



LAISSEZ-FAIRE IN POPULATION: THE LEAST BAD SOLUTION

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This essay by David Friedman was published originally in 1972 by the Population Council. At that time the world was certainly overpopulated by books and journalism prophesying doom as a result of massive over-population and subsequent mass world famine. (*Famine - 1975*, by William and Paul Paddock was one such popular work, now discretely forgotten like yet another of the Jehovah's Witnesses' date for the end of the world.) Those famines that have subsequently occurred have had nothing to do with any alleged inevitable "over-population" and everything to do with socialist agricultural policies or deliberate "social engineering" and genocide of class or racial enemies. The overpopulation theme has been of late less stridently proclaimed by the hysterical environmentalists in favour of other forms of doom (eg. nuclear power, global warming etc.) but it nevertheless persists. We are therefore pleased to make David Friedman's paper available once again.

I have also appended a supplementary bibliography of market-oriented work on this subject which, in main, has appeared since the original publication of this paper. Although it does not attempt to be exhaustive I hope it will be useful to those who wish to explore the subject further. Obviously, the subject is closely related to the broader issue of doom-mongering allegations that natural resources are running out. I have resisted the temptation to expand this bibliography to cover in depth this side of the question.

Chris R. Tame, Director

David Friedman is a leading advocate of the "anarcho-capitalist" wing of libertarianism. He is the author of *The Machinery of Freedom*, widely hailed as one of the best introductions to libertarianism, and of *Price Theory: An Introductory Text*. He has also written articles on both "medieval anarchism" and the private enforcement of law in *The Journal of Legal Studies*, as well as other articles in *The International Review of Law and Economics*, *The Journal of Political Economy*, *Public Choice*, and *The Journal of Economic Theory*. He has addressed special LA seminars on the subjects of "What Do Libertarian Economists Do?" and "The Case For and Against Anarchism: An Economist's View". The LA has also published his essay *Rational Anarchism* in its Libertarian Reprints series.

LAISSEZ-FAIRE IN POPULATION

THE LEAST BAD SOLUTION

DAVID FRIEDMAN

INTRODUCTION

This essay analyzes United States population problems, focusing on the consequences of individual freedom of choice. The general argument for freedom of choice depends on individuals bearing the costs, and receiving the benefits, of their own actions. It is widely believed that this condition does not and cannot hold in matters of population, that parents, in deciding to have children, impose a large part of the cost of that decision on people other than themselves and their children, and must do so under any tolerable social institutions, and that parents are therefore likely to have "too many" children.

I investigate that thesis in Chapters 1-6 and conclude that it is false. Under present institutions, most of the cost of most children is borne by themselves and their families; the part of the cost transferred to others is insufficient to alter the population substantially. Furthermore, the amount of the cost so transferred could be reduced by institutional changes that I suggest. I conclude that parental freedom of choice is the best available way of determining population.

In Chapter 7 I discuss the likely effects of the continuation of current United States population trends, to discover whether those trends are an experimental disproof of the conclusion of Chapter 6.

Two preliminary points should be mentioned. The first concerns the concept of value. The values discussed in this essay are all values to human beings. I will be concerned not at all with the question of whether virgin forests, endangered species, or the survival of the human race has some absolute value above and beyond value to specific persons.

Only human values affect human action. Since I am interested in comparing the results of different population policies with each other, not with some divine ideal, and since all of the alternative policies depend on the decisions, and hence the values, of humans (whether politicians or parents) for their implementation, I can ignore any value that is not of value to someone; no policy will achieve it, except by accident. If there exist ends that matter not at all to persons but are of transcendental importance in the eyes of God, God will have to take care of them Himself. This essay is addressed to more mundane readers.

I will measure values according to the principle of consumer sovereignty: The value of something to someone is what he is willing to pay for it - what other values, monetary or otherwise, he is willing to give up in exchange. Thus human values are measured by actions, not words.

A common objection to this procedure is that it limits itself to "economic values", and excludes more subtle cultural or spiritual values. This is false. The value of a Beethoven symphony, insofar as it is reflected in the actions of individuals who wish to hear that symphony and are willing to give up other things they value to do so, is as much an economic value as the value of a ham sandwich. So is the value to a parent of having a child to love, as shown by the large costs parents are willing to bear to obtain that value.

One kind of value that is difficult to deal with in this way is the value of particular political institutions. Since everyone in the country is under the same government, citizens are not easily able to buy the political institutions of their choice. There is therefore no easy way of measuring the value to the citizens of those institutions. That value may be relevant to the issue of population. It is sometimes argued that a large population makes democratic institutions

more difficult, and a dense population increases perils to civic order. It can also be argued, in the other direction, that the social strains produced by any government attempt to control population would be a greater threat to our political institutions than any likely growth in population. There are so many factors involved in the workings of political institutions, and they are so poorly understood, that any such prediction is little more than a guess. These questions will not be dealt with in this essay.

The second point concerns the attitude I take in this essay toward government. Most writers on population make no distinction between "The correct thing should be done by government," and, "The government should decide what is correct and do it." They see a government as a means for imposing their conclusions about what should be done on the society as a whole. At the worst, they fear that the government may be slow to assume new responsibilities or overly timid in applying its powers. The possibility that it might make the wrong decision and act in the wrong direction is rarely discussed.

Consider, for instance, Kingsley Davis' article¹ "Population Policy: Will Current Programs Succeed?" His central argument is that current population policy is directed toward giving parents control over the number of children they have. He attacks the supporters of such policy for implicitly assuming that if parents can decide how many children they can have, the "proper" population will result. He argues that this assumption is false and concludes "that current programs will not enable a government to control population size." But it never occurs to him to discuss *his* implicit assumption - that if a government *can* control population size, the result will be the "optimum" population in terms of the welfare of its individual members. That assumption I reject. I shall treat governments, not as agents of divine wisdom, but as human organizations, and will attempt to predict their future performance on the basis, not of hopes, but of past performance.

I will sometimes speak as though the only two alternatives were parents controlling the number of their children, and government controlling it for them. This is a gross oversimplification, but not, I think, an unfair one. Insofar as government does anything more than arrange that people shall bear the costs of their own acts, it is, to that degree, substituting its judgement for theirs.

At various points in this essay I will state conclusions in terms of "optimum population" or "maximising human welfare." These terms have a rather technical meaning in economic analysts, both weaker and more specific than what they suggest in normal speech, and it is worth stating.

A situation is optimal (technically, pareto-optimal) if no change could be made that would increase the welfare of one person and decrease that of no person. Here "increase the welfare of one person" means, in accordance with the principle of consumer sovereignty stated earlier, "give one person an alternative he prefers."

Such a definition permits the consideration of some changes that help one person and hurt another since several such can be combined into a change that helps someone and hurts no one. But the concept of pareto-optimal does not allow the comparison of all possible alternatives with one another. It is used in economics because no satisfactory definition of optimum that does permit all such comparisons has been found.

1. IS POPULATION A SPECIAL CASE?

The general economic arguments in favor of freedom of choice - laissez-faire - can be found in the textbooks.² They consist essentially in showing that, under a properly functioning free market, the prices (monetary and otherwise) people pay for things reflect the real cost of producing those things, and the prices they receive reflect the value of what they produce to those who use their products. When an individual makes economic decisions he therefore bears all of the resulting costs (either directly, as when he spends his time doing something, or indirectly, when he pays in money the cost borne by someone else who spends his time) and receives all of the resulting benefits (either directly, as when the benefit is his pleasure in doing the job, or indirectly, when he receives money from someone else who consumes what he produces). If total costs are less than total benefits, he should make that decision and will, since he, as well as the society as a whole, benefits. If total costs are greater than total benefits, he should not and will not.

Is this argument applicable to the decision to have a child? The answer depends on two questions. The first, which I shall discuss in this chapter, is whether there are special features of that decision such that a parent, even if he bears all the costs and receives all the benefits, is incompetent to make it - or, more precisely, less competent than someone else. The second question, which I discuss in Chapter 2, is whether, and to what degree, parents bear the costs and receive the benefits resulting from their decision to have children.

Let us start, then, by assuming that the decision to have a child imposes no costs outside the family - an assumption that will be discussed in detail in Chapter 2. Are parents for some reason incompetent to make that decision? The decision to "buy" a child is different from the decision to buy a box of soap in important ways. First, the purchase requires long-term calculation; second, it is only made a few times. The purchaser of soap can try the soap out, see how his laundry looks, and buy another brand next time. The experiment takes a few weeks, and the cost of a mistake is a dirty shirt. By the time a parent finishes discovering whether he really likes bringing up his first child, he has already had his last. By the time it is clear what kind of world the children will live in - a question relevant to whether they should be brought into it - the children are grown and the parent, a grandparent.

