OVERGRAZING BEHAVIOR AND RATIONALITY:

A DYNAMIC PERSPECTIVE

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ABSTRACT

Although humans are assumed to be rational beings, there has been little consensus regarding the criteria for distinguishing rational from irrational behaviors. For example, overgrazing that often results in a tragedy of the commons is usually considered irrational. A subsequent question may be why there are always some rational people engaging in irrational overgrazing. Based on rationality theories and related research findings, this research analyzes the overgrazing behavior in the National Health Insurance system of Taiwan.

The research findings indicate that system sustainability, the effectiveness of control, and the possibility of jumping out of the system are the critical factors that have effects on overgrazing behavior and the rationality orientation. If system sustainability is not a question, rational and opportunistic agents tend to be driven by greed, and the effectiveness of control is crucial in determining the behavior of the agents. However, once the system is perceived to be unsustainable, the motive of fear may dominate and the possibility of jumping out of the system becomes critical for the agents to choose between self-restrained and overgrazing behaviors. In addition, it is suggested that the "it won't be me effect" may be responsible for the eventual collapse of the system.

Keywords: National Health Insurance, Rationality, Overgrazing Behavior, Catastrophe Theory, System Dynamics.

A cottager and his wife had a Hen that laid a golden egg every day. They supposed that the Hen must contain a great lump of gold in its inside, and in order to get the gold they killed it. Having done so, they found to their surprise that the Hen differed in no respect from their other hens. The foolish pair, thus hoping to become rich all at once, deprived themselves of the gain of which they were assured day by day.

Aesop Fables, Translated by George Fyler Townsend.

INTRODUCTION

Ever since Herbert A. Simon created the term "bounded rationality" in his book *Administrative Behavior*, many, albeit not all, people seemed to agree that human beings tend to have limited cognitive capacities to process information in decision making. Nowadays, the words that "human behavior is *intendedly* rational, but only *limited* so" (Simon, 1976) have been widely known and taken into account in research by a significant proportion of people in economics and other social sciences. In addition, a variety of theories that intend to explain the behaviors of human beings are built on the basis of this assumption (Argote & Greve, 2007, 337-349).

In the field of neo-institutional economics, both transaction cost theory and agency theory have included bounded rationality as a basic assumption that characterizes the nature of human agents in organizations. In addition, both theories also advocate that some agents tend to maximize their own benefits by taking opportunistic actions once information asymmetry exists between the agents and their counterparts (Jensen & Meckling, 1976, 305-360; Williamson, 1981, 548-577). Following this thread, how organizations should deal with the uncertainty resulting from opportunistic behaviors has become one of the primary concerns of organizational theorists (Stinchcombe, 1990).

In a study that focused on probing the financial problem of the National Health Insurance (NHI) system in Taiwan, I found that some medical care institutions tended to act opportunistically in the process of providing medical services. This kind of opportunistic behavior, which I would denote as “overgrazing behavior,” has displayed some complicated while interesting properties that may not be seen as rational in the sense that it may make every individual actor embedded in the health system worse off in the long run.

To further investigate the phenomena of the overgrazing behavior, this paper proposes the following two research questions. First, if rational behaviors refer to those that will result in certain pleasant consequences, why do some agents overgraze that may make themselves worse off at a later stage? An explanation to this question may be that those agents behave so because they do not exactly know what the consequences will be like (Grafton, 2000, 504-517). This answer may not be fairly convincing and persuasive given the second question. That is, what if some agents still make the same choice even though they are well aware of the consequences that may result from their overgrazing behavior? In the following sections of this paper, I will first investigate the nature of rationality, followed by a discussion about the relationship between overgrazing behaviors and common property resources. Based on the research findings in the NHI system of Taiwan, the rationale of overgrazing behavior will be examined and its implications for understanding the essence of rationality will be discussed.

THE NATURE OF RATIONALITY

Although it is generally assumed and agreed that people usually have reasons for what they do (Simon, 1986, S209-S224), there has been little consensus regarding the criteria for distinguishing rational from irrational behaviors. In fact, since different fields tend to use the words rational or rationality from “many different ultimate points of view and toward many different ultimate ends, …what is rational from one point of view may well be irrational from another” (Brubaker, 1984). Thus, rationality, being a multifaceted and paradoxical concept, has spurred a recurring controversy and debate in the literature (Haltiwanger & Waldman, 1985, 326-340). Due to the fact that different conceptualizations about rationality tend to reflect various fundamental features regarding social reality for different purposes, research conducted on a multidisciplinary or interdisciplinary basis may be able to provide insights that can help resolve the controversy of rationality to a certain extent (Genov, 1991, 206-211).

On the other hand, it is not clear whether a kind of rational behavior will always be seen as rational in a complex and continuously changing system. Based on this concern, Simon (1978, 1-16) insists that theories of rationality should also include the process of choice as the actors move through time since "a theory of rationality that does not give an account of problem solving in the face of complexity is sadly incomplete" (p. 12). Therefore, to investigate the dynamics of rationality should be a crucial part for building more realistic theories, hence furthering our understanding about the essence of rationality. Following the reasoning process in the literature, the discussions below will aim at providing a brief review of the studies that have intended to elaborate the nature of rationality and addressing problems related to these studies.

The Multivalent Embodiments of Rationality

According to Brubaker (1984), there are at least sixteen apparent meanings of "rational" that can be found in Max Weber's writings concerning modern capitalism and ascetic Protestantism (p. 2). For example, Weber defines formal rationality as "a matter of fact" which refers to "the calculability of means and procedures", while "substantive rationality a matter of value" which refers to "ends of results" (Brubaker, 1984). Moreover, there are also subjective and objective rationality. The former tends to define actions as rational "only from the subjective point of view of the actor", and the latter discerns rational actions depending on "the judgment of a scientific observer" (Brubaker, 1984). In Weber's opinion, a formally rational behavior may be substantively irrational; subjectively rational actions may be objectively irrational, and vice versa.

Kalberg (1980, 1145-1179) attributes the contradictory nature of rationality to Weber's scattered and fragmented discussions that may mystify rather than clarify the concept of rationality. In addition, since individuals' interests, hence their perceived realities, may change over time, the heterogeneous realities perceived by different actors on the basis of means-end calculations often lead to the multivocality of rationality. As a result, it seems inevitable that the concept of rationality in Weber's oeuvre has the following shortcomings in interpreting the actual behaviors of human agents in social systems.

First, rationality is seen as a relative rather than an absolute concept. Therefore, a rational behavior observed from one standpoint may be criticized as irrational from another standpoint. In the cases that lack a unified configuration of values, whether an action is rational or irrational will simply depend on the values held by individual observers. Whereas many different values often simultaneously exist in a social system, theories of rationality built on the basis of this relative manner may complicate rather than simplify the phenomena under investigation.

Second, since pairs of rationality (e.g., formal versus substantive, subjective versus objective) are often defined according to opposite value judgments, rationality and irrationality are two mutually exclusive concepts located at two extremes rather than a continuum. An action can only be considered as either rational or irrational in a discrete manner. No intermediate position or different degrees of rational behavior is permitted.

Hardly can we assess a kind of behavior as more rational or less rational that may be always present in our daily life.

