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An Economic Theory of Clubs¹

By JAMES M. BUCHANAN

The implied institutional setting for neo-classical economic theory, including theoretical welfare economics, is a régime of private property, in which all goods and services are privately (individually) utilized or consumed. Only within the last two decades have serious attempts been made to extend the formal theoretical structure to include communal or collective ownership-consumption arrangements.² The "pure theory of public goods" remains in its infancy, and the few models that have been most rigorously developed apply only to polar or extreme cases. For example, in the fundamental papers by Paul A. Samuelson, a sharp conceptual distinction is made between those goods and services that are "purely private" and those that are "purely public".³ No general theory has been developed which covers the whole spectrum of ownership-consumption possibilities, ranging from the purely private or individualized activity on the one hand to purely public or collectivized activity on the other. One of the missing links here is "a theory of clubs", a theory of co-operative membership, a theory that will include as a variable to be determined the extension of ownership-consumption rights over differing numbers of persons.

Everyday experience reveals that there exists some most preferred or "optimal" membership for almost any activity in which we engage, and that this membership varies in some relation to economic factors. European hotels have more communally shared bathrooms than their American counterparts. Middle and low income communities organize swimming-bathing facilities; high income communities are observed to enjoy privately owned swimming pools.

In this paper I shall develop a general theory of clubs, or consumption ownership-membership arrangements. This construction allows us to move one step forward in closing the awesome Samuelson gap between the purely private and the purely public good. For the former, the optimal sharing arrangement, the preferred club membership, is clearly one person (or one family unit), whereas the optimal sharing group

¹ I am indebted to graduate students and colleagues for many helpful suggestions. Specific acknowledgement should be made for the critical assistance of Emilio Giardina of the University of Catania and W. Craig Stubblebine of the University of Delaware.

² It is interesting that none of the theories of Socialist economic organization seems to be based on explicit co-operation among individuals. These theories have conceived the economy either in the Lange-Lerner sense as an analogue to a purely private, individually oriented social order or, alternatively, as one that is centrally directed.

³ See Paul A. Samuelson, "The Pure Theory of Public Expenditure", *Review of Economics and Statistics*, vol. xxxvi (1954), pp. 387-89; "Diagrammatic Exposition of a Theory of Public Expenditure", *Review of Economics and Statistics*, vol. xxxvii (1955), pp. 350-55.

for the purely public good, as defined in the polar sense, includes an infinitely large number of members. That is to say, for any genuinely collective good defined in the Samuelson way, a club that has an infinitely large membership is preferred to all arrangements of finite size. While it is evident that some goods and services may be reasonably classified as purely private, even in the extreme sense, it is clear that few, if any, goods satisfy the conditions of extreme collectiveness. The interesting cases are those goods and services, the consumption of which involves some "publicness", where the optimal sharing group is more than one person or family but smaller than an infinitely large number. The range of "publicness" is finite. The central question in a theory of clubs is that of determining the membership margin, so to speak, the size of the most desirable cost and consumption sharing arrangement.¹

I

In traditional neo-classical models that assume the existence of purely private goods and services only, the utility function of an individual is written,

$$(1) \quad U^i = U^i(X_1^i, X_2^i, \dots, X_n^i),$$

where each of the X 's represents the amount of a purely private good available during a specified time period, to the reference individual designated by the superscript.

Samuelson extended this function to include purely collective or public goods, which he denoted by the subscripts, $n+1, \dots, n+m$, so that (1) is changed to read,

$$(2) \quad U^i = U^i(X_1^i, X_2^i, \dots, X_n^i; X_{n+1}^i, X_{n+2}^i, \dots, X_{n+m}^i).$$

This approach requires that all goods be initially classified into the two sets, private and public. Private goods, defined to be wholly divisible among the persons, $i=1, 2, \dots, s$, satisfy the relation

$$X_j = \sum_{i=1}^s X_j^i,$$

while public goods, defined to be wholly indivisible as among persons, satisfy the relation,

$$X_{n+j} = X_{n+j}^i.$$

I propose to drop any attempt at an initial classification or differentiation of goods into fully divisible and fully indivisible sets, and to incorporate in the utility function goods falling between these two extremes. What the theory of clubs provides is, in one sense, a "theory of classification", but this emerges as an output of the analysis. The first step is that of modifying the utility function.

