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**DISTRIBUTIVE PROBLEMS
IN THE PROVISION OF GLOBAL PUBLIC GOODS**

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Distributive problems in the provision of global public goods¹

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Abstract

Providing (global) public goods involves a number of distributive questions. Some of them have been relatively neglected in the literature. Distributive questions arise in the assessment of under-provision, production and use of global public goods. Issues of quality of, and access to, global public goods are of specific relevance. Distributive issues also arise when deciding the appropriate benchmark of optimal provision. The chapter suggests some policies to tackle distributive issues in the provision of global public goods.

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1. Introduction.

The concept of global public goods has recently been introduced to indicate those public goods that tend to benefit people in more than one country and do not discriminate against population groups or generations².

Problems of non-optimal provision of public goods, specifically of under-provision, obviously arise in market economies. Existence of public goods is indeed considered to be a case of market failure, i.e. a case in which the market fails to guarantee (allocative) efficiency. The same problems of market failure apply to global public goods: operation of markets fails to provide that amount of clean environment, knowledge, financial stability, etc. which will make some people (countries) better off, without making any other worse off. In order to ensure efficiency more of (global) public goods should be produced with the help of institutions other than the market.

In this chapter we deal with distributive issues arising in connection with the optimal provision of global public goods. In fact, a not well-developed dimension of availability of (global) public goods is the distribution of their net benefits as among different people and countries.

Public goods are usually thought of as having a positive impact on all.

A 'pure' public good is indeed non-rival and non-excludable. Non-rivalry means that it benefits many people (or countries, in the case of global public goods) at the same time. Unlike private goods (like cakes and other ordinary goods), which, when used by someone, cannot be used by someone else, use of a pure public good by additional persons does not involve facing additional costs of production. Non-excludability means that it is extremely difficult or impossible to reserve usage of the good for one person (or country). These features of pure (global) public goods, while implying that, at least in principle, all benefit from them, do not mean that:

1. all (global) public goods are 'pure'. Most of them in reality are rival or excludable to some extent.
2. Every person or country has the same kind of benefits from using them. Some could not even have access to (global) public goods.

This is but a case of distributive problems arising in connection with (global) public goods. They are indeed numerous.

First, distributive problems originate in relation to the assessment of the optimal provision of global public goods, i.e., with reference to the financial contribution or other circumstances that influence the disposition of people and countries to provide some amount of a global public good. There are problems in *assessing the potential contribution* of people and countries to production of (global) public goods, i.e., their willingness to pay for the provision of (global) public goods. These problems have a distributive dimension. We will briefly deal with them in Section 2.

² For a similar definition see Kaul, Grunberg, Stern (1999). Some first contributions to global public goods are Sandler (1992), Barrett (1993), Runge (1993), Cornes and Sandler (1996).

Other distributive questions arise in connection with production of (global) public goods. Contrary to the so-called ‘Warr neutrality property’ of public goods, in reality there are important cases where the contribution to provision of (global) public goods depends on the distribution of income and wealth. According to how these are distributed as among people and countries the amount of the (global) public good produced will be different. These problems are dealt with in Section 3, with reference to the kind of ‘*provision technology*’ that characterises each good.

Distributive problems also arise when *using* global public goods, in relation to the quality of, and access to, such goods for different people and countries. (Global) public goods tend to benefit all people (countries), but in a differentiated way. As we have already said, the contribution of a global public good to different people and countries is different and there are different possibilities to have access to it for each one of them. The case of the Internet is exemplary from this point of view. The Internet is a global public good that can convey information and knowledge. However, access to the web is for many people precluded due to the existence of a number of constraints. We will consider these issues in Section 4.

Distributive problems arising in *producing and using* global public goods are strictly intertwined, as we show in Section 5. For instance, issues of quality and access, which appear to arise only when using a good, depend to some extent on the kind of provision technology.

The next sections of the chapter deal with distributive problems in connection with the benchmark of under-provision. Allocative static efficiency is the usual benchmark. We will deal with the appropriateness of such yardstick in Section 6, arguing that in some cases more appropriate benchmarks – such as dynamic efficiency or capabilities - can be found. Section 7 deals with capabilities as a yardstick for measuring under-provision of global public goods alternative to allocative or dynamic efficiency. Obviously, distributive consequences of filling the gap in under-provision would be different according to the benchmark.

The final Section is about possible solutions to distributive problems.

2. Issues arising when allocative efficiency is the yardstick of under-provision.

The usual paradigm for assessing existence of under-provision of public goods is allocative (static) efficiency, i.e., the possibility of one or some individuals obtaining more satisfaction without forcing other individuals to do with less. In this and the following three sections we refer to the usual type of valuation of under-provision of global public goods, in terms of allocative efficiency. In all four sections distributive questions are raised, possibly together with other questions.

Applied analysis of externalities and public goods in terms of allocative efficiency is often made in terms of a very popular technique, which is cost-benefit analysis. Some authors have questioned the possibility of this technique to provide a definite basis for deciding commitments to long-term programs such as those discussed in relation to climate change (Lind, 1995). This notwithstanding, cost-benefit analysis, together with other techniques, can offer at least approximate valuations.

