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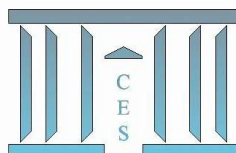
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Abstract

This paper provides an explanation of the emergence of the standard textbook definition of public goods in the middle of the 20th century. It focuses on Richard Musgrave's contribution in defining public goods as non-rival and non-excludable – from 1939 to 1969. Although Samuelson's mathematical definition is generally used in models of public goods, the qualitative understanding of the specificity of pure public goods owes more to Musgrave's emphasis on the impossibility of exclusion. This paper also highlights the importance of the size of the group to which benefits of a public good accrue. This analysis allow for a reassessment of the Summary table of goods which first appeared in Musgrave and Musgrave (1973) textbook.

Keywords: Richard A. Musgrave, social goods, public goods, non-rivalry, non-exclusion

De la définition économique des biens collectifs. Les apports de Richard A. Musgrave

Cet article retrace l'émergence de la définition standard des biens collectifs au milieu du 20e siècle. On y traite de la contribution de l'économiste américain Richard A. Musgrave à la définition des biens collectifs comme répondant à un double critère de non-exclusion et de non-rivalité. Dans la deuxième partie, on met en lumière l'importance de la taille du groupe concerné pour la définition des biens collectifs, ce qui nous permet de proposer (troisième partie) une amélioration au tableau synthèse qui apparaît pour la première fois dans le manuel de Musgrave et Musgrave (1973).

Mots clés : Richard A. Musgrave, biens sociaux, biens collectifs, non-rivalité, non-exclusion

JEL Codes: H41, B29, A22

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Introduction

This paper is on the history of the concept of Public Goods which came to maturity in the new American Public Finance, roughly from 1939 to 1969. It focuses on Richard A. Musgrave's contribution which has been overshadowed by Samuelson's (1954; 1955) brilliant formal exposition. The former's impact is decisive especially on the standard textbook definition. Contrary to what has been claimed by Malkin and Wildavsky (1991), there is a constant or at least very popular way of defining (pure) public goods in textbooks as the goods which are neither rival, nor excludable. Musgrave (1969) was the first to use this two-criterion definition as Pickhardt (2006) has justly noted (in a paper that focused mainly on Samuelson's definition of public goods).

Specialized articles on the definition of public goods like Sandmo (1987); Cornes and Sandler (1994); Sturn (1998); Ver Eecke (1999) use this two-criterion. It is also used in popular public economics texts like Myles (1995); Cornes and Sandler (1996); Stiglitz (2000); Hindriks and Myles (2006); Rosen and Gayer (2009); Gruber (2011), as in general introductory textbooks such as Mankiw (2006, 2003); Ragan and Lipsey (2007); Nicholson and Snyder (2008), and even in more advanced manuals like Varian (1992) and Mas-Colell et al. (1995).¹ It is striking that none of the aforementioned authoritative texts, except for Ver Eecke's 1999 paper – which as a matter of fact is not a highly quoted paper – refer to Musgrave on the topic of public goods. Microeconomic textbooks are not generally praised for their historical depth, yet they all mention Samuelson. The largest specialized book on the topic, Cornes & Sandler's (1996) *The Theory of Externalities, Public Goods and Club Goods* contains short historical references to Adam Smith and David Hume on public goods, but none of the original contributions of Musgrave appear in the 26 pages of references at the end of the volume. This observation corroborates Medema's remark on how textbooks treat the history of economics: "their historical discussions, to the extent that they exist, are generally limited to bits about the giants of the past, on whose shoulders the moderns stand, scattered throughout the text" (Medema, 2011, p. 25). Thus, perhaps Musgrave is not referred to because he didn't win the Nobel Prize, or perhaps his modesty on his own contributions is to blame. Another explanation would be that his contribution, or 'synthesis' (Sturn, 2010), in the theory of public goods is mainly conceptual and has not led to any formal mathematical model which are the building blocks of contemporary economic texts.

In the history of economic thought literature, Johnson (2006) explained the different interpretations of K. Wicksell by James M. Buchanan and Musgrave, and Sturn (2006, 2010) has analyzed in details the influence of interwar *Finanzwissenschaft*, and other German and Austrian sources on Musgrave's theory of Public

¹The later describe public goods as 'nondepletable' (p. 359) and note that they can be classified according to a second distinction – whether exclusion is possible or not (p.360). The authors also refer to 'nonrivalrous' as synonymous to 'nondepletable'.

Finance. Dougherty (2003) acknowledged Musgrave’s role in the conceptualization of the free rider hypothesis, and Pickhardt (2006) showed that “it was indeed Musgrave who primarily assembled the popular contemporary definition of public goods mentioned above” (p. 448). Moreover, one should recognize the work of Australian economist John G. Head (1962; 1965; 1968; 1977) who commented and tried to solve some theoretical issues in the academic discussion on public goods in the 1960s and 1970s by referring extensively to Musgrave. One recent exception is the entry on Richard A. Musgrave in the *New Palgrave Dictionary of Economics* written by Mieszkowski (2008) who claims that Musgrave made “original and lasting contribution” in “public goods theory”, but he does not give proofs of his claim.

Hence, no systematic and retrospective analysis of Musgrave’s contribution in defining public goods has been made – to my knowledge. In complement to Sturn (2010), I would like to stress in this paper that free riding was central to Musgrave’s market failure approach to public goods which sets him apart from the voluntary approach which received so much attention in public economics since the 1970s. Furthermore, following the two-criteria definition, many introductory texts like Mankiw (2006, 2003); Hindriks and Myles (2006); Ragan and Lipsey (2007); Nicholson and Snyder (2008), and Gruber (2011) make use of a two by two table in order to classify 4 different families of goods according to the possibility of excluding consumer from their benefits or not, and if they are intrinsically rival or not. This pedagogical device was first conceived by Musgrave and Musgrave (1973), although no reference to its origin is to be found in any textbooks.

Another way of situating this paper is to separate the conceptual stages of the modern concept of public good in public finance. First (1), one can circumscribe a qualitative understanding of the issues at stake in public goods. Lumpiness, jointness, or indivisibility is one dimension that was first recognized by old Continental public finance scholars.² The other dimension – the impossibility of exclusion – which leads to free riding which, in turn, create difficulties for charging and for revealing preferences was first stated very clearly by Musgrave. The association of the two necessary criteria which eventually made its way in textbooks has to be also credited to Musgrave. This will be the main concern of the first section of the paper.

Second (2), comes the mathematical definition of collective consumption goods given by Samuelson (1954, p. 387): Let there be n private consumption goods in an economy $X_1 \dots, X_n$ which can be divided among s agents ($i = 1, \dots, s$) according to the equation $X_j = \sum_{i=1}^s X_j^i$. Let also be m collective consumption goods ($X_{n+1} \dots, X_{n+m}$) which are such that for every good j from $n+1$ to $n+m$, the following relation holds: $X_j = X_j^i \forall i$. In other words, those peculiar goods

²Namely Wagner, Sax, Mazzola, Wicksell, Lindahl, Cassel and others whose foundational work are partly translated in Musgrave and Peacock (1958). On their contribution, see Sturn (2006, 2010); Medema (2005); Wagner and Backhaus (2005); Sinn (2009), and Musgrave’s (1983a; 1985; 1996a; 1997) papers on the history of public finance.

are simultaneously and collectively consumed (in equal amounts) by all the agents: “each individual’s consumption of such a good leads to no subtraction from any other individual’s consumption of that good” (*ibid*). Samuelson then derives the necessary condition for optimal provision of those collective goods which states that the *sum* of the marginal rate of substitution over all the agents must be equal to the marginal rate of transformation between every pair of goods. This mathematical development and the further precisions made by Samuelson (1955, 1958) have been extensively discussed by Musgrave (1983b); Pickhardt (2006) and will not be the object of this paper.

Third (3), there is the concept of ‘merit wants’ which has been invented by Musgrave (1957) to describe types of public wants that can be satisfied by goods (merit goods) “provided for through the public budget, over and above what is provided for through the market and paid for by private buyers” (Musgrave, 1959, p. 13). Contrary to social goods (Musgrave’s name for public goods), merit goods can involve interference with consumer’s sovereignty. Examples of merit goods are transfers in-kind like housing for the poor, funding for elementary education, health, public parks and museums, etc. Merit goods can only be understood as a complement to the concept of pure public (or social) good in public finance. Therefore, although this paper will not cover the debate on merit goods, it is hoped that by improving our understanding of public goods, it constitutes a step in a better appreciation of the problem that merit goods raise.³

Fourth (4), following Wicksell (1896) and the market failure verdict, Musgrave (1939) suggested that in order to provide the public (social) goods in line with the preferences of consumers, political solutions for determining which goods and services should be provided by the State must be studied. An interesting discussion is to be found in Musgrave (1959, chapter 6), but major developments in this area grew into two different sub-disciplines namely Social Choice Theory and Public Choice, and will therefore neither be the topic of this paper.⁴

Fifth (5), the 1960s and 1970s saw the extension and the generalization of the concept of public goods to impure or mixed goods. The major contributors to this work are James M. Buchanan, Charles M. Tiebout, and Mancur Olson. Although Musgrave didn’t play a key role in the burgeoning of this literature, his 2x2 table constitute a brilliant synthesis of the diversity of goods. In the second and third section of this paper, I would like to show how this table can be improved by incorporating the size of the group to which benefits accrue as a third variable in the typology of public goods. Surprisingly, while Musgrave’s critique of the voluntary approach to public goods rests on an argument about the effect of large

³For a recent discussion, see “The Merits of Merit Wants” by Richard Sturn, Paper presented in May 2013 at the 17th Annual ESHET Conference (Kingston, UK).

⁴For preliminary historical work on the emergence of Public Choice and Social Choice, see “The rise and fragmentation of collective choice in the postwar era” by Béatrice Cherrier and Jean-Baptiste Fleury, Paper presented in May 2013 at the 7th Annual HISRECO Conference (Cergy, FR).

number, he was not the first to see how public goods should be qualified by the size of the group. The other strand of thought followed by the theorists advocating voluntary exchange, through the prism of external effects rather than focusing on objective goods and market failure, developed more naturally the idea that the size of the group was an important characteristic of public goods.