¹ Note that an economic theory of clubs can strictly apply only to the extent that the motivation for joining in sharing arrangements is itself economic; that is, only if choices are made on the basis of costs and benefits of particular goods and services as these are confronted by the individual. In so far as individuals join clubs for camaraderie, as such, the theory does not apply.

Note that, in neither (1) nor (2) is it necessary to make a distinction between "goods available to the ownership unit of which the reference individual is a member" and "goods finally available to the individual for consumption". With purely private goods, consumption by one individual automatically reduces potential consumption of other individuals by an equal amount. With purely public goods, consumption by any one individual implies equal consumption by all others. For goods falling between such extremes, such a distinction must be made. This is because for such goods there is no unique translation possible between the "goods available to the membership unit" and "goods finally consumed". In the construction which follows, therefore, the "goods" entering the individual's utility function, the X_j 's, should be interpreted as "goods available for consumption to the whole membership unit of which the reference individual is a member".

Arguments that represent the size of the sharing group must be included in the utility function along with arguments representing goods and services. For any good or service, regardless of its ultimate place along the conceptual public-private spectrum, the utility that an individual receives from its consumption depends upon the *number of other persons with whom he must share its benefits*. This is obvious, but its acceptance does require breaking out of the private property straitjacket within which most of economic theory has developed. As an extreme example, take a good normally considered to be purely private, say, a pair of shoes. Clearly your own utility from a single pair of shoes, per unit of time, depends on the number of other persons who share them with you. Simultaneous physical sharing may not, of course, be possible; only one person can wear the shoes at each particular moment. However, for any finite period of time, sharing is possible, even for such evidently private goods. For pure services that are consumed in the moment of acquisition the extension is somewhat more difficult, but it can be made none the less. Sharing here simply means that the individual receives a smaller quantity of the service. Sharing a "haircut per month" with a second person is the same as consuming "one-half haircut per month". Given any quantity of final good, as defined in terms of the physical units of some standard quality, the utility that the individual receives from this quantity will be related functionally to the number of others with whom he shares.¹

Variables for club size are not normally included in the utility function of an individual since, in the private-goods world, the optimal club size is unity. However, for our purposes, these variables must be explicitly included, and, for completeness, a club-size variable should be included for each and every good. Alongside each X_j , there must be placed an N_j , which we define as the number of persons who are to participate as "members" in the sharing of good, X_j , including the

¹ Physical attributes of a good or service may, of course, affect the structure of the sharing arrangements that are preferred. Although the analysis below assumes symmetrical sharing, this assumption is not necessary, and the analysis in its general form can be extended to cover all possible schemes.

i th person whose utility function is examined. That is to say, the club-size variable, N_j , measures the number of persons who are to join in the consumption-utilization arrangements for good, X_j , over the relevant time period. The sharing arrangements may or may not call for equal consumption on the part of each member, and the peculiar manner of sharing will clearly affect the way in which the variable enters the utility function. For simplicity we may assume equal sharing, although this is not necessary for the analysis. The rewritten utility function now becomes,

$$(3) \quad U^i = U^i[(X_1^i, N_1^i), (X_2^i, N_2^i), \dots, (X_{n+m}^i, N_{n+m}^i)].^1$$

We may designate a numeraire good, X_r , which can simply be thought of as money, possessing value only as a medium of exchange. By employing the convention whereby the lower case u 's represent the partial derivatives, we get u_j^i/u_r^i , defined as the marginal rate of substitution in consumption between X_j and X_r for the i th individual. Since, in our construction, the size of the group is also a variable, we must also examine, $u_{N_j}^i/u_r^i$, defined as the marginal rate of substitution "in consumption" between the size of the sharing group and the numeraire. That is to say, this ratio represents the rate (which may be negative) at which the individual is willing to give up (accept) money in exchange for additional members in the sharing group.

We now define a cost or production function as this confronts the individual, and this will include the same set of variables,

$$(4) \quad F = F^i[(X_1^i, N_1^i), (X_2^i, N_2^i), \dots, (X_{n+m}^i, N_{n+m}^i)].$$

Why do the club-size variables, the N_j 's, appear in this cost function? The addition of members to a sharing group may, and normally will, affect the cost of the good to any one member. The larger is the membership of the golf club the lower the dues to any single member, given a specific quantity of club facilities available per unit time.

