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Common Pool Resources Dilemma: Theorizing What Drives Sharing States to Cooperate

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Abstract

The free-rider problem is ever present in the common pool resources (CPRs) discourse. This is owing to exclusion and substractability, which are the defining characteristics of the CPRs. Communities and civilizations, as well as modern states, have struggled to reduce the degree of the free-rider problem in the common pool resource (CPR) context. By and large, the international nature of a number of CPR clusters has consistently and increasingly centered the debate, on how best can the sharing states cooperate to address the free-rider problem at both the international and the local scale. The article sets out to discuss and assess the explanatory power of the three main theories that derive the states that share CPRs to cooperate. The approach centers on analyzing the explanatory power of the theories at the international level.

Introduction

Common pool resources (CPRs) are defined as resources in which excluding potential appropriators or limiting appropriation rights of users is nontrivial (but not necessarily impossible) and the yield of the resource system is subtractable. In other words, CPRs are natural or man-made resources from which it is difficult to exclude or limit users once the resource is provided, and one person's consumption of resource units makes those units unavailable to others (Ostrom, Gardner and Walker 1994; Ostrom 1999).

There is a variety of clusters of the CPRs depending on geographical, ethnic and cultural considerations. Different nations, regions, tribes, religions as well as civilizations share the CPRs at varying scales. The most common examples of CPRs include lakes, rivers, oceans, fishing grounds, forests, atmosphere, and grazing lands. In this context, the resources harvested by

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one user (fish, trees, grass) are unavailable to others. The CPRs are likened to the wealth that is free for all, and therefore valued by no one because he who is foolhardy enough to wait for its proper time of use, will only find that another has taken it already (Gordon 1954; Ostrom 1990; 1999).

Against this backdrop, it is plausible to posit that, once the resource units that are produced by a CPR have a high value and institutional constraints do not restrict the way resource units are appropriated, individuals face strong incentives to appropriate more and more resource units, leading to congestion, overuse, and even the destruction of the resource itself. The situation is likely to occur owing to the fact that the CPRs are a particular class of goods or events in the world that share two important attributes, which are exclusion and subtractability.

By exclusion reference is made to the difficulty of excluding individuals from benefiting from a good. In this regard, it is very costly and difficult to exclude or limit potential beneficiaries (users) from consuming resources once they are provided by nature or through the activities of other individuals. On the other hand, subtractability attribute refers to the fact that there is subtractability of the benefits consumed by one individual from those available to others. That is, the category of goods in which one person's use of the resource subtracts the availability of such a goods to others. For instance, if one fisherman lands a ton of fish, those fish are not available for other fishermen. This is often contrasted to one person's use of a weather forecast, which does not reduce the availability of the information in that forecast for others to use (Ostrom, Gardner and Walker 1994). Indeed, these two attributes separate common pool resources from other types of goods as shown in table 1.

Table 1: A General Classification of goods

		Subtractability	
		Low	*High*
Exclusion	*Difficult*	Public Goods	Common-Pool Resources
	Easy	Toll Goods	Private Goods

Source: Ostrom, Gardner and Walker (1994).

Excluding or limiting potential beneficiaries from using the CPRs is a nontrivial problem due to a number of reasons. In some cases, it is the sheer size or, more generally, the physical attributes of the CPR. For instance, the

total cost of fencing an inshore fishery, let alone an entire ocean, is prohibitive. In other cases, the additional benefits from exclusion, or placing restrictions on use, are calculated to be less than the additional costs from instituting a mechanism to control use (Ostrom 1990; 1999).

Ostrom, Gardener and Walker (1994) group CPR problems into two broad clusters. On the one hand, there are appropriation problems, and on the other hand, there are provision problems. In appropriation problems, the production relationship between yield from the CPR and the level of inputs required to produce that yield is assumed to be given. In this context, they borrow the term appropriation from Plott and Meyer (1975) to refer to the process of withdrawing units, and thus the term appropriator for all those who withdraw units including fishers, irrigators, groundwater pumpers, hunters and herders to mention but a few. Under appropriation problems, the problems to be solved relate to excluding potential beneficiaries and allocating the subtractable flow. Accordingly, this can be accomplished by various means, including agreement on the level of appropriation, the method for appropriation, and the allocation of output.

Provision problems, on the other hand, are related to creating a resource, maintaining or improving the production capabilities of the resource, or avoiding the destruction of the resource. Provision problems focus on the behavioral incentives for appropriators to (a) alter appropriation activities within an existing CPR that alters the productive capacity of the resource (demand-side provision), or (b) contribute resources for the provision or maintenance of a CPR (supply-side provision). Simply put, they (Ostrom, Gardener and Walker 1994) argue that, in appropriation problems, the flow aspect of the CPR is what is problematic, and in the provision problems, the resource facility or resource stock of CPR is what is problematic. A number of models have attempted to describe and discuss the CPR problems and complexities. In this regard, I discuss the two most influential models.

The Tragedy of the Commons

In his 1968 seminal article, the tragedy of the commons, Gareth Hardin highlights the problem of CPRs. The thesis of his model holds that, environmental degradation is bound to occur whenever many individuals use a scarce resource in common. To illustrate the logical structure of his model and argument, Hardin uses a concept of pasture that is open to all the herders in a village. He then examines the structure of this situation from the

perspective of a rational herder (Hardin 1968; Holzinger 2008; Ostrom 1990). In a village of the commons it is expected that each cattle herder will try to keep as many cattle as possible on the pasture. So long as the land has a certain carrying capacity, this arrangement may not cause any problems for a long time.