Third, through the discussions of rationality, Weber intended to convey an ethical implication that he believed would help build an ideal world characterized by methodical ways of life (Kalberg, 1980, 1145-1179). His arguments are basically normative rather than empirical. Following this orientation, a majority of theories of rationality, particularly in economics, tend to base their arguments on a normative viewpoint instead of illuminating the nature of man from a descriptive perspective. However, since it is the real world that provides the most fertile sources for formulating good research questions and conducting fundamental scientific inquiry, a theory of how people do behave may provide more enlightening and useful insights than theories about how they should behave (Simon, 1955, 99-118, 1979, 493-513).

Finally, all the categories of rationality have focused primarily on the static aspect of decision making. Nevertheless, since it is unlikely that human agents make decisions isolated from the social systems in which they are embedded, rationality should be considered as a characteristic of social systems, rather than a characteristic of social action alone (Genov, 1991, 206-211). When human agents are in interactive situations of complication (e.g., the situations depicted in game theory), this kind of classification may have problems and limitations when modeling the behaviors of human agents in the real world (Arthur, 1994, 406-411).

According to the problems discussed above, it seems that the different types of rationality that appeared in Weber's and other following works have provided little help for interpreting and predicting the behaviors of human agents. Nonetheless, before jumping to the ground for finding answers to resolve the problems, an important preliminary work that needs to be done is perhaps to get a further understanding about how rationality by itself can be defined and measured.

The Properties of Rationality

Much of the controversy and debate surrounding rationality is often derived from different definitions regarding what constitutes rationality, not in the fact of rationality itself. In the literature, rational behavior used to be attributed to one of the following three dimensions: utility-maximizing, information-processing, and expectation-forming.

Rationality as Utility-Maximizing

Neoclassical economics postulates an economic man who has a utility-maximizing orientation (Williamson, 1985). As delineated by Simon (1955, 99-118):

> This man is assumed to have knowledge of the relevant aspects of his environment which, if not absolutely complete, is at least impressively clear and voluminous. He is assumed also to have a well-organized and stable system of preferences, and a skill in computation that enables him to calculate, for the alternative courses of action that are available to him, which of these will permit him to reach the highest attainable point on his preference scale.

Simon (1955, 99-118) criticized the economic man assumption as unrealistic since human beings do not appear to have the ability to process a full range of relevant information for making optimal decisions in the real world. Instead, an agent can only make suboptimal choices that are satisficing rather than maximizing. As a result, people have incrementally shifted to regard satisficing as a more valid assumption than maximizing for delineating rational behavior (e.g., Becker & Chakrabarti, 2005, 63-83; e.g., de Boer, Gaytan, & Arroyo, 2006, 444-455).

Although Simon's argument is reasonable in the sense that human agents do encounter limitations when they intend to make optimal decisions, it may not be sufficient to completely reject the utility-maximizing assumption. As a matter of fact, given the constraints of human agents' available knowledge, even though it is not possible for them to obtain the optimal results, their desire for utility-maximizing should not be ignored. In other words, that human agents have the desire to maximize their utility does not necessarily imply that the desire can be actually realized under the cognitive limits of their ability (Perrow, 1986). Therefore, to assume that human agents have a maximizing orientation is not a matter of can or cannot, but a matter of will or will not. In this sense, the utility-maximizing assumption of rationality may be seen as an inherent property or nature, instead of the actual ability, of human beings.

Rationality as Information-Processing

To revise the utility-maximizing assumption of traditional economics, Simon (1955, 99-118) rejected omniscient rationality by articulating that human beings have limited cognitive ability to process information that only permits them to make choices within a set of limited alternatives. Specifically, in the case of facing a complex and uncertain environment, it becomes unlikely that a human agent can find the best answer for gaining an optimal payoff. To highlight the effect of bounded rationality, Simon (1981) firmly pointed out: "What a person cannot do what he will not do, no matter how much he wants to do" (p. 36).

Again, although human agents do have limited cognitive ability that prevent them from making optimal decisions, the information-processing model does not necessarily preclude the possibility that human agents tend to possess an inclination to maximize their interests. In effect, Simon (1976) himself also implicitly based his argument on the maximizing assumption and acknowledged: "Two persons, given the same skills, the same objectives and values, the same knowledge and inclination, can rationally decide only upon the same course of action" (p. 39). It appears that the controversy between Simon and traditional economists can be attributed to the different definitions about the property of rationality, with the former focusing his concern on human agents' abilities and the latter focusing on human agents' intentions. The information-processing model, therefore, may be seen as complementing rather than excluding the utility-maximizing model.

Despite the fact that the information-processing model does not provide sufficient reason to reject the utility-maximizing model, that it regards rationality as the ability of information-processing has undoubtedly provided valuable insights. First, it illuminates the possibility that different agents tend to have different levels of ability to process relevant information. Therefore, different degrees of rationality should be identified depending on the information-processing ability of individual agents. Second, it reminds us that the ability of a specific agent may change over time by gaining experiences and learning new knowledge in a dynamic environment (Agodi, 1991, 199-205). In this sense, the rationality of this agent may constantly shift its position on a continuum according to his or her available knowledge at different points in time (Ackoff, 1983, 719-722).

Rationality as Expectation-Forming

Utility-maximizing assumption usually encounters difficulties when the optimal result of an agent is dependent upon the actions adopted by other agents who keep on interacting with him or her in a dynamic complex system. To cope with these difficulties, rational expectations theory was proposed by using the maximization of human agents' subjective expected utility to replace utility maximization (Muth, 1961, 315-335; Simon, 1978, 1-16). According to Muth (1961, 315-335), expectations are "informed predictions of future events" which depend "specifically on the structure of the relevant system" (p. 316). In addition, although no agent can be perfectly informed regarding either the future state or even the current state, human agents tend to make decisions and behave accordingly on the basis of their expectations and some underlying theory (Frydman, O'Driscoll, & Schotter, 1982, 311-319).

In spite of the critique that rational expectations theory tends to pass over rather than solving the problems of defining optimal behavior (Simon, 1978, 1-16), it has shed new light on the study of rationality in two ways. On the one hand, it has highlighted the dynamics of expectations as well as rationality. As asserted by Muth (1961, 315-335), "[E]xpectations would change when either the amount of available information or the structure of the system is changed." Therefore, it permits human agents to improve their predictions by learning and gaining information related to the situations of the system (DeCanio, 1979, 47-57). On the other hand, it points out the fact that many agents simultaneously exist in a system and that human agents rarely make decisions in an isolated environment. As described by Lucas (1975, 1113-1144), since agents diffuse through the system and each of them may possess different amount of information in hand, they tend to make decisions according to the posterior informational state as well as the agent's speculation about the expectations of other agents. An interaction effect is always present in a complex dynamic system and the structure of the system will be determined not only by the behavior of a specific agent but also by the behaviors of other agents. In this sense, rationality should be seen as a relative rather than an absolute concept. Rationality, therefore, is not a matter of whether the action taken by a specific agent will lead to the optimal result, but a matter of what kind of actions will be taken by different agents in the system and what effects the actions will produce on the system as a whole.

According to the above discussions, we may conclude that human beings by nature intend to arrive at a decision that is able to maximize their utility or interest. However, under the cognitive limit of collecting perfect information and making accurate calculations, they tend to form expectations on the basis of available information or knowledge already in hand. Then, the decisions that they believe will lead to the best results are made and related actions are taken so as to attain the results they have anticipated. To investigate the concept of rationality may need to include all the three properties stated above so that we can concentrate our attention to the behavior of human beings while avoiding the endless debate about the definitions of rationality.

