The Evolution of Obedience Norms

in the Repeated Carrot-and-the-Stick Game*

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Abstract

Reciprocity norm in the U.S. Congress and state assemblies has been studied extensively. By contrast, obedience norms frequently observed in many legislative bodies outside the United States have received relatively little attention. We seek to provide an evolutionary account of obedience norms. Drawing on a detailed observation of the legislative game in the Korean National Assembly, we model it as the repeated carrot-and-the-stick game. The results show that obedience is an evolutionarily stable strategy (ESS).

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1.1. Introduction

In the U.S. Congress and state assemblies there is a time-tested observation of reciprocity norm in the organization of their legislative activities (Matthews, 1960; Clapp, 1963; Feno, 1962; Asher, 1973; Wahke, Eulau, et. al., 1962). Also, the evolution of the norm is well understood. The important works of Weingast (1979), Axelrod (1981), Shepsle and Weingast (1981), and Taylor (1976, 1988) have all made a significant contribution to our understanding of how reciprocity can evolve as an institutional practice.

In a marked contrast to the study of reciprocity, the legislative norm of obedience has been little studied. In many legislatures outside the United States, especially in countries where party discipline is strong or where authoritarian regimes reduce their representative assemblies to a rubber-stamp organization, members cannot act as the equals as their American counterparts do. There is a strong pressure for them to obey party leadership or an authoritarian chief executive. In either case, obedience and compliance are what is routinely expected of legislative members. Since there are numerous legislative bodies around the world which resemble very little the unique structure of American legislatures, it may well be the case that the obedience norms are more widely practiced than the norm of reciprocity (Mezey, 1979; Kim, Barkan, et. al., 1984; Lowenberg, et. al., 1985).

In an attempt to model the evolution of obedience, we focus on the Korean National Assembly, a typical case in which a set of hierarchical norms structure the behaviors of legislative members[1)] (Kim and Pai, 1981; Kim and Park, 1985; and Kim, 1988). In Korea as elsewhere legislative members pursue three goals: reelection, personal influence, and the legislation of good public policy (Fenno, 1973). Resources are required to achieve any of these goals and the needed resources in the National Assembly are highly concentrated in the hands of a few leaders.

The first step for a member's reelection is to obtain a party nomination. A member seeking reelection without an endorsement by a party faces an insuperable odds in Korean electoral process. The exclusive power to nominate a candidate rests with party leadership, making the member's personal loyalty to the top party leader an important condition for renomination. Also, the costs of running a successful election campaign are so high that few individuals can finance it out of their own personal resources. One estimate for the 1988 National Assembly election shows a figure of 800 million won (approximately one million in U.S. dollars), an average amount spent by the winning candidates.[2)] Members need to raise a significant financial support to organize a successful reelection campaign and for this support, they depend heavily on the leader of their party or faction.

Election campaigning does not stop after an election for the members who harbor political ambitions. They must manage their districts and consolidate their electoral bases, both of which require time, effort and money. One recent study (Park, 1988) shows that members take these tasks very seriously indeed. Each member, the study revealed, spent more than one-third of his/her working hours in home district, an average of 12 days per month. This level of activity in district compares favorably even with the district activities of the members of the most democratic legislatures elsewhere. Each member maintains two or three district offices, the expenses of which the member has to pay for. Other district activities are also organized on regular basis: supporters' meetings, open forums, neighborhood gatherings. Members frequently give receptions and sponsor seasonal outings to entertain their core support groups. All of these cost money, and a large part of this expenditure is paid for with the funds supplied by the leader of a member's party or faction.

Personal influence is another goal that a member strives to attain. In the U.S. Congress where the norms of the egalitarian sort such as reciprocity govern members' behaviors, there exist a variety of ways a member can build his personal influence. Acquiring an expertise, a reputation of being hardworking and dependable, accumulating seniority, and demonstrating that one is a team player are normal routes to gaining personal influence. By contrast, these same qualities and experiences render little help in the Korean National Assembly, which is an example of a legislative body in which most prominent norms are of the hierarchical sort (Kim, 1988). Instead, for a Korean legislative member the most effective route to influence is to be chosen to chair a standing committee, to receive a key party post, or to gain a cabinet appointment. The power of appointment to all of these coveted positions of influence rests with party or factional leadership. Therefore, a member has to depend on a direct personal help by a powerful leader to achieve influence.

Legislating a good public policy is also a part of a member's goal. In the Korean National Assembly, however, individual members have little influence on lawmaking. A majority of bills are submitted by government, nearly all of which are routinely passed on the floor. For example, a total of 633 bills were proposed in the 9th National Assembly, 1973-1979 (Shin, 1985). Of these 76 percent were government bills. Individual members have a right to submit bills and in the 9th Assembly members' bills accounted for 24 percent of the total. The difference is even more striking if one examines the passage rates. Eighty-five percent of the government bills became laws, whereas a small 15 percent of member's bills did similarly. If a member develops a bill which he believes is a good policy, he can win its passage only if he receives a strong backing by the top leader of his party or faction. Such a backing is, of course, contingent upon a member's loyalty and obedience to the top leader.

All of the vital resources that a member needs to achieve his goals are in fact concentrated in the hands of a few top leaders. In structural terms the pattern of resource distribution in the National Assembly resembles closely what Lasswell and Kaplan (1950) characterize as an 'agglutinated structure' of values. All vitally important political resources are tightly linked together and come in a single package, so to speak. If a member enjoys a direct access to and confidence of a top leader, that alone is sufficient to bring him all of the resources he would need to achieve his political goals. Agglutination and concentration of resources define the legislative game in the Assembly, which we shall call 'the carrot-and-the-stick game'.