In deciding whether to have another child, a parent must rely on his guesses about the future; those guesses are likely to be wrong. And even if the parent is extraordinarily wise, there are limits to how far ahead he will bother to plan. For most of us, what happens 40 or 50 years from now is of less than urgent concern.

But this is even truer of the government. The alternative to having parents decide the number of children they have is having the government decide the number of children to be had. In making that decision, the government is in the position of a consumer consuming a commodity once. The time span for which the government must plan is nearer 100 years than 50. And the government that does that planning has not a proportionately longer time horizon than the individual parent but a shorter one.

Aggregate population responds slowly to changes in fertility. It has been calculated that if fertility rates fall during the next five years to a level corresponding to a long-term stable population (net reproduction rate of 1.0) it would be over 50 years before the U.S. population stabilized, and the population would stabilize at a level 36 percent higher than the present population. If an NRR of one is reached by the year 2000, we will not approach our maximum population until about 2050. Thus, even if government policies could effect fertility rates immediately, the effects would be felt over the next few generations.

But experience suggests that the government makes decisions almost entirely on the basis of short-run calculations. Familiar examples are economic policy - notoriously calculated for its effect on economic conditions at the next election - and foreign policy. Thus, we have "reliable sources" saying that President Nixon plans

to have combat forces out of Vietnam "by the election," and frequent predictions, some from near the President, of GNP and unemployment as of the autumn of 1972. The perfection of economic science may yet produce a permanent four-year business cycle, peaked in election years.

It appears that, although the decision of how many children to have is a difficult one for parents to make correctly, it is still more difficult for government, and government is even worse equipped than parents to make it.

It can be argued that the government can afford to gather much more information for its decisions than the individual parent. This argument is true, although practical experience may make us doubt that decisions actually made by the government are wiser than those of individuals. But even if the government is wiser, it has an enormously more difficult problem to solve. Each parent need only decide on the costs and benefits to himself and his child of having the child. The effects of increased population on the welfare of the poor (assuming the parent is not poor) on the climate of the earth and the effect of different age distributions of population on the social structure of the society are almost irrelevant. The parent need only estimate the effect of increased family size on his family and the effect of a particular age distribution of his children on his problems in rearing them. It is precisely this sort of division of labor, under which an unmanageably large problem is divided into a multitude of parts, each to be solved by the individual that that part affects, which makes the free market such an efficient mechanism for solving economic problems.

True, the government may be better able to hire experts to extrapolate present trends and calculate what sort of world our children will live in. If so, let it make such calculations and publish them. Individual parents will then be free to use those predictions in their decisions - allowing for their own experience of the reliability of government predictions.

Some writers claim that, experimentally, parents are totally irrational consumers and that arguments like the above, which assume some degree of rational calculation, are thus invalid. If parents decide to have children entirely on the basis of what they have been brought up to view as a "good" family size, independent of any economic calculations of present or future costs, population, left to itself, will behave randomly and perhaps catastrophically. It might be hoped that government control, however clumsy, would be an improvement.

This case - the "irrationality" of the decision to have children and, hence, the irrelevance to it of economic analysis is the basis of Judith Blake's attack³ on Gary Becker's economic analysis of fertility.⁴ The attack applies to my analysis as well as to Becker's; the controversy is therefore worth a brief examination.

Becker argues, on the basis of his analysis, that family size should correlate positively with income and that it fails to do so only because low-income parents are unable to plan their families. He presents evidence that, where contraceptive knowledge is equally available to all economic classes, such a positive correlation exists. Blake argues that studies of how many children parents want show a negative correlation with income.

There are two things wrong with Blake's argument. The results of the studies she lists do not conflict with Becker's prediction. Her explanation of why Becker's prediction is wrong does not conflict in any fundamental way with his analysis.

In most of the studies Blake cites, subjects were asked such questions as, "How many children do you think makes the nicest size family?" and, "What would be the ideal number of children for the average American family?" As a way of learning how many children people will choose to have, given the constraints of their incomes, that method makes as much sense as measuring demand for cars by asking the question, "How many cars of what kinds would it be nice to have?" Rolls-Royce and Cadillac would discover new markets of astonishing size.

Only three of the studies Blake lists asked parents how many children they themselves wanted to have. In all three there was a small positive correlation with income.

The effect is clearer in later studies⁵ that correlate number of children desired with both family income and cost of rearing children as measured by the income the wife could get if she worked instead. The number of children desired goes up with income but down with cost. This is how most demand curves behave.

The exception is the so-called inferior good. The demand for Fords might fall with increasing income. Becker asserts that children do not appear to be an inferior good since it is not obvious that there exists any better (but more expensive) substitute. Much of Blake's argument is reduced to the assertion, not that parents are irrational consumers, but that children are an inferior good - inferior to golf, business, and the League of Women Voters. If this assertion is true, it contradicts one of Becker's assumptions but not the basis of his analysis.

Additional evidence on consumer rationality can be found in secular fertility trends. Over the long term, the net cost of rearing children has been rising because of the movement away from the use of child labor (especially on the farm), the increasing cost of schooling, the increased opportunities for the mother outside the home, and the gradual disappearance of the traditional pattern of children supporting parents in their old age. Under these circumstances we would expect rational parents to decrease the size of their families. They did.

Consider also the effect of economic conditions on fertility. At the bottom of the depression, with short-term income low and long-term prospects - for both parents and children - bleak, birth rates should fall. They do.

There is also evidence in the behavior of parents in various countries before the industrial revolution. As David Landes says in *Unbound Prometheus* (6, p. 22); "... insofar as there were variations in birthrates - and they range from 55 to 60 per thousand in Colonial America and French Canada to 15 per thousand in Iceland at the beginning of the eighteenth century - they seem to have been closely related to the ratio of resources to population ... an excellent example of rationality in a particularly crucial and sensitive area of life."

It thus appears that consumer rationality, while doubtless imperfect, exists. And imperfect consumer rationality must be compared to the imperfect rationality of a government that reflects the imperfections of its constituents. I see no reason to suppose that individuals will be less rational in their private population decisions than in their political ones. Political decisions, after all, have an externality of almost 100 percent; the good result of a wise vote is divided equally among the whole population. There is, therefore, little incentive for the voter to spend much time or effort to vote wisely.

2. THE LOGIC OF EXTERNALITIES

Garret Hardin, in a justly famous essay,⁷ argues that the dilemma of population "has no technical solution." He uses the metaphor of a commons used by several herdsman but owned by none. The commons will be overgrazed since each herdsman receives all of the benefit from adding another animal to his herd and divides the cost of the resultant overgrazing with the other herdsman. Hardin applies the same analysis to population. Each new child imposes costs not only on its parents but also on others. As with the commons, the benefit goes to the individual making the decision, but he need pay only part of the cost. "Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. ... Freedom in a commons brings ruin to all."

The argument, as Hardin states it, contains a fundamental error. A commons will be overgrazed, but there is a natural limit to the size of the herd, and that limit may be reached before the commons is

grazed to extinction. Under some circumstances overgrazing will be slight.

Hardin asserts that the positive utility gained by the herdsman who increases his herd is +1 and the cost he pays is only a fraction of -1 since he divides it with others. He neglects to say what values are being multiplied by +1, in the one case, or a fraction of -1 in the other.

The correct statement is that the herdsman gets +1 times the value of grazing an additional animal and a fraction of -1 times the cost. Hardin implicitly sets costs equal to value. This is true only when the commons is bearing the optimum number of animals since at the optimum any small change costs exactly as much as it produces. This is the familiar equilibrium condition of economics. His argument proves only that if the number of animals is optimum it will be to the interest of the individual herdsman to add more so that a commons will always have more than the optimum number. The herds will stop increasing when the return from an additional animal falls below the value of that part of the cost paid by the individual herdsman; at that point, even though he absorbs only part of the cost, the addition is still unprofitable. This point usually occurs before the commons is grazed to extinction.*

This analysis is important for population. Under Hardin's argument, as he concedes, there is no problem as long as the parents of a child, and the child himself, bear all the costs resulting from his birth. But, he argues, that condition does not occur. Since we are not willing to let children starve, one man's child may become another's dependent. In addition, the new child imposes some of the costs of his life on existing "common" property through pollution. Thus parents and child bear only part of the cost.

But how large a part? Hardin makes it sound as if any fraction less than unity implies a catastrophe, but that is nonsense. If 99 percent of the cost of children is borne by the general public, the forces of the market will not regulate population at all successfully. But if 99 percent of the cost is borne by the parents, population will only rise to that degree of overpopulation at which the cost of an additional person is 101 percent of his "value."

To analyze the degree to which parents will or will not decide to have the "proper" number of children, I must first discuss the nature of what economists call "externalities," and then go on to discuss the particular sorts of externalities connected with the birth of a child.

