The Impact of Leadership Turnover and Domestic Institutions on International Cooperation in a Noisy World.

Fiona McGillivray and Alastair Smith*
Department of Politics
New York University
726 Broadway, NY, NY 10003
January 22nd 2003

Abstract: In the context of a noisy, continuous choice prisoners’ dilemma we examine how leadership turnover and domestic institutions affect the depth and reliability of cooperative agreement that can be enforced between states through the use of "leader specific punishment" strategies. If foreign nations target punishments against leaders observed to cheat on cooperative arrangements (that is to say they refuse any future cooperation as long as the responsible incumbent remains in office) then citizens remove leaders caught cheating, providing the cost of doing so is less than the value of the cooperation foregone. For leaders who are easily replaced, being caught cheating cost them their job. Since cheating jeopardizes their tenure, such leaders can credibly commit to deeper and more reliable cooperation. We derive hypotheses about the patterns of cooperation and leadership turnover predicted under different institutional arrangements.

*We gratefully acknowledge the financial support of the National Science Foundation, SES-0226926. We thank George Downs and David Rocke for their useful comments.
The prisoners’ dilemma is a commonly used metaphor for international cooperation: mutual cooperation benefits both parties; yet each side has a dominant strategy to cheat on the agreement (Axelrod 1984; Axelrod and Keohane 1986; Bendor 1987; Downs and Roche 1990; Gourevitch 1996; Milner 1992; Pahre 1994). In such a setting, cooperation is maintained by conditioning future cooperation upon past behavior. In particular nations threaten to end future cooperation in response to cheating. Providing nations value the long run benefits of cooperation more than the short term returns from exploiting the other side’s cooperative behavior then cooperation can be maintained (Axelrod 1984; Axelrod and Keohane 1986).

While this intuition is powerful, which explains the popularity of these ideas in the literature (Baldwin 1993; Goldstein 1991; Gowa 1986; Keohane 1984, 1986; Keohane and Nye 1987; Krasner 1983; Milgrom, Weingast and North 1990; Milner 1992; Oye 1986; Ruggie 1993), cooperation within the prisoners dilemma fails to account for many of the real world features of international cooperation. First, cooperation is rarely the black and white decision of cooperate or defect. Rather nations typically choose a degree of cooperation. We might term this the depth of cooperation.

Second, the world is a noisy place that is open to interpretation. Unfortunately, this allows for the possibility that actions are misinterpreted with nation A perceiving nation B to have cheated on the agreement when in fact nation had acted in accordance with the agreement, or vice versa.

Thirdly, and we think most importantly, cooperation in the prisoners’ dilemma is a possibility result. While it states that cooperation is possible if nations are sufficiently patient (the precise level of patience given by the parameters of the game), it provides few comparative statics as to how factors affect the depth and quality of cooperation. For instances, it does little to explain why some nations enact cooperative agreements while other do not. Scholars have observed that regime type influences cooperation, with democracy generally engendering greater cooperation1. The standard infinitely repeated prisoners’ dilemma story offers no accounts for these institutional differences.

We address these three issues using a model of cooperation where nations choose a level of output, P, in a noisy environment. Within this context we examine the depth of possible agreement and how this level of cooperation can be influenced by domestic political arrangements.

We embed our study squarely within the extant literature by studying the continuous choice prisoners’ dilemma proposed George Downs and David Rocke (1995). In this game each of two nations (A and B) choose a level of protection, P_A and P_B respectively, which result in pd like payoffs. Absent any cooperation, both nations choose protection levels of 100. Both sides gain from cooperation in

---
the sense that if they both reduce protection they are both better off. However, the payoffs are pd like in that each side gains by reneging on this reduced level of protection, obtaining a temptation payoff for itself, and a suckers payoff for the other nation (Lambertini 1997; Molander 1985).

Consistent with Downs and Rocke’s original interpretation, we often refer to \( P \) as a level of protection, yet the setting is more general. For instance, \( P \) might be a level of pollution, production levels within a cartel (such as OPEC), or a level of extraction from a common pool resource.