It now becomes possible to derive, from the utility and cost functions, statements for the necessary marginal conditions for Pareto optimality in respect to consumption of each good. In the usual manner we get,

$$(5) \quad u_j^i/u_r^i = f_j^i/f_r^i.$$

Condition (5) states that, for the i th individual, the marginal rate of substitution between goods X_j and X_r , in consumption, must be equal to the marginal rate of substitution between these same two goods in "production" or exchange. To this acknowledged necessary condition, we now add,

$$(6) \quad u_{N_j}^i/u_r^i = f_{N_j}^i/f_r^i.$$

¹ Note that this construction of the individual's utility function differs from that introduced in an earlier paper, where "activities" rather than "goods" were included as the basic arguments. (See James M. Buchanan and Wm. Craig Stubblebine, "Externality," *Economica*, vol. xxxi (1962), pp. 371-84.) In the alternative construction, the "activities" of other persons enter directly into the utility function of the reference individual with respect to the consumption of all other than purely private goods. The construction here incorporates the same interdependence through the inclusion of the N_j 's although in a more general manner.

Condition (6) is not normally stated, since the variables relating to club size are not normally included in utility functions. Implicitly, the size for sharing arrangements is assumed to be determined exogenously to individual choices. Club size is presumed to be a part of the environment. Condition (6) states that the marginal rate of substitution "in consumption" between the size of the group sharing in the use of good X_j , and the numeraire good, X_r , must be equal to the marginal rate of substitution "in production". In other words, the individual attains full equilibrium in club size only when the marginal benefits that he secures from having an additional member (which may, and probably will normally be, negative) are just equal to the marginal costs that he incurs from adding a member (which will also normally be negative).

Combining (5) and (6) we get,

$$(7) \quad u_j^i/f_j^i = u_r^i/f_r^i = u_{N_j}^i/f_{N_j}^i.$$

Only when (7) is satisfied will the necessary marginal conditions with respect to the consumption-utilization of X_j be met. The individual will have available to his membership unit an optimal quantity of X_j , measured in physical units and, also, he will be sharing this quantity "optimally" over a group of determined size.

The necessary condition for club size may not, of course, be met. Since for many goods there is a major change in utility between the one-person and the two-person club, and since discrete changes in membership may be all that is possible, we may get,

$$(7A) \quad \frac{u_j^i}{f_j^i} = \frac{u_r^i}{f_r^i} > \frac{u_{N_j}^i}{f_{N_j}^i} \Big|_{N_j=1}; \quad \frac{u_j^i}{f_j^i} = \frac{u_r^i}{f_r^i} < \frac{u_{N_j}^i}{f_{N_j}^i} \Big|_{N_j=2}$$

which incorporates the recognition that, with a club size of unity, the right-hand term may be relatively too small, whereas, with a club size of two, it may be too large. If partial sharing arrangements can be worked out, this qualification need not, of course, be made.

If, on the other hand, the size of a co-operative or collective sharing group is exogenously determined, we may get,

$$(7B) \quad \frac{u_j^i}{f_j^i} = \frac{u_r^i}{f_r^i} > \frac{u_{N_j}^i}{f_{N_j}^i} \Big|_{N_j=k}$$

Note that (7B) actually characterizes the situation of an individual with respect to the consumption of any purely public good of the type defined in the Samuelson polar model. Any group of finite size, k , is smaller than optimal here, and the full set of necessary marginal conditions cannot possibly be met. Since additional persons can, by definition, be added to the group without in any way reducing the availability of the good to other members, and since additional members could they be found, would presumably place some positive value on the good and hence be willing to share in its costs, the group always remains below optimal size. The all-inclusive club remains too small.