As is well known, benefits and costs are assessed in terms of willingness to pay (WTP) of people for the public good in question. This certainly reflects the existing distribution of income and wealth and therefore gives a biased indicator of under-provision. The question in any case arises of how to measure WTP. The method of contingent valuation can help in collecting information about the WTP of different individuals or countries. It gives a valuation based upon responses of individuals about what their actions would be if a specific hypothetical situation would occur.

In a similar fashion, WTP and the contingent valuation method can be used in assessing under-provision of global public goods, when the yardstick of under-provision is the usual one, i.e., allocative efficiency. In this case, however, some questions arise that can be relevant for some global public goods.

First, the framing and embedding effects (Kahneman and Knetsch, 1992; Diamond and Hausman, 1994) tend to arise. Responses tend to depend on the way (in particular, on the order) questions are framed. In addition, valuations are often very similar for different surveys even where theory suggests that the responses be different³. Other difficulties can derive from the possibility that some agents do not have a clue as to what some specific global public goods are or how to truly value them. These problems are all of specific relevance for those global public goods, such as peace, freedom, financial stability, for which either there can be true problems of definition or equity (ethics) considerations are of overriding importance. For such goods application of the method of contingent valuation should be regarded as giving very unreliable information. The case for excluding application of this method to such global public goods is then very strong.

In addition, a number of specific issues arise for global public goods because contingent valuation can be applied to citizens of the various countries or to their governments. When the method of contingent valuation is applied to public goods in general, there is no problem in referring it to ordinary people. When, however, it is to be applied to global public goods, the problem arises of choosing between ordinary people of the countries involved, some representative people or official representatives of those countries. There are practical considerations for choosing the latter alternative: easiness and informativeness. However, an issue of representation might arise. For theoretical purposes representative agents of each countries can also be considered. A bias could then arise because of the different size of countries. Boadway and Hayashi (1999) have reached some important results, which also involve distributive issues. We will deal with them in the next section.

3. Distributive issues in producing global public goods and the ‘provision technology’

Neutrality of (re)distribution in providing (global) public goods?

A seemingly well-established proposition regarding effects of redistribution of income on the provision of public goods is the so-called ‘Warr neutrality property’.

³ E.g., Diamond and Hausman (1994: 46) report a WTP for cleaning one lake roughly equal to that for cleaning five lakes (including the one asked about individually).

According to this property the aggregate provision of a pure public good in the Nash non co-operative equilibrium is independent of the distribution of a given income as among a set of individuals each of whom strictly makes a positive contribution to the provision of the public good (Warr, 1983).

This proposition, however, holds only for one of the three main cases of provision technology, that of a summation (or additive or Ricardian; see Cornes and Sandler, 1996) technology, corresponding to the standard case encountered in the literature on public goods.

The ‘provision technology’, or the ‘production technology’ or the ‘technology of supply’ of a public good specifies how individual contributions add to the total public supply of the public good in question. There are three main cases of provision technology: the ‘summation’ technology, the ‘best-shot’ technology and the ‘weakest-link’ technology (Hirshleifer, 1983). If a public good is produced with a summation technology, each individual (country, in the case of global public goods) contributes to the production of the public good. This is, e.g., the case of clean air: everyone contributes to the production (or waste) of this public good. In the best-shot case the individual (country) who can contribute the most to the public good determines the level of the collective provision. This is the case of cure of many diseases. In the weakest-link case, such as in the case of contagious disease prevention, it is the smallest provision that determines the level of collective provision⁴.

When the technology is of a ‘summation’ type, distribution is irrelevant in public good production. One dollar redistributed from person A to person B has no effect on the provision of, say, clean air. B’s contribution to the provision of this public good increases as a result of her higher income, whereas A’s contribution will be reduced by exactly the same amount. In a similar way, taxation of contributors in order to finance extra provision of clean air is ineffective, since every dollar spent in the public sector provision of clean air will determine a fall of an equal amount in the private sector provision of the same public good (Cornes and Sandler, 1996: 165). In this case inefficiency simply arises because all the agents tend to contribute too little to the production of the public good.

When, however, the technology is of the weakest-link or best-shot type, another possible source of inefficiency, related to distribution, arises: ‘it may be the wrong individuals who are contributing’ to the provision of public goods (Cornes and Sandler, 1996: 187); then an appropriate redistribution can increase allocative efficiency.

Exploitation of the rich by the poor countries?

The best-shot case, i.e. the case when it is the largest contribution that determines the level of the public good, applies to disease cure, research and development, knowledge creation. With specific reference to global public goods, Olson and Zeckhauser (1966) raised the issue of a possible *disproportionate burden sharing*, with a higher share of contributions by larger countries. This would be a special case of *exploitation of the great by the small* (Olson, 1965).

⁴ For other cases of provision technology see Cornes and Sandler (1996).

