PUBLIC GOODS AND PUBLIC POLICY REVISITED

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1. Introduction

Some years ago I published a survey paper «Public Goods and Public Policy» (7) (13) on certain aspects of the theory of public goods. In the following discussion I propose to revisit some of the central issues treated in that paper.

When I wrote my 1962 paper, interest in the theory of public goods was only just beginning to develop. Samuelson's seminal papers (14) (15) (16) had been published in 1954, 1955 and 1958. Selections from the pioneering contributions of Lindahl and Wicksell had been published by Musgrave and Peacock (10) in 1958, and Musgrave's important contribution in *The Theory of Public Finance* had appeared in 1959 (8). Apart from Musgrave's treatise, the theory of public goods was not discussed in the public finance textbooks, and there was much controversy and uncertainty regarding the meaning and significance of the public goods concept. As we shall see, some of these controversies and uncertainties have now been largely resolved. Others, however, remain.

2. The Concept and Characteristics of a Pure Public Good

In his original paper (14, p. 387), Samuelson had defined a pure public or collective consumption good as one «which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good, so that $X_{n+j} = X^{i}_{n+j}$ simultaneously for each and every i^{th} individual and each collective consumption good.» In *The Theory of Public Finance* Musgrave defines a corresponding concept of pure social wants which «are those wants satisfied by services that must be consumed in equal amounts by all» (8, p. 8).

With this concept, which dates back to Continental discussions of the late 19th century, Samuelson and Musgrave had hoped to provide a strong polar case which the student of public expenditure could set alongside the grand Walrasian model of competitive general equilibrium in private goods. The reader of their

original contributions was left in very little doubt that pure public goods (at least) are a legitimate and indeed a necessary item of public expenditure and cannot be left to the market. Precisely *why* this is the case was, however, much less clear. Whereas Musgrave appeared to emphasize the problem of impossibility of price exclusion, Samuelson maintained that this was not the essential characteristic of the public good. It therefore seemed clear that the original concept was multidimensional with more than one characteristic, and a proper understanding of the theory required that these characteristics should be clearly defined and sharply distinguished. This was a major concern of my 1962 paper.

In that paper I argued that the public good concept has two main characteristics, joint supply and impossibility of price exclusion. In Samuelson's definition the first and most obvious characteristic is that the services of a public good are in joint supply in the special sense that, once a unit of the service is made available to one person, an identical-quality service unit can be made available to other persons at no extra cost. These descriptively identical services to the various members of the community are strictly joint products analogous to the descriptively different joint products, such as meat and hides, of traditional Marshallian joint supply analysis. My joint supply terminology has been the subject of considerable dispute, with Samuelson (17), in particular, emphasizing the dangers of any analogy with Marshallian joint supply. However, whether the term is joint supply (Head, 1962) (Buchanan, 1968), joint consumption (Musgrave, 1959), non-rival consumption (Musgrave, 1969), consumption externality (Samuelson, 1969) or collective consumption (Shoup, 1969), it seems clear that we are all referring to the same characteristic, and the differences are merely semantic.

The second distinct characteristic, emphasized (as we have already noted) by Musgrave, is impossibility of price exclusion. As he puts it, «People who do not pay for the services cannot be excluded from the benefits that result» (8, p.8). This characteristic is not discussed explicitly in Samuelson's first two papers, but it is clearly implied since $X_{n+j} = X^{i}_{n+j}$ holds *by definition* only if price exclusion is impossible. Beginning with his 1958 paper (16, p. 335), Samuelson has, however, insisted repeatedly that the jointness characteristic is in some sense *more basic* than impossibility of price exclusion, and there is some evidence that he has converted both Musgrave and Buchanan to this point of view.

Price exclusion problems are, of course, familiar to us from the traditional welfare literature as the crucial distinguishing characteristic of the Pigovian concept of external economies. In my 1962 paper I therefore referred to this second characteristic as simply an extreme case of external economies. However, external economies may also exhibit the jointness characteristic (as witness Samuelson's preferred terminology for this characteristic). A distinct term such as «impossibility of price exclusion» or Professor Shoup's «non-excludability» is therefore indispensable.