The goal of the paper is twofold. First, it aims at filling the gap described above in the history of the theory of public goods, by appraising Richard A. Musgrave's contribution. As Medema (2011) recently argued, textbooks are worthwhile to study in a historical perspective, because they are important mechanisms in the transmission and in the normalization of knowledge. This paper is not a comprehensive study of a textbook, but an inquiry on one important element found in many textbooks. Thus, it is hoped that this paper will contribute to the understanding of the construction of one layer of the domain of modern public finance. Second, it is claimed that the textbook definition of public goods and the 2x2 table that results is a useful pedagogical device to introduce students to public economics by suggesting a clear first best solution to the question of the boundary of State action. Hence, the third section suggests a small improvement in the way the theory of public goods is taught with the use of the summary table.

1 Musgrave's writings on Social Goods

'Semantics, as the history of economic thought so well shows, is not a trivial matter' (Musgrave, 1969, p. 142).

Musgrave himself might be partly responsible for the failure to recognize his contribution in the general understanding of the public goods problem, as he is quite humble on the matter. In the autobiographical papers (1983a; 1997), as in the different essays on the history of public finance (1983b; 1985; 1987; 1991b; 1996a), he does not acknowledge his input on public goods (with the exception of merit goods). He merely credits himself for having transmitted the scandinavian model to English-language scholars (Musgrave, 1987). His german background gave him a "comparative advantage" (Musgrave, 1996b) on the topic of public finance. Hence his modest self-appraisal: "My initial paper on the Wicksell-Lindahl model (1939), I like to think helped to bring the problem to the attention of Paul Samuelson, then a fellow graduate student at Harvard" (*ibid.*). This claim has been partly corroborated by Samuelson who remarked in a brief eulogy of Musgrave: "All I ever knew about the Wicksell-Lindahl Paradigm of Public Goods, I learned only from Musgrave's 1937 Ph.D. dissertation." (Ott et al., 2008, p. 233) Therefore, it seems reasonable to start by investigating Musgrave's first paper, based on his doctoral dissertation, in which he introduces the voluntary exchange model of public expenditure.

The Critique of The Voluntary Exchange Theory

Two years after handing in his PhD thesis at Harvard, Musgrave's first paper was published in the *Quarterly Journal of Economics* in 1939 while he was serving as instructor in the economics department. The paper is a reconstruction of the Voluntary Exchange Theory of Public Economy as can be found in E. Sax, De Viti De Marco, K. Wicksell, and in a more matured form in E. Lindahl. In their perspective, "taxes accordingly appear as voluntary payments rendered by the individual in exchange for services supplied by public economy, and in accordance with his evaluation of those services." (Musgrave, 1939, p. 214). The young Musgrave, by then 29 years old, put forward many arguments against the voluntary approach – but his main contention is the unrealistic nature of the model which relies on the hypothesis of voluntary exchange: "[C]onsidering the predominantly compulsory nature of the actual revenue-expenditure process, this assumption must be rejected as highly unrealistic." (*ibid.*, p. 219) As he puts it in the conclusion of the paper, to be a useful guide for policy, a theory of Public Economy must be compatible with the real institutional framework: "There is little merit in sacrificing the practical significance of our theoretical framework for the apparent benefit of unrealistic simplification." (*ibid.*, p. 237)

The most important argument, for this investigation, against the plausibility of the voluntary payment for public services is to be found in a long footnote that must be quoted at length:

We note the theoretical difficulty which arises for the voluntary exchange theory in the event that some of the members of the community should attempt to benefit from public services without in turn being eager to contribute their share [...] if the total cost of public services is covered by a large number of contributors, a reduction in the contribution of any one contributor will fail to affect notably the total supply of public services – either from the point of view of this contributor or in the eyes of other contributors who join in the consumption of the same indivisible services. Hence the reduction will result in a gain for the contributor in question without leading to reprisals. If all contributors should accordingly decide to reduce their contributions, the volume of public services will tend to shrink, and an unstable situation will result. (p. 219-220, n.5)

One finds here the first clear exposition (at least in English) of what would later be called the *free rider* hypothesis.⁵ It derives from the situation where a *large*

⁵On the use of the expression, Tuck (2008, p. 19) acknowledges Buchanan (1965b) originality: "[He] spelt out the relevance of large groups to the 'free-rider' problem in public finance theory, and drew attention to a similarity between this argument and the prisoners' dilemma, though he was also well aware of the important difference between them." Yet, Tuck (2008, p. 202) later writes that "[George] Stigler's discussion of cartels in the 1966 edition [of *The Theory of Price*] effectively introduced the term 'free rider' into academic discourse, though it was a term which

number of individuals contribute to a collective good or service. Because of this large number of contributors and the fact that they all benefit collectively from the service, one individual could reduce his contribution (if he was not forced to pay for it) without the others noticing it. This individual would then be free riding – benefiting from the service without actually paying for it – but if many act like him, the aggregate level of contribution would fall and the service could not be properly funded. This is the essence of a problem of collective action.⁶

Marciano (2013) remarks that Buchanan (1964) aptly described the ‘the spectre of the free rider’ in public goods. Buchanan uses the expression again in 1965a; 1965b; 1966 and in many other papers and books published later. H Musgrave adds another characteristic to the nature of public services. He writes: “All parties jointly benefit from the same total of public services” (*ibid.*, p. 224). To which he adds in a footnote: “The product of public economy is ‘divisible,’ in the sense that its supply may be increased by small units, but ‘indivisible,’ in the sense that no separate ‘benefit shares’ may be attributed to individual purchasers.” (p. 224, n.9) In sum, one can find already two central dimensions of public services: 1) Voluntary provision cannot be sustained because of the free rider mechanism and 2) they provide ‘joint’ benefits, or benefits which cannot be divided among the members of the economy.

In place of the Voluntary Exchange Theory, Musgrave proposes a ‘planning’ model that would be applicable to a mixed private-public economy. A government in such an economy has two problems to solve: “the choice of wants to be satisfied” and the “execution of such want satisfaction” (*ibid.*, p. 232). The later problem is easily solved by applying the “principle of least cost” (*ibid.*). As to the former, which is more substantial, the task is to choose between the satisfaction of alternative public and private wants (under the assumption of want homogeneity). The public authority must resort to a given ‘scale of social wants’ which is “registered through the medium of public policy.” (*ibid.*, p. 233)

The next year, Neal (1940) published a critique of Musgrave’s ‘Planning Approach’, contending that the formation of a social preference scale in which an individual could compare the benefits he gets from the protection of an additional destroyer to eating another apple was not feasible. Concluding that the provision of collective demands must then be arbitrary, he warned against such ‘partial planning’ which would ‘subvert the democracy’ since individuals would not always be able to exercise and express their rational judgment. What is interesting here is

had long been used among trade unionists.” Despite that claim, Marciano (2013) remarks that Buchanan (1964) aptly described ‘the spectre of the free rider’ in public goods. Buchanan uses the expression again in 1965a; 1965b; 1966 and in many other papers and books published later. Hence it seems it was rather Buchanan who used the expression first in the context of public goods.

⁶This line of reasoning will be taken up by Olson (1965). See Section 2 herein.

not so much this extension of the Mises-Hayek argument to ‘partial planning’, but the reply that Musgrave (1941) published the year after.

For resorting to a planning model that gives legitimacy to the government action in providing goods and services, Musgrave insists on the difference of nature between collective and private wants. Although both types of wants are homogeneous in the sense that they are assessed by the individual⁷ in the formation of his preferences – an act that falls outside the scope of economics – they differ since “collective wants are satisfied only where the cost of supplying goods or services is financed out of general revenue and where the benefits accrue to the community at large or to some of its members independent of their own contributions” (Musgrave, 1941, p. 319, n.3). One could notice that the first feature of collective wants given here is positive, rather than normative. It is not far from the positive sociological or institutional approach that defines public goods as those that are provided by the State.⁸ Yet, the other feature – that these wants are satisfied by goods which benefit every member of a given group (community) independently of each individual’s contribution hints at a normative criterion. This must be so because the individuals are coerced into consuming the goods, since if they were asked for a voluntary contribution, they would free ride and the service would not be provided. Thus, coerced tax funding is necessary to avoid the free rider pitfall. Musgrave frames the issue further: “[T]he individual members of the community will attempt to minimize their contributions, knowing that *they can not be excluded* (my emphasis) from the benefits” (Musgrave, 1941, p. 320, n.4).

This last remark is the first occurrence in Musgrave’s writings of the idea that voluntary provision (i.e. market allocation) of collective goods will fail because of the impossibility of exclusion. In other words, and assuming a retrospective point of view, it has been found that individuals express collective wants that must be satisfied by the Public Economy because the goods provided give rise to benefits independently of individual contributions since exclusion is not possible (within a certain group). What’s more, these goods are indivisible in the sense that individuals benefit ‘jointly’ from them. The intuitions of the standard textbook definition are accordingly already there, but the specific rationale of each criteria are not yet clear and explicit.

In addressing the unrealisticness criticism of his model by Neil, Musgrave formulates the core idea of his normative approach⁹ to public finance: “I am aware that my model offers no realistic theory of a descriptive sort, but it is realistic in the sense of pointing towards an attack on the real issues of present day public finances. The planning model expresses the rationale of efficient government; it supplies us with a norm against which the accomplishments of our actual revenue-expenditure

⁷A somewhat similar idea is already stated by De Viti de Marco (1934, p. 38): “Only the individual can feel pain or pleasure; in this respect, the wants of the group as a whole do not differ from individual wants, since both have their origin in the individual.”

⁸See for example Colm (1956) or Malkin and Wildavsky (1991).

⁹On this, see Desmarais-Tremblay (2012)

process may be checked" (*ibid.*, p. 324). This will be the guiding line for his work in the 1950s which led to the publication of the *Theory of Public Finance* in 1959.