The leader who has a full array of vital resources rewards a member when the latter obeys. If a member disobeys, the leader punishes in either of two ways: withdraw the support or inflict a direct pain. We have examined a few select cases in which a member disobeyed. Punishment took several different forms, all very costly to the defecting members (Kim, 1985). In the first instance, a defecting member was immediately denied an equal access to the resources the leader controlled. In another case, a recalcitrant member failed to get his party nomination. For another defecting member, the leader of his faction refused to supply campaign funds and ultimately led him to his defeat. A member who defected between elections had to suffer a sudden cut in the flow of funds to finance his routine district activities. In some cases defecting members found themselves ostracized and abandoned even by their close friends and colleagues. They felt isolated and ineffective as legislative members.

One of the more severe forms of punishment involves expulsion. There were instances in which defecting members were expelled from a party when they disobeyed the will of their top leader. An expulsion means much more than a loss of one's party affiliation. It means the loss of almost everything that matters for a successful political career: a nomination, funds, organizational support, and a social stature. Unquestionably, the most severe form of punishment is corporal. We have observed several such cases in the Korean legislative politics. Defecting members were arrested without a warrant, when they disobeyed the will of president who was also the head of the government party. They were physically abused at the intelligence agency and were later imprisoned under fabricated accusations.

Legislative game in Korea is based on a system of rewards and punishments. What is distinctive about the Korean system is that all the vital resources are concentrated at the disposal of a few top leaders, which enables the leadership to induce a nearly total obedience. Viewed from the perspective of members who seek resources, there are no alternative sources but those controlled by their leaders. This relationship makes the system of rewards and punishments highly effective in the Korean National Assembly.

In `the workaday lingo' we observe the salience of obedience norms, too. In the vocabulary used in the Korean National Assembly one frequently hears the words and sometimes the code words, all admonishing members of the dos and the don'ts: `Never act before you receive a directive from above,' `Always fall into the line,' `Try to read your leader's mind in advance,' `Obey the directive from above,' and `Close the formation.' These phrases strike a ring very much similar to the ones used in the military organization. There are also many words with similar connotations: `the words from the command post,' `the intent of the higher-up,' `the power core,' `boss,' `inner circle,' `insubordination,' `the holder of real power,' and 'the royal court'.(Kim, 1988) Phrases and words such as these reflect the fact that the relationships among legislative members are hierarchically organized and that they are expected to conduct themselves in a manner consistent with a superior-subordinate framework.

1.2. The Carrot-and-the-Stick Game in the Korean National Assembly

In this section we discuss three examples of the carrot-and-the-stick game to show how the game is played in the real life. The first case shows how a loyal member, so dedicated to his leader that he willingly committed an illegal act, was later rewarded more than amply. The second case shows how stiff a price a member has to pay when he disobeys. The final case shows an example in which a leader failed to reward a deserving member and what effect that failure had on the group he led.

Case 1. Member S belongs to the YS faction (the Young Sam Kim faction). This faction is arguably the most enduring and the best known factional grouping. Mr. Kim formed his faction in the mid-60s and led it successfully to the present. It may not be inaccurate to say that Mr. Kim has ridden on the back of this faction on his way to the `Blue House,' the presidential mansion.[3)] Member S started his political career working as a personal aide for Mr. Kim. His rise in rank and influence was steady as his loyal service was duely rewarded. By 1989 member S was a major figure both in the legislature and in his party of which Mr. Kim was president then. In April, 1989 a midterm election was to be held in the *Donghai* district due to the death of the incumbent. Mr. Kim seized this opportunity and tried to transform the contest into a people's referendum on the performance of President Roh Tae Woo and his ruling party. Member S, in his capacity as the Secretary-General of his opposition party, was put in charge of overseeing the *Donghai* district election. It was hotly contested election with its outcome hanging in the air. In the heat of the campaign a scandal broke out, involving the illegality of member S's action. In order to enhance the chance of his party's nominee, member S attempted to buy off a candidate of another party. The purpose was to force the candidate to withdraw from the election and with his removal from the race it was thought the party's nominee would have a better chance. A large sum of money was allegedly handed over to tempt the candidate to withdraw his name. The scandal made the headlines in the weeks that followed. Under pressure member S had to resign from his legislative seat and also from his party post of Secretary-General. Soon after, he had to give up his party membership as well.

Member S got himself into trouble in the line of his duty, i.e., to produce a winner at all cost. He made a mistake but it was clearly in compliance with the directive of his party leader. Moreover, he gave up all of what he had worked for so hard ever since he joined the YS faction as a young aide. Perhaps, what was even more admirable, seen from the viewpoint of his factional leader and members, was his decisiveness with which he alone assumed the responsibility for the scandal. In fact, this is a prime example of self-sacrifice committed to protect the good name of one's leader.

Loyalty and obedience must be rewarded. Otherwise, a strong bond between a leader and a follower can not be sustained for long. Indeed, this is exactly what happened in the 1992 general election. Member S ran in one of the districts where the YS faction had strength. Since his resignation a year earlier, he had no formal access to organizations and he had no other choices but to run as an independent. As is well-known, independents seldom do well in national elections. However, he won with a large margin surprising many people. How could it happen? The answer is: *loyalty and obedience pay* in factional politics. Mr. Kim's party chose a weak candidate, largely unknown to most voters, to run against member S, a sort of conspiracy to make it certain that member S win. As soon as he regained his seat, member S rejoined the YS faction. A member reads his leader's mind and does his utmost to achieve the leader's preference. Rewards of more influence, coveted appointment, money, and reelection are a loyal member's dues.