However, this does not imply that poor countries (i.e., countries with a lower per capita income) exploit rich countries for at least three reasons. First, this would be so only if each country were assumed to be represented by one citizen and differences in country size were thus reduced to differences in per capita income⁵. If this assumption is set aside, differences in country size can no longer be reduced to differences in the income of the representative citizen and must be referred to both per capita income and the population. When per capita incomes are identical, since national governments tend to internalise benefits accruing to all their citizen from the provision of global public goods, more populated countries would free ride less than other countries; in that case countries that are smaller from the point of view of their population would tend to exploit larger countries. In conclusion, for countries having either identical per capita incomes or identical populations, there will be a larger contribution of larger countries in proportion of their national incomes. However, the disproportionate burden sharing hypothesis does not hold in general in the case of a country having a larger population and a lower per capita income than another (Boadway and Hayashi, 1999), which is the case of many LDCs.

The second reason why in practice poor countries do not exploit rich countries lies in the protection of intellectual property rights. A large part of the global public goods for which the best-shot technology holds is protected by patents or by availability of complementary knowledge (which in many cases is country- or firm-specific).

The third reason why there is no exploitation of the great by the small has to do with the possible biases in the global public goods produced by large countries when the provision technology is of the best-shot kind. We will deal with this aspect in section 5.

The case for redistribution favouring global public good provision

The weakest-link case, i.e. the case when the level of the public good is given by the lowest individual contribution tends to hold for disease prevention, collective defence, financial stability, preserving bio-diversity, tropical forest, ocean fish stocks, controlling floods and desertification, fighting drug diffusion, crime and corruption.

Existence of a weakest-link technology is a powerful argument in favour of an *initial* redistribution to the advantage of poor countries. In the process transfers to developing countries will produce benefits also for donor countries, because of the improvement in efficiency due to the provision of the global public good. Aid to poor countries will help them to produce more of the global public goods, which will have beneficial effects not only for them but for the more developed countries as well.

4. Distributive problems in using global public goods.

Since the initial formulation of the theory of public goods, it has been clear that:

⁵ This is indeed the assumption of a number of studies following Olson and Zeckhauser (1966).

1. the case of pure public goods is a polar one (see Samuelson, 1955: 356) as is the case of pure private ones; in reality there are a few public goods that are non-rival and non-excludable;
2. provided that (consumption) public goods are those ‘which all enjoy in common’ (Samuelson, 1954: 387), ‘there is an element of variability in the benefit that can go to one citizen’ (Samuelson, 1955: 356) and the goods are ‘provided for each person to enjoy or not, according to his tastes’ (Samuelson, 1955: 350). A similar statement can be made for public goods that enter the production function as inputs: they are provided for each firm to exploit in accordance with its production plan: their use and productivity can then be different for different firms.

This implies that provision of public goods has distributive consequences as between different people and countries⁶.

Non-rivalry and non-excludability are abstract features of public goods⁷. In reality one should verify the extent to which a (global) public good adds to the well-being or production possibilities of an agent (country). This involves consideration of differential quality and access.

4.1. Quality of global public goods.

Even if a public good is non-rival, it does not have the same utility or productivity (or does not enhance capabilities in the same way) for everyone. Each agent (or country) has different preferences as well as technologies and endowments and the physical characters of public goods differ. The distribution of effects in terms of satisfaction or production (or capabilities) of different public goods as among different people (and countries) is moreover different, since the characteristics of each public good are different. In particular, the proportion between nation-specific benefits to total benefits differs as among different global public goods (Sandler and Forbes, 1980).

This implies that producing different global public goods has different distributive consequences⁸: providing a healthy environment will have consequences that are valued differently by different people (countries); similarly for financial stability, free trade, desertification, global warming, intellectual property protection.

Let us consider these global public goods briefly.

Environment

A healthy environment contributes positively to human well being everywhere and for everyone. However, very poor people (and countries) everywhere will value it

⁶ Such different distributive consequences are at the very foundation of satisfying allocative efficiency in the production of public goods through the method of personalised prices devised by Lindahl. Assessing WTP also starts from the recognition that the effects of public goods are different for different consumers and firms.

⁷ Zero marginal costs are similarly abstract. From the strict point of view of production, zero marginal costs are sufficient for defining a (global) public good.

⁸ Awareness of the differential consequences of producing different global public goods can be derived from World Bank (2001), when ‘producing pro-poor international public goods’ is advocated.

less than other people (countries) will, even if they had complete information about the negative effects of pollution and the like⁹, since their main contingent problem is likely to be hunger. In many cases, providing a healthy environment will certainly contribute much more to the well being of the rich than to the poor's, at least presently. A number of poor people and countries clearly reveal their preference for more goods, even to the cost of a more polluted environment. Acknowledgement of this preference is at the very foundation of the exclusion of developing countries from the limits stated in the Kyoto protocol. The overall pattern of future agro-environmental impacts seems to be one of trade-offs – even if of a decreasing seriousness - between agricultural production and environment (Fao, 2000b).