At a certain point, however, the benefits from using the pasture start decreasing as a consequence of overgrazing (Hardin 1968). Consequently, each herder receives a direct benefit from his own animals and suffers delayed costs from the deterioration of the commons when his and others' cattle overgraze. Each rational herder is motivated to add more cattle, simply because of focusing on individual marginal utility much as he receives the direct benefit of his own animals and bears only a share of costs resulting from overgrazing. Holzinger (2008) and Ostrom (1990) frame this in terms of costs, by positing that, the marginal benefits of an additional animal falls fully to the individual herder, while all other herders share the marginal costs of additional animal in terms of decreasing benefits as a result of overgrazing. The tragedy is owing to the fact that it is rational for each and every herder, to add another animal in his or her herd, whereas the carrying capacity of the pasture is limited, hence ruining it at the end.

The Prisoner's Dilemma Game

The prisoner's dilemma game is conceptualized as a noncooperative game in which all players posses complete information (Ostrom 1990). In this game, each player has a dominant strategy in the sense that the player is always better off choosing this strategy – to defect, no matter what the other player chooses. The model is conceptualized from a legal perspective with a prosecutor suspecting two prisoners of a felony, but can currently prove their involvement only in a misdemeanor (McAdams 2009). The prosecutor offers each prisoner the same inducement to confess to the felony as summarized below in table 1.2: "If you are the only one to confess, I will reward you by dropping all charges," which is represented in table 1.2 by the payoff of 0. "If you are the only one not to confess, I will use your confederate's testimony to convict you of the felony and obtain for you the maximum five years in prison (-5); if neither of you confesses, you each get one year for the misdemeanor (-1); if both confess, I will convict you both of the felony, but give you an intermediate sentence of three years (-3)." In this context, to select the strategy of not confessing (by the prisoners) is to cooperate, and to select the strategy of confessing (by the prisoners) is to defect (McAdams 2009). Accordingly, altruism can of course change the game, but the standard

assumption is that each prisoner cares only about his or her own punishment.

Table 2: The Classical Prisoner's Dilemma

		Player 2	
		Cooperate	Defect
Player 1	Cooperate	-1, -1	-5, 0
	Defect	0, -5	-3, -3

Source: McAdams (2009).

With these payoffs, if Player 2 cooperates, Player 1 is better off defecting (receiving a payoff of 0) than cooperating (-1). If Player 2 defects, Player 1 is better off defecting (-3) than cooperating (-5). Therefore, Player 1 has a dominant strategy of defecting; it is her best move regardless of what Player 2 does. Because the payoffs shown are symmetric, Player 2 has the same dominant strategy. Therefore, the only equilibrium is Defect/Defect (McAdams 2009). In table 1.2, and subsequent matrices, an equilibrium is indicated by underlining the payoffs. The game is termed a dilemma because this theoretically inevitable outcome is worse for each prisoner than another possible outcome, Cooperate/Cooperate.

In the CPR context, prisoner's dilemma game signals that each party sharing the resource is likely to stick to their dominant strategy (to defect no matter what other player chooses), and hence end up producing an equilibrium that is the third-best result for both (Ostrom 1990; 1999). The equilibrium resulting from each player selecting his or her best individual strategy is, however, not a Pareto-optimal outcome. A Pareto-optimal outcome occurs when there is no other outcome strictly preferred by at least some player that is at least as good for the others (Ostrom 1990; Ostrom, Gardner, and Walker 1994). Against this backdrop, the prisoner's dilemma game reveals that, individually rational strategies can lead to collectively irrational outcomes. This revelation challenges a fundamental faith that rational human beings can achieve rational results (collectively).

Holzinger (2008) provides a more vivid manifestation of prisoner's dilemma insofar as CPRs provision is concerned. She holds that, two players, A and B, have the choice between two strategies: they can either contribute one unit to the public good or not contribute. Each of the four possible outcomes is associated with a certain payoff for each player (the "row player," A's payoff is given first), whereby 4 represents the first and 1 the last preference of the

players. Accordingly, both players' first preference is for the outcome where they themselves do not contribute, but their opponent does. Their second preference is that both players contribute and have the benefit of the full amount of the good. Their second-to-last preference is that neither contribute and thus the good is not provided. The players' last preference is the situation in which they themselves contribute to the good but their opponent does not. Table 3 presents a prisoner's dilemma model as applied in common goods provision.

Table 3: Prisoner's Dilemma in Common Goods Provision

		Player B	
		Contribute one unit	Do not contribute
Player A	Contribute one unit	3, 3	1, <u>4</u>
	Do not contribute	<u>4</u>, 1	<u>2, 2</u>

Source: Holzinger (2008).

