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Regional Public Goods: Typologies, Provision, Financing, and Development Assistance

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To our wives: Susan and Jeannie

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Preface and Acknowledgement

This monograph is the first systematic effort to focus on regional public goods as a class distinct from national and global public goods. Unlike these latter classes of public goods, regional public goods (bads) affect a domain of recipients that does not fit into standard political jurisdictions and, as such, present unique institutional problems. A crucial task is to distinguish regional public goods from other geographical classes in terms of properties and policies. The purpose of this monograph is not only to illuminate the myriad classes of these goods, but also to indicate the implications that these regional public goods have on the giving of foreign assistance for development.

In recent years, the donor community is coming to appreciate that the financing and provision of regional, national, and global public goods must be an integral part of foreign aid. In some instances, public goods consist of the infrastructure that underlies well-functioning market economies. In other cases, they promote an economy's productivity and growth through better health, a cleaner environment, and increased knowledge. Security, a regional public good stemming from peacekeeping, makes developing countries more attractive to foreign direct investment, an important source of savings to finance investment and growth. Political stability also protects physical and human capital, while allowing for market exchange and trade.

Regional public goods assume myriad forms with different properties of publicness, which, in turn, determine incentives for donors and recipients to provide these activities. Unless the policy community understands these incentives and what they imply about actions to promote these goods' provision, informed policy making will not be achieved. Alas, the subtleties of the various classes of regional public goods and their implications must be mastered. This monograph facilitates this mastery.

In the tradition of Mancur Olson and Douglass C. North, this monograph applies insights from the studies of collective action and the new institutional economics. That is, the correction of market failures informs policy with respect to the provision and financing of public goods, while improved institutional arrangements foster this same goal.

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All views expressed are *solely* those of the authors, and do not reflect the views or policies of EGDI, Bertil Odén, the Swedish Ministry of Foreign Affairs, CIS, Rhodes College, or the University of Southern California.

List of Acronyms and Abbreviations

AIDS	acquired immune deficiency syndrome
AIP	Apparel Industry Partnership
ASEAN	Association of South East Asian Nations
CDC	Centers for Disease Control
CFCs	chlorofluorocarbons
CGIAR	Consultative Group for International Agricultural Research
CO_2	carbon dioxide
DOTS	Directly Observed Treatment, Short Course
ECOWAS	Economic Community of West African States
EMEP	Cooperative Program for Monitoring and Evaluation
EU	European Union
Fonagro	Regional Fund for Agricultural Technology
G-8	Group of Eight
G-10	Group of Ten
GDP	gross domestic product
GEF	Global Environment Facility
GIS	global information systems
GPGs	global public goods
HIV	human immunodeficiency virus
IFOR	Implementation Force
INTELSAT	International Telecommunications Satellite Organization
ISO	International Standardization Organization
KFOR	Kosovo Force
LDCs	less-developed countries
LRTAP	Long-Range Transboundary Air Pollution (Convention)
MERCOSUR	Mercado Común del Sur (Common Market of the South)
MIM	Multilateral Initiative on Malaria
MMV	Medicines for Malaria Venture
NAFTA	North American Free Trade Agreement
NATO	North Atlantic Treaty Organization
NGOs	nongovernmental organizations
NO_x	nitrogen oxides
NPGs	national public goods
OECD	Organization of Economic Cooperation and Development
ODI	Overseas Development Institute
R&D	research and development
RPGs	regional public goods
RES	resolution
SADC	Southern African Development Community
SFOR	Stabilization Force

SIEPAC	Sistema de Interconexión Eléctrica Para América Central (Central American Power Grid)
SOC	social overhead capital
TB	tuberculosis
TPGs	transnational public goods
TRIPS	Trade Related Aspects of Intellectual Property Rights
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNICEF	United Nations Children's Fund
USAID	US Agency for International Development
Valdivia	Group of Temperate Southern Hemispheric Countries on Environment
VOCs	volatile organic compounds
WHO	World Health Organization
WTO	World Trade Organization

Note: Acronyms for UN peacekeeping missions are displayed in Table 5.

Executive Summary

Globalization in conjunction with technological advances has broken down traditional national borders for many activities and resulted in more cross-country interactions. As a consequence, there is a heightened importance of transnational public goods (TPGs) whose benefits are, to some extent, nonrival and nonexcludable among nations. The presence of these TPGs is having a major impact on foreign development assistance in the 1990s as aid in the form of both national and transnational public goods is beginning to figure more prominently.

Many traditional forms of aid have always supported health, education, infrastructure, and other forms of what is increasingly referred to as public goods. The public goods framework, which is advocated in this study, is however not just old wine in new bottles. It allows the reader to see how globalization and the development of new technologies have augmented such goods that now impinge more greatly on the well-being of developing countries.

Much of the focus in the public goods literature has either been on the national or global level. In between global public goods (GPGs) and national public goods (NPGs), there lies the important class of regional public goods (RPGs), whose benefit range is larger than a nation but equivalent to some well-defined set of nations.

RPGs differ from GPGs and NPGs in a number of essential ways that limit the provision and financing of RPGs for development purposes. For example, donors are more comfortable in supporting development-related NPGs through grants and loans to recipient countries, whose actions can be easily controlled and monitored, rather than to some regional institution or collective. Donors have relied on multilateral institutions (e.g., the World Bank) to manage and coordinate funds from myriad sources for the support of GPGs. In the case of RPGs, regional institutions are much weaker in terms of reputation, experience, and funds than their global counterparts. Often donor assistance is given to nations to provide RPGs, because these nations can raise the proper collateral or assume the necessary responsibility tied to the assistance. Unfortunately, aid at the national level for RPGs may be ineffective, since recipient nations are not properly motivated to supply RPGs in sufficient quantity to account for the positive spillovers conferred on other regional members. Analogously, global institutions may be more interested in GPGs than RPGs, so that the latter gets too little support. Poverty-reducing RPGs also differ from other public goods because outside donors may derive few, if any, direct benefits. To better reflect the preferences of those requiring poverty-reducing RPGs, donors must provide more support to regional institutions.

This monograph contributes to the understanding of RPGs by developing an improved typology that not only accounts for the basic properties of

public goods (i.e., nonrivalry of benefits and nonexcludability of nonpayers), but also for the aggregation technology. The latter indicates how individual contributions to the public good determine the overall level available for collective consumption. The typology further avoids the common pitfall of labeling as public goods those institutions or regimes that provide them. Classes of RPGs – pure public, impure public, club, and joint products – are each further subdivided by the aggregation technology. All classes are illustrated with relevant examples, most of which are drawn from development. The classes of RPGs are then related to the underlying incentives for nations or collectives to provide these goods efficiently without outside guidance or explicit policy. When incentives are perverse (e.g., pure public good abiding by a summation technology), explicit policy intervention to support RPGs is required; otherwise, such actions are unnecessary. For club RPGs and joint product RPGs with substantial country-specific benefits, clubs or nations acting on their own can provide RPGs quite efficiently. Regional clubs achieve efficient results, but raise equity concerns and provide a role for donors to make sure that developing countries can afford the club fees for essential RPGs. A variety of policy prescriptions follow from this analysis.

Regional institutions need to acquire greater capacity to finance RPGs in the area of health, the environment, and knowledge, since these are the areas where RPG needs are growing and are the most pressing. Regional institutions that require strengthening include the regional development banks. Once enlarged by donor countries and the global multilaterals, such regional institutions can assume a larger role in supplying RPGs in the future. Donors must also be prepared to support regional collectives that link member states into power grids, research groups, and environmental blocs, because the benefit ranges of the underlying RPGs have little interregional spillovers and such collectives can take advantage of economies of scale. To establish global networks for financing RPGs, donors should continue to rely on the multilateral institutions as an intermediary owing to their past success, extensive infrastructure, and global reach. Recent instances of successful networks include the Global Environmental Facility (GEF) and the Consultative Group for International Agricultural Research (CGIAR). Such networks can draw on their global reach for fundraising, while responding to specific regions' RPG needs.

New participants – nongovernmental organizations (NGOs), charitable foundations, and partnerships – also have a role to play in funding RPGs. In many cases, these new participants bring greater resources to the provision of RPGs by drawing from new sources of funds and not merely crowding-out old sources. Reliance on NGOs, private companies, and charitable foundations has a downside, since such organizations may be pursuing an agenda (e.g., ideological concerns or commercial interests) not reflective of the interests of either the global community or the recipient countries.

Partnerships among diverse agents from the public and private sectors have proven useful in financing some RPGs, especially those in health and the environment. Further partnerships for other RPGs should be pursued so long as the commercial interests do *not* compromise the legitimacy and political access that traditional aid agencies have labored to gain.

The proper level from which to address the provision and funding of RPGs is an essential concern. There are both supporting and detracting factors regarding the subsidiarity principle, whereby a regional jurisdiction for supply of an RPG is made to *match* the public good's range of spillovers. The advisability of subsidiarity hinges on weighing opposing influences that include economies of scope, economies of scale, the aggregation technology of the RPG, and the capacity of regional institutions. There is no general prescription, so that the jurisdictional decision for each RPG must be decided individually. If the requisite regional institution has sufficient financial capacity and if economies of scope and scale are achieved at the regional level, then subsidiarity is desirable for supplying the RPG. Many environmental and health RPGs lend themselves to provision at the regional level owing to the limited interregional spillovers. For a variety of reasons (e.g., significant interregional spillovers, regional providers pursuing their own agenda), peacekeeping, knowledge creation, and financial stability practices are better supported at a global level given the pivotal nature of such activities.

Given competing demands for RPGs, NPGs, and GPGs, donor countries must make tough choices not only between supporting these goods, but also between financing them and more traditional forms of aid. The distinction between supporting RPGs and NPGs, and traditional forms of aid is not clearly understood and requires further study. Initial attempts to measure aid-related public good spending are fraught with difficulties. Donor countries must differentiate the multilateral emphasis on RPGs that stem from mission creep from the demand for RPGs that arises from a region developing the ability to meet basic human needs.

1. Introduction

Globalization in conjunction with technological advances has broken down traditional national borders for many activities and resulted in more cross-country interactions (Rodrik, 1997). As a consequence, there is a heightened importance of transnational public goods (TPGs) whose benefits are, to some extent, nonrival and nonexcludable among nations.[1] TPGs can differ widely in their reach: efforts to curb acid rain have favorable consequences on downwind countries over a wide region, while actions to limit ozone-depleting chlorofluorocarbons (CFCs) generate benefits globally by protecting the stratospheric ozone shield. TPGs can influence diverse sectors, including the environment, health, knowledge, financial stability, and peace and security (Kaul, Grunberg, and Stern, 1999; Reinicke, 1998a,b; Sandler 1997, 1998; World Bank, 2001a).

The presence of these TPGs is having a major impact on foreign development assistance in the 1990s as aid in the form of both national and transnational public goods is beginning to figure more prominently (Kanbur, Sandler, with Morrison, 1999). Based on conservative estimates, Raffer (1999, p. 12) argues that foreign aid in the form of public goods has gone from about 10 percent of total assistance to about 20 percent in the late 1990s. When he, instead, employs a less conservative measure, *public good aid* is over 40 percent of the total of foreign assistance in the middle 1990s. In more recent estimates, a preliminary study by Hewitt, Morrissey, and Willem te Velde (2001) provides evidence that the financing of both national and transnational public goods through development assistance has risen from about 15 percent in the early 1980s to almost 40 percent in the late 1990s. Traditional forms of aid to improve welfare are being replaced by public goods as portended by Sandler (1997, p. 183). This replacement is evident because the upward trend in public good aid has come at a time when foreign assistance as a total has not really increased (Hewitt, Morrissey, and Willem te Velde, 2001). There is a two-way street between development and TPGs: these goods further development, while a country's development is required to support the provision and utilization of TPGs.

Much of the focus in the public goods literature has either been on the national or global level.[2] National public goods (NPGs), whose benefits primarily stay within the nation's confines, include education, national defense, public health infrastructure, dams, geoclimatic-specific agricultural research, and local roads. In contrast, global public goods (GPGs) provide

[1] On the definition of TPGs and their properties, see Cornes and Sandler (1996), Sandler (1997, 1998, 2001), and the discussion in Section 2.

[2] The implied neglect of regional public goods is made by Cook and Sachs (1999) and Stålgren (2000). In fact, some analysis of regional public goods can be found in Arce and Sandler (2001), Kanbur, Sandler, with Morrison (1999), Sandler (1997, 1998), and Sandler and Sargent (1995).

benefits worldwide to developed and developing countries, and involve curbing global warming, protecting the ozone shield, preserving biodiversity, and promoting global financial stability. In between GPGs and NPGs, there lies the important class of regional public goods (RPGs), whose benefit range is larger than a nation but equivalent to some well-defined set of nations. By their nature, the spillover range of RPGs does not coincide with traditional jurisdictions, consisting of nation-states or a global community, served by a multilateral institution such as the United Nations.[3] This past failure to focus on RPGs is difficult to explain, because there are few examples of public goods with worldwide spillovers, while there are myriad examples of RPGs, such as power grids, reducing acid rain, peacekeeping, drug interdiction, watershed management, cleansing a lake, and forest fire suppression. For allocative purposes, the existence of RPGs may, in some instances, require the creation of new institutions or the strengthening of existing institutions (e.g., regional development banks). As for other kinds of public goods, some RPGs may be allocated by the relevant agents (i.e., nations in the case of RPGs) with little conscious policy or intervention, while, for other RPGs, a good deal of intervention is required.

At the outset, we must address how a public good conceptual framework facilitates the understanding of foreign assistance. This question is especially germane, since many traditional forms of aid have always supported health, education, infrastructure, and other forms of NPGs. What has changed in recent years is the support of public goods whose benefits extend *beyond* a recipient nation to its neighbors and, in some instances, to far-distant countries. The growing support of these TPGs is showing up in the recent breakdown of foreign assistance by the World Bank (2001a), Raffer (1999), and others. In those cases where the benefits spill over to the donor countries, there is a self-motivating rationale for contributing that was unrecognized by traditional motives for giving aid. For health, security, the environment, and financial stability, there is a new awareness that the adequate provision of public goods not only fosters the development of the recipients, but it also bolsters world development. Thus, the public good framework introduces an efficiency argument that was previously absent from the aid debate. As such, this efficiency rational can justify additional aid flows.

The public good framework allows the reader to see how globalization and the development of new technologies have augmented such goods that now impinge more greatly on the well-being of developing countries.

[3] The rise of a new regionalism with trading blocs have, in the case of the European Union (EU), given rise to a regional government that addresses allocative concerns with respect to a host of RPGs. Other trading blocs may also evolve to assume responsibility for some RPGs. On the new regionalism, see Dodds (1998), Hettne, Inotai, and Sunkel (1999), and Stålgren (2000).

Because public goods differ from one another in terms of incentives to contribute to their provision, an understanding of such goods indicates which development TPGs are likely to be supported voluntarily by donors. Thus, institutional activities by the World Bank and other multilateral institutions can be concentrated on raising funds for those TPGs for which incentives are not supportive for voluntary contributions.

A word of caution is, however, necessary. Most foreign assistance still takes the form of improvement to the health and welfare of the people in developing nations. This assistance is still founded on equity considerations and is only public in the sense of making the world a better place for all. That is, most traditional assistance still involves recipient-specific goods. Future exercises to measure the TPG component of foreign assistance must be careful to distinguish traditional forms of foreign assistance from those with a strong TPG aspect.

This monograph has seven purposes. First, it distinguishes RPGs from other classes of public goods in terms of the contributors, their incentives, institutional arrangements, and policy options. Second, alternative classes of RPGs are characterized in terms of an improved typology that captures the three essential properties of publicness – nonrivalry of benefits, nonexcludability of nonpayers, and the technology of aggregation (i.e., the way in which individual contributions determine the overall level of the good).[4] Third, this typology is related to the incentives to support the public good and the need for policy intervention. Fourth, for those TPGs requiring intervention, we identify when such goods are best addressed at the regional level based on a principle of subsidiarity and other pertinent considerations. Fifth, the RPG typology is used to recommend some alternative institutional arrangements for allocating resources to the financing and provision of RPGs. Sixth, the role of RPGs in foreign assistance is addressed to guide donor countries in their altruistic efforts to support development. Finally, three case studies of RPGs that are especially germane for developing countries are presented. These studies of peacekeeping, acid rain, and the health sector serve to illustrate principles stemming from the analysis. Each of these three examples represents an activity of growing importance for developing countries. If, for example, recent trends continue, peacekeeping will represent the greatest spending by the developed countries on RPGs in less-developed countries (LDCs) (Sandler and Hartley, 1999, Chapter 4). The provision of environmental and health RPGs will continue to grow in importance. In health, the G-8 countries' pledge of $1 billion at the summit in Genoa, Italy during July 2001 foreshadows this growth.

Throughout the monograph, a number of themes dominate the analysis. One theme is the importance of distinguishing the RPG provision from its

[4] The technology of aggregation was first introduced by Hirshleifer (1983). Also, see Cornes (1993), Cornes and Sandler (1996), and Vicary (1990).

financing. Another theme concerns the factors that separate RPGs from other public goods – i.e., what is gained by studying RPGs? A third theme is RPGs' growing importance in strategies of development assistance. A fourth theme hinges on how the characteristics of RPGs can guide policy. A final theme involves Sweden's role in providing aid in the form of RPGs.

The remainder of the monograph consists of ten sections. Section 2 contains definitions and essential preliminaries concerning aspects of public goods and alternative concepts of a region. In Section 3, a complete typology of RPGs is presented and then related to efficiency, distribution, and other concerns. Factors that distinguish RPGs from other public goods are addressed in Section 4. Institutional considerations are also analyzed. Section 5 concerns how the principle of subsidiarity can guide institutional responsibility for financing RPGs. In Section 6, the two-way relationship between RPGs and development is discussed. Sections 7–9 include the three specific case studies. The role for Sweden in financing RPGs as part of its development assistance program is investigated in Section 10, followed by concluding remarks in Section 11.

2. Definitions and Other Preliminaries

2.1 Pure public good and free rider

In its classic representation, a *pure public good* possesses two properties – nonrivalry of benefits and nonexclusion of nonpayers – which differentiate these goods from those that can be traded in markets.[5] A good's benefits are nonrival when their consumption by an economic agent (e.g., an individual, a nation) does not detract, in the least, from the consumption opportunities still available to others from the same unit of the good. For equatorial Africa, consider the eradication of a disease-carrying pest, such as the parasitic worm that causes river blindness (onchocerciasis). One resident's gain from a more pest-free environment does not, in any way, limit the health benefits to others stemming from efforts to eradicate the worm or reduce the contagion. Nonrivalry of benefits is often equated with a *zero marginal cost of extending consumption to additional users*, so that there is no cost in terms of crowding or capacity building. If, however, additional consumers must be given the ability to take advantage of the good (e.g., through education or a hook-up charge), or if their consumption reduces benefits through crowding, then there is a nonzero marginal cost associated with extending the good's benefits to others. Even if the production of the good is discrete, so that a certain level must be provided (e.g., one weather satellite or none), the consumption of its benefits leads to continuous or indivisible benefits as more individuals consume the benefits.

If, once the good is provided, its benefits are received by payers and nonpayers alike, then the good's benefits are nonexcludable. The provider cannot, therefore, inhibit a nonpayer from taking advantage of the good's benefits, and this inability limits the incentives of benefit recipients to want to pay for the good. Again, consider the worm eradication program. A more worm-free environment provides reduced health risks for all regional residents. Because the program provides both nonrival and nonexcludable benefits, eradication represents a pure public good. Other examples of such goods for LDCs include discovering a cure for malaria and maintaining domestic tranquility.

Nonexclusion of nonpayers pose a *free-rider* problem, since those who benefit from a pure public good have a strong motive to understate or hide their true gains. By not voluntarily paying for these benefits or supporting the public good, the recipient nation can use its money and resources to purchase private goods, whose benefits can be withheld unless a payment is made. For example, efforts by Kenya to clean up the waters of Lake Victoria can substitute for efforts by Tanzania and Uganda to do the same. If Kenya

[5] On the definition and properties of a pure public good, see Cornes and Sandler (1996), Kanbur, Sandler, with Morrison (1999), Sandler (1992, 2002), and Sandler and Arce (2001). The last reference focuses on health-promoting TPGs.

were to do so, and *then* ask the other coastal nations for a contribution, the collection is anticipated to be meager – why pay for something that has already been received free of charge? Free riding implies a suboptimal provision, since the providing nation is apt to include only the marginal benefits conferred on its own citizens when deciding provision.[6] Benefit spillovers received by others are ignored and this results in too little of the good being provided. There is a Prisoner's Dilemma problem where each potential supplier has a best strategy to hide its preference by free riding, but such actions on the part of all (most) nations leads to little or none of the good being supplied (Sandler, 1992, 1998). Ironically, exercising one's best action from an individual viewpoint results in a poor outcome for everyone.

In essence, there is a property rights protection problem associated with pure public goods, insofar as the provider cannot control who receives the benefits. If a national government supplies the public good, then this problem can be partially circumvented by taxing its citizens to provide financing. This remedy is not sufficient to achieve allocative efficiency, because provision and taxing decisions require the government to know its citizens' valuation of the public good, and this is difficult, if not impossible, to ascertain for a *pure* public good without the ability to read minds. At the transnational level, the property rights problem is exacerbated, because benefit spillovers conferred on other nations cannot be recouped from taxes imposed by the providing nation (Livingston, 1989). The requisite supranational government does not yet exist, except in the emerging instance of the EU, where some taxing authority to provide RPGs is in place – e.g., efforts to clean up sulfur emissions. In a North-South context, the problem of preference revelation is even more difficult, since the contributors (i.e., donor countries) may not be the consumers of the public good. That is, efforts to eradicate malaria in tropical countries must currently be supported by countries where the disease poses no real risk. Contributing nations must guess the benefits derived from recipients for such a pure public good. Such situations can result in an "exploitation" situation where the rich carry a disproportionately large burden of the good's support for the poor countries (Olson, 1965; Sandler, 1992). In other cases (e.g., eradicating AIDS), the donor countries also gain and their incentives to act are stronger, but so too is the likelihood of exploitation. Of course, this so-called exploitation may be fully justified from an equity viewpoint. North-South burden-sharing disputes are prevalent in the negotiations over the Kyoto Protocol, where the South feels that the burden should be carried by the North, which has been responsible for much of the accumulation of

[6] Throughout the monograph, we use efficiency in a static sense. Our later remarks about institutional design, however, adhere to a more dynamic notion of efficiency.

greenhouse gases to date (Adibe, 1994, pp. 497-498; Dodds, 1998; Reinicke, 1998a).

A third property of publicness concerns the technology of supply aggregation (or the aggregation technology), by which individual contributions determine the overall level of the public good.[7] Until recently, most public good analyses implicitly assume that individual contributions are merely added together when determining the total level of the public good. In the case of global warming, actions to limit CO_2 emissions in terms of reduced tonnage equal the sum of the individual cutbacks, so that a *summation* technology applies. But other aggregation technologies may equate the overall level of a public good to either the smallest or largest contribution by an agent (see Section 3). This third property of publicness proves useful for two reasons. First, it allows for a further subdivision of public good classes beyond those determined by nonrivalry and nonexcludability considerations. Second, this property has implications for optimality and the need for corrective policy.

The term public good does not necessarily mean that some form of government needs to provide the good. Some public goods (e.g., national defense) are provided by governments, while some fully rival and excludable private goods (e.g., food and medicine for the needy) are also supplied by governments. In the latter case, public supply is justified by equity or income distributional concerns. In addition, some public goods (e.g., LANDSAT surveying services) are provided privately since exclusion can be practiced. Voluntary firefighters in Santiago, Chile provide fire protection and are not publicly funded despite strong elements of nonrivalry and nonexcludability when a fire poses collateral damage. Publicness, instead, refers to the possession of some degree of nonrivalry and/or nonexclusion of benefits, and not who finances the good. The agent who underwrites the public good need not be the one who produces it. Production should be done by the least-cost supplier, so that cost efficiency is pursued. Military weapons are often produced by private defense contractors (e.g., Lockheed-Martin, Thomson-CSF, Daimler-Chrysler) even though the purchase of these weapons and their subsequent deployment by nations or alliances provide a public good in the form of security to those protected. Thus, even pure public goods can be privately produced, but publicly financed. The cleanup of an oil spill along an African coastline can be by private firms, paid by the affected countries. The real dilemma lies with the financing, not with the actual production (Sandler, 2001; World Bank, 2001a).

[7] In an aid context, the importance of the aggregate technology and public good provision is discussed by Ferroni (2000), Jayaraman and Kanbur (1999), Kanbur, Sandler, with Morrison (1999), and Sandler (2001).