Nevertheless, in some situations protecting environment can be *complementary* to fighting hunger and producing more food. Lack of environment protection can result in negative effects on food production after only a very short time lag. Environmental sensitivity is indeed an important feature of the vision of agriculture going under the name of 'sustainable agriculture' (Pretty, 1995). In some densely populated areas of Nepal maintenance of soil fertility, based on manuring from cattle fed with forest products, is threatened by deforestation. Deforestation practised by 'shifting' cultivators (i.e., farmers that fell patches of forest, plant their crops and move to other patches of forest as soon as yields decline substantially) destroys the soil organic matter, thus reducing yields in a very few years, whereas a system of farming that closely mimics the dense natural vegetation of the humid forest is sustainable in the long run. Soil erosion in slope lands threatens crop yields, which declined in some areas by 8-21 percent over the period 1970-1995. More generally, environment-protecting techniques of land management can have a positive impact on the level of production and productivity in agriculture (Blaikie, Brookfield, 1987; Cuffaro, 1997; Pingali, 1997, Fao, 2000b). In addition, global warming, while having net benefits – at least in the medium run - for developed countries, has a negative impact on some developing country regions, particularly sub-Saharan Africa (Fao, 2000b). Finally, 'most of the negative impacts from agriculture on environment can be reduced by an appropriate mix of policies and technological changes' (Fao, 2000b: 200; see also Pretty, 1995; Conway, 1997).

A clean environment is complementary to nutrition also from the point of view of food consumption: at least some instruments for fighting hunger require an appropriate environment to be effective. The case of powder milk for infant nutrition, which cannot be used in places lacking clean water is well known and needs no extensive statement. Clean water is a big problem in many developing countries also from other points of view, since its availability certainly adds to safety of food and the possibility of achieving proper nutrition standards. In addition, since in many countries (in particular, in Africa) 'food production is not only a source of food but also the main source of incomes for the majority of people facing food insecurity, it is impossible to understand the causes of...poverty and undernutrition...unless

⁹ Lack of information and uncertainty as to the true effects of pollution or global warming, etc. are likely to reduce the valuation of environment given by everyone, rich and poor as well. The poor can however suffer from lack of information more often than other people can.

we...(consider) factors responsible for the disappointing growth records of local food production' (Platteau, 1995: 448). Desertification is one such factor¹⁰.

Financial and foreign exchange instability

Financial instability (e.g., stock price volatility, firm bankruptcy, etc.) hits households and firms everywhere, but can be tolerated more by rich people, since they are wealthier and have a more diversified portfolio.

In any case, the cost of financial instability, when it occurs is higher, in relative terms, for developing than for developed countries. The estimated cost of the Argentinean banking crisis of 1980-82 was as high as 55% of GNP and that for Chile in 1981-87 was 41%, whereas the hardest banking crisis that hit the United States in the 1980s cost only 2.5-3.0% of GNP (Wyplosz, 1999:154).

Free trade

Free trade can add more to developed countries' well being than to LDCs'. The latter can even loose from an open trade regime in some circumstances, as history teaches us. Hegemonic countries have always been in favour of free trade, whereas latecomers have defended themselves by protecting home production. Awareness of this fundamental asymmetry is at the basis not only of safeguard clauses in favour of LDCs guaranteed by multilateral trade agreements, namely those stemming from the WTO, but also of programs tending to strengthen managerial and export abilities of LDCs in the presence of free trade obligations and free access of these countries to the markets of developed countries (World Trade Organization, 1997, 1998).

Desertification and global warming

Desertification is more of an actual concern for people living on the boundaries of desert or in already warm places. Global warming can hit more people in temperate zones. Nordhaus (1999) reports some rough estimation of differential effects of global warming on the GNP of various countries. Some countries – like Australia and Bangladesh - might be highly hit by global warming and the ensuing sea-level rise, since a large part of their population is living at or near sea level; some other countries might even draw a large (short- or medium-run) benefit from global warming, since this can enhance their agricultural productivity (Sandler, 1997: 100, 105).

¹⁰ There are other cases of important interrelationships between the effects of different global public goods: preventing or curing diseases has positive effects on food use and labour productivity and, then, the possibility to combat hunger (UNCTC, 1981, Smil, 1987, Drèze, Sen, Hussain, 1995, Fao, 2000a). A classic study proved that in the poor villages of the Indian Punjab a much larger fall in mortality and under-nutrition was achieved when a fixed sum of cash was divided between health care and nutrition support than when it was concentrated on one or the other (Taylor et al, 1978, cited in Fao, 2000a: 232).

Intellectual property protection

This may have a bias in favour of innovations that tend to favour more some people or countries. As we will see later, there are also biases in *access* to this global public good (Stiglitz, 1999, p. 315).

Intellectual property right protection certainly fosters production of innovation whose benefit span all over the world. It has however distributive consequences: a tighter protection will benefit (up to a certain point: see Stiglitz, 1999) developed countries more than LDCs for various reasons. First, a large part of producers come from more advanced countries (or work for firms and institutions situated or originating in such countries) and are compensated for the fruits of their work. Secondly, more developed countries have effective competition policies that ‘mitigate the risks that result from the abuse of monopoly power associated with a patent’ (Stiglitz, 1999: 315). Thirdly, most LDCs lack the local knowledge needed to ‘fertilise’ global knowledge, e.g., for the poor state of the education system.