She furthers that, given the incentive structure, rational individuals will end up with an alternative that is both collectively and individually undesirable, which is nobody contributes to the CPRs provision. The strategy "do not contribute" (defect) as opposed to "contribute" (cooperate) is a dominant one for both players, meaning that they will choose this strategy regardless of what the other players does. Consequently, the only stable equilibrium is the outcome where the common good is not provided at all. This outcome is a Nash equilibrium, that is, it represents the players' best responses to each other. The best responses of a player to the other player's strategy choices are underlined in the matrix in table 1.3. At a Nash equilibrium both players' payoffs are underlined in table 1.3.

The tragedy of the commons and the prisoner's dilemma game are closely related models that have delineated the accepted way of viewing many problems that individuals face when attempting to achieve collective benefits (Ostrom 1990; Ostrom, Gardner, and Walker 1994). Central to each of the two models is the free-rider problem. The free-rider problem accrues whenever one person cannot be excluded from the benefits that others provide (Ostrom 1990). The resulting situation is that each person is motivated not to contribute to the joint effort, but to free ride on the efforts of others. If all participants choose to free ride, the collective benefit will not be produced. As such, the temptation to free ride in such situations may dominate the decision process, and thus all will end up where no one wanted to be.

Alternatively, some may provide while others free ride, leading to less than the optimal level of provision of the collective benefit.

A number of prominent scholars have attempted to put forth suggestions on how to reduce the free-rider problem in the provision of CPRs (Ostrom 1999; Schlager, Blomquist and Tang 1994; Schlager 1994; Sengupta 1991; Tang 1992; 1994; Wade 1994). The four main suggestions that have been proposed by the scholars include:

i. *Affecting the characteristics of CPR users through boundary rules* – boundary rules can affect the types of participants with whom others interact. Emphasis is on enhancing the likelihood of reciprocity norms in CPR by increasing the proportion of participants who are well known in a community, have long-term stake in that community, and find it costly to have their reputation for trustworthiness harmed in that community. Boundary rules might relate to individual's citizenship, residency, membership in a particular organization, ethnicity, clan, and caste.

ii. *Affecting the set of allowable actions through authority rules* – authority rules can take different forms from simple to complex formulas. The simple formula may apply, for instance, in many forest resources that are closed to all forms of harvesting during one portion of the year and open for extraction by all who meet the boundary rules during the open season. Other forms may apply when a fisher is assigned to a fixed location (a fishing spot) or to a fixed rotational schedule, a member of a founding clan is authorized to cut timber anywhere in a forest, an irrigator is assigned to a fixed percentage of the total water available during a season or to a fixed time slot.

iii. *Affecting outcomes through payoff and position rules* – changing payoff rules so as to add penalties to actions that are prohibited can reduce the free-rider problem. The CPR beneficiaries can adopt norms that rule breakers should be ostracized or shunned, and individual appropriators tend to monitor each other's behavior rather intensively. Three broad types of payoff rules that are used extensively include (a) the imposition of a fine, (b) the loss of appropriation rights, and (c) incarceration. The severity of each of these types of sanctions can range from very low to very high and tends to start on the low end of the scale. Passing the rules that

impose costs can be relatively simple. The challenge, however, is on how to monitor behavior to ascertain if rules are being broken.

iv. *Affecting outcomes through changes in information, scope and aggregation rules* – these rules can be used to in ways that complement changes in boundary, authority, payoff and position rules. For instance, many smaller and informal systems rely entirely on a voluntary exchange of information and on mutual monitoring. Where resource units are very valuable and the size of the group is larger, more and more requirements are added regarding the information that must be kept by appropriators or their officials. Scope rules, on the other hand, are used to limit harvesting activities in some regions that are being treated as refugia. Ostrom (1999) argues that if no appropriation from these locations is allowed, the regenerative capacity of a system can be enhanced. Aggregation rules are used extensively in collective choice processes and less extensively in operational settings. However, one aggregation rule that is found in diverse systems is a requirement that harvesting activities be done in teams. This increases the opportunity for mutual monitoring and reduces the need to hire special guards.

It is important to observe that the suggestions put forth are likely to be effective in a CPR context that is under the custodianship of one state. In a CPR context that involves more than one state, the suggestions can hardly hold due to a number of considerations, the most important one being sovereignty. For instance, boundary rules, authority rules, payoff and position rules as well as changes in information, scope and aggregation can hardly hold and make sense in a CPR context involving River Nile or River Jordan. River Nile, which is the world's longest river is shared eleven riparian states of Burundi, Rwanda, Uganda, Eritrea, Democratic Republic of Congo, Kenya, Tanzania, Ethiopia, Sudan, South Sudan and Egypt with the length of 4,258 miles (6,853 km), and a combined population of more than 300 million inhabitants (NBI 2014). As the river flows from upstream to downstream, before it discharges into the Mediterranean Sea, the rules to reduce free-rider problems as proposed by the above scholars hardly make sense.

Likewise, in the context of the seriously contested CPRs that are not devoid of politics such as River Jordan, the suggestions are equally vulnerable. The countries sharing the basin of River Jordan are at odds with each other.

Israel, Jordan, Lebanon, Syria and Palestine have all been embroiled in protracted conflicts at some point in time in such a way that one cannot apply the suggestion offered above.

Against this background, and considering the growing international pressure on scarce resources, the CPRs that are shared by more than one country have dominated the debate on how best to ensure that the sharing states cooperate to protect and preserve them. This is owing to the pervasive nature of states, which act as rational egoists obsessed with furthering their own gains, at the expense of other states they share the same resources with.