In my 1962 paper I argued that jointness and non-excludability are not merely conceptually distinct but are also completely independent. Both Samuelson and Musgrave had clearly recognized from the outset that jointness need not imply non-excludability. A theatrical performance, for example, is joint but may be charged for. There has, however, been some dispute as to whether non-excludability necessarily implies the coexistence of jointness. Musgrave originally suggested that there is such a relationship, and Buchanan (2) presents an interesting argument in support. In the light of more recent discussions, such as Shoup (19) and Musgrave (9), it now seems reasonably clear that the two characteristics are quite independent.

More recent discussions, such as Shoup (19), have also revealed the existence of a third public goods characteristic, overlooked in my earlier paper, viz. nonrejectability or impossibility of rejection. If some individuals, e.g. Quakers, may place a negative marginal evaluation on a public good like national defence, the equal consumption condition ($X_{n+j} = X^i_{n+j}$) will still hold by definition only if consumption of the service is unavoidable or non-rejectable. This characteristic appears to be of relatively minor importance for the analysis of public goods (as distinct from public bads), so I shall rule it out by assuming that individual marginal evaluations are always positive, or at least non-negative.

Even if we ignore the non-rejectability characteristic, however, the pure public good is evidently no simple polar case, as Samuelson might appear to suggest, but a double-polar case of joint supply and impossibility of price-exclusion. Although the modern analysis of this case came of age in 1975, the precise role and relative importance of these two characteristics in the theory of public goods is still quite unclear in the literature. In turning now to a discussion of the supply of public goods, I shall try to focus particular attention on these questions of precise role and relative importance.

3. Provision for Public Goods

The modern analysis of provision for public goods has three main steps or stages, not all of which were at all fully and explicitly developed in the original contributions of Samuelson and Musgrave.

3.1. Optimal Provision for Public Goods

The first step is the rigorous statement and derivation of the optimum conditions for public goods supply. This phase of the analysis was fully developed in Samuelson's early papers and represents perhaps his major contribution to the subject. His well known finding is that the conditions for efficient resource allocation in a world with a public good differ radically from the more familiar

conditions for a private goods world. In the simple two-person, two good case of his 1955 paper (15), he shows that, where one of the two goods is purely public, the marginal rate of transformation must equal the summed marginal rates of substitution, i.e. $MRS^A + MRS^B = MT$, or in the multi-person case $\Sigma MRS^i = MT$. This contrasts with the corresponding private goods case where we require $MRS^A = MRS^B = MT$.

In accordance with his «social welfare function» approach to welfare economics, Samuelson then proceeds to determine the conditions for a welfare maximum where «... the social welfare significance of a unit of any private good allocated to private individuals must at the margin be the same for each and every person» (15, p. 353). This further distributional requirement is, however, no different from that for an all-private-goods world. It was a misunderstanding on this point which led to Musgrave's well known contention that the public good introduces a fundamental welfare indeterminacy which does not exist in an all-private-goods world. This is another controversy which seems now finally to have been resolved.

It is important to notice that the $\Sigma MRS = MT$ condition results from the jointness characteristic of the pure public good. The non-excludability characteristic therefore contributes nothing at this stage of the analysis.

3.2. Problems of Market Provision

The second step in the analysis is to show that a market mechanism is incapable of satisfying the $\Sigma MRS = MT$ requirement for optimal provision of a public good. If we can show that market provision is seriously in adequate we presumably have a strong prima facie case for public provision.

In view of its fundamental importance it is surprising to find that this aspect of the theory is left largely undeveloped in the original Musgrave and Samuelson contributions. Samuelson simply asserts market failure without indicating whether it is likely to be large or small. He does, however, insist that the problem does not disappear if the non-excludability characteristic is assumed away (16, p. 335). Musgrave, by contrast, asserts that the market will produce nothing; and he suggests also that there would be no problem if it were not for impossibility of price exclusion (8, p. 10, n. 1.) Surveying these rather sparse comments in my 1962 paper, I argued that both characteristics cause market failure, and for this reason I was inclined to accord them «separate but equal» status in the theory. Most writers have simply been content to assert market failure, normally under-provision of public goods, leaving the precise role of jointness and non-excludability quite unclear.