People (countries) taking advantage of the provision of some global public goods are then different from those who benefit from provision of some other global public goods.

In some cases (e.g., tropical deforestation) different qualities of the global public good are amenable to a case of joint production of true global public goods, local (regional) public goods and private goods. Forests, in particular, yield some global public goods (by sequestering significant amounts of carbon, which would, if released, accelerate global warming), while giving rise to localised public goods (favourable climate effects and erosion prevention) to the nations and their neighbours as well as truly private outputs (e.g., timber) (Sandler, 1993, 1997). If the global public good is intergenerational, differences in consequences can be attenuated: someone (some country) having little benefit now can have higher future benefits.

Different distributive consequences can in general be derived for different people or countries. True global public goods have an impact diffuse all over the world and all countries should favour their production. Those that have mainly a regional impact have the nature of club goods and tend to be demanded and produced (even if sub-optimally) by the countries involved only. Private goods are demanded and produced by each country (agent) interested.

The question can arise whether provision and distribution of global public goods should be dealt with separately or jointly. One position would be that it is best to get the efficient mechanism (e.g. clubs for club goods) established first and to deal with the equity aspects after the fact by giving potential members the wherewithal to join. However, since producing (global) public goods is always expensive and the effects are different as between people and states, a problem of precedence in filling the gap in under-provision arises. This should be solved by taking distributive problems into account at the same time as those of choosing as among different projects of global public goods implementation. Some useful precepts for solving equity questions in the provision of global public goods are suggested in section 8.

4.2. Access to global public goods

This raises questions *similar* to those of quality of global public goods. In some cases, however, it is more appropriate to speak in terms of access rather than quality. Properly, impossibility to have access to a global public good means the existence of a constraint, e.g. a budget constraint. Questions of quality are more in terms of higher costs to face or lower satisfaction (well being) when using global public goods, because different people have a different set of complementary goods and substitutes or different preferences or technologies.

Characteristics of non-rivalry and non-excludability do not guarantee the real possibility that the global public good enters the utility (or production) function, *were someone (some country) in a condition not to pay accession costs directly or indirectly necessary for the exploitation of the global public good.*

Checking *accession* costs to public goods is complementary to ascertaining the existence of zero marginal costs on the production side: even if marginal costs of production are zero and the global public good is there, some people (countries) cannot take advantage of it, for the existence of budget constraints, lack of pre-requisites, fragility of the economic and social system, etc.

Use of knowledge provides a very important example of difficulties of access to global public goods for poor people and countries. Patents are the first obvious barrier for their access to knowledge. They reduce the scope for introducing innovative methods of production, cure of diseases as well as amusement (as in the case of music, novels and the like). But difficulties of access are not confined to patents.

Let us consider the case of connectivity as an example. A large fraction of human knowledge is, at least in principle, freely available. It can be acquired through the internet, a global public good that has an immense power as a tool for sharing knowledge and spreading it all over the world (Spar, 1999). However, the internet can be exploited only by people having at least the following endowments: literacy, electricity power, access to a phone network, purchasing power to buy a pc or to pay for other, less expensive, means of access; in any case, possibility to face current costs of connection and operation. Only 0.4% of people living in South Asian and Sub-Saharan countries have access to the web as compared to 54.3% in the United States (United Nations Development Programme, 2001). Reduced access to the Internet by people living in LDCs thus implies a disadvantage for them that can have heavy negative consequences on their growth and development.

Another important example of difficult access to global public goods is given by prevention of diseases. In many cases poverty makes it impossible to acquire those private goods or expertise or social infrastructure allowing people to benefit from the goods in question. Unavailability of clean water, shortage of food, unhealthy diets, lack of surveillance for emerging infections, inappropriate waste disposal are among the most important factors preventing access of the poor to health. From the point of view of cure of diseases, of the same importance in limiting access to health is the 'claim that several breakthroughs of significance to poor population, like a new and effective cholera vaccine, are technically feasible but the fruits of this knowledge are not being applied, because private companies that own the patent rights lack the

commercial incentive necessary to bring the products to market' (Chen, Evans and Cash, 1999: 302, n.10).

The question of access to global public goods is thus an aspect of inequality of income and wealth. Some people (countries) could benefit from global public goods only if they were put in a position of overcoming access barriers to global public goods. This is of special interest for global public goods whose production technology is of the weakest (weaker) link type (more recently, Sandler, 1998).

5. Joint questions of production and use of global public goods.

Obviously enough, questions of production and use of global public goods are not disjoint: quality of, and access to, global public goods much depend on their provision technology.

This is the case, e.g., of drugs and, more generally, of knowledge production. Knowledge is a biased global public good in terms of quality and access, and poor people and countries can then be discriminated in their consumption of this good.

It is well known that inventions follow trajectories that are highly environment-dependent (see Arthur, 1986; Arthur and Lane, 1994). The features of 'inventions' are then specific to that environment. In particular, it must be expected that both the cost and the possibility of using inventions are environment-specific. An invention will be more expensive and its use will require certain relatively high standards if it is developed in advanced countries. It will be less expensive and require lower standards if developed in less advanced countries.

