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PROBLEMS IN THE THEORY OF PUBLIC CHOICE

SOCIAL COST AND GOVERNMENT ACTION

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In Illinois where I was born—and indeed in most of the two American continents—the common mosquito is a major pest. With the development of DDT during World War II, a cheap way of reducing the mosquito population became available, and a very large number of communities in the years after World War II hired aircraft to fly low over the city and spray it with DDT. Recently this has become much less common. The reduction in the amount of such spraying is partially the result of a realization that the DDT spray has other effects on the natural environment than the reduction of the mosquitoes, and that some of these other effects may be quite undesirable, and partially the result of home air conditioning. A person living in an air-conditioned home is unlikely to spend as much time outside as a person living in a non-air-conditioned house. Although the amount of aerial spraying of mosquitoes has been considerably reduced in recent years, a number of other techniques which are both less effective in dealing with mosquitoes and more expensive have been adopted in some areas. They are not as widespread as aerial spraying was, let us say, ten or fifteen years ago.

The reader may wonder why a discussion of social cost should begin with this technological discussion of a rather unusual local problem. The reason is simple. Almost all of the problems involved in decisions as to what types of activity should be undertaken by the government will be found in this simple example. Further, there is absolutely nothing in the way of a traditional solution to this problem. One of the greatest problems in talking about

the new discoveries in the field of social cost, externalities, and what we might call the economics of the government sector is that most people have learned, normally very early in life, the existing tradition. Those who have not accepted the existing tradition normally learn some particular attack on it which is in many ways just another tradition. Thus discussion of government activities runs instantaneously into a barrier of very strongly held ideas. If we discuss mosquito abatement, however, we normally find a complete absence of these traditions or antitraditions and hence can deal with the problem with less emotional difficulty.

To return, then, to the mosquitoes, let us assume that we are in 1952 and that we are living in a small town in Iowa where our mosquito problem is bad. We could undertake a spraying campaign in our own backyard. We could buy in a local supermarket a suitable insect spray and spray our backyard and perhaps spray a little into the neighbor's yard. This spray would in general reduce the number of mosquitoes in the area, partly by killing the ones who were there at the time we sprayed and partly because the spray left some residium on the vegetation and mosquitoes landing on the residium might be killed. Nevertheless, this would be a very expensive and not tremendously efficient way of reducing the number of mosquitoes.

Another method of mosquito abatement was available, however; for \$50.00 we could hire an airplane and this would spray the entire town with a density to give me or any other citizen considerable mosquito abatement. This method, like