We add noise to the system by assuming imperfect observation of players’ choices (Bendor 1987, 1993; Bendor, Kramer and Stout 1991; Molander 1985; Signorino 1996; Wu and Axelrod 1995). Although the choices are \( P_A \) and \( P_B \), players observe the actions \( Q_A \) and \( Q_B \), which include some noise. Consistent with other approaches (Downs and Rocke 1990; Green and Porter 1984; Porter 1983), to examine the possibility of cooperation Downs and Rocke assume that nations will play some cooperative level \( \bar{P} \), unless one of the player’s observed action is above some threshold, \( H \). Should this latter contingency arise, they proceed to play the non-cooperative Nash strategy for \( T \) periods before restoring cooperation.

Given the pd structure of the game, each nation myopically wants to increase its level of production above the cooperative level \( \bar{P} \). However, by doing so they increase the risk of their actions being observed as over the threshold. Remember their observed action is the combination of their actual actions and some stochastic error. Hence the cooperative level \( \bar{P} \) represents a compromise between increasing short term gains and jeopardizing future cooperation.

Through such a mechanism limited cooperation can be maintained. As in the simple pd story, players trade-off the long run gains from cooperation against the short term gains from cheating on the agreement. Although this mechanism captures the fact that nations’ choices are typically a matter of degree in a noisy environment (rather than straight cooperative and defect), it still fails to explain why some nations cooperate and other do not. Within the context of the Downs and Rocke model, we propose a mechanism in which regime type strongly influences the depth of possible cooperation between states and the patterns of cooperation we anticipate between states. Before describing the game and mechanism formally, we pause to outline the basic feature of our conception of how leaders and regime type affect international cooperation. First we introduce the intuition behind our conception of international cooperation. In particular, we discuss why leaders who are easily replaced can more credibly commit to maintain high levels of cooperation than can leaders who are hard to replace. Second, we discuss how domestic political institutions affect the ease of leader replacement. Via this latter discussion we provide a mechanism through which to relate the important theoretical concept in our model, the ease of leader replacement, with real world political institutions.

In the standard pd story cooperation is maintained through the threat of the loss of future cooperation if caught cheating. Hence if nation A cheats then nation B refuses to cooperate with it in future periods. Rather than treating A
and B as unitary actors, suppose nation A is lead by leader \( \alpha \) and nation B is lead by leader \( \beta \). Rather than refusing to cooperate with nation A for leader \( \alpha \)'s decision to renege on an agreement, supposes nation B refuses to cooperate with leader \( \alpha \). This is to say, B targets punishment at the actual leader responsible for cheating rather than at the nation she represents. By using the leader specific punishment of refusing to cooperate with \( \alpha \), but being willing to cooperate with any successor, B provides \( \alpha \) with a powerful commitment to cooperate (McGillivray and Smith 1998; Guisinger and Smith 2002).

Suppose leader \( \alpha \) is observed to have cheated, i.e. her observed action, \( Q_A \), is above the threshold \( H \). Such a contingency under the leader specific punishment strategy means that cooperation ceases for \( T \) rounds. Hence if \( \alpha \) remains in power, the citizens in A give up the opportunity of \( T \) periods of cooperation. Yet since B will cooperate with \( \alpha \)'s successor, A can avoid the loss of \( T \) periods of cooperation by replacing \( \alpha \). Providing the cost of replacing \( \alpha \) is less than the value of \( T \) periods of cooperation then being caught cheating costs \( \alpha \) her job.

If, as we believe, leaders are primarily concerned with keeping their jobs then when leader removal is relatively easy, \( \alpha \)'s survival in office is dependent upon not being observed to cheat. As such, leaders who are easily removed reduce the chance that \( Q_A \) is greater than the threshold for punishment (\( H \)) by reducing \( P_A \). Of course, if the cost of leader removal is greater than the value of lost cooperation, then leaders caught cheating are not replaced. Since their tenure in office is not in jeopardy, such leaders have less incentive to avoid the risk of being caught cheating. In short, they are less able to commit themselves to cooperate.