If the provision technology is of the summation kind, there is no much concentration of production of global public goods in one country or in a group of countries sharing similar characteristics. The risk of an environment-dependent invention is then lower. In the case of the other two main provision technologies, however, the risk may be high. But there is a fundamental asymmetry between the best-shot and the weakest-link technology. The former implies production of global public goods by more advanced countries. The latter implies production by less advanced countries. In the case of a weakest-link technology the possible bias in the cost of the global public good does not seem to impose any constraint in the use of this good by other, richer, countries. Think of health: successful prevention of diseases obtained by poor countries simply produces the desired result also for rich countries. On the contrary, biases can be attached to best-shot technologies. Specificity of the environment where the invention is developed implies a higher cost of the invention and modality of use of it that can make the invention simply not accessible to other, less developed, countries.

Let us consider health care. There are a number of biases in the ways health care is in fact 'produced':

1. 'Diseases affecting large proportions of humanity are given comparatively little attention.' (Lee, Mills, 2000: 775). The Global Forum for Health Research (2000) estimates that less than 10% of research funds are spent on diseases accounting for 90% of the 'global burden of disease'. Then distribution of income and wealth is not without effects on the provision of global public goods. In fact, 'understanding the health needs of poorer

communities is critical to the collective good of health world-wide' (Lee, Mills, 2000: 776).

2. Even when diseases more relevant for LDCs are investigated, a bias can arise because of the preference given to cure instead of prevention. In particular, in the case of AIDS there might be an interest to cure AIDS by the use of drugs, instead of preventing its diffusion by appropriate and cheaper means of prevention.

In general, the essential role in preventing diseases played in many countries by access to clean water and hygienic conditions is often disregarded. In a similar way, when health crucially depends on the use of drugs, the complementary role (and expensiveness) of strengthening the local health system is often neglected¹¹

3. A problem related to that of the preference given to cure instead of prevention arises because 'the nature of the research and the application of findings can undermine efforts of resource poor countries to deal with the primary problem... Researchers suggest that children under six months be given vitamin A supplements... Giving capsules to children to resolve dietary deficiencies tells their families the problem is beyond their control' (Black, Loff, 2001: 995), thus reducing their sense of responsibility and effort to find solutions to food problems.
4. 'Simple and low cost technologies, appropriate for use in settings with few resources, are undervalued and hence inadequately researched' (Lee, Mills, 2000: 775).
5. There is a tendency, common also among international agencies, to generalise solutions inappropriately from one country to another (Godlee, 1994). In some cases minor adaptations are possible which can facilitate access of low-income earners; in some other cases this will not be possible.

6. The question of the paradigm for assessing under-provision

The usual paradigm for assessing existence of under-provision of public goods is allocative (static) efficiency. Markets tend to under-provide public goods, since the producer of such goods does not benefit herself alone, but also benefits others. In a similar way, under-provision of global public goods is assessed in terms of the same benchmark (Kaul, Grunberg, Stern, 1999: xxi)¹².

There are reasons for assessing under-provision in terms of allocative static efficiency, to be found in the history of economic thought. In fact, the concept of

¹¹ For each dollar used for antiretrovirals, three more are needed for an adequate health service infrastructure (Kallings, Vella, 2001).

¹² For intergenerational public goods Sandler and Smith (1976) have suggested adopting the concept of intergenerational allocative efficiency: that position, departing from which it is impossible to improve the well-being of any person at any time without harming some other person in the current or in a different generation (see also Sandler, 1999). Such a concept corresponds to an enlargement of the space of agents whose position must be 'protected' when improving the position of a certain agent. From a certain point of view this concept is a simple adaptation of the usual paradigm to a specific kind of public goods.

public goods emerged or consolidated as a case of market failure in terms of allocative (static) efficiency.

The question can however be raised whether in some contexts, e.g. public goods having an impact on the dynamic performance of the economy, there is a better indicator of (the effects of) under-provision. Some kind of dynamic efficiency (e.g., the impact of global public goods on the rate of growth of the economy¹³) can be an alternative – possibly, more appropriate - indicator in some instances.

This seems to be the case of intellectual property right protection. The GNP growth rate could be a synthetic indicator of the impact of economic policies on welfare, apart from intra-generational distributive aspects. It must however be considered that the growth rate would miss considerations of well being different from – and, possibly, in contrast with – material ones.

Once we have raised the question of the best indicator of under-provision, some more general remarks are in order.

First, both the concept of allocative efficiency (because of its reference to a psychological indicator of well being like utility) and the specification of dynamic efficiency we have just suggested for intellectual property right protection (because of its reference to material indicators such as the rate of growth of GNP) can be unsatisfactory, in the light of Sen's remarks (Sen, 1979, 1982a: 29-31). From a normative point of view, capabilities, i.e., the possibilities for people to perform certain functionings, are an indicator of the personal advantage that can be more suitable than either psychological or purely material indicators. The possibility to refer to the concept of capability in dealing with problems of public goods must be analysed more in depth. We will do that in the next section. In any case, adopting a different yardstick certainly has different consequences on distribution.

