition of the economy rather than improve it. It is to be noted that the standard suggested way of making the benefit–cost calculation would not take this aspect into account.

Another way of seeing the points made above is to look at the problem in terms of the average *acquired* quality of the population. Here, quality is looked at in terms of nurture and human investment and not from a genetic viewpoint. If the middle-class families are more responsive to birth control than poor families, and if the nurture and schooling component is higher in the middle classes, then the average quality of the population may be lowered as a consequence of a family planning programme.

[5] See Simon Kuznets, *Modern Economic Growth* (New Haven, 1966), pp 80–81.

(5) The costs of acceptance and the costs of achieving a prevented birth are, in my opinion, very much understated in the analyses carried out thus far. For example, Enke argues in the following manner: the insertion of an IUD will cost approximately $2 per person and the average IUD will stay in place for approximately two years; and since the ratio of women in the childbearing ages to the number of children born per year is approximately 5 to 1, the cost of a prevented birth is about $5.[6] This sort of computation is plausible on the surface, but it is to my mind likely to be off the mark. First, very little is known about the actual costs of administering family planning programmes. The estimates vary from a low of about $24 in Taiwan to something over $7,000 per birth prevented.[7] Secondly, there is little relation between the cost of acceptance of contraception and the cost of a *net* birth prevented.

There is a great deal of actual and potential substitutability between techniques of population control. Thus, a good deal of the acceptance which occurs on the basis of a specific birth control programme may simply be substitutes for other population control techniques and may not, in fact, reduce family size to any significant degree. For example, suppose that a birth control programme results in a simultaneous reduction in the age of marriage by, say, five years. This may easily more than compensate for the effects of the birth control programme. Similarly, other means of control, apart from other means of contraception, such as abortion, infanticide, late marriage, and so on, may be dropped in favour of some more readily available means of family planning. The main point of this section is that the costs of a family planning programme cannot be estimated without knowing the degree of substitution that is taking place. High acceptance rates and high substitution rates may go hand in hand.

(6) It has been argued above that to the degree to which children represent a voluntary redistribution of income within the family, the consumption by such children should not be considered as a social cost, and the consumption saved through such potential birth preventions should not be looked upon as potential benefits. However, there may be external diseconomies as a consequence of a certain number of children being born. For example, an increase in family size may increase educational costs per child. The costs of such interdependencies are, of course, appropriate social costs. However, if only the interdependent costs saved were included in the calculation, then the benefits of birth prevention would be very much smaller than those involved in the formula we started with.

(7) The benefit–cost formula does not take into account the value of alternative policies which may alter the incentives to have children and which may result in a reduction in family size. For example, some of the indirect benefits of increasing the education of women or increasing the employment of women in non-agricultural pursuits may increase the age of marriage or, in other ways, set up incentives which lower desired family size. It is possible that in some instances the benefits and cost analysis of such policies may yield better results than those involved in direct family planning programmes.

[6] Enke, *ibid.*, p. 48.

[7] See *Studies in Family Planning*, No. 12, June 1966, p. 15. There are difficult interpretation problems in all such estimates.

(8) A family planning programme may have adverse effects on income distribution. Let us assume that it is financed out of general taxes. It is quite possible that it would benefit responsive middle-class (or other non-marginal) families more than the relatively unresponsive poor families. Hence, one could see this as a vehicle for subsidizing the middle class by taxing the poor.

(9) Consider the following example. Suppose that we have a population that is optimal from the point of view of income per worker, and assume that it is stationary. Assume also that there is a large amount of capital so that its marginal product is zero. The population and the economy are both assumed to be stationary so that net savings and net investment are also zero. In this model, the population is as well off as it could possibly be. If the birth rate were reduced, then, by our initial assumption, income per worker would fall since there is no advantage in this case in having more capital per worker. However, a benefit–cost analysis of the type suggested by Enke would suggest that the benefits of birth prevention are still greater than the costs. For each person the amount consumed over a lifetime is exactly equal to the amount produced. But, because in such a system there would still be time preference, and since consumption activities precede production activities, the result of the discounting procedure would be such that the discounted value of the benefits is greater than the discounted value of the costs. Yet, from the way the example is constructed, we know that reducing the birth rate would, in fact, make the situation worse (i.e. lower income per head) rather than improve it.

(10) To a considerable extent the benefits exceed the cost as a result of the discounting procedure. But this depends in part on the fact that we assume that the value of a prevented birth would have the same result as if a child were not born into an existing family starting at the point of potential birth. Probably, something akin to a fallacy of composition is involved here. What might be an appropriate calculation for an individual family at the point of potential conception does not hold for society. To see this consider the following example.

Visualize two 'twin' societies that are identical in every respect but one. One society, call it '*conprodia*' (consumption before production) is made up of individuals who consume before they reach the working age and produce. The second society, '*prodconia*' (production before consumption) is made up of 'people' who are born full-blown producers and consume at a later stage in their life. We assume that the number of consumption-without-production years and the number of consumption-plus-production years are the same per person in both societies. While the age structures of the two societies are not assumed to be identical, they differ only to the extent necessary so that the ratios of those who work to those who are dependants are identical in both societies. Assume also that both have stationary populations and stable age structures. Looked at from a macro-economic viewpoint the two societies are indistinguishable. The burden of dependency is the same in both cases. If we assume that the marginal products of labour and consumption are close to each other, then the application of the benefit–cost formula would, for *conprodia* dictate the desirability of birth prevention whereas for society *prodconia* it would indicate the desirability of increasing the birth rate. Yet from a macro-economic viewpoint the two societies are the same. The point is that in considering the flow of generations over time there is something

arbitrary about using the individual as the basic unit and abstracting from that flow and claiming as representative that portion of it during which consumption precedes production. It would be less arbitrary to use the family as the basic unit and to abstract from the flow of generations so that production is simultaneous with consumption. Yet the calculated results according to the formula would be very different.