2.2 Neutrality and pure public goods

When a *pure* public good possesses a summation technology, an important policy dilemma results owing to the *perfect substitutability* among contributors. This substitutability leads to a neutrality theorem where policy actions in the form of supranational or collective provision (by the World Bank or UNDP) to bolster suboptimal provision at the voluntary level *will fail*, if this supranational provision draws its finances from those countries already contributing to the pure public good.[8] That is, collective provision may crowd out national provision on a dollar-for-dollar basis for RPGs if the nations already supporting the public good voluntarily are also made to support the collective decision. Neutrality has disappointing implications for financing RPGs not only through collective efforts, but also through income redistribution from large to small contributors. Engineered income redistribution, underwritten by the wealthy contributors, has no net impact on the overall level of the RPG; those gaining income merely increase their RPG contributions by the amount that those transferring income (i.e., the wealthy countries) decrease their contributions. This follows because contributors to a pure public good view public good benefit spillovers received from others equivalently to extra income. To maintain their welfare levels, nations let the increased public good supply, coming from either the collective effort or the income redistribution, to offset their voluntary support of the public good. The end result is no gain in the overall provision of the pure public good.

To escape the neutrality theorem, either the perfect substitutability of contributions must be relaxed, or else the collective provision or income redistribution must be supported by noncontributors (Cornes and Sandler, 1984, 1996). If one nation's contributions is not viewed the same as those of another, then substitutability is no longer perfect. When the contribution to an RPG by one nation is either cheaper than others or possesses unique benefits, substitutability is imperfect and neutrality does not hold. Greater efforts by a nation with special expertise or efficiency in providing healthcare may yield a net increase, even when such efforts are financed by other healthcare providers, since a dollar-for-dollar trade-off is not implied (Jayaraman and Kanbur, 1999). When, moreover, a nation's support of the public good yields benefits not associated with the contributions of others, neutrality fails to apply, so that collectively directed efforts, reliant on such a nation, can augment supply. For RPGs, charitable foundations (e.g., the Rockefeller Foundation, Wellcome Trust) and nongovernmental organizations (NGOs) (e.g., Doctors Without Borders) can circumvent

[8] The first formal statement of the neutrality theorem is by Warr (1983), followed shortly thereafter by Cornes and Sandler (1984, 1985). Extensions and clarifications can be found in Bergstrom, Blume, and Varian (1986) and Cornes and Sandler (1996).

neutrality by drawing their funds from noncontributors to the public goods. The World Bank (2001a, p. 113) estimates that foundations and private philanthropy financed at least $1 billion of TPGs in 2000. Another $2 billion came from trust funds set up with multilaterals. According to the World Bank (2001a, pp. 110-117), these $3 billion represent some 60 percent of *core* activities to produce TPGs.

Another $11 billion are spent on *complementary activities*, which "prepare countries to *consume* the international public goods that core activities make available – while at the same time creating valuable national public goods" (World Bank, 2001a, p. 110). Funds for these complementary activities are estimated to come from country-based financial support in the form of foreign assistance. Even in the stubborn case of regional purely public goods, there is an important financial role for multilaterals, foundations, NGOs, and donor nations.

2.3 Geographical spillovers and the notion of a region

Although region is often used to denote a geographical unit within a country, throughout this monograph region refers to a geographical area that includes territory or reach in more than a single country. The range of benefit spillovers from a public good identifies it as a national, regional, or global public good. The notion of nationwide[9] and global spillovers is unequivocal, which is not the case for regionwide spillovers. A region is a territorial subsystem of the global system, whose basis might be geological (based on earth formations such as plains, a coastline), geographical (based on location such as a particular continent), or political (based on shared political values such as socialism). Geological formations, such as a river or a mountain range, might determine an RPG's spillover range – e.g., a mountain range might limit the spread of a pest. For a geographical region, a country's position may determine the consequences of a TPG – e.g., efforts to curb the ozone shield depletion has a greater influence on nations in the higher Southern Latitudes. At times, the regional distinction can be linguistic as in Latin America, where Brazil is separated from the rest of the region. Language differences can inhibit the benefit spillovers of knowledge-based RPGs. Regional distinctions may also arise from preferential economic arrangements of trading blocs or other associations (e.g., EU, North American Free Trade Agreement (NAFTA), Association of South East Asian Nations (ASEAN), Mercado Común del Sur (MERCOSUR)). Such arrangements can define the extent of spillovers from an RPG.

The message is that the regional reach of a public good's benefit spillovers, or its so-called economic domain, may be determined by a host of factors as

[9] If the public good's spillovers cover only a subset of the nation, we shall still refer to it as an NPG.

diverse as shared values to geological considerations. In many cases, contiguity is neither a necessary nor a sufficient condition for receiving benefit/cost spillovers from RPGs. The economic domain of an RPG often does not coincide with established political or organizational jurisdictions. By their nature, the benefits from RPGs extend beyond the nation-state and may even extend beyond a regional organization's jurisdiction. For example, efforts by the EU to control sulfur emissions among its members has beneficial spillovers on downwind East European countries. Clearly, a regional collective in Africa formed to address a common health problem may provide benefit spillovers to other nonmember nations on the continent that face the same threat. The failure to match an RPG's spillover range with a political jurisdiction is a real concern.

3. Further Classes of Public Goods and Typologies

We have already seen that the properties of nonexclusivity and nonrivalry distinguish public goods from private goods, and that geographical, political, and other properties can distinguish RPGs from global or national ones. All typologies require a value judgment as to what to stress. For our purposes, we construct alternative typologies of publicness in order to derive new insights as to how institutional structures and policy recommendations can be tailored for the types of RPGs that promote development.

We avoid a common pitfall in defining public goods – i.e., the tautology of labeling as public goods those institutions or regimes that provide them. As examples, the UN Development Program (UNDP) is an organization that targets poverty reduction, while the World Bank is a "knowledge bank" of best development practices. The Montreal Protocol on Ozone Depletion restricts the use of CFCs and halons in signatory countries to protect stratospheric ozone. The institutions themselves are not the public goods. Instead, UNDP activities produce public goods in the forms of conflict prevention, better health and an improved environment (Kaul, Grunberg, and Stern, 1999, p. 12). The *knowledge* that the World Bank provides to member nations is the public good, while the *reduced ozone degradation* that results from the Montreal Protocol is the public good.

3.1 Impure public goods

In practice, nonrivalry and nonexclusivity are ideals that are rarely achieved. When there is *partial* rivalry in consumption or *imperfect* excludability of noncontributors, then an *impure* public good results. For example, as the number of entry points to a region increases, a given amount of pest control becomes less effective (thins if we are thinking about a lengthened border), and this implies that the activity is partially rival. Similarly, a poor country may require a fee for immunization (it may even be advised by a development multilateral), and those who cannot afford to immunize are excluded. If this causes the overall population to fall short of the critical mass required for regional immunity, then the public benefits of such a program are compromised.

The provision of impure public goods is rarely all-inclusive; hence, there is a role for foreign aid. Without aid, partial rivalry implies that access may be restricted to those with sufficient income, regardless of whether they derive the greatest benefit from the good. Yet even aid allocated according to where the marginal benefits of provision are greatest will often require some area within the region to do without (e.g., a strategy centered on either rural or urban delivery of vaccines). At the same time, neutrality is less of a concern, implying that redistributive policy within the region may increase overall provision.

3.2 Club goods

A *club good* is partially rival for its members, but excludable to nonmembers. At the national level, club goods include extension services and communication networks, which are excludable and subject to some rivalry. The rationale for forming a club is that universal access causes rivalry in terms of crowding or congestion. By restricting access to fee-paying members only, the club ensures that utilization of the shared good produces a benefit for members that meets or exceeds this fee. The club fee or toll charges a user the crowding costs that a visit imposes on the membership. Members with a greater preference for the shared good will visit more frequently and, in so doing, pay more in *total* tolls. The exclusion mechanism forces them to reveal their greater taste, so that members frequent the club until the toll per unit equals their derived marginal benefit from a visit. The toll proceeds are then used to finance the efficient amount of provision (Buchanan, 1965; Sandler and Tschirhart, 1980, 1997), so that a club is an efficient allocative mechanism.

Multiple clubs may form that provide the same type of good – but to varying degrees – to different jurisdictions' members. Free trade areas are a common occurrence of a regional club. Economic theory suggests that the most efficient free-trade area is the world itself. Regional differences in cohesion – the level of development, health and safety standards, and labor rights – are akin to congestion effects for the purposes of organizing and benefiting from diminished trade barriers. Hence, the prevalence of multiple free-trade areas rather than a single global area.

A downside of clubs is that exclusion can occur not only because of differences in willingness to pay, but also in ability to pay. For example, the International Telecommunication Satellite Organization (INTELSAT), a satellite communication network, charges nations according to signals transmitted and received. Some developing nations may not have the means to afford sufficient utilization of the network. This creates the problem of inequitable exclusion, and consequently there may be a role for aid to pay club entrance fees for LDCs (Kanbur, Sandler, with Morrison, 1999, p. 82). Moreover, some clubs do not even exist, because of the lack of funds possessed by potential members. The 10/90 problem – the fact that less than 10 percent of the world's research expenditure goes towards 90 percent of its diseases – is a clear illustration of the inequality of prioritizing research based on ability to pay.

3.3 Joint products

A transnational activity that gives rise to multiple outputs that may vary in their degree of publicness is an example of a joint product. In particular, an activity that yields both purely public transnational benefits and country-specific benefits is an instance of joint products (Cornes and Sandler, 1984).

Such joint product activities may also confer private benefits on all, or a subset, of the providers of public goods. In fact, the providers may be producing the public good (or bad) solely to capture the private benefit. This latter perspective is that of the *externality* – the idea that the gains or costs of an activity are not just limited to the individual undertaking the activity. Education, an NPG, can be viewed as a process in which individuals invest in their private human capital, while producing a positive externality by increasing a society's overall level of productivity. This aspect of education is a primary source of increasing returns to scale in the endogenous growth literature. Less incentive to free ride exists when the jointly produced private and public goods are complements so that voluntary contributions are nearer to socially optimal (efficient) levels (Cornes and Sandler, 1996).

In contrast, acid rain is an example of a negative externality that is usually regional (see Section 8). Acid rain may be jointly produced when fossil fuels are burned for private benefit. Once sulfur particulates are released into the atmosphere, they possess partially rival and nonexcludable properties when they fall to earth in the form of acid rain. Here, the public bad is overprovided as its harmful effect on others is not taken into account when an agent decides production of the sulfur-emitting activity (e.g., electric generation).

Joint products are not limited to externalities. For example, there is the "warm glow" – feeling of satisfaction or obligations fulfilled – associated with foreign aid. Thurow (1971) argues that achieving economic efficiency may entail income redistribution when contributors derive utility from the income of others (and its distribution). For our study, the "warm glow" is important because it provides an additional motivation beyond altruism for a donor nation to provide assistance.

The greater the *share of excludable benefits* derived from a joint product, the more optimal will be the provision of the activity. These excludable benefits mean that a nation must provide the activity if it is to receive them. Free riding can only involve the nonexcludable joint products. In addition, joint products need not exhibit the neutrality property; any redistribution of income is influenced by the preferences of the individuals for the jointly produced private good. To engineer an increase in the activity, the redistribution needs to favor those deriving a larger share of private benefits, who are the suppliers that gain the most from increasing the activity from augmented income.

3.4 A preliminary regional typology based on the degree of publicness

In Table 1, the preliminary typology of publicness is based on the geographic range of spillovers, thus defining national, regional, and global public goods, and the degree of nonrivalry and nonexclusivity (pure public, impure, club

Table 1. Alternative kinds of public goods and spillover range

Spillover Range	Pure Public	Impure Public	Club	Joint Product
National	• Deterrence of enemies • Financial accounting standards	• Surveillance of borders • Interstate highway network	• Extension services • Communication network	• Education • Charitable activities
Regional	• Watershed management • Malaria cure	• Pest control • Immunizing populations	• Airports • Power grids	• Peacekeeping • Reducing acid rain
Global	• Curbing global warming • Limiting ozone shield depletion	• Reducing organized crime • Limiting contagions	• INTELSAT • Universal Postal Union	• Protection of rain forest • Some forms of foreign assistance

goods, and joint products). Although our discussion of examples focuses on the RPGs in Table 1, we include examples of national and global public goods for each of the four kinds of public goods. Watershed management and a cure for malaria represent purely public regional goods. Watersheds are the land areas that drain into a body of water (river, stream, or ocean), so that they represent an RPG that is geographically linked. The maintenance of the watershed depends on the pollution that seeps into ground water aquifers that feed larger bodies of water. This seepage, in turn, affects a region's water quality. Aquifer pollution is a public bad (and is therefore expected to be oversupplied), while water quality is a public good (and is likely to be undersupplied).

If a cure for malaria were found, it will be accessible worldwide. The cure is an RPG because it holds particular interest in tropical regions, where the incidence and social cost of the disease are most intense. Pharmaceutical multinationals have had a lack of interest in researching a cure, as potential beneficiaries require a very low cost per patient dosage. This leads to a market failure, because there is little financial incentive for drug companies to find a cure. The type of market intervention required to stimulate collective action in finding a cure has come in the form of a partnership – the Medicines for Malaria Venture (MMV) (see Section 9).

At the global level, curbing global warming and limiting ozone shield depletion are purely public, because their benefits are nonrival and nonexcludable worldwide. Deterrence of enemies provided by a country's armed forces is purely public to all residents within a nation. The adherence to a sound financial accounting standard also provides nonrival and nonexcludable benefits to a nation's citizens through the encouragement of trade.

Pest control and immunizing populations are examples of regional impure public goods. Up until 1988, the primary means of combating river blindness by the World Health Organization (WHO) was the aerial dusting of riverbeds in order to eradicate the flies that host the parasite that carries the virus. As the system of riverbeds designated for dusting is expanded, there is rivalry in the use of larvicide, which must either be spread thinner, or new sources of financing need to be found to maintain the level of coverage.

At the level of the individual, immunization clearly has private benefits, and it creates public benefits when the level of immunization reaches a critical mass. Moreover, the concept of herd immunity is an illustration that a public good need not be entirely nonexclusive to be effective. *Herd immunity* means that a population as a whole can be protected from an infectious disease if a certain proportion is immunized. The idea is that individuals can be protected from a disease just because those within their neighborhood are immune. This provides the basis for immunization through childhood vaccination (e.g., measles, mumps, and rubella). But under certain circumstances, vaccination programs can lead to an *increase* in disease burden among adults if a sufficient level of childhood vaccination is not attained. Thus, the decision to vaccinate is dependent upon the level of vaccination within the region, and whether high uptake can be guaranteed among regional contacts.[10] Once an immunization program begins, there is clearly a role for aid to ensure that uptake reaches critical mass (e.g., 90 percent at school entry age for mumps and 95 percent for measles).

At the national level, surveillance of borders is impurely public, because efforts applied to one part of the border limits monitoring elsewhere along the border. An interstate highway network is an impure public good for a nation, because drivers can be excluded from entry and increased traffic creates rivalry in the form of longer transit times and accidents. Organized crime has become a worldwide public bad. Efforts to fight this crime in one country divert resources from addressing the problem elsewhere, so that there is a rivalry. At the global level, action to limit contagious diseases is also an impure public good owing to rivalry.

In Table 1, an airport hub is a regional club good whose access is defined by slotting fees for runways. Examples include Heathrow (Britain), Frankfurt (Germany) and de Gaulle (France) for travel in Europe; Haneda (Japan) and Hong Kong for travel in Far East; Mexico City, Sao Paulo (Brazil) and Miami for travel in Latin America; and Johannesburg (South Africa), Jeddah (Saudi Arabia), and Dubai (United Arab Emirates) for travel in Africa and the Middle East. A power grid is another example of a regional club good. The Sistema de Interconexión Eléctrica Para América Central (SIEPAC) will pass through Costa Rica, Guatemala, Honduras, Nicaragua, Panama, and El

[10] For an introduction to herd immunity, see the website at http://www.pitt.edu/~super1/lecture/lec1181/index.htm.

Salvador, with each country agreeing to share its infrastructure, as a form of membership fee. A single regulatory board will manage administration of the distribution of power.

We have previously noted that extension services and communication networks represent club goods at the national level. Also, INTELSAT is a satellite-based communication network that links nations worldwide in a fee-charging club. The network is the club good, which is subject to rivalry in terms of signal interference. The Universal Postal Union links the national mail services into a network to facilitate transnational mail delivery. Fees are based on the number of pieces of mail sent abroad and nonmembers can be excluded.

The final categorization of RPGs in Table 1 is that of joint products. Acid rain has already been mentioned as such an example. Peacekeeping is another example of a regional activity with joint products, for which nations nearer to the conflict receive some country-specific benefits in addition to regionwide pure public benefits from enhanced stability. The protection of the rain forest provides global benefits from sequestering carbon and preserving biodiversity along with region-specific benefits from watersheds and erosion control. Some forms of foreign assistance yields not only global benefits from reduced poverty, but also donor-specific benefits from enhanced donor status. This status appears especially important for those countries that commit 0.7 percent of GDP to aid, as is true of some Scandinavian donors. Tied aid with conditions that benefit the donor displays donor-specific and recipient-specific benefits. When this aid funds an RPG (e.g., pollution reduction), there may also be a public good component that extends beyond the donor and recipient countries. Not all forms of foreign assistance possesses this latter component.

3.5 A fuller typology based on the aggregation technology

We now turn to a method for discerning a region's capacity for producing a public good – and perhaps its need for aid – that is based upon the relation between the overall supply of the good and the individual contributions towards its provision. The typical, often implicit, assumption is that the supply of a public good equals the *sum* of the overall contributions. When this is the case, each nation's contribution is a perfect substitute for that of another contributor, while the costs of contributing are nation-specific.[11] This is the reasoning that supports Olson's (1965) intuition of the free-rider problem for situations of collective action (and the associated Prisoner's Dilemma). There are, however, other ways that the contributions of nations can be aggregated to create a public good, thereby resulting in alternative

[11] Here, we are framing our discussion in terms of public *goods*. An analogous discussion could be made in terms of public *bads*.

prognoses for successful regional collective action. For example, a regional dike is only as effective as its lowest point; hence, the sum of dike-building efforts does not characterize the public benefit. Rather, the minimal effort determines the overall level of the public good. In introducing considerations of dike-building and other public goods, Hirshleifer (1983) labeled the description of how individual efforts are transformed into a public good as the *social composition function*. Such processes are also called the *technology of public supply aggregation* (Sandler and Sargent, 1995; Murdoch and Sandler, 1997) and *contribution aggregator* (Arce, 2000, 2001). The consideration of how contributions are aggregated in creating RPGs is becoming a third dimension of publicness with important implications for policy recommendations for provision (Sandler, 1998; Arce and Sandler, 2001).

3.5.1 Summation RPGs

Several examples of aggregation technologies are given in Table 2 for RPGs. *Summation* refers to the case where the overall level of an RPG corresponds to the sum of country contributions. The distribution of contributions or the identity of contributors is immaterial. For example, the amount of pollutants in the atmosphere depends on the sum of emissions. Air pollution is largely nonexclusive and nonrival within a region, making it purely public. As the income of countries within a region increases, a threshold is typically reached beyond which countries show a greater interest in improving their environment – at very low income levels, the environment gives way to subsistence concerns. Desertification is another example of summation; national boundaries do not matter as the public bad (e.g. human and livestock mortality due to drought) is created by the sum of the overall hectares ravaged by wood gathering and nonsustainable farming.

Next, consider examples of impure RPGs in the summation row of Table 2. Public health infrastructure in the form of clean water, sanitation, sewage, and sterilization processes also follow summation, being the sum of efforts to supply these processes. These goods are subject to thinning; there is rivalry in provision. This is a cause for concern, because regional interdependence may arise through the transmission of disease due to public health failures. For example, Garrett (2000) identifies how such failures resulted in a wave of epidemics across the former-Soviet Union and Eastern Bloc region less than a year after the collapse of the Soviet Union in 1991. Drug-resistant tuberculosis, diphtheria, polio, hepatitis, and even childhood mumps swept though the region due to the lack of funding for health services. Another example of a summation-based impure RPG is that of regional marketing boards for the purposes of addressing food security, establishing commercial standards, and implementing rural delivery programs. The capacity of these boards equals the sum of the individual efforts to provide them. Prior to independence, concerns about famine in India and the Middle East inspired

Table 2. Alternative regional public goods and aggregation technologies

Aggregation Technology	Pure Public	Impure Public	Club	Joint Product
Summation: overall level of public good equals the sum of country contributions	• limiting air pollution • desertification	• providing public health infrastructure • market boards for commodities	• satellite communication network • transnational parks	• deterrence through peacekeepeing • preservation of rain forests
Weighted sum: each agent's contribution can have a different additive impact on the overall level	• reducing ambient pollutants • limiting the spread of AIDS	• limiting runoff pollution • curbing acid rain	• free trade agreements • power grid	• eliminating the threat of terrorism • eliminating threats of revolutions
Weakest link: the smallest effort determines the public good level	• inhibiting the spread of a pest • labor standards	• surveillance of a disease outbreak • drug interdiction	• transportation network • Basle Accord among G-10	• family planning • security intelligence
Best shot: The largest effort determines the public good level	• cure for orphan diseases • monitoring technologies	• agricultural research findings • genetically engineered crops	• crisis management squad • satellite launch site	• quelling of a flareup by peacekeepers • bioprospecting

marketing boards in British East and Central Africa (Jones, 1984, p. 115). Support of such boards can certainly be interpreted as a role of foreign aid.

Examples of club goods that abide by the summation aggregator include regional satellite communication networks and transnational parks. The capacity of the network corresponds to the sum of the satellites deployed, whereas the size of a park equals the total area allocated. Each exhibits rivalry in the form of crowding. The number of satellite slots over any geographical region is limited. Moreover, increased satellite traffic often degrades the quality of service as a system's capacity is approached. If multiple users share a single channel, the effect is not unlike rush hour in a subway where some users have to wait for another car, because the one in the station is full. Another possibility is that channels are layered and increased use has the effect of interference between competing transmissions. Transnational parks also become congested and this can diminish the quality of a visit and may have implications for the experience of future generations as well (Sandler, 1999). Charging entry fees in such a

way that the marginal willingness to pay for users meets or exceeds the fee reduces rivalry while providing funds for financing.

The quantity of a joint product can also hinge on the sum of contributions. In Table 2, deterrence as derived from armed forces increases with the size of these forces. Some of the armed forces that produce deterrence can also be used for internal emergencies (e.g., during a natural disaster) or for policing civil disobedience, thus giving rise to joint products. From a national perspective, a nation's own deterrence capability is purely public, as it is unlikely that residents can plausibly be excluded. However, deterrence may also appear as a nation-specific good, since it is purchased at an opponent's expense (implying rivalry). Consequently, there are two perspectives on security as an RPG, depending upon whether members of a region are antagonists or not.

The preservation of rain forests is another example of an RPG that produces joint products in terms of trapping greenhouse gases, and as a source for bioprospecting and species diversity. As is the case for desertification, national boundaries do not matter for CO_2 sequestration – only the overall hectares available matter. In contrast to desertification, where the private benefits are relatively few, it is becoming increasing clear that the commercial potential of rain forests extends far beyond what has been attained via logging. Latex and bioprospecting revenues imply that rain forest preservation is a significant source of renewable joint products.

3.5.2 Weighted-sum RPGs

A second contribution aggregator is that of *weighted sum*, where the overall level of the public good is again determined by the sum of national contributions, but the marginal impact of each nation's contribution varies according to the nature of the externality. *Ambient* air quality is such an example. The dissipation of ambient pollutants in the atmosphere depends on their distance from the source of emissions. Such concentrations are reflected in the weights assigned to cleanup efforts of a particular nation in the region. When a nation limits emissions, it creates a benefit relative to the concentration of pollutants in the air. This benefit is, however, purely public, because a country's enjoyment from the cleanup in no way limits the ability of other nations within the region from benefiting from a reduction in ambient pollution. The influence of emission cutback is proportional to an abating country's efforts.

Another example of a weighted-sum RPG is limiting the spread of AIDS. The distribution of AIDS cases has become a regional problem, with growth of new cases being proportionally higher in Western sub-Saharan Africa (approximately 70 percent). There is also a strong foothold threatening East Asia and Brazil. As there are different attitudes toward sexual practices, and varying degrees to which education on preventing the spread of the disease

takes hold, different regional weights must be applied in determining the spread of the disease. The effectiveness of collective action in combating AIDS will then also follow a weighted-sum technology.