In responding to the challenge, the countries sharing CPRs have rolled out joint measures and established cooperation frameworks to enable them manage such resources effectively and efficiently. Such cooperation frameworks have established specific international institutions designated to supervise and coordinate the set standards by the sharing states. Some few examples include the Central Commission for Navigation on the Rhine (CCNR), International Commission for Protection of the Rhine (ICPR), International Fishermen's Association of Lake Constance (IBF), International Commission for Protection of Lake Constance (IGKB), Lake Victoria Basin Commission (LVBC), Lake Victoria Fisheries Organization (LVFO), the Nile Basin Initiative (NBI), the Zambezi River Authority (ZRA), Lake Chad Basin Commission (LCBC) and the Mekong River Commission (MRC).

In the following section, I review the three most prominent theories that drive states that share CRPs to cooperate and establish specific institutions to guide the management of CPRs. I analyze the public goods theory, the regime theory and the principal-agent theory to assess their explanatory power with regards to the management of international CPRs by the sharing states. I argue that no single theory, among the three, can adequately explain why states cooperate in CPR context to address the free-rider problem. Each theory is found vulnerable and wanting, and its only when they complement each other that they can provide an impeccably comprehensive understanding of the subject in question (what drives states to cooperate in CPRs contexts).

Public Goods Theory

The theory of public goods is firmly deep-rooted in welfare economics and public finance. Its basic concern is the observation that some goods show properties, which make them ill suited for purely private provision or

individual use (Holzinger 2008). As a consequence of these properties, the market will produce inefficient results. In other words, this scenario entails goods with these characteristics will be under produced in private sector, or may not be produced at all (Feldman 1997; Holcombe 1997). Public goods can therefore be defined as goods having one or both of the characteristics of nonexcludability and jointless in consumption (Holcombe 1997). This definition is tantamount to common pool resources definition discussed earlier. Goods that are joint in consumption are also called collective-consumption goods or nonrival consumption goods, and therefore the terms are used interchangeably in this context.

Paul Samuelson (1954; 1955) was the first scholar to develop the theory of public goods provision. He defines collective consumption goods by nonrivarly of consumption. That is, collective consumption goods are goods that once produced, all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good (Samuelson 1954). According to this definition, public goods are viewed as goods with extreme positive external effects. By external effect, what is meant is that one person's activity has an effect on another person's utility function (Holzinger 2008). Regarding nonrival goods, one person's activity appears in the utility functions of everybody else within the scope of the public good. Simply put, if one person provides the good, everybody can use it (Feldman 1997; Holzinger 2008; Samuelson 1955).

In his theory, Samuelson derives the conditions for the optimal quantity of a collective consumption good. According to him, the optimal quantity of the public good is achieved, if the economy is in a Pareto-optimal state, that is, a state where one person can only be made better off by making another person worse off (Holzinger 2008). To him (Samuelson 1954), optimality condition for public goods requires that the sum of the marginal utilities of the public good should equal the marginal cost of production of the public good. In other words, the total net benefit of the goods has to be maximized. The main problem with this optimality condition, however, is the absence of a decentralized pricing system that can serve to determine optimally these levels of collective consumption (Samuelson 1954; Holzinger 2008).

According to Samuelson (1954), supply and demand are coordinated through the price mechanisms in such a way that a general competitive equilibrium and, thus, a Pareto-optimal state of the economy is achieved. This argument

is firmly deep-rooted in the premises of perfect competition, neoclassical production functions (no economies of scale existing) and, convex indifference curves (implying that consumers have rational preferences). In the context of public goods, the argument about striking the Pareto-optimal state does not hold. This is due to public goods' characteristic features, which render it impossible for the market to secure their provision efficiently (Samuelson 1954; 1955).

In the presence of public goods, rational and selfish individuals have an incentive not to reveal their true preferences for the public good. This is because once the good is provided, no one can be excluded from its use. It is against this backdrop that rational individuals have the opportunity and want to free ride on the good, while nobody is ready to bear the costs for its provision (Holcombe 1997; Holzinger 2008). As a result, the good will not be provided at all or it will at least be provided in insufficient quantity. This is a sub-optimal state, as many individuals would not benefit from the good. This is the reason as to why spontaneous market coordination cannot be relied upon in the case of public goods. Individual rationality leads to collectively suboptimal results (Holzinger 2008).

Likewise, the theory holds that the collectively organized provision through a central agency such as the government is not free from the problem of rational incentives. If someone tries to organize provision to overcome the suboptimal state and in doing so tries to collect contributions from potential users according to their personal benefit from the good, this is doomed to failure. Holzinger (2008) clarifies this argument by positing that rational potential users will misrepresent their true preferences, so much so that they pay less, as they still are able to use the full amount of the good. Consequently, the contributions collected will not suffice to provide the optimal amount of the good. Therefore, the public goods theory as developed by Samuelson shows that the market mechanism does not produce optimal results. The theory also shows that other mechanisms, including state provision, face a problem of obtaining correct information about the preferences of the collective for the public good. The bottom-line of the theory is that whether one relies on the market or on the state, the consequence is bound to be under-provision of the public good (Holzinger 2008; Samuelson 1954).