A second general remark concerns the limit of making use of a yardstick different from that of allocative efficiency in indicating under-provision. There are really arguments to show that some goods are under-provided in terms of allocative efficiency. Strictly speaking, one should demonstrate that for those goods there is also under-provision in terms of other indicators. In other words, one should demonstrate that the market leads to under-provision of the good in question not only from the point of view of allocative efficiency but also in terms of other yardsticks.

Let us take the case of the intellectual property right protection. We know that this good is non-rival and non-excludable and that for goods having such characteristics there is under-provision in terms of allocative static efficiency. One should demonstrate that there is under-provision also in terms, say, of dynamic efficiency or capabilities. A formal demonstration is beyond the scope of this chapter. For practical applications it should be enough to show that when one speaks of under-provision of some good in terms of yardsticks different from allocative efficiency, raising provision of the good in question raises the level of the variable chosen as a yardstick. For instance, there is under-provision of intellectual property right protection in terms of dynamic efficiency (as measured by GNP growth rate) if a higher protection, say a 1-year longer protection, increases the growth rate. In a similar fashion, intellectual property right protection is under-provided in terms of capabilities

¹³ It should be a sustainable rate of growth.

if a 1-year longer protection leads to an increase in the variable chosen as an indicator of capabilities.

7. Capabilities as the yardstick of under-provision

As is well known, the concept of capabilities has been introduced by Amartya Sen to overcome the limitations of making recourse to utility information, on one side, or to the quantity of goods and services, on the other, as a normative benchmark for assessing the impact of actions. As already said, both psychological and material indicators are inappropriate for judging consequences of actions on human well-being (Sen, 1979, 1982a).

There is no overall index of situations contributing to human capabilities. This is difficult to devise for such a comprehensive concept and the variety of actual positions of different people. A number of composite indices have been constructed, instead, to measure various aspects of capabilities¹⁴ having in some cases specific relevance for some groups of persons, characterised by gender or socio-economic situations. The first and more comprehensive such index has been the Human Development Index (HDI), initially suggested in United Nations Development Programme (1990), which takes account of life expectancy at birth, educational attainment (as indicated by adult literacy rate and a combined enrolment ratio) and adjusted per capita income. It has been followed by other indicators, such as the Gender Development Index (GDI), the Gender Empowerment Measure (GEM), the Human Participation Index 1 (HPI-1) for developing countries and Human Participation Index 2 (HPI-2) for industrialised countries, which give a more specific account of the impact of human actions on the well-being of some sections of the world population¹⁵ and, thus, of distributive aspects of the impact of human actions on capabilities.

All these indices are calculated for each country. They tend to measure the gap between reality and the optimum (given by the maximum possible value for the component indicators) for each country. For instance, this is the case of the first and more famous index, the HDI: for each of its composing indicators a minimum and a maximum value are chosen and the position of each country is assessed within this range¹⁶. The indices allow for inter-country comparisons.

A number of uses of such indices are possible. The Human Development Report already makes some general assessments on the effects of policy choices and events on the indices. For instance, 'of the 101 countries for which HDI trends between 1975 and 1998 are available, all but Zambia had a higher HDI in 1998 than in 1975' (United Nations Development Programme, 2000: 148). In principle, the index for each country could also be aggregated by sum to get an overall value for the whole world or the distribution of the HDI index by groups of countries could be calculated. One could also calculate the rate of growth of the index on a country or world basis.

¹⁴ Better to say, the indices are a measure of functionings.

¹⁵ For a more detailed description of the content of such indicators of human development see United Nations Development Programme (2000: 269-73).

¹⁶ Income is transformed in log terms.

For our purposes, even if we can't say that there is under-provision of global public goods in terms of capabilities for the reasons expounded in section 6, the indices mentioned can be used to assess the impact on capabilities of increasing the provision of global public goods. Apart from the effects on GNP, which are more frequently assessed, it is not difficult to calculate direct and indirect effects of providing some additional quantity of a certain global public good on, e.g., longevity and knowledge. A positive overall effect on the HDI of some global public good provision would pragmatically indicate that there is under-provision of such a good. Distributive issues arising from global public good provision could be tackled not only by way of the usual statistical tools applied to the overall HDI¹⁷, but also accompanying it with consideration of the other indicators mentioned above.

The questions of access to, and quality of, global public goods have a specific relevance in the case when capabilities are the benchmark of under-provision. Improvement of capabilities deriving from provision of some global public good, especially in the case of poor people and countries, requires an assessment of the quality of the global public goods involved and a test of accessibility. Existence of a theoretical impact of some global public good on the variables assumed as indicators of capabilities would not be enough to induce a decision to provide the global public good. Specific tests ascertaining the possibility of some persons or countries to have access to the good or benefit from it would be needed.

8. Some possible solutions to distributive problems.

How to face distributive problems?