Joint Goods

Detailed analysis of market failure due to the joint supply characteristic finally began with a paper by Thompson in 1968 (20). The setting for Thompson's analysis is a world in which both producers and consumers have perfect knowledge

of all preference functions for a purely joint good, i.e. a pure public good for which price exclusion is assumed to be costless. In this setting it is well known (and had been pointed out before Thompson) that conferring a legal monopoly on a single profit-maximizing producer would ensure efficient provision. Since consumer preferences are known and the services of a joint good cannot generally be retraded, the monopolist can discriminate perfectly and output and consumption will be Pareto-optimal. Thompson's rather remarkable contribution was to show that under perfect competition output will necessarily be *overexpanded* in this omniscient world. To illustrate the degree of overexpansion which may be involved, Thompson notes that, in the special case of constant costs, the community would be just as well off with a zero output of the joint good (20, p. 7).

A world in which producers and consumers have perfect knowledge of all preference functions is, however, of very little interest. The essential raison d'etre of the market system in relation to private goods is that it provides an economical method of communicating accurate information on individual demands under realistic conditions in which such information is effectively decentralized and known only by the potential consumers themselves. The important question is whether the market can perform the same function in the case of price-excludable public goods.

The first detailed attempt to analyze perfectly competitive production of joint goods where individual demands are unknown appears in a paper by Demsetz in 1970 (5). Applying the Marshallian joint supply analogy, Demsetz argues that output and consumption will in fact be Pareto optimal under competition, provided only that producers can distinguish and effectively separate the different categories of consumers and that there are large numbers of consumers in each demand category. According to Demsetz, competitive bidding by buyers in each demand category will serve to reveal the relevant marginal evaluations, and equilibrium will be established at a Lindahl optimum with price equal to marginal evaluation for each category of consumers.

Unfortunately this is a perfect example of the dangers, emphasized by Samuelson (17), of an uncritical application of Marshallian joint supply analysis to public goods. In contrast, say, to the market for meat in the Marshallian meat and hides analysis, more for one consumer in a particular demand category for the joint good entails no reduction in the amount available for any other consumer. The competitive bidding which ensures marginal evaluation pricing in each submarket (for meat and hides) in the Marshallian case is therefore wholly absent in the case of a joint good. As Lindahl first pointed out in 1928 (10, p. 223, n. 12), the market situation on the buying side is in fact analogous to monopsony rather than to competition. The Demsetz analysis therefore breaks down.

The most convincing solution thus far appears in a paper by Oakland (11) published in 1974. Since firms lack knowledge of the differing preference functions of different individuals, Oakland argues, as against Demsetz, that the price of any

given unit of the joint good must be identical for all consumers of that unit. At the same time a central feature of his solution is that different prices will be charged for different units of the joint good.

Beginning with the supply side of his economy, and assuming constant costs, Oakland notes that, under competition with free entry, any given unit of the good will be produced if and only if revenues just equal costs, i.e., $Pn = c$, or $P = \frac{c}{n}$ where P is the price of that unit to each consumer, n is the number of consumers of that unit, and c is the average (equal to marginal) cost of producing that unit. If different numbers of individuals consume the different units of the joint good, the prices of these units must clearly differ.

On the demand side Oakland observes that potential consumers will be ndifferent between different units of the joint good having different numbers of iconsumers. (The good is purely joint in the Samuelson sense that additional consumers of a given unit in no way reduce the enjoyment of existing consumers.) As we have seen, however, *prices* will vary over units if the number of consumers differs as between different units. Consumers will therefore purchase the cheapest units first. In general, according to Oakland, an equilibrium will be established with a number of different prices which may (but need not) be as large as the number of distinct consumer demands.