An externality is a cost imposed upon one person by another person's action without the first person's consent. The economic arguments for a policy of laissez-faire depend on individuals bearing the

*Unless the commons is such that its bearing capacity disappears only as the flock approaches infinite size, it can be shown that it is impossible for rational farmers to graze it to extinction. The argument goes as follows:

Let N be the number of animals on the commons.
Let $V(N)$ be the average net profit per animal when the commons is bearing a herd of N .

The optimal value of N is that at which $NV(N)$ is maximal; that is, $d[NV(N)]/dN = 0$.

For a farmer owning a fraction f of the total herd, the benefit of increasing the herd by adding an additional animal to his flock is $fV(N)$. The cost is $-fN dV/dN$; this is the reduction of the value of the rest of his flock. He thus continues to increase his herd as long as

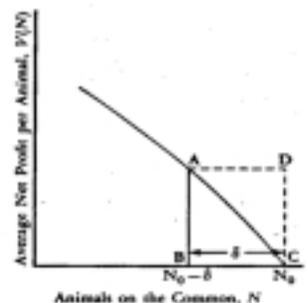
$$fV(N) - fN dV/dN > 0 \quad (1)$$

Consider the figure. If $V(N)$ goes to 0 for some finite N_0 , and if equation 1 is satisfied up to N_0 , then by integrating equation 1 from $N_0 - \delta$ to N_0 we get:

$$\text{Area of the (approximate) triangle } ABC > V(N_0 - \delta) \times f\delta \quad (2)$$

But, since $V(N)$ is decreasing, the area of the triangle is less than the area of the square $AB \times DC$. But that area is $V(N_0 - \delta) \times \delta$. Thus however small $f\delta$ may be, one can always take δ small enough to make inequality 2 impossible.

N here is treated as a continuous variable. For integral N , the argument holds a fortiori.



costs of their own actions. Given that condition, one can argue that laissez-faire will produce the best possible economic decisions. Each individual bears all of the costs resulting from the decisions he makes and receives all of the benefits; it is thus in his interest to make the decision that maximizes net benefits.

Suppose that we accept this argument. There remains the critical condition that each individual bears the costs (and receives the benefits) of his own actions. That this is the normal situation in a private-property economy has been argued at great length elsewhere.² There are, nonetheless, exceptions; these are what we call externalities. Externalities can be divided into two classes: transfer effects and net externalities. A transfer effect is an externality resulting from actions of A that transfers wealth from B to C while doing no net damage. For example, suppose I become a physician. The good I do my patients is compensated for by the money they pay me; there is no externality unless I over- or under-charge. In addition, by increasing the total number of doctors I, through the law of supply and demand, slightly lower the price doctors are able to charge. All other doctors are slightly poorer; all their patients are slightly richer. This is a transfer effect. Since economists have no satisfactory basis for comparing the desirability of alternative distributions of the same wealth, they generally ignore transfer effects except for occasional comments on the "social desirability" of the resulting distribution of wealth - generally defined as its congruence with their readers' prejudices. I shall follow this practice.

There remain net externalities, such as pollution. I burn leaves on my lawn. The smoke annoys my neighbors. I receive the benefit of clearing up my lawn without the cost of having the leaves hauled away; my neighbors bear some of the cost. I may decide to burn leaves even if the total cost of doing so (my time and trouble plus my neighbors' sore throats and watering eyes) is larger than the cost of alternative means of disposal.

There is a negative externality; I harm others without their consent. There are also positive externalities. If I spend time and money keeping my lawn and garden beautiful, my neighbors receive part of the benefit. I might fail to keep up my garden even though the benefits exceed the costs; I pay all the costs and get only some of the benefits.

If the positive and negative externalities of an act are equal, the result is either no externality (if the positive and negative externalities are distributed in the same way among the same individuals) or, at most, a transfer effect. My clearing leaves off my lawn, and so improving its appearance, may be a positive externality to exactly the same neighbors who suffer a negative externality when I burn the leaves. If the alternative to burning the leaves is leaving them alone, the two externalities may cancel; to the extent that they do, the incentives determining my action will correspond accurately to its real costs and benefits. In deciding on the merits of laissez-faire with regard to population, we must try to compare the total positive and negative externalities resulting from a child's birth.

The calculation is made more difficult by the question of whether the externalities are those external to the parents or external to the family as a whole. We begin by considering the family as a single unit. We shall then go on to discuss the implications of the distinction between the interest of the parent and of the child.

Considering the family as a single unit means, implicitly, allowing the parents to make decisions for the child on the basis of costs and benefits to be borne by the child during his lifetime. This seems inconsistent with the idea of having each person bear the costs and benefits resulting from his decisions.

But the decision to conceive a child is made before the child exists. It must therefore be made by someone else; the question is by whom. Our normal assumption, with regard to other decisions affecting the child, is that the decision should be made by the parents. The parents, on the average, are more concerned with the welfare of their child than is any other adult; thus transferring the decision from the parents to the government (which is to say, to the other voters acting together) makes matters even worse. The parent, as

decision maker, is the closest approximation to the child himself that is available.

Putting it in terms of externalities, the parents, more nearly than any other adult or group of adults, internalize the child's costs; they perceive costs to their child as costs to them and benefits to their child as benefits to them.

If we consider the family as a single unit, most net externalities that seem implicit in social-welfare legislation disappear. This fact can be seen by considering the externalities connected with government support for schooling.

When I decide to have a child, that decision imposes a cost on the taxpayers who will have to pay for the child's schooling. When the child grows up, he himself pays taxes for other children's schooling. The cost of his schooling is a negative externality; his existence (age 25) does not increase schooling costs, but his taxes lower the burden of those costs for other citizens. In comparing the positive and negative externalities, we must make due allowance for the facts that the negative externality comes immediately and the other is delayed several decades. The consequence is that the two externalities will exactly cancel for the average individual, if and only if, the rate at which total school expenditures are increasing is the same as the market interest rate. This has been approximately true of late.

To put the same analysis a little differently, the parent, deciding whether to have children, must calculate, implicitly or explicitly, all of the costs and benefits resulting to himself and the child. In that calculation, the total cost for education will be less than the real cost to the society as a whole. But the total income the child will get will also be less than his total productivity (the benefit to the society as a whole) by (among other things) the amount of taxes he will pay for school expenditure.

It might be argued that the child, by having children himself, will impose additional schooling costs on the society and that these taxes are needed to make up for those costs. But those children will themselves be taxpayers, and each will eventually pay for his own education. By pairing up the costs and benefits resulting from the first decision to have a child, ignoring both costs and benefits of later decisions by that child to have children himself, we show that the net externality for the average child is about zero.

What about the nonaverage child? If a particular parent expects to receive more than the average subsidy for schooling but expects that his child will pay less than the average in taxes, then for that family government subsidy of schooling is a subsidy to have children; his childbearing has a net negative externality; thus, ignoring all other effects, he would have fewer children than he "should."

As far as elementary and secondary schooling are concerned, this effect is small. School taxes and per-pupil expenditure are both closely related to parents' income, as is the child's later income. A particular child, according to where he lived and how much he earned, might end up paying more (or less) than the cost of his schooling in taxes. But unless the parent can predict this amount in advance, it cannot influence his decision to have the child.

Institutions of higher education are another matter. They are attended by only a minority of the population, and that minority comes mostly from the upper socioeconomic classes. Since most pupils are at heavily subsidized public institutions, the cost is borne largely by state taxes; the incidence of state taxes tends to be somewhat regressive. There is, thus, one well defined group that can expect to have its children's education subsidized by more than the children will later pay to subsidize other children's education. There is another group for which the opposite is true. Subsidy of higher education implies a negative externality from the bearing of rich children and a positive one from the bearing of poor children.

Welfare expenditures create externalities in the opposite direction. A parent whose children are likely to receive aid for dependent children can expect to receive more than the average per-capita expenditure on welfare; since the children will probably have below-average incomes, they will probably pay less than the per-capita

average in taxes toward welfare. Thus, welfare implies a negative externality from poor children and a positive one from rich children.

In all of these examples the total externality (for the population as a whole) is zero. What some lose, others gain. Some parents have an incentive to have too many children, others too few. These effects may or may not cancel in such a way as to leave the total birthrate unaffected; even if they do cancel, they will still alter the distribution of that birthrate.

Pollution is a different problem - a game in which everyone can lose. In a society where polluters are not forced to bear the costs of their pollution, an extra person is, among other things, an extra polluter. Since the act of pollution itself involves externalities, he will pollute even when the benefit he gets (by lower operating costs in a factory, for instance) is less than the damage done to others. His existence causes costs to others that are not matched by any equal benefit to him. His parents' decision to have him, therefore, has a net negative externality.