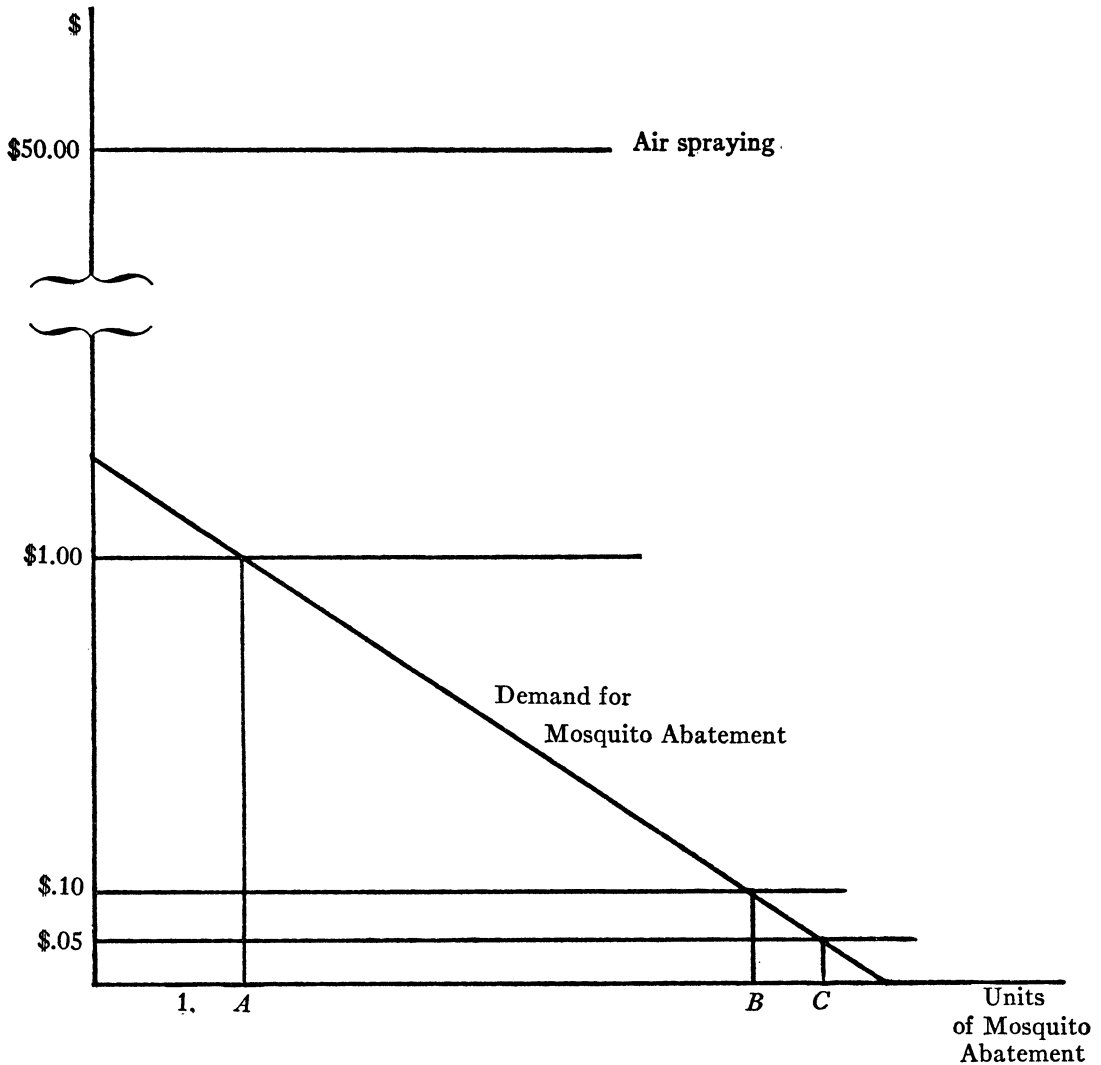


FIGURE 1

the use of handsprays, could be intensified with additional deaths of mosquitoes. The situation is shown on Figure 1. For some individual the demand for mosquito abatement is shown by the usual slanting line. If he chooses to use the handspray method, then the line marked \$1.00 will indicate the cost of killing "one unit" of mosquitoes. The individual will choose to purchase A units, and the total cost he will run for this will be represented by the

rectangle to the left of A . The individual will not be interested in hiring an airplane which, from the standpoint of the individual, is completely dominated by handspraying. He can obtain any amount of mosquito abatement in his own yard that he desires more cheaply by handspraying than from the air.

The situation changes radically, however, if the individual clubs together with the other citizens of the town to hire the

airplane. Suppose there are 1,000 citizens in the town and they get together to hire the plane. The cost to each of them for mosquito abatement in his backyard falls to five cents a unit and the total amount consumed would rise to C . Under these circumstances the entire mosquito abatement demand would be taken up by air spraying rather than handspraying because, once again, there is strict dominance of this particular technological method.

Clearly, the individual if given a choice would prefer C mosquito abatement by air spraying to consuming A units by hand-spray. Thus there would be a good argument for collective provision of mosquito abatement. Suppose, however, that instead of having some government instrumentality undertake mosquito abatement, an effort is made to have various individuals privately contribute money to hire an airplane. Under these circumstances the cost of hiring an airplane depends on the number of people who have contributed. If only 500 people are willing to contribute, then the cost of mosquito abatement by air (per unit) would be ten cents and they will choose to purchase the amount B .