Case 2. This case shows how severely a defecting member is punished. The case in question is known as `the October 2 Incident of Insubordination.' The incident occurred in 1971. Several months into his administration, President Park Chung Hee decided to expand his control of power. In the National Assembly his ruling party had a comfortable majority of 112 seats out of a total of 175. The incident had to do with the vote of no confidence against three cabinet ministers. In the summer, 1971 several widely publicized cases of social disturbances broke out. When the Assembly convened in the fall, members of opposition began to investigate the causes of the disturbances and decided to place the blames on three ministers. The opposition did not have enough votes to carry the day.

President Park, the authoritarian leader of the governing party, made it clear that the vote of no confidence asked by the opposition be blocked. When the votes were counted, a shocking result emerged. A majority voted no confidence in one of his ministers. It was clear that twenty-two of his members defected, collaborating with the opposition on that vote. President, infuriated by this act of massive disobedience, quickly issued an order to his intelligence chief to identify the defectors and their ring-leaders. The punishments that followed were swift, harsh and final as the following eyewitness accounts indicate (Lee and Kang, 1988: 332-333):

> *Kim So_ng-Gon*, one of the four most powerful leaders of the Democratic Republican Party, went to bed early at home in this fateful night. At about midnight his phone rang loudly and he woke up. He heard an excited voice at other end of the line.
>
> > "Hello, people from the agency are on their way to your house. Listen, get out of your house right now, and go to a hideout."
>
> He got into his clothes in a hurry and ran to the door. It was too late. He heard the footsteps outside. As he turned back and rushed into a nearby closet, a dozen or more dark figures broke into the house and he was dragged out of the closet of his home like a dog. He resisted. After all, he was one most prominent politician of the day. The people from the agency kicked the old man brutally. Another agent pulled off his moustache to humiliate him. He was later taken to an unknown intelligence place. Time was 12:30 a.m.
>
> *Kil Jae-ho*, a member of `the Gang of Four' who ran the party on behalf of President Park was a very important politician. A key member of the 1961 *coup* and the person who was most responsible for General Park's ascent to power. Mr. Kil was the number 2 man in the party hierarchy. In the early morning hour, at about 2 a.m., a group of men from the agency came to his home. One of the men said:
>
> > "We are here to take you in."
> >
> > "Where are we going?"
> >
> > "Our chief wants to talk to you, Sir."
> >
> > "If he has something important to talk about, why couldn't he come himself?"
> >
> > "Look, you bastard. What do you think you are ..."
>
> The men in the black jackets punched him and beat on his head till his face and body were pitifully bloodied. Then, they left hauling a corpse-like body to an unknown place.

This was only the beginning of their punishment. They were subsequently interrogated by the Korean Central Intelligence Agency and the confessions of their involvement were forcefully extracted. At a party meeting held later, they were summarily dismissed from all the positions they held both in the party and in the legislature. They were also stripped of their party membership, a severe punishment of expulsion. They never recovered from it. Others who were involved all met a similar fate. The `sticks' in factional politics are swift and brutal, indeed. It clearly shows that defection does not pay.

Case 3. The so-called `JP division' was one of the largest and most powerful factions in the 60s. The group formed around Mr. Jong-pil Kim, who was a leading military officer in the 1961 *coup* and who later played a central role in creating the Democratic Republican Party which undergirded the eighteen year rule of President Park Chung Hee. At one time, he was considered the most powerful leader second only to President himself. The fact that he was a close relative of President Park must have also helped in more than one way to propel his rapid rise in power.

As a factional leader, Mr. Kim has earned an unenviable reputation of doing the least to protect his loyal followers. The case in point involved member K, who was the second in command in the JP group. Member K, reading the inner thoughts of his boss, quietly set out to lay the organizational bases in anticipation of the leader's quest for Presidency. A presidential election was scheduled to occur in 1971. And President Park, in the midst of his second term, could not seek a third term because of the constitutional term limitation. This was the context in which member K was performing his expected role.

However, the situation within the ruling party was complex. Those who were not part of the JP faction had a different agenda: they wanted to amend the Constitution so that the sitting President could serve another term. This led to a clash between the supporters of the amendment and the JP faction. The amendment group, armed with both implicit and explicit approvals of ambitious President Park, came out ahead in the conflict. The result was a decision adopted in a DRP members' meeting to expel member K and others for inciting dissension. This was a crippling defeat for the JP faction. While the fate of his second in command was being decided in the party, Mr. Kim did not provide any help. Member K did what he did merely to advance his leader's political cause. He did what any loyal and dedicated follower would do. Instead of being rewarded for his effort, member K suffered a desertion by his leader. Given his stature and influence and his special personal relationship to President Park, Mr. Kim could have done much more to protect the career of one of his most trusted and loyal members. This case shows that a member acts loyally and the leader takes *no action* to reward him. The JP faction has been observed to be a distinctly less cohesive group than others, and it may be the results of its leader's lukewarm support for his followers, especially at the time members needed his help most.