Regime Theory

Since the 1980s regime theory has become a dominant theory for explaining international institutions. International regimes encompass sets of implicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a certain area of international relations (Krasner 1983). Regimes are deliberately constructed, partial international orders on either a regional or global scale, which are intended to remove specific issue-areas of international politics from the sphere of self-help behavior (Hasenclever, Mayer and Rittberger 1997; 2000; Ruggie 1975). By creating shared expectations about appropriate behavior and by upgrading the level of transparency in the issue-area, regimes help states (and other actors) to cooperate with a view of reaping gains in the form of additional welfare or security. There are three main schools of thought/approaches in the regime theory. The three schools of thought have shaped the discussion of regimes and they include neoliberalism, which bases its analyses on constellations of interests; realism, which treats power relations among states as its key variable; and cognivitism, which emphasizes actors' causal and social knowledge (Young and Osherenko 1993). Each of these schools of thought has articulated and defended a distinct view on the origins, stability, and consequences of international regimes as I highlight below.

Neoliberalism

Neoliberalism is the school of thought in regime theory, which emphasizes the role of international regimes in helping states to realize common interests (Axelrod and Keohane 1986; Keohane 1983; Stein 1983). In so doing, it portrays states as rational egoists who care only for their own absolute gains (Hasenclever, Mayer and Rittberger 2000). The basic tenet of neoliberalism is that cooperation makes all participants better off (states in this context), but it is hard to achieve owing to the pervasive uncertainty that characterizes international life. In particular, states are uncertain as to whether they can rely on their cooperation partners' promises (Axelrod 1984; Hasenclever, Mayer and Rittberger 1997; 2000). Neoliberalism holds that, in order to increase mutual transparency of behavior and linking issues through time (so much so that reciprocal strategies are applicable), regimes reduce this uncertainty as they migrate the fear of cheating or being exploited by the other parties, and hence make it easier for states to embark on collaborative ventures (Axelrod 1984). Neoliberalism is firmly deep-rooted in the premises of economic theories of institutions focusing on the role of information and transaction costs (the costs associated with the conclusion, monitoring and enforcement of agreements).

Against this backdrop, neoliberals are of the view that regimes enable states to cooperate, and that through the institutional structure of the regime, the states have the possibility to foster cooperation and overcome cooperation problems like Prisoner's dilemma (Verweij 2000). That is to say regimes promote the common good for all participants and are therefore able to improve the situation of every participant. Neoliberals point out that, although states lack sense of obligation, they think twice before they violate agreed upon rules. States with a reputation for opportunism will find it more difficult in the future to be accepted as partners in a potentially more beneficial regime (Hasenclever, Mayer and Rittberger 1997; 2000). Furthermore, since international institutions are difficult to construct, states are expected to hesitate to put an existing regime at risk (Keohane 1984).

Realism

Realism is another school of thought in regime theory, which is at odds with neoliberalism. Realism holds that regimes enable states just to coordinate their actions, and that they do not foster cooperation between states (Gilpin 1981). The realists hold that the distribution of capabilities among actors (basically states in this context) critically affects both the prospects for effective regimes to emerge and persist in an issue-area and the nature of the regime that result, especially insofar as the allocation of the benefits from cooperation is concerned (Baylis and Smith 2001; Hasenclever, Mayer and Rittberger 1997; 2000). This thinking is influenced by the theory of hegemonic stability, which interprets regimes as international public goods that are in short supply unless a dominant actor (hegemon) takes the lead in their provision and enforcement (Lake 1993). Propounders of hegemonic stability are skeptical whether regimes can be upheld in the absence of a strong leader (hegemon) who has a stake in them (Kindleberger 1981; Lake 1993).

Therefore, the realists argue that international regimes are more difficult to create and harder to maintain than neoliberals believe. They hold that the likelihood of a regime to be put in place and to be stable is greatest when the expected gains are balanced (at least for the most powerful members) such that relative losses do not accrue (Baylis and Smith 2001; Hasenclever, Mayer and Rittberger 2000). They differ with neoliberals on this aspect by positing that it is relative gains, rather than absolute gains by actors (states) that are key drivers of states in regime formation. That is to say states are sensitive to relative gains in favor of their partners. They liken regimes to a coordination game, where two actors have to find a coordination strategy to get an

outcome, which benefits both, but not to the extent they both would have liked (Baylis and Smith 2001; Hasenclever, Mayer and Rittberger 1997).

Cognitivism

Cognitivism is another school of thought in the regime theory, which is at odds with both neoliberalism and realism. It criticizes realists and neoliberals for treating actors' preferences and perceived options as exogenous givens, that is, as facts, which are either assumed or observed, but not theorized about (Hasenclever, Mayer and Rittberger 2000). According to the cognivists, the realists and neoliberals treatment of actors' preferences and perceived options as exogenous ignores or trivializes a significant source of variation in international behavior.