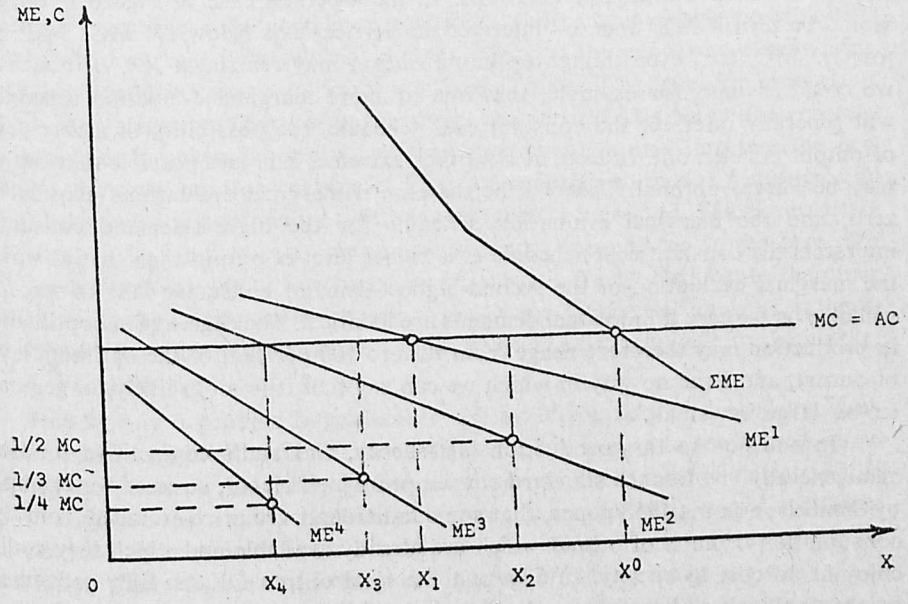

Figure 1

Oakland's solution is illustrated in Figure 1 for a simple case of just four potential consumers with marginal evaluation schedules ME^1, ME^2, ME^3 and

ME^4. According to Oakland, competition will ensure that the first OX_4 units will sell for precisely $^1/_4$ MC and these units will be purchased by all four consumers. A further X_4X_3 will then be sold to the three highest demand consumers at a price of 1/3 MC; and a final X_3X_2 units will be sold to the two highest demand consumers at a price of $^1/_2$ MC. Total output is therefore OX_2.

Some of the details of the equilibrating process are not entirely clear in Oakland's exposition, but if we assume provisionally that he is correct, it seems clear that a competitive market is generally capable of producing significant quantities of a purely joint good. As he points out, however, the competitive equilibrium departs from Pareto optimality in two respects, and this is easy to see from Figure 1. In the first place total output OX_2 is generally too small. At OX_2 the summed marginal evaluations exceed marginal cost, and the optimum is at OX^0 where $\Sigma ME = MC$. Is the degree of suboptimality in production likely to be large or small? The answer appears to be very sensitive to the shape and position of the individual marginal evaluation schedules in relation to marginal (and average) cost. (Figure 1, of course, shows only one particular case.) At one extreme it is just possible that nothing whatever may be produced. This will be the case if the marginal evaluation schedule for each individual intersects the vertical axis below $\frac{1}{m}$ MC, where m is the individual's position in a ranking of potential consumers in accordance with their marginal evaluations. In the 4-person case of Figure 1, output would be zero if ME^4 was to intersect the vertical axis below 1/4 MC, ME^3 below 1/3 MC, etc., even though optimum output may remain at X^0. If, however, we could assume, for example, that one or more marginal evaluation schedules will generally intersect the constant cost schedule, the possibility of a zero level of output is ruled out. Indeed, at the other extreme, it is just possible that output may be Pareto optimal. This will be the case if marginal evaluations may fall to zero, and the marginal evaluation schedule for the highest-demand consumer intersects the constant cost schedule at a higher level of output than that at which the marginal evaluation of the second-highest-demand consumer falls to zero. It will also be the case if individual demands are identical. The degree of suboptimality in production may therefore range from zero to 100 per cent of the optimum level of output, and I see no way in which we can say that it is more likely, in general, to be large or small.