Since regime type affects the ease of leader replacement, it also affects the depth of cooperation to which leaders can commit. Dyads of democratic nations, in which leader replacement is relatively easy, can commitment to greater levels of cooperation than can dyads involving a nation with relatively high costs for leader replacement. Further for any given threshold, \( H \), specified in an agreement, the probability of observing cheating (i.e. \( Q > H \)) is lower when leaders are easily removed. When a leader’s tenure is in jeopardy she tries were possible to mitigate the risk, in this case by lowering \( P \).

Finally, our arguments suggest important differences in the dynamic patterns of cooperation. When leader removal is easy then cooperation should be deeper and cooperation failures less frequent. Yet, in the unlikely event that cooperation does falter we anticipate the rapid replacement of the responsible leader and the associated rapid normalization of cooperative arrangements. In contrast, when leader removal is harder, cooperation is less deep and cooperation failure is more common. The inability of the citizens to easily replace leaders means that following an incidence of cheating, non-cooperation persists until either the specified \( T \) periods of punishment are completed, or until (for exogenous reasons) the leader is replaced. Hence under the leader specific mechanism prolonged periods of punishment following cheating are only likely when leader replacement is difficult. Under these circumstances, leadership turnover reinvigorates cooperation.
Nations are not unitary actors. Rather nations have complex organizational structures that shape how decisions are made. Although there is massive variation in polities, all political systems share the feature that some leader or group of leaders is chosen by the residents of a state to make choices on behalf of the polity as a whole. For those of us fortunate enough to live in democratic society these ideas should be quite standard. The people choose leaders through elections. The leaders rule and then based upon the leaders’ performance the citizens decide whether or not to retain them at the next election. While this idea of the citizens as principals hiring leaders to act as agents on their behalf is obviously a massive simplification, it is an analytical framework that can be applied across all forms of political regime. Regimes differ by which residents have a nominal say in who is leader – the selectorate– and how many of these potential supporters a leader needs to keep her job– the winning coalition.

In democratic societies typically all citizens (although not all residents) form the selectorate and, depending upon the specific institutional rules, the leader typically requires the support of about half of the selectorate to ensure she keeps her job. Many monarchies also require democratic election, although the set of people with a say in who shall be king is much smaller. The capacity to be brought into the winning coalition is restricted to those of noble birth, hence a monarch’s winning coalition is typically small. Autocratic systems also have small winning coalitions, although they can vary greatly in the selectorate size. In military juntas, for instance, coalitions are drawn from the ranks of the military elite, a relative small selectorate. In contrast, corrupt electoral systems with universal franchise provide a mechanism through which practically any citizen can be brought into the winning coalition. In such systems, a small winning coalition is chosen from a large selectorate.

Bruce Bueno de Mesquita, Alastair Smith, Randolph Siverson and James Morrow (2003, 2002, 1998, hereafter BdM2S2) build their explanation of politics from this basis. They argue that when the coalition is small, leaders focus resources on policies that enrich the few members of the coalition. In contrast, when the coalition is large, to survive leaders need to maintain the support of many and that resources are too thinly stretched for the effective use of private goods. Hence, leaders from large coalition systems shift their policy focus more towards effective public policy. Public goods, such as law and order, defense, public health, promotion of economic opportunity, etc., simultaneously promote the interests of all members of the coalition as well as the interests of those outside the coalition. Given the relatively small importance of private goods in large coalition systems, coalition members have little to fear from exclusion from a future coalition, since most of the benefits that leaders provide are public in nature. As such supporters of the incumbent have little reason to be loyal.