There are two strands within the cognivitism school of thought, weak and strong cognitivism (Blatter 2009; Hasenclever, Mayer and Rittberger 1997; 2000). Weak (minimalist) cognitivism focuses on the role of causal beliefs in regime formation and change. The main thrust of the weak cognitivists is that neoliberals and realists underrate both the degree of uncertainty which decision makers face in many issue-areas today and their capacity for complex learning, which extends to both means and ends (Goldstein and Keohane 1993). The weak cognitivists further that uncertainty about causal relationships creates a demand on the part of decision makers for reliable knowledge, which in turn, can become a source of political influence for those who can supply it. Weak cognitivists emphasize the role of epistemic communities in international policy coordination and the conditions as well as mechanisms for government learning (Levy 1994; Hasenclever, Mayer and Rittberger 1997; 2000).

Strong cognitivism, on the other hand, emphasizes on the social character of international relations (Keohane 1988). Like weak cognitivism, strong cognitivism is concerned with actors' knowledge but rather than causal beliefs it accentuates social knowledge (knowledge of norms and understandings of self and another). This sociological stance brings them into even sharper opposition to realists and neoliberals. Strong cognitivists reject the conception of states as rational actors, who are atomistic in the sense that their identities, power, and fundamental interests are prior to international society and its institutions (Hasenclever, Mayer and Rittberger 1997; 2000). They hold that states are as much shaped by international institutions as they shape them (Wendt and Duvall 1989). Moreover, strong cognitivists argue that any durable pattern of interaction affects actors' self-understandings and

their image of the others. In the process, cooperative norms are internalized, even when, initially, they were viewed by actors as mere instruments to further their individual goals (Wendt 1994).

Against this backdrop, strong cognitivists tend to attribute a greater measure of effectiveness and robustness to international institutions than do both realists and neoliberals. Unlike neoliberals and realists who portray states as utility maximizers, the behavioral model that underlies strong cognitivism is that of a role player (Hasenclever, Mayer and Rittberger 2000; Young 1986). Role-playing at international level is manifested when governments perceive obligations with other states and a community of states to be real and binding despite the fact that they may not always honor them (Hasenclever, Mayer and Rittberger 1997; 2000). In a world of role-players international norms take precedence and operate as an essential yardstick in states' selection of foreign policy goal and options (Franck 1990). A role player making decision asks what is appropriate for it to do in a given situation, rather than how it can maximize its individually defined goals (Hasenclever, Mayer and Rittberger 2000). Table 4 summarizes the key components of the schools of thought in regime theory.

Table 4: Key Components of the Schools of Thought in Regime Theory

	Realism	*Neoliberalism*	*Cognitivism (Especially Strong Cognitivism)*
Central Variable	Power	Interests	Knowledge
Metatheoretical Orientation	Rationalist	Rationalist	Sociological
Behavioral Model	Relative gains seeker	Absolute gains maximizer	Role player
Institutionalism	Weak	Medium	Strong

Source: Hasenclever, Mayer and Rittberger (2000).

Principal Agent Theory

Principal agent theory is best suited to explain monitoring and information problems in a cooperation relationship that involves more than one party. It addresses basic behavioral issues that arise when two or more parties work towards a relationship with shared economic objectives (Eisenhardt 1989; Keil 2005). These problems accrue when one party in the cooperation relationship (the principal) delegates work to another party (the agent).

According to Jensen and Meckling (1976), the theory has four major assumptions, which are:

(i) The parties, principal and agent, have rational behavior and rational expectations and interact on the basis of freedom of contract and private property.

(ii) Activities undertaken by the agent that result from his or her activities have external effects on the principal's profits and success.

(iii) The agent has discretionary freedom due to incomplete and asymmetric information and monitoring costs. The agent's discretionary freedom leads ex-ante to uncertainty (since the principal cannot rely on any motivation like loyalty or conscientiousness) and ex-post to concrete disadvantages. The less the ability to control the agent's activity (the greater the information asymmetry), the greater is the principal's uncertainty.

(iv) Divergence of interests exists in that the agent shows opportunistic behavior to maximize her own expected profits instead of acting in line with the goals of the principal. The three types of opportunistic behavior are hidden characteristics (abilities and skills of the agent are not common knowledge), hidden intention (agent has goals and interests not known by the principal) and hidden action (principal cannot fully control the agent's actions).

The theory holds that the principal controls (through monitoring) and manipulates (through incentives) the agent into meeting contractual obligations in a cooperation relationship (Eisenhardt 1989). Therefore, the principal is assumed to be active and in charge, specifying preferences, creating incentives and designing contracts, while the agent is assumed to be passively reactive to the terms and conditions of the principal's offer. The theory suggests that principals have problems in ensuring that agents carry out their functions in the interests of the principal, because of two major inherent problems in the contractual relationship. These problems are adverse selection and moral hazards (Arrow 1985).

The adverse selection problem occurs in a cooperation relationship because, before the start of the interaction (ex ante), the principal cannot fully judge the agent's ability to carry out tasks. This is because of the hidden characteristics and hidden intentions that agents have, which they can use to maximize their own gains (Arkelof 1970; Keil 2005). Therefore, in a

cooperation relationship, the principal enters into a contract with the agent without being sure of the agent's capacity to deliver. On the other hand, the problem of moral hazard occurs after the agent is selected. It largely emanates from the inability of the principal to completely monitor and control the behavior and actions of the agents in performing their duties (Arrow 1985; Jensen and Meckling 1976). The underlying cause of the problem is information advantage concerning the quantity and quality of the agent's input and output (hidden information). It gives an agent the opportunity to utilize discretionary freedom and maximize his/her gains through reduced efforts and unnecessarily high budgets (to mention a few), which lead to inefficiency. The best way to reduce moral hazard is by introducing an incentive system, which homogenizes the goals of principal and agent, which can be arranged in such a way that the agent's payoff is a function of the principal's gains.