Toward the *Theory*

In 1941, Musgrave moved to Washington to work as a research economist at the Federal Reserve. He soon got in charge of the fiscal affairs section, later to become a special assistant to the Fed chairman, Marriner Eccles (Musgrave, 1997). But he eventually missed academia and accepted a position at the University of Michigan at Ann Arbor in 1948, then he moved to John Hopkins in 1958, and then to Princeton at the Woodrow Wilson School in 1962 (Musgrave, 1991a, 1997). Peacock (1992) recalls having read a first draft of the *Theory of Public Finance* when he met Musgrave in 1953 and Samuelson (1955, p. 334) refers to a preliminary version in a footnote. That year, Musgrave presented a paper at the annual convention of the Econometric Society in which he set forth the basic structure of his normative *Theory* in 3 branches (the service branch, the distribution branch, and the stabilization branch) which correspond to the three main functions of the public budget. Each branch performs its function on the assumption that the two others will meet their objective. For the service branch, which is responsible for determining the goods and service that must be provided to satisfy public wants, this means that a "proper" state of distribution has been secured by the distribution branch and that full employment is guaranteed by the stabilization branch. This implies that the service branch can balance its budget, or that public services can be provided according to the Benefit Principle¹⁰ which links revenues and expenditures together.

Musgrave again assumes homogeneity between private and public wants, they are both "individual wants" (Musgrave, 1957, p. 334). The main difference between the two being that "goods and services supplied in the satisfaction of *public* wants *must be consumed in equal amount by all* (original emphasis)." (*ibid.*) Two implications are then drawn by the author. First, if a voluntary solution would be possible, then the aggregate demand curve for an indivisible good must result from the *vertical* addition of the individual demands. This result can somehow be derived from Lindahl's model and was stated in those terms by Bowen (1943) and later recuperated by Samuelson (1955).

Second, "since the same amount will be consumed by all, individuals know that they cannot be excluded from the resulting benefits. This being the case, they are not forced to reveal their preferences through bidding in the market. The 'exclusion principle', which is essential to exchange, cannot be applied; and the market mechanism does not work." (*ibid.*)¹¹ In this quote, Musgrave draws a

¹⁰With the exception of merit wants which arise out of a problem of separating the service and the distribution branch in the case of transfers in kind.

¹¹At this point, Musgrave credits Wicksell (1896) for this reasoning, but one cannot find it so clearly stated in Wicksell, at least not in the parts that have been translated by James M.

causal explanation of market failure from the distinctive character of public wants. Clearly here both the indivisibility or jointness, and the impossibility of exclusion are linked together. The former has received a clearer statement probably influenced by Samuelson's (1954) mathematical definition quoted above: The same amount of good is consumed by all. Then, Musgrave infers that this leads to the impossibility of exclusion. In some sense, this claim is tautological. If somebody was excluded, then there would be at least one individual not consuming the good, therefore it wouldn't be a public good according to this definition.¹² Thus, knowing that they cannot be excluded, individuals will not be forced to reveal their preferences and the market fails both as a mechanism of preference revelation (to know which goods in which quantity must be produced), but also – as it was already clear in 1939 – as a way to pay for the goods.

In the *Theory*

In the published version the *Theory*, the service branch is renamed *Allocation branch*. Its function is to provide for the satisfaction of *Public Wants*, which are of two kinds: Social Wants and Merit Wants. Notice the slight difference with the previous definition: "Social wants are those wants satisfied by services that must be consumed in equal amounts by all. People who do not pay for the services cannot be excluded from the benefits that results; and since they cannot be excluded from the benefits, they will not engage in voluntary payments. Hence the market cannot satisfy such wants. Budgetary provision is needed if they are to be satisfied at all." (Musgrave, 1959, p.8). Here the impossibility of exclusion is not inferred from the jointness in consumption. Musgrave argues that this specificity leads to two problems. First, preferences will not be revealed, hence the government has to find a way to 'induce' citizens to reveal them. Second, even if preferences would be known, contrary to market functioning, there is no single given optimal solution. Thus a Social Welfare function is required to select the desired state of distribution.¹³ Musgrave adds some further clarification on social wants: "[S]uch wants cannot be satisfied through the mechanism of the market *because* (my emphasis) their enjoyment cannot be made subject to price payment". (*ibid*, p. 9) In the case of private goods, property rights entitle the owner to exclude others from enjoying the benefits she derives from the good. This is what Musgrave calls 'the exclusion

Buchanan in Musgrave and Peacock (1958). Musgrave might have had this passage in mind: "If the individual is to spend his money for private and public uses so that his satisfaction is maximized, he will obviously pay nothing whatsoever for public purposes (at least if we disregard fees and similar charges). Whether he pays much or little will affect the scope of public services so slightly, that for all practical purposes he himself will not notice it at all. Of course, if everyone were to do the same, the State would soon cease to function. The utility and the marginal utility of public services (Mazzola's public goods) for the individual thus depend in the highest degree on how much the others contribute, but hardly at all on how much he himself contributes." (p. 81-82)

¹²This ambiguity will be resolved later when it is shown that one must introduce a group variable.

¹³Head remarks that Musgrave is wrong on this, since even in a world of purely private goods, there is rarely a single optimum.

principle' and it does not apply in the case of social wants. Hence, in one sense, Musgrave (1959) seems to think that it is the impossibility of exclusion that is the cause of market failure. This is a source of disagreement with Samuelson and Head who argue that the market failure is caused by the jointness dimension in public/social goods.¹⁴

As in the 1939 and the 1941 papers, the most important words on social goods of 1959 are to be found in a footnote that must be quoted in full:

It is evident that the case of social wants must involve joint consumption, but joint consumption, as usually defined, does not necessarily involve social wants. A circus performance involves joint consumption on the part of those who attend. Yet entrance fees can be charged, different amounts can be consumed by various people and the service can be provided through the market. Demand schedules can be added horizontally. (See p. 76) For a social want to arise, the condition of equal consumption must apply to all, whether they pay or not. In other words, we must combine the condition of joint consumption with that of inapplicability of the exclusion principle. Only then will demand schedules be added vertically. (*ibid*, p. 10 n.1)

For the first time, it is clearly stated that two conditions must be met in the case of social wants – which on consistency grounds should have called for a rewriting of the definition of social wants given earlier. This fact becomes evident in the case of an outdoor circus, which was one of the two examples of public goods, along national defense, given by Samuelson (1955, p.350). Musgrave observes here that circuses, contrary to national defense, do not result in market failure. Hence there must be another necessary condition for market failure in the case of social wants, namely impossibility of exclusion.

Finally, the author reckons that since voluntary payments are not possible, public services satisfying social wants must be provided free of direct charge (*ibid*, p. 15). Since the Distribution and Stabilization branches are assumed to meet their objectives, funding for those services can follow the Benefit principle. In practice, this would imply a proportional tax if the elasticity of demand with regard to income is around one. If it is larger than one, then the tax would need to be progressive, and if smaller than one, regressive.

¹⁴This results from the fact that Samuelson's (1954) model is too simplistic to account for the institutional reality. Musgrave praised Wicksell's intuition, to criticize Samuelson's attitude: "He [Wicksell] thus pioneered a normative approach to voting procedures, a model which links the efficiency problems of social goods provision to the applied issues of how an efficient solution can be achieved in practice. Samuelson, on the contrary, chose to set aside this aspect of the problem as leading into an unmanageable game-theoretical morass; but by sticking to the more tractable issue of efficiency conditions, this rendered social good theory somewhat of a scholastic exercise, of little help to improving the fiscal performance of the real world setting. I have tried to reestablish such a linkage, but this is not an easy task." (Musgrave, 1983a, p. 95)

In a widely read paper at the time, Head (1962) tried to “examine the meaning of the public good concept as it appears in Samuelson’s theory, and relate it to the more familiar Pigovian and Keynesian theories of public policy”. He identifies two characteristics in Samuelson’s public goods: ‘jointness in supply’ (or ‘indivisibility’) and ‘external economies’ (or ‘jointness in demand’, which he linked to impossibility of exclusion). Although he surveys all the appropriate works and proceeds to a sharp and original analysis, the paper is confusing – at least to the retrospective reader. This is partly to blame on the attempt to relate all the concepts of the emerging public economics field together in an all-embracing argument for government intervention. One must acknowledge his idea of identifying two necessary dimensions of public goods, but his taxonomy was not favored by history¹⁵, even if that paper was positively referred to by Olson (1965) and Buchanan (1968).

The Biarritz paper

After three years at Princeton, Musgrave moved back to Harvard in 1965 with a joint appointment in the Department of Economics and the Law School (Musgrave, 1997, p. 25). The year later, he presented a paper at a conference in Biarritz organized by the International Economic Association.¹⁶ In this paper, titled *Provision for social goods*, Musgrave reviews “the polar case of a pure social good”¹⁷ and then suggests some generalization to mixed goods. The author explains the shift in his phenomenological view point: “To emphasise that the distinguishing characteristic derives from the nature of the good, rather than the utility function, I now prefer the term social good to my earlier terminology of social want” (Musgrave, 1969, p. 126).¹⁸ The author then proceeds to (re)define social goods: “The first is the characteristic of non-rivalness in consumption, i.e. the existence of a beneficial consumption externality. The second is the characteristic of non-excludability from consumption. The two are distinct features and need not coincide. Each plays a different role” (*ibid*). This is the standard textbook definition that is still used nowadays.

Musgrave then explains that non-rivalness, the fact that the consumption by one individual does not reduce the benefits enjoyed by another individual while consuming the same good, is responsible for the vertical addition of demand curves. It is also this characteristic which leads to the different necessary condition for optimality that Samuelson (1954) derived. Incidentally, Pickhardt (2006) noted that Musgrave (1983b, p. 332, n.7) acknowledged that it was Samuelson’s (1955, p. 356) claim that there exists some “element of variability in the benefits that can go to

¹⁵Fifteen years later, Head revisited his 1962 paper, recognizing that “[in a sense] non-excludability is the more potent cause of market failure” (Head, 1977, p. 235).

¹⁶The proceedings of the conference have been edited by Julius Margolis and H. Guitton under the title *Public Economics: An analysis of Public Production and Consumption and their Relations to the Private Sectors*, and published by MacMillan in 1969

¹⁷Samuelson (1955) uses the term *pure* public good and admits that it constitutes a *polar* case.

¹⁸Sturm (2006, p. 51) notes that the expression ‘collective needs’ was used more often than ‘collective goods’ in the Austrian school of public finance, from F.B.W. Hermann to E. Sax.

one citizen *at the expense* (Musgrave's emphasis) of some other citizen" which led him to coin the term non-rivalness in consumption.