Limiting run-off pollution and curbing acid rain are examples of impure public, weighted-sum goods. Cutbacks in pollution run-off depend on location, so that different weights must be applied. Run-off pollutants deposited in one location cannot also be deposited in another location, thus leading to rivalry. Chemical reactions in the atmosphere convert sulfur dioxide and nitrogen oxide emissions into sulfuric and nitric acid-laden rain, snow, and fog (acid rain). The amount of sulfur dioxide and nitric oxides in the atmosphere is determined by the sum of all emissions. The damage caused by acid rain is clearly localized; fallout is heavier nearer to the source of emissions, which implies that one nation's actions are not a (perfect) substitute for another. There is, therefore, a difference between ambient air quality and deposition that corresponds to the difference between pure and impure public goods, even though both correspond to a weighted-sum aggregator. For deposition, rivalry occurs because a ton of sulfur falling on one lake is a ton that cannot fall on another.

The most studied regional club good is that of trade agreements, which include the EU, NAFTA, ASEAN, and MERCOSUR. Trade agreements partially exclude nonmembers from free-trade benefits, which depend, in part, on the level of domestic economic activity, and the economic size and growth rate of each trading partner. More sustained growth will benefit all members, although in less than a proportional way. Indeed, Padoan (1997, p. 109) argues that the ultimate benefits derived from a trade agreement are a function of the level of economic activity that each potential partner brings and the level of cohesion among members. Cohesion is defined as a relatively equal social and territorial distribution of employment opportunities, wealth, income, and economic expectations. Cohesion problems are then akin to the problem of congestion in determining club size. Congestion worsens with a greater diversity of membership. Such diversity means that weights may have to be applied to the rivalry that a member creates for the trading club – congestion is not anonymous or independent of the user. Expansion of membership in the trade club will halt once the costs for cohesion management equal the benefits of integration.

The SIEPAC power grid is another example of a club RPG. Hydrological diversity makes the project a weighted-sum technology. Nevertheless, all members of the region will benefit from a higher quality of service at reduced cost and centralized regulation. The project is being funded by the Inter-American Development Bank and the Spanish Government. Additional contributors to the initial feasibility study included the Danish Fund and US Evergreen Fund.

Our final category of a weighted-sum RPG is that of joint products. Thwarting terrorism is an example where rivalry can occur. If a region is

subject to terrorism, then one nation's efforts to head off instances on its own soil may cause a spillover to neighboring nations whose efforts may be less vigilant (Enders and Sandler, 1995; Sandler and Lapan, 1988). Spatial weights need to be applied to efforts to minimize the terrorist threat owing to the location of terrorists and their intended targets. Joint products from these efforts arise from country-specific and regionwide benefits. Eliminating threats of revolutions works along similar lines. There are usually different pockets of threats, so that the risk of a spillover of revolutionary activity to another country is a function of the distance and direction of the threat, implying different weights for the public bad caused by political instability.

3.5.3 Weakest-link RPGs

A *weakest-link* RPG is one whose level of provision is entirely determined by the smallest contributor. For agricultural pests, agricultural inspection at external borders to inhibit the entry of a pest determines a region's exposure. A nation that makes no effort to screen for pests may impose significant costs on its neighbors, potentially making the efforts of its neighbors meaningless unless shared borders are additionally monitored. Significant cost savings can be achieved if vigilance is maintained at the region's perimeter.

Labor standards represent another RPG where weakest-link efforts can determine the overall level of the public good. As skill levels are fairly equal among LDCs within the same region, it is often the case that the weakest labor standards attract the most labor-intensive direct investment from multinational firms. In order to remain competitive, other countries feel obliged to lower their standards, leading to a regionwide decrease in wages and standards.

A novel response toward promoting labor-standards RPGs has been actions by civil society. For example, with increased awareness of labor conditions abroad, the Clinton administration established the Apparel Industry Partnership (AIP), a working group of apparel industry representatives, union members, consumer groups, and human rights NGOs that created the Fair Labor Organization as an independent NGO with the authority to accredit monitors, assigned the responsibility of certifying that the AIP's labor code of conduct was being enforced. This is an example of how donor activity can work in the form of a network, rather than through the traditional type of aid.

In Table 2, impurely public weakest-link RPGs are indicated in the second column. Consider the surveillance of diseases, which prepares a region to address outbreaks at their inception. During the 1994 plague in India, the lack of regional monitoring stations caused a delay in the reporting of information regarding the outbreak. Moreover, the information was of a poor quality. The same can be said of the early monitoring of the spread of AIDS

by the Centers for Disease Control (CDC) in the United States. As potential points of entry for a disease increase, the effectiveness of a given monitoring effort tapers off, making surveillance partially rival. The least reliable information gathered determines the preparedness and subsequent safety of the region. The same analogy holds for illegal drug interdiction efforts. As different avenues for trafficking proliferate, officials must make a choice as to which holes to plug.

The overall flow of traffic in a regional transportation network is largely determined by bottlenecks and other inadequate portions of the system. As such, the capacity of the network hinges on its weakest component, making the network a weakest-link club good. The EU has addressed these regional transportation bottlenecks with a massive investment in roads from member countries' interior (e.g., Ireland, Greece) to major airports and seaports. Road transportation costs are often prohibitive in many regions of the world, and this retards the integration of member nations with the region and the world economy, as well as rural-urban integration within member nations. Furthermore, the economic liberalism that has accompanied globalization implies that there is less public funding for this form of weakest-link infrastructure investment. As a consequence, club funding has been underwritten by regional development banks participating in public/private financing of toll roads to address this weakest-link aspect.

Another example of a weakest-link regional club good is that of international banking. The Basle Capital Accord of July 1988 was the culmination of a 15-year effort among G-10 nations to avert a race to the bottom in terms of capital requirements and supervisory practices. International banks were practicing financial regulation arbitrage, a weakest-link form of public bad where banks exploited differences in margin requirements and capital requirements that did not allow regulators to appreciate the new risks involved in international banking (Reinicke, 1998b, pp.103-105). Membership in the Basle Accord is granted through the establishment of a tightly coordinated web of national banking regulations, intended to prevent banks from evading capital requirements and then experiencing cycles of competitive deregulation. Such deregulatory cycles involve one country lowering its standards in an effort to protect the competitive standing of its banks. The intention of the Accord is to level the playing field, so that banks within the G-10 region could not increase business volume without adequate capital backing. The relevance of Basle for the developing world is that it has generated a principle of *horizontal subsidiary*, where financial institutions outside the G-10 are being pressured by their customers to adopt Basle's standards voluntarily (Reinicke, 1998b, p. 117). Clearly, the presumption is that Basle and its proposed 2001 extension will head off further weakest-link financial difficulties in emerging market regions.

Our final examples of weakest link are with respect to joint products. By

definition, the members of a region are subject to *Tiebout effects*, in which people "vote with their feet" according to the provision of public goods (or lack thereof). As such, a population explosion in one area of a region can cause migration and stress on neighboring countries' institutions, and there is usually very little cross-country compensation for such effects. Alternatively, effective family planning within a nation lessens migration pressures throughout the region and also yield country-specific benefits in terms of increased nutrition, and greater opportunities for women. Thus, family planning is a weakest-link activity with joint products. Maintaining secrecy about military and antiterrorist intelligence is also a weakest-link activity with multiple outputs. While access to intelligence may be restricted, it only takes one member to break a secret. The acquisition of intelligence – say, with respect to a pending revolution – provides regionwide benefits along with a country-specific benefit to the first to learn the information.

3.5.4 Best-shot RPGs

The last aggregation technology in Table 2 is *best shot*, with which the greatest level of effort determines the overall level of the public good. For example, in the less-developed world, there are "orphan diseases," so called because they occur in areas of the world where the financial incentives to find a cure are lacking. But once a cure is found – a best-shot effort – knowledge of it would be both nonexclusive and nonrival. Another RPG of this type is the satellite that Brazil has launched to track deforestation in the Amazon region. Only one satellite is needed for such efforts regionwide. The lack of a satellite during the mid-1990s produced a data gap on the growth rate of Amazon deforestation. Such a gap illustrates that best-shot activities *can* be underprovided; the level of effort made by the unilateral provider may not maximize the region's overall benefit from the public good.

Agricultural research findings denote best-shot examples of impurely public goods that typically exhibit economies of scale in their creation and dissemination. Impurity applies because there is a nonzero marginal cost of extending the benefits from these findings to additional users. Even if the marginal cost of provision is low, there is the danger that a region's needs will be underprovided. Genetically engineered crops are an example of a best-shot good, where ability to pay, capacity for use, and acceptance of biosecurity risk have prescribed a benefit that is almost exclusively possessed by industrialized regions. Approximately 75 percent of the area sown to transgenic crops is in the United States. This outcome appears to be an agricultural equivalent of the 10/90 problem for health, where developing country farmers lack the capacity to benefit from genetically developed disease and drought-resistant varieties.

The Fonagro regional fund for agricultural technology in Latin America

and the Caribbean is an example of an institution formed to create RPGs (World Bank, 2001a). The mission of Fonagro is to contribute toward poverty reduction and effective management of the resource base through: (i) adding a permanent net flow of resources for agricultural research in the Americas, (ii) encouraging innovative research of cross-country relevance, and (iii) promoting research cooperation and collaboration though competitive mechanisms. Fonagro is financed through contributions from fourteen member nations. At least two member countries must cooperate on any given project. Fonagro represents a *region-based network* of nations to promote the kinds of agricultural advances appropriate to geoclimatic conditions of Latin America.

Best-shot club goods include crisis-management squads and satellite launch sites. A single well-equipped and well-trained squad can be deployed when needed and users charged accordingly. In Europe, a rapid-response force is being organized as an alternative for contingencies that do not receive NATO or UN backing. The experience with East Timor is an example of how such regional entities need to evolve elsewhere in the world. Australia has led the peacekeeping effort in East Timor, in stark contrast to the norm of US or NATO-led coordination of peacekeeping. Furthermore, ASEAN efforts in coordinating with Australia in East Timor suggests the need for an East Asian organization to respond to civil crises within the region. There is also potential for a regional best-shot clubs for satellite launch facilities, where users can be charged on a per-launch basis. For example, Brazil's Alcantara facility is located very near the equator, making it ideal for commercial launches of geosynchronous satellites. As launch facilities require heavy infrastructural investment, capacity must be regionally coordinated, so that the need for upgrades is infrequent. Clubs provide a natural solution for the provision of this best-shot good.

Best-shot RPGs can also produce joint products. For example, when peacekeeping quells a flareup in a member nation, it also contributes to the overall stability within the region. NATO's action in Kosovo relied heavily on US armaments, owing to the sophistication of the technology (a best-shot characteristic) needed to see through the cloud cover of the country. Bioprospecting is another best-shot RPG with joint products. The world is not uniformly biodiverse, and so bioprospecting in tropical regions is a best-shot endeavor. However, the knowledge and products that result from bioprospecting involve property rights, not unlike monopoly rents. Exclusivity due to imperfect substitutability among biodiverse areas can lead to innovative partnerships that foster development. The INBio partnership between Merck and the Costa Rican government is an example (Meyer, 1999, p. 110). INBio has the primary objective of inventorying the biodiversity of the country – information that will be made freely available to noncommercial users. Similar information – tied to chemical extracts – adds value to raw genetic resources and is marketed to commercial users.

Thus, INBio produces joint products in the form of general and need-specific information on biodiversity.

3.6 Provision and aid

Table 2 can also be used to raise the question of what the different categories of publicness indicate about the potential for regional collective action. For example, is the problem of underprovision endemic to all cases? If free riding is pervasive, then cooperation requires a higher degree of coercion than commonly associated with voluntary foreign aid. Furthermore, what role does capacity play in terms of the ability either to provide a public good on one's own or to take advantage of one provided by an outside donor? What institutional arrangements overcome the provision problems specific to each contribution aggregator? Table 3 partly summarizes answers to these questions for each of the aggregation technologies previously surveyed.

A summation aggregator leads to a Prisoner's Dilemma situation, in which every nation has the incentive to free ride, so that provision is undersupplied

Table 3. Optimality and proposed institutional arrangements for various classes of regional public goods

Aggregation Technology	Pure Public	Impure Public	Club	Joint Product
Summation	• undersupplied • treaty or multilateral	• undersupplied • multilateral	• efficient • club structure	• some undersupply • treaty or multilateral
Weighted sum	• somewhat undersupplied • treaty, if information available	• somewhat undersupplied • bargaining, if localized	• efficient • club structure	• some undersupply • treaty or multilateral
Weakest link	• supply may be efficient • regional collective, rich nation contribution, partnership	• somewhat undersupplied or efficient • regional collective, rich nation contributing, partnership, or loose agreement	• undersupply owing to externality • official intervention	• some undersupply or efficient • treaty or multilateral
Best shot	• undersupply or efficient • partnership	• undersupply or efficient • partnership	• efficient • club structure	• efficient • coordination needed

(Sandler, 1998) because a contribution by any nation is a perfect substitute for that from any other of the region. The associated market failure requires some kind of regional institution building (e.g., treaty or multilateral institutions) to realign individual incentives.

The structure of incentives, however, is far different once we consider pure public good aggregators other than summation. For weighted sum, an RPG can be considerably less undersupplied as collective action corresponds to more locally directed benefits, which increase the incentive for unilateral action. At the same time, there is a danger that efforts toward coordinating collective action will merely codify what individual nations would otherwise do voluntarily in the presence of localized gains (Murdoch, Sandler, and Sargent, 1997). Hence, care must be taken to ensure aid resources are devoted toward promoting actions beyond what individual incentives dictate.

For weakest-link pure public goods, the problem is no longer one of enforcing provision, but rather ensuring an acceptable standard of provision. There is no incentive to contribute beyond the level provided by the poorest nation in the region, insofar as greater contributions do not increase the overall level of the RPG. On the surface, there appears a potential for a judicious redistribution of income within a region – or careful allocation of foreign aid – because if a lagging member's provision is increased to match that desired by other members, then efficiency can be achieved. However, the connection between aid and increasing the capacity to produce weakest-link RPGs is tenuous for a couple of reasons. First, just as weakest-link technology provides an argument for donors to do more, it also supplies an incentive for recipients to do less (Stålgren, 2000, pp. 24–25). This is because the recipients can free ride on the donor's efforts to reach a more acceptable efficient level. Second, Vicary and Sandler (2002) find that it makes a difference as to whether a donor makes a cash transfer, from which the recipient provides the weakest-link public good, or the donor supplies it in-kind through its own activity within a recipient nation. The question is pivotal because the donor may have a cost advantage in creating the public good. For example, during an outbreak of the Ebola virus, it may be more effective for a donor nation to dispatch a team of its own medical staff to contain the virus, rather than supply funds to support local authorities who possess less logistical and medical experience in containing a disease. In fact, during the 1995 Ebola outbreak in Zaire, a few donor nations supplied medical personnel, and the rest provided cash for control efforts (Garrett, 2000). This again reflects the Vicary-Sandler argument that those who have a comparative advantage should do it in-kind, while others may be more effective at sending cash.

To summarize, weakest-link RPGs requires the *coordination* of actions across a region's membership. Whether aid is provided for a country to take its actions, or whether the action is taken on a country's behalf is determined by the opportunity cost in creating the public good. In Table 3, this is

reflected through the recommendation of regional collectives to coordinate action. When capacity is at issue, rich nations can contribute, or directly intervene, depending upon comparative advantage considerations. Moreover, public-private partnerships can address the problem (Ferroni, 2000; Sandler, 2001, 2002).

For best-shot RPGs, the question of in-kind versus cash donations remains even though there is no need for collective action by more than a single actor within the region. Best shot is characterized by *unilateral* action by one member of the region, where undersupply is a function of the capacity of the supplying entity. This type of capacity problem is far different than weakest link, where each nation's capacity needs to be raised equivalently to achieve regional efficiency. With best shot, the role for aid is to ensure that the single best supplier produces enough to efficiently provide for the entire region (Ferroni, 2000). For example, given the concentration of biodiversity in Costa Rica – at least 4 percent of the earth's terrestrial species (Meyer, 1996, p. 459) – it makes sense that the Costa Rican government is a *partner* with Merck in order to bolster their collective bioprospecting expertise while tapping into Merck's willingness to pay.

Once we move from the pure public case the prospects for regional collective action generally increase for all aggregation technologies (see Table 3), with specific qualifications for weakest link. As expected, once some level of rivalry is present, impurely public goods are more likely to be provided within a region, either because a contributor can capture some nation-specific benefits or else exclusion can be practiced. There is less need for coercion and more incentive to bargain or to form partnerships. Similarly, to the extent that joint products produce nation-specific benefits, their presence reduces the incidence of undersupply for RPGs.

Club goods, as always, can be efficiently provided as long as the members themselves are the only ones exposed to the externalities created by club activity. A novel insight is that weakest-link clubs may produce congestion externalities that are not taken into account by tolls, thereby leading to suboptimal allocation and the need for official intervention. Consider a regional airport hub. Whereas membership fees allocate landing slots, they certainly do not take into account the effect of a breakdown in the hub itself, which could detour or halt traffic from myriad connecting airports. For example, a four-hour computer failure in air traffic control at London's Heathrow Airport on 17 June 2000 resulted in some delays lasting 48 hours and impacted much of Europe.

3.7 Provision, financing, and the aggregation technologies

We conclude this section with the overlooked observation that the *financing* of RPGs is separate from the issue of provision. Productive efficiency of RPGs has to do with *minimizing the cost of production*, and this does not have

to depend upon the three properties of publicness. Moreover, the agent financing the RPG need not be the one which actually produces the good.

The aggregation technology determines the incentives to contribute and, hence, the need, if any, for additional financing through regional collective action. The ultimate source of any additional financing, however, need not follow the distribution pattern prescribed by the aggregation technology. That is, *funding for any RPG could follow a summation technology*, while the impact of the distribution of funds to providers then adheres to the corresponding technology of the RPGs. A role for aid to fund the RPG can be directly discerned from this perspective, raising the question of cash or in-kind transfers discussed above. A caveat exists, however, if nonsummation RPGs are to be funded through the summation of contributions. Specifically, the problem of perfect substitutability of contributions reappears, implying free-riding concerns when contributors cannot commit to allocating funds according to their comparative advantage in obtaining these funds.

4. RPGs and the Problem of Collective Action

In the previous section, we identified characteristics such as the degree of publicness and the aggregation technology as being primary determinants of RPG provision. In conjunction with these characteristics, we must also be concerned with how the *regional* aspect itself plays into the potential for collective action. When problems are regional rather than national, there is less incentive to act toward correcting the market failures associated with RPGs. If, for example, an RPG is an externality that affects two or more countries, there is no centralized government responsible for formulating or enforcing a policy (e.g., tax or subsidy) to internalize and correct the resulting market failure. Indeed, national governments may be at odds as to whether collective action is even necessary. The initial step toward RPG provision requires a consensus that collective action is in the interest of the states involved.

There are also cases where there is a comparative advantage for regional provision of GPGs. For example, rain forests provide global benefits in the form of carbon sequestration and biodiversity, so that biomass burning to clear rain forests produces a global externality. When a regional action yields a GPG, this is further justification of region-based aid. A regional stance may behoove countries when soliciting aid or when negotiating debt-for-nature swaps, since such a stance may limit transaction cost as donors need not consummate agreements with each nation.

4.1 RPGs versus GPGs

Even where there is a consensus on the need for action, the incentives for regional action in developing areas can often be less than those for action to create GPGs. This is true for several reasons. First, there is often little or no leadership from dominant countries or from multilateral institutions for RPGs. An indigenous leader nation is absent in many regions of the developing world, because there is no nation or multilateral institution that has the wherewithal to identify and bring together the necessary stakeholders to tackle RPG provision. In contrast, the (exclusionary) trade provisions contained within the Montreal Protocol on CFCs were created at the global level by developed nations exercising leadership, to provide an incentive for LDCs to forgo less costly CFC-based technology (Benedick, 1991). Yet leadership need not be coercive; the United States, Canada, and several Nordic states took the lead in banning CFC use in aerosols years before the Protocol was signed. This type of *leading by example* is often conducive for collective action, especially when it allows other countries to learn efficient behavior (Arce, 2001).

Second, there is the political issue of competitive rivalry among members of a region. If an issue is closely associated with one of the rivals, then

political status may improve with the successful creation of an RPG. Diplomatic competition may therefore be a barrier to successful collective action. For example, there is inherent competition among Arab nations to be viewed as the central Islamic state, while in South America there are multiple diplomatic and economic rivalries among Brazil, Argentina, and Chile, despite their joint participation in MERCOSUR.

Third, regional issues are often given lesser priorities than global ones. This is often a question of the difference in perspective between developed and developing countries. Developed countries have historically put a high priority on environmental GPGs, whereas developing countries desire traditional forms of aid and *poverty-reducing* RPGs. Such RPGs often do not provide direct benefit spillovers to donor countries. Orphan drugs fall into this latter category. There are even regional differences between the North and South about the development of AIDS drugs. In the North where the spread of AIDS is diminishing, the focus is on treatment, which happens to be a highly profitable area for pharmaceutical companies. In the South, the spread of AIDS may not have reached its peak, so there is more incentive for R&D in the direction of a cure or vaccine, which may not require repeated (profitable) cocktail therapy. To be effective, such a drug would have to be widely available at low cost.

Foreign assistance is necessary because taxation of the LDCs' constituency to fund RPGs is not really an option. Developing countries have a low revenue base from which to fund national priories, much less regional ones. Regional institutions are unlikely to be granted the authority to collect taxes. Donor nations have historically been more oriented to assisting nations rather than regions, where there is no single representative authority or government. In a recent study, Cook and Sachs (1999) determine that up until now there has been no donor culture for regional initiatives. They (pp. 442-444) find that regional aid programs – unallocated by country – represent a very small proportion of total aid disbursements – 7.4 percent to Africa, 2.3 percent to the Americas, and 3.8 percent to Asia. In many cases, identifying the proper recipient for RPG-related donations is not obvious. When regional institutions must be created to augment provision, there are high transactions costs; but such regional institutions may be necessary if an appropriate recipient is to exist.

4.2 Building from prior regional success

One area where regional collective action has been successful for LDCs is that of regional trade agreements, which may be an attempt by nations to regain sovereignty lost during the process of globalization in the 1990s. LDCs have been quick to form these agreements as a means of exercising control over trade issues that can no longer be managed under the auspices of national sovereignty. As is the case for globalized trade, RPGs imply a lack of

ownership at the national level. Moreover, regional institutions often take on a life of their own. As members become accustomed to dealing with each other in one area – e.g., peacekeeping or trade – lines of communication open that can be used to facilitate other forms of cooperation at reduce transactions costs. For example, the members of ASEAN have used the formal channels established in a trade agreement to coordinate their stance towards political actions and peacekeeping in East Timor. In the same way, the Southern African Development Community (SADC, formerly SADCC) put pressure on Lesotho in 1995-96 to preserve political legitimacy, and there was also discussion of SADC intervention in Mozambique (Page, 2000, p. 243).

There are numerous other examples where regional institutions have taken on a life of their own toward the provision of RPGs. The EU was first a vehicle for trade cooperation, before it evolved to create common economic policies, a monetary union, and common foreign and security policies (Kahler, 1995, p. 22). MERCOSUR, which began as a customs union, has taken a multilateral stance towards negotiating integration with NAFTA, contrary to the US preferred position of bilateral negotiations with each member. MERCOSUR also promotes democracy throughout the region, as evidenced by its dissuasion of a military coup in Paraguay during 1997. Finally, NAFTA has established labor and environmental side agreements. Building off previously established institutions limits transaction costs.

4.3 Collective action and the regional agenda

Young (1998, Chapter 1) summarizes the process of building international regimes into three stages: agenda formation, negotiation, and operationalization. Agenda formation is the way in which an issue enters into (regional) awareness through formal political channels. Negotiation – the most studied stage of international regime building – begins with formal discussions among stakeholders and ends with the signing of an agreement. Operationalization refers to the process of moving the agreement from paper to practice, and then monitoring to ensure that the conditions of the agreement are met. What is novel in identifying the three stages is that each corresponds to a different type of collective action problem (Arce, 2001).

Agenda formation requires consensus building – i.e., the issue must be framed in such a way that all stakeholders are identified. This stage is weakest link; the omission of a single stakeholder or a refusal to recognize the issue defines the potential for any future success. Negotiation is weaker link; an aggregator related to the weakest link, but where unilateral action *does* produce marginal benefits.[12] Weaker-link situations have been shown to

[12] For weaker-link public goods, the lowest contributor produces the highest marginal benefit. Other contributors produce positive marginal benefits, but the effectiveness of unilateral action is tempered by the need for coordinated action among all contributors.

be akin to chicken games (Arce and Sandler, 2001), where some compromise must be made in order for an agreement to be met. Operationalization is often an example of best-shot technology. For example, the monitoring of environmental agreements often requires state-of-the-art detection technology. In other cases, a regional network, NGO, or other body is created in order to administer or manage the agreement on an international basis.