Information asymmetry occurs in the principal agent relationship because agents typically know more about their tasks than the principals. In cooperation relationships, parties tend to have different information available to them (Perunovic and Pedersen 2007). Therefore, due to the agent's full knowledge, it is possible to skew information in their favour at the expense of the principal. It is against this background that the principal fails to effectively monitor the agent. The value of the theory lies in understanding the relationship between the parties involved in a cooperation relationship (states in this context), how risk is allocated among the parties, the trade-off between the costs of information, managing the relationship through monitoring and evaluation, the cost of risk bearing and the incentives operating in relationship agreements (Eisenhardt 1989; Perunovic and Pedersen 2007).

Assessment of the Explanatory Powers of the Theories

The Public Goods Theory

The public goods theory application with regards to states' decisions to cooperate in CPRs contexts cannot be overemphasized. At the international level, in which a number of states sharing a certain CPR decide to forge a cooperation relationship and come together under one umbrella, the explanatory power of the theory is embedded in its key assumption about the market failure in a CPR context. States, which are individual actors and rational players, seem to realize that the normal market principles of supply and demand, which are responsible to coordinate the provision of CPRs through a decentralized price mechanisms fail to bring about the Pareto-

optimal state. In this context, states then decide to go about the problem by establishing a centralized mechanism to coordinate their activities with regards to the CPRs. It is at this juncture that cooperation frameworks among states are forged, so much so that they can bring about a common good to all the sharing states. Once the central agency is formed, through a cooperation framework that can take a regional nature, it is expected to act in furthering the gains of the member states.

However, as the theory reckons, the central agency is bound to run into problems associated with identifying true preferences of states, which are likely to misrepresent their true preferences given the fact that chances to free ride are still guaranteed even in the newly formed cooperation relationship. This explains why a number of CPRs cooperation arrangements that have been established have continued to fail to live up to the expectations and attain their set objectives. Therefore, the theory accounts for establishment of cooperation relationships among the sharing states but falls short on accounting whether the very cooperation arrangements are best suited to address the free-rider problem. In fact, the theory is negative on the prospect of the newly formed cooperation arrangements to be able to address the free-rider problem at the international scale. It predicts that any attempts by the central agency are likely to run into quagmire due to information problems from the sharing states. This is the flaw of the theory because some cooperation arrangements that have been established by sharing states have thrived the challenge and are quite effective in carrying out their set objectives. This can be observed in CPRs contexts involving the Great Lakes of North America that are shared by the United States and Canada and Lake Constance that is shared by Germany, Austria and Switzerland. Therefore, whereas the theory succeeds to explain that it is market failure that is likely to lead states into cooperation in a CPR context, on the one hand, it falls short in explaining the prospect of such cooperation to thrive, on the other hand.

It is against this backdrop that the theory fails to adequately offer theoretical explanation on what drives states to cooperate. States do not decide to cooperate in a CPR context so as to fail. The costs associated with establishing cooperation relationships are sometimes too high for states to just cooperate in order to fail to realize their set objectives. It is important to observe that states tend to calculate the pluses and minuses before they get into such arrangements. Therefore, the negative prospect portrayed in the theory is flawed and dented due to the fact that some states have forged very successful cooperation relationships in the CPRs contexts.

Regime Theory

In the regime theory, neoliberalism is the appropriate school of thought that is best suited to explain what drives countries sharing CPRs to cooperate. The main thrust of neoliberalism that cooperation enables states to cooperate, and that through the institutional structure of the regime, the states have the possibility to overcome cooperation problems like Prisoner's dilemma qualifies the approach to be best suited to adequately explain the free-rider problem in the context of regional and international cooperation. The key assumption of neoliberalism is that international cooperation promotes the common good for all partner states and therefore best suited to improve the situation for each of them.

On the other hand, realism is ill suited to offer any explanation in this context since it is more obsessed with power question among member states in a cooperation framework. Its assumption does not hold in the context of states, which set up cooperation framework to address the free-rider problem. In the context of CPRs shared by states, to assume that they set up institutions, most of which are very context-specific such as navigation, irrigation or fisheries, to simply coordinate matters rather than to carter for the common good of navigators, irrigators or fishers is to miss a point. Likewise, cognitivism is also lacking in the context of explaining cooperation among states in the CPRs context. This is because it treats states as having no perceived interests and gains when they forge a cooperation relationship involving the resources that they share. It is important to observe that one of the pre-requisites to effective management of CPRs is the existence of incentives for transboundary cooperation. Several scholars agree that in order for any CPRs cooperation to blossom among sharing states, economic incentives between the sharing (cooperating) states need be very transparent for the individual sharing countries (Klaphake 2006; Wirkus and Börge 2006). It is on this very aspect that cognitivism falls short. It is partly right that knowledge plays part in the formation of regime. However, assuming that knowledge is solely the basis for formation of cooperation among states jointly sharing a CPR is myopic. The so called role-model state, which is supposed to lead while adhering more to the norms, rather than its own interests is yet to exist in this context. If this were the case, one would not expect to see states embroiled in protracted negotiations and discussions about how to best benefit from the shared resources. More so, international and regional organization would not have so many problems in monitoring

compliance of the states to the set CPRs standards, and states could be more willing and forthcoming in sharing information regarding the very CPRs.