In addition to this production inefficiency, Oakland's competitive solution also generally involves the standard consumption inefficiency, stressed for example by Samuelson in his 1958 paper, that some individuals are price-excluded from the consumption of units of output which are already available and which they could enjoy at no cost to society. In Figure 1 the total output OX_2 is fully consumed by the two highest-demand people, but the two lowest-demand people are price-excluded from consumption of some units which they could enjoy at no social cost. These additional welfare costs may also be large or small in relation to total benefit. They will tend to be large, for example, where consumer demands are relatively elastic.

Public Goods

Recent analysis of joint goods therefore clearly supports Samuelson's original assertion that a decentralized market regime of perfect competition is not generally capable of ensuring an allocatively efficient supply of goods exhibiting the pure jointness or collective consumption characteristic. There is little sign however, of the traditional conclusion from the older public goods literature, which we find also in Musgrave (8), that little or nothing can be provided through the market. Musgrave, as we have seen, specifically attributes the complete failure of the market to impossibility of price exclusion. What difference does it make to the market failure problem if we add the further characteristic of impossibility of price exclusion and transform the purely joint good into the purely public good?

In the simple case of four consumers presented in Figure 1, let us assume that price exclusion is not possible. We shall continue to assume that our four consumers behave independently, so that we have an interaction process analogous to the multiconsumer competitive model. Following Olson and Zeckhauser (12) and others, equilibrium under independent adjustment (and ignoring income effects) is established at a level of output for the pure public good of X_1, with the highest demand person 1 paying the full cost of the equilibrium output. As in the case of a purely joint good, it is easy to see from Figure 1 that the level of output must generally be suboptimal. Moreover the degree of suboptimality must generally be greater than where the good is merely joint. Indeed it is clearly possible that nothing whatever may be produced in cases where, if the good was merely joint, the Oakland solution would be Pareto-optimal. This will be true, for example, if individual demands are identical but intersect the vertical axis below the constant cost schedule. In general, however, where some demands may intersect the cost schedule, the small-number analysis of Figure 1 suggests no reason for supposing that the degree of suboptimality need be very greatly increased. Moreover, there is no sign of the familiar consumption inefficiency encountered in the case of a joint good. The total output purchased by person 1 is freely available to the other consumers. In the small-number setting of the Olson-Zeckhauser analysis, it therefore appears that impossibility of exclusion may add relatively little to the market failure problem for joint goods.

However, in a genuine large-number setting of the sort envisaged by Musgrave, a more significant difference seems likely. This is easy to see if we assume explicitly that there is not just one but hundreds or thousands of demands like ME^1 (and ignore the other schedules in Figure 1). In this simple case we know that Oakland's joint goods equilibrium is Pareto optimal, and will as a rule be much larger than OX_1 which (if we ignore income effects) remains the most plausible equilibrium solution for the non-excludable case. In general, I think we can say that as long as no single economic unit has a demand which is large in relation to the aggregate of all demands, a significant increase in the degree of market failure can reasonably be expected when we add non-excludability to the jointness charac-

teristic. In this sense I am inclined to argue that non-excludability is the more potent cause of market failure.

3.3. Problems of Political Provision

The third and final step in public goods analysis is to consider the possible advantages and problems of public provision. The demonstration of significant market failure problems in the supply of public goods provides, of course, no guarantee that the political mechanism will prove more effective. In their original contributions both Samuelson and Musgrave recognize explicitly that political provision for public goods must pose difficult problems, and both stress the problem of determining individual preferences. However, neither of them provides much in the way of formal analysis, and we are left with the very strong impression that a significant improvement can generally be expected under public provision. Reflecting this relative neglect, my 1962 paper contains no discussion of the problems of political provision, but it is clearly implied that government has a clear comparative advantage in relation to both public goods characteristics.