4.4 Role for aid and networks

Having considered the *regional* aspects of RPGs, we need to address several additional issues for collective action. The first arises when there is the absence of leadership due to underdevelopment, political rivalry, or the inability to build upon an existing security or trade regime. Without leadership at the regional level, there is a need for North-South partnerships that can bring an issue to the forefront, and facilitate provision. One interesting alternative to state-led leadership, posited by Reinicke and Deng (2000), is that of *advocacy networks*. Successful networks providing GPGs include the Consultative Group for International Agricultural Research (CGIAR), the World Commission on Dams, the International Standardization Organization's ISO 1400 set of environmental management standards, and the International Campaign to Ban Landmines. While Reinicke and Deng's focus is at the global level, there is no reason why advocacy groups cannot take on a leadership function at the regional level. Such networks must build on existing institutions where possible and keep their own bureaucracies to a minimum.

Second, networks also explicitly work to build capacity towards successful RPG provision. For example, in health-related RPGs, there is very little that nations within a region can do on their own without input from pharmaceutical companies. A case in point is the regional impact of spraying for the flies that carry the river blindness parasite, which only indirectly attacked the problem. When Merck was brought in through its Mectizan Donation Program, the use of Invermectin (Mectizan) to treat (and possibly interrupt) river blindness transformed the problem from the repeated need for aerial dusting to a more manageable problem of establishing a distribution system for Invermectin. The decline in river blindness also meant that West African farmers could move into the fertile and well-irrigated Volta basin without fear of the disease.

Allowing for generic AIDS drugs that violate patent rights is counterproductive toward providing international pharmaceutical conglomerates with the proper incentive to develop cures for orphan drugs. In Africa, there is a need for an advocacy group to bring all concerned parties together in order to address jointly the issues of patent rights on existing AIDS drugs, and the need for future research on a cure for AIDS in regions

whose constituents or healthcare systems will not be able to afford prolonged treatments over the long run.

Hewitt, Morrissey, and Willem te Velde (2001) identify three potential components of the costs of providing a TPG: developing the means of provision, coordinating provision, and implementing provision. When the means of provision is something like the cure for a disease, the aggregation technology is best shot, so that funding should be concentrated where the effort ensures the greatest chance of success. This may, at times, mean that a private entity provides the good (e.g., defense contractors, pharmaceutical conglomerates), and the question is then how does the private entity settle the issue of the public funding of its research. Coordination involves mobilizing resources, funding, and developing systems for the delivery of the RPGs. Such activities often involve weighted sum, where assignments are based on differences in comparative advantage in the coordination of provision versus funding. For example, condom distribution generates the RPG of AIDS prevention in Africa. The decision by Coca Cola in June 2001 to involve itself in condom distribution in Africa makes a great deal of sense, because its distribution network is already in place. Other channels for distribution are, however, not redundant.

Implementation cost is an example of how summation or a common pool for funds can be used to finance a public good regardless of the aggregation technology. It is unlikely that the countries in sub-Saharan Africa can even afford generic brands of HIV-AIDS drugs, much less the prices proposed under a two-tiered system that respects patent rights. Hence, there is a need for aid to implement any such drug delivery program.

In summary, RPGs involve a paradigm for foreign assistance that is different from GPGs or NPGs, because the institutional capacity to build a consensus on the issues, produce the RPG, and ensure its distribution is often inadequate or nonexistent. RPGs frequently require regional, rather than global, institutions. There is a need for development cooperation *to finance advocacy networks as a substitute for national leadership*. Moreover, regional institutions are often underfunded, especially those that are not security or trade related. Even at the level of regional development banks, there is far less funding concentrated on RPGs than those that are allocated to NPGs on a by-country basis.

5. Subsidiarity Principle

The principle of *subsidiarity* rests on the notion of *fiscal equivalence*, first put forward by Breton (1965) and Olson (1969), which indicates that the decision-making jurisdiction should coincide with the region of spillovers, so that those affected by the public good determine its provision decision. Thus, the political jurisdiction is made to match the economic domain of benefits. In a global context, subsidiarity recommends that GPGs be addressed by global bodies, such as the United Nations and the World Health Organization (WHO), while RPGs are allocated by regional organizations, such as ASEAN and EU. By matching jurisdictional and economic interests, subsidiarity seeks to promote allocative efficiency where the sum of the marginal benefits of those affected by an RPG is equated to the marginal cost of provision.[13] When the political jurisdiction extends beyond the range of RPG spillovers, taxes or other financial instruments are then imposed on some people (nations) that do not benefit, thus motivating oversupply by those deciding provision. If, instead, the political jurisdiction is smaller than the range of RPG spillovers, then the decision maker will fail to include benefits conferred on those outside of the jurisdiction, and, as a consequence, too little of the RPG will be supplied. Suppose that a disease presents a specific threat to five West African nations, then subsidiarity implies that a collective of these five nations is best suited from an interest viewpoint to address the provision of a health-promoting public good.[14]

Subsidiarity not only places the problem on the most appropriate participants – those with most to gain from the public good – but it also economizes on transaction costs, which are expenses associated with any mode of allocation (e.g., a market, a club, a multilateral organization, a public-private partnership). This saving in transaction costs results, because decision-making expense is duly limited by not including nations with little or no interests in the RPG. As the number of parties involved in a decision increases, decision-making costs increase, as bargains must be reached to achieve the required consensus.

[13] This is the so-called Samuelson's condition for pure public goods for which $\Sigma MRS = MC$, where MRS is the marginal rate of substitution between the public good and private good and MC is the marginal cost ratio between these two goods. The sum is over those receiving spillover benefits from the public good (Cornes and Sandler, 1996).

[14] Dr. Rikard Forslid (Stockholm University) raises an issue concerning our use of fiscal equivalence as a justification of subsidiarity in the case of development assistance. His concern arises because the funds for RPGs in development are not raised by those who decide provision at the regional level. Even though this is true, fiscal equivalence still applies, in part, because decision makers for provision within the appropriate domain of RPG spillovers can better reflect local preferences than can the financers (e.g., donors, World Bank). In the United States, revenue sharing, where the federal government collects the money and then gives it to the states to spend, is founded on the principle of fiscal equivalence even though the money is not being raised at the jurisdictional level. Economies of scale in fund raising justify this financial arrangement.

When applied to their fullest extent, fiscal equivalence and subsidiarity result in a mosaic of different regional authorities to address RPGs for both developing and developed countries. Ideally, a separate regional body would be assigned to each RPG. Taken to its extreme, nations would be members of myriad regional collectives with overlapping jurisdictions.

5.1 RPGs and subsidiarity in practice

Despite the recent rise of a new regionalism where region-based collectives have formed to address RPGs (Dodds, 1998; Hettne, Inotai, and Sunkel, 1999; Kahler, 1995; Mansfield and Milner, 1999), global multilateral organizations and rich nations remain the dominant providers of RPGs in contrast to the recommendations of the subsidiarity principle. Thus, we must inquire as to the possible reasons why subsidiarity is not being applied in practice, unlike what we observe within nations, where a plethora of subnational political jurisdictions (e.g., local school boards, water jurisdiction, police districts) form along the lines of fiscal federalism. What are the opposing influences to subsidiarity at the transnational level? Will the new interest in RPGs strengthen regional collectives? These questions are essential concerns of this monograph.

There are at least three offsets to subsidiary – two stem from efficiency concerns and one from a practical consideration. The first offset has to do with *economies of scale*, where the cost per unit of an activity – say, the provision of an RPG – falls as a greater number of units are provided. Suppose that two geographically separated regions require the same RPG. If each region forms its own regional collective to provide the good, then the cost per unit will be higher than when some more inclusive global body provides the RPG for both regions. When the reduced cost from scale economies more than offsets any lost in efficiency from the noncoincidence between the decision-making body's jurisdiction and the economic domain of the RPG, the use of a global multilateral is justified. Of course, this offset need not result if either the savings from scale economies are modest or the inefficiency of noncoincidence is large. Some RPGs may be produced in sufficient quantity when serving a single region, so that scale economies are achieved and a larger jurisdiction is not required.

The second efficiency-based offset to subsidiarity comes from the observation that many multilaterals – e.g., the World Bank, the EU, the United Nations, and the North Atlantic Treaty Organization (NATO) – provide a host of RPGs and GPGs with nonoverlapping economic domains. The World Bank not only gives out foreign assistance to alleviate poverty and promote development, but it also produces research. Since the 1990s, the Bank is increasingly involved with health-promoting RPGs (Sandler and Arce, 2001). Even NATO, which was initially created to provide a single RPG – security in Europe against Soviet aggression – now supplies other

RPGs in terms of peacekeeping, curbing terrorism, verification of treaties, traffic control, scientific research, and drug interdiction (Sandler and Hartley, 1999, 2001).

This multiple provision can often be justified by *economies of scope*, which arise when the cost of providing two or more RPGs jointly in the same institution is less expensive than supplying them in different institutions. Economies of scope can be traced to cost savings stemming from common costs attributable to the shared use of some inputs when allocating resources to multiple RPGs. Such common inputs may include administrative staff, communication networks, support staff, meeting rooms, research facilities, transportation arrangements, and scientific personnel. Underutilized infrastructure in a multilateral organization may be partly responsible for these economies of scope. When, however, the existing infrastructure has reached capacity, a multilateral institution must weigh the cost of expanding its infrastructure to accommodate further TPGs, or to assign additional TPGs to either specialized institutions or to independent institutions. Both practices are observed: the International Maritime Organization, WHO, and the International Telecommunication Union are specialized UN agencies, while the World Trade Organization (WTO) is a new independent institution. As new institutions for RPGs are needed, multilaterals must make an analogous decision. A bias toward specialized agencies is anticipated as an existing multilateral organization tries to broaden its influence despite inefficient consequences. A drawback of the practice of specialized agencies concerns the possibility that the provision of a public good by one agency may conflict with the provision of another public good by another agency within the same institution. In the United Nations, actions by the UNDP to promote development may be at odds with the mandate of the UN Environmental Program (UNEP) to protect the global environment (Kanbur, Sandler, with Morrison, 1999). This conflict may be suppressed when interests in the same institution are involved, while it may be more quickly recognized when separate organizations are concerned.

The practical-based third offset to subsidiarity involves whether the appropriate regional institution has the capacity to address the problem. It is common that regional institutions, unlike their global counterparts, do not have this capacity, which is an essential policy concern that sets RPGs apart from GPGs. Consider a health exigency such as river blindness in Western Africa. The Economic Community of West African States (ECOWAS) is the appropriate regional institution to address the problem according to the principle of subsidiarity. However, in practice, ECOWAS did not have the means to deal effectively with the problem, so that the WHO initiated a vector control program over 25 years ago to curb the pest that carries the disease.

Sometimes, the agenda of a regional institution rather than its capacity may be the issue. For example, ECOWAS, which is effectively controlled by

Nigeria, intervened in an alleged peacekeeping mission in Liberia's civil war. This intervention led to much bloodshed and looting, contrary to the mission's intention (Dorn, 1998). Thus, the motives of a regional collective must be examined when applying the subsidiarity principle, since self-serving actions by a dominant country might result.

Next, consider the capacity and related issues with regards to the various regional banks – African Development Bank, Inter-American Development Bank, and Asian Development Bank – which according to the subsidiary principle would be the most appropriate multilateral institution to *fund* RPGs, currently supported by the World Bank. For these regional banks to take on this greater responsibility, a number of changes are required. First, funding of these institutions must be augmented; otherwise, the requisite capacity is not there. This requires a redistribution of funds from the World Bank to these regional banks. Second, these banks will have to change their current orientation from funding NPGs to financing RPGs. A study by Hewitt, Morrissey, and Willem te Velde (2001, Table 3.1) indicate that, during 1996-98, the Asian Development Bank and the Inter-American Development Bank allocated just 6.86 percent and 1.97 percent, respectively, of their aid expenditures to RPGs, while these institutions allocated 47.34 percent and 69.15 percent, respectively, to NPGs. This same bias to NPGs' funding is evident in the World Bank's (2001a, Chapter 5) assessment of aid-based funding of public goods by institutions and country donors, and derives from regional banks having an easier time securing collateral from a nation than from some regional collective. A collective action problem may arise among member states of a regional collective when repaying loans. Unless these regional collectives develop and come to represent a secure borrower, the NPG bias of regional banks is unlikely to be resolved. Third, country and other donors to the World Bank development activities must come to see the benefits in supporting RPGs at the regional level if their financing is going to be adequate.

5.2 Two additional considerations regarding subsidiarity

There are two further considerations for applying the subsidiarity principle when assigning regional institutions with the responsibility to supply RPGs. The first may or may not support subsidiarity depending on the underlying aggregation technology of the RPGs, whereas the second supports subsidiarity. For best-shot RPGs, worldwide institutions that can pool efforts to achieve a greater overall effort is more supportive of such goods over smaller regional institutions, even though the latter is more in keeping with subsidiarity. Thus, the public-private partnership for MMV, which is a best-shot RPG, is being funded at the global level by WHO, the World Bank, donor countries, and foundations. However, for a weakest-link RPG, such as a prophylaxis against a region-specific pest, funding at the regional level is

justified to ensure that all countries meet a required standard of protection. By being nearer to the problem, a regional institution is better equipped to spot the laggards than a global counterpart.

The second consideration has to do with aid institutions that provide two or more RPGs, whose contributing countries may be different. Suppose that such an institution supplies just two RPGs, each of which represents the interest of a unique set of donors. Further suppose that the donors (the principals) cannot fully observe the actions of the institute (the agent) in supporting the alternative RPGs. A *common agency* problem then occurs (Dixit, 1996; Siqueira, 2001; Siqueira and Sandler, 2001). In trying to provide the proper incentives to motivate the institution, each group of principals is concerned that its support may be applied to the RPG for which it has no interest. As a consequence, each group withholds some of its support, so that the common agent is not properly motivated to work sufficiently hard to supply either of the RPGs.[15] This problem, prevalent in multi-tier governments (e.g., fiscal federal systems) and multi-task international organizations, is an offset to economies of scope. The common agency problem supports single-purpose institutions, guided by subsidiarity.

5.3 Taking stock of subsidiarity

The analysis shows that there are both supporting and detracting factors regarding the subsidiarity principle when applied at the regional level to the choice of the institutions providing RPGs. To determine, in practice, whether a global or regional institution is best and whether it should be single or multi-purpose, an analyst must weigh the opposing influences from economies of scope and scale, the aggregation technology of the RPGs, the capacity of the regional institution, and the problem of common agency. If a net assessment of opposing factors is ascertained, then a determination as to the advisability of the subsidiarity principle can be reached. At times, a dominant influence by one of these factors may be sufficient to make a recommendation of the appropriate jurisdiction required.

Given so many diverse influences, one would suspect a variety of institutional scenarios in the real world, which is indeed the case. In Table 4, a taxonomy for institutions supporting RPGs and GPGs is displayed, according to the number of public goods provided (one or more than one) and the number of participants (three or less and more than three). Participants can include donor countries, charitable foundations, multilateral

[15] In a principal-agent analysis, the presence of agency cost, required to motivate an agent to work hard, results in a second-best outcome. The outcome with common agency is describes as a third-best result, inferior to that of the standard agency problem. Inefficiency is due to agency cost *and* free-riding behavior on the part of the principals when motivating the common agent (Dixit, 1996; Siqueira, 2001).

Table 4. A taxonomy of institutions for supporting RPGs and GPGs

	Small number of participants	Large number of participants
Single RPG or GPG	US-Russian Space Station,US-Cuban Anti-Hijacking Treaty	Fonagro, Montreal Protocol on CFCs, WTO, Universal Postal Union, MMV, Onchocerciasis Control Program, International AIDS Vaccine Initiative, UN Peacekeeping
Multiple RPGs or GPGs	Gates Foundation, Rockefeller Foundation, Bilateral Aid Arrangements, Cultural Exchange Programs	CGIAR, NATO, EU, ECOWAS, Global Environment Facility (GEF), Antarctic Treaty System, World Bank, UN, Regional Development Banks (e.g., African Development Bank, Inter-American Development Bank)

Adapted from Sandler and Hartley (2001).

institutions, and NGOs. Four alternative classes are delineated along with examples in each category. Institutions with one to three participants that supply a single public good include the US-Russian Space Station for scientific research and the US-Cuban Anti-Hijacking Treaty. The Gates Foundation and other institutions listed in the lower left-hand cell include one or few participants who provide multiple RPGs. For example, the Rockefeller Foundation is a stand-alone institution that supports health, environmental, and knowledge RPGs.

In the top right-hand cell are those institutions that draw their finances from four or more supporters, but provide just a single public good. For example, Fonagro is funded by countries in Latin America and the Caribbean to support region-specific agricultural research (World Bank, 2001a, p. 116). As such, Fonagro reflects subsidiarity. The Inter-American Development Bank also supports Fonagro. The Multilateral Fund of the Montreal Protocol, underwritten by developed countries, is intended to assist "Article 5" developing countries acquire substitutes to CFCs and other ozone depleters.[16]

Finally, the bottom right-hand cell indicates those institutions relying on four or more participants to underwrite multiple RPGs and GPGs. For instance, the CGIAR is supported by the World Bank, foundations, and commercial interests to engage in a wide range of biotechnology activities

[16] Article 5 of the Protocol indicates which countries are entitled to help from the Multilateral Fund. These countries were also given a ten-year period reprieve after ratification before they had to curb their CFC consumption (Benedick, 1991). This reprieve period served as an inducement to ratify the Protocol.

including new green revolutions, geared toward developing countries. The Global Environment Facility (GEF) supports all manners of sustainable development and is interested in reducing air and other forms of pollution in developing countries (World Bank, 2001a, p. 115). GEF receives funding from the UNEP, the UNDP, the World Bank, and donor countries (Ferroni, 2000, p. 9). The myriad RPGs and GPGs supplied by NATO, the EU, the World Bank, and regional development banks need no further discussion. In this cell, the Antarctic Treaty System is supported by signatory countries to address a host of environmental and knowledge public goods related to Antarctica (Young, 1998). This treaty reflects the subsidiarity principle, since only those countries with claims or interests to Antarctica are involved.

In practice, subsidiarity has played a role with respect to region-based collectives supplying some RPGs. If regional institutions can be duly strengthened by donor countries and the global multilaterals, then these regional institutions will play a much bigger role in supplying RPGs in the future. In the absence of significant scale and scope economies, subsidiarity can justify this enhanced role.

6. RPGs and Development

6.1 Impact of RPGs on development

Serious attention has been paid to the role of public goods in development since Hirschman's (1958) study of the relationship between agriculture and development, and investment in infrastructure as a means of sustaining economic growth. In regards to agriculture, regional marketing boards have already been mentioned as a way for ensuring delivery of foodstuffs to remote areas of economic activity (e.g. mining), and as a central voice for the demands for infrastructural investment to transport production within the region to international markets. Transportation links (via river or over land) to population centers and ocean ports are examples of RPGs in terms of infrastructure that sustains development. If development is to be maintained, then another essential infrastructure concerns food security, so that people do not become ill from microorganisms in their food.

Social overhead capital (SOC) primarily refers to infrastructural investment that is complementary to private capital. In addition to transportation links, regional development requires other forms of SOC such as power grids, communication networks, and established property rights. When a regional, rather than national, perspective is taken for such investments, it changes the size of the identifiable market supported by the SOC. RPGs that provide SOC in support of markets promote development through cost reductions arising from economies of scale, lowered transaction costs, and increased efficiency through specialization (Stålgren, 1999, p. 35). SOC is often lumpy in the sense that a certain threshold of service must be attained for the infrastructure to complement private capital – e.g., roads must connect and power grids must transport electricity from remote dams to urban areas. When SOC is lumpy, there is a *timing* rationale for aid – i.e. inadequate SOC can cause bottlenecks that postpone development and private investment. Bottlenecks must be anticipated; otherwise, it is difficult to coordinate capital investment to take full advantage of other RPGs such as trade agreements.

In a study on the effect of investment on transport infrastructure and growth, Richaud, Sekkat, and Varoudakis (1999) find statistical evidence of regional transportation spillovers in Africa, where there are significant numbers of land-locked countries. Dividing the continent into four regions, these authors find that improved infrastructure in a given country generates growth spillovers in adjoining countries. As the decision to invest in transport infrastructure is primarily a national one, such spillovers are not anticipated to be taken into account. A regional perspective would, however, make these spillovers part of this decision; hence, it is suggested that external aid aimed at improving infrastructure in Africa might be better provided at a regional, rather than national, level.

There is also an intellectual aspect to SOC in terms of the recognition and

enforcement of property rights, needed for well-functioning markets and to attract investment. Uniformity in legal and labor standards provides a level playing field, on which investment can fully exploit variations in the comparative advantage of nations comprising the region. Sound financial and accounting practices make the business environment transparent, thereby identifying the most efficient use for private capital. The institution of these standards and practices is even becoming part of regional trade agreements. Best-practice knowledge in these areas can come from multilaterals, NGOs, and donor nations.

In the post-Cold War era, security has come to the forefront as a basic problem of underdevelopment with a regional dimension (see Section 7). Security is essential if regions are successfully to address collective action problems. Without security, regional interactions become Prisoner's Dilemma problems – there is little incentive to reciprocate on cooperation because of instability where leaders, institutions, and external agents are constantly changing. Insecurity at a border not only impedes the flow of goods, but it also creates a refugee problem that places greater demands on neighboring countries' social services. The number of refugees and internally displaced persons has increased to over 40 million, so that relief spending has reached 15 percent of all aid in some peak years (Overseas Development Institute, 1999), thereby siphoning funds away from directly productive forms of RPG expenditure.

Security is an area where regional solutions often require in-kind intervention. Military responses by the regional actors themselves may be problematic because of the lack of political, military, or financial capacity. In sub-Saharan Africa, regional instability has stemmed from the lack of governance in the Democratic Republic of Congo. Moreover, valuable indigenous resources have not only supported the conflict, but motivated the greed that fueled many such conflicts (Collier and Hoeffler, 2000). The benefits of security extend beyond humanistic issues, since a secure environment is one in which collective action may be achieved through bargains facilitated by stable institutions.

6.2 Development prerequisites

While many RPGs support the development process, development is itself a prerequisite for regions to take full advantage of the benefits embodied in RPGs. For example, television broadcasts are partly excludable, because access requires the purchase of a television and the availability of electricity. Insufficient development may imply a lack of capacity to benefit from many RPGs. Moreover, growth fosters a tax base from which to finance RPGs. The adequate tax base is especially critical for financing weakest-link public goods, insofar as the lowest incomes determine the smallest provision and, hence, the overall level of RPG provision. The most inadequate public

finance system can solely determine the regional supply for some RPGs. Even best-shot public goods, provided by an outside donor or another member nation, may present problems for nations lacking the capacity to consume them.

Any RPG that is based on technology – satellites, communication networks, medical treatment – requires human capital in the form of schooling and training. Education is a joint product activity with private benefits to the consumer and public benefits to the region in terms of increasing the capacity to derive benefits from RPGs. In many areas of the world, development must take place before education becomes a priority. For example, in areas where women devote a great deal of time toward the foraging of energy sources (e.g., wood, coal), alternative energy sources would free up women for other productive activities, while producing environmental benefits through cleaner (e.g. photovoltaic, wind, or solar) energy sources. Hence, the funding of alternative fuel sources is an example of an RPG that ultimately doubles as a GPG for the donor country.

Aid for RPG provision often implies that a certain level of development has been achieved. While donor fatigue and RPGs as substitutes for traditional aid are currently prevalent in the literature, a focus on RPGs is most relevant once basic human needs have been met. The reason why traditional aid for development is less prominent than in the past is because of the tremendous progress that has been made in Asia, the Middle East, and Latin America over the last fifty years (Lancaster, 2000). This progress facilitates the paradigm shift towards RPGs and GPGs.

6.3 Incentives for development cooperation

The need for prerequisites to benefit from RPGs emphasizes the complementary nature of international development cooperation (Stålgren, 2000, p. 18). RPGs are often complementary to national and global public goods. Moreover, there remains the issue of apposite commercial motives for supplying development-promoting RPGs by donor countries. Aid can be seen as a means to create consumption capacity with potential trading partners, thereby establishing new markets for the donor's own products. For example, Japanese foreign aid in the 1980s flowed toward creating an infrastructure that benefited Japanese (and other) foreign investment in the region (Kahler, 1995, pp. 20). When RPGs contribute to growth, they also create demand through an LDC's imports of intermediate products, technology, capital goods, and consumer goods. More subtle is the idea that as income rises with development, a region increases its demand for environmental public goods, thereby converging LDC preferences for environmental TPGs and GPGs with those of developed nations.