Therefore, based on the explanation above, neoliberalism adds more value in the CPRs cooperation context between the sharing states than any other school of thought in the regime theory. Its central assumption that cooperation is best suited to overcome CPRs problems (such as prisoner's dilemma) elevates it above other approaches and makes it more valid to the ongoing discussion. This assumption is equally in conformity with the public goods theory as to why states cooperate in a CPR context. However, the point of departure between the two theories is that whereas public goods theory assumes that such cooperation is likely to suffer from information problems associated with member states not disclosing their true preferences, neoliberalism is more positive in assuming that such cooperation is likely to thrive and live up to expectations. This is owing to the existing institutional norms that are binding and thus the states sharing the CPRs tend to think twice before violating them. However, the approach/theory falls short in explaining how the very institutional norms it establishes will deal with the problem of information between sharing states, which are so keen on extending their free riding behavior.

It is one thing to have institutional norms in place, but to monitor their implementation is an entirely different matter. Effective management of CPRs among sharing states is not only dependent on information exchange about the resource between sharing states, but also monitoring the exact actuality of how much the individual countries are implementing the agreed institutional norms. In this regard, neoliberalism falls short. Therefore, whereas neoliberalism helps to explain the reasons for states to cooperate in a CPR context, its explanatory power is limited and narrow in expounding how to deal with monitoring problems and how to address the (self-proclaimed) cooperation problems like Prisoner's dilemma.

Principal Agent Theory

The principal agent theory complements both the public goods theory and the regime theory by providing an explanation that is lacking in the two theories. The theory is more concerned with two parties that enter into a cooperation relationship with one party acting as the principle and the other party acting as the agent. The theory is vulnerable in explaining why states sharing CPRs decide to forge a cooperation relationship. This is assumed to be a given in the theory. The theory sets off assuming that the two parties

(states) are already in a relationship with shared economic objectives. In this context it is lacking, and it can be very well complemented by the public good and regime theories to understand why the states entered in such an arrangement in the first place.

However, the theory adds more value to the two previous theories by providing explanation about how the principals can monitor the agents and contain the information problem, which reduces the free-rider problem. In an already formed cooperation arrangement in the CPR context, the institutions and regional organizations formed act as the principals and member states act as agents. The theory delineates the moral hazard problem to be expected given the limited capacity by the principal to monitor agent's compliance to the set standards. As such, the theory proposes a number of ways to address the problem including introducing an incentive system, which homogenizes the goals of the principal and agent, which can be arranged in such a way that the agent's payoff is a function of the principal's gains. This can be the best way for cooperation to blossom in CPRs contexts. The win-win situation, according to principal-agent theory, ought to be designed in such a way that it straddles beyond the states sharing the CPRs to accommodate the established regional institutions. Only this way can the information problem be contained and hence the free-rider problem. Therefore, the principal-agent's limited explanatory power regarding what drives states sharing a CPR to cooperate is compensated by the abundant explanatory power that it offers to complement the public goods and regime theories in this regard. Moreover, it offers more options including how to allocate risks between states sharing a CPR and how to effectively manage cooperation relationships through monitoring and evaluation.

Conclusion

The public goods theory triggered the discussion as to what drives the states sharing CPRs to cooperate. According to it, market failure to guarantee effective provision of the CPRs is the principal reason for the states sharing the CPRs to cooperate. The theory is skeptical as to whether the central agency established out of cooperation arrangement will live up to the expectations. In fact, it is of the view that given the nature of the CPRs, exclusion and subtractability, cooperation in the CPRs context is bound to fail. The regime theory, as is informed by neoliberalism, offered a positive prospect for the states sharing the CPRs to succeed in furthering the common good of all. The theory claims that cooperation among states sharing CPRs has better prospect for addressing cooperation problems such as prisoner's

dilemma. However, it falls short in explaining how the information problem, which is pointed out by the public goods theory can be addressed.

The principal agent theory responded by providing the answer on how to go about addressing information problem and hence the chronic free-rider problem. This is because once the information problem is solved, the sharing states can hardly misrepresent their true preferences in the CPR context. It is important to observe that introducing an incentive system, which homogenizes the goals of the principal and agent, which can be arranged in such a way that the agent's payoff is a function of the principal's gains can be hard in public sphere as opposed to the private sphere. However, this can be attained if the sharing states are serious and committed to the existing cooperation.

The article started by introducing the concept of CPRs and explaining the defining characteristics that gives the CPRs their uniqueness. It then proceeded to present the two main models that manifest the outcome to be expected in a CPR situation. The free-rider problem was identified to be the main culprit behind the outcome. It then analyzed some theoretical suggestions on how to go about the problem. The suggestions were deemed to be shaky and vulnerable especially in the international CPRs context. The article then gave a theoretical account of what drives the states sharing CPRs to cooperate, therein assessing the explanatory power of each of the three theories. This was done under the assumption that a single theory is insufficient to account for the set objective of the article.

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