Different people (countries) will derive different benefits from filling the gap of under-provision of different global public goods. In particular, poor people (countries) will enjoy more some global public goods (e.g., elimination of tropical diseases, desertification, global warming and financial instability) than others (e.g., free trade and labour standards; general environment protection). Then choosing to fill the gap of under-provision for one global public good instead of another will have different welfare implications. Some people can favour actions aiming at promoting production of some global public goods instead of others. There may even be a struggle for questions of priority that could hamper implementation of a program of filling the gap in global public good under-provision. This could be even more so in an international context as compared to what could happen within one country, because of the fragmentation of government sanctioned by the Westphalian system of nation states (Nordhaus, 1999).

There are however some precepts for agenda setting that could ease solutions:

- a) The existence of complementarity between different global public goods noted above could make it easier to find convergence in decisions to fill the gap of under-provision of some global public goods.

¹⁷ The HDI is already calculated by region and by groups of countries characterised by different levels of income or human development (United Nations Development Programme, 2000: 148, 160).

- b) Bargaining in an international context can guarantee solutions that are *as a whole* appropriate, i.e. give significant benefits, to *all* countries *at the same time*, if they agree on a set of simultaneous measures, each one offering different net benefits. One possibility would be to link negotiations on different global public goods (*issue linkage*), e.g., those on intellectual property right protection to those on tropical deforestation: some common principle (recognition of Property Rights) could be applied to both which favour developed countries in one negotiation (intellectual property right protection) and LDCs in the other (property rights to genetic material gathered from forests).
- c) In any case, to global public goods having different consequences for different people (countries) an argument can be applied similar to the one put forward by Hotelling (1938) for policies causing some people to be better off and others worse off. Hotelling argued that problems of compensation arising for each such policy would no longer hold if and when all the policies were adopted, since net benefits would spread over all people. In the case of global public goods, in a number of years all countries would derive significant benefits if a number of global public goods were provided. This argument can be reinforced in the case of intergenerational global public goods.
- d) Increasing possibilities of access to global public goods by all countries, in particular by LDCs, certainly adds to the well being of people. Access should be guaranteed directly by means of subsidies at least in some cases. This could be the case of intellectual property rights in general. The contribution of poor countries to the provision of innovation is certainly negligible in general (except for innovative cures for specific diseases such as tropical diseases), at least as far as the current period is concerned. Their benefits from free exploitation of some innovative knowledge would however be very high, especially if they were put in a position to undertake the actions preliminary to employing such a knowledge: their productivity would considerably rise as a result of that. International agreements for the protection of intellectual property rights could be made easier were a 'World Fund for the free exploitation of IPR by LDCs' created.¹⁸ In some cases of innovations, in particular for some kinds of drugs, increasing possibilities of access by LDCs might require some intervention at the stage of global public good production, since – as we said in section 5 – innovations may be biased in terms of costs and possibility of their practical use. In any case, access to essential drugs is a human right, crucially depending, among other things, on their affordability. WTO/TRIPs Agreement protects and enforces intellectual property rights,

¹⁸ With reference to drugs, the President of the International AIDS Society has said 'that medicines for the South cannot be constrained by the tight boundaries of market transactions, and that care and treatment should be provided on the basis of the need and not on ability to pay' (Vella, 2001: 2). In the same vein are the yearly \$3-4 billion funding requested by UNAIDS (2001) and the Global AIDS Fund asked by people engaged in the cure of HIV/AIDS (Hale *et al*, 20001) from the G8 summit in Genoa and partially granted.

including those for drugs. Patent protection prevents generic competition, but the TRIPs Agreement provides a number of safeguards that can be exploited by poor countries. Such safeguards include compulsory licensing, parallel importation, exceptions to exclusive rights and other measures which allow for generic competition (World Health Organisation, 2001)

- e) To solve questions of inappropriateness of innovations, specifically in the cure of diseases, from the point of view of LDCs some notations and suggestions are in order. First, innovations and cures should be looked for in the context of the general conditions and problems of these countries. It is true that ‘some initial distortion within a system due to a vigorous initiative may help to reformulate and reorient the existing order of things and thus contribute towards accelerated growth. But where the impact of the insert is disproportionate to the systems’ capacity for coping with the change, such “improvement” tends to result in a net loss for the total system in terms of loss of cohesion and systems’ efficiency’ (Siem Tjam, 1994: sect. III) Secondly, developing countries must participate in debates and decision about priority setting, regulatory frameworks, and codes of ethics for research¹⁹. Developing countries should not be seen as recipients of charitable handouts but as partners in producing innovation that can tackle their major problems, nutrition, health, environment²⁰. Starting from the understanding of needs of poorer countries, the support of developed countries can be crucial in producing global public goods such as health, clean environment, and knowledge.

¹⁹ A Consultative Group on International Agricultural Research has operated with some success. Lessons from the experience made with this Group might be useful for the health sector as well. In addition, regional co-operation can be fruitful (Sitthi-amorn, Somrongthong, 2000)

²⁰ This statement is a generalisation of a similar one referred to health research only made by Lee, Mills (2000: 776).

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