7. Peacekeeping

With our first application to peacekeeping, we move from a general discussion of RPGs to three specific cases in Sections 7-9. These cases illustrate the applications of the principles developed in Sections 1-6 to show how the conceptual framework of public goods can assist policy analysis in the support of security, the environment, and health in developing countries.

In its traditional form, *peacekeeping* involves the deployment of military personnel to monitor or observe a ceasefire between hostile forces. Peacekeepers are dispatched when opposing sides agree to their presence.[17] Given their light armaments, *traditional peacekeepers* can do little to maintain the peace if hostilities resume. At times, small peacekeeping forces are deployed to observe a ceasefire (e.g., the Dominican Republic in 1965), while, at other times, large forces are deployed to serve as a buffer between hostile forces (e.g., Cyprus during 1964-74, Sinai during 1956-67 and 1973-79). Peacekeepers can also assume a more active role by assisting in the transition to democracy by training police forces, establishing legislative and other democratic institutions, and providing humanitarian relief (e.g., Haiti from 1996 on, Kosovo from 1999 on). This fuller role is known as *peacemaking*. Some peacekeeping mission may only involve facilitating the transition to democracy (e.g., West New Guinea during 1962-63, Namibia during 1989-90).

The most logistically demanding form of mission is *peace enforcement*, where uninvited forces are sent to separate warring sides in order to impose a peace on at least one unwilling combatant. Such actions require a major deployment of heavily armed forces that can fend off either side. Sophisticated weapons and large-scale firepower are needed for peace enforcement. The end of the Cold War has witnessed a number of these peace enforcement missions as either UN-financed or non-UN-financed actions, including operations in Kuwait, Bosnia, Somalia, Haiti, and Kosovo. Earlier examples of peace enforcement were the UN mission to the Congo during 1960-64 and the non-UN-financed mission during the Korean War in 1950.

Since the breakdown of communism starting with the Velvet Revolution in Czechoslovakia in 1989, peacekeeping has assumed an increased importance as illustrated by Figure 1, which displays UN members' support of peacekeeping missions (in millions of current-year dollars) during the 1979–2000 period.[18] Peacekeeping payment data were drawn from the

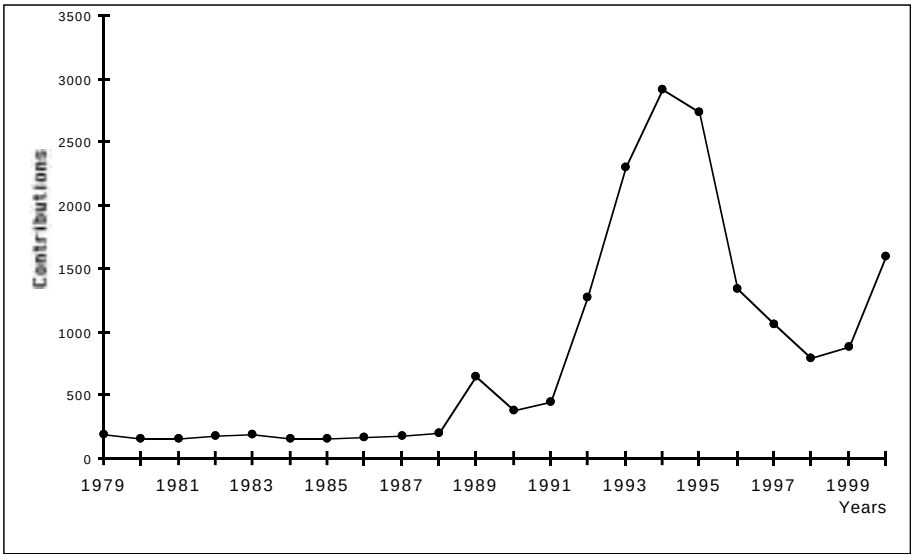
[17] On the various kinds of peacekeeping missions, see Cerjan (1994), Diehl, Druckman, and Weil (1998), Fetherston (1994), Hill and Malik (1996), Palin (1995), Ratner (1995), Rikhye and Skjelsback (1990), Sandler and Hartley (1999), and the UN Department of Public Information (1996).

[18] Hirofumi Shimizu compiled the statistics for this graph from UN budgets.

annual UN (1979-2000) *Status of Contributions* and the biennial UN (various years) *Financial Report*. The chart indicates actual, not assessed, payments by UN members to ongoing peacekeeping missions in each year.[19] Prior to 1987, UN spending on peacekeeping was around $200 million per year. From 1988 to 1994, this spending grew ten-fold to over $3 billion in current dollars before falling during the 1995-98 period. This drop in 1995 was precipitated by NATO's takeover of the peacekeeping mission in Bosnia (i.e., the deployment of the Implementation Force (IFOR)), which had accounted for half of UN peacekeeping spending in 1994. From 1998 to 2000, there was another upsurge in expenditure on official UN peacekeeping missions, with spending approaching $2 billion in Figure 1.[20]

Since 1990, overall spending peacekeeping is much greater than what is displayed in Figure 1, because spending on non-UN-financed missions are not included. For example, some $61 billion was spent on Desert Shield and Desert Storm during 1990-91 (US Department of Defense, 1992). Other non-UN-financed missions included Operation Deny Flight in Bosnia (1993-1995), Operation Provide Comfort in Northern Iraq (1991), IFOR and Stabilization Force (SFOR) in Bosnia (1995 on), and the Kosovo Force (KFOR) in Kosovo (1999 on). Some of these operations were UN mandated

Figure 1. UN members' paid assessments to peacekeeping: 1979–2000



[19] Assessed payments for peacekeeping must be distinguished from actual payments, because nations do not always pay their assessments. Actual payments are a better measure of true burdens (Khanna and Sandler, 1997; Khanna, Sandler, and Shimizu, 1998, 1999).

[20] Spending on these missions is estimated to be between $2.6 billion and $3 billion (World Bank, 2001a, p. 117). Figure 1 underestimates the spending since it records paid assessments and not what has been spent.

but not UN financed, as in the case of KFOR. Annual expenditure on select non-UN-financed missions ran into the billions of dollars per year. At its height, IFOR consisted of 70,000 troops primarily drawn from the United States, the United Kingdom, France, and Germany (US Department of Defense, 1996). Only a very small fraction of peacekeeping spending in the form of humanitarian relief shows up as foreign direct assistance, even though much of the spending, with the exception of the Gulf War of 1991, has been aimed at providing stability to developing and transitional economies (Hewitt, Morrissey, and Willem te Velde, 2001; World Bank, 2001a).

7.1 UN peacekeeping missions to date

To put things into perspectives, we give a brief overview of past UN missions. Table 5 lists all UN peacekeeping missions by their name and acronym from 1947 to the middle of 2001. In addition, the missions' duration, purpose, and authorization are given. Authorizations beginning with an S refer to the Security Council, whereas those starting with an A refer to the General Assembly resolution (RES). Missions in boldface were ongoing as of 4 June 2001. Mission length varies greatly with some lasting over fifty years (e.g., UNTSO along portions of the Israeli border, UNMOGIP in Kashmir), while others ended within a year (e.g., DOMREP in the Dominican Republic, UNASOG in Libya and Chad). The geographical distribution of missions is: 19, Africa; 9, Middle East; 9, Europe; 8, Latin America (including Central America and the Caribbean); 6, Asia; and 3, the Pacific. Caution must be exercised in viewing these numbers, because some missions were renamed as new phases were reached (e.g., peacekeeping turned to assisting the transition to democracy, as in Haiti), which bloats the total for a region. In recent years, most of the new UN peacekeeping operations have been in Africa and Europe.

At least four distinct stages of UN-financed peacekeeping have evolved since the founding of the United Nations (Hill and Malik, 1996; Ratner, 1995). First, there was the initial inactive period, 1947-56, with four missions mostly involving ceasefire monitoring, with the exception of UNEF I in the Sinai. This latter operation required UN peacekeepers to provide a buffer, which eventually failed, between Israeli and Egyptian forces. Second, an active period ensued during 1957-74, for which there were nine new missions, primarily of the observer type. One mission – ONUC – to end hostilities in the Congo placed UN peacekeepers in jeopardy and resulted in deaths of 250 peacekeepers. ONUC sadly demonstrated that UN forces were ill-equipped to carry out complicated and ill-defined missions to maintain the separation of warring troops (Hill and Malik, 1996; Rikhye and Skjelsback, 1990; UN Department of Public Information, 1996). At its height, ONUC deployed over 20,000 peacekeepers and put strains on the

Table 5. UN peacekeeping missions, 1947–2001

Operation	Duration	Purpose and Authorization
UN Special Committee on The Balkans (UNSCOB)[a]	1947–52	Investigate foreign support of guerrillas in Greece. (A/RES/109)
UN Truce Supervision Organization (UNTSO)	1948 to date	Monitor ceasefire lines between Israel and neighbors. (S/RES/50)
UN Military Observer Group in India and Pakistan (UNMOGIP)	1949 to date	Monitor ceasefire in Kashmir. (S/RES/47)
UN Emergency Force I (UNEF I)	1956–67	Create a buffer between Israeli and Egyptian forces in the Sinai. (A/RES/998)
UN Observation Group in Lebanon (UNOGIL)	1958	Monitor military forces in Lebanon. (S/RES/128)
UN Operation in the Congo (ONUC)	1960–64	Aid the Congolese Government restore order. (S/RES/143)
UN Security Force in West New Guinea (UNSF). Also known as UNTEA	1962–63	Administer West Irian prior to transfer of territory to Indonesia. (A/RES/1752)
UN Yemen Observation Mission (UNYOM)	1963–64	Monitor military forces into Yemen from Saudi Arabia. (S/RES/179)
UN Peacekeeping Force in Cyprus (UNFICYP)	1964 to date	Maintain order from March 1964 until 1974. Thereafter monitor buffer zone between Turkish and Greek partitions. (S/RES/186)
Mission of the Representative of the Secretary-General in the Dominican Republic (DOMREP)	1965	Observe ceasefire between opposing defacto authorities. (S/RES/203)
UN India-Pakistan Observation Mission (UNIPOM)	1965–66	Monitor ceasefire in the aftermath of the 1965 war. (S/RES/211)
UN Emergency Force II (UNEF II)	1973–79	Provide a buffer between Israeli and Egyptian forces in the Sinai. (S/RES/340)
UN Disengagement Observer Force (UNDOF)	1974 to date	Monitor the separation of Israeli and Syrian forces on the Golan Heights. (S/RES/350)
UN Interim Force in Lebanon (UNIFIL)	1978 to date	Provide a buffer between Israel and Lebanon. (S/RES/425)
UN Good Offices Mission in Afghanistan and Pakistan (UNGOMAP)	1988–90	Monitor Soviet troop withdrawal from Afghanistan. (S/19836) & (S/RES/622)
UN Iran-Iraq Military Observer Group (UNIIMOG)	1988–91	Monitor ceasefire following Iran-Iraq War. (S/RES/598)
UN Angola Verification Mission I (UNAVEM I)	1989–91	Monitor Cuban troop withdrawal from Angola. (S/RES/626)
UN Transition Assistance Group (UNTAG) in Namibia	1989–90	Supervise transition from South African rule to independence. (S/RES/632)

Table 5 (Cont)

UN Observer Group in Central America (ONUCA)	1989–92	Monitor compliance with Esquipulas II agreement and facilitate the demobilization of Nicaraguan Contras. (S/RES/644)
UN Iraq-Kuwait Observation Mission (UNIKOM)	1991 to date	Monitor buffer zone between Iraq and Kuwait following the Gulf War. (S/RES/689)
UN Angola Verification Mission II (UNAVEM II)	1991–95	Monitor the ceasefire, the creation of new army, and the holding of elections. (S/RES/696)
UN Observer Mission in El Salvador (ONUSAL)	1991–95	Monitor the ceasefire, human rights, elections, and the demobilization and reintegration of forces. (S/RES/693)
UN Mission for the Referendum in Western Sahara (MINURSO)	1991 to date	Organize, conduct, and monitor referendum on independence from Morocco. (S/RES/690)
UN Advance Mission in Cambodia (UNAMIC)	1991–92	Advance planning for UNTAC. (S/RES/717)
UN Protection Force (UNPROFOR)	1992–95	Initially create conditions for peace by ensuring demilitarization of three zones in Croatia. Monitor ceasefire in Croatia and elsewhere in the former Yugoslavia. (S/RES/743)
UN Transitional Authority in Cambodia (UNTAC)	1992–93	Supervise elections, disarmament, and demobilization of forces. Ensure the repatriation of refugees. (S/RES/745)
UN Operation in Somalia I (UNOSOM I)	1992–93	Provide humanitarian relief operations; monitor ceasefire. (S/RES/751)
UN Operation in Mozambique (ONUMOZ)	1992–94	Monitor and verify demobilization and disarmament; verify withdrawal of foreign troops; assist in monitoring elections; coordinate humanitarian aid. (S/RES/797)
UN Operation in Somalia II (UNOSOM II)	1993–95	Maintain secure environment for humanitarian relief efforts. End hostilities and bring about reconciliations. First UN peace-enforcing mission (S/RES/814)
UN Observer Mission Uganda/Rwanda (UNOMUR)	1993–94	Monitor the borders between Rwanda and Uganda; confirm end of military aid to Rwanda (S/RES/846)
UN Observer Mission in Georgia (UNOMIG)	1993 to date	Monitor military forces in Georgia and Abkhazia (S/RES/858)
UN Observer Mission in Liberia (UNOMIL)	1993–97	Monitor military forces in Liberia. (S/RES/866)
UN Mission in Haiti (UNMIH)	1993–96	Bring peace to Haiti. Reinstate elected President; train a police force; and hold general elections. (S/RES/867)

Table 5 (Cont)

UN Assistance Mission for Rwanda (UNAMIR)	1993–96	Monitor ceasefire and compliance with Arusha Peace Agreements; provide security for Kigali; monitor repatriation of refugees. (S/RES/872).
UN Aouzou Strip Observer Group (UNASOG)	1994	Monitor Aouzou-Strip between Libya and Chad. Lasted under two months May 94-June 94. (S/RES/915)
UN Mission of Observers in Tajikistan (UNMOT)	1994–2000	Monitor military forces in the civil war. (S/RES/968)
UN Angola Verification Mission III (UNAVEM III)	1995–97	Monitor the elections and the neutrality of the Angolan National Police. Help in the implementation of the Lusaka Protocol. (S/RES/976)
UN Confidence Restoration Operation in Croatia. (UNCRO)	1995–96	An offshoot of UNPROFOR. Provide proper environment for a negotiated settlement in Croatia. (S/RES/981)
UN Preventive Deployment Force (UNPREDEP)	1995 to date	Prevent expansion of the conflict in Bosnia to Macedonia. (S/RES/983)
UN Mission in Bosnia and Herzegovina (UNMIBH)	1995 to date	Assist in the transition to peace. (S/RES/1035)
UN Transitional Administration for Eastern Slavonia, Baranja and Western Sirmium (UNTAES)	1996–98	Assist in maintaining peace. Supervise the demilitarization. Train police. (S/RES/1037)
UN Mission of Observers in Prevlaka (UNMOP)	1996 to date	Monitor the peace in Croatia. (S/RES/1038)
UN Support Mission in Haiti (UNSMIH)	1996–97	Assist in transition to democratic rule. Train and monitor the new police force. Monitor the elections. Ended July 1997. (S/RES/1063)
UN Verification Mission in Guatemala (MINUGUA)	1997	Verify implementation of the Comprehensive Agreement on Human Rights signed on 29 March 1994. (S/RES/1094)(A/RES/48/267)
UN Observer Mission in Angola (MONUA)	1997–99	A follow-up to UNAVEM III. Intended to assist UNITA and the Angolan government establish a lasting peace. Promote human rights, verify the integration of UNITA elements into the government, and provide offices for mediation (S/RES/1118)
UN Transition Mission in Haiti (UNTMIH)	1997	A follow-up to UNSMIH to finish the transition process to democratic rule. Started on 30 July 1997 and ended in November 1997. (S/RES/1123)
UN Civilian Police Mission in Haiti (MIPONUH)	1997–2000	Successor of UNTMIH to professinalize the Haitian National Police as part of the transition process to democratic rule. (S/RES/1141)

Table 5 (Cont)

UN Mission in the Central African Republic (MINURCA)	1998–2000	Assist national security forces in maintaining order. Monitor ceasefire and dispose of weapons. Assist in restructuring of police forces. Provide advice and technical support for national elections. (S/RES/1159; 1182; 1201; 1230)
UN Observer Mission in Sierra Leone (UNOMSIL)	1998–99	Monitor the military and security situation in Sierra Leone. Advise on police training and practices. Mission replaced with a larger UN peacekeeping effort. (S/RES/1181)
UN Interim Administration in Kosovo	1999 to date	Reestablish an administrative structure in Kosovo, including legislative, executive, and judicial structures. Assist the returning refugees. Facilitate the return to democracy. Train local police. (S/RES/1244)
UN Mission in Siera Leone (UNAMSIL)	1999 to date	Implement the Lome Peace Agreement. Facilitate disarmament and demobilization. Assist in the transition to stability and democratic rule. (S/RES/1270; 1289; 1346)
UN Transitional Administration in East Timor (UNTRET)	1999 to date	Administer the transition of East Timor to independence. Establish an effective administration. (S/RES/1272)
UN Organization in the Democratic Republic of the Congo (MONUC)	1999 to date	Monitor and implement the ceasefire agreement. Facilitate humanitarian relief efforts. Monitor human rights. (S/RES/1258; 1273; 1279; 1291; 1332)
UN Mission in Ethiopia and Eritrea (UNMEE)	2000 to date	Monitor the ceasefire and provide humanitarian assistance. (S/RES/1320)

Note: "to date" refers to 4 June 2001. Current missions are in boldface.
[a] Not always considered an official UN peacekeeping mission.
Sources: Hill and Malik (1996) and Web page "Comprehensive List of UN Peacekeeping Operations," Center for International Relations, Swiss Federal Institute of Technology, Zurich, Switzerland, http://www.fib.ethz.ch/fib/pko/allops.html. Further update for 1997 on taken from Web pages United Nations Peacekeeping Operations, *http://www.un.org/Depts/dpko/dpko/ops.htm*

UN regular budgets, which underscored that the United Nations needed to locate alternative sources of funding for its peacekeeping activities (see below). A significant consequence of ONUC was to curb the UN interest in peacekeeping. Third, a dormant phase characterized 1975-87, during which only the UNIFIL mission in Lebanon was begun. This mission employed UN peacekeepers as a buffer between Israeli forces and hostile elements in Lebanon and continues today. Fourth, there is the highly active current

period of 1988-2001, where there have been forty missions of varying complexity. Numerous recent operations involved peacemaking and peace enforcement. Obviously, UN resources and capabilities have been severely stretched during the post-Cold War era (Palin, 1995; Sandler and Hartley, 1999); some relief has been provided in Europe by NATO-guided peacekeeping operations.

UN missions, listed by their acronyms, are characterized in Table 6 into six categories. Myriad taxonomies can be designed – e.g., Diehl, Druckman, and Wall (1998) provide a finer taxonomy. Since some missions serve more than one purpose, such missions are included in more than one category and are denoted by an asterisk in Table 6. Traditional peacekeeping missions that

Table 6. UN peacekeeping mission taxonomy

Observing and Monitoring:		
UNTSO (1948 on)	UNIIMOG (1988–91)	UNAMIR (1993–96)*
UNMOGIP (1949 on)	UNAVEM I (1989–91)	UNASOG (1994)
UNOGIL (1958)	UNPROFOR (1992–95)*	UNMOT (1994–2000)
UNYOM (1963–64)	UNOSOM I (1992–93)*	UNMOP (1996 on)
UNIPOM (1965–66)	ONUMOZ (1992–94)*	UNOMSIL (1998–99)*
DOMREP (1965)	UNOMUR (1993–94)	UNAMSIL (1999 on)*
UNFICYP (1974 on)*	UNOMIG (1993 on)	MONUC (1999 on)*
UNDOF (1974 on)	UNOMIL (1993–97)	UNMEE (2000 on)*
UNGOMAP (1988–90)		
Buffer Between Forces:		
UNEF I (1956–67)	UNEF II (1973–79)	UNIKOM (1991 on)
UNFICYP (1964–74)*	UNIFIL (1978 on)	
Humanitarian:		
UNOSOM I (1992–93)*	UNOSOM II (1993–95)*	UNMEE (2000 on)
ONUMOZ (1992–94)*	MUNOC (1999 on)	
Political Help During Transition:		
UNTEA (1962–63)	UNMIH (1993–96)	MONUA (1997 on)
UNTAG (1989–90)	UNAMIR (1993–96)*	UNTMIH (1997)
ONUCA (1989–92)	UNAVEM III (1995–97)	MIPONUH (1997 on)
UNAVEM II (1991–95)	UNCRO (1995–96)	MINURCA (1998–2000)
ONUSAL (1991–95)	UNMIBH (1995 on)	UNOMSIL (1998–99)*
MINURSO (1991–on)	UNTAES (1996–98)	UNMIK (1999 on)
UNAMIC (1991–92)	UNSMIH (1996–97)	UNAMSIL (1999 on)
UNTAC (1992–93)	MINUGUA (1997)	UNTAET (1999 on)
ONUMOZ (1992–94)*		
Peace Enforcing:		
UNPROFOR (1992–95)*	UNOSOM II (1993–95)*	UNMIH (1993–96)*
Others:		
UNSCOB (1947–52)	ONUC (1960–64)*	UNPREDEP (1995 on)

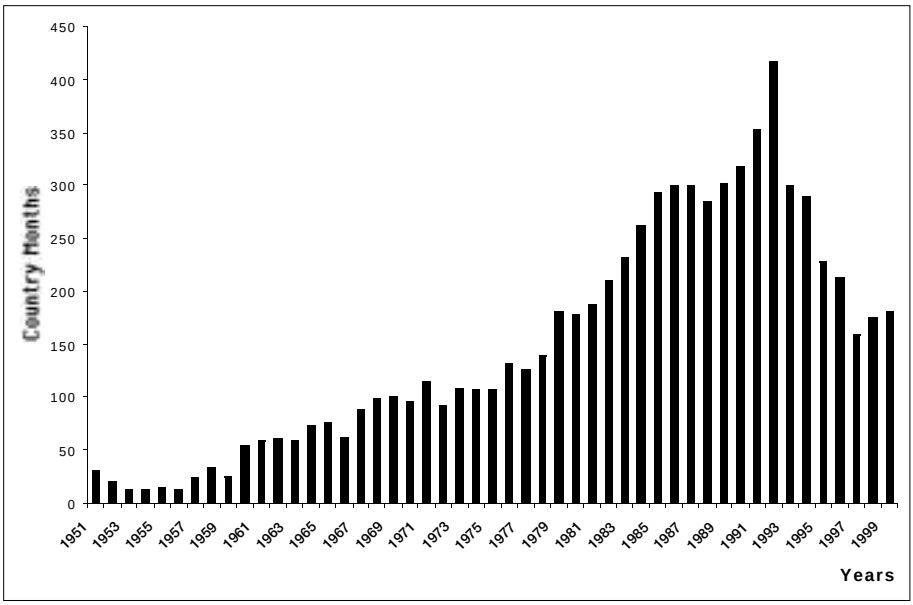
*indicates that the mission is listed under more than one category.
Mission's names and descriptions are in Table 5.

involve either monitoring ceasefires *or* providing a buffer between forces number twenty-five and five, respectively. Clearly, standard peacekeeping constitutes a large class of missions and is logistically less complex and risky than buffering hostile forces. A third class, consisting of five operations, is the provision of humanitarian assistance, where peacekeeping troops deliver and distribute food, clothing, and shelter to refugees, typically endangered by a civil war. The provision of political assistance during a transition to democracy or independence is a fourth category, consisting of twenty-five missions. The most demanding operation is that of peace enforcement – the fifth category in Table 6, where three missions are listed. Peacekeeping operations that are difficult to categorize are indicated as "others" and involve three missions. For example, ONUC tried to assist the Congolese government to restore order, which was more than traditional peacekeeping, but less than peace enforcement.

An important change in mission type is prevalent during the current active period, where operations have often involved humanitarian aid, political assistance, or peace enforcement. The increase in the complexity and number of operations is behind the elevated spending since 1988, previously displayed in Figure 1. This proclivity for more involved missions will maintain the financial burden of peacekeeping at high post-Cold War levels in the years to come. If spending on non-UN-financed missions (e.g., IFOR, SFOR, KFOR) are also included, then peacekeeping burdens would be much larger still.