Rationality in Dynamic Situations

Based on the assumption that human agents are heterogeneous in terms of information-processing and expectation-forming abilities, Haltiwanger & Waldman (1985, 326-340) suggest that there exist two types of agents—sophisticated and naïve. The former tend to have correct or rational expectations, while the latter often have incorrect expectations. Moreover, sophisticated agents have a disproportionately large effect on equilibrium when more of them choose the same path that may exhaust the limited resources of a system, hence results in a tragedy of the commons. On the other hand, in situations that the more agents who make the same decisions, the better off they will become, the presence of many naïve agents who do not choose the correct path tends to have disproportionately large effect on equilibrium. The two situations which exhibit the properties as stated above are denoted as congestion effects and synergistic effects, respectively. Although it seems that the reasoning of Haltiwanger and Waldman is logically correct, whether an expectation is correct (i.e., rational) or incorrect may deserve further discussion.

First, sophisticated agents are defined as having correct expectations that will lead to correct decisions. However, whether an expectation is a correct one should be dependent upon the result it generates. In other words, only if the result shows that the action taken by an agent makes him/her better off, can we then conclude that the expectation is correct, or rational. In contrast, if the result displays a negative effect to the agent, we may consider the expectation as incorrect. Although this kind of reasoning may be criticized as a kind of result-oriented hindsight, it is not uncommon that we usually are not so certain about the correctness of our expectations beforehand, particularly in a dynamic complex system where congestion effects are present. In this sense, Haltiwanger and Waldman (1985, 326-340) also acknowledge that assuming rational expectations in situations exhibiting congestion effects may need justifications.

Second, it is assumed that sophisticated agents who have correct expectations will always behave correspondingly, therefore making themselves better off in situations exhibiting synergistic effects. This assumption, however, may depend on what they think the other agents will choose their path (Lucas, 1975, 1113-1144). In other words, although a sophisticated agent considers the other agents to be rational and expects them to take correct actions in a collaborative effort, he or she may choose to betray so as to increase his or her own benefit, at least in the short run. As a result, the other sophisticated agents may become worse off due to the betrayal of this agent. This scenario is quite familiar to many people given that opportunism is often a nature of, at least some, human agents. As has been pointed out by Williamson (1985), "It is not necessary…that all parties be given to opportunism in identical degree.…[But] were it not for opportunism, all behavior could be rule governed."

Finally, Haltiwanger and Waldman (1985, 326-340) assume that agents do not learn to adapt to the situations contrary to their expectations by arguing that many economic situations are not repeated. Moreover, even though many situations do repeat, there are still a proportion of agents who have no previous experience with the situations. However, since there are also some situations that human agents do learn from their daily experiences in the real world (Arthur, 1991, 353-359, 1994, 406-411), the applicability of this model to complex dynamic situations in real life may inevitably encounter difficulties.

To illuminate the concerns stated above, the following discussions will focus on the overgrazing behavior that has been found in the National Health Insurance System in Taiwan.

OVERGRAZING BEHAVIOR AND COMMON PROPERTY RESOURCES

The term “overgrazing” has been widely used in the literature of various fields. A significant number of studies, particularly in the fields of ecology, biology, land economics, and agricultural economics, have focused on exploring the problems, causes, and effects of overgrazing. Nevertheless, most publications tend to consider overgrazing as an irrational and problematic phenomenon that needs to be properly controlled and inhibited so as to avoid further land degradation and environmental deterioration. Rarely, if any, are there discussions regarding the rationale of overgrazing behavior in the sense that it may be rational or irrational, and under what circumstances.

In the following sections, I will first provide an overview of overgrazing behavior, followed by illustrating the payment structure and its effects on the behavior of the medical care institutions of the NHI system in Taiwan. Then, the overgrazing behavior and coping strategies currently adopted are discussed.

An Overview of Overgrazing Behavior

Overgrazing that often results in a tragedy of the commons is not a unique phenomenon restricted only to the behaviors of herdsmen as Hardin (1968, 1243-1248) has described. Rather, it has been related to “a number of current social and environmental problems such as the overharvesting of trees, the exploitation of whales, underusage of public transportation, and air and water pollution” (Fusco, Bell, Jorgensen, & Smith, 1991, 61-74).

Originally, overgrazing refers to situations where livestock density grows beyond the carrying capacity of a rangeland. Overgrazing occurs when grazing rates exceed the production rates of vegetation in the rangeland (Rowntree, Duma, Kakembo, & Thornes, 2004, 203-214). According to Libecap (1981, 151-158) and Johnson and Libecap (1980, 332-347), overgrazing is a result derived from the presence of common property rights without a formal allocation of rangeland. In general, when resources are commonly held and the exploitation of the resources by self-interested individuals is not properly regulated, overexploitation of resources is usually inevitable. As a result, overgrazing may lead to the exhaustion of resources and the inexorabe collapse of the system on which the individuals depend for gaining their benefits and living (Aquino & Reed, 1998, 390-413; Gardiner, 2001, 387-416; Hardin, 1968, 1243-1248).

In a common resource pool where overgrazing behavior is highly likely to occur, gaining cooperation from the agents in the system becomes extremely important for maintaining the sustainability of the system (Aquino & Reed, 1998, 390-413; de Janvry, McCarthy, & Sadoulet, 1998, 658-664). To motivate cooperative behavior that helps alleviate the problems of overgrazing, it is suggested that coercion and the provision of selective incentives can be two feasible strategies (Obach, 2003, 312-318). On the one hand, by means of implementing regulatory policies accompanied with intensive monitoring, it is hoped that the overgrazing behavior can be deterred. On the other hand, policies providing additional payoffs are used to change people's attitudes about overgrazing and increase their willingness to cooperate.

Whereas coercion requires effectively monitoring the behavior of myriads of agents in the system, regulatory policies that are not supported by sufficient financial and human resources will be doomed to failure (Grafton, 2000, 504-517). Using selective incentives without an in-depth understanding about the motives of the people, on the other hand, will not meet their needs or arrive at any positive results. To the contrary, it may be very possible that the provision of inappropriate incentives will tend to exacerbate the problem of overgrazing (Doran, Low, & Kemp, 1979, 41-47).

Although cooperation seems to be the best policy for sustaining the whole system, and many community members do voluntarily behave in a cooperative way, it is also not uncommon that there are always some individuals who choose to overgraze so as to maximize their own gains (Dawes & Thaler, 1988, 187-197; Obach, 2003, 312-318). There are two reasons for making such a choice. First, since the effects of overgrazing will be shared by all the community members, it is individually rational to leave the negative externality on others as long as the overgrazing behavior is not caught and punished (de Janvry et al., 1998, 658-664; Gardiner, 2001, 387-416). Second, according to the partial compliance assumption, a free rider effect often exists when the majority chooses to be self-restrained and a small proportion of the community members who overgraze do not produce so great a negative effect as to determine the fate of the whole system (Gardiner, 2001, 387-416; Obach, 2003, 312-318).

As a matter of fact, in situations accompanied by high uncertainty regarding the future availability of the resource, gaining a share now is more promising and better preferred than waiting for uncertain future gains (Aquino & Reed, 1998, 390-413). In addition, it is also argued that natural selection tends to select out those individuals who are more self-restrained in exploiting a commons in accordance with their conscience (Hardin, 1968, 1243-1248). Therefore, it often appears that overgrazing instead of self-restraint is the dominant incentive of the people in a social dilemma (Dawes, 1980, 169-193).