Assuming that this voluntary method of purchasing mosquito abatement is adopted, the individual would be rational not to make his ten cent payment. If he is not a member of the group making the payment, he receives the mosquito abatement free. If, on the other hand, he decides to make his payment and we assume that the amount of money he puts in is then invested in purchasing additional aircraft time for the whole city, then he faces a price for purchasing mosquito abatement in his yard of \$50.00 a unit. This price is clearly way above the amount that he wishes to pay. It is extremely unlikely that individuals would be willing to make voluntary contributions.

Normally only a government could provide the airplane spraying.¹

We thus have what appears to be a fairly unambiguous argument for a governmental agency compelling the citizens of this small town to make the five cent payments for the hire of an airplane. The citizens themselves would be better off under this arrangement and would presumably favor it. There has, however, been an implicit assumption in the discussion so far—which is that each of the citizens has exactly the same demand for mosquito abatement. Presumably, this is not true. This means that a decision must be made as to how much mosquito abatement should be purchased. In order to consider this decision, let us shift to Figure 2 in which we show the demand curves for mosquito abatement of three citizens (Mr. A, Mr. B, and Mr. C). Note that if there is no decision to hire an airplane, the three individuals will simply purchase different numbers of units of mosquito abatement through the use of the handspray: Mr. A purchasing a' units, Mr. B purchasing b' units, and Mr. C purchasing c' units.

If, however, it is decided to hire an airplane and engage in collective provision of mosquito abatement, then some kind of decision must be made as to how much mosquito abatement should be purchased. It will be noted that the three individuals have different ideas as to how much this should be—represented by a , b , and c on the diagram. I have carefully constructed this example so that their preferences on this particular point would be what is known as “single peaked.”² If we consider

¹ Sometimes informal pressures can function very much like a government. As a general rule, however, human experience seems to indicate that informal pressure is not sufficient and we normally use governmental pressure in such cases.

² Cf. Duncan Black, *The Theory of Committees and Elections* (Cambridge, 1958).