In contrast, in small coalition systems supporters of the incumbent are typically extremely loyal, particularly when the selectorate is also large. Since private goods make up a substantial portion of the rewards, current members of the coalition face a large loss of welfare if they are excluded from future
coalitions. The smaller the coalition size and the larger the selectorate becomes the greater the risk of exclusion from future coalitions becomes should the incumbent be deposed, and therefore the more loyal the incumbent’s supporters become. BdM2S2’s arguments, and the substantial evidence they report to support them, suggest domestic political institutions strongly affect the ease of leader removal.

In large coalition systems supporters of the incumbent face few costs or risks from deposing the incumbent and so are prepared to do so even if the leader produces even a modest public policy failure. Supporter of small coalition leaders risk losing access to valuable private goods should the incumbent be deposed. As such, they are prepared to tolerate massive public policy failures rather than depose the incumbent. Effectively supporters in small coalition systems pay a high cost from deposing their leader: they forsake their guaranteed access to private goods. In contrast, supporters in large coalition systems pay a lower cost from deposing the incumbent since a much small proportion of the rewards in such systems are private in nature. As such BdM2S2’s framework provides a metric to measure the cost of leader removal. For our modeling purposes we assume the citizens act as principals who hire an agent — the leader — to rule on their behalf. Using BdM2S2’s conceptual framework of the winning coalition and selectorate we can relate domestic political institutions to the cost of leader removal.

Representative institutions, such as democracy, are characterized by large winning coalitions and hence a low cost of leader removal. As we shall now show, relative to more autocratic systems with their small coalition and higher costs for leader replacement, cooperation between states with representative institutions is deeper and less prone to failure.

1 The Model

We start our analysis by examining existing work by Downs and Rocke (1995). We shall use their continuous choice prisoners’ dilemma as a launching pad from which to explore the role of domestic politics in shaping international cooperation. Doing so forfils several goals. First, they provide a very general framework that captures the essential nature of the problems of international cooperation. Second, it allows observation of the impact of institutional arrangements in an environment that is already known.

While not all cases of international cooperation involve pd like incentives, many, for instance, involve problems of coordination, the prisoners’ dilemma represents a common and pernicious problem. It is particularly difficult to solve because despite the opportunities for mutual gain, each party has a myopically dominant incentive to cheat on any agreement. Downs and Rocke axiomize the properties of the pd like game in the continuous choice setting. Using a Taylor series approximation around the non-cooperative Nash equilibrium they state the shape of utility functions that satisfy these properties (1995, p. 101-104). They also state a specific utility function with which they construct their
examples. Although our arguments readily generalize to a broad range of utility functions, throughout we focus on their specific example. In particular, nations A and B pick levels of production $P_A$ and $P_B$ ($P_i \in \mathbb{R}^+$) and receive payoffs of $U_A(P_A, P_B) = -(P_B - 100) - (P_A - 100)^2 + 0.9(P_A - 100)(P_B - 100) + 0.1(P_B - 100)^2$ and $U_B(P_A, P_B) = -(P_A - 100) - (P_B - 100)^2 + 0.9(P_A - 100)(P_B - 100) + 0.1(P_A - 100)^2$ in each round. The game is infinitely repeated and payoffs are discounted according to a common discount factor $\delta$. Table 1 illustrates the properties of these utility functions for some selected values.

<table>
<thead>
<tr>
<th>Nation B’s protection level $P_B$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nation A’s protection level $P_A$</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>100</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

In single shot play the unique sub-game perfect equilibrium is $P_A^* = 100$ and $P_B^* = 100$, which results in payoffs of $U_A(P_A^*, P_B^*) = 0$ and $U_B(P_A^*, P_B^*) = 0$. As Table 1 shows, both nations gain from a mutual reduction in protection. Yet, as cooperation deepens and $P$ is lowered, each side gains enormously from defecting. In general for any given level of $P_B$, A’s best response is $BR_A(P_B) = 55 + 0.45P_B$. Hence at maximum cooperation (0,0), A’s optimal defection is to $P_A = 55$ which produces payoffs of 3125 and -5702.5. As cooperation deepens, the temptation to cheat and the cost of being exploited become huge.