National defense is a similar case. The cost of national defense is virtually independent of the number of people in the area being defended. Some elements of that cost, such as the expense of recruiting an army of a given size, actually fall with increasing population. An additional child causes no increase in the cost of defending the country. But a child grows up to become a taxpayer. The taxes he will pay for national defense will lower the cost of that defense to the rest of the population; they are a net positive externality resulting from his birth.

Another externality is the effect of increasing population on fixed resources of land, raw materials, and so on. But this is only a transfer effect. Any fixed resources that the additional child consumes he gets by exchanging the product of his labor (or money inherited, or something else that is his) for them. The person giving up those resources receives something he considers of equal value; otherwise he does not make the deal. The additional demand for fixed resources raises their cost, but this merely causes a transfer from those who buy those fixed resources to those who sell them. How important the effects of that transfer are likely to be I will discuss later; in any case, no net externality is involved.

So far we have considered the family as a whole. If we consider separately the interests of parents and children, the analysis becomes enormously more complicated.

A situation in which a parent makes decisions in terms of costs and benefits to his child allows the possibility of either the parent sacrificing the child's interests to his own or the parent sacrificing his own interests to the child's. One can best avoid this problem by arranging for the parent himself to bear all of the costs directly resulting from the parent's decisions while the child bears costs resulting from decisions the child makes; thus, each will have the proper incentive to make the proper decision.

Consider, for instance, schooling. Since, under present law, schooling is compulsory for a certain number of years, bearing a child results directly in the cost of that schooling. We argued above that the net externality on the family as a whole is about zero. But that net externality of zero was made up of a subsidy paid to the parent and another subsidy paid by the child. So a parent who has children does not bear the full cost of his act; some of it is imposed upon the children. A relatively selfish (or short-sighted) parent would have more children than if he had to bear the real cost himself.

The ideal situation would be one in which there were no externalities, inside the family or out. Each person would make decisions for which he would bear the full costs. The problem is that being born (or not being born) has a significant effect on the child's life. In principle, having been brought into the world, one can always leave it if one does not like it; in practice, few individuals view suicide as a viable alternative.

So the best one can do is make sure that the parent bears the costs resulting directly from his decisions. This procedure would include the costs of compulsory schooling, feeding, and clothing the child

until he is old enough to make decisions for himself. It would not include the cost of going to college; that decision the child can make for himself. He will receive most of the benefits and should pay the cost.

The results of this analysis, in summary, are:

For the pattern of births to be that which most nearly maximises human welfare:

1. The net externalities of childbearing, as perceived by parents when they decide to have children, should be zero. If the net externalities for most parents are positive, they will be led to have too few children, if negative, too many. If the externalities are positive for some and negative for others, the net birth rate may or may not be distorted, but the distribution of births among families will be.
2. Those costs of childbearing that result directly from decisions of the parents should be borne by the parents. Those that result from decisions of the children should be borne by the children.

Condition 1 by itself will be sufficient, provided that parents can be trusted to make decisions correctly on behalf of their children. Condition 2 is an imperfect attempt to provide for the difficulties that result if parents cannot be trusted to do so.

3. CALCULATIONS

In comparing the various costs connected with bearing children, we must allow for the fact that they are paid at different times. This allowance is usually made by discounting the value of each expenditure back to a common point in time.

Suppose, for instance, that an individual is in a position either to borrow or loan money at 5 percent. To him, a cost of \$100 today is exactly equivalent to a cost of \$105 a year from today. He can convert the former to the latter by paying it with a loan that matures in a year; he can do the reverse by lending out \$100 now and collecting back \$105 just in time to pay the cost.

Thus, one can add together a series of costs spread over time by "discounting" each cost back to the same initial point. If the costs were \$100 today, another \$100 five years from now, and another \$100 ten years later, one would add together the first \$100, the second \$100 discounted back five years (multiplied by $1/1.05^5$), and the third \$100 discounted back 15 years. The sum is the amount which, if he had it today, would pay off all three costs. In this example the sum is \$226. The first \$100 of that will pay the initial cost. The next \$78, let out at 5 percent, will be just enough in five years to pay the next \$100. The remaining \$48 will have grown to another \$100 when the third bill comes due.

Real people are rarely in a position to borrow or lend unlimited amounts of money at a single interest rate; it is therefore less than obvious what rate should be used in calculating the discounted value to an average parent of future costs. I have calculated all my numbers for two rates - 5 percent, about what one is likely to receive from a savings account, and 10 percent, the approximate rate one is likely to be charged for borrowing money and also the approximate average return on money invested on the stock market.

The table on page 7 shows the total value of various costs of and subsidies to childbearing, discounted back to the date of birth of the child. All calculations are approximate. I have assumed that the child is a dependent of his parents until his eighteenth birthday, becomes a taxpayer at age 20, earns a constant income from 20 to 64, and no income thereafter. The child is assumed born in 1971. Assumptions about future population growth went into some of the calculations, but the results are not sensitive to them.

One column shows the total value discounted at 5 percent. The next shows it at 10 percent. The column after that one shows the total number of people receiving the particular subsidy at any instant, and the next one shows the percentage of the population that eventually receives the subsidy. It should be noted that a larger number does

not necessarily mean a larger percentage since the total subsidy may be received over varying periods of time. A subsidy that goes to 10 percent of the population, if given to each recipient over a period of one year, is being given, at any instant to 20 million people. If it is given over two years, the number will be 40 million.

The figures for the subsidy in aid for dependent children have been calculated on three different assumptions. Line 4a assumes that every recipient child is on aid from birth to age 19; 4b assumes that parents become self-supporting when the child gets to be eight (and, presumably, requires less attention); the third assumes that the parents go on aid when the child is five, and remain until he is 19 (and no longer eligible). The total number of children receiving the subsidy varies with the assumption; in reality, of course, different families follow different patterns.

In looking at the table, the first thing we note is the relatively small size of most of the externalities compared with the cost borne by the parents themselves. If we consider those externalities external to the family as a whole, we have, for the "average" child (who neither gains nor loses on welfare or higher education), only line 3. For the welfare child, we have the sum of line 3 and one of lines 4a, b, or c. For the upper-class child who goes to a state university we have the sum of lines 3 and 6. If we consider the 5 percent interest column and use line 4c, the net subsidy to the poor is about 5 percent of the cost of bringing up the child. This is presumably an underestimate since the cost will be lower for a poor child as will the amount he can expect to pay for defense; still it suggests that even in the extreme case of an aid-for-dependent-children child, the net subsidy is not all that high. For the upper-class child, the net subsidy is - \$1,900, or about 9 percent of the cost. One should perhaps increase

line 6 to allow for the probability of postgraduate work; on the other hand, line 3 underestimates here, just as it overestimated before.

If we use the 10 percent interest for our calculations, the subsidies are about 22 percent for the poor child, and zero for the rich one.

Next we do the calculation in terms of the short-run interest of the parent. For the average parent this calculation means adding line 2 and lines 4 (a, b, or c), 5, 6, and 7, each multiplied by the fraction of children involved. Using 4c we get \$9,300 for 5 percent interest or about 42 percent of line 1, and \$6,000 for 10 percent interest, or about 50 percent.

These numbers are much higher than the previous ones. If, conceptually, we are calculating in terms of the interests of people presently alive, we should include some fraction of line 3, which would somewhat reduce the total; after all, many of those presently alive will still be paying their taxes when the child starts paying his and thus lowering the per-capita cost of defense. We should not include his tax contribution to education, however; that must be offset by the educational costs of his offspring. We were able to avoid doing so on the earlier set of assumptions because their costs could be borne by their own later taxes, but those taxes will be paid long after most of the people presently alive stop paying taxes - or doing anything else.

So, after reasonable correction, the subsidy to childbearing, calculated in terms of costs and benefits to the present generation, is about 40 to 50 percent of the monetary costs to the parents. The majority of this subsidy comes from one item - free public schooling. Aid for dependent children is a relatively minor amount; even if we added in the cost borne by those presently alive as a result of

Line	Item	Subsidy (thousands of dollars)		Number of recipients at one instant (millions)	Fraction of population affected (%)
		(at 5% interest)	(at 10% interest)		
1	Total monetary cost borne by a family on a moderate income in bringing up its third child	22	12		
2	Savings from tax deduction of \$750 per year	1.8	1.4		
3	Cost to child of fixed expenses of government (\$107 billion per year in defense, veterans benefits, and interest on the national debt, imposing taxes of \$690 per year per adult age 20-64)	-4.6	-1.1		
	Subsidy in aid for dependent children, per child, @\$760 per year, if received				
4a	ages 0-18	9.1	7	6	9
4b	ages 0-7	4.9	4.5	6	26
4c	ages 5-18	5.6	3.7	6	12
5	Expenditure on public elementary and secondary schools: \$940 per year ages 6-18	6.4	4.2	44	87
6	Government subsidy to public higher education: \$1,800 per year ages 18-21	2.7	1.1	6	39
7	Government subsidy to private higher education: \$1,400 per year ages 18-21	2.1	.9	2	12

Line 1: Source: reference 8.