Consider, now, the relation between the set of necessary marginal conditions defined in (7) and those presented by Samuelson in application to goods that were exogenously defined to be purely public. In the latter case, these conditions are,

$$(8) \quad \sum_{i=1}^s (u'_{n+j}/u'_r) = f_{n+j}/f_r,$$

where the marginal rates of substitution in consumption between the purely public good, X_{n+j} , and the numeraire good, X_r , summed over all individuals in the group of determined size, s , equals the marginal cost of X_{n+j} also defined in terms of units of X_r . Note that when (7) is satisfied, (8) is necessarily satisfied, provided only that the collectivity is making neither profit nor loss on providing the marginal unit of the public good. That is to say, provided that,

$$(9) \quad f_{n+j}/f_r = \sum_{i=1}^s (f'_{n+j}/f'_r).$$

The reverse does not necessarily hold, however, since the satisfaction of (8) does not require that each and every individual in the group be in a position where his own marginal benefits are equal to his marginal costs (taxes).¹ And, of course, (8) says nothing at all about group size.

The necessary marginal conditions in (7) allow us to classify all goods only after the solution is attained. Whether or not a particular good is purely private, purely public, or somewhere between these extremes is determined only after the equilibrium values for the N_j 's are known. A good for which the equilibrium value for N_j is large can be classified as containing much "publicness". By contrast, a good for which the equilibrium value of N_j is small can be classified as largely private.

II

The formal statement of the theory of clubs presented in Section I can be supplemented and clarified by geometrical analysis, although the nature of the construction implies somewhat more restrictive models.

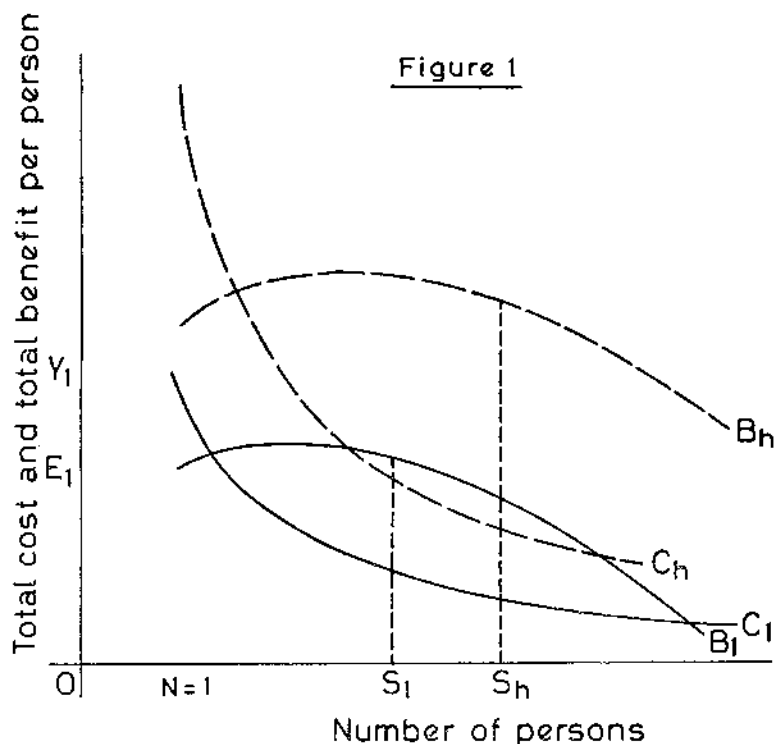
Consider a good that is known to contain, under some conditions, a degree of "publicness". For simplicity, think of a swimming pool. We want to examine the choice calculus of a single person, and we shall assume that other persons about him, with whom he may or may not choose to join in some club-like arrangement, are identical in all respects with him. As a first step, take a facility of one-unit size, which we define in terms of physical output supplied.

On the ordinate of Fig. 1, we measure total cost and total benefit per person, the latter derived from the individual's own evaluation of the facility in terms of the numeraire, dollars. On the abscissa, we measure the number of persons in possible sharing arrangements. Define the full cost of the one-unit facility to be Y_1 , and the reference individual's

¹ In Samuelson's diagrammatic presentation, these individual marginal conditions are satisfied, but the diagrammatic construction is more restricted than that contained in his earlier more general model.

evaluation of this facility as a purely private consumption good to be E_1 . As is clear from the construction as drawn, he will not choose to purchase the good. If the single person is required to meet the full cost, he will not be able to enjoy the benefits of the good. Any enjoyment of the facility requires the organization of some co-operative-collective sharing arrangement.¹

Two functions may now be traced in Fig. 1, remaining within the one-unit restriction on the size of the facility. A total benefit function and a total cost function confronting the single individual may be



derived. As more persons are allowed to share in the enjoyment of the facility, of given size, the benefit evaluation that the individual places on the good will, after some point, decline. There may, of course, be both an increasing and a constant range of the total benefit function, but at some point congestion will set in, and his evaluation of the good