From a mountainous literature on political decision-making, I am inclined to think that the Downs model of majority voting yields the most direct and immediate insights into the problems of public provision. Following Downs (6), let us therefore consider the provision of a pure public (joint *and* non-excludable) good in a parliamentary democracy characterized by competition for political power between two vote-maximizing political parties. If both parties have perfect knowledge of voter preference functions, and voters have perfect knowledge of party programmes, competition for votes will tend to force each party to propose a Pareto-optimal programme of public goods supply. For any non-optimal programme, there will be many optimal programmes capable of attracting unanimous voter support. If the parties must announce their programmes simultaneously, the maximization of electoral prospects clearly requires that party programmes should be Pareto-efficient. The analytical setting here corresponds closely to that of Thompson's analysis of market provision for purely joint goods where, as we saw earlier, an omniscient profit-maximizing monopolist will ensure optimal provision. In Thompson's analysis, however, the introduction of competition leads to over-expansion, whereas in the political setting of the Downs model, competition provides the incentive to efficiency.

The assumption that political parties have perfect knowledge of voter preferences and voters have perfect knowledge of party programmes is, of course, extremely unrealistic. When we relax these assumptions we immediately encounter the problem, stressed by Samuelson and Musgrave, of determining individual preferences for public goods. If, for example, voters believe that tax shares will be related to revealed preferences, they will have an obvious incentive to behave strategically and understate their true preferences for public goods. Any party

attempting to design a Pareto-optimal benefit tax programme would therefore find itself involved in a multitude of bilateral monopoly relationships with individual voters. Evidently no close approach to Pareto optimality could generally be expected by this route. If a fixed tax constitution could somehow be established, strategic misrepresentation of voter preferences may be avoided. However, except in very special cases of the sort first analysed by Bowen (1), the fixed tax constitution will generally produce distortions of its own. The problem here is analogous to that of the franschised monopolist attempting to supply a joint good in a situation where consumer preferences are unknown. If he attempts to discriminate perfectly, consumers will have every incentive to misrepresent their true preferences. If, as a result, he abandons any attempt to discriminate and announces (say) a uniform price, the problem of strategic misrepresentation of true preferences disappears, but Pareto-optimal provision is generally impossible even if the monopolist is profit regulated.

Analysis of the Downs model serves, I think, to point up rather clearly the possible advantages of public provision in relation to the non-excludability characteristic. Although we encounter preference-determination problems closely analogous to those involved in market provision of joint goods, there is no sign of the fundamental non-excludability problem that, since nothing can be charged, nothing will be provided. Possession of the tax power (or printing press) effectively transforms the public good into a joint good for purposes of political provision. The log-rolling models of Buchanan and Tullock (4) serve to warn us, however, of «political externalities» which may further impair political performance. Under majority voting, interest groups may combine to support special-benefit projects, the cost of which is borne out of general taxation. As a result, some of the advantages of public provision in relation to the non-excludability characteristic may be lost due to the emergence of precisely analogous problems in the political process. In standard large-number cases there is nevertheless a strong presumption that a significant net improvement can generally be expected.

In the case of the jointness characteristic the benefits from political provision seem somewhat uncertain. Possession of the tax power here offers the possible advantage that government can provide the joint good at a zero price, thus avoiding the familiar problem of consumption inefficiency. The serious problem then emerges, however, of achieving a reasonable approximation to an optimal level of production under public provision, bearing in mind our finding above that a competitive market is likely to supply quantities which may not be greatly suboptimal. Recent research on the demand-revealing process suggests that it may nevertheless be possible to devise procedures which will ensure reasonably accurate preference revelation by consumers of a purely joint good. And it is interesting to observe that the most promising of these procedures, notably the «Clarke tax», discussed in a recent paper by Tideman and Tullock (21), clearly requires the exercise of the tax power for its effective implementation. This technique could not therefore

be employed by private firms, even in the sbecial case of a franchised monopolits. It would thus appear that government has a clear comparative advantage, even in relation to the jointness characteristic; and the same argument further reinforces the strong presumption in favour of government provision in the case of the non-excludable purely public good.

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