So what is behind the heightened peacekeeping in recent years? An important factor has been the increase in intra-state wars since 1980. Figure 2 indicates the number of country months of civil wars worldwide for the 1951–99 period. Country months consist of the sum of months worldwide that countries experienced a civil war on their own territory during a calendar year. The data used for Figure 2 comes from Singer and Small (1993) *Correlates of War Project* and from updates for the 1990s provided by Anke Hoeffler from Oxford University. In Figure 2, there is an upward trend in civil war months displayed from the mid-1970s until 1993. After a large decline during 1994-97, the incidence of civil wars is creeping up again. In 1998, there were 25 major civil wars raging in Africa, Asia, and elsewhere (Sollenberg, Wallensteen, and Jato, 1999). In large part, inter-state wars during the Cold War era, fought by surrogate nations for the superpowers, have given way to intra-state wars in the post-Cold War era. These civil wars can impose costs on other countries – particularly those in the same region (Bobrow and Boyer, 1997), in the form of collateral damage, refugee inflows, reduced trade flows, higher defense spending, increased terrorism, and reduced foreign direct investment. Other more widespread spillover consequences can stem from disruptions to resource supply lines (e.g., from civil wars fought in Central Africa) or the spread of political instability.

Figure 2. Country months of civil war in the world: 1951–99



7.2 Peacekeeping as a public good

If intra-state and inter-state conflicts have negative consequences on other countries, then peacekeeping efforts to end such wars represent a TPG. That is, the peace and stability achieved through peacekeeping operations give rise to nonexcludable and nonrival benefits. Under the guise of peacekeeping, humanitarian missions also produces public good benefits for the world community by improving the well-being of those in need. Countries with an altruistic interest in those less fortunate derive a benefit from such assistance. Even operations to secure democracy can have transnational benefit spillovers by extending political freedoms and fostering peace. Peace is further bolstered by transitional assistance if democracies are truly less apt to go to war than autocracies, as many have argued (Russett, 1993). Peace enforcement creates nonexcludable and nonrival benefits by ending hostilities and their negative consequences.

A pertinent question concerns whether peacekeeping is a pure public good or an activity with joint products. Recall from Section 3 that a transnational activity with joint products yields both purely public transnational benefits and country-specific benefits. In the case of peacekeeping, country-specific benefits may assume at least two forms: (i) status enhancement for a contributing country whose standing in the world community is elevated, and (ii) neighborhood stability for a country whose proximity to the conflict presents special risks. Canada, Japan, and the Scandinavian countries take rightful pride in their disproportionately large efforts, in terms of GDP, to support UN peacekeeping. On numerous

occasions, these countries have reminded the world community of their large peacekeeping support. When criticized for failing to pay some of its UN peacekeeping assessments in the 1980s and 1990s, the United States was quick to point out its support of non-UN-financed peacekeeping operations.

If a peacekeeping country is nearby a conflict, then collective action to achieve peace is anticipated to provide the country with some specific benefits, not gained by other more-distant countries. Such country-specific benefits arise from the reduced risk that the conflict will spread to it. Furthermore, propinquity can also result in country-specific benefits as trade flows and growth are enhanced for neighbors with the return of political stability to the region. Clearly, conflicts in Kosovo and Bosnia posed greater dangers for NATO allies near to the Balkans than those further away. Similarly, fighting in East Timor presented greater dangers to Australia than to Europe or North America. Recent empirical work shows that civil wars have significant negative influences on the growth of neighboring countries (Murdoch and Sandler, 2001, 2002); in some cases, neighborhood effects on growth are equal or greater than those within a conflict-ridden country. This is especially true in Africa, where a civil war may plague many regional neighbors of the same country.

The provision of regional security may involve some subtle, but essential, tradeoffs owing to rivalry (Stålgren, 2000, p. 19). If conflict is present in multiple countries within a region (e.g., Rwanda, Burundi, and the Democratic Republic of the Congo), then the deployment of peacekeepers in one area means that there are fewer troops to deploy in other areas – a spatial rivalry results. Any attempt to dispatch a given set of peacekeepers to more countries must necessarily lead to a thinning of forces (Sandler, 1977; Sandler and Hartley, 2001). Hence, some of the jointly produced outputs from peacekeeping are impurely public. Another crucial tradeoff arises when the deployment of peacekeepers to one country causes the rebels or warring factions to shift their activities and safe havens to a neighboring country, where peacekeepers are not present.[21] Thus, peacekeeping may have some adverse consequences if these transferences are not anticipated. An *overall regional orientation is required* when dispatching peacekeeping forces, *or conflict may migrate*. The Balkans illustrates this concern, since conflict has moved to another country as peacekeepers brought stability to one country. Once the regional nature of the peacekeeping problem is recognized, a larger deployment of forces is needed so that potential nearby venues for conflict are also secured.

Given its country-specific and impure outputs, peacekeeping is a regional activity with joint products. The presence of country-specific benefits should motivate peacekeeping efforts, especially by those countries nearer to a

[21] This type of transference was first analyzed by Sandler and Lapan (1988) in a terrorism context.

conflict. Thus, NATO has taken over peacekeeping in the Balkans, but has relied on the United Nations for peacekeeping in Africa. This could change if an African conflict were to threaten strategic resource supplies for NATO.

The existence of regional and global purely public outputs, stemming from peacekeeping, also means that free-riding incentives are relevant both within a region and beyond, so that efficient resource allocation to peacekeeping is not assured (Mendez, 1999). Efficiency hinges on the ratio of excludable benefits (i.e., country-specific and club good outputs) to total benefits associated with peacekeeping. As this ratio nears one in value, so that all peacekeeping benefits are excludable, nations can be expected to support peacekeeping operations. If, however, the ratio is near zero, then peacekeeping benefits are primarily nonexcludable and free riding is a greater concern. With mostly pure public benefits, peacekeeping is likely to be supported by the large, rich nations, that gain the most from regional and global stability (Olson, 1965; Sandler, 1992).

The ratio of excludable to nonexcludable peacekeeping benefits is difficult to measure directly, because the quantity of country-specific and other jointly produced outputs do not lend themselves to quantification. By examining the way in which peacekeeping burdens are actually carried, a researcher can infer something about the size of this ratio. If such burdens, as measured by the percentage of GDP devoted to peacekeeping, are disproportionately shouldered by the rich countries, then this suggests that the ratio is near zero, indicating mostly pure public benefits. If, instead, peacekeeping burdens are not positively correlated with income, then the ratio is closer to one with a high proportion of excludable benefits. In a recent study, Khanna, Sandler, and Shimizu (1998) find evidence of a positive correlation between UN peacekeeping burdens and a country's GDP rank during the first half the 1990s for samples of key contributors to peacekeeping.[22] This suggests that a sizable share of benefits from peacekeeping is purely public during recent years. When non-UN-funded operations are included, this disproportionality is even greater (Khanna, Sandler, and Shimizu, 1998, pp. 190-191).

In more recent ongoing work by Hirofumi Shimizu and Todd Sandler, a positive correlation between peacekeeping burdens and GDP is significant at

[22] When measuring peacekeeping burdens, it is important to base these measurements on financial and not troop support of peacekeeping. For UN missions, countries are compensated for providing peacekeeping troops. Troop contributors are reimbursed at a flat rate of approximately $1,000 per month for each soldier (Durch, 1993, pp. 39–40). Countries providing well-trained troops do not come close to recovering their opportunity cost, which can run upward of $5,500 per month, whereas those sending poorly trained troops may receive several times their opportunity cost. From an incentive perspective, it is not surprising that some countries with low opportunity cost troops (e.g., Pakistan, India, Bangladesh) are among the largest troop suppliers in recent years. Since no payment is given for troops sent on non-UN-funded peacekeeping missions, troop contributions for these operations do reflect a burden.

the 0.05 level for 1995, 1998, and 1999.[23] This finding is consistent with the rich countries shouldering disproportionately large burden during high-spending years but not during low-spending years. Thus, disproportionality is anticipated for 2000, a high-spending year. As peacekeeping spending increases, even greater disproportionality of burden sharing and implied pure publicness are anticipated.

Table 7 displays the financial contributions to UN peacekeeping operations for some select years. All figures are in millions of current-year US dollars. The sample includes twenty-eight countries, which account for over 95 percent of UN peacekeeping spending. Table 7 indicates that some changes in the distribution in burden sharing have occurred in recent years. In particular, Russia now carries a reduced burden, while Japan carries a larger burden. In judging these burdens, one must remember that Russian contributions, for example, fell by a much greater proportion from 1996 to 1998 than the drop in peacekeeping spending. Another noteworthy finding is that the burdens of peacekeeping are shouldered by just fifteen percent of the world's nations. Variation in some sample countries' payments (e.g., the United States) is due to not fully paying their assessment in one year but making it up in another year.

Table 8 displays peacekeeping burden shares more explicitly for select years. For a given year, the numbers in the table are computed in two steps. First, the *ratio* of a country's spending on UN peacekeeping missions is computed by placing this spending over the country's GDP for a given year. Second, those ratios are rank ordered from highest (assigned a 1) to lowest (assigned a 27 or 28). For example, Sweden had the fifth highest peacekeeping rank in 1994 and 1999, while the United States had the tenth and twentieth ranks in 1994 and 1999, respectively. The annual variation in the ranks arise from countries not paying obligations when due or from changes in the assessment formula. A high spending level does not necessarily translate into a high spending rank if a country's GDP is relatively high. For their GDP size, Belgium, the Netherlands, New Zealand, Canada, Spain, and Sweden typically do more than their shares in terms of their GDP ranks. The test for disproportionate burden sharing reported in footnote 23 comes from comparing the ranks in Table 8 to the GDP ranks. If these two ranks are correlated, then the rich are carrying the burdens for the poor.

7.3 Institutional factors behind burden sharing

Following the ONUC (1960-64) operation in the Congo, it became apparent that large peacekeeping missions put too much stress on the regular UN budget, so that an alternative source of funding was needed. To fund

[23] The correlations (with z-values in parentheses) are as follows: 0.333 (1.80) for 1994; 0.383 (2.07) for 1995; 0.25 (1.35) for 1996; 0.233 (1.26) for 1997; 0.367 (1.98) for 1998; and 0.427 (2.55) for 1999. A z-value of 1.96 or greater is significant at the 0.05 level.

Table 7. Sample countries' actual peacekeeping payments to the United Nations, select years (millions of current-year dollars)

Country	1992	1994	1996	1998	2000
Australia	21.6	48.3	18.3	12.1	31.0
Austria	10.8	23.9	10.9	8.3	9.0
Belgium	16.9	36.8	23.5	9.4	19.1
Canada	47.7	99.4	39.3	23.0	57.2
China	11.7	28.2	25.8	10.1	11.7
Czech Republic[a]	6.7	5.9	0.0	n/a	2.0
Denmark	9.3	20.6	9.1	5.6	14.5
Finland	8.1	18.0	7.8	4.4	11.4
France	114.6	159.0	110.0	69.7	112.1
Germany	131.0	275.2	124.3	80.6	211.8
Greece	2.1	2.1	1.3	2.1	3.5
Iceland	0.2	0.8	0.4	0.3	0.7
Ireland	2.8	5.8	2.7	1.8	4.7
Italy	37.1	147.0	61.4	47.1	105.5
Japan	122.5	372.7	116.9	141.9	135.0
Luxembourg	0.9	1.9	0.9	0.5	1.4
The Netherlands	23.1	46.1	19.9	13.8	30.8
New Zealand	3.7	7.7	3.0	1.9	4.6
Norway	8.9	18.6	6.8	5.0	12.9
Poland	1.4	1.5	2.2	n/a	3.0
Portugal	0.4	1.5	1.7	0.6	0.7
Russia	0.0	247.9	264.7	35.7	61.3
Slovakia	n/a	0.0	0.1	n/a	0.2
Spain	14.2	83.3	46.4	19.5	21.5
Sweden	16.0	35.6	15.2	8.6	22.6
Turkey	0.4	0.5	3.4	1.1	2.4
United Kingdom	93.5	194.7	89.3	50.7	129.2
United States	542.7	991.7	278.1	206.5	503.0
UN Total	1274.6	2920.6	1338.6	792.4	1598.1
Sample % of Total	97.9	98.4	95.9	96.0	95.3

Sources: United Nations (1992–2000), *Status of Contributions*, United Nations (various years) and authors' calculations.
Note: Figures are rounded to nearest $100,000; n/a denotes not available.
[a] Czechoslavia figures reported for 1992.

peacekeeping in Cyprus (UNFICYP) beginning in 1964, the United Nations relied with mixed success on voluntary contributions (Mills, 1990, p. 97). Given the large share of regional and global pure public benefits associated with peacekeeping, free riding is anticipated in any such voluntary scheme with a few wealthy nations underwriting cost. To create a more permanent and reliable funding source to cover the annual expense of peacekeeping, the General Assembly passed a resolution on 11 December 1973, which established *assessment accounts* for peacekeeping missions. These accounts went into effect in 1974 and required UN members to pay fixed shares of the yearly expense of peacekeeping operations. These payments are in addition to UN regular membership dues. The implementation of these

Table 8. Peacekeeping burden in rank order for select years

Country	1990	1992	1994	1996	1998	1999
Australia	12	9	13	17	18	18
Austria	20	16	19	15	5	16
Belgium	9	8	7	2	6	6
Canada	10	6	4	6	4	8
China	24	21	23	21	26	27
Czech Republic[a]	3	1	12	28	21	24
Denmark	16	15	15	13	19	15
Finland	22	7	3	7	15	12
France	7	5	20	5	2	17
Germany	11	13	16	10	8	9
Greece	5	23	24	26	24	22
Iceland	19	19	17	8	11	25
Ireland	21	17	21	20	23	23
Italy	23	20	11	11	3	4
Japan	4	18	22	22	9	2
Luxembourg	13	12	18	14	20	19
The Netherlands	15	10	14	12	12	11
New Zealand	18	2	9	16	13	10
Norway	6	11	8	18	17	14
Poland	1	24	26	25	14	13
Portugal	26	25	25	24	27	21
Russia[b]	2	27	1	1	1	1
Slovakia	n/a	n/a	28	27	25	28
Spain	25	22	6	3	16	3
Sweden	17	14	5	9	7	5
Turkey	27	26	27	23	28	26
United Kingdom	8	4	2	4	10	7
United States	14	3	10	9	22	20

Sources: for GDP data: 1990 figures are from World Bank (1995); 1992–98 figures are from World Bank (2000); 1999 figures are from the World Bank Internet site: http://www.worldbank.org. The 1990 GDP figure for Germany is taken from the United Nations (1996), and the 1999 GDP figure for the Czech Republic is taken from IMF (2001).
Notes: n/a indicates not available.
[a] Figures for 1990 and 1992 are those for Czechoslovakia.
[b] Figures for 1990 are those for the former-Soviet Union.

assessment accounts is a clear recognition of the concern for free riding. Members had some flexibility in meeting their assessments by refusing to pay for some mission. Such refusals are, however, in violation of UN rules. Once a member is in arrears for its assessed amounts for two full preceding years, Article 19 of the UN Charter provides that the member can lose its voting privilege in the General Assembly (Mills, 1990, pp. 92–93). This punishment was almost applied to the United States recently, until it started to settle its past peacekeeping assessments.

The assessment account distinguished four classes of nations: the five permanent members of the Security Council (A); twenty-two developed countries, not permanent members of the Council (B); wealthy developing countries (C); and specifically identified less-developed countries (D).

Permanent members of the Security Council were initially assessed over 63 percent of peacekeeping spending. In total, countries in groups C and D only picked up 2 percent of peacekeeping spending. This is the factor behind the concentration of peacekeeping burdens on the twenty-eight countries in Table 7.[24] The assessment formula is based on two considerations: (i) influence on peacekeeping (by Security Council members) and (ii) income levels. Although assessed percentages have changed on occasion (e.g., in 1991 following the communist upheavals in Europe), the overall burden-sharing picture in terms of assessment (not payments) has remained fairly constant.

7.4 Peacekeeping as an RPG

The rise of non-UN-financed peacekeeping missions in the Balkans and elsewhere is an indication that some conflicts have significant region-specific benefits that can attract actions by a collective of nations close to the conflict. In Europe, NATO has assumed these operations in the 1990s. If the EU develops its rapid deployment forces as planned, then they may direct some European-based peacekeeping missions in future years.[25] Regional organizations may provide more concerted peacekeeping responses, because members have a greater stake in achieving political stability in their region owing to collateral damage and other negative externalities (e.g., refugees, terrorism). Greater homogeneity of tastes within a regional organization, in contrast to a world body like the United Nations, implies that consensus can be reached more quickly. A rapid response is also enhanced by a regional organization's proximity to the conflict – troops have a shorter transport distance. Speed is essential, because an early end to bloodshed leads to less pent-up grievances that may erupt into further conflict at a later date. Casualties from conflict have an intergenerational consequence as hatreds from past murders are passed from generation to generation.

At least four concerns are present if regional organizations are to undertake a greater peacekeeping role. First, these regional organizations must obtain the military power to discharge peacekeeping operations in an efficient and decisive manner. NATO possesses this capability, whereas ECOWAS is a different story. Even the EU has a long way to go to achieve this goal. Most regions of the world do not have a regional institution with sufficient peacekeeping resources, thus the reliance on the United Nations. Second, regional organizations must acquire the financial resources and the

[24] On these financial arrangements, see Durch (1993), Klein and Marwah (1996), Mills (1990), Reed, Vaccaro, and Durch (1995), and Sandler and Hartley (1999).

[25] Since much of the EU rapid deployment force will also serve NATO purposes, the development of the EU force can pose problems for NATO. These problems are heightened because some NATO members are not part of the EU and some EU members are not part of NATO.

ability to replenish these funds during peacekeeping operations. Given the prevalence of regionwide purely public benefits associated with such operations, the regional organization would have to institute an assessment scheme like that of the United Nations if burdens are to be shared among countries. Many regional institutions lack this kind of authority. Third, regional peacekeeping must reflect the interest of the indigenous nations and not just that of a dominant country. For example, peacekeeping in the southern half of Africa must not be driven by a South African agenda; similarly, peacekeeping in Asia must not be directed by a Chinese agenda. Fourth, regional peacekeeping by a local organization is unlikely to account for benefit and cost spillovers to adjacent regions, which will result in an underprovision of peacekeeping. In a recent article, Dorn (1998) raises a concern with respect to regional peacekeeping, which he feels lacks "the moral authority of a world body" (p. 3) like the United Nations.

If the recent past portends the future, then peacekeeping will be a concern for the international community for the foreseeable future. There are a number of insights derived from this section's analysis. First, the pure public share of the benefits from peacekeeping appears to be growing in recent years and is greatest during high-spending periods. This means that reliance on *voluntary* contributions from a regional or world community will fail. Second, a sizable share of the benefits from peacekeeping is region specific, so that a role for regional institutions to carry out peacekeeping is justified. Third, to fulfill this role, these institutions must be developed and strengthened in terms of their military and financial resources. If a country-specific agenda is to be avoided by such regional peacekeeping actions, then no single country must dominate. Fourth, the United Nations must work in conjunction with these regional organizations. In some cases, the United Nations can help in financing the operation, while, in other cases, it can divide up the tasks with regional organizations. Fifth, in those regions where a proper regional institution does not exist, peacekeeping must be directed by the United Nations. The same is true for operations with large global benefits from peacekeeping.

8. Acid Rain and Other Regional Environment Problems

Acid rain is the quintessential RPG with a reach that extends for hundreds to thousands of miles as sulfur emissions remain aloft for .01 to 7 days, while nitrogen oxides (NO_X) travel for 2 to 8 days (Alcamo and Runca, 1986, p. 3). Satellite imagery now shows that an eastern US sulfate plume stretches all the way to Europe (Hill, 1997, p. 11), which had not been believed possible. Countries can actively facilitate the transference of sulfur externalities interregionally by heightening smoke stacks on fossil-fuel power plants. When sulfur and NO_X emissions from electric generation, transportation, manufacturing, and other activities combine in the atmosphere with water vapor and tropospheric ozone, sulfuric and nitric acids can form. As precipitation – rain, snow, fog – cleanses the atmosphere, acid pollutants fall to earth and degrade lakes, rivers, coastal waters, and forests. In lakes and rivers, reduced pH levels make for an inhospitable environment that kills fish and their habitats. As the pH levels of water bodies decrease, the bacterial decomposers are affected, which, in turn, cause imbalances in organic matter and reduce nutrients to support ecosystems. Even dry depositions of sulfur and NO_X have the dire consequences of increasing the acidity of soils and watersheds. Increased soil acidity appear to make trees more susceptible to diseases and pests. Acid rain also destroys the facades of monuments and buildings, especially those made from soft stone – e.g., sandstone. In their ambient (airborne) form, sulfur and NO_X are detrimental to human health – particularly, the young and the old (Schwartz, 1991).

Even though both sulfur and NO_X result in transboundary acid rain, the composition of their sources differs greatly. For Europe, the OECD (1990) assigns sulfur polluters as follows: 47.8 percent, fossil-fuel power plants; 37.4 percent, industry; 10 percent, residential and commercial activities; and 3.7 percent, mobile sources (e.g., cars and trucks). OECD also breaks down NO_X polluters as follows: 53.6 percent, mobile sources; 23.5 percent, fossil-fuel power plants; 15.4 percent, industry; 6.1 percent, residential and commercial activities; and 1.3 percent, miscellaneous. Sulfur primarily comes from state-regulated energy plants, while NO_X mainly comes from harder-to-control small mobile polluters. The collective action prognosis for controlling sulfur-based acid rain is more favorable than that for curbing nitrogen-based acid rain. Seemingly identical problems may require different interventions at the regional level. Not surprisingly, much greater progress has been made with respect to curbing sulfur, rather than nitrogen, emissions in Europe – i.e., the 1994 Oslo Protocol commits most signers to 30 to 80 percent cutbacks in sulfur from 1980 levels by 2000, while the 1988 Sofia Protocol commits signers to a maintenance of 1987 levels of NO_X emissions (Murdoch, Sandler, and Sargent, 1997; Sandler, 1992; Murdoch, Sandler, and

Vijverberg, 2002). By 1994, 21 European countries had reduced sulfur emissions by 50 percent from 1980 levels (Fridtjof Nansen Institute, 1997, p. 87).

Regional collective action for acid rain has come in the form of conventions and protocols. On 13 November 1979, the Long-Range Transboundary Air Pollution (LRTAP) Convention was adapted at a high-level meeting of the UN Economic Commission for Europe on the Protection of the Environment. The treaty was later ratified on 16 March 1983 by Austria, Belgium, Bulgaria, Canada, Czechoslovakia, Denmark, Finland, France, East Germany, West Germany, Greece, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Soviet Union, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States, and Yugoslavia (UNEP, 1991). The LRTAP Convention mandated scientific investigations and evaluation of the acid rain problem, aided by an elaborate network of monitoring stations throughout Europe to track emissions, their transit, and subsequent deposit downwind. This exercise, performed by the Cooperative Programme for Monitoring and Evaluation (EMEP) of the Long-Range Transmission for Air Pollutants in Europe, identified the spatial pattern of sulfur and NO_X pollutants in the region, so that importers could be distinguished from exporters of these pollutants – obviously, the former has more to gain from a subsequent protocol curbing emissions.

Conventions merely recognized that a problem might warrant action, whereas a protocol mandates explicit actions after sufficient evidence is uncovered that a problem exists. A number of such protocols followed. For sulfur emissions in Europe, the Helsinki Protocol on 8 July 1985 required ratifiers to reduce sulfur emissions by 30 percent or more from 1980 levels, as soon as possible or by 1993. The Protocol entered into force on 2 September 1987 after a sufficient number of signatories ratified the treaty. For NO_X, the framing of an analogous agreement was much slower and more modest in its mandate. The Sofia Protocol for NO_X was framed on 31 October 1988 and later ratified on 14 February 1991. Signatories were required to maintain 1987 pollution level by 31 December 1994.

As nations, for the most part, achieved the Helsinki Protocol's mandate and began to exceed mandated cutbacks in sulfur, a stricter Oslo Protocol was framed on 14 June 1994 and mandated cutbacks more in keeping with a nation's ability to reduce sulfur. In contrast to earlier protocols, the Oslo Protocol was based on minimizing control costs for achieving given levels of cutbacks. Abatement costs are minimized when cutbacks are assigned to countries, so that each nation faces the same marginal costs of abatement. If these abatement costs vary among nations, as they do, then the nations with smaller such costs could take on more cutbacks as a percentage of emissions than those with higher abatement costs. Such transfers of responsibilities reduce aggregate abatement costs while maintaining abatement levels. The

design of the Oslo Protocol is to limit unfair burdens being placed on those nations whose energy consumption and production patterns make it extremely expensive to meet the same percentage cutbacks in sulfur emissions. On 5 August 1998, the Oslo Protocol entered into force. As of 10 July 2001, the treaty has been ratified by 23 nations.