Overgrazing Behavior in the National Health Insurance System

The NHI system of Taiwan was inaugurated in 1995. By integrating three major social health insurance programs and extending the program to cover the previously uninsured population, the NHI system includes almost all people (i.e., 98.29% in 2006) in Taiwan as its beneficiaries (i.e., the insured and his/her dependents). In addition, approximately 97% of the medical care providers have become the contracted medical care institutions except those which provide medical service items not covered by the NHI (e.g., the treatment of drug addiction, cosmetic surgery, artificial reproduction, etc.) or those which have built up a good reputation so that the patients are willing to pay the medical expenses by themselves.

The Structure of the Medical Care Payment

In the first three years, the contracted medical care institutions of the NHI system were paid according to a retrospective fee-for-service method on the basis of a negotiated fixed-fee reimbursement schedule. That is, the contracted medical care institutions were reimbursed every month according to the service expenses claimed by them (Lee & Jones, 2004, 307-326). Since fee-for-service payment tends to encourage oversupply and a supplier-induced demand, the medical care agents are often induced to increase the quantity of services, to provide unnecessary treatment, or worse, to commit the fraudulent upcoding of visits. Retrospective payment, on the other hand, tends to result in input-intensive, gold-plated services that encourage resource consumption (Robinson, 2001, 149-177). As a result, it would not be surprising for the NHI system to incur a drastic inflationary expenditure during the first three years after the installation of the retrospective fee-for-service payment mechanism.

To cope with the rapid growth in medical care expenditure (i.e., an average growth rate of 18.6% per year) from 1995 to 1998, the Bureau of National Health Insurance (BNHI) decided to implement global budgeting as a strategy for containing its costs. Under the global budget, the total amount of medical care expenditures is determined annually prior to the commencement of each fiscal year by the Negotiation Committee for Medical Expenses. In addition, the annual amount of medical care expenditures is adjusted according to changes in the population, demographic composition, and the inflation rate on the basis of medical payments the previous year. The method of determining medical care expenditures, therefore, carries the feature of a prospective form of payment that can be used as an effective financial antidote to attenuate the rapid growth of the medical care expenditure (Lee & Jones, 2004, 307-326; Robinson, 2001, 149-177). With the introduction of global budgets, although the average growth rate of the medical care expenditures has been held to about 5% every year, some other problems resulting from fee-for-service payment still remain.

Unlike the global budgets in other countries which reimburse medical care providers based upon the services provided and the corresponding amount of money claimed, the unit price of the medical services in Taiwan is retrospectively determined by means of ex-post pricing (Lee & Jones, 2004, 307-326). In other words, a relative point value is calculated by dividing the ex-ante determined budget cap with the total points of service claimed by the contracted medical care institutions.

Ideally, the relative point value is expected to equal 1 New Taiwan (NT) dollar per point. However, since the lump-sum expenditure per year is independent from the amount of services provided, it can be that the less the total points of service claimed by the medical care institutions, the greater will be the relative point value. By contrast, it can also be that the greater the total points of service, the smaller the relative point value will become. Being designed in this way, the global budget in the NHI system of Taiwan has a feature of blending a prospective form of payment with fee-for-service mechanism (Lee & Jones, 2004, 307-326). The effects of this payment structure on the behaviors of the medical care providers are discussed below.

The Behaviors of the Medical Care Institutions

The primary concern of implementing global budgets usually focuses on cost-containment so as to control the growth of medical care expenditures over time. Nevertheless, it has been found that a capped global budget combined with the fee-for-service payment is analogous to a common property resource (Hurley & Card, 1996, 1161-1168). Under this form of prospective fee-for-service reimbursement, the income of any individual medical care provider is inevitably affected by the collective action of other providers (Hurley, Lomas, & Goldsmith, 1997, 343-364; Lee & Jones, 2004, 307-326). A spreadsheet simulation can be used to illustrate the interactive effects on the income of the medical care providers in the NHI system.

In the spreadsheet simulation, it is assumed that the global cap is $1,000. In addition, it is assumed that there are 10 medical care agents, and each of them claims 100 points of service. The total points claimed therefore would be 1,000. As shown in Table 1, when all agents are cooperative with none of them make extra points of claim, the relative point value equals $1.00, and the percentage loss to them is 0. However, if a specific agent claims 10 more points to increase its income, the relative point value will drop to $0.99. As a result, the income of the overgrazing agent increases 8.91%, whereas each of the cooperative agents will encounter a loss of 0.99% of its income. When nine individual agents claim 10 extra points of service, the total points become 1,090, and the loss of the cooperative agent increases to 8.26%, while the income of each overgrazing agent only increases 0.92%.

The worst situation happens if all the agents decide to graze the medical commons by claiming 10 extra points respectively. As shown in the fourth row of Table 1, none of the agents can earn more than $100, whereas everyone has to incur a greater cost in terms of providing more services but receiving the payment with a smaller relative point value (i.e., $0.91). In contrast, if all the agents have made an undersupply decision by decreasing the quantity of their services to 80 points each, the total points claimed will drop to 800 with a relative point value equaling to $1.25. In this case, although the income of every cooperative agent remains unchanged, they are better off in the sense that all of them can work less while maintaining the same level of income.

Table 1 The Effects of Global Budgets on the Income of Medical Care Providers

Total Points Claimed	Relative Point Value	Income of Each Cooperative Agent	Income of Each Overgrazing Agent
1,000	$1.00	$100.00 (0%)	—
1,010	$0.99	$ 99.01 (-0.99%)	$108.91 (8.91%)
1,090	$0.92	$ 91.74 (-8.26%)	$100.92 (0.92%)
1,100	$0.91	—	$100.00 (0%)
800	$1.25	$100.00 (0%)	—

The results of the above simulation indicate that the behavior of the medical care institutions can be threefold. First, all the medical care institutions may reach a consensus and work cooperatively to provide an adequate quantity of service so that everyone would receive a fair share of the total payment. Second, some institutions tend to be more opportunistic and gain more by not restraining their quantity of service. The other institutions which do restrain their service quantity will incur certain losses because of a lower relative point value resulting from the behavior of those overgrazing institutions. Finally, all the medical care institutions may cooperatively decide to provide services at a lower level of quantity so as to enjoy the benefit of undersupply without sacrificing their income.

In reality, all the three types of behavior have been present in the NHI system in Taiwan. As shown in Table 2, the relative point values of the four forms of medical care institutions vary between 0.70 and 1.30, and some of them are close to 1.00. For those relative point values close to 1.00, it may imply that the related medical care institutions tend to behave cooperatively in a more self-restrained manner. A relative point value greater than 1.00, on the other hand, tends to indicate that there has been an undersupply of medical services based on the consensus of the medical care institutions. In contrast, a smaller relative point value below 1.00 may suggest that the involved medical care institutions are more likely to overgraze the clinical commons.

Among the three types of medical care behavior, the ideal type is of course the cooperative and self-restrained one that leads to a relative point value close to 1.00. The problem of undersupply can be easily remedied by decreasing the amount of the budget in the next year. The overgrazing behavior, however, has been a tight spot for the BNHI to resolve with limited achievement. The constitution of the overgrazing behavior in the NHI system and the coping strategies of the BNHI are discussed in the next section.