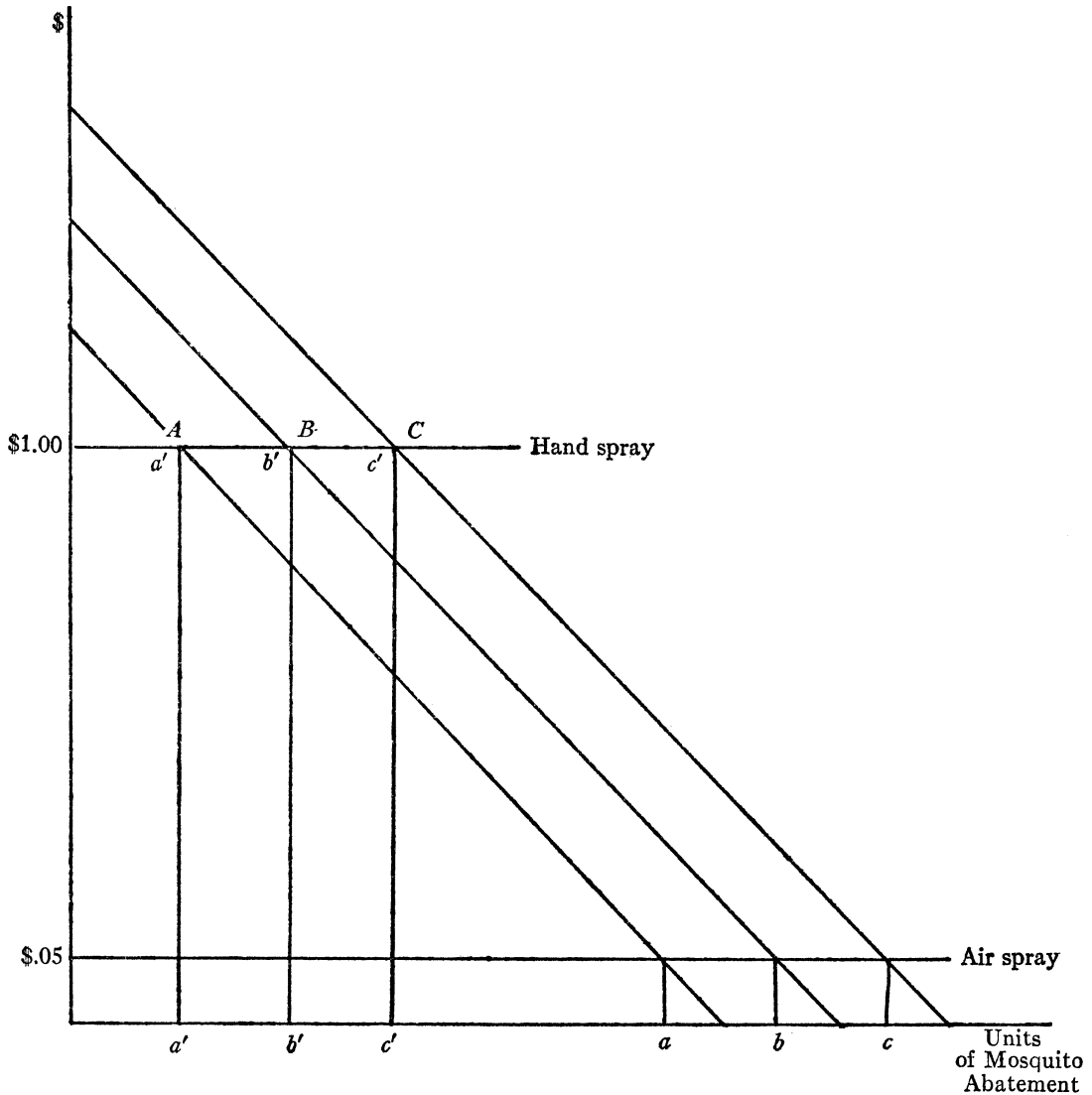


FIGURE 2

ourselves as dealing with only a three-man community and they make decisions by majority voting, and in this particular type of situation there are arguments for doing this, then we would predict that they would purchase the amount b of mosquito abatement. This means that Mr. A and Mr. C have failed to obtain their optimum amount of mosquito abatement.

It does not, of course, follow from the

fact that the individuals could make a perfect adjustment of how much mosquito abatement they wish to purchase if we use handsprays and must anticipate in most cases that they will not obtain their exact optimum amount of mosquito abatement if we use airplanes to spray, that hand-spraying is superior. It merely follows that there is a cost involved in the air spraying which should be taken into ac-

count. Assuming again that we have our society of 1,000, I would compare my desire for handsprays (that is, how much I would purchase in the way of mosquito abatement by hand) with what I thought was the likely outcome of the voting process in terms of the amount which would be obtained by collective provision. I would anticipate that the collective provision would not turn out to be exactly the amount that I wanted at that price. It would not follow from this that I would favor exact adjustment under what we might call market provision to imperfect adjustment under collective arrangements. Indeed, I presume most people in areas where mosquitoes are bad if confronted with the particular problem that I have outlined would choose the collective provision. Note, however, that this means that they are choosing a less than optimal arrangement of the resources by their own preference ordering. There is, in a sense, an externality imposed upon them by the choice of the collective decision process. They will no longer be able to make an ideal adjustment.

Let us now inquire what is the ideal size of the government unit which deals with mosquito abatement. First, we should note the limits that are placed upon this by the technology of aircraft spraying. In order to be efficient, the aircraft should spray the entire town and certain nearby mosquito breeding areas. An effort to spray half of the town would give much less than half the protection. In other words, it would be a very bad bargain. Therefore, the minimum size of government units which decides to hire the airplane would be our small town in the Middle West.