¹ The sharing arrangement need not be either co-operative or governmental in form. Since profit opportunities exist in all such situations, the emergence of profit-seeking firms can be predicted in those settings where legal structures permit, and where this organizational form possesses relative advantages. (Cf. R. H. Coase, "The Nature of the Firm", *Economica*, vol. iv (1937), pp. 386-405.) For purposes of this paper, such firms are one form of club organization, with co-operatives and public arrangements representing other forms. Generally speaking, of course, the choice among these forms should be largely determined by efficiency considerations.

will fall. There seems little doubt that the total benefit curve, shown as B_1 , will exhibit the concavity property as drawn for goods that involve some commonality in consumption.¹

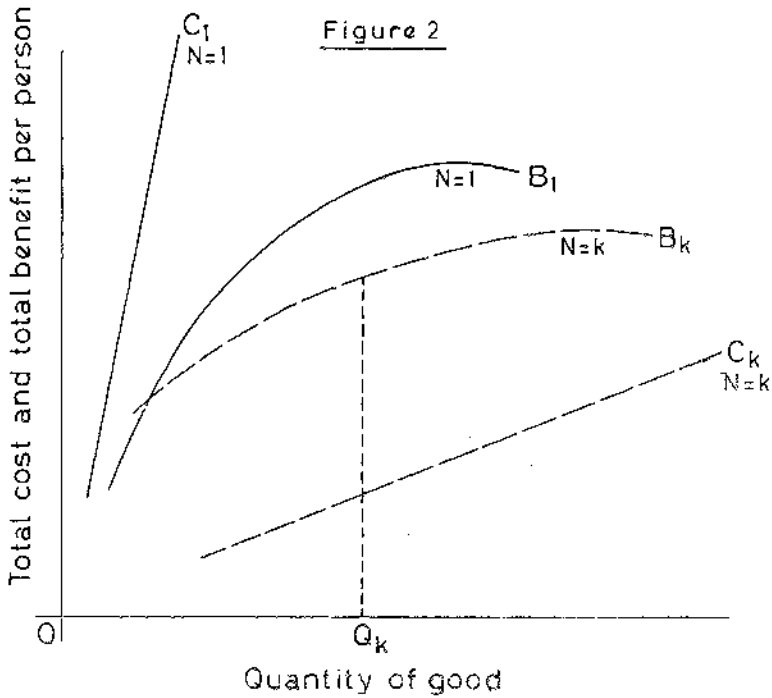
The bringing of additional members into the club also serves to reduce the cost that the single person will face. Since, by our initial simplifying assumption, all persons here are identical, symmetrical cost sharing is suggested. In any case, the total cost per person will fall as additional persons join the group, under any cost-sharing scheme. As drawn in Fig. 1, symmetrical sharing is assumed and the curve, C_1 , traces the total cost function, given the one-unit restriction on the size of the facility.²

For the given size of the facility, there will exist some optimal size of club. This is determined at the point where the derivatives of the total cost and total benefit functions are equal, shown as S_1 in Fig. 1, for the one-unit facility. Consider now an increase in the size of the facility. As before, a total cost curve and a total benefit curve may be derived, and an optimal club size determined. One other such optimum is shown at S_h , for a quantity of goods upon which the curves C_h and B_h are based. Similar constructions can be carried out for every possible size of facility; that is, for each possible quantity of good.

A similar construction may be used to determine optimal goods quantity for each possible size of club; this is illustrated in Fig. 2. On the ordinate, we measure here total costs and total benefits confronting the individual, as in Fig. 1. On the abscissa, we measure physical size of the facility, quantity of good, and for each assumed size of club membership we may trace total cost and total benefit functions. If we first examine the single-member club, we may well find that the optimal goods quantity is zero; the total cost function may increase more rapidly than the total benefit function from the outset. However, as more persons are added, the total costs to the single person fall; under our symmetrical sharing assumption, they will fall proportionately. The total benefit functions here will slope upward to the right but after some initial range they will be concave downward and at some point will reach a maximum. As club size is increased, benefit

¹ The geometrical model here applies only to such goods. Essentially the same analysis may, however, be extended to apply to cases where "congestion", as such, does not appear. For example, goods that are produced at decreasing costs, even if their consumption is purely private, may be shown to require some sharing arrangements in an equilibrium or optimal organization.