2. Model

The legislative game in the Korean National Assembly is modelled as an infinite repetition of 'the carrot-and-the-stick game' between a leader and a follower. In the stage game, G, a legislative member whom we call the Follower moves first; he chooses either to obey a 'directive,' explicit or implicit, from his Leader (O) or to resist it (X). Next, observing the member's move, the Leader decides his choice among the three actions; to reward (R), to punish (P), or not to take any action (N). If the member obeys, a surplus w is produced as a result of the Leader-Follower cooperation and the benefits earned are divided between them. If the member disobeys, the Follower receives a small payoff $b > 0$, but the Leader gets nothing. Our reasoning for this assumption is that the Follower makes some gains in terms of his popularity and votes when he projects an image of being an independent-minded and principled representative. Those who always vote with their faction or party are often ridiculed in Korea as *gusugi* or the mindless voting automata.

Also, for simplicity let us assume that the Leader pays a fixed amount k to the Follower when he decides to give a reward to the Follower, where $b < k < w$[4)]. The Leader pays a cost $c > 0$ to punish the Follower and the damage to the Follower is $p > 0$. Finally there is no change in either player's payoff when the Leader does not take any action. The tree diagram of the carrot-and-the-stick game is as shown in Figure 1.

To analyze the longterm relationship between the Leader and the Follower we assume that players play the carrot-and-the-stick game infinitely many times. We denote the infinitely repeated game $G(\infty)$. Following evolutionary game theory we analyze a population game model. There is a large population of agents.[5)] A player in the population can take the role of the Follower with probability π, where $1/2 < \pi < 1$, and take the role of the Leader with probability $1-\pi$. The matching rule is that a Leader is always matched against a Follower and vice versa. That is, two role identified players play the infinitely repeated carrot-and-the-stick game $G(\infty)$. Since every player is symmetric from the ex ante point of view, we define a new symmetrized game $G\sim(\infty)$ for our population model. A player's strategy in the game $G\sim(\infty)$ is a role contingent plan $\sigma = (\sigma_F,\sigma_L)$; a player takes a strategy σ_F as the Follower and takes a strategy σ_L as the Leader in the game $G(\infty)$.

We assume that players make mistakes with small but positive probability at every decision node. Following Fudenberg and Maskin (1990) we also assume that players' preferences are lexicographic: payoffs conditional on no mistake are infinitely more important than payoffs conditional on one mistake, which are infinitely more important than payoffs conditional on two mistakes, and so on. This lexicographic preference is justified when the probability of mistake is small in the following sense: the most likely event, with probability almost 1, is that no player makes a mistake. The next likely event, with a small probability ε, is for exactly one mistake somewhere along the infinite course of play. Two mistakes has probability about ε^2, and so on.

Finally we restrict the strategy space to the set of pure strategies of finite complexity.

Informally, a strategy of finite complexity is a finite program that can be run on a finite computer with bounded memory (for a formal definition, see Kalai and Stanford, 1988).

A pair of finitely complex strategies $\sigma = (\sigma_F,\sigma_L)$ gives rise to a sequence of actions $[(a_F(1),a_L(1)), (a_F(2),a_L(2)), ...]$, where $a_F(t)$'s and $a_L(t)$'s are the Follower's and the Leader's actions in period t = 1, 2,..., respectively. Because σ is finitely complex, the sequence of actions must repeat itself eventually, i.e., form a repetitive cycle. We suppose that players do not discount their future payoffs.[6)] That is, players maximize their time-average payoffs. Player i's time-average payoff from σ is

$$U_i(\sigma) = \lim_{T\to\infty} 1/T \sum_{t=1}^{T} u_i(a_F(t),a_L(t)), \text{ for } i = F \text{ and } L,$$

where $u_i(a_F(t),a_L(t))$ is player i's stage game payoff function in period t. Let $U_i(\sigma|h)$ be player i's expected payoff from σ conditional on history h occurring, where the length of history h, l(h), is τ. Then, if $[(a_F(\tau+1), a_L(\tau+1)), (a_F(\tau+2), a_L(\tau+2)),...]$ is the sequence of action pairs induced by σ after history h,

$$U_i(\sigma|h) = \lim_{T\to\infty} 1/T \sum_{t=\tau+1}^{T+\tau} u_i(a_F(t),a_L(t)), \text{ for } i = F \text{ and } L.$$

For m=1,2,..., let $U_i^m(\sigma)$ be player i's expected payoff conditional on there having been m mistakes, when players choose strategies σ. We call $U_i^m(\sigma)$ player i's "mth-order" payoff from the strategy pair σ. The lexicographic assumption implies that, for any two strategy pairs σ and σ', if m<m' any difference between $U_i^m(\sigma)$ and $U_i^m(\sigma')$ outweighs a difference between $U_i^{m'}(\sigma)$ and $U_i^{m'}(\sigma')$ in a player's performance.

We can derive the payoff function in the game $G\sim(\infty)$ from the payoff function in the game $G(\infty)$. A player's payoff, when he chooses $\sigma = (\sigma_F,\sigma_L)$ and the population frequency is $\sigma' = (\sigma_F', \sigma_L')$, is the following:

$$V(\sigma;\sigma') = \pi U_F(\sigma_F,\sigma_L') + (1-\pi)U_L(\sigma_F',\sigma_L).$$

Likewise a player's expected payoff conditional on history h occurring, when he chooses σ and the population frequency is σ', is

$V((\sigma;\sigma')|h) = \pi U_F((\sigma_F,\sigma_L')|h) + (1-\pi)U_L((\sigma_F',\sigma_L)|h)$.