The Overgrazing Behavior and Its Coping Strategies

A global budget blended with a fee-for-service payment tends to create a strategic game among medical care institutions that often inevitably results in overgrazing behavior (Hurley & Card, 1996, 1161-1168; Hurley et al., 1997, 343-364; Robinson, 2001, 149-177). The overgrazing behavior in the NHI system of Taiwan can be divided into three forms—over-utilization, the provision of unnecessary treatment, and upcoding.

Over-utilization exists when an individual physician increases the number of visits to the point that an appropriate level of medical care service is exceeded. Since the average time per visit is shortened, the quality of the medical services provided may decrease correspondingly. The provision of unnecessary treatment, on the other hand, includes encouraging return visits, referring to excess examinations or tests, persuading the patients to accept non-essential injections, etc. Finally, upcoding implies those fraudulent activities such as the intentional misuse of higher diagnosis codes for an illegal upcharge and making spurious or false claims. To the extent that all these overgrazing behaviors are not effectively controlled, they may aggravate the depletion of the medical commons, which in turn deteriorates the predicament of resource scarcity and even impairs the sustainability of the NHI system.

Table 2 The Relative Point Values in the NHI System

Year	Dental Institutions	Chinese Medicine Institutions	Physician Clinics	Hospitals
1998				
Q3	0.9714			
Q4	0.9925			
1999				
Q1	0.9823			
Q2	1.0207	N/A		
Q3	1.0223			
Q4	0.9996			
2000				
Q1	0.9801		N/A	
Q2	1.0597			
Q3	0.9862	1.1627		
Q4	0.9966	1.1210		N/A
2001				
Q1	0.8984	1.2983		
Q2	0.9724	1.1466		
Q3	0.9898	1.1966	1.2510	
Q4	0.9598	1.0439	1.0650	
2002				
Q1	0.9613	1.1239	1.0710	
Q2	0.9933	0.9490	0.9876	
Q3	1.0114	0.9949	1.0016	0.9474
Q4	0.9933	0.9877	1.0075	0.9098
2003				
Q1	0.9603	0.9885	0.9305	0.8615*
Q2	1.0190	0.9588	1.0859	0.8615*
Q3	1.0098	0.9011	1.0231	0.8615*
Q4	1.0384	0.9120	0.8641	0.8615*
2004				
Q1	0.9445	1.0021	0.8738	0.8083
Q2	0.9591	0.8522	0.8870	0.7988
Q3	0.9926	0.8129	0.8129	0.7081
Q4	0.9535	0.8339	0.7656	0.6998
2005				
Q1	0.9555	0.9466	0.7437	0.8201
Q2	0.9763	0.8757	0.7766	0.8482
Q3	1.0204	0.9232	0.8199	0.8351
Q4	1.0124	0.9991	0.8224	0.8338
2006				
Q1	0.9596	1.0634	0.8519	0.8800
Q2	0.9911	0.9951	0.9077	0.8935
Q3	1.0106	0.9303	0.8670	0.8786
Q4	0.9983	1.0007	0.8913	0.9022

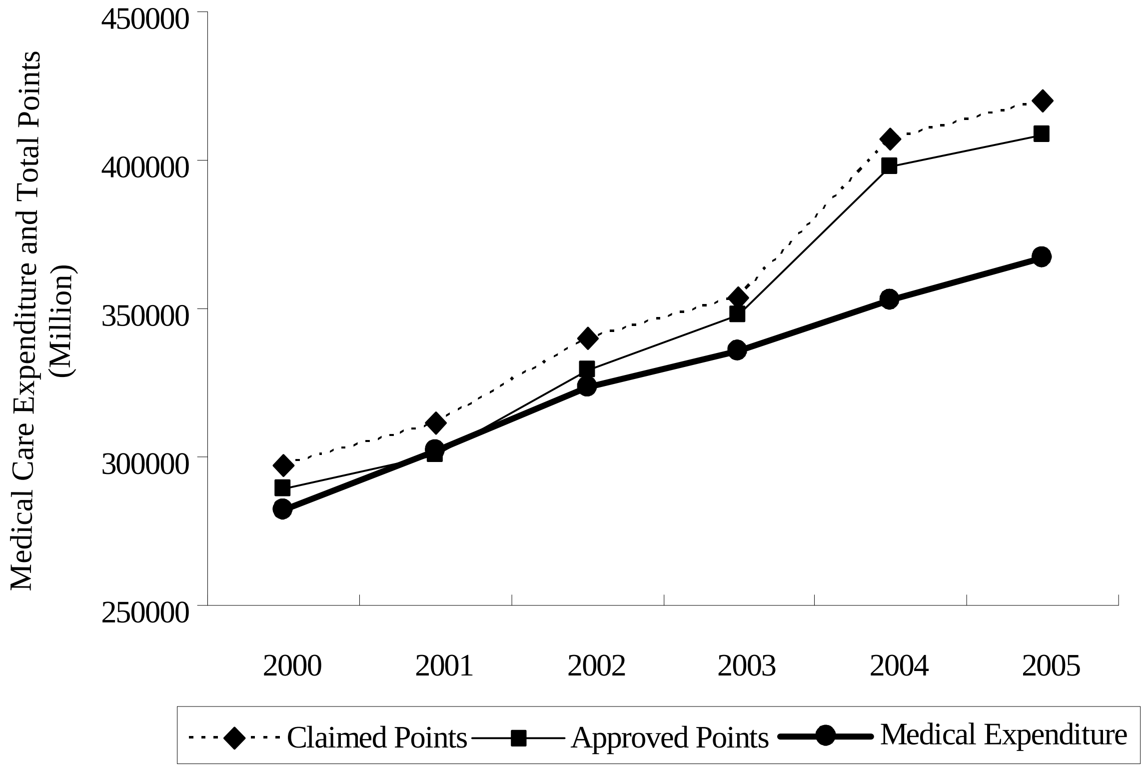
Source: Department of Health, Executive Yuan, Taiwan

To cope with overgrazing behaviors, the BNHI has implemented a series of strategies based on the experiences of other countries. On the one hand, since resource scarcity tends to induce overgrazing behavior, setting a resource replenishment rate closer to the need of the agents may reduce their incentives to overgraze (Aquino & Reed, 1998, 390-413; de Janvry et al., 1998, 658-664). Based on this assumption, the annual medical care expenditure was negotiated to increase at an average growth rate of about 5% from 2000 to 2005. However, according to the opinions of the medical care institutions, an ideal expenditure growth rate should be no less than 10% per year. It is unlikely that a 5% growth of the expenditure can effectively eliminate the problem of resource scarcity. Therefore, all the medical care institutions still need to compete with each other to gain sufficient shares. This tendency can be found in Figure 1 in the sense that there always exists a gap between the claimed points and medical care expenditures.

On the other hand, it is suggested that cooperation is greater when resources are distributed more equally (Aquino & Reed, 1998, 390-413). Monitoring the behavior of the agents and the enforcement of the rules of the game are particularly important for guaranteeing the equal distribution of resources (Grafton, 2000, 504-517). To put the medical care service under effective control, the strategies that the BNHI has implemented include utilization review, physician profile analyses, tariff control, individual billing thresholds, admission growth, and on-site investigation. By means of carrying out these strategies, the BNHI intends to eliminate, or at least to effectively reduce, the overgrazing behaviors of the contracted medical care institutions.