Musgrave again states that non-excludability of social goods leads to a difficulty in revealing preferences. National defense combines both characteristics, but some goods exhibit only one of the two. An uncrowded bridge is a non-rival good but exclusion and toll charging is possible. Yet, it is not efficient (Pareto-optimal) to exclude anyone from the consumption of such a good since she would benefit from it at no additional cost. On the other side, the orchard which benefits the nearby bees give rise to a rival consumption (there is a depleting amount of nectar available to many apiarist neighbours), but the market fails because of the impossibility of exclusion, or of very high exclusion cost, which boils down to the same thing.

With the given definition of non-rivalness as externality in consumption, Musgrave extends the polar case to mixed cases by resorting to variations in the characterization of the utility function of two consumers. For agent A, the polar case is $U_A = U(X_A, Y)$ where X_A is a private good and Y is a social good and $U_B = U(X_B, Y)$ for agent B. If Y is a partially social good, then the part paid by A might not affect as much B as it benefits A. This would be the case for water treatment by two neighbours living along a waterway. By splitting the respective part paid by the two agents, one can thus rewrite $Y = Y_A + Y_B$ and allow variation in the intensity of the benefits that accrue to one agent, for example by letting γ vary for example in $U_A = U(X_A, Y_A + \gamma Y_B)$ and likewise for agent B. The author analyzes all the (7) cases and summarize them in a 4x4 table in which the polar case of pure private good lies in one corner and the pure social good in the other diagonal-opposing corner.

In an addendum, added after the conference to respond to Samuelson's (1969) critique of his paper, Musgrave notes that 'Professor Samuelson, in his preceding paper, rejects the taxonomy of pages 136-7, and proposes that one should draw only a single line between the knife-edge concept of the purely private good (my Case 1) and all the rest.' (Musgrave, 1969, p. 142). After explaining why his analysis is compatible with Samuelson's general formulation, Musgrave wisely remarks "semantics, as the history of economic thought so well shows, is not a trivial matter; and I remain persuaded that systematic explanation of non-polar situations will be helpful, as they may point to different policy solution" (*ibid*).

Public Finance in Theory and Practice

Musgrave coauthored an introductory textbook on Public Finance with his wife, which was first published by McGraw-Hill in 1973.¹⁹ The third chapter, on *The Theory of Social Goods*, starts by a discussion of the conditions that make the

¹⁹ The 778 pages book has been reedited in 1976, 1980, 1984 and 1989. Richard Musgrave retired from Harvard in 1981, and the couple moved to California where Peggy Musgrave got an appointment at the University of California, Santa Cruz and where Richard Musgrave also continued to teach and write for some years. (Musgrave, 1991a). He passed away in 2007.

market an efficient allocation mechanism, i.e. the application of the exclusion principle and the rivalness in consumption which makes exclusion efficient. The authors then proceed to explain a “first instance of market failure”, namely when exclusion is impossible (Musgrave and Musgrave, 1973, p. 53). This leads to problems of revelation of preferences, at least in the case where the number of participants is large. Then, they describe a ‘second instance’ of market failure: “[W]here consumption of certain goods is nonrival. Such goods are here referred to as ‘social goods’.” (*ibid.*) After presenting both cases of market failure, the authors comment on the ‘combined cause’:

While the features of nonrival consumption and nonexcludability need not go together, in fact they frequently do. In these instances-e.g., air purification, national defense, streetlights-exclusion both *cannot* and *should not* be applied (original emphasis). Since these are situations where both causes of market failure overlap, it may be futile to ask which is the ‘more basic’ cause. However, the nonrival nature of consumption might be considered as such, since it renders exclusion undesirable (inefficient) even if technically feasible. (*ibid.*, p. 54)

This citation is interesting in two regards. First, Musgrave identifies clearly both non-excludability and non-rivalness as distinct causes of market failure. Second, he admits that in one sense non-rivalness is the ‘more basic’ one, although the question is ‘futile’. According to Head (1977), Samuelson eventually convinced Musgrave that this later feature is more important than non-exclusion. Head does not give evidence for this claim, but in addition to the change in emphasis that was noticed between 1959 and 1969, one can observe that in the second edition (1976) of the textbook, the authors invert the order of presentation of the two causes of market failure, explaining nonrival consumption before nonexcludability.

After the previous quote, the authors summarize the different possibilities in a 2x2 table (see Table 1). In this table, case 1 represents the private-good case where

	Exclusion	
Consumption	Feasible	Not Feasible
Rival	1	2
Nonrival	3	4

Table 1: ‘Summary’ table. Source: Musgrave and Musgrave (1973, p.54)

exclusion is possible and the consumption is rival. The author then explain that “[i]n all other cases, market failure occurs [...] If we applied the term ‘social good’ to all situations of market failure, cases 2, 3 and 4 would all be included. It is customary, however to reserve the term for case 3 and 4, i.e., situations of nonrival consumption”.(*ibid.*) This is the table that one finds in many public finance and

introductory microeconomics texts without reference to its origin. The tables found in the textbooks surveyed display examples of goods rather than numbers in the cells. The first occurrence of this practice (after preliminary research) appears in a chapter by Ostrom and Ostrom (1977) who do not make any reference to Musgrave and Musgrave (1973).²⁰ This table is reproduced in the Appendix 1.

To sum up, Musgrave was mainly responsible for the crystallization of the standard textbook definition of public goods (non-rival, non-excludable). What's more, his conceptualization of public goods (or rather social goods as he calls them) is different from the one developed by some of his contemporaries, chiefly James M. Buchanan. Musgrave adhere to a market failure theory of public goods. In this setting, the characteristics of public goods identified by Musgrave help us to understand why markets fail and why government intervention is required. Moreover, it helps us to delineate the free rider intuition and the collective dimension in some services provided by the State. In spite of this explanatory role, public goods are first and foremost recommendations for State action in a normative theory of the public household.²¹

2 Considering the size of the group

Two neighbours may agree to drain a meadow, which they possess in common: because it is easy to know each other's mind; and each must perceive that the immediate consequence of his failing in his part, is the abandoning the whole project. But it is very difficult, and indeed impossible, that a thousand persons should agree in any such action; it being difficult for them to concert so complicated a design, and still more difficult for them to execute it; while each seeks a pretext to free himself of the trouble and expense, and would lay the whole burden on others. Political society easily remedies both these inconveniences (Hume, 1740, Book II, part II, p. 239).

Those local or provincial expences of which the benefit is local or provincial (what is laid out, for example, upon the police of a particular town or district) ought to be defrayed by a local or provincial revenue, and ought to be no burden upon the general revenue of the society (Smith, 1776, V, I, p. 300).

In his seminal papers, Samuelson (1954, 1955) did not consider any limitation to the universal *jointness* (or non-rivalry) of his collective consumption goods. The

²⁰Ostrom (2002) uses a similar table, yet confusingly imply that the table is constructed around a fusion of 'Musgrave's classification' (Exclusion feasible or not) and 'Samuelson's Classification' (whether consumption by one subtract from total available to others). Rather than recognizing Musgrave's synthesis, Ostrom argues that Samuelson and Musgrave both "attempted to find a single criterion".

²¹For the dual role of the theory, see my complementary (working) paper *Normative and Positive Theories of Public Finance: Contrasting Musgrave and Buchanan* (2012).

public is indeterminate. Hence, national defence was considered as a collective good of the same type as a circus performance. Musgrave improved the understanding of the problem by remarking that circus performances were subject to the exclusion principle. Though one can further refine the analysis by noting that street lighting does not benefit the same ‘group’ of people than national defence. This fact was observed by Smith who recommended – following a strict application of the benefit principle – that a whole country should not have to fund the lighting of a particular city. Besides, Hume reasoned that some collective action problems could be solved by a mutual (voluntary) agreement when the number of individuals concerned was quite small – otherwise, government action would be required. Likewise, Robinson and Friday could agree to provide themselves with non-rival and non-excludable public goods without having the need to establish a coercive government. Thus, to refine the understanding of public goods, one can consider the size of the relevant group affected by their provision.

I identify three reasons to consider this dimension of the problem. First, there is an apparent paradox that must be resolved: Musgrave was not mainly responsible for the development of the theory of public goods along the line, but in one sense it is central in understanding the peculiarity of his conception of public goods. Second, the analysis explains to a certain extent the development of the theory in the second half of the 1960s which is partly embodied in the 2x2 table invented by Musgrave & Musgrave. Third, I will show that all of the refinements are not represented in the table. Hence, it will be suggested that the table could be improved by adding a third variable, namely the size of the group to which benefits accrue (section 3). This investigation contributes to the main goal of the paper which is to characterize Musgrave’s theory of public goods.

The first step to unfold the apparent paradox is to distinguish three qualitative levels of the size of the group variable: small numbers, large numbers and very large numbers. To these three levels correspond two transitions, or conceptual thresholds. How different are large number situations from small numbers situations? Is the optimal solution different for goods that affect large numbers of people, yet within a localized area, than for goods that affect very large numbers of citizens nationwide or globally? Musgrave contributed to both issues. As quoted in the previous section, he indicated that the free rider phenomenon rested on the assumption of large numbers, but did not discuss the matter further. Besides, he initiated a new sub-branch of public finance, fiscal federalism, where a thorough reflexion took place on how community structures impacted the efficient allocation of public goods.

Given this, why was not Musgrave mainly responsible for the development of the theory along the size variable? The first obvious answer is that the theory normally evolved, as other scientific endeavours, by collaborative work toward a generalization (e.g. Olson (1965)) and by considering more specific cases (eg. Tiebout’s (1956) local public goods and Buchanan’s (1965a) club goods). Moreover, the in-

terest of public finance scholars drifted with the evolution of american political issues. Fiscal centralization reached a peak in the middle of the 1950s and declined thereafter (Oates, 1999). After WWII, public economists were focused on national government as a solution to the most pressing problems (Fischel, 2000). As Musgrave already remarked in 1971:

My generation of public-policy oriented economists has been essentially centralist in approach. In part, this was due to our concern with macro problems which by their very nature must be handled at the central level. But it was due also to a political climate in which centralised action stood for positive policy responsibility, while decentralisation stood for minimising public sector activity and public interference. I am not persuaded that this nexus has ceased to hold,²² but one must take note of the voices for decentralisation which now come from all sides of the political spectrum (Musgrave, 1971, p. 4).