Sometimes we analyze a numerical example, in which w = 10, b = 1, k = 4, p = 7, and c = 2. The tree diagram of this game is shown in Figure 2.

3. Analysis

In this section we characterize the set of ESS's in the infinitely repeated carrot-and-the-stick game. As was initiated for the repeated Prisoner's Dilemma by Axelrod and completed by later works (e.g. Fudenberg and Maskin, 1990; Binmore and Samuelson, 1992; Kim, 1992), we can also prove the existence theorem and the efficiency theorem for some weaker version of ESS in our game. It will be shown that, because of the difference in game rules, the ESS's in our game do not imply the norm of reciprocity but the norms of factional leadership and obedience to directives.

We begin our analysis with the traditional game theoretic approach. In traditional game theory a Nash equilibrium is the most standard solution concept. A strategy combination in a game is called a Nash equilibrium if it satisfies the mutual best response property. In the analysis of a multistage game sometimes there are implausible Nash equilibria in which at least one player chooses an incredible threat. In that case a refinement of Nash equilibrium, a subgame perfect Nash equilibrium, is widely used as the main solution concept. A Nash equilibrium in a game is called a subgame perfect Nash equilibrium if it induces a Nash equilibrium in every subgame.

In the sequel we will characterize both the set of subgame perfect Nash equilibria and the set of ESS's for the repeated carrot-and-the-stick game. Formal definitions of these solution concepts are as follows.

Definition: A strategy combination σ in the game $G(\infty)$ is a subgame perfect Nash equilibrium if it is a Nash equilibrium and induces a Nash equilibrium in every subgame.

Definition: A strategy σ in the game $G\sim(\infty)$ is evolutionarily stable if, for all finitely complex strategies σ', one of the following two conditions hold:

(i) There exists $\bar{\varepsilon}>0$ and m^* such that

$$V^m(\sigma; (1-\varepsilon)\sigma+\varepsilon\sigma') \geq V^m(\sigma'; (1-\varepsilon)\sigma+\varepsilon\sigma') \text{ for all } m<m^* \text{ and all } \varepsilon\in(0,\bar{\varepsilon}), \text{ and}$$

$$V^{m^*}(\sigma; (1-\varepsilon)\sigma+\varepsilon\sigma') > V^{m^*}(\sigma'; (1-\varepsilon)\sigma+\varepsilon\sigma') \text{ for all } \varepsilon\in(0,\bar{\varepsilon}).$$

(ii) There exists $\bar{\varepsilon}>0$ such that

$$V^m(\sigma; (1-\varepsilon)\sigma+\varepsilon\sigma') \geq V^m(\sigma'; (1-\varepsilon)\sigma+\varepsilon\sigma') \text{ for all } m \text{ and } \varepsilon\in(0,\bar{\varepsilon}).$$

The above definition of ESS is the same as that of neutral ESS except that lexicographic preference ordering is considered. If players do not make a mistake, an ESS is a neutral ESS. The mistake imposes strong restrictions on a player's behavior in subgames which would not have been reached without tremble. It can be shown that our definition is equivalent to Fudenberg and Maskin's (1990).

Lemma 1 shows that an ESS is a symmetric Nash equilibrium strategy which satisfies additional stability conditions.

Lemma 1: A strategy σ in $G\sim(\infty)$ is an ESS if and only if, for all finitely complex strategies σ', either condition (iii) or condition (iv) holds:

(iii) there exists m^* such that

(A-1) $V^m(\sigma;\sigma) \geq V^m(\sigma';\sigma)$ for all $m<m^*$, and

(A-2) $V^m(\sigma;\sigma') \geq V^m(\sigma';\sigma')$ if the equality holds in (A-1); and

(B-1) $V^{m^*}(\sigma;\sigma) \geq V^{m^*}(\sigma';\sigma)$, and

(B-2) $V^{m^*}(\sigma;\sigma') > V^{m^*}(\sigma';\sigma')$ if the equality holds in (B-1).

(iv) For all m,

(C-1) $V^m(\sigma;\sigma) \geq V^m(\sigma';\sigma)$, and

(C-2) $V^m(\sigma;\sigma') \geq V^m(\sigma';\sigma')$ if the equality holds in (C-1).

Proof: It is straightforward to show that conditions (i) and (ii) are equivalent to conditions (iii) and (iv) respectively.

It is easy to show that the ESS condition implies the Nash equilibrium condition in the underlying game.

Lemma 2: An ESS $\sigma = (\sigma_F,\sigma_L)$ in G~(∞) is a Nash equilibrium in G(∞).

Proof: Condition (A-1), (B-1), or (C-1) implies that $V(\sigma;\sigma) \geq V(\sigma';\sigma)$ for all σ'. That is, for all $\sigma'=(\sigma_F',\sigma_L')$,

$$\pi U_F(\sigma_F,\sigma_L) + (1-\pi)U_L(\sigma_F,\sigma_L) \geq \pi U_F(\sigma_F',\sigma_L) + (1-\pi)U_L(\sigma_F,\sigma_L').$$

Let $\sigma'=(\sigma_F',\sigma_L)$. Then we have

$$U_F(\sigma_F,\sigma_L) \geq U_F(\sigma_F',\sigma_L) \text{ for all } \sigma_F'.$$

Next let $\sigma'=(\sigma_F,\sigma_L')$. Then we have

$$U_L(\sigma_F,\sigma_L) \geq U_L(\sigma_F,\sigma_L') \text{ for all } \sigma_L'.$$

The above two conditions show that (σ_F,σ_L) is a Nash equilibrium in the game G(∞).