² For simplicity, we assume that an additional "membership" in the club involves the addition of one separate person. The model applies equally well, however, for those cases where cost shares are allocated proportionately with predicted usage. In this extension, an additional "membership" would really amount to an additional consumption unit. Membership in the swimming club could, for example, be defined as the right to visit the pool one time each week. Hence, the person who plans to make two visits per week would, in this modification, hold two memberships. This qualification is not, of course, relevant under the strict world-of-equals assumption, but it indicates that the theory need not be so restrictive as it might appear.



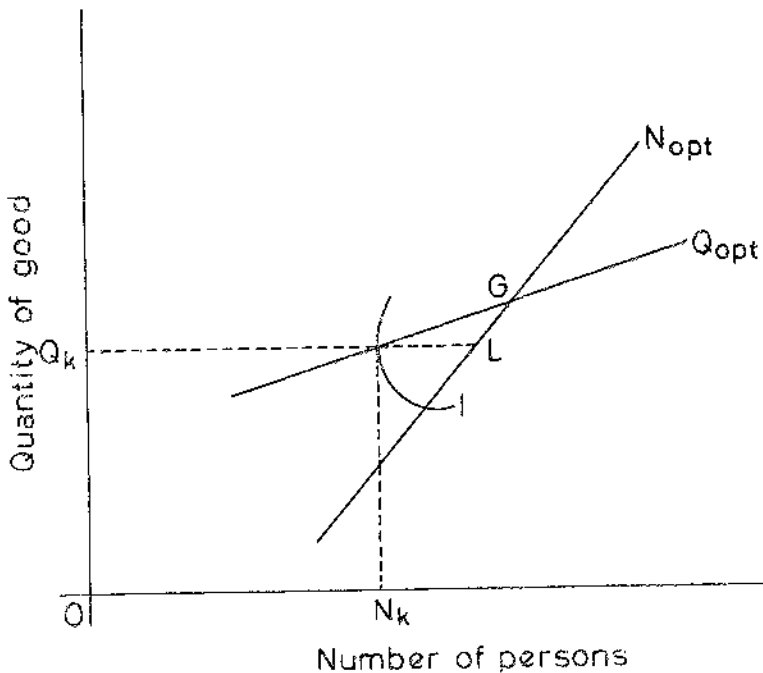
functions will shift generally downward beyond the initial non-congestion range, and the point of maximum benefit will move to the right. The construction of Fig. 2 allows us to derive an optimal goods quantity for each size of club; Q_k is one such quantity for club size $N=K$.

The results derived from Figs. 1 and 2 are combined in Fig. 3. Here the two variables to be chosen, goods quantity and club size, are measured on the ordinate and the abscissa respectively. The values for optimal club size for each goods quantity, derived from Fig. 1, allow us to plot the curve, N_{opt} , in Fig. 3. Similarly, the values for optimal goods quantity, for each club size, derived from Fig. 2, allow us to plot the curve, Q_{opt} .

The intersection of these two curves, N_{opt} and Q_{opt} , determines the position of full equilibrium, G . The individual is in equilibrium both with respect to goods quantity and to group size, for the good under consideration. Suppose, for example, that the sharing group is limited to size, N_k . The attainment of equilibrium with respect to goods quantity, shown by Q_k , would still leave the individual desirous of shifting the size of the membership so as to attain position L . However, once the group increases to this size, the individual prefers a larger quantity of the good, and so on, until G is attained.

Fig. 3 may be interpreted as a standard preference map depicting the tastes of the individual for the two components, goods quantity

Figure 3



and club size for the sharing of that good. The curves, N_{opt} and Q_{opt} , are lines of optima, and G is the highest attainable level for the individual, the top of his ordinal utility mountain. Since these curves are lines of optima within an individual preference system, successive choices must converge in G .