We now integrate noise into the system. Rather than observing $P$ precisely we assume nations observe $Q_i = P_i + \varepsilon_i$, where $i = A, B$ and $\varepsilon_i$ is a stochastic error with distribution $F(x) = \Pr(\varepsilon < x)$ and associated density $F'(x)$. In particular, in each round we assume $\varepsilon_A$ and $\varepsilon_B$ are independently distributed normally with mean zero and variance $\sigma^2$.

This describes the setup of Downs and Rocke (1995). We now add our principal-agent conceptualization of domestic politics using the following game form.

Figure 1: The domestic version of the continuous choice prisoners’ dilemma.

The game is infinitely repeated, with the following stage game:

1) $\alpha$ and $\beta$, the leaders of nations A and B respectively, play the continuous choice prisoners’ dilemma. In particular, they pick a level of protection $P_A$ and $P_B$, respectively. The actual production decisions $P_A$ and $P_B$ remain private information for $\alpha$ and $\beta$. However, their observed actions $Q_A$ and $Q_B$ become publicly observable to all players.

2) At cost $k_A$ and $k_B$ respectively, the citizens of A and B can replace their respective leaders. These choices are made independently.

3) All players receive payoffs. In addition to the payoff from the continuous choice pd, leaders receive a payoff of $\Psi$ if they retain office.
1.0.2 Enforcing cooperation through the threat of withdrawing future cooperation.

Before describing the leader specific punishment strategy it is useful to discuss some preliminaries. There are two phases in the equilibrium: the cooperative phase and the punishment phase. Players start in the cooperative phase and continue until someone appears to cheat. By appearing to cheat we mean their observed level of production $Q_i$ is above the threshold $H_j$. At this point the player is no longer in good standing and the opposing side enters the punishment phase, where for $T$ periods the players play the non-cooperative Nash equilibrium. The threshold level $H$ plays a key role in the derivation of the equilibrium as it controls movement between cooperative and punishment phases of the game. For our purposes it does not matter whether the threshold is set explicitly or implicitly. What matters is that in equilibrium each side knows what constitutes acceptable versus unacceptable behavior. Similarly both nations know the length of punishment $T$.

It is convenient to introduce the notation $S^t_A$ to indicate the standing of nation A’s leader at the end of period $t$. At the start of the game or following the replacement of A’s leader nation A is in "good standing" $S^t_A = 0$.

The evolution of A’s standing is as follows:

$$S^t_A = \begin{cases} 0 & \text{if leader } \alpha \text{ is replaced in period } t \\ 0 & \text{if } S^{t-1}_A = 0 \text{ and } Q_A \leq H_B \\ 0 & \text{if } S^{t-1}_A = 0 \text{ and } S^{t-1}_B > 0 \\ T & \text{if } \alpha \text{ retained, } S^{t-1}_A = 0, S^{t-1}_B = 0 \text{ and } Q_A > H_B \\ S^{t-1}_A - 1 & \text{if } \alpha \text{ retained, } S^{t-1}_A > 0 \\ \end{cases}$$

In words this means that A maintains a good standing ($S^t_A = 0$) if its leader is replaced, A is observed to have cooperated ($Q_A \leq H_B$), or if B is in poor standing ($S^t_B > 0$). If both leaders are in good standing and $\alpha$ is observed to cheat ($Q_A > H_B$) then for the next $T$ periods A is in poor standing, $S^t_A > 0$.

As is common in infinity repeated games, although the statement of the equilibrium is complex, the path of play is straightforward. Therefore we briefly describe the key features of the path of play for each of two scenarios: high and low cost of replacing leaders.

When the cost of replacing leaders is high, the citizens do not replace leaders in poor standing since the benefits of immediately restoring cooperation are too small to justify the cost of changing the leader. This case reduces to the unitary actor scenario, where the only incentive to maintain cooperation is the loss of $T$ future periods of cooperation.