A fourth noteworthy protocol is the Geneva Protocol of 11 November 1995, which concerns Volatile Organic Compounds (VOCs), such as ammonia, methane, carbon monoxide, and non-methane VOCs. The Geneva Protocol is intended to curb those compounds that cause surface ozone pollution. Because many compounds contribute to the ozone (haze) problem in cities, separate protocols will be eventually required to control specific emissions to varying degrees. Efforts to control VOCs have been slow relative to sulfur emissions. Progress on curbing long-range pollutants has been aided by treating each pollutant separately rather than bundling them together. As a bundle, progress would have followed a weakest-link scenario where the pollutant with the hardest-to-agree-upon limits would determine the speed of progress in reaching an agreement on the group of pollutants.

Other protocols have recently been framed under the LRTAP Convention. Although the Convention did not assign any limits to emissions, it has established a network by which European nations have jointly been able to address air pollution problems. Within Europe, the LRTAP framework facilitates actions to curb air pollution by reducing transaction costs (e.g., delegates already exist along with an infrastructure) and opening up communication channels.

8.1 Transport matrix and weighted-sum aggregator

Based on EMEP data, a *transport matrix* is calculated that identifies the final destination of emitted sulfur and NO_X (Eliassen and Saltbones, 1983; Sandnes, 1993). Emitters are arranged in alphabetical order along the matrix's columns, while the recipients are arranged in alphabetical order along the matrix's rows. Any entry – say in the *i*th row and the *j*th column – denotes the amount of the emission from the *j*th country deposited on the soil of country *i*. By dividing every entry by an emitter's total emissions, we transform each entry to represent the deposition as a proportion of country *j*'s total emissions. When these matrices are multiplied by the vector of cutbacks from the region's countries, the reduced deposition of pollutants is determined for the countries. Suppose that 10 percent of French sulfur emissions ends up falling on Germany. Further suppose that France reduces its emission by 1000 tons from 100,000 to 99,000 tons. Then the matrix multiplication indicates that 100 fewer tons of French sulfur pollution fall on German soil. Entries along the matrix's diagonal depicts the percentage of self-pollution, which represents a strong self-motivating factor for reducing

emissions. Countries that are on the receiving end for a lion's share of their own emissions will want to act even in the absence of some form of collective action.

The importance of this transport matrix is that it embodies the aggregation technology, which for sulfur, NO_X, and VOCs is a weighted-sum technology. Quite simply, the weights are the entries in the transport matrix. Since the sum of the weights in each column sums to one, *sulfur is fully rival as a deposit* – six tons dropped on one country cannot also be deposited on a second country. The actual weights are determined by the prevailing wind, rain patterns, and emitters' location. Additionally, deliberate actions by the emitters can aid in the transfer of the pollutants further afield.

The transfer matrix is capable of representing other technologies of aggregation. If, for example, all entries are ones, then everyone gets a 100 percent of the output and a summation pure public good is being represented. If, instead, only the diagonal entries are ones and all others are zero, then the activity is a private good with only the provider receiving the good. The technology of aggregation, as embodied by the transport matrix, captures incentives to provide the associated RPG (Sandler and Sargent, 1995). To make this case, consider some differences between the transport matrices for sulfur and NO_X in Europe. In the case of sulfur, the majority of nations received over 50 percent of their *own* sulfur emissions as depositions (Sandnes, 1993). These self-pollution percentages are much smaller for NO_X. Thus, countries are more motivated to do something about sulfur than NO_X. NO_X is much lighter than sulfur, so that a relatively larger share of the emissions leaves the European region altogether, landing in the seas or in Asia. This transport beyond the region further limit incentives for actions. The pattern of depositions is also different with a relatively larger share landing in the east, where many nations were communist at the time of the framing of the first two protocols – i.e., Helsinki and Sofia. Empirical studies show that political and economic freedoms tend to promote environmental interests and actions (Congleton, 1992; Murdoch and Sandler, 1997; Murdoch, Sandler, and Sargent, 1997). The Western European countries were more effective in putting the sulfur problem on the table than the Eastern European countries were in putting the NO_X problem on the table. Because many of the communist countries were *net importers of pollutants* owing to their easterly location, they were keen to become part of a treaty that limited emissions. Typically, totalitarian states are reluctant to enter into treaties that limits their autonomy.

8.2 The effectiveness of the Helsinki Protocol

How effective was the Helsinki Protocol in directing regional collective action? Moreover, can similar treaties be used to provide other RPGs? These questions are examined here. When the Helsinki Protocol was framed in

1985, a majority of European countries were close to achieving the soon-to-be mandated 30 percent cutback. In 1985, these countries had on average reduced emissions from 1980 levels by 20.6 percent (Murdoch, Sandler, and Sargent, 1997, Table 1, p. 289). Nevertheless, there was a large variation among countries with some having a 25 percent *higher* level of emissions than in 1980 (i.e., East Germany and Greece) and other displaying a larger than 40 percent cutback (i.e., Austria, Belgium, France, the Netherlands, and Sweden). Prior to the 1994 Oslo Protocol that augmented sulfur cutbacks, there was an identical pattern: the majority of nations had achieved levels of emission reduction that were later encapsulated in the treaty. But this time, the nation-tailored cutbacks assigned much smaller reductions to the laggards, whose "energy pathway" meant high marginal abatement costs – see Table 9.

Table 9. Mandated sulfur emission cutbacks from 1980 levels in percentage: Oslo Protocol

	Mandated Cutbacks from 1980 levels (percentage)		
Country	**2000**	**2005**	**2010**
Austria	80		
Belarus	38	46	50
Belgium	70	72	74
Bulgaria	33	40	45
Croatia	11	17	22
Czech Republic	50	60	72
Denmark	80		
Finland	80		
France	74	77	78
Germany	83	87	
Greece	0	3	4
Hungary	45	50	60
Ireland	30		
Italy	65	73	
Liechtenstein	75		
Luxembourg	58		
The Netherlands	77		
Norway	76		
Poland	37	47	66
Portugal	0	3	
Russian Federation	38	40	40
Slovakia	60	65	72
Slovenia	45	60	70
Spain	35		
Sweden	80		
Switzerland	52		
Ukraine	40		
United Kingdom	50		
European Community	62		

United Nations (1994, Annex II, pp. 15–16).

A clear pattern of treaty making emerges in which a majority of nations are near to achieving a standard of reduced emissions that they then encode in a treaty. But does such action increase the RPG of improved environmental quality through less pollutants? Statistical tests indicate that noncooperative behavior explains much of the cutbacks (Murdoch, Sandler, and Sargent, 1997); however, this does not deny that some cooperative gains are also present. In fact, a recent economic analysis shows that cooperation is present at the framing stage prior to implementation (Murdoch, Sandler, and Vijverberg, 2002). Even though the majority of countries have achieved the mandated action prior to the framing of the treaty, the protocol commits laggards to follow the others. Setting lower standards for some nations is more desirable than having them outside the treaty, where they can serve as a pollution haven and, thus, undo the efforts of the treaty (Buchholz, Haslbeck, and Sandler, 1998). Moreover, the treaty ties the hands of the ratifiers – at least morally[26] – to stay the course and not back track, when increased economic activity would result in greater emissions unless further abatement efforts are expanded.

There is also a dynamic at play. The treaty puts participants in the frame of mind that they must try to exceed existing limits to position themselves for subsequent updates and amendments. The underlying interaction is seen as a repeated game, where short-term gains from opportunistic behavior may result in longer-term losses as others take retribution. The enduring character of new treaty arrangements cannot be emphasized too much, since they provide incentives to escape the standard pessimism stemming from anticipated strategic responses.

Even though a large part of the reduction in sulfur cutbacks were voluntary in the absence of institutionalized cooperation, the treaty still served to augment the provision of the RPG through reciprocal commitment, peer pressure, demonstration effect, and a mindset. This regional cooperative mindset is even stronger in the EU where the Large Combustion Plant Directive of 24 November 1988 led to further restrictions on sulfur and NO_X emissions for some polluters prior to updates to the Helsinki and Sofia Protocols. Other regional trade and security blocs – e.g., ASEAN, MERCOSUR, SADC – can promote similar mindsets. Even when these organizations are initially intended for other purposes, they can provide environmental RPGs to take advantage of economies of scope. A notable regional institution is the Group of Temperate Southern Hemisphere Countries on Environment (The Valdivia Group), which includes Argentina, Australia, Brazil, Chile, New Zealand, South Africa, and

[26] Even though a treaty is not enforceable, it places a moral obligation on signers to abide by their pledged cutbacks, and this obligation increases as more countries join. Levy (1993) calls this obligation "tote-board diplomacy." Also, see Morisette et al. (1990) on how treaties and obligations differ among different environmental problems.

Uruguay. Valdivia is concerned about RPGs (e.g., preservation of fisheries) and GPGs (e.g., curbing global warming, limiting stratospheric ozone depletion) (Dodds, 1998).

Despite the success with respect to sulfur, the slower and more restrained actions with respect to NO_X and VOCs limit euphoria. These latter experiences show that more costly RPGs that must constrain a larger number of small agents are not so easy to achieve through treaty arrangement. The different outcomes with respect to sulfur and other inducers of acid rain underscore that one must be cautious when generalizing from seemingly similar collective action problems.

8.3 Transport matrix and other pollutants

The differential weights, assigned to the actions of the various agents to reduce acid rain through lower emissions, also apply to other RPGs. For waterborne pollutants, a country's location and water flows (e.g., currents) imply that the same provision of the RPG (e.g., reduced waste effluence) by alternative suppliers adds differently to the cleaning of the environment. At the regional level, efforts to curb the spread of a pest may also have differential impacts owing to the distribution of food in the pathway of the pests and where the prophylaxis is applied. If a weighted-sum aggregator applies, then collective provision of the RPG is more apt to follow once the potential suppliers determine the patterns of weights, as in the case of sulfur. This follows for at least two reasons. A knowledge of the weights allow the providers to identify their vested interest, if any, in supplying the RPG. Second, policies to engineer a greater provision of the RPG through a redistribution of income require a knowledge of the weights. Suppliers whose provision is assigned a larger weight are the ones who will provide more of the RPG through an income transfer. Intelligence of the technology of public supply is a necessary ingredient for aiding the supply of RPGs.

Spatial consideration represents one reason why differential weight may apply to RPGs. Another factor could come from cultural differences, so that identical efforts toward supplying an RPG, such as hygiene, may result in varying impacts on the overall level of the good. Geographical aspects – mountains, rivers, lakes – may also influence how each provider's contribution bolsters the total RPG. Even the density of the jungle cover could influence the weights associated with some RPGs.

As LDCs' energy consumption grows, acid rain will become a worse problem. Given the fragility of some of the flora in the tropics, acid rain may come to pose an environmental disaster for some developing countries with regional consequences. The localized nature of this problem will mean that countries within the region will have to address the problem through a regional treaty or some other regional collective. The Valdivia Group is a regional collective intended to coordinate efforts at the regional level to

supply such environmental RPGs. From a regional perspective, Valdivia is problematic with countries drawn from *three distinct* geographical locations with little or no interregional spillovers. Moreover, members represent vastly different stages of development. To achieve a unity of purpose, such groups should be organized by regions with linkages among neighboring regions where distinct spillovers exist – e.g., Central and South America. The Southern Hemisphere is not a useful regional category.

8.4 Global networks of regional collectives

Our focus on acid rain is merely representative of the plethora of environmental problems confronting developing regions. Environmental degradation involves the air, rivers, ground water, coastal waters, soil, and forests. Given the regional nature of many of these concerns, collective action is needed at the regional level. This raises a number of recurring issues. First, what is the role of foreign aid in providing appropriate regional collectives the capacity to address germane environmental issues? Second, what is the role of multilateral global institutions in fostering these actions at the regional level? Third, what role can networks among regions play in coordinating complementary actions?

Unlike the European collective for acid rain, developing regions lack both the finances and the expertise to tackle such concerns. Thus, assistance from multilateral institutions, donor countries, NGOs, and charitable foundations is sorely needed. Initially, this assistance should take the form of a monitoring grid, modeled after the European one provided by EMEP, so that sources and victims of the pollutants are identified. Donors who provide assistance must realize that a healthy environment adds to productivity, the quality of life, and development. Unlike global warming and other GPGs, regional acid rain problems may not impose costs on donors, so that their motivation must be altruism and not derived from environmental benefit spillovers. Expertise must be provided by the UN Environmental Program and other multilateral bodies. These global bodies may be more effective at the regional level if some subsidiary regional counterparts are created. After the environmental problem is sufficiently understood, these developing areas will also need funds to address the problem. Such funds need to be part of the foreign assistance package.

The GEF is an example of an infusion of funds from various donors (including the World Bank, UNDP, UNEP, NGOs, and others) to support environmentally oriented projects in developing regions. Since 1991, the GEF has raised $5.6 billion, which has been leveraged to provide additional funding (World Bank, 2001a, p. 115). GEF supports projects generating public good spillovers at the global, regional, and local level. GEF intends in the future to strengthen national strategies for environmental preservation by moving away from projects in favor of program assistance (World Bank,

2001a, p. 115). While this reorientation is desirable, there is also a need to consider strengthening regional institutions that can supply an overall coherence to efforts to address environmental RPGs.

GEF links developing countries throughout the world into a global network where they can seek environmental assistance. This network would be even more effective if regional entities were also connected and supported by GEF. Global oversight by the GEF or some other body is needed to establish and support these regional networks when interregional spillovers are present. Incentives are often perverse for these regions to form their own network for some environmental issues. Again, consider acid rain, where prevailing winds carry pollutants eastward. A western region has little or no incentive to form a linkage with its eastern neighbor owing to the unidirectional flow of the externality. Hence, a global coordinator is needed to establish such networks. For reciprocal externalities, the network of regions may form more naturally without the oversight at the world level. Regional networks are a novel means for addressing GPGs in which the regional needs are not the same.

In a recent report, GEF efforts to curb deforestation in 20 tropical moist forest countries are evaluated (World Bank Operations Evaluation Department, 2000). With its 1991 initiative, GEF interest with the rain forests has to do with the jointly produced GPGs of biodiversity and carbon sequestration. The report (2000, p. 40) credits GEF funds with inducing recipient countries to borrow further funds to address the deforestation and sustainable development problems. Such client countries *are motivated to borrow by their country-specific* benefits – e.g., ecotourism, watershed preservation, reduced erosion. A number of insights follow from this evaluation of GEF. First, deforestation is a regional problem and must be addressed from a regional, and not country, perspective. Second, GEF provides this regional perspective by creating a network of recipient countries and interested donors. Third, significant and effective public-private partnerships – the World Bank and World Wildlife Federation, World Bank and NGOs – are fostered by GEF, thus demonstrating that RPGs can be addressed through some global networks of donors and recipients. The success of GEF in establishing this global network of disperse regions hinges on the presence of jointly produced GPGs. Without these GPGs, a regional organization would have been needed in place of GEF to link the nations of a region.

9. Health-Promoting RPGs

The majority of the less-developed regions of the world are currently experiencing a deficit in the provision of expertise, medicines, and infrastructure that support public health. The 10/90 problem – which asserts that the health issues concerning 90 percent of the world's population receive only 10 percent of allocated research funding – illustrates the consequences of prioritizing research based on ability to pay. Furthermore, the economic decline that many LDCs experienced during the 1980s caused budget cuts that slashed public health expenditures, which were not necessarily replenished during the 1990s because of neoliberal policies that limit public spending, including health.

According to the 1990 *World Development Report*, it costs roughly $12 per person to deliver basic public health services (World Bank, 1990). As Table 10 illustrates, the average public expenditures on health over 1990-98 often failed to reach this basic figure. Most disturbing are the expenditures for South Asia and sub-Saharan Africa, which are $3.50 and $7.50 per capita, respectively. Even when the amount is slightly above $12, as is the case for Asia and the Pacific, any surplus will not cover expenses related to AIDS and drug-resistant tuberculosis (TB), which are projected to escalate in LDCs.

As LDCs address healthcare issues during the new millennium, a major change is that they have lost a sense of national and local ownership over their health policies. Health expenditure and healthcare in indebted LDCs are nowadays much more determined by international donors than by their own governments (Wilde et al., 2001). This parallel loss of control at the national level in health is suggestive that a regional approach to health is warranted. Other rationales for a regional approach include loss of infrastructure, exposure to common diseases, and the spread of disease due to economic and political refugees.

The underprovision problem for public goods is typically framed in terms of free riding, but the 10/90 problem and failing public health infrastructure illustrate that regional public health issues are quite often associated with

Table 10. Per-capita public expenditure on health, 1990–98: Middle and low income regions

Region	Per-capita expenditure (1999 dollars)
East Asia and Pacific	17
Europe and Central Asia	86
Latin America and Caribbean	127
Middle East and North Africa	49
South Asia	3.5
sub-Saharan Africa	7.5

Source: World Bank (2001b).

insufficient capacity. Underprovision may be due to the lack of capacity stemming from the inability to finance a weakest-link RPG to an acceptable standard, insufficent development to take advantage of an RPG, or inadequate financing of a best-shot RPG.

9.1 Capacity: examples

Virtually all of the 300 medicines on the WHO's Model List of Essential Drugs are no longer under patent protection and can be produced generically; nevertheless, these drugs are not affordable to low-income individuals or health systems. A capacity problem exists in the form of the inability of LDC citizens and governments to avail themselves of the health benefits taken for granted in the developed world. In the same way, the primary causes of disease-related deaths in developing regions are TB, AIDS, and malaria. The burden of these orphan diseases is exacerbated, because there is little demand for a cure within developed countries. We focus on several examples of efforts to build capacity for disease eradication to demonstrate how health-related RPGs reflect a variety of aggregation technologies.

Guinea-worm disease (dracunculiasis) was first thought to be specific to India, but has been documented in central Africa, the Middle East, and Pakistan, and affected some 3.5 million people in 1986. As a water-borne infectious disease, it can be eradicated by filtering or treating drinking water to prevent contamination by disease-carrying flea larvae. Guinea-worm disease has no known cure. Any infected victim who washes boils containing larvae in the water supply (e.g., river or stream) becomes the weakest link in spreading the disease.

The Centers for Disease Control (CDC) initiated consultancies on Guinea-worm in the early 1980s. As nomads within the region typically use pipes to filter their water for potability, a strategy was developed for the distribution of enough larvae-inhibiting pipes for every person within affected regions. An additional benefit of the filters is that they are not Guinea-specific; they improve the overall quality of the drinking water. By 1988, the Carter Center of Emory University helped to organize donor consortia for filters with UNDP and UN Children's Fund (UNICEF) that included the United Arab Emirates, Saudi Arabia, US Agency for International Development (USAID), Keidanran (a Japanese business group), DuPont, and Precision Fabrics Group. By the mid-1990s, WHO was able to report 97 percent eradication, with over half the remaining cases occurring in the Sudan, where war prevented a population-wide distribution of filters.[27]

[27] The disease is certified as absent only after three consecutive years pass without any cases being found by WHO's surveillance system.

Malaria control is another example of an RPG where underprovision is due to a lack of capacity. Even though this mosquito-transmitted disease is entirely curable and preventable, there are an estimated 300-500 million cases annually, primarily in tropical Africa. Between one and three million deaths occur each year because of misdiagnosis or lack of treatment. Malaria control activities are centered on four critical actions: the distribution of insecticide-treated bednets; prompt diagnosis and treatment; antimalaria therapy for pregnant women at risk; and early identification and effective response to epidemics (The Lancet, 2000). These efforts primarily abide by a summation technology based on the number of bednets distributed. Another pertinent regional issue is that political and military action can cause refugees with little or no immunity to move into high-transmission areas – e.g., Africa, Cambodia, and Afghanistan (Meek and Rowland, 1998). Refugee-related malaria deaths result because treated nets are costly and timely funding is unlikely to be organized. The Roll Back Malaria Program (RBM) was initiated in 1998 as a cooperative venture between WHO, UNDP, UNICEF, World Bank, malaria-affected countries, regional development banks, and the private sector to create the capacity to address the first three critical actions for malarial control.

River blindness is a disease that affects a multitude of countries in Africa and has been found in the Arabian Peninsula and Latin America. As mentioned in Section 3.4, flies that breed in nearby riverbeds were initially believed to cause the disease, so that eradication efforts involved the aerial dusting of riverbeds with insecticide. Later, it was discovered that the culprit was a fly-borne parasite that enters the victims' bloodstream, where it creates skin and eye disorders, which, if left untreated, lead to blindness. An alternative strategy to inhibit the spread of river blindness was formulated that involved the distribution of the drug Invermectin, a single dose of which provides yearly control of the disease. A novel aspect of the WHO-led best-shot effort was the participation of Merck, which gave away community-sized dosages. The capacity issue was, thus, addressed through unilateral provision by the entity with the comparative advantage. The success of this public-private partnership cannot be understated; by 1999, the disease was virtually eliminated in West Africa. An interesting aspect of the Invermectin program is that variations exist across regions. In Latin America, trials are underway to test if multiple doses of Invermectin can prevent the disease.

AIDS is emaciating Africa; the burden of the disease both in human and financial terms is posing a significant barrier to development within the region. At the same time, patents for medicines that inhibit AIDS raise serious property rights issues. A downside of patents is that exclusion occurs not only due to differences in willingness to pay, but also to differences in ability to pay. For example, the annual cost to treat a single patient with AIDS is up to 100 times the average gross domestic product (GDP) per capita in LDCs. While patents are necessary to ensure profitability of R&D,

it is also the case that five commonly used drugs against AIDS – didanosine, lamivudine, nevirapine, stavudine, and zidovudine – were largely developed as a result of public funding of research (Schull, 2000). By charging such high prices for AIDS-related drugs, LDCs point out that pharmaceutical companies are free riding off of donor-nation R&D expenditures. From the perspective of pharmaceutical companies, LDCs that attempt to circumvent patents are the free riders. It has yet to be determined whether the United States and European countries, which subsidize AIDS research, will view such expenditures as a form of foreign aid and insist that recipient pharmaceutical companies reflect the subsidies in their pricing policies in LDCs. Because anything other than a (yet-undiscovered) vaccine involves long-term antiretroviral treatment, pharmaceutical companies are unlikely to mimic Merck's generosity.

AIDS has heightened awareness of the relationship between patent protection and burden sharing in terms of reduced-cost access to pharmaceuticals. For example, is it possible to extend patent protection on "blockbuster" drugs in developed countries in order to underwrite R&D of drugs of interest to developing regions (Earnshaw, 1999)? Such a mechanism would be welcomed by pharmaceutical companies in comparison to the regional manipulation of the WTO's Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement. Under the provision of TRIPS, a government could authorize parallel imports of a patented drug where it is sold more cheaply. The danger is that the drug exporter may be violating the original patent. Alternatively, a government is unilaterally allowed to license a patent to others (or itself) if it provides adequate compensation to the patent holder. Either TRIPS measure creates the prospect of pricing arbitrage throughout a region, which would additionally decrease profits. Innovative solutions must be found to provide best-shot RPGs related to AIDS.

9.2 The evolution of donor forms

What is striking about our examples of health-related RPGs is that the organization of such efforts has evolved to reflect decentralization in the process of provision. For the first 40 years since its inception in 1950, WHO was the leading coordinator of myriad local organizations on international health issues. Yet by 1990, World Bank expenditures on health exceeded those of WHO. Although the Bank has greater financial resources and experience with sectoral reform, WHO possesses a much greater degree of medical expertise; therefore, the two have formed complementary partnerships in many areas. The World Bank's regional hub in Budapest of its Health, Nutrition, and Population sector strategy is an example of a regional network. WHO has adapted so that donation programs for health are being replaced by structured partnerships. Such public-private partnerships represent a real break in the traditional thinking that public health RPGs

must be provided by public institutions.[28] These partnerships have increasingly allowed international health efforts to expand their scope beyond the delivery of existing medicines and to assume a greater role in facilitating interaction between private and public sector organizations.

A defining example of how health efforts have been expanded and decentralized through these new donor forms is the Medicines for Malaria Venture (MMV). A spin-off of the WHO's RBM Project, MMV, is an independent not-for-profit foundation created to increase the level of participation of pharmaceutical companies in malaria research. MMV involves the funding of partnerships – primarily between academic institutions and pharmaceutical companies – for drug discovery and development projects. Initial donors include the Gates Foundation, Exxon Mobil, Global Forum for Health Research, International Federation of Pharmaceutical Manufacturers Associations, Netherlands Ministry for Development Cooperation, Rockefeller Foundation, Swiss Agency for Development Cooperation, UK Department for International Development, World Bank, and WHO. The Wellcome Trust became the first secretariat in 1997 of the Multilateral Initiative on Malaria (MIM) – MMV's umbrella organization – with the Fogarty International Center of the National Institutes of Health to follow.