Furthermore, since Musgrave conceptualized public goods as non-excludable, he did not face the question of how to determine who should be excluded (what is the relevant group). More generally, public provision was for him a solution to the market failure caused by free riding, not a challenge like it became for Buchanan in the 1960s (Marciano, 2013). Finally, one could argue that the externality (spillover) conceptualization path taken by others leads more naturally to consider the size dimension of the problem, than the Samuelson-Musgrave approach in terms of objective goods.

2.1 Differentiating small groups from large groups

In 1939, Musgrave noted that a voluntary exchange theory was not appropriate to describe situations involving “a large number of contributors” (Musgrave, 1939, p.219) to the funding of a public service. This intuition was generalized by Olson (1965) into a theory of collective action failure for large groups. In his framework, groups and collective goods are firmly linked. Groups of individuals have common interests and they succeed in furthering their interest when they provide themselves with a public good. The State is such a group which provides public goods for its citizens (Olson, 1965, p. 15). Public goods are defined to be non-excludable (‘cannot be excluded’) within a group. Non-exclusion is the defining characteristic, but Olson also remarks that some groups (the ‘inclusive’ ones) also exhibit ‘jointness in supply’,²³ but it is not the case for ‘exclusive’ groups, like members of a cartel.

²²He would later reaffirm this view: “Following half a century of fiscal activism and central leadership, the call now is for downsizing the federal budget and a devolution of fiscal responsibilities to the state and local levels. [...] Behind the call for devolution of federal programs, if less audible, is also support for shifting from a superior and progressive federal tax system to relying on less equitable state and local taxation and to widening the scope for fiscal competition. Similarly, devolution [...] also carries an expectation that lower-level government means less government” (Musgrave, 1999, p. 172-173).

²³On the definition of public goods, Olson refers to Samuelson (1954, 1955), Musgrave (1959) and Head (1962).

In the latter, the benefit their members derive from a higher price decreases as more of them join the group.

An important clarifying step in our conceptual story is taken by Olson, again in a footnote: “[M]ost collective goods can only be defined with respect to some specific group. One collective good goes to one group of people, another collective good to another group; one may benefit the whole world, another only two specific people” (Olson, 1965, p. 14). His central results is that large (latent) groups will fail to provide themselves with a public good unless they can coerce their members in contributing to the cost, or if they can set up separate incentives for them to contribute voluntarily. In other words, if we focus on voluntary action, only small groups where one member can provide the good by bearing the full cost on his own will succeed in furthering their interest. In large groups, three factors add up to explain the failure of voluntary provision: (i) the larger the group, the smaller the fraction of benefit accrue to one individual (if benefits are partly rival), (ii) the larger the group, the less likely that any individual will want to bear the cost on his own,²⁴ and (iii) the larger the group, the greater the organizational costs (Olson, 1965, p. 45).

Olson’s book was published the same year as Buchanan’s famous paper on *club goods*. They both addressed the question of how the size of the group influenced the voluntary (interested) provision of a public good. As Olson remarked: “Both of us have been working on this problem independently, and until very recently in ignorance of each other’s interest in this particular question. Buchanan generously suggests that I may have asked this question earlier than he did” (Olson, 1965, p. 38, f.58).²⁵ Yet, in order to understand Buchanan’s contribution and his different vision of the issue at stake, one must study his earlier work on externalities.

In 1962, James M. Buchanan published a paper with Craig Stubblebine in which they attempt to clarify the notion of *Externality*. They derive necessary conditions for Pareto equilibrium equivalent to those presented by Samuelson (1954) and concluded that their “analysis allows the whole treatment of externalities to encompass the consideration of purely collective goods” (Buchanan and Stubblebine, 1962). In fact, their framework is more general and can be extended to cover impure collective goods. Carrying on this research agenda,²⁶ Kafoglis and Buchanan (1963) build a two-person geometrical model (that they consider representative of the n-person model) where the agents negotiate and reach an agreement on the provision of goods which benefit them both. The objective is to show that if strategic considerations are neglected, private agreement can lead to optimal public good provision without the need for coercive State intervention. Yet, the authors admit that when

²⁴ One has to bear the total cost on his own. Because of the free rider mechanism, it cannot be expected that every beneficiary will voluntarily contribute his share.

²⁵ Buchanan (1965b, 1968) refers to Olson (1965).

²⁶ For a thorough analysis of Buchanan’s original treatment of externalities, as an alternative to the market failure approach of Samuelson and Musgrave, see Marciano (2013).

a large number of agents are concerned, voluntary agreement might be very costly and agents could contemplate a collective-coercive solution; but there is no way to determine that this last option would be the best:

[W]hen the interactions extend over a large number of persons, the costs of attaining voluntary agreements may become prohibitive, and any approach to the ‘optimal’ solution in this fashion may be precluded. It is in reference to such situations that collectivization arguments are applied. A complete analysis would, however, take into account the costs of reaching collective or political decisions, and, when this set of problems is included, there is no a priori way of determining whether or not the ‘optimal’ solution may be approached through this means (*ibid*, p. 412).

The year later, Buchanan (1964) gave a simple exposition of the problem of the free rider (probably the first occurrence of this expression in public finance) and the contractarian solution that he proposed in order to extend the voluntary approach to cover collective action.²⁷ As it becomes clear, part of Buchanan’s research agenda in the 1960s is to determine how far can the voluntary, market-like interaction can be extended in the face of spill-over (external) effects.

In this perspective, Buchanan (1965a) developed another generalization of Samuelson’s concept of collective good in *The Theory of Clubs*, or ‘co-operative memberships’. In this famous model, Buchanan assumes that exclusion is feasible and that the ‘jointness’ (non-rival) dimension of the club good is variable. A representative individual receives utility from a good, for example a swimming pool, that he can share with other members of the club. As more individuals are allowed to share the good, each of them receives a lesser benefit, but pays a smaller cost. For a given amount of the good, the optimal size of the group (club) is determined at the point where the marginal benefit of another user is equal to its marginal cost. Then for a given size of the group, one determines the optimal amount of the good, by assuming that the individual also values another private good.²⁸

In this framework, Samuelson’s pure collective good is a club good of infinite optimal number of members, and a purely private good is a club good with optimal group size of one. This parallels Musgrave’s claim that pure social goods should be provided free of charge to everyone since they are non-rival. Said differently, there is a positive marginal social benefit of providing the good to another user at zero marginal cost. By building this model, Buchanan wants to show that there is continuity between private and public goods in order to break the ‘public goods entail public provision’ argument. To do so, he has to take into account the size of the group to which benefits accrue²⁹, and develops an *ex post* categorization of

²⁷On Buchanan’s constitutional political economy, see Marciano (2009b).

²⁸In fact, the quantity of the good, the number of members (and the cost distribution among them) must be simultaneously determined. (Buchanan, 1965a, p. 12)

²⁹Assuming for simplicity that the group of individuals who benefit are the same who pay for

goods with respect to the size of the optimal group which should provide them. Despite that, he does not yet stress the threshold between small numbers and large numbers. With Olson's argument in mind, it is clear that since Buchanan assumes voluntary cooperation in clubs, his argument would work only for the foundation of clubs of relatively small numbers. If we further assume that the clubs are already organized, then one could expect even large-number clubs to sustain themselves owing to their ability of excluding non contributors.

Moreover, exclusion must be possible: "In so far as non-exclusion is a characteristic of public goods supply, as Musgrave has suggested, 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" (Buchanan, 1965a, p. 13). Yet, if exclusion is not possible, then the free rider problem arises – writes Buchanan. This leads him to recommend that, whenever possible, arrangements to secure property rights should be studied in order to decrease exclusion costs or to adjust exclusion boundaries to the optimal size.

In *Ethical rules, expected values, and large numbers*, Buchanan (1965b) provides an explanation of why voluntary cooperation can be rational in small groups but not in larger ones. The goal of his paper is to study how the "size of the group within which [an individual] interact" is a critical determinant of "what influences [his] choice among ethical rules" (*ibid.*, p.1). Buchanan considers two such ethical rules: 'the moral law' which dictates cooperation in all cases, and the 'private maxim', or 'expediency criterion'. In a rational game-theoretic setting, the individual's choice of ethical rule will depend upon his expectation of the behaviour of others. In a small group, he can expect that his choice will have an effect on others. Therefore, in such a setting, it is not impossible that the group coordinate on the 'moral law', but in a large group where one's choice cannot influence others, it will always be rational to select the private maxim. Thus, if all the individuals follow this rational reasoning, no one will choose the 'moral law' and voluntary cooperation will fail because of the 'large-number dilemma'. According to the author, the free-rider problem is a 'direct analogue' of the large-number dilemma.

Buchanan clarify further the issue by pointing out a distinction which frequently goes unnoticed between the free rider problem and the prisoners' dilemma: "The difference between the prisoners' dilemma and the large-group ethical dilemma discussed here lies in the fact that, as ordinarily presented, the former remains a small-group phenomenon. The results emerge because of the absence of communication between the prisoners and because of their mutual distrust. The large-number dilemma is a more serious one because no additional communication or repetition

the cost of the good.

of choices can effectively modify the results” (*ibid.*, p.8). Confronted with a public good problem in a small number setting, selfish rational individuals might want to transfer the cost on somebody else: ‘Let George do it’. But there is no such personal interaction in large-number problems. This argument will be reiterated by Buchanan in 1967 and in the chapter on ‘The Free-Rider Problem’ in his 1968 book. Large number behaviour is not ‘strategic’; there is no bargaining taking place (Buchanan, 1968, p. 81), the individual “simply treats others as a part of nature” (*ibid.*). It is rather in a small-number setting that the individual “will find it to his advantage to conceal his true preferences and to give false signals about those preferences to his opponents-partners” (*ibid.*).

Nevertheless, Buchanan is partly mistaken on the cause of free riding. He writes: “If the potential benefits are genuinely non-divisible among separate persons, each one will find it to his own private advantage to refrain from making voluntary contributions toward the costs of provision” (Buchanan, 1965b, p. 9). Indivisibility is an ambiguous concept (Head, 1970; Ver Eecke, 1999), but is closer to ‘jointness’, ‘lumpiness’, or ‘non-rivalry’, than non-exclusion. Non-rivalry is not responsible for the free riding mechanism, it is rather the absence of exclusion as Musgrave and Olson have shown. In a small club or in a large club,³⁰ the possibility of excluding members who do not pay prevent the manifestation of the free rider spectre. Hence, even if the good is provided simultaneously to all agents who are concerned, it is not sufficient to conclude that free riding will occur.