As exhibited in Figure 1, both the claimed points and the approved points were increasing in a corresponding manner. With the exception of 2001 when the approved points are approximately the same as medical care expenditures, the growing trend of these two values suggests that the regulatory strategies did not produce the expected effects. It also implies that the overgrazing behaviors will not disappear when an external regulatory power armed with sufficient financial and human resources is lacking. Since it is apparent that everyone will become worse off once the NHI system collapses by the ever-growing overgrazing behaviors, the reasons why so many rational medical care agents still tend to make such seemingly irrational overgrazing decisions would be worthwhile for further examination.

Figure 1 The Growth of the Medical Care Expenditure and the Points Claimed and Approved from 2000 to 2005



THE RATIONALE OF OVERGRAZING BEHAVIOR

Rationality is seen as a property of human agents. People make judgments about the behaviors of other people on this basis. This viewpoint, however, may not provide much help for interpreting the rationale behind a decision when two or more purposeful agents or systems interact in a dynamic way (Ackoff, 1983, 719-722).

For instance, given the assumption that human agents intend to maximize their utility based on self-interest, and that some agents are opportunistic and tend to seek self-interest with guile (Williamson, 1987), at least two types of medical care agents can be identified in the NHI system. The first group appears to be more self-restrained and cooperative for the sake of sustaining the system. The second group, on the other hand, tends to overgraze the medical commons opportunistically with little care about the sustainability of the NHI system. If the scenario ends here, we can easily draw a conclusion that the former is rational and the latter irrational. Otherwise, we may also speculate that the two groups display contradictory behaviors because their instrumental values differ despite that they may possess the same terminal value. Or, in Weber's terms, the two groups of agents have the same substantive rationality but different instrumental rationality.

Nonetheless, along with the development of the scenario, it is found that some agents who were self-restrained may change their mind to join the overgrazing group at a later stage. By contrast, some agents who were in the overgrazing group may become self-restrained when necessary. Should the same agents who have made opposite decisions at different points in time be seen as both rational and irrational? According to the concept of rationality, what would be a reasonable explanation for distinguishing this kind of shifting back and forth between self-restrained and overgrazing behaviors?

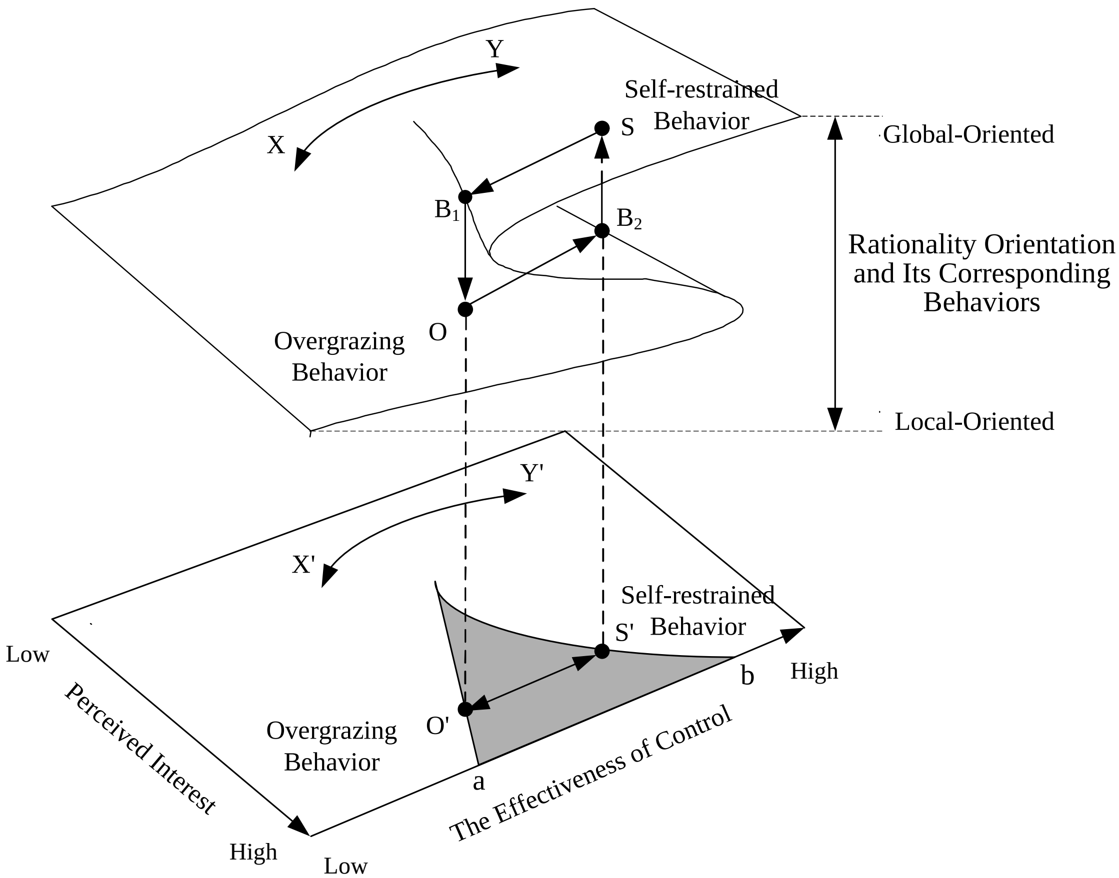
Regarding the phenomenon described above, Ackoff (1983, 719-722) has provided another perspective by arguing that rationality-irrationality should not be considered as a dichotomy or contradictory qualities, but as a choice among different models from which corresponding behaviors are derived. On the basis of Ackoff's argument, the concept of rationality will be further examined with a catastrophe model that illustrates the rationale of the behavior of individual agents and a causal loop diagram that provides explanations to infer the overgrazing behavior as a product of individual opportunism as well as collective interactions.

A Catastrophe Model of Overgrazing Behavior

Catastrophe theory was developed in the late 1960s. Based on topology, it is claimed that catastrophe theory is capable of providing a universal method for studying jump transitions, discontinuities, and sudden qualitative changes in dynamic systems (Arnol'd, 1992). Among the seven elementary catastrophes (i.e., the fold, the cusp, the swallowtail, the elliptic umbilic, the hyperbolic umbilic, the butterfly, and the parabolic umbilic) that can be used to describe the discontinuous changes of phenomena (Zeeman, 1977), the cusp catastrophe, which is the most commonly applied one (Kauffman & Olive, 1994, 206-221), is selected for illuminating the rationale of the overgrazing behavior in the NHI system.

The cusp catastrophe displays the following five typical properties: bimodality, sudden jumps, hysteresis, divergence, and inaccessibility (Flay, 1978, 335-350; Saunders, 1980). Moreover, two sets of variables are used in the cusp catastrophe. The state variable is the one that demonstrates the states of the system. The control variables are those that govern the evolution of the system (Saunders, 1980; Wildgen, 1982). According to the above definitions, the rationality orientation and its corresponding behaviors are the state variable which delineates whether the rationality of a specific agent and his or her behavior is global-oriented or local-oriented. An agent with global-oriented rationality tends to generate self-restrained behavior, whereas an agent with local-oriented rationality tends to display overgrazing behavior. On the other hand, the two control variables are perceived interest (i.e., the splitting factor) and the effectiveness of control (i.e., the normal factor) which jointly determine the behavior of a specific agent (Zeeman, 1977). The nonlinear relationships among these variables are exhibited in Figures 2.