Even though pharmaceutical companies have access to funding that are orders of magnitude greater than in many health organizations, these companies have not been interested in malaria because new medicines (or a cure) are not expected to be highly profitable. MMV represents a way to underwrite R&D expenditure in order to give malaria-endemic regions access to research capacity that would not be affordable at a country level. While other RBM projects focus on the problem from a (weighted) summation perspective (e.g., mosquito netting), MMV is a best-shot approach. Best-shot capacity issues are addressed by pooling financial sources and then matching them with those who possess the technological expertise.

Of the three initial discovery projects funded by MMV, none involved an Africa-specific institution. A capacity deficit remains in the inability of the medical and scientific community of malaria-endemic countries to use MMV research funds directly. Because malaria control must be conducted in the South, there must be effective North-South communication and implementation of research-based recommendations. In order to address this issue, MIM aims to strengthen human resources, institutions, and research capacity in Africa.

[28] Private sector organizations include NGOs (Médecins Sans Frontièrs, Oxfam and Red Cross/Crescent) and foundations (Gates, Rockefeller, Soros, and the Wellcome Trust). Pharmaceutical and chemical companies are examples of private sector organizations.

9.3 Future implications

Health-related RPGs are perhaps the best illustration that nonsummation aggregators are prevalent and important considerations for external assistance. Both weakest-link and best-shot RPGs involve market failures that may have more to do with lack of capacity, rather than free riding. Indeed, Buse and Walt's (2000b) categorization of public-private partnerships in health can be expressed in terms of the capacity-aggregator connection. *Product-based partnerships* address weakest-link failures due to insufficient willingness or ability to pay and take the form of drug donation programs. *Product-development partnerships* are best shot – they serve the dual purpose of raising funds for provision and matching funding with least-cost providers (e.g., orphan drug research). In this way, public-private partnerships can be seen as aid for reprioritizing research to overcome the 10/90 problem.

Public-private partnerships circumvent the neutrality theorem through the provision of funds not previously involved with tax-based financing of health issues. Moreover, partnerships are the source of growth of new funds for cooperation in health (Buse and Walt, 2000a). In this age of donor fatigue, these partnerships illustrate how public goods can be voluntarily provided through private means. Furthermore, both NGOs and private foundations can signal the importance of emerging health problems to national donors through the funding of pilot projects.

Another policy implication is that partnerships exploit interests that might otherwise be in conflict. For example, the pharmaceutical industry holds a virtual monopoly on drug development and associated patent rights. Any attempt to circumvent this monopoly power through TRIPS is likely to reduce the incentive for future R&D into orphan drugs. A partnership, by contrast, takes advantage of any monopoly power that is the product of superior R&D and opens the way for future collaboration in drug development. The promise of partnerships comes from the identification of common ground by exploiting both private and public insights on cooperation in health.

While public-private partnerships represent a promising vehicle for mobilizing RPG provision in the health sector and beyond, there are important complications to be considered as well. For example, is the motivation of private corporations purely altruistic? Certainly, Merck's experience with pharmaco-philanthropy has yielded a favorable corporate image and has abated public pressure related to corporate responsibility and accountability. Inroads in treatment, distribution, and training – all necessary for health-related partnerships to be successful – also represent a "first-mover" or "pioneering" advantage to contributing multinationals corporations. Brand goodwill due to a first-mover advantage can allow pharmaceuticals to maintain revenue share despite the expiration of a patent. From this

perspective, partnerships may provide a framework for a company to preempt the competitive effects of compulsory licensing as provided for in TRIPS (Watal, 2000, p. 743). Another consideration is the ethical question of whether research trials should take place in LDCs where the end product may not be affordable, or the vast majority of local physicians may not have adequate training or equipment (Buse and Walt, 2000a).

Such partnerships may also affect the reputation of traditional health multilaterals in myriad directions. If, for example, an agency is perceived as being unduly influenced in their policy by large international companies, it may run into legitimacy problems.[29] At the extreme, some public-private partnerships are formed precisely to address the adverse effects of a multinational's commercial interests. For example, a partnership of WHO, Harvard Medical School, and Médecins Sans Frontièrs is reducing the high cost of multiple-drug resistant tuberculosis drugs in LDCs by essentially forming a monopsony to negotiate reduced prices, coordinate bulk purchases with suppliers, and provide advanced funds for purchases. Alternatively, the fact that private NGOs such as the Gates Foundation, Open Society Institute, and Wellcome Trust are incredibly well-funded means that they can set agendas that do not depend upon the interests of donor nations that fund the multilaterals. Public-private partnerships may be far less politically influenced, but at a possible tradeoff of including commercial interests.

There are several challenges for the successful provision of health-related RPGs. First, recipient nations must have legitimate representation in such partnerships. This requires capacity building in LDCs both in terms of infrastructure and expertise. Depending upon the aggregation technology, developing regional capacity is likely to be as effective, and far less costly, as increasing the capacity of each member state. Second, whereas the distribution of health risks stemming from malaria, Guinea-worm, and AIDS is clearly regional, coordination with public-private partnerships has primarily occurred at the national level. A regional approach has the potential to produce greater benefits, because most diseases are unrestricted by political boundaries. Regional organizations possess greater bargaining power for negotiating the price of drugs than their national counterparts. Additionally, their participation creates economies of scale for distribution networks. Third, donor nations have yet to fully engage in the process of public-private partnerships, leaving an important source of funding out of the equation. Finally, public-private partnerships have the potential to harness substantial knowledge and financial resources if a balance can be maintained with the slippery slopes of patent protection, market structure, and increased political access for commercial participants. The public benefits produced by such partnerships must be compromised as little as possible.

[29] We thank Bertil Odén for this insight.

10. Lessons for Sweden and Other Donors in Focusing Aid on RPGs

Swedish policy toward foreign assistance has gone through many transformations since the inception of Swedish aid to LDCs in the mid-1960s.[30] In giving this assistance, Sweden's overriding goal has been to alleviate poverty in less-fortunate countries. Over the decades, different tactics have driven Swedish aid: in the 1960s, the interest was in achieving the preconditions to sustained growth through an infusion of money for projects; in the 1970s, more attention was paid to sectors and the social dimension; and in the 1980s, the focus was accountability and the encouragement of market forces (e.g., export-led growth). By the 1990s, the new institutional economics with its emphasis on transaction costs and the establishment of property rights (North, 1990) became the primary driver of Swedish aid. Thus, the need for capacity building within recipient economies had taken center stage with the hope that the proper institutions will provide the right environment for aid to be effective. Interest grew in giving assistance to LDCs with "good" macroeconomic policies and an absence of corruption. Democratic values were also stressed as part of the proper institutional background of the recipient countries. Over the years, Sweden embraced a variety of aid objectives, including the reduction of poverty (first and foremost), the proper use of natural resources, the achievement of gender equality, and the promotion of sound democratic institutions. A large share of Swedish foreign aid has always been channeled through multilateral organizations, with much of the remainder being given directly to recipient countries. Africa and Asia has been favored continents for Swedish aid in the 1990s (Carlsson, 1998, p. 26).

Currently, the donor community has shown a greater interest in supporting public goods – NPGs, RPGs, GPGs – through foreign assistance. Particular attention is paid to public goods involving the environment, health, security, and knowledge (Hewitt, Morrissey, and Willem te Velde, 2001; World Bank, 2001a). Although multilateral institutions have a crucial role in coordinating the finances for RPGs and GPGs, there is a greater distrust of these institutions (Carlsson, 1998; Rodrik, 1997). If this distrust continues, then new scaled-down regional institutions or else networks will have to finance the RPGs. Various *partnerships* involving multilateral institutions, private firms, charitable foundations, NGOs, and donor governments are being forged to finance RPGs, as shown in the previous section on health RPGs.

[30] This paragraph draws its information from Carlsson (1998).

10.1 A look at the record

In Table 11, the shares of aid devoted to TPGs and NPGs are displayed for select Organization for Economic Cooperation and Development (OECD) countries and snapshots in time. Many assumptions are required by Hewitt, Morrissey, and Willem te Velde (2001) to identify the public goods and make the spending calculations. In reporting their figures, we must caution that this is an initial study. Although there are some individual exceptions, there are some notably clear trends indicated. First, donor countries spend a much greater share of aid on supporting NPGs than on TPGs, which includes RPGs. Even though TPGs are becoming more important from a policy viewpoint in the 1990s (Kaul, Grunberg, and Stern, 1999; Sandler, 1997), the *share gap* between NPGs and TPGs is generally widening, which is cause for concern. Sweden certainly fits this disturbing tendency. Second, there has been an upward drift of the share of aid targeted to TPGs since the early 1980s. As shown in the table, this is true for the average donor nation, but there are a number of notable exceptions. Third, there is a large upward trend in the share of foreign assistance given to NPGs. Donor nations – and Sweden in particular – have a proclivity to favor support of NPGs over TPGs. Fourth, the Scandinavian countries devote a sizable share of their aid to providing public goods. Given that aid amounts have been relatively flat over the last decade, Table 11 implies that public good aid is replacing some traditional forms of foreign assistance.

When spending on TPGs is broken down by category, there are a few

Table 11. Share of aid devoted to TPGs and NPGs, selected OECD countries and periods

	TPG/Total Aid (in percent)			NPG/Total Aid (in percent)		
Countries	**1980–82**	**1990–92**	**1996–98**	**1980–82**	**1990–92**	**1996–98**
All OECD donors	4.98	6.76	8.79	11.24	21.67	29.40
Austria	5.04	5.77	3.83	2.57	8.34	43.05
Belgium	1.73	0.00	6.42	0.62	2.90	27.18
Canada	9.17	8.01	5.31	19.85	11.27	26.85
Denmark	7.03	10.03	12.98	23.84	40.44	34.73
Finland	3.52	11.25	18.66	10.59	14.73	32.13
France	5.19	5.60	14.27	7.59	8.35	16.96
Germany	4.10	2.36	5.77	4.12	5.31	23.62
Japan	3.90	8.51	7.80	7.72	7.20	17.31
The Netherlands	4.83	8.73	13.37	11.14	20.00	26.77
Norway	12.74	6.61	12.02	17.89	22.15	26.99
Sweden	11.25	13.81	13.93	13.24	35.65	43.89
United Kingdom	0.65	9.32	9.78	1.95	28.36	27.97
United States	4.01	3.18	8.50	12.93	32.77	37.77

Source: Hewitt, Morrissey, and Willem te Velde (2001, Table 3.1, p. 19).

interesting observations.[31] Environmental TPGs constitute on average over 80 percent of donors' spending on aid-based TPGs. This share has fallen during the 1996-98 period as money for TPGs are redirected toward peacekeeping and health TPGs. For a few countries (i.e., Austria, Belgium, France, Norway, and Sweden), spending on knowledge-based TPGs have increased.

10.2 The choices ahead

A key choice today concerns the division of foreign assistance between traditional poverty reduction and aid-supported provision of public goods. In evaluating this division, one must remember that spending on many forms of NPGs – e.g., health, education, infrastructure – serves traditional poverty-reducing roles. The division that is much more problematic is between TPGs and NPGs, insofar as an increased share of aid devoted to TPGs necessarily diverts funds from traditional aid unless spending for development assistance is increased. New sources of funds for public good assistance are coming from NGOs and charitable foundations. Partnerships formed with these institutions to support some crucial RPGs provide Sweden and other donor countries with an opportunity to support these goods without limiting other activities aimed at reducing poverty. Additionally, partnerships promote the provision of best-shot TPGs, where efforts must be pooled and concentrated. When a minimal threshold for an RPG must be achieved, partnerships can also be forged among Nordic countries to attain the threshold.

Sweden and other donors must develop ways of financing RPGs without necessarily donating these funds to nations directly, since recipients are not suitably motivated to provide RPGs at a level that accounts for the positive spillovers conferred on other regional members. Until stronger regional institutions are developed and supported by better-endowed regional development banks, donor countries must continue to rely on multilateral institutions, such as UNDP, UNEP, WHO, and World Bank, to attract the necessary funds to underwrite RPGs. Effective networks between regions are anticipated for the foreseeable future to be supplied by organizations like GEF, CGIAR, and WHO that are part of these global multilateral institutions. There is also a need for donor countries to nurture and support new stand-alone regional organizations (e.g., SIEPAC, Fonagro) as vehicles for supplying RPGs. By integrating Central American countries into a power grid, SIEPAC provides an RPG in the form of infrastructure that promotes market exchanges from the enhanced capacity and reliability of electric supplies. Donor nations should take a more active role in creating such

[31] The figures behind the statements in this paragraph comes from Hewitt, Morrissey, and Willem te Velde (2001, Table 3.2, p. 26).

regional networks and institutions, because vested interest within the multilaterals may inhibit them from relinquishing their oversight of such RPGs. For infrastructure especially, a regional approach is required, so that roads, waterways, and communication networks are regionally complete.

Within the class of TPGs, there is also the choice between GPGs and RPGs. Donor countries possess greater incentives to provide GPGs, since they receive a direct benefit from their provision. If donors count their contributions to GPGs, such as curbing global warming and ozone shield depletion, as part of foreign assistance, there may result less funds for the kinds of RPGs and other activities that truly alleviate poverty. Recent exercises to calculate spending on TPGs and GPGs as part of aid may give an inflated figure for spending on curbing poverty.

A final choice involves which types of RPGs and NPGs are most effective for supporting development. Although environmental public goods have figured most prominently to date, many exigencies are anticipated to decrease their share of foreign assistance. The AIDS epidemic is a prime example, with estimates running as high as an additional $11 billion needed to treat those infected in LDCs. Malaria is another health concern. With millions dying, MMV and other efforts will attract funds. If civil wars remain a prominent feature in the developing world, and there is every indication that they will, then more aid will be required to rebuild war-torn economies. In other instances, aid is needed to provide security for countries that are neighbors to civil wars. This security represents an RPG which limits the contagion effects of conflicts. Such aid also minimizes collateral damage, which can weaken an economy and cause it to slip into civil unrest (Murdoch and Sandler, 2001, 2002).

Expenditure on knowledge-based RPGs can also bolster development. For example, discovery of new agricultural technologies and methods will lead to new green revolutions. Many of these discoveries are geoclimatic specific, so that they represent an RPG rather than a GPG. With continued emphasis on building the right institutions, spending on economic and financial governance will also increase. Such governance also promotes financial and trade stability in the ever more integrated global markets (Rodrik, 1997), and, in so doing, yields joint products. This jointly produced GPG motivates donors to increase attention paid to these goods.

In choosing among these classes of RPGs, Sweden or any donor nation must decide where they perceive the highest marginal payoff, consistent with the goals underlying their foreign assistance program. With Sweden's emphasis on the proper use of natural resources, environmental RPGs will continue to figure prominently. The Nordic countries have been leaders during the last 30 years in providing environmental public goods (Benedick, 1991). In contrast, poverty reduction may be best served by health RPGs, NPGs, and more traditional forms of assistance (e.g., provision of food and clean water). The gender goal may be best served by NPGs that stress

education, since a more educated woman will have greater autonomy over her destiny. Knowledge-based RPGs may also foster the gender goal. In summary, support of public goods raises a host of choices for donor countries in terms of the mix of goods supported and the channels through which to support them.

11. Concluding Remarks

We have covered much ground with respect to RPGs in this monograph. In summarizing, it is instructive to return to the basic themes identified in the introduction. The first theme indicates that RPG provision must be distinguished from its financing. Provision can be done in the private sector so as to minimize cost, while financing requires coordination among countries and other donors. In the case of aid-financed RPGs, coordination can be directed by a global or regional multilateral institution (e.g., World Bank, regional development bank, regional trading bloc). In other cases, public-private partnerships are providing the coordination in fundraising and in matching the funds to expertise. The nature of the requisite coordination hinges on the underlying technology of the RPG, which determines the incentives of the potential supporters.[32] For example, best-shot RPGs require financial coordination, so that funds are channeled to the supplier most apt to provide the goods. In contrast, weakest-link RPGs may involve a capacity problem, where some countries in a region do not have the means to supply the goods at an acceptable level, so that others must assist them.

A second theme recognizes that RPGs are different than NPGs and GPGs, and that this difference can inhibit collective action unless mitigating actions are taken. Donor countries are more experienced with supporting NPGs through grants and loans to recipient countries. For GPGs, donors have relied on multilateral institutions to manage and coordinate funds from myriad sources. Benefit spillovers serve to motivate donors to support GPGs; the same is not necessarily true for RPGs if donors do not reside in the region of recipient countries. Competitive rivalries among member states of a region can inhibit the provision of RPGs. The requisite regional institution, whose jurisdiction matches the spillover range of the RPG, often does not exist or is too weak to provide the RPG. The study of RPGs teaches us that the necessary infrastructure for providing these goods are insufficient and needs to be improved. Provision of this infrastructure presents a difficult collective action problem as nations within a region must either form new regional institutions or rely on global institutions to relinquish tasks to regional collectives. Networks among member states may serve as a novel institutional arrangement for providing RPGs. In some instances, global networks are necessary to account for the interregional spillovers.

A third theme recognizes the growing importance of RPGs in promoting development. This calls for a new mode of thinking, where a nation's development strategy is viewed from a regional perspective, so that investment in NPGs recognize regional implications. The increase importance of RPGs for environmental, health, knowledge, and security

[32] This is yet another instance why the public good framework adds to our understanding of foreign assistance.

means that trade-offs must be made among RPGs, NPGs, and GPGs spending. These trade-offs change over time with regional exigencies.

A fourth theme involves how the three essential properties of RPGs – nonrivalry of benefits, nonexclusion of nonpayers, and the aggregation technology – determine incentives to provide the RPGs, and, thus, the need for public policy. For example, most club RPGs can be provided and financed efficiently through a club arrangement, so that the concern should be in giving LDCs the money to join these clubs. For purely public RPGs abiding by summation, free riding is a worry and an institution is needed to finance the provision of these goods. A weakest-link RPG raises a completely different issue – i.e., how to bring up inadequate levels of RPG supply at the national level to an acceptable standard. Because the minimal national contribution fixes the overall level of the RPG available for consumption throughout the region, free riding is not the problem, but having the means to afford the good is the issue – the so-called capacity problem. The typology of RPGs developed in the monograph has much to say about the prognosis for adequate supply and the desired public policy intervention, if any. To understand the role of RPGs in development assistance, policymakers must master the subtle distinctions and policy implications among different kinds of RPGs.

A final theme involves the role of Sweden and other donor nations in providing foreign assistance in the form of RPGs. The support of such goods presents some clear choices not only involving which public goods to support, but also concerning which form of poverty reduction (RPGs or traditional aid) to finance. Donors must ascertain whether they have a comparative advantage in providing some RPGs and, if so, they should specialize some efforts on these RPGs. Additionally, donors must consider partnerships, networks, and multilateral institutions to leverage their funds.

11.1 Some important conclusions

Many conclusions derive from our analysis. Some of the more important ones follow:

- Regional institutions need to be given some greater capacity to finance the provision of RPGs. This capacity can be achieved if the global multilateral institutions agree to channel more funds to regional development banks and regional institutions. Donor nations may also want to strengthen these regional institutions if adequate supplies of RPGs are to be achieved.
- RPGs present a more difficult collective action challenge than NPGs and GPGs, since the latter kinds of goods possess more established mechanisms of support. Donors have more practice in supporting NPGs through bilateral assistance and in financing GPGs through multilateral

institutions. Moreover, unlike GPGs, donors may not benefit directly from RPGs and this will limit contributions.

- Although environmental RPGs have been the most supported RPG to date, interest in other RPGs has grown at the expense of environmental goods in recent decades. In particular, spending on health and peacekeeping RPGs has increased greatly. This increased spending diverts foreign assistance from traditional poverty-reducing activities and the provision of NPGs. Thus, greater development assistance is needed if poverty is to be addressed in a globalizing world.
- In many instances, environmental public goods can be allocated by regional treaty or through networks coordinated by multilateral organizations. In the case of health RPGs, novel public-private partnerships have proved useful for providing these goods. Peacekeeping has been provided by the United Nations and NATO with relatively few nations carrying the burdens. This disproportionate burden sharing is anticipated to worsen in the coming years.
- Novel institutional arrangements – including partnerships among diverse donors, and global and regional networks – may be a means for supporting RPGs. Partnerships can bring in diverse interests, so as to draw on different participants' comparative advantage, while networks can be used to better match jurisdictions with the spillover range of the RPGs. Both institutional forms can address the capacity issues that arise with weakest-link and best-shot RPGs. However, public-private partnerships raise concerns about the motives of the private participants that must be taken into account.
- Policy recommendations for RPGs must account for the properties of publicness. Blanket statements with respect to free riding, suboptimality, or the need and form for outside intervention do not apply.
- RPGs are necessary for economic development, while, at the same time, economic development is also necessary to provide LDCs with adequate capacity to take advantage of RPGs.
- Generally speaking, the proper decision-making jurisdiction for RPGs should match the goods' range of spillovers. Nevertheless, factors – e.g., economies of scope, economies of scale, common agency considerations, the aggregation technology, sources of funds – may dictate less than a perfect coincidence.
- The three specific examples highlight how the differences in publicness properties can guide policy when providing RPGs.

11.2 Future directions

Preliminary figures on money spent in the aid process on TPGs and NPGs point to the increasing importance of such activities (World Bank, 2001a). If donor nations are to position themselves to be effective in light of these changes in the composition of foreign assistance, then an understanding of these RPGs is required. The insight that institutions within recipient countries matter for effective development assistance must be extended to the understanding that regional institutions also matter greatly. If RPGs are to be supplied efficiently, then these institutions must be improved. This requires the design of alternative institutional arrangements that differ from treaties and trading blocs. Treaties tend to be too loose with little or no enforcement, whereas trading blocs are intended to supply free trade as a RPG. Conflicts of interest may arise when such blocs are used to supply multiple RPGs.

Much more research effort is required in investigating the relative merits of public-private partnerships and networks for the financing and provision of RPGs. Thus far, these partnerships appear somewhat suited for augmenting capacity requirements of best-shot RPGs, so that contributions are pooled. For weakest-link RPGs, these partnerships can channel assistance to poorer nations in a region, so that their support of RPGs meet acceptable regional standards. The nature of these partnerships, who participates (i.e., public or private entities), and their motives should be investigated further. Similarly, the institutional structure of networks for providing RPGs need to be studied. Should these networks be at the global or regional level? How should networks be encouraged when they do not exist? What form should they assume? These are pertinent questions for future scrutiny.

Better data is needed on how donors support the various classes of public goods in the form of aid. To date, the first set of estimates are very crude. Thus, more effort is required in accounting for the spending on aid-financed RPGs, so that trade-offs can be better addressed. The adequacy of current aid flows is questionable in light of the greater share of an apparently fixed amount going to RPGs, NPGs, and GPGs. There is a real potential for crowding-out that can make a case for many donor countries to increase the share of their GDP going to foreign assistance. Most nations come nowhere near the 0.7 percent or greater share of GDP allocated to aid by the Scandinavian countries. Despite sustained foreign assistance over the last 50 years, tremendous disparities in well-being still characterize the world, with a relatively small group of nations accounting for the overwhelming percentage of world GDP and wealth. The interest in RPGs is motivated to find more effective means for alleviating world poverty and promoting development.

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THE EXPERT GROUP ON DEVELOPMENT ISSUES (EGDI)

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Regional Public Goods: Typologies, Provision, Financing, and Development Assistance

Pollution, disease and armed conflicts are examples of problems whose consequences often cross borders. How to combat such ills, especially in poor countries, has in recent years been intensely debated in terms of promoting global public goods.

This study contributes to the debate through its focus on *regional* public goods (RPGs), a focus that has received much less attention than the provision of public goods at the global level. Through the means of a new typology, Daniel G. Arce M. and Todd Sandler identify several classes of RPGs. The incentives to efficiently provide a public good depend on the good's class. Some RPGs can be efficiently provided with little public intervention while others pose real public policy concerns.

The financing of RPGs for development and poverty reduction is addressed. The authors emphasize that the funds for RPGs for development are limited. At the same time, many RPGs, relating to important areas like the environment and health, are particularly suitable for provision at the regional level. Donors should therefore give more support to regional institutions. Under certain conditions, these donors should also pursue partnerships with actors such as private companies and nongovernmental organizations. Networks and other institutional arrangements are discussed.

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