At the end of the paper, Buchanan makes an interesting remark about the historical evolution of cooperation norms:

[I]f the sweep of history is considered to make inevitable and irrevocable the interaction of larger and larger numbers of persons in an ethical context, the analysis must imply that a smaller and smaller proportion of individuals will come to base their own actions on some version of the generalization or universalization principle ([‘moral law’]). The scope for an individualistic, voluntaristic ethics progressively narrowed through time. As individuals, increasingly, find themselves caught in the large-number dilemma with respect to ethical choices, a possible logical explanation is provided for resort to political-governmental processes which can, effectively, change the rules and impose standards of conduct common to all individuals (Buchanan, 1965b, p. 12).

However, the author wants to avoid as much as possible having to resort to coercive governmental processes. Thus, he advocates solutions to foster small number interactions: “What are the possible means of factoring down complex social interaction systems into small-group patterns?” (*ibid.*) One way is to allocate property rights that will favour – by their nature of allowing exclusion – the emergence of small

³⁰To follow Olson, we should admit that large number clubs might fail to organize, for lack of incentive but once they are already in place, the possibility of excluding non-contributing individuals allow them to operate without loss.

clubs.³¹ But if political action is inevitable, then following Wicksell, Buchanan propose that unanimity (or quasi-unanimity) must be required for decisions at the constitutional level (Buchanan, 1968). This requirement reintroduce strategic small-number interactions, especially if bargaining and trade of votes between the citizens is allowed.

Those proposals are consistent with Buchanan's general view of Constitutional political economy. Already in the *Calculus of Consent*, Buchanan and Tullock noted that "[i]f the organization of collective activity can be effectively decentralized, this decentralization provides one means of introducing marketlike alternatives into the political process" (Buchanan and Tullock, 1962, p. 114). This idea was also at the core of Tiebout's (1956) seminal paper on local public goods.

2.2 Local public goods, metropolitan finance and fiscal federalism

The question that I tackle in this subsection is what differentiates large numbers from very large numbers on the population scale. In other words, rejecting the small-number case as irrelevant for most public good issues, I now focus on the refinement of the typology of public goods along the geographic scale.³²

Tiebout first discussed his idea of market-like revelation process for local public goods as a PhD student in Musgrave's graduate seminar at the University of Michigan in 1952 (Fischel, 2000).³³ In the published version of the paper, the central issue that Tiebout (1956) addresses is taken from Musgrave's 1939 article, Samuelson (1954), and a draft version of the *The Theory of Public Finance*: "The core problem with which both Musgrave and Samuelson deal concerns the mechanism by which consumer-voters register their preferences for public goods" (Tiebout, 1956, p. 417). Implicitly Tiebout observes that some public services provide benefits to a community, but not to another one.³⁴ Hence assuming that there are no spill-over between communities, he builds a model in which every citizen chooses the community that offers him the fiscal package (tax and services) that best fits his preference. If there is a large variety of fiscal packages on offer, the citizen is forced to reveal his preference for public goods by moving (voting with his feet) to one community or another. For a fixed bundle of services, there is an optimal size for every community which is determined by the minimum of the average cost curve for the goods and services. The author acknowledge that in the case of important spill-overs between communities, 'some form of integration' at

³¹A similar line of policy emerged out of Coase's (1960) ideas: in small number externality problems, if transaction costs are insignificant, private arrangements will bring about an optimal solution and State intervention is not required (except to set up and enforce property rights).

³²For a discussion on the relation between the economic approach to federalism and the political concept of subsidiarity, see Josselin and Marciano (2004).

³³Musgrave (1999) confirms the fact but does not give any time reference for the event.

³⁴In the *Theory*, Musgrave noted that social goods "contribute to the welfare of the whole community. The benefits resulting from such services will accrue to all who live in the particular place or society where the services are rendered" (Musgrave, 1959, p.9-10).

a higher governmental level might be required. This argument will be developed in details in a paper that Tiebout presented in 1959 at a Conference organized by James M. Buchanan on behalf of the Universities-NBER.

In this paper, Tiebout (1961) develops a model for fiscal federalism relying only on economic efficiency. This contrasts with Musgrave's (1961) paper presented at the same conference where fiscal federalism is rationalized with respect to different political objectives of fiscal equalization (between regions and between individuals), and efficiency. Tiebout's starting point is the recognition that public goods do not all provide universal benefits: "[P]ublic goods have a spatial extent on the benefits side. Moreover, benefits from public services may not accrue equally to all residents of a region" (Tiebout, 1961, p. 80).

Tiebout assumes the case of pure collective consumption goods (non-rival). He considers four different characteristics of spatial extension of benefits and discuss how they impact the optimal fiscal structure, also taking into account economies of scale. The characteristics are: 1) "benefits from some services accrue in the same amount to all persons within a region"; 2) "benefits from some services taper off from the site of production"; 3) "benefits from some services have a spillover effect"; and 4) "benefits from some services reinforce each other while others do not". This conceptualization is important for our story, because it is one of the first refinements on the supply of public goods within the new american theory, and also because it will probably influence Buchanan's (1968) typology of public goods.

After graduating from Ann Arbour, Tiebout was appointed associate professor of political science at UCLA, before moving to the geography department at Washington University in 1962.³⁵ While at UCLA, he participated in an interdisciplinary working group on local governance which also included Vincent Ostrom and Elinor Ostrom. The latter recalls that they were much influenced by their reading of Buchanan and Tullock (1962), especially the idea of decentralization: "Both [the] decentralization and size factors suggest that[,] when [where] possible, collective action [activity] should be organized in small rather than large political units. Organizations [organization] in large units may be justified only by the overwhelming importance of the externalities [externality] that remain[s] after localized and decentralized collectivization" (Buchanan & Tullock, 1962; quoted by Ostrom, 2011, p. 371).³⁶

In a paper that would become very influential in political science, Ostrom, Tiebout, and Warren (1961) addressed the problem of governance in metropolitan areas. The authors describe those areas as 'polycentric political system', which means that different levels of government overlap, but not in a concentric struc-

³⁵Charles M. Tiebout died of a heart attack in 1968, aged 43 (Fischel, 2000).

³⁶The words in brackets correspond to the *Collected Works of James M. Buchanan* edition (quote herein p. 115).

ture. Those governments are taken as providing public goods and services for their citizens. Here it is recognized that the objectives of the governments can be multifold, which complicates further the problem of designing an optimal multi-level polycentric system: “In designing the appropriate ‘package’ for the production and provision of public goods several criteria should be considered. Among these are control, efficiency, political representation and self-determination” (Ostrom et al., 1961, p. 835). Since public goods are perceived as solutions to externality problems, the authors naturally consider the spatial extent of the benefits provided by those goods and services:

A function of government, then is to internalize the externalities – positive and negative – for those goods which the producers and consumers are unable or unwilling to internalize for themselves, and this process of internalization is identified with the ‘public goods’. Not all public goods are of the same scale. Scale implies both the geographic domain and the intensity or weight of the externality. A playground creates externalities which are neighborhoodwide in scope, while national defense activities benefit a whole nation – and affect many outside it. Thus, for each public good there corresponds some ‘public’ (*ibid.*, p. 832).

They argue that the exclusion principle is a defining characteristic of public goods, but is not sufficient to classify all goods in order to recommend the best way of providing them. Therefore, they introduce the concept of ‘packageability’ to describe the ability of good or service provision to encompass all its effect within a definite area (group of citizens). The representation of public goods that emerge is similar to that of a club good in the sense that it is non-excludable within a certain group, but exclusive to this group, which means that others outside the fence are excluded. But there is at least two differences with the club good (1965) concept: first, it is applicable to government provision, as club goods are thought of as voluntary organizations. Second, the theory of club goods assumes that exclusion is technically feasible, but in local public goods it is possible that benefits decrease with distance which means that technical exclusion is not properly required.³⁷ In their own words: “Viewing the boundaries of a local unit of government as the ‘package’ in which its public goods are provided, so that those outside the boundaries are excluded from their use, we may say that where a public good is adequately packaged within appropriate boundaries, it has been successfully internalized” (*ibid.*, p. 835). The authors provide an interesting distinction between three definition of the group relevant for the issue of public good provision, or three ‘elements of scale’ as they describe it: (i) the ‘scale of the formal organization’ which provides the good; (ii) the public, ie. those affected by the good; and (iii) the ‘political community’, which is the group of individuals “who are actually taken into account in

³⁷In practice both effects can combine. In the case of a municipal library, it is possible to exclude residents of the adjacent town from getting in, but there is a distance at which anyway the service will not be beneficial for them.

deciding whether and how to provide it” (*ibid.*, p. 836). In practice the three groups rarely correspond, but the ideal solution which respect efficiency, responsibility and accountability “would require that these three boundaries be coterminous”(*ibid.*).

The year later, Tiebout and Houston (1962) published a paper in which they carry on this refinement of the modern theory of public goods to ‘lower levels of government’. They discuss a framework for public good provision with a hierarchical order (which reminds of Musgrave’s (1959; 1961) fiscal federalism framework) where higher levels of government have overriding responsibilities and powers and can delegate some to lower levels. When applied to public good provision, it yields a normative typology along the size of the group variable:

From the set of all goods, (1) a sub-set of goods are considered national social goods and are provided by the federal government; for example, national defense. (2) Another sub-set of goods are voted partly regional and partly national social goods. Both the federal and lower-level governments provide these mixed goods; for example, highways.(3) All other goods are left to the option of non-federal levels of government. This process is repeated at each level of government. State governments, the next level below the federal, classify some of the goods as state social goods, for example, state police. Another class is considered mixed – education, for example – and so down through the lowest level of government. The remaining goods, the vast majority, are private market goods. After such an ordering is determined, governmental units, conceptually, can be created to correspond to the scope of the various goods. (Tiebout and Houston, 1962, p. 413)

What have we learned so far? In this second section, I highlighted the contribution to the concept of public goods made by a part of the corpus by focusing on the size of the group dimension. This ‘variable’ is a reconstruction of many discussions which considered the geographic scale of provision or the number of individuals interacting in a collective action problem as important factors affecting the optimal provision of public goods. I have focused on two different qualitative regions of the domain of the variable where a threshold is faced: going from small numbers to large numbers; and from local to national concerns. This conversation is mostly taking place in normative public finance. In Musgrave’s framework, the goal is to advise State administrations on ‘what should be done’, and ‘by whom’. The objective is to get a first-best recommendation, which can later inform more practical questions. In this respect, I contend that genuine public good problems are faced in large-number situations. Small number situations arise in family settings, groups of friends, in oligopolistic industries, or in committees, but as Musgrave once put it, large number situations are “typical for most social goods problem” (Musgrave, 1971, p. 35). Despite the fact that strategic interactions can pose prob-

lems for voluntary cooperation, small groups can succeed in providing themselves with non-rival goods that benefit their members.