Line 3: All of these items are roughly independent of future changes in population; the analysis applicable to defense is therefore applicable to the others as well. By ignoring the tendency of income to be higher in later years, I have probably overestimated the magnitude of this term. On the other hand, the assumption that defense spending will remain fixed may be overly optimistic.

Lines 6 and 7: The figures probably overestimate the subsidy to students; I suspect that much of the money is actually spend to subsidize research, which has little effect on the cost to parents of rearing their children.

Line 3-7: The numbers were all calculated from figures in the 1971 *Statistical Abstract*.⁹

a child going on welfare when grown up, it would make little difference.

What about the subsidies to specific, nonaverage, parents? For a child on aid for dependent children the savings from tax deduction can be ignored; the parent is not paying taxes. So, adding lines 4c and 5, we get a subsidy of \$12,000 for 5 percent interest and \$7,900 for 10 percent interest. These are probably overestimates since for the poor child less than the average will be spend for his schooling.

For a child who goes to a state university, the sum of lines 2, 5, and 6 gives a total subsidy of \$10,900 (5 percent interest) or \$6,700 (10 percent).

It is interesting to note that the subsidy to the rich child and the poor child are about the same (although the subsidy to the poor is larger relative to the poor family's income and thus to their expenditure on the child), while the number of children eventually subsidized is three or four times as high for the rich as for the poor.

Our overall results are that net subsidies, if we do our calculations in terms of the long-run interest of the family, run about plus or minus 20 percent of the monetary costs of rearing the child, varying according to what particular part of the population we consider. If we calculate in terms of the interests of the present generation (assuming in other words, that parents take no account of future costs and benefits to their children) the subsidy can run to more than 50 percent. How large an effect subsidies of this size can have will be discussed in the next chapter.

It must be repeated that the numbers are highly approximate; using 4a and 4b instead of 4c would alter some of them significantly. Furthermore, line 1 includes only monetary costs and doubtless represents even those costs poorly for families at one extreme or the other of income.

4. HOW BIG IS BIG?

In this chapter I estimate the effect on population produced by a given amount of externality in order to translate the conclusions of the previous chapter into birthrates and population sizes. There is no good way of making this estimate, but the least bad is probably to take advantage of some calculations done by Jacob Mincer in 1963.⁵

Mincer calculated demand equations for children as a function of family income and wife's income (when employed). He conjectured that, for a given family income, the higher the wife's income, the smaller the number of children since a large part of the cost of rearing children is the time of the mother, and the value of that time is greater the larger the mother's potential salary. The results of his calculations confirmed that conjecture; number of children increased with family income (wife's potential income held constant). The numerical results of these calculations give us a measure of the effect of cost of children on the number of children a family has. A difference of wife's potential income can be converted into a difference of total cost by estimating the number of years of work lost by the wife for each child and discounting that cost back to the birth of the child. A change in family size can be converted into a change in birthrate in an equally straightforward fashion. The result is just what we need - birthrate as a function of the cost of a child.

Such calculations are by no means precise. Mincer's method implicitly assumes that the number of children depends on two or three independent factors and on nothing else. The existence of other elements which are correlated with wife's income, such as wife's education, can distort the results. Furthermore, even if Mincer had an exact measure of parent's willingness to change their family size in response to changing costs, it would apply only to the particular groups of people he sampled. He used three samples from 1950, one of white, urban, employed couples, one of employed couples in large northern cities, and one of employed northern nonfarm couples. He also used a sample from 1940 of employed couples from large northern cities.

Although all of the results were qualitatively similar, there were substantial quantitative differences; within the 1950 samples the coefficient linking wife's income to family size varied over almost a factor of two. Since the makeup of all three samples was similar, either factor is very sensitive to the circumstances of the parents and would vary much more if other groups were studied or else there is a large random fluctuation, in which case Mincer's results must be considered approximate. In either case, one must be cautious in applying them. Unfortunately nothing better is available (as far as I know), and we must therefore use Mincer's data, for what it is worth, if we wish to get some idea of the effect of subsidies (or antisubsidies) on the birthrate. I have done so.

The effect is very small. A change of \$1,000 in the cost of having a child alters the birthrate by about 1/20 of 1 percent. With current birthrates, that alteration corresponds to a change in the rate of population increase of about 1/500 of 1 percentage point.

In Chapter 3 I concluded that the largest subsidy to any particular group, under the most pessimistic assumptions, was about \$12,000 per child. That corresponds to increasing the growth rate of population by about 1/50 of a percentage point. If that subsidy were given to all children, the result, over a century, would be a 2 percent change in the population.

In fact the subsidies to most children under most assumptions are much lower, and some children are antisubsidized, creating an effect in the opposite direction. If one accepts Mincer's numbers, the actual effect of existing subsidies and antisubsidies, over a century, would probably be to alter population by much less than 1 percent.

Even allowing for the possibility that Mincer's numbers may be considerably off, the conclusion is that the effect of existing subsidies and antisubsidies on total population insofar as we can estimate it, is negligible.

One cannot be quite so optimistic about the effects on the growth rates of different groups within the population. The larger figures for the subsidies may be applicable to the whole group even though not to the whole population. Even more important, the members of some groups - in particular very low-income parents - may behave quite differently from the people Mincer studied. If we try to allow for this difference by multiplying Mincer's figure by a factor of ten, the conclusion is that the effect on the groups most sensitive to such effects might be a change of about 20 percent over a century. That is larger but not, I think, large.

One can reasonably object that all these calculations, with their assumptions and inferences, depend on very artificial assumptions about human behaviour, assumptions that may prove false. This is true, as it is true of all economic argument. But the defense - as with all economic argument - is that we must make the best calculations we can and use them until we can make better. The uncertainty of the derivation of one number is no ground for rejecting it in favor of another that has no derivation at all.

5. SUGGESTIONS

The ideal situation is one in which parents are free to decide how many children they have, but everyone involved bears the costs of his own decisions. I have argued that present institutions approximate that situation much more closely than is often supposed, especially if we accept the idea of parents making decisions for their children. What changes in our institutions would bring us closer still?

In answering that question, I will try to limit myself to the effects of our institutions on questions of population. Obviously, existing institutions have, or at least once had, some intended purpose; if that purpose is sufficiently important, it may be desirable to retain the institution even if its effects on population are undesirable. To attempt to discuss the desirability and undesirability, in every respect, of every institution affecting population would carry us far afield. Although I will sometimes discuss the purposes of such institutions,

principally to see whether the effect on population can be eliminated without affecting the original purpose, I will leave it to the reader to decide whether the alterations that I advocate on population grounds are, all things considered, worth making.

The first step in reducing externalities is to reduce or eliminate all subsidies to childbearing. Insofar as the family is considered as a unit, the main subsidies to childbearing are state higher education and welfare. The former should be eliminated. Insofar as it is desirable that able individuals without financial resources be able to go to college, their expenses should be financed by loans to be paid back from their later income; such a plan has recently been introduced by Yale University.

Welfare is a more difficult problem. If we treat the family as a whole, there is no way to achieve the objective of welfare - subsidizing poor people - without subsidizing the production of poor people, that is, the birth of children to poor parents. The only solution is to abolish welfare.

If we assume, however, that individuals, especially poor individuals, make their decision primarily in terms of immediate costs and benefits to them, and only to a much lower degree in terms of future costs and benefits to their children, additional alternatives become available. Such an assumption might be justified - for the poor - by the class analysis of Banfield,¹⁰ who argues that the lower class, which provides most of the welfare population, is characterized, even defined, by the possession of a very short time horizon. If this argument is true, it is only necessary to make child-bearing a losing proposition for the parents, not for the family as a whole. It can be made so by making the welfare payments received by a family independent of the number of children. In terms of calculations of "need" this procedure would oversubsidize small families, undersubsidize large ones, or do both. But it would also impose the cost of an additional child entirely on the parents. The disadvantage of this imposition is that they may transfer the cost of the child, thus thwarting the purpose of the program.

There is another possible approach to the problem. Insofar as parents are completely selfish and shortsighted, they presumably do not want children, and aid for dependent children will only cause childbearing if the aid makes childbearing not merely cheap, but profitable; if, in other words, the amount given per child is more than the parent spends. Reducing the amount is not a satisfactory solution; a sufficiently selfish parent could always reduce the amount he spent below the minimum necessary to take reasonable care of the child, at which point aid for dependent children would no longer fulfill its original function. It is difficult, expensive, and perhaps undesirable for the welfare agency to watch the parent closely enough to be sure how much is spent on the child.