Figures 2 The Dynamics of Rationality and Its Corresponding Behaviors



As shown in Figures 2, the unfolding surface is projected onto the plane under it. The trajectory of behavioral change on the unfolding surface is identically demonstrated on the plane. The line between points X and Y indicates that when the perceived interest is relatively low, the behavior of a specific agent changes smoothly and proportionally with the changes of the effectiveness of control. If the effectiveness of control increases as a result of intensive utilization reviews, physician profile analyses, and on-site investigations, the medical care agents would behave in a more self-restrained way and display a greater degree of compliance with the rules. In the reverse situation, when the effectiveness of control decreases, overgrazing behaviors would increase as long as it is safe to do so.

When the perceived interest increases to the extent that a bifurcation occurs, the surface splits into two parts. The lower part is a state corresponding to local-oriented rationality where overgrazing behavior dominates, while the higher part represents the state of self-restrained behavior derived from global-oriented rationality. Both these two states are structurally stable in the sense that the medical care agents would prefer to stay in the current state until they find that the current state has disappeared due to a drastic change in the effectiveness of control. For example, as the perceived interest of a specific medical care agent increases to the greatest degree, only when the value of the effectiveness of control is greater than b (i.e., the point at the right side of the shaded region), will this agent become self-restrained. By contrast, once the value of the effectiveness of control is less than a (i.e., the point at the left side of the shaded region), this agent will overgraze the medical commons with little concern for the welfare of other agents.

On the other hand, the shaded region on the plane is the inaccessible area where any behavior shift is unlikely to occur. B_1 and B_2 represent two bifurcation points where dramatic behavioral changes may occur. When an agent who had been self-restrained (denoted as point S) discovered that the overgrazing behaviors of other agents were growing as a result of the decreasing effectiveness of control reflected by the small relative point value of the prior period, his or her behavior would shift toward point B_1 and abruptly fell to point O at B_1. At point O, the behavior of this agent will be dominated by overgrazing so as to keep his or her interest at the maximum level as he or she desires. Conversely, once an agent enjoys the interest received in the overgrazing state (i.e., point O), this agent is unlikely to change his or her behavior unless the effectiveness of control can be raised to the level beyond point B_2. At B_2, a trivial increase of the effectiveness of control will produce a sudden jump of the behavior of this agent from B_2 to point S. At point S, self-restrained behavior becomes the dominant pattern of the agent.

Although the above analysis is theoretically plausible in the sense that there seems to exist an equal probability that an agent tend to choose between overgrazing behavior and self-restrained behavior, the speculation may not be flawless in the real world. In effect, since the highest relative point value that a self-restrained agent can earn is not likely to be greater than 1.0 under BNHI's regulation, whereas an overgrazing agent can always earn more than his or her share of the global budget as long as the majority of the medical care agents are self-restrained, then the benefit of continuing to overgraze the commons is usually greater than self-restraint. Therefore, there exists an asymmetry of the perceived interest between the two states of overgrazing and self-restraint. Shifting from self-restraint to overgrazing is easier than the reverse. However, both overgrazing and self-restrained behaviors are rational in terms of seeking to improve one's own interest as well as the probability of individual survival. The only difference is perhaps that the rationality of the former tends to be local-oriented with a free-rider propensity, while the rationality of the latter puts greater weight on the sustainability of the system in which the agent considers his or her interest and survivability to be embedded.

Although the catastrophic analysis is helpful for illuminating the behavioral changes of the medical care agents, it inevitably encounters limitations when we try to explain the reason why some agents who had regarded sustainability of the system as crucial to their interest would switch to overgrazing even though they were fully aware that collective overgrazing behavior might lead to the collapse of the system. Since everyone embedded in the system will be worse off once the system collapses, the decision process of the agents who turn from global-oriented rationality to local-oriented rationality may be of great interest to explore. This issue will be discussed in the next section.

A System Dynamics Analysis of Overgrazing Behavior

In the literature, many scholars have analyzed the behaviors of overgrazing and cooperation from a prisoner's dilemma perspective (Aquino & Reed, 1998, 390-413;

Gardiner, 2001, 387-416). Moreover, in the discipline of economics, scholars usually assume that human agents are essentially self-interested and therefore expect others to defect in social dilemmas. As a result, human agents, as selfish rational fools, tend to act according to their expectations about other agents and egoistic payoffs in social dilemmas despite the fact that their choices may lead to suboptimal outcomes for all involved (Dawes & Thaler, 1988, 187-197; Frank, Gilovich, & Regan, 1993, 159-171, 1996, 187-192).

The rational fool postulate, however, is criticized as an oversimplified model that does not always hold in real social settings that are more sophisticated (Agodi, 1991, 199-205; Dawes & Thaler, 1988, 187-197). For instance, no matter whether in single or multi-trial experiments, it was found that not everyone tended to free ride in situations of making contributions to the public good. In addition, even in finite games where both parties acting as rational players were assumed to have sufficient reason to defect on the last trial, the research findings did not completely support this speculation since cooperation never fell to zero (Dawes & Thaler, 1988, 187-197). For this reason, the assumption that human agents tended only to be rational fools is considered inappropriate, thus should be rejected.

The research findings stated above are plausible and convincing only to the extent that not all human agents are rational fools. Yet, neither do the findings exclude the fact that some people do defect either at the beginning of the game because of their opportunistic nature, or after some repetitions when they have learned something from prior trials. Therefore, the counter-argument that there are always some agents who will free ride is also true. Moreover, most of the research findings are derived primarily from laboratory experiments. Since the stake provided in the laboratory settings has been usually five to ten dollars which is trivial to the subjects, the payoffs of the subjects is insignificant relative to the payoffs of the people who are striving for subsistence in similar social dilemmas. To generalize the research findings to the real world may not be adequate.

On the other hand, TIT-FOT-TAT has been shown as a widely used strategy to retaliate against defectors in infinitely repeated prisoner's dilemma games. However, since adopting the TIT-FOR-TAT strategy tends to punish the cooperators instead of the defectors in a multiparty context, it is unlikely that any rational player will use this strategy for the purpose of retaliation (Aquino & Reed, 1998, 390-413; Dawes & Thaler, 1988, 187-197). This argument, although logically correct, does not suffice to rule out the possibility that human agents will do whatever they think is necessary to protect their own interest. After all, the defection, or overgrazing, of any individual agent has only a small marginal effect on the whole system. Furthermore, as long as everyone in the system overgrazes, no one will complain to be harmed by others, at least at the present moment (Gardiner, 2001, 387-416).