Consider the following alternative formulation: Suppose we choose the potential family, starting at the point of entry into the labour force, as our natural unit. The potential family is assumed to make a lifetime decision with respect to number of children and their spacing at the time of entry into the work force. Up to retirement, consumption and production are simultaneous events. Now, consider the special but almost universal case in which later entrants into the work force have more education than earlier ones. Some recent findings suggest that formal and informal education are really the most important form of capital, and the most significant form of investment is investment in people. (This involves some mixture of nurture, formal education, the influence of the environment on individuals, and *initial* on-the-job training.) Thus every entrant into the labour force may be seen as entering with more capital available to him than the average in the population. Now, it is reasonable to assume that consumption per labour unit (our composite 'sexless' labour units in this case) is approximately equal to the average consumption in the population, but production of new entrants is greater than the average since they enter with more capital than the average.

The formula possesses four stages, in the first three of which production is usually greater than or equal to consumption. The first stage, say roughly between ages 15 to 22, is the pre-children stage in which consumption is the average for society but production is greater than the average. The second stage, say ages 22 to 40, is the stage in which children are born, nurtured and educated, in which we could reasonably assume that production is approximately equal to consumption. In this stage parents share their income with their children, although a portion of it involves investment in their children. In the third stage the children enter the labour force on their own, and here family production is again greater than consumption. The fourth stage, the retirement stage, say after age 60, consists only of consumption and in this last stage the benefit of birth prevention is, of course, greater than the costs. The relevant benefit–cost formula would look as follows:

$$\sum_{t=15}^{t=22} \frac{B_t - C_t}{(1+r)^{t-15}} + \sum_{t=23}^{t=40} \frac{B_t - C_t}{(1+r)^{t-15}} + \sum_{t=41}^{t=60} \frac{B_t - C_t}{(1+r)^{t-15}} + \sum_{t=61}^{t=65} \frac{B_t}{(1+r)^{t-15}} \gtreqless P.$$

In the first three expressions it may be true that $B_t \leqslant C_t$ at least in some cases – perhaps in many cases. The present value of this last stage is likely to be insignificant given the discounting procedure. Here we have a formulation of the problem and a set of reasonable assumptions which could show results opposite to the usual one of the benefit–cost analysis. The results of this procedure might recommend an increase in the number of children per family in many cases.

We achieved our unusual result by making the following four basic assumptions: (1) the family rather than the individual is the basic unit, (2) family income rather than income per family member

is the basic welfare variable, (3) entrance into the society is at time of the entry into the work force, (4) entrants have more capital because of a steadily increasing level of education at time of entry than the average for the population. All these assumptions are empirically just as reasonable and justified as the initial assumptions and yet they could yield results which are the exact opposite of those in the initial formulation. In fact these results could favour, up to some point, larger rather than smaller families. Of course, it would be easy to think of changes in the formulation which would yield different results. However, it is significant for our evaluation of the Enke type of formulation that we can work out a reasonable formulation of a benefit–cost type that could prove to be a counter-example. This formulation is in some sense a more useful one empirically, in that it is likely to be sensitive to the rate of investment in schooling, the rates of return to such investment, and the actual empirical values of consumption and marginal product per worker in specific cases.

The following table, which shows the ratios of earnings for a number of countries of those with almost no schooling as against those with elementary schooling, shows the reasonableness of our assumptions for countries in which a significant proportion of the labour force has less than two or three years of elementary schooling.

*Earnings, schooling, and age*

| Country | Years of education | | | Ratio |
|---|---|---|---|---|
| | | 0–1 year | 5–6 years | |
| Mexico (A) | At age 32 | $560 | $1,154 | 2·60 |
| (B) | No age given | $597 | $1,196 | 2·00 |
| Colombia (C) | At age 32 | $397 | $1,430 | 3·60 |
| (G) | At age 25–29 | Hourly 0·91 pesos | Hourly 2·61 pesos | 2·87 |
| Chile (D) | No ages | 54·9 | 101·4 | 1·84 |
| India (E) | At age 32 | 850 rupees | 1,500 rupees (7 years) | 1·76 |
| Venezuela (F) | 23–65 years | 3,750 B's | 7,500 B's | 2·00 |

SOURCES: (A) Martin Carnoy, 'Aspects of labor force mobility in Latin America', *Journal of Human Resources*, **11**, 4 (Fall 1967), p. 529.

(B) Marcelo Selowsky, 'Education and economic growth: Some international comparisons', *Economic Development Report No. 83*, CIA (Harvard University), p. 36, Table 6.

(C) Carnoy, *op. cit.*, p. 528.

(D) Selowsky, *op. cit.*, p. 49, Table 14.

(E) Selowsky, *op. cit.*, p. 60, Table 19.

(F) Carl B. Shoup, *A Report. Fiscal System of Venezuela* (Johns Hopkins, Baltimore, 1959), p. 407.

(G) Marcelo Selowsky, 'The effect of unemployment and growth on the rate of return to education – The case of Colombia', November 1968, *Economic Development Report No. 116*, CIA (Harvard University).

## CONCLUSIONS

We cannot calculate a meaningful benefit–cost ratio until (1) we have a satisfactory set of social welfare criteria for birth prevention; (2) we know the behavioural elements that determine the incidence and total effects of the family planning programme envisaged; (3) the nature of the cost functions of birth control activities; (4) until we know the behavioural forces that determine the degree of substitution between the induced or subsidized means of family planning as against alternative population controls; and (5) unless we do it from a macro-economic viewpoint which takes as many interdependencies as possible into account.