Q.E.D.

Lemma 3, which was first proved by Selten (1983) for a finite extensive form game, shows the relationship between an ESS and a subgame perfect Nash equilibrium.

Lemma 3: An ESS in G~(∞) is a subgame perfect Nash equilibrium in G(∞).

Proof: Since we allow players to make a mistake with positive probability at every information set, every subgame is reached with positive probability. An ESS in G~(∞) must induce a Nash equilibrium in every reached subgame by Lemma 2. Therefore an ESS is a subgame perfect Nash equilibrium in G(∞). Q.E.D.

Lemma 3 shows that the set of ESS's in the symmetrized game is a subset of the set of subgame perfect Nash equilibria in the original game. Hence the first step to characterize the set of ESS's in a game is to find the set of subgame perfect Nash equilibria in the original game.

It is easy to show that there is a unique subgame perfect Nash equilibrium in the one-shot game. In this equilibrium the Leader will not take any action whatever strategy the Follower chooses, and the Follower does not obey the directive. There is another imperfect pure-strategy Nash equilibrium in the stage game; the Follower obeys the Leader's directive, and the Leader does not take any action if the Follower obeys, but the Leader punishes the Follower otherwise. This Nash equilibrium is not sensible since the Leader uses an incredible threat; if the Follower really does not obey, the Leader does not have an incentive to punish the Follower. We can also show that the subgame perfect Nash equilibrium is the unique ESS in the stage game when players make mistakes.

This result does not change when the game is repeated finitely many times. In the finitely repeated game the unique subgame perfect Nash equilibrium is the repetition of no interaction between two players in every period. This strategy combination is also the unique ESS when players make mistakes. For example, if every player makes a mistake with the same probability $\varepsilon > 0$ at every decision node, each player's unique best response is to choose the equilibrium strategy with as high probability as possible. Hence the above strategy combination is a strict Nash equilibrium under the uniform tremble, which implies that it is an ESS in the finitely repeated game.

On the other hand if the game is repeated infinitely many times we have qualitatively different results. As the Folk Theorem (Aumann, 1985; Fudenberg and Maskin, 1986) implies, there are many subgame perfect Nash equilibria with different payoffs: For any individually rational and feasible payoff we can always find at least one subgame perfect Nash equilibrium which supports it. For example players can receive Pareto efficient payoffs by using the equilibrium in the stage game as the threat strategy. That is, on the equilibrium path players choose the actions which result in the efficient outcome, and if somebody deviates from the equilibrium path they choose the equilibrium of the stage game from then on forever.

There are many inefficient subgame perfect Nash equilibria too. The infinite repetition of subgame perfect equilibrium of the stage game is still a subgame perfect Nash equilibrium in the repeated game. There is a more severe threat strategy in the infinitely repeated game; a player can use the minimax strategy to punish the other player who deviates from an equilibrium path. The set of equilibrium paths which can be supported by this severe punishment strategy is big. Formally this observation is summarized in Theorem 1.

To state Theorem 1, let us observe that the Follower's minimax strategy combination is (X,PP), and that the Leader's minimax strategy combination is (X,NN). The minimax payoffs of both players are as follows: $\min_{a_L} \max_{a_F} u_F(a_F,a_L) = b-p$, and $\min_{a_F} \max_{a_L} u_L(a_F,a_L) = 0$. Finally we define the set of individually rational and feasible payoffs to be $V = \{(u_F,u_L) \in F : u_F \geq b-p, \text{ and } u_L \geq 0\}$, where F is the convex hull of the set of all feasible payoffs in the game G.

Theorem 1: Suppose players do not make mistakes in implementing strategies. For any $v=(u,u') \in V$ there exists a subgame perfect Nash equilibrium in the game $G(\infty)$ in which players receive the expected payoff v.

Proof: For any $v \in V$, let S be a path with average payoff v and such that each player gets more than v infinitely often. We will construct a subgame perfect equilibrium by first classifying the subgames into three states; S, S_F, and S_L.

Consider the following strategies: "Begin in the cooperative state S. If a subgame belongs to state S, then the action combination following S has to be played and remain in this state as long as there are no deviations. If player i deviates, then the state moves to S_i and player i has to be minimaxed for $N = \max \{(b+k+p)/(u-b+p), (w+k)/u'\}$ periods, for i = F and L. It is easy to check that the number N satisfies the following two inequalities:

$(b+k) + N(b-p) < -p + Nu$, and

$w < -k + Nu'$.

After the N periods have elapsed, return to the cooperative state S, regardless of whether there were any deviations from the punishment."

To verify that these strategies are a subgame perfect equilibrium, we can show that there is no strategy that improves a player's payoff in any subgame. The condition on N ensures that any gains from deviations in the cooperative state are removed at the punishment state, so no sequence of a finite or infinite number of deviations can increase player i's payoff above u (or u'). Moreover, even though minimaxing a deviator is costly in terms of per-period payoff, any finite number of such losses are costless with the time-average criterion. Thus, player j's average payoff in a subgame where player i is being punished is u' (or u), and no player j can gain by deviating in any subgame for $j \neq i$. Therefore the strategies are a subgame perfect equilibrium.

Q.E.D.

Example: For further analysis let us analyze the numerical example introduced in section 2. In the stage game there is a unique subgame perfect Nash equilibrium, in which the Follower does not obey the Leader's directive and the Leader does not reward the Follower whatever he does.