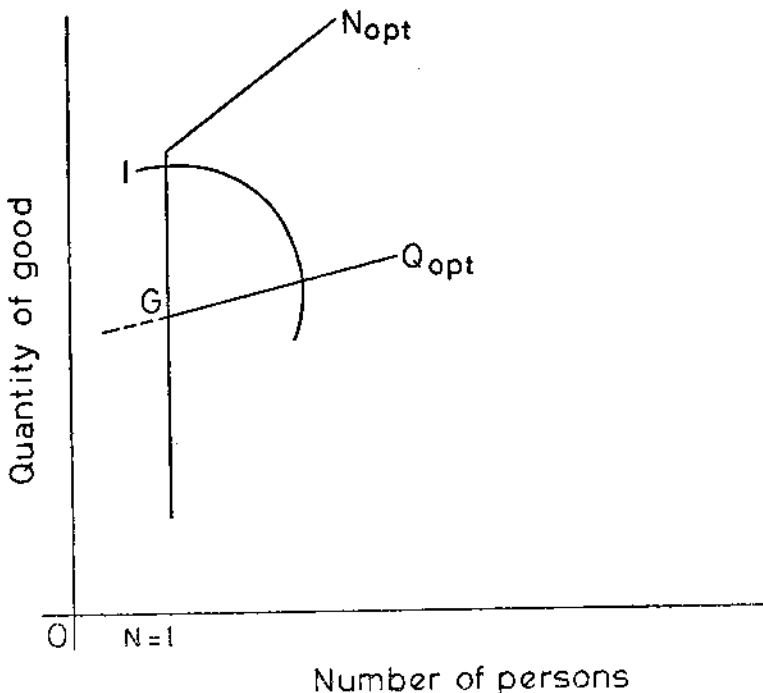
It should be noted that income-price constraints have already been incorporated in the preference map through the specific sharing assumptions that are made. The tastes of the individual depicted in Fig. 3 reflect the post-payment or net relative evaluations of the two components of consumption at all levels. Unless additional constraints are imposed on the model, he must move to the satiety point in this construction.

It seems clear that under normal conditions both of the curves in Fig. 3 will slope upward to the right, and that they will lie in approximately the relation to each other as therein depicted. This reflects the fact that, normally for the type of good considered in this example, there will exist a complementary rather than a substitute relationship between increasing the quantity of the good and increasing the size of the sharing group.

This geometrical model can be extended to cover goods falling at any point along the private-public spectrum. Take the purely public

good as the first extreme case. Since, by definition, congestion does not occur, each total benefit curve, in Fig. 1, becomes horizontal. Thus, optimal club size, regardless of goods quantity is infinite. Hence, full equilibrium is impossible of attainment; equilibrium only with respect to goods quantity can be reached, defined with respect to the all-inclusive finite group. In the construction of Fig. 3, the N curve cannot be drawn. A more realistic model may be that in which, at goods quantity equilibrium, the limitations on group size impose an inequality. For example, in Fig. 3, suppose that the all-inclusive group is of size, N_k . Congestion is indicated as being possible over small sizes of facility, but, if an equilibrium quantity is provided, there is no congestion, and, in fact, there remain economies to scale in club size. The situation at the most favourable attainable position is, therefore, in all respects equivalent to that confronted in the case of the good that is purely public under the more restricted definition.

Figure 4



Consider now the purely private good. The appropriate curves here may be shown in Fig. 4. The individual, with his income-price constraints is able to attain the peak of his ordinal preference mountain without the necessity of calling upon his fellows to join him in sharing

arrangements. Also, the benefits that he receives from the good may be so exclusively his own that these would largely disappear if others were brought in to share them. Hence, the full equilibrium position, G , lies along the vertical from the $N=1$ member point. Any attempt to expand the club beyond this point will reduce the utility of the individual.¹

III

The geometrical construction implies that the necessary marginal conditions are satisfied at unique equilibrium values for both goods quantity and club size. This involves an oversimplification that is made possible only through the assumptions of specific cost-sharing schemes and identity among individuals. In order to generalize the results, these restrictions must be dropped. We know that, given any group of individuals who are able to evaluate both consumption shares and the costs of congestion, there exists some set of marginal prices, goods quantity, and club size that will satisfy (7) above. However, the quantity of the good, the size of the club sharing in its consumption, and the cost-sharing arrangements must be determined simultaneously. And, since there are always "gains from trade" to be realized in moving from non-optimal to optimal positions, distributional considerations must be introduced. Once these are allowed to be present, the final "solution" can be located at any one of a sub-infinity of points on the Pareto welfare surface. Only through some quite arbitrarily chosen conventions can standard geometrical constructions be made to apply.