By rather similar methods we can determine the maximum size of government units for mosquito abatement. In general, every increase in the size of the unit reduces the likelihood that the final provi-

sion will be very close to the desires of a given citizen. This is particularly true in something like mosquito abatement where different communities presumably have different levels of mosquito infestation. In general, as the size of government units is increased the number of externalities internalized is increased but the adjustment of the government activity to the desires of any individual voter is decreased. In our particular case, mosquito abatement, the laying off of these two factors leads pretty unambiguously to the view that the small Iowa community should provide its own mosquito abatement. With other problems, of course, other solutions should be expected.

So far, we have been talking about the problem of mosquito abatement about ten years ago. There has been considerable technological change since that time. Let us confine ourselves to considering only those discoveries which indicate that simple airplane spraying of DDT is not a desirable way of dealing with the problem. It has been realized that there are a large number of secondary costs from this operation and that these secondary costs may well be much in excess of the benefit to the spraying process. As a result, the technology of mosquito abatement no longer mainly depends on this very cheap method of killing mosquitoes. We need not go into the more complicated and more expensive methods that are now in general use. It is perfectly possible that tomorrow someone will invent another method of getting rid of mosquitoes that is as cheap as aerial spraying of DDT was thought to be when it was widely used, but we can simply note that present methods are expensive and inquire what effect this would have on the reasoning so far.

The first possible effect of the increase in expense of mosquito abatement by collective measures might be that the unit cost of a given amount of mosquito abate-

ment by collective measures would be equal or higher than if one restricts mosquito abatement to the private use of sprays in one's own backyard. In this case, which is an easy one, the proper decision of course would be to abandon completely all collective efforts to reduce mosquitoes. The second possibility (also very easy) is that mosquito abatement either by public or by private means might become so expensive that it would be no longer desired by individuals. Here, again, the proper solution is to have no public program for mosquito abatement, and we would also anticipate that there would be no private abatement either. Both of these are easy problems and in both cases we need go no further with our analysis.

The interesting question, however, is what would we do if the use of various public means for reducing the mosquito population (let us say, specialized treatment of breeding areas of mosquitoes) is still a less expensive method of obtaining a certain amount of mosquito abatement than is private spraying, but that the difference becomes small. On Figure 3 I have drawn in this problem.

We assume here that methods of mosquito abatement by collective means exist and these are efficient enough so that if all members of the community are compelled to contribute the cost of purchasing one unit of mosquito abatement it will be \$.95 per head, whereas private purchase of one unit of mosquito abatement would remain at \$1.00. If we consider only Mr. B, clearly collective provisions would be desirable. He would be better off purchasing x units of mosquito abatement at \$.95 instead of purchasing b units at \$1.00 which is his market economy alternative. His net benefit is measured by the areas shaded horizontally and slanting to the left in Figure 3.

If, however, we consider a community consisting of three members (Mr. A, Mr.

B, and Mr. C), the situation is more complicated. Mr. A, for example, benefits from the establishment of the new level of mosquito abatement to the extent of the horizontally shaded trapezoid in the upper left. He is injured through the necessity of buying more mosquito abatement than he wants even at the new price to the extent of the vertically shaded triangle. Clearly, he is much worse off with collective provision than he would be with individual provision. Mr. C is affected in a somewhat more ambiguous way. His gross gain is the gross gain of Mr. B plus the little dotted triangle. He, however, suffers a loss to the extent of the shaded triangle from not being able to purchase the additional mosquito abatement privately. This loss will only be suffered if it is not possible for him (for technological or for legal reasons) to supplement the public provision at the same cost as he could have bought mosquito abatement privately before. If the public provision of mosquito abatement actually reduced the cost of additional mosquito abatement (which is conceivable), he might gain. If the public provision did not completely bar private but simply made private supplement rather inefficient (which I imagine is the common case), then Mr. C would face a supply curve somewhat like the horizontal dashed line and would purchase $c' - x$ amount of private mosquito abatement. The gross cost to him of the new arrangement then would be the trapezoid lying between this horizontal dashed line and the \$1.00 line. If this were a smaller area than the rectangle to the left of the new supply quantity, he would gain in net terms.