The equilibrium payoffs are 1 for the Follower and 0 for the Leader, which are Pareto dominated by the payoffs of the outcome (O,R). But the outcome (O,R) cannot be supported by a Nash equilibrium, since the Leader does not have an incentive to reward the Follower. This outcome cannot be a part of the equilibrium outcome even when the game is repeated finitely many times.

If the game is repeated infinitely many times and players do not discount their future payoffs, there are many subgame perfect Nash equilibria. The Folk Theorem says that any feasible payoffs, which are greater than or equal to the minmax payoffs (-4,0), can be subgame perfect Nash equilibrium payoffs. The set of individually rational and feasible payoffs is the shaded area in Figure 3. In other words there are too many subgame perfect equilibria and the traditional game theoretic explanation does not provide a sharp prediction about how players play the infinitely repeated game.

On the other hand if we use ESS as the solution concept we can show that many subgame perfect Nash equilibria are not evolutionarily stable. For an inefficient subgame perfect Nash equilibrium we can construct a mutant strategy which invades the population successfully and destabilizes the original population state. We prove this observation in Theorem 2.

Let us define an efficient payoff for the game $G\sim(\infty)$. A payoff vector (u,u') in G is efficient if it maximizes the weighted sum of players' payoffs, i.e., $(u,u') \in \text{argmax}\ \{\pi u_F+(1-\pi)u_L \mid (u_F,u_L)\in F\}$.

Theorem 2: If σ is an inefficient subgame perfect Nash equilibrium of finite complexity in the game $G(\infty)$, then it is not evolutionarily stable in the game $G\sim(\infty)$.

Proof: Because σ is finitely complex, there is a history h* that minimizes $V((\sigma;\sigma)|h)$. Since σ is an inefficient, $V((\sigma;\sigma)|h^*)$ is inefficient too. Choose a sequence of action pairs $\{(a^*_F(t),a^*_L(t))\}$

such that $a^*_F(t)=O$ and $a^*_L(t)=R$ for all t. Fix actions $a_F \neq a_F(\sigma_F|h^*)$ and $a_L \neq a_L(\sigma_L|(h^*,a_F))$, where $a_i(\sigma_i|h^*)$ is the action induced by the strategy σ_i after history h* for i = F and L. Let σ' be a strategy that coincides with σ except after history h*. After h*, define $\sigma'=(\sigma_F',\sigma_L')$ so that σ_F' plays a_F and σ_L' plays a_L given that the Follower takes the action a_F. If both players choose (a_F,a_L) in the first period after h*, σ' plays the sequence $\{(a^*_F(t),a^*_L(t))\}$ beginning in the second period after h*. If at least one player fails to play (a_F,a_L) in period l(h*), then σ' coincides with σ beginning in period l(h*)+1.

We can show that the strategy σ' can invade the population of σ. First observe that V((σ;σ)|h*) = V((σ';σ)|h*), since σ' converts to σ after h* if its opponent does not play according to σ'. But V((σ',σ')|h*) > V((σ,σ')|h*), since σ' receives the efficient payoff after the history h*. Therefore σ' invades the population of σ and σ is not an ESS. Since h* is arbitrary the argument shows that no inefficient equilibrium σ is an ESS. Q.E.D.

As was shown in the proof of Theorem 2, an ESS must choose an efficient outcome not only on the equilibrium path but also off the equilibrium path. That is, an ESS must choose efficient threat strategies in the punishment phase. Finally it can be shown that some efficient Nash equilibria in the game G(∞) are ESS's in the game G~(∞).

Theorem 3: If $k \leq w(1-\pi)/\pi$, then there exists an ESS in the game G~(∞).

Proof: First observe that the payoff vector (k,w-k) results in an efficient payoff in the game G~(∞) if the following two inequalities hold:

$$\pi k+(1-\pi)(w-k) \geq \pi(b+k)+(1-\pi)(-k), \text{ and}$$

$$\pi k+(1-\pi)(w-k) \geq (1-\pi)w.$$

The second inequality always hold when $\pi > 1/2$, and the first inequality holds if $k \leq w(1-\pi)/\pi$.

That is, if $k \leq w(1-\pi)/\pi$, players can receive the efficient payoff $\pi k+(1-\pi)(w-k)$ in the game $G\sim(\infty)$ by playing a subgame perfect equilibrium with payoffs (k,w-k) in the game $G(\infty)$.

Next let us construct a strategy $\sigma = (\sigma_F,\sigma_L)$:

The Follower takes a strategy σ_F; Start out with O in the first period and continue to play it except when the Leader did not take the action R after the Follower's move O in the previous period. Play X if the Leader did not choose R after O in the previous period.

The Leader takes a strategy σ_L; Start out with RP and continue to play it unless he did not take the action R after the Follower's action O in the previous period. Choose NN if he did not choose R after O in the previous period.

We claim that the above strategy σ is an ESS. It is obviously a combination of strategies of finite complexity. It can be shown that the strategy is stable against invasion of any other strategy: no other strategy which takes different actions on the equilibrium path can invade the strategy σ, since σ receives the efficient payoff. Hence it satisfies the condition (ii) on the equilibrium path. When there is one mistake, the strategy σ again receives the efficient payoff. So we cannot construct a successful invading strategy which takes different actions along this history. Hence it satisfies the condition (ii) on these off-the-equilibrium paths. The same property holds for any number of mistakes. This

completes the proof that the strategy σ is an ESS in the game $G\sim(\infty)$. Q.E.D.