When the cost of replacing leaders is low, citizens replace leaders caught cheating. By doing so the citizens ensure continued cooperation. Since leaders primarily care about keeping their jobs, they are careful to avoid being caught cheating. This desire to avoid cheating allows leaders to commit to maintain a level of commitment that the principals (the citizens) themselves could not maintain.

We now state the leader specific punishment strategy for period $t$. We state the strategy for nation A and leader $\alpha$. B’s strategy is analogous. For clarity
we separate the two cases:

**Proposition 1** *(Unitary actor: high cost case)*

If \( k_A \geq U_A(\bar{P}_A, \bar{P}_B) \frac{\delta - \delta^{t+1}}{1 - \delta + (\delta - \delta^{t+1})(1 - F(H_B - \bar{P}_A))} \) and \( \bar{P} \) satisfies equation 1 below, where \( p_A = 1 - F(H_B - \bar{P}_A) \) and \( p_B = 1 - F(H_A - \bar{P}_B) \) then the following is a subgame perfect equilibrium:

1) If both leaders are in good standing \( (S_A^{t-1} = 0 \text{ and } S_B^{t-1} = 0) \) then \( \alpha \) plays \( P_A = \bar{P}_A \). If either leader is in poor standing \( (S_A^{t-1} > 0 \text{ or } S_B^{t-1} > 0) \) then \( P_A = \bar{P}_A = 100 \).

2) The citizens retain leader \( \alpha \).

\[
D \frac{dU_A(\bar{P}_A, \bar{P}_B)}{dP_A} - U_A(\bar{P}_A, \bar{P}_B) \frac{dp_A}{dP_A} (1 - p_B) (\delta - \delta^{t+1}) \tag{1}
\]

where\( D = (1 - (1 - p_A)(1 - p_B)\delta - (1 - (1 - p_A)(1 - p_B))\delta^{t+1}) \)

Proof: see Downs and Rocke 1995, 1990; Porter 1983; Green and Porter 1984. We discuss the major aspects of the proof below.

**Proposition 2** *(Domestic politics: low cost case)*

If \( k_A \leq U_A(\bar{P}_A, \bar{P}_B) \frac{\delta - \delta^{t+1}}{1 - \delta + (\delta - \delta^{t+1})(1 - F(H_B - \bar{P}_A))} \) and \( \bar{P} \) satisfies equation 2, then the following strategy is a subgame perfect Nash equilibrium:

1) If both leaders are in good standing \( (S_A^{t-1} = 0 \text{ and } S_B^{t-1} = 0) \) then \( \alpha \) plays \( P_A = \bar{P}_A \). If either leader is in poor standing \( (S_A^{t-1} > 0 \text{ or } S_B^{t-1} > 0) \) then \( P_A = \bar{P}_A = 100 \).

2) If both players are in good standing and \( \alpha \) is not observed cheating \( (S_A^{t-1} = 0, S_B^{t-1} = 0 \text{ and } Q_A \leq H_B) \) then the citizens in nation A retain leader \( \alpha \). If \( \alpha \) and \( \beta \) are in good standing \( (S_A^{t-1} = 0, S_B^{t-1} = 0) \) but \( \alpha \) is observed cheating \( (Q_A > H_B) \) then A replaces \( \alpha \). If \( \alpha \) is in poor standing \( (S_A^{t-1} > 0) \) then A deposes \( \alpha \) if \( k_A \leq U_A(\bar{P}_A, \bar{P}_B) \frac{1 - \delta^{t+1}}{1 - \delta + (\delta - \delta^{t+1})(1 - F(H_B - \bar{P}_A))} \) and retains \( \alpha \) otherwise.

\[
\bar{P}_A \in \arg \max_{P_A \in \mathbb{R}^+} U_A(P_A, \bar{P}_B) + F(H_B - \bar{P}_A) \frac{\Psi}{1 - \delta F(H_B - \bar{P}_A)} + \frac{\delta}{1 - \delta} U_A(\bar{P}_A, \bar{P}_A) \tag{2}
\]