The obvious solution is to make the subsidy partly or entirely in kind instead of in cash. The government might, for instance, offer free nutritious meals to all children, as in a free lunch program, instead of paying the parents, as in aid for dependent children.

If we are going to argue in terms of the interest of the parent, instead of the family, we must consider another subsidy to childbearing that is an order of magnitude larger than the subsidy in child welfare. That is, of course, the subsidy of elementary and high schools. The same arguments imply that that subsidy should be ended and parents required to bear the full cost of schooling their children.

Traditionally the argument for public schooling has been that the child's education benefits not the child himself but the whole society; as a more productive worker he makes all of us rich. Were that argument correct, his contribution to all of us would be a positive externality, balancing the cost of his schooling. But it is not correct. To the extent that an educated individual is more productive, he is able to command a correspondingly higher salary; so the benefit of his schooling goes primarily to him.

A variant of this argument holds that we all benefit by the wise voting of educated individuals. Evidence for this thesis is hard to find. Some of us may share William F. Buckley's opinion that we

would be better off ruled by the first 1,000 names in the New York City telephone directory than by the faculty of Harvard.

Even if we do not benefit from everyone's schooling, we certainly do not get all, or even most, of the benefit. So this argument implies at most that government should subsidize a small part of the cost of schooling; \$40 billion a year for schooled votes is a little steep.

One could argue that if grade-school dropouts are going to go on welfare, subsidizing their schooling is cheaper than supporting them for the rest of their lives. This is, at most, an argument for subsidizing the schooling of the very poor. Even for them, if the argument is correct, it might be better to make schooling compulsory but make the parents pay for it out of their welfare checks; that would increase still further the "oversubsidy" of small families or the "undersubsidy" of large ones, but it would also impose on parents the true cost of having children.

I argued earlier that, if polluters are not forced to bear the cost of their pollution, childbearing has negative externalities. It is thus desirable, from the point of view of population, to alter our legal institutions in such a way as to impose the cost of polluting on polluters. Ways in which this might be done are discussed at some length by Donlan in his new book.¹¹

Tax deductions for children mean that a parent's decision to have children imposes higher taxes on other taxpayers; these deductions are a negative externality. Its size, as the table shows, is small, and comparable to the size of the positive externality resulting from the lower per-capita fixed expenditures of a larger population. The former is an inducement to parents to have more children than they would otherwise want; the latter is a reason why present taxpayers should want to provide an inducement of about that size. Considered in terms of cost to the whole family, it is not an externality at all for the same reason public schooling is not. There seems to be no pressing argument for raising the exemption, lowering it, or leaving it where it is.

Obviously, since my analysis implies that present subsidies to childbearing should be abolished, it also implies that new ones should not be instituted. Free child-care centers are an obvious example.

So far, I have dealt entirely with changes in the direction of keeping population down and have therefore suggested alterations in pronatalist laws. This is consistent with current prejudices, which hold that the population is obviously too big and growing too fast. As a matter of consistency, I must also consider laws that hinder population growth. The most important such law is probably the limitation on immigration.

As long as they pay their own way, new immigrants are a benefit, not a cost, to those already present. Indeed in some ways the arguments for permitting immigration are even stronger than the arguments for permitting parents to bear children. We do not know whether children yet unborn would prefer existence to nonexistence. We do know that the immigrants prefer America to wherever they came from; if they did not they would not come. In addition to any possible benefits to relatives, employers, customers, or others of the present population who gain by the presence of the new immigrants, there is - unless the immigrants are all idiots who came here by mistake - an immense benefit to the immigrants themselves.

Opponents of immigration argue that the new immigrants compete with those already here and so drive down wages. This is an extraordinarily antiegalitarian argument. It justifies the sacrifice of an immense benefit to the potential immigrant - who may presently be earning under \$1,000 a year - to avoid a small cost to far richer American workers.

In fact, if immigration did lower wages for some jobs, this would not represent a net loss to the previous inhabitants of the country but merely a transfer; those lower wages would mean lower prices to the consumers of these workers' labor. And wages for other kinds of work, complementary rather than competitive with the new immigrants, would rise.

This whole argument assumes, of course, that the new immigrants pay their own way. When the United States had a policy of virtually unlimited immigration, that assumption was true automatically since there was no substantial welfare. To make it true again, one would have to make new immigrants ineligible for welfare for a long enough period to discourage any who might come for the express purpose of living on the - to them - munificent bounty of the state.

Given that condition, the arguments of this essay provide no reason why we should not return to a policy of unlimited immigration.

If all the changes suggested in this chapter were made, columns 4-7 of the table would be wiped out. This change would reduce externalities under the largest possible calculation to less than 13 percent (positive), and on the lowest calculation to more than -3 percent. One would expect, if anything, the resulting population to be slightly below optimum size.

6. ERGO

I have argued that even under present institutions freedom of choice is the best way of controlling population. In Chapter 5 I suggested ways of making freedom of choice work even better. There remains the question of what policies my conclusions imply.

First, of course, individuals should be free to decide how many children they will have. This means that birth control and abortion should be legal. It does not mean that they should be free. One of the costs of not having a child is the cost of birth control (or abortion). If that cost is higher than the cost of having a child, the child should be had; there is no reason for the taxpayers to bear the cost of providing the individual with something not worth enough for him to purchase for himself.

This argument breaks down if the taxpayer, rather than the parent, is going to bear the cost of the child. In that case, paying the parent not to bear the child may be cheaper than supporting the child, once born. This is an argument, not for the right of the poor to have free birth control, but for the possible prudence of giving it to them.

As for the not-poor, the argument implies that provision of birth control devices or information does not necessarily mean that such policies cannot be justified on other grounds. The provision of free information by government is frequently - perhaps too frequently - defended in terms of the "public good" argument; that question is outside the scope of this essay.

Second, laws that coercively deny individuals some alternatives other than having children and thus give them an artificial incentive to have children, are undesirable on population grounds. The laws against homosexuality, for instance, insofar as they achieve their purpose, tend to force individuals out of sterile relationships into fertile ones. Similarly, laws against cohabitation (reinforced by strong social pressures) tend to force individuals into a relationship - marriage - in which childbearing is more attractive than in the relationship "living in sin" - that the individuals would have preferred. It might thus be desirable, not only to abolish laws against cohabitation, but to create new forms of marriage contract, legally binding and, hopefully, socially accepted, more suitable than present contracts to those who do not yet desire children.

Here again, to say that a law is undesirable on population grounds does not necessarily mean that it should be repealed; it might be justified for other reasons.

Third, the government should attempt, insofar as possible, to make all laws neutral with regard to population - that is to say, the government should try not to introduce externalities of either sign into the decision to have children.

7. MEANWHILE

So far I have discussed what population policy is best in terms of an analysis of decision-making by individual parents. Of necessity such an argument is highly abstract since it deals with questions of "what who might do if ..." The conclusion of my analysis was that the proper population policy would be one of *laissez-faire*. The obvious next question is what the results of such a policy would be as judged by what we know about the United States. If all of us are going to suffocate by the year 2000, my analysis provides only the gloomy satisfaction of knowing that we killed ourselves in the most rational possible way. Readers may conclude that if my best possible solution is catastrophe they should have stopped reading many chapters ago and started looking for better solutions of their own. Even if our general experience of government argues that it will, "on the average," do a worse job of population control than individual parents, it can hardly do much worse than killing us.

The calculations used in this section assume no radical change in the behaviour of American fertility. That means that by the year 2000, the United States population will be around 260 million and growing very slowly; if fertility rates continue to fall, as they have been falling since the mid-1950s, the growth rate should reach zero sometime in the twenty-first century, with a United States population of between 300 and 500 million.

Gross national product is assumed to continue to increase at about 4 percent per year. This rate would give the U.S. three times its present GNP by the year 2000, and twenty times its present GNP by the middle of the next century.

The question to be resolved is whether such growth will run into any insuperable obstacles - whether at some point in the next few generations Americans will find that further growth, in population or in standard of living, is impossible, or, worse yet, that growth which has occurred threatens their survival.

Basically there are four arguments for the imminence of disaster. We will poison ourselves with the pollution of an ever larger and dirtier population. The pressure of rising population on a fixed supply of land (or perhaps a supply diminished by erosion) will leave us hungry and overcrowded. The burden of too many people on inadequate capital resources (roads, factories, houses, etc.) will make it impossible for us to maintain our standard of living. We will "run out of" natural resources.

I have discussed what should be done about pollution, but not how effective, or costly, doing it will be. If "charging polluters the cost of their pollution" means, with an increased population, charging each person \$20,000 a year to breathe, the solution is not very useful. How expensive will it be to reduce pollution, in whatever way, enough to compensate for increasing population?