Unlike Fudenberg and Maskin (1990) we do not have a general existence theorem, since the underlying game is an asymmetric game. There does not exist an ESS if $k > w(1-\pi)/\pi$. In this case we can construct a non-Nash equilibrium strategy which invades the population of efficient equilibrium strategy successfully.

The strategy used in the proof of Theorem 3 is similar to the strategy Tit-For-Tat in the repeated Prisoner's Dilemma. It is also a nice, provokable and forgiving strategy; it starts out with cooperation, punishes the other player's deviation only once, and comes back to the efficient equilibrium path.

Besides this strategy there are many other ESS's in the game, since what happens in finitely many periods do not matter at all as long as players do not discount their future payoffs.

Example (continued): In the previous numerical example the payoff vector (4,6) in Figure 3 is Pareto efficient if $1/2 < \pi \leq 9/10$. Any subgame perfect Nash equilibrium which does not support this payoff either on the equilibrium path or off the equilibrium path is not evolutionarily stable. For an inefficient subgame perfect Nash equilibrium we can always construct a successful invading strategy which receives the efficient payoff when matched against itself. On the other hand it can be shown that there exists an ESS which supports the efficient payoff vector (4,6). The strategy used in the proof of Theorem 3 is an example of ESS.

4. Concluding Remarks

We have presented a sketch of the structure of factional and partisan politics in the Korean National Assembly. Two salient features of the structure were noted: an inordinate degree of resources concentration and the severity of punishment. Our initial intuition led us to hypothesize that observed obedience norms must be a stable and efficient outcome in a legislative body where resources concentration is high and punishment for defection severe.

We have sought an evolutionary explanation for obedience norms. A game model we call the carrot-and-the-stick game is constructed to see if the norm is an evolutionarily stable strategy. Our results show that it is an ESS in the Korean legislative game. We must mention here two caveats regarding the model we have employed. The first has something to do with our simplifying assumptions of no discounting and pure strategies of finite complexity. In the future modelling effort we will relax these assumptions and incorporate both a discount rate and mixed strategies into our theoretical model. The second limitation relates to the dynamics of evolutionary process. Norms such as obedience, reciprocity, specialization evolve over time in a parliamentary body, and this process of evolution should properly be conceptualized as a dynamic one. Hence, we will take it into account in our future study so that evolution is analyzed as a dynamic process. One possible approach is to adopt an explicit dynamic model of Markov chain as in Kandori, Mailath and Rob (1993).

Much has been said about the reciprocity norm in Congress, so much so that one is led to believe it is a universal norm in every democratic legislature. Obviously, this is an unwarranted expectation. It is, we believe, more likely that reciprocity norm is, if not uniquely American, then confined to a very small number of legislatures whose structure of legislative game is similar to the United States. We speculate that the informal rule of reciprocity would not be observed in an overwhelming majority of world's parliamentary bodies. On the contrary, obedience norms that we have analyzed or some of their variants may turn out to be most salient in many legislatures. One of our aims is to direct our research attention to a set of hierarchical norms which is fundamentally different from the type of norms observed in the American legislative process.

Notes

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1) Previous studies have identified several important behavioral norms in the Korean National Assembly. In addition to obedience norms, others include the norms of deference to the older members, appeal to one's group leader for an arbitration when conflict arises among individual members, legislative productivity which means that each member should do his utmost to help pass as many government bills as possible in the shortest possible time, political taboos which prohibit a member from making any statement relating to the person of president, his relatives, or various intelligence agencies. What is common to all of these norms is the central fact that they are the rules to regulate hierarchical relationships (Kim, 1988). The hierarchical nature of the legislative norms found in the Korean National Assembly may change in the future. In February 1993 a civilian rule after three decades of military regime was estabilished with the election of President Kim Young Sam. Many believe that the event signals a beginning of democratic transition. What effect this transition might have on the working of the Asssembly remains to be seen. One of the authors is currently studying the changes in committee practices and party organizations to assess such changes.

2) The accuracy of compaign spending data is always problematic, and this is even more so in the Korean politics. There is, however, an agreement among the informed observers and students of

Korean elections that a candidate must spend a minimum of one million US dollars to win. (Park, 1990) This may be a very conservative estimate for today.

3) In 1990 Mr. Kim Young Sam led his opposition party to a merger with both the governing Democratic Justice Party and a minor party (the New Democratic Republican Party). The merger created a dominant majority party, called the Democratic Liberal Party. After a period of byzantine and fractious factional maneuvers, Mr. Kim emerged eventually as the leader of his party. He ran in 1992 as a presidential candidate for this governing party and won, an ironic turn of the event for a politician known for leading the opposition all his life.

4) We assume that utility is transferable. It is not a restrictive assumption here, since the main results of our analysis do not change even if we assume nontransferable utility. Later when we symmetrize the game in a population model we have to assume comparability between the Follower's and the Leader's utility.

5) For simplicity we assume that the population is infinite. The analysis becomes more complicated for a finite population model, and an ESS need not be a Nash equilibrium in general. But we can show the efficiency result of ESS for a finite population model as in Sobel (1993).

6) No discounting assumption may be unrealistic, but it makes the following analysis easier. In the case of discounting we can allow invasion by clustering to destabilize inefficient Nash equilibria as in Axelrod (1981). The full implication of clustering is not understood yet in current evolutionary game theory.

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