Thus, public goods in public finance start from a large number assumption. Then, non-rivalness is added as a defining characteristic. Next comes the question of exclusion. Buchanan argues that exclusion is possible most of the times (and at reasonable costs) which explains why he proposed a theory of public goods as club goods that assumed exclusion. On the other side, Musgrave insisted that non-exclusion was typical for genuine social goods and thus that public provision was required. Yet, even if exclusion was possible, Olson proposed a convincing argument that would challenge the possibility of organizing large (latent) groups into clubs. In the end, as Marciano (2013, 2011) suggested, Buchanan is more optimistic than Musgrave (and Samuelson and Olson) on the possibility of voluntary cooperation between individuals. This is to be contrasted with Buchanan's claim that Musgrave is more 'optimistic about the workings of democratic politics' – namely the capacity of the State to bring about an efficient solution – than he is (Buchanan, 1999, p. 108). Farrant and Paganelli (2005, p. 85) solve this apparent paradox by noting that Buchanan is also a 'best-case thinker' (optimistic), but at the constitutional (and pre-constitutional stage), assuming universal knavery (pessimism) at the post-constitutional stage only.

Besides, even if collective goods are non-excludable, they still benefit a public, or group of individuals which normally defines an area. At one extreme, they are universal, they benefit the whole planet (e.g. the Earth's atmosphere). At the other extreme, they benefit only a neighbourhood (e.g. street lightning). On efficiency grounds (assuming the benefit principle applies), this points in the direction of structuring the levels of government in order that the decision units correspond to the public concerned by the goods to be provided.

3 The summary table restated

In this last section of the paper, I would like to go back to the summary table of Musgrave and Musgrave (1973).³⁸ As it was shown in the introduction, this table is frequently used in basic textbooks. Thus, it is worthwhile to consider if it can be improved to take into account an essential dimension of the discussion that was presented in the previous section, namely the size of the group to which benefits accrue. For the sake of simplicity, I suggest that the size variable be reduced to a binary domain: local goods or national ones.³⁹

I discuss below three reasons for such a refinement of the table. First of all, I think it can improve introductory teaching of public economics by giving a more precise typology to students without being cumbersome. Second of all, it represents

³⁸See Table 1, p. 14.

³⁹It could be argued that the most interesting 'higher level' would be global, rather than national.

a partial synthesis of Buchanan's (1968) typology with Musgrave's one. Third of all, it consolidates Musgrave's definition and respects his vision.

The table is a representation of the typology of goods that results from considering how goods and services differ according to two criteria (or binary variables): non-rivalry and non-exclusion. As it was shown, those criteria were formulated in the context of a discussion on the economic rationale for public intervention. Assuming large-number situations (except for private goods), the two cases of mixed goods call for some form of public regulation or funding, and the pure public (social) good box contains goods that are both non-rival and non-excludable – hence they must be publicly provided. The objective is to give a first approximation of what *ought* to be done by the State, and at the same time introduce students to some of the issues that will be discussed in public finance/public economics. It should be noted that this recommendation set follows solely from the objective of restoring efficiency (from a situation of potential inefficient market failure). This is implicit in the whole discussion on public goods. Musgrave also acknowledged (and defended) that governments could act on different values or principles, especially equity. His fiscal federalism framework is structured on this broader set of principles, as is the original Allocation function of his *Theory* which also included provision of goods to satisfy merit wants. Yet, here, efficiency will still be the only objective considered.

This being said, take the examples of two pure public goods: street lighting and national defence. It is clear that they should both be provided by the State, but, not by the same level of government. This would call for a split of the pure public good cell (see Table 2 below). Likewise, some toll goods or clubs would be local, for example public libraries, swimming pools; and others national, for example highways. Although this category has not been discussed here, the same could be applied for Common-Pool resources. Fish stock of a lake is a concern for surrounding residents, but oceans are a matter of national or international regulation.

		Consumption	
		Rival	Nonrival
Exclusion	Feasible	private goods	large clubs small clubs
	Not Feasible	large common-pool resources small common-pool resources	national pure public good local pure public goods

Table 2: *Refined* summary table. Source: Author's adaptation from Musgrave and Musgrave (1973).

I have come across two French manuals which present a much more detailed typology of goods. In his 1988 *Fondements de l'économie publique (Foundations*

of public economics), Jean-Jacques Laffont considers 5 criteria for pure public goods and draws a tree graph representing all the possibilities resulting from 4 of those criteria. For example, pure public goods respect the following criteria: (i) not destroyed by use/consumption, (ii) non-excludable, (iii) mandatory consumption/use, (iv) collective concern, and (v) no possibility of congestion. The graph (see Appendix 2) shows the 8 different types of public goods deriving from three binary criteria (exclusion possibility, mandatory consumption and (spatial) concern). Likewise, Picard (1992) takes up Laffont's typology in 5 criteria and draws a graph showing the 16 different types of goods that result from 4 criteria (exclusion is feasible, mandatory use, congestion, which community is concerned).

The weaknesses of those typologies are clear. First, if all their criteria are taken into account, the visual representation of the typology is cumbersome – at least 16 different categories, not counting the private goods. Moreover, they do not cover the common-pool resources (rival, yet non-excludable goods and services). Second, I doubt that congestion adds an independent dimension to the analysis. For rival goods, it is certainly redundant. In the case of club goods, the ability to exclude provides a way to control the number of users therefore preventing crowding. As for pure public goods, they are assumed congestion-free up to a certain point. When crowding occurs, the goods or services stop being non-rival. For example, a bridge is considered non-rival up to the point of congestion; then rivalry sets in. Hence, non-rivalry (or 'non-destruction by use', as Laffont and Picard write) and congestion are not independent criteria.⁴⁰

In 1968, James M. Buchanan published a monograph titled *The Demand and Supply of Public Goods* in which he synthesizes his work on public goods and externalities during the past decade. In the 9th chapter, he constructs a typology of goods to address the question: *Which goods should be public?*. The first criterion that he selects is indivisibility. Pure private goods are purely divisible and pure public goods are purely indivisible in Samuelson (1954) sense that the quantity available to all is the quantity available to each. This dimension has been shown to be represented in Musgrave's concept of non-rivalry (Ver Eecke, 1999). Buchanan argues in favour of a second criteria: "Goods and services will not hold the same rank in the scale as the size of the group changes. It is necessary to supplement the ranking by a second one that describes the range or limit over which the indivisibility characteristic, if it exists, holds" (Buchanan, 1968, p. 164). The two criteria are assumed to be continuous which allow for a (cartesian) plane visual representation of the typology that follows (see appendix 3). The author discusses 5 typical cases: (1) private goods, (2) partly divisible goods which benefit groups

⁴⁰Mandatory usage is an interesting dimension which is not covered here for two reasons. First, in the Samuelson definition of joint-consumption (non-rivalry), the goods which are provided to all, are consumed by all – no discrepancy is allowed. Second, one could argue that the legal requirement or not to consume a good is more a matter of institutional implementation, than an objective and general characteristic.

of small size (or small-number externalities), (3) partly divisible benefits extending to groups or large size (or large-number externalities), (4) fully indivisible goods with interactions limited to groups of small size (club goods), and (5) purely public goods (*ibid.*, pp. 164-168).

From Buchanan's typology, I venture to say that one can import the size of the group criterion, while focusing on larger groups and replacing the indivisibility criterion by non-rivalry. Furthermore, I stress once more that non-exclusion is an important characteristic of Musgrave's vision of public goods. These flaws in Buchanan's analysis have been criticized by Head (1970):

In the light of his earlier analysis of the large-number voluntary exchange model, it is, however, surprising that he ([Buchanan]) does not bring out more clearly the drastic failure of the market in the large-number model of a pure public good. Even more than in earlier sections of the book, the analysis here seems blurred by his failure to draw a clear distinction between the two major public goods characteristics of joint supply and impossibility of exclusion. Instead, these two characteristics are apparently lumped together under the portmanteau term 'indivisibility', which conceals more than it reveals in a public goods context. [...] However, unless the further characteristic of impossibility of exclusion applies, a market mechanism (a legal monopoly, or even perfect competition) may function tolerably well, though of course not perfectly. [...] If, by contrast, price-exclusion is also impossible, market techniques fail disastrously in what Buchanan calls their allocation and financing functions. [...] These conclusions suggest that the heavy emphasis on the joint supply characteristic of public goods in Buchanan (and also in Samuelson) is in some respects dangerously misleading (Head, 1970, p. 119-120).

Musgrave also criticized Buchanan's reliance on two-agents models to explain how voluntary cooperation might result in efficient public good provision: "While I feel that small-number case remains important in its own right, I agree that the large number problem is the central issue. I am sceptical, however, about the analytical usefulness of small-number theory for the large number case (Musgrave, 1970, p.123). Marciano (2009a) noted that Buchanan (1964) criticized Robbins' definition of economics as a science of choice – favouring instead a catallactic (exchange) approach to the science. Buchanan argued that Robinson Crusoe's problem was a technical issue for engineers, not a matter of interest for economists who should instead study (voluntary and subjective) exchanges between individuals. In the case of genuine public goods problems though, as Buchanan himself recognized, a two-persons model is not the appropriate framework. Buchanan criticized Robinson economics, but at times (1967; 1968) he merely added Friday to the story (or Tizio and Caio as he named them) which I think is still a 'Robinsonade' when the

aim is to apprehend collective good issues.