Now the question arises naturally whether it would be desirable to undertake public provision of the mosquito abatement granted that we have this small three-person community. If the provision of public mosquito abatement injures both A and C and benefits B, then the ordinary

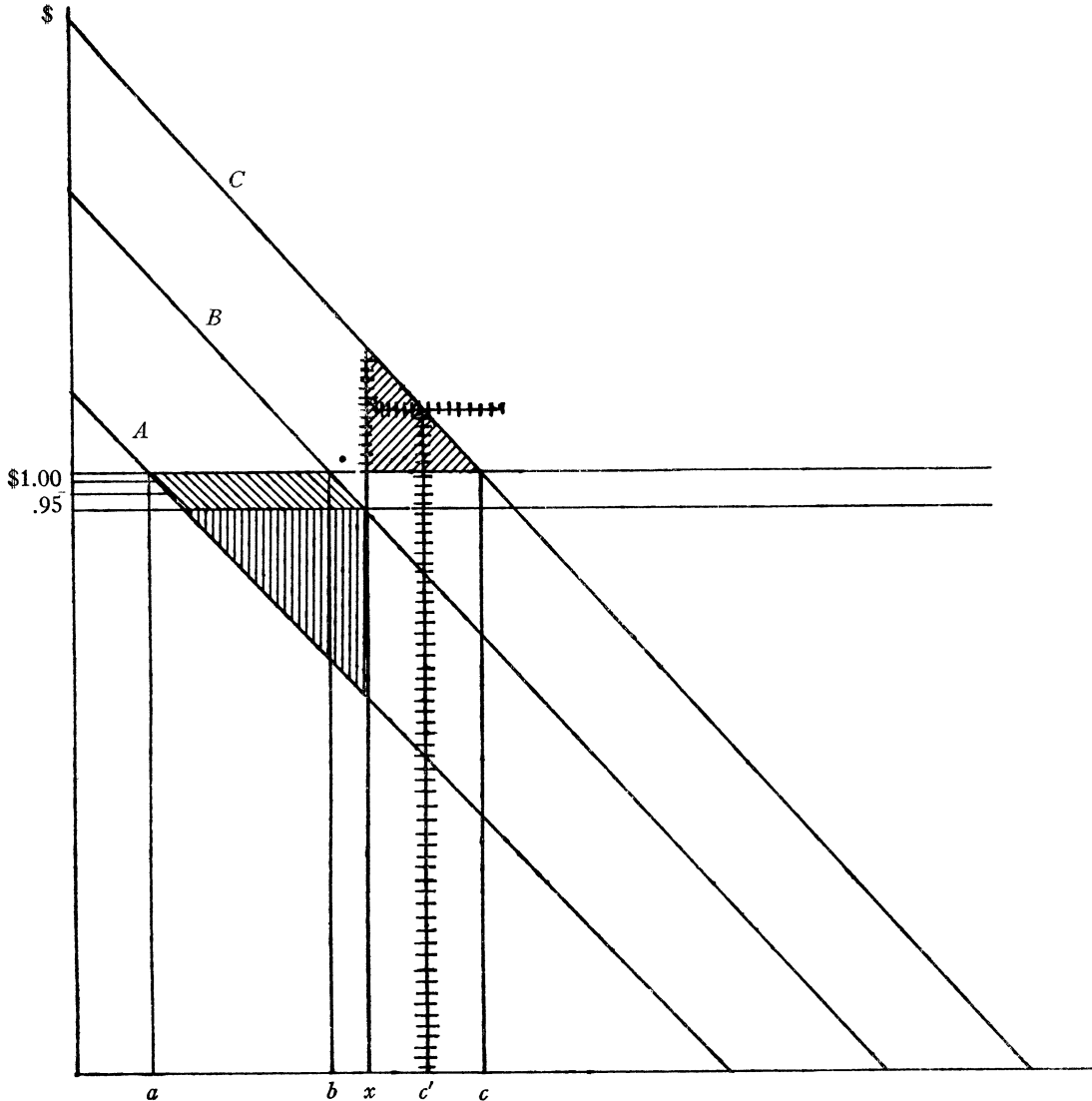


FIGURE 3

welfare economist can inquire whether B is able to compensate A and C for this injury. If (and this is also quite possible) the provision benefits both B and C but injures A, then, of course, it will be more likely that compensation can be undertaken. Unfortunately, when we are talking about public goods and where the quantity of public good consumed is set by voting or any other collective process, com-

pensation becomes almost impossible in the real world.