The approach used above has been to impose at the outset a set of marginal prices (tax-prices, if the good is supplied publicly), translated here into shares or potential shares in the costs of providing separate quantities of a specific good for groups of varying sizes. Hence, the individual confronts a predictable set of marginal prices for each quantity of the good at every possible club size, independently of his own choices on these variables. With this convention, and the world-of-equals assumption, the geometrical solution becomes one that is relevant for any individual in the group. If we drop the world-of-equals

¹ The construction suggests clearly that the optimal club size, for any quantity of good, will tend to become smaller as the real income of an individual is increased. Goods that exhibit some "publicness" at low income levels will, therefore, tend to become "private" as income levels advance. This suggests that the number of activities that are organized optimally under co-operative collective sharing arrangements will tend to be somewhat larger in low-income communities than in high-income communities, other things equal. There is, of course, ample empirical support for this rather obvious conclusion drawn from the model. For example, in American agricultural communities thirty years ago heavy equipment was communally shared among many farms, normally on some single owner-lease-rental arrangement. Today, substantially the same equipment will be found on each farm, even though it remains idle for much of its potential working time.

The implication of the analysis for the size of governmental units is perhaps less evident. In so far as governments are organized to provide communal facilities, the size of such units measured by the number of citizens, should decline as income increases. Thus, in the affluent society, the local school district may, optimally, be smaller than in the poor society.

assumption, the construction continues to hold without change for the choice calculus of any particular individual in the group. The results cannot, of course, be generalized for the group in this case, since different individuals will evaluate any given result differently. The model remains helpful even here, however, in that it suggests the process through which individual decisions may be made, and it tends to clarify some of the implicit content in the more formal statements of the necessary marginal conditions for optimality.¹

IV

The theory of clubs developed in this paper applies in the strict sense only to the organization of membership or sharing arrangements where "exclusion" is possible. In so far as non-exclusion is a characteristic of public goods supply, as Musgrave has suggested,² the theory of clubs is of limited relevance. Nevertheless, some implications of the theory for the whole excludability question may be indicated. If the structure of property rights is variable, there would seem to be few goods the services of which are non-excludable, solely due to some physical attributes. Hence, the theory of clubs is, in one sense, a theory of optimal exclusion, as well as one of inclusion. Consider the classic lighthouse case. Variations in property rights, broadly conceived, could prohibit boat operators without "light licenses" from approaching the channel guarded by the light. Physical exclusion is possible, given sufficient flexibility in property law, in almost all imaginable cases, including those in which the interdependence lies in the act of consuming itself. Take the single person who gets an inoculation, providing immunization against a communicable disease. In so far as this action exerts external benefits on his fellows, the person taking the action could be authorized to collect charges from all beneficiaries under sanction of the collectivity.

This is not, of course, to suggest that property rights will, in practice, always be adjusted to allow for optimal exclusion. If they are not, the "free rider" problem arises. This prospect suggests one issue of major importance that the analysis of this paper has neglected, the question of costs that may be involved in securing agreements among members of sharing groups. If individuals think that exclusion will not be fully possible, that they can expect to secure benefits as free riders without really becoming full-fledged contributing members of

¹ A note concerning one implicit assumption of the whole analysis is in order at this point. The possibility for the individual to choose among the various scales of consumption sharing arrangements has been incorporated into an orthodox model of individual behaviour. The procedure implies that the individual remains indifferent as to which of his neighbours or fellow citizens join him in such arrangements. In other words, no attempt has been made to allow for personal selectivity or discrimination in the models. To incorporate this element, which is no doubt important in many instances, would introduce a wholly new dimension into the analysis, and additional tools to those employed here would be required.

² See R. A. Musgrave, *The Theory of Public Finance*, New York, 1959.

the club, they may be reluctant to enter voluntarily into cost-sharing arrangements. This suggests that one important means of reducing the costs of securing voluntary co-operative agreements is that of allowing for more flexible property arrangements and for introducing excluding devices. If the owner of a hunting preserve is allowed to prosecute poachers, then prospective poachers are much more likely to be willing to pay for the hunting permits in advance.

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