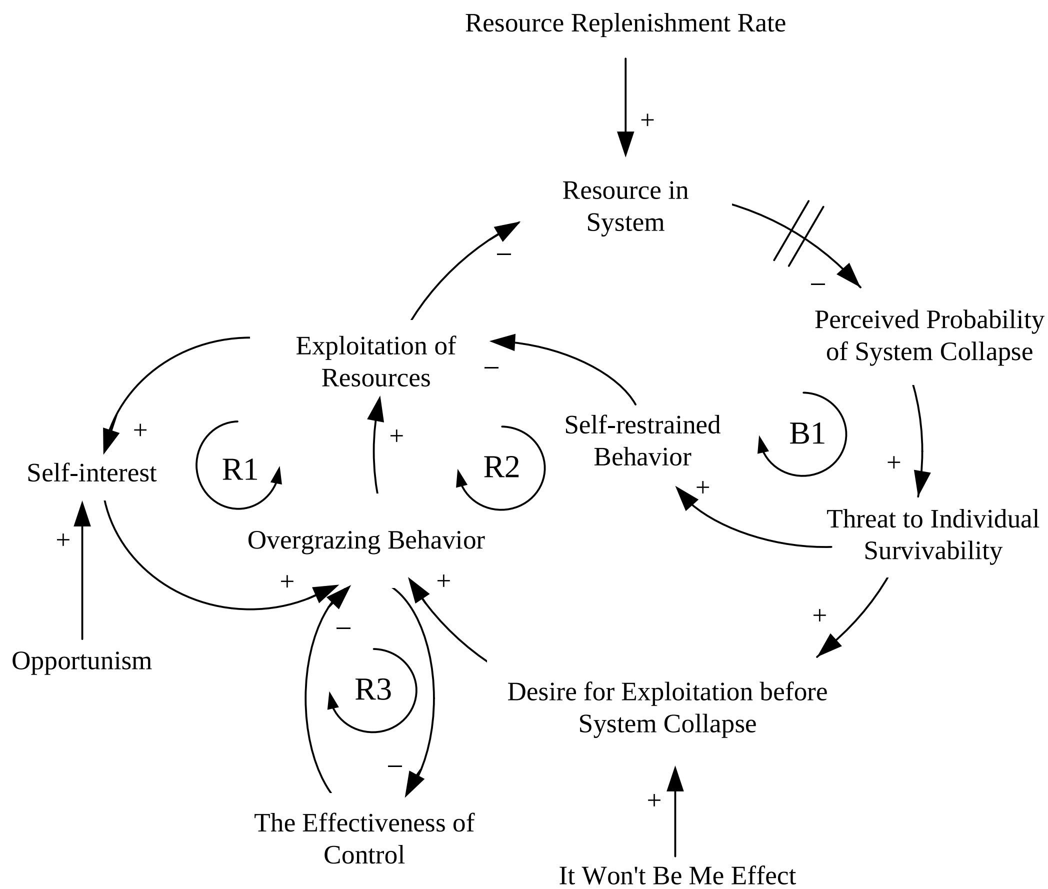
While it is controversial and unclear whether human agents tend to be cooperators or defectors, an important fact that should not be ignored is the tacit presumption that every player will stay in the system until the end of the game. Even in the single trial experiments, it was still assumed that the system would be sustained and it might be possible for the players to play the game again some other time. This presumption, however, may not hold when there are chances for some, albeit not all, of the players to jump out of the system at their own will. In effect, as Gardiner (2001, 387-416) has argued to enlighten the intergenerational issue concerning overpollution, "It is collectively rational for most generations to cooperate…[but] individually rational for all generations not to cooperate" since repeated interaction and mutual benefit between present and future generations do not exist. As rational beings, the best choice for the present generation is to exploit the commons as much as they can and leave the problem to future generations (pp. 404-405). This argument implicitly implies that the present generation cares little about the consequences of overexploitation because they may have already jumped out of the system (i.e., passed away) when the crisis of system collapse really happens.

Taking into account the possibility of jumping out of the system, the overgrazing behavior of medical care agents in the NHI system can be interpreted with the causal loop diagram below. As shown in Figure 3, there are four feedback loops in the system. The reinforcing loop R1 on the left describes the fact that there are always some agents who are opportunistic by nature and intend to increase their self-interest by means of exploiting the resources in the medical commons. If the effectiveness of control is high, the intention to overgraze resulted from opportunism may be effectively deterred. However, as has been discussed previously, the overgrazing behavior in the NHI system of Taiwan has continuously increased despite the BNHI implementing a series of coping strategies. Therefore, some other factors that may cause the deterioration of overgrazing should be further examined. The rationale behind the behavior dynamics is illustrated by the balancing loop B1 and the reinforcing loops R2 and R3.

Since the replenishment rate of medical care expenditures has been approximately 5% per year, which is considered insufficient for satisfying the need of the medical care institutions, resource scarcity in the NHI system is apparent. Worse, the only way for the BNHI to keep medical care expenditures growing at an annual growth rate of 5% is to raise the premiums, and this has become more and more difficult since the real income of the people in Taiwan is decreasing due to inflation and deterioration of the economy. Therefore, some people have pessimistically predicted that the collapse of the NHI system may occur once a significant number of the insured cannot afford to pay their premiums.

As the feedback loop B1 indicates, when the resource in the NHI system is abundant, the perceived probability of system collapse will be low. By contrast, despite that there is a time lag between resource scarcity and the perception of the agents, the decrease of the resource tends to boost the perceived probability of system collapse, and this perception will in turn lead to a higher degree of threat to the survival of individual medical care agents. If the threat to the medical care agents is perceived as moderate, they may tend to cooperate by displaying self-restrained behavior and engaging in less exploitation so as to sustain the system on which they depend for earning their living. On the other hand, as indicated by the reinforcing loop R2, once the medical care agents perceive the threat to their survivability to be high, an "it won't be me" effect may be activated that denotes the agents' fears and a desire to grab as much of the resource as possible with the expectation to leave the system prior to system collapse. Once the "it won't be me" effect appears, a bifurcation of the behavior of the agents may occur. That is, the desire for exploitation before system collapse may incrementally become a dominant incentive, which subsequently leads to a greater level of overgrazing behavior. As a result, as the reinforcing loop R3 indicates, the increase of overgrazing behavior will lower the effectiveness of control, which in turn exacerbates overgrazing and makes loop R3 a vicious circle.

Figure 3 The Causal Loop Diagram of Overgrazing Behavior and System Sustainability



According to the scenario described above, the conclusion that the motive of greed has greater effects than the motive of fear on free-riding behaviors derived from the experiment of Dawes & Thaler (1988, 187-197) may need to be reconsidered. In the NHI system of Taiwan, it has been found that while the motive of greed may be a dominant factor for overgrazing under normal circumstances, the fear of the agents regarding their threatened subsistence can be a more powerful factor for explaining ever-growing overgrazing behaviors. Once the "it won't me effect" is activated and the vicious circles R2 and R3 appear, the eventual collapse of the system seems inevitable.

CONCLUSION

Rationality can be either global-oriented or local-oriented, or any blended form between these two extremes. Correspondingly, the behavior of agents can be self-restraint or overgrazing, or a mixture of the two. Moreover, in dynamic situations, the rationality orientation as well as the behavior of agents may change in accordance with feedback from the environment over time.

In line with the logic stated above, the research findings indicate that medical care agents tend to continuously reassess the state of the NHI system based on the changes of relative point values and the replenishment rate of medical care expenditures, and then adapt their expectations and behaviors to maximize their own interests. In addition, system sustainability, the effectiveness of control, and the possibility of jumping out of the system are the three factors that have effects on the rationality orientation and the behavior of medical care agents.

On the one hand, if system sustainability is not a question, the motive of greed tends to dominate the system, and the effectiveness of control is crucial in determining the behavior of the agents. If the effectiveness of control is high, self-restraint seems to be a rational strategy since agents can continuously obtain a share equivalent to their medical care services. By contrast, if the effectiveness of control is relatively low, overgrazing is rational since self-restraint will inevitably result in interest loss.

On the other hand, once the system is perceived to be unsustainable, the motive of fear begins to dominate the system. Then, the possibility of jumping out of the system becomes critical for the agents to choose between self-restraint and overgrazing. If the agents are deeply embedded in the system, they must become more self-restrained since they can go nowhere else once the system collapses. If the agents expect it to be highly likely for them to jump out of the current system with little chance to suffer the fate of destruction, to overgraze as much of the resource as possible prior to system collapse seems to be the most rational choice to make.

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