Automobiles are the largest single source of air pollution. It is possible, at the present state of the art, to reduce auto emissions by 90 percent at a cost of a few hundred dollars per car. Even allowing for the possibility that poor maintenance will substantially degrade pollution control mechanisms, present devices should suffice to keep the pollution from automobiles, as of 2000, down to levels below the present. If we are willing to pay for maintenance of pollution-control devices, we should be able to do much better than that. Further, there is no reason to expect the state of the art to remain constant, and, if it does, there appear to be several viable alternatives to the internal combustion engine. A substantial charge to car owners for their pollution will obviously create a market incentive for the development of such alternatives.

Air pollution from other sources appears to allow similar control - especially if electric power generation moves more and more to nuclear power.

So-called thermal pollution is a problem only in the very short-run or (as will be discussed later) a very long-run sense. As long as we are not actually heating up the earth, thermal pollution is an alteration in our environment, but not, in any real sense, a degradation; a

river with water temperature 60° is not essentially inferior to one with a temperature of 55°. There is a short-run problem since the river is initially populated by life forms adapted to its old temperature. But there is no shortage of natural warm rivers from which to take appropriate life forms to replace those that cannot accept the new conditions. How to accomplish the smooth transition in a reasonable length of time is, doubtless, a difficult technical problem for biologists and ecologists, but there is no obvious reason why it should be insoluble.

Problems of water pollution are more complicated than those of air pollution, because there is no single cause comparable to automobiles. However, if we judge by current expenditures on sanitation and sewage treatment (about \$3 billion a year by state and local governments), water-treatment facilities could be vastly expanded under the pressure of charges for pollution without substantially lowering our standard of living.

What all of this suggests is that the Hardin formula (population \times standard of living = pollution) is nonsense. It ignores the fact that almost all kinds of pollution are, at various costs, preventable, that much pollution is already being prevented (or treated), and that this prevention happens even though we spend a negligible fraction of our national income on preventing pollution. While the cost of treating or preventing the pollution attendant upon economic growth will doubtless slow down that growth somewhat, there is no reason to expect the effect to be large.

The absurdity of treating increased pollution as the unavoidable by-product of increased standard of living can be seen by comparing Belgium to India. Belgium has a much higher population density and a much higher standard of living than India. Environmental pollution - judged by standards as simple as the drinkability of water and the attractiveness of the countryside - is far lower.

So far I have not dealt with the catastrophes that some writers have predicted - the melting of the polar ice cap, exhaustion of earth's supply of oxygen, and the like. A detailed discussion of these problems is beyond the scope of this essay. I will content myself with a few comments.

The catastrophes divide themselves into the disproven and the unproven; an example of the first is the prediction that thermal pollution will substantially raise the temperature of the earth. Straightforward thermodynamic calculations show that this heating will not be an appreciable effect for over a century. By that time we should have several solutions available - ranging from thermonuclear power, with its much lower waste-heat-to-power ratio to artificial manipulation of earth's cloud cover - designed to decrease the absorption of heat from the sun and so compensate for artificial heat production. Similarly, the arguments about oxygen break down on the fact that the amount of oxygen in the atmosphere is many times more than would be required to oxidize all the organic material on earth. There is not, in other words, enough carbon in the biosphere to turn any substantial fraction of the oxygen in the atmosphere into carbon dioxide.

Of the unproven catastrophes, none depends for its solution on control of population, at least for the next century or so. Certainly none depends on the control of United States population. All can be solved even with a growing population, and, even with a relatively stable population, none will be solved unless the evidence of danger becomes far less ambiguous.

One example is the possibility of global effects from increased concentrations of DDT. The use of DDT can be abolished; it is being abolished in the United States. If it were clear that its continued use by other countries posed a catastrophic threat to life on earth, those countries would stop using it - or be made to stop. Until that happens, they will continue to use it in increasing amounts, whether or not we control our population.

We come next to the danger that we will run out of land. For the U.S. in the next century this is a fantasy.

The impression that people live close together because there is nowhere else to put them is an illusion; in fact there is plenty of room. People live close together because they like to, because the advantages of living close together outweigh the disadvantages. A single statistic makes this clear. To populate the entire land area of the United States at the density of the five boroughs of New York City, the United States would require a population of slightly under a hundred billion. We are, in other words, more than two orders of magnitude, that is, a factor of 100 away from the point where lack of space will become a serious influence on population density.

Our situation with regard to farmland, while not quite so secure, poses no problems for the immediate future. We are presently able to produce considerably more food than we need even though we insist on consuming large amounts of animal protein, which is very expensive in both land and money. Furthermore, our present productivity per acre is low compared with that of Japan, where a much greater scarcity of land justifies more labor- and capital-intensive techniques. At the most, a rise in population would encourage a decreased use of animal protein in favor of substitutes, such as the soy protein that is already coming into use, and would make economic more productive food-production techniques. This change to more productive techniques would directly affect the cost of unprocessed food; the cost of processing would presumably be unaffected. At present, we spend about \$250 a year per capita to produce food. Doubling or tripling that over the next 50 years would hardly have much affect on our overall standard of living.

Increased population would increase the value of land. This increase would be a transfer effect as already discussed. Since total rent on all land is now only a few percent of national income (and falling), even a sizable increase in the value of land would have little effect - "socially desirable" or "socially undesirable" - on the distribution of wealth.

Fixed capital resources are no problem for the United States. Since only about 10 percent of national income comes from the rent on capital, maintaining or increasing the present ratio of capital to population requires the investment of only a small part of national income. Throughout this century the ratio has increased in spite of rising population.

We come, then, to the last problem - the limiting effect of fixed amounts of natural resources on the growth of population and standard of living.

It must be remembered that ordinary raw materials (iron, for instance) cannot be consumed. They can only be changed from a more useful to a less useful form - or vice versa. Such a change is reversible - at a price. Iron ore is changed into more useful iron and then into still more useful steel. The steel, having been made into automobiles, eventually becomes less useful scrap. The scrap can, at a cost, be made back into iron.

The cost is partly a function of how the material is used. Iron mixed with other metals is more expensive to reuse than pure iron scrap. To the extent that iron becomes scarce, and thus expensive, the increased cost will provide a strong market incentive to avoid using it in ways that make it difficult to reclaim.

Whatever the problems of fixed resources with regard to population, those problems have nothing to do with any breakdown of the practicality of laissez-faire (with regard to resources, not population) or the efficacy of the market. On the contrary, to the extent that a resource is scarce, and thus expensive, it is profitable to use it efficiently and to spend large amounts of money to reclaim it after use. Even if the resource is not scarce in any immediate sense, if it is predictable that it will become scarce at some time in the future, the same effect occurs through a more complicated chain of events. Speculators realize that the price of iron ore, for example, will be very high in 50 years. They therefore buy large quantities of iron ore (presumably *in situ*) for speculative purposes. They keep buying it until the present price gets as high as their estimate of its value 50 years from now, discounted by the interest rate to allow for the cost of holding resources inactive. Speculative demand (for fu-

ture use) pushes up the price, forcing users to economize on their use.

Lest this be regarded as a purely hypothetical analysis, I should point out that this is exactly what happened to silver in the early 1960s. It became plain, to everyone except the United States treasury, that the price was going to rise eventually. Speculators therefore started accumulating silver, driving up its price.

Examples of recycling, prompted by strictly market incentives, are numerous. Currently about half of the iron produced in the U.S. gets recycled. Recycling of silver, a much more expensive material, goes to the point of extracting (during development) much of the silver used in photographic films.

Recycling is a practical market solution to the problems of scarce resources and one that comes into effect when it becomes worth the cost. As long as our consumption can be met by recycling, increase demand will at most raise the cost of raw materials enough to pay for recycling. At present costs, it is already profitable to do a considerable degree of recycling, so it is unlikely that the increase required will be great. Since present expenditure on raw materials is only about \$60 per capita per year, costs of raw materials could easily triple or quadruple by the end of the century without substantially diminishing our standard of living.

Can recycling provide raw materials without limit to any population at all? No. To understand the ultimate limits of recycling, one should ask, not how much iron we consume each year, but how much we are using at any instant. How much iron, in other words, is actually tied up in the cars, buildings, etc. of the United States? You can't recycle my car - I'm driving it. However, efficient our recycling, if the population gets so large that the total amount of iron actually in use reaches the total amount available, we must either stop the growth of population or decrease the amount of iron used per capita.

For materials that do not have readily available substitutes, decreasing per-capita use might mean decreasing our standard of living or, at least, spending resources that might otherwise have gone to increase that standard on providing substitutes.

It would be very interesting to know, for each of the major raw materials (perhaps, more simply, each elements), how many pounds per capita are actually tied up, in use, in our present society, and how those amounts compare with the total amount of that resource available. We could then calculate how large a population could be supported at our present standard of living before we were forced to find substitutes.