**Corollary 3** *For an interior solution \( \bar{P}_A \leq H_B \), equation 2 implies*

\[
\frac{d}{dP_A} U_A(\bar{P}_A, \bar{P}_B) - \Psi \left( \frac{F'(H_B - \bar{P}_A)}{1 - \delta F(H_B - \bar{P}_A)} \right) = 0 \tag{3}
\]

We discuss the most salient feature of the proof below and discuss the remaining details in the appendix.
1.0.3 The Logic of Cooperation

Here we explore the logic behind the propositions stated above.

High cost of leader replacement (the unitary actor case). The following analysis largely reproduces Downs and Rocke (1995, p. 97). We start by deriving the value of playing the game starting with both sides in good standing ($S_A^{t-1} = 0, S_B^{t-1} = 0$). Providing this good standing is maintained, $\alpha$ and $\beta$ play $P_A = \bar{P}$ and $P_B = \bar{P}$. Given these levels of production, the probability of $A$ accidently being observed to cheat is $p_A = \mathbb{P}(Q_A > H_B) = \mathbb{P}(P_A + \varepsilon_A > H_B) = \mathbb{P}(\varepsilon_A > H_B - P_A) = 1 - F(H_B - P_A)$. Similarly, the chance $B$ being caught ‘cheating’ is $p_B = 1 - F(H_A - P_B)$.

Using recursion, the value of playing $P_A = \bar{P}_A$ and $P_B = \bar{P}_B$ can be calculated as $V_A = U_A(\bar{P}_A, \bar{P}_B) + (1 - p_A)(1 - p_B)\delta V_A + (1 - (1 - p_A)(1 - p_B))(\frac{2 - \delta^{T+1}}{1 - \delta} U_A(P_A^*, P_B^*) + \delta^{T+1} V_A)$. The first term represents the value of the game in the current period. The second term is the discounted value of the game multiplied by the probability that neither side is observed cheating. The final term is the probability that one side is observed to cheat multiplied by the payoff of the non-cooperative outcome for the next $T$ periods before the restoration of cooperation. $\alpha$ also receives the office holding benefit $\Psi$ in every period.

Yet, since $\alpha$ receives this payoff regardless of her action we have excluded it from the calculation. Since $U_A(P_A^*, P_B^*) = 0$ this reduces to

$$V_A = \frac{U_A(\bar{P}_A, \bar{P}_B)}{(1 - (1 - p_A)(1 - p_B)\delta - (1 - (1 - p_A)(1 - p_B))\delta^{T+1})} \quad (4)$$

In its choice of $\bar{P}_A$ A faces a trade-off. It increases its immediate payoff by increasing $P_A$; however doing so increases the risk of cooperation breakdown. The following first order condition ensures these incentive are exactly balanced and is the basis of equation 1:

$$\frac{dV_A}{dP_A} = \frac{1}{D^2} \left[ DU_A(P_A, \bar{P}_B) - U_A(\bar{P}_A, \bar{P}_B) \frac{dp_A}{dP_A} (1 - p_B)(\delta - \delta^{T+1}) \right] = 0 \quad (5)$$

where $D$ is the denominator in the expression of $V_A$ in equation 4. While this FOC is complex, Downs and Rocke have calculated the best possible treaties under a variety of parameters.