The problem is that we will be unable to find out the amount of the compensation. Mr. A probably has not given much thought to how much he would require to compensate him for a combination of x provision collectively and the appropriate taxes. If asked to give thought to this rather strange problem, he has absolutely

no motive to correctly interpret his own feelings. This would be particularly true if we were dealing not with our small three-man community. A might be concerned with the prospect that too large a claim for damages on his part might make the whole project impossible. Thus, there will be some limit to the degree to which he would exaggerate the loss which he would suffer. Similarly, B and C even if they are benefited probably would be hard pressed to put a monetary value on their benefit if we asked them and have substantially no motive to do so accurately.

As a general principle, attempting to get voters voting on some issue to compensate each other out of their individual surpluses for their individual losses is not a feasible political proposition. Thus, we cannot use the traditional welfare economics method of making a direct payment from the people who gain to the people who were injured. There is, however, another and rather debatable tool in the welfare economist's tool kit. Some (but not by all means all) welfare economists would argue that if we could compute that the payment would be possible, then it is not necessary to make it. Under this line of reasoning if there is a net social benefit, we don't need to concern ourselves with the way in which it is distributed. This method of applying the Paretian criterion is controversial and I do not wish to endorse it here. There is, however, a variant on it which is clearly a respectable rule and one which we will use.

According to this variant, if we anticipate making a large number of decisions in the future and if we cannot tell who will be benefited and who will be injured by each of these collective decisions but anticipate that most members of the society will find themselves benefited sometimes and injured sometimes, then the rule of simply computing whether there is a net benefit or not and using that for all of these

decisions would probably give to each individual in society a positive discounted future income stream. It could be said under this argument that if we found a "net gain" we could undertake the collective provision of mosquito abatement without worrying about the fact that some people (particularly Mr. A) are injured. It will be noted that the use of this argument involves an income transfer. Mr. A is injured, Mr. B is benefited, and depending on the particular parameters of the problem Mr. C may be either benefited or injured. This transfer is clearly not something we would positively favor. That is particularly true since as a general rule most members of society who are interested in restricting the consumption of any particular good are apt to be poorer members. Thus transfers of the sort we are now talking about are apt to be transfers from the poorer to the better-off members of the community. Poor Mr. A is made worse off, middle-class Mr. B is benefited and upper-class Mr. C may gain.

It will be noted that the basic parameters which have led us to choose either collective or private provision of mosquito abatement have been essentially technological. It is, therefore, sensible to pause briefly and inquire exactly what the nature of technological superiority of collective provision is. At first glance, one might think that it was simply an example of an ordinary scale economy, but this is clearly not so. General Motors has surely exhausted all the scale economies that are available in the manufacture of Chevrolets, yet we find no need for collective provision here. General Motors can sell its cars to people scattered all over the United States without worrying very much about whether the next-door neighbor of any given purchaser of Chevrolet has a Ford.

The special characteristic of aerial spraying of mosquitoes is that it is gener-

ally impossible to do it economically on one city lot at a time. In order to get any economy into the operation at all it is necessary to spray a fairly broad area. This is partly because the plane must fly from its airport to the place where it releases the spray anyway and partly that the characteristics of the spray are such that it is apt to cover several surrounding house lots anyway. If only one of them is paying for it, the others will receive a free

ride. The problem, then, is geographical contiguity. Geographical contiguity is a basic characteristic of almost all such areas where we would choose collective provision. The distinction between any economy of scale which can be obtained only if the customers are located next door to each other and an economy of scale which can be obtained without this type of contiguity is fundamental.