The third argument in favour of ‘tuning up’ Musgrave & Musgrave *Summary table* is that the proposed refinement respect their vision. It is motivated by a desire to consolidate a useful pedagogical device. Musgrave’s larger *Theory of public finance* structured in three branches – in which this whole discussion on public provision of collective goods took shape – has always been praised as a useful pedagogical device (R. A. Musgrave, 1989; Solow, 2008; P. Musgrave, 2008). In addition, Musgrave and Musgrave (2003) recently corroborated the idea that the size of the group to which benefits accrue was an important dimension of public goods. In the prologue of a book on *Global public goods*, they stated:

Non rival availability of benefits to all members of the benefiting group is the essential characteristic of public goods, but the group has to be defined. Groups can be defined along various dimensions. Public concerts provide benefits to people who like music but are of no value to the deaf. Many groups can be considered. But among them the area over which benefits extend is of particular concern to this volume, with its linkage of public and global in the role of global public goods (Musgrave and Musgrave, 2003, p. xiii).

Conclusion

Samuelson’s (1954) simple exposition of the necessary conditions for optimal provision of collective goods was presented as an addendum to the chapter on Welfare Economics of his *Foundations* (1948). It generated a fresh wave of interest in America for public expenditure theory in public finance, out of which grew public economics as a new branch of economics. Musgrave was conducive to raising Samuelson’s interest in the public good issue. Still, after Samuelson’s brief involvement in this discussion, Musgrave made other important contributions toward the standard textbook definition of public goods which have not been recognized in the literature. Thanks to him, non-exclusion is generally recognized as a defining characteristic of public goods. In the discussion that took place in the 1950s and 1960s, different conceptualizations of the problem of public goods emerged. I have highlighted Musgrave’s particular interpretation. Non-exclusion from the consumption of a public good causes free riding to occur which leads to preference-revelation problems. This first instance of market failure can combine with a second one. When goods are non-rival, their free availability to everyone – made possible only through public provision – is socially desirable (Pareto improving). In retrospect, it is obvious that this policy recommendation rests on the assumption of a benevolent government (that does not *fail*).

Olson and Buchanan helped to clarify the significance of large numbers for the

free rider phenomenon. The latter explained why this dilemma was not to be confused with the two persons prisoner's dilemma. However, Buchanan saw public provision as a challenge and tried to make voluntary provision work in the face of the spectre of the free rider. Thus, he argued that most of the times, goods provide only partially indivisible benefits to a relatively small group of persons. This allowed for a decentralized local solution to the problem. Besides, Buchanan argued that exclusion was rarely impossible, which permit voluntary clubs to provide the goods. Both arguments delegitimize the intervention of the central government in providing goods.

Nevertheless, the large number assumption is central in Musgrave's assessment of public goods. Indeed, when the number of potential consumers is small, the ability to exclude does not matter much. That explains why the fiction of Robinson Crusoe and Friday is not relevant for public goods analysis in public finance. Contrary to Buchanan, Musgrave did not favour forging small number interaction situations, partly because it creates a new set of imperfections due to strategic behaviour (Musgrave, 1969).

In sum, genuine public goods issues in public finance arise when a large number of citizens, of a definite community, demand non-rival and non-excludable goods and services. This community can be either local, national, or global. The concept of public good (or social good) is thus an ideal concept (Ver Eecke, 1999) which can be represented in a table, along with some departures from it. Since it is an ideal concept, it is not to be looked for directly in the world. When trying to apprehend real-world public services with Musgrave's typology, some concessions must be made. For instance, implicit institutional constraints and political traditions are weaved into every bottom-up fit. In spite of that, I think the summary table of this typology is a useful pedagogical device. As Sturn (2010, p. 307) aptly remarked: "Musgrave's influence on modern Public Economics is an example of how the dissemination of innovations is enhanced by a suitable expository framework."

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Appendix 1

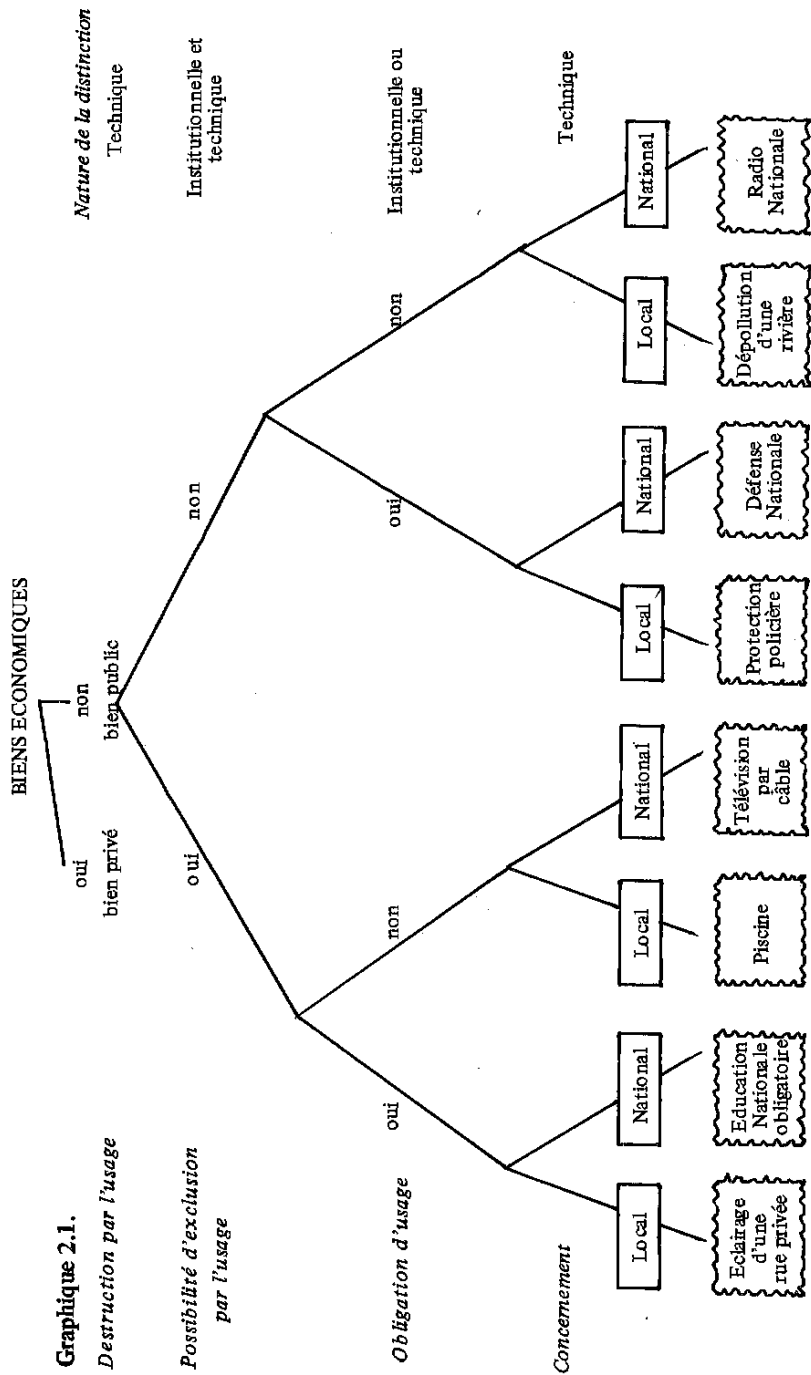
FIGURE 1 Types of Goods

		Jointness of Use or Consumption			
Exclusion	<i>Private Goods:</i> Bread, shoes, automobiles, haircuts, books	<i>Toll Goods:</i> theaters, night-clubs, telephone service, toll roads, cable TV, electric power, libraries		Feasible (Low Cost)	
	<i>Common-Pool Resources:</i> water pumped from a groundwater basin, fish taken from an ocean, crude oil extracted from an oil pool	<i>Public Goods:</i> peace and security of a community, national defense, mosquito abatement, air pollution control, fire protection, streets, weather forecasts, public TV		Infeasible (Costly)	
		Alternative Use	Joint Use		

SOURCE: Author.

Source: Ostrom and Ostrom (1977, p. 168)

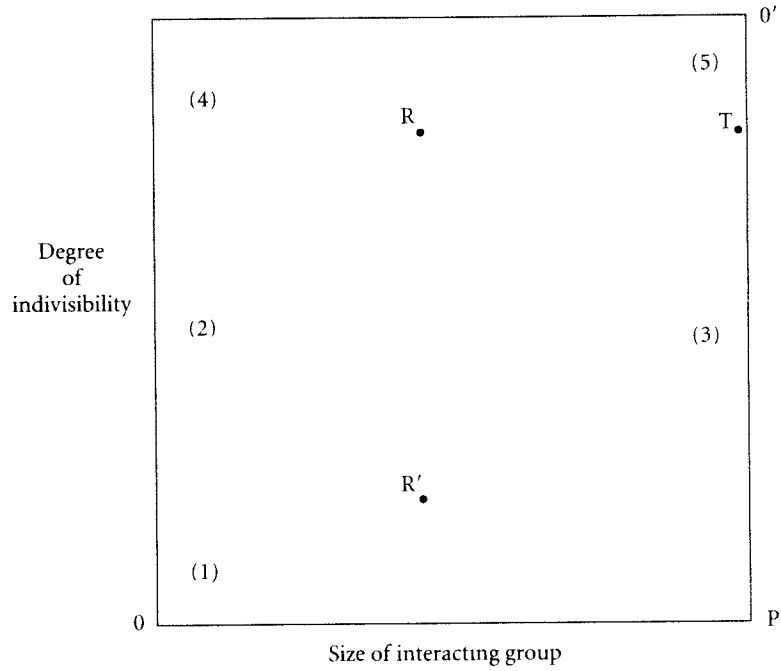
Appendix 2



Pour un bien privé, la possibilité d'exclusion d'usage est simplement la possibilité ou non du vol. C'est donc une distinction purement institutionnelle. De même l'obligation d'usage d'un bien privé est aussi de nature institutionnelle.

Source: Laffont (1988, p. 41)

Appendix 3



Source: Buchanan (1968, p. 165)