We would also have some idea of how high a standard of living our present population could attain before running into the same limit. This calculation would be more difficult and would yield a less precise result. "Doubling" one's standard of living certainly does not mean doubling the number of pounds of food consumed each day; it probably does not mean doubling the tonnage of iron made use of. Still, one could get some idea of the effect by comparing amounts used in our society by individuals of different incomes.

I have calculated approximate figures for iron, probably the most important raw material, and almost certainly the one for which the necessary information is most readily available. Given the approximations that I used, my results are probably good to within about a factor of two.

My conclusion is that present known world resources of iron ore contain enough iron to provide the average amount of iron used in the United States to a population of 40 billion. Alternatively, they would allow a world population of four billion to have a standard of living at which the per-capita use of iron was ten times as high as it now is in the United States.

In total known resources, I include both reserves that are presently economic to work and "potential reserves," whose quality is too low to be presently worth using. The first category contains little more than half the total. So even if we limit ourselves to iron ore that is presently economic to mine, the figure is still over 20 billion per-

sons. If we limit ourselves to United States reserves (which are, perhaps, most relevant for U.S. population figures), the figure is again over 20 billion, since the U.S. has over half the world total. If we limit ourselves to presently usable U.S. reserves, the number drops to eight billion - still a sizable population for the United States.

So running out of iron is not a serious threat, for either the United States or the world. I suspect that similar results would hold for other metals, but the calculations, as far as I know, have not been done.

As was mentioned earlier, problems with limited natural resources involve transfer externalities. One effect of an increased demand for iron is to make owners of iron ore beds richer and buyers of cars poorer. Given the amount presently spent on raw materials, the effect is not likely to be very significant as far as changes in the distribution of wealth in the United States are concerned. If, however, the United States continues to be a net importer of raw materials, the rise in these prices will benefit the exporting countries; since the exporting countries tend to be very poor, the effect might be significant for them. In total, it might involve the equivalent of a once-and-for-all capital transfer of between \$10 billion and \$100 billion.

There is only one natural resource that is not recyclable. That is entropy,¹² which may be conveniently thought of as usable energy. It is the use of entropy (strictly speaking, the increase of the entropy of one thing necessary to decrease the entropy of another) that distinguishes fuels, which are consumed, from raw materials, which are not.

Consider gasoline. We could take the waste products of an internal combustion engine and put them back together. But we would have to use at least as much power as we got out of the gasoline by burning it. Since the point of having gasoline is as a source of power, the process would be utterly pointless.

Four major sources of usable energy are available. There is accumulated organic fuel - coal, oil, natural gas - now the main source of commercial energy. There is solar power. That, converted into electricity by hydroelectric plants, is a secondary source of commercial power; converted into food by plants, solar power is the main source burned by the human body. There is fissionable material for reactors. There is deuterium, which, in principle, can be used in fusion reactors.

Organic fuels remain important because they are slightly cheaper than nuclear sources and because most of the cheap locations for hydroelectric power are already being utilized. If the cost of using fuel to produce power goes up, either because of charges imposed for pollution or because of increased scarcity, the other power sources can substitute at only slightly higher costs.

World reserves of organic fuels correspond to about 400 times the present annual consumption; even if we assume a steady rise in rate of power consumption, they should last well into the next century. Reserves of fissionables are several times as large; reserves of deuterium for fusion power are still larger.

The heat absorbed by the earth from the sun is about 15,000 times greater than present power consumption; almost all of it is, in principle, usable power. If power consumption grows at 4 percent a year, in about 250 years we will require all of it.

This is not the ultimate limit of power consumption. About one-half of one-billionth of the sun's light falls on earth; about half of that is absorbed. If we get desperate enough to start building solar mirrors to trap all that wasted power, we can continue a 4 percent annual growth rate for another 560 years. In a little over 800 years, we will have to stop increasing world power consumption or else find some source other than the sun.

In summary, there seems no reason to believe that a policy of laissez-faire in population - combined with a policy of imposing the cost of pollution on polluters - will threaten the standard of living of the next few generations of Americans.

So far most of my discussion has been limited to the effect in the United States of events in the United States. Many people argue that demographic trends outside U.S. borders pose a threat, not only to the populations directly concerned, but to the U.S. as well. They argue that we must set an example by controlling our population, or that we must take strong actions to encourage and subsidize population controls abroad, or both.

The "good example" argument makes little sense. We are already setting a good example - whatever that may be worth; United States population is growing at less than half the average rate for the world. It is hard to see why lowering the U.S. rate from 1 percent to zero would make much difference to countries that have not been able to get their rate below 2 percent. Besides, if they want an example of a highly successful society with a stable population, they can look at Japan; how many examples do they need?

The whole argument sounds like something cribbed from Lewis Carroll. We have to cure a population problem we don't have in order to get other countries to cure population problems they do have. It is like a father taking his son's medicine to prove it does not hurt. Whatever the moral relationship of the United States to the rest of the world, it is not paternal.

There remains the alternative of bribing other countries to keep down their populations. Is this alternative in our interest? Is unrestrained population growth abroad a threat to the United States?

Most arguments for this thesis start with the idea that unrestrained population growth will have catastrophic effects on the welfare of foreign populations. I am not certain that the assertion is true, but will assume it for the moment.

We are rich. They are poor, numerous, and hungry. They will be driven to attack us and take what we have and they need. The impoverished masses of the earth will rise in their righteous wrath to seize their food from the fat exploiters. Etc.

It makes a fine morality play, but poor geopolitics. Abyssinia did not, after all, invade Italy. India's plans for adding England to an Indian empire have not gone very far. The Manchurian campaigns of World War II occurred in poor China, not (relatively) rich Japan.

It is doubtless true that poor people covet their neighbor's land. So do rich people. The question is, can they get away with taking it? If so, they are likely to try, however rich they are and however poor their victims - as the colonial powers proved repeatedly in the last century. If not, they won't. Under conditions of modern warfare, military strength depends mainly on wealth and technology; hordes of starving peasants are not very effective. Especially if the projected victim is the United States; it's hard to swim the Pacific.

If we are really worried about future attack, and if population increase really leads to poverty, the United States should be sabotaging birth control programs, instead of subsidizing them.

A similar argument can be made in economic instead of military terms. The United States consumes large amounts of raw materials, some of which are imported. If the rest of the world has a huge, hungry population, it will consume the resources itself, and we will be left out in the cold.

Here again, the argument breaks down on the assumption that the population is not only large but poor. Starving Indians cannot compete with rich Americans in bidding for the mineral resources of Africa; they are too near subsistence to be able to offer any high price. Even starving Africans cannot compete for the resources of Africa. If we have things to offer (food and fertilizer, say) that are much more valuable to them than the minerals required by a developed, technological society, they will sell us those minerals. That is precisely what has been happening for the past 25 years, in independent black African countries just as in colonies. The developed countries of Europe and America outbid the Africans in the competition for African resources. The individual African, or individual African government, would rather sell to a foreigner at a high price than to a neighbor at a low one.

If population increase causes poverty, and if the major effect on the United States of other countries' development is to bid away resources from us, it is in our interest to encourage population growth and discourage development.

Let me state the relation of premise and conclusion differently. Assume that a shortage of fixed resources is a very major problem for a world (or country) with a large population. That assumption implies that a large population will cause poverty. It also implies that the United States should worry seriously, in the future, about foreign nations bidding natural resources away from us. If that assumption is right, it is in our interest to encourage population, and poverty, in the underdeveloped world.

In my opinion, the premises of these ugly arguments are false.

For the same reasons discussed earlier in this section, when dealing with the United States, I do not think that fixed resources are a major problem. If I am right, the development of underdeveloped countries will not be catastrophically affected by what happens to their populations. Further, the development of those countries will not injure us; the prices of raw materials will rise enough to encourage recycling and more efficient use, but that rise will be only a small cost to us. Since the development of other countries greatly increases the opportunities for profitable trade, the net effect would almost certainly benefit us.

One final remark. I suspect most writers who argue that world poverty poses a threat to us, and should be prevented for that reason, of arguing dishonestly. They really believe that world poverty is bad because it is bad for people to be poor - even foreigners. With that position I agree. They put the argument in terms of American self-interest in the hope of thereby prying money out of the taxpayers.

This is a dangerous game to play. If we accept the premise on which their argument is based (which premise is, I think, false), it follows that America's self-interest is to keep the rest of the world poor. If forced to choose, the American taxpayers may prove less altruistic - and more practical - than their intellectual leaders.

CONCLUSION

It is coming to be widely believed that the results of allowing parents freely to decide how many children they have must, in the long run, be catastrophic under any tolerable social institutions. It is already widely believed that the results of allowing parents freely to decide how many children they have, in the United States, have already proved catastrophic, or soon will. I can find no justification in economic theory for the first belief. I can find no justification in either economic theory or the present circumstances of this country for the second.

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