Next we examine the citizens’ decision to retain their leader. If the incumbent is caught cheating in the current period (assuming both leaders are otherwise in good standing) then the citizens can expect $T$ period of non-cooperative behavior before the restoration of cooperation. Thus, the value of retaining a leader who has just been caught cheating is $\frac{2 - \delta^{T+1}}{1 - \delta} U_A(P_A^*, P_B^*) + \delta^{T+1} V_A = \delta^{T+1} V_A$. If alternatively the citizens remove their leader at a cost of $k_A$ then they can immediate restore their nation’s good standing. The payoff from this
is $-k_A + \delta V_A$. Hence providing $k_A > V_A(\delta - \delta^{T+1})$ the citizens never replace their leader.\(^2\)

1.0.4 Low cost of leader replacement (the domestic politics case).

When the cost of leader replacement is low then citizens depose leaders caught cheating in order to avoid the suspension of cooperation.\(^3\) Given the threshold, $H_B$, if leader $\alpha$ chooses an output level of $P_A$ then she is observed to cheat with probability $p_A = \Pr(Q_A > H_B) = \Pr(\epsilon_A > H_B - P_A) = 1 - F(H_B - P_A)$. Similarly, $\beta$’s chance of being caught cheating is $p_B = 1 - F(H_A - P_B)$. Given the citizens’ replacement strategy if a leader is caught cheating then she is immediately removed and cooperation continues. Hence, in equilibrium if $\alpha$ and $\beta$ choose effort levels $P_A$ and $P_B$ then $\alpha$’s expected value of playing the game (starting with a good standing) is $V_\alpha = \frac{1}{1-\delta} U_A(P_A, \bar{P}_A) + \sum_{t=1}^{\infty} (1-p_A)^t \delta^{t-1} \Psi = \frac{1}{1-\delta} U_A(\bar{P}_A, \bar{P}_A) + \frac{F(H_B - \bar{P}_A)}{1-\delta F(H_B - \bar{P}_A)} \Psi$.\(^4\) The first term represents the payoff from the cooperative outcome of the continuous choice pd in every period. Remember that even if the leader is removed she still continues to receive the payoff from cooperation under the next leader. The second term represents the net present value from office holding given that the leader retains office with probability $(1 - p_A)$ in each period.

We now examine $\alpha$’s choice of optimal $P_A$ in the immediate period. We do so mindful that in all future periods $\alpha$ or any successor will play $\bar{P}_A$. If $\bar{P}_A$ is an equilibrium strategy then it must be the optimal strategy to pick it in the immediate round given it will be played in all future rounds and given the strategies of other players. Specifically, we need to ensure there is no one period defection that $\alpha$ prefers in the immediate round given that she (or any replacement) intends to play $\bar{P}_A$ in future. $\alpha$’s payoff from playing $P_A = \bar{P}_A$ in the immediate period is $EU_\alpha(P_A; \bar{P}_A, \bar{P}_B) = U_A(P_A, \bar{P}_B) + F(H_B - \bar{P}_A) \Psi + \delta V_\alpha + (1 - F(H_B - \bar{P}_A)) [\frac{1}{1-\delta} U_A(\bar{P}_A, \bar{P}_A)]$. The first term represents $\alpha$’s immediate payoff from the current period’s play of the continuous pd given $\alpha$’s choice of $P_A$. The second term is the probability that $\alpha$ is not observed cheating (given her choice $\bar{P}_A$) multiplied by the value of retaining office this period and the expected value of playing the game in future periods ($V_\alpha$). The final term is the probability that $\alpha$ is caught cheating (given her choice $\bar{P}_A$) multiplied by the value of cooperation in all future periods under new leadership. Substituting $V_\alpha$ into this expression yields $EU_\alpha(P_A; P_A, P_B) = U_A(P_A, P_B) + F(H_B - P_A) \frac{\Psi}{1-\delta F(H_B - P_A)} + \frac{\delta}{1-\delta} U_A(\bar{P}_A, \bar{P}_A)$.

If $P_A = \bar{P}_A$ is a best response given B’s strategy, the citizens’ strategy and

\(^{2}\)Note that since the citizens do not replace their leader facing $T$ periods of punishment, they would not want to remove their leader when facing less that $T$ periods of punishment. That is if the citizens were to replace their leader they would do so immediately.

\(^{3}\)Such penalties against leaders are often referred to as audience costs (Bueno de Mesquita and Lalman 1992; Fearon 1994; Schultz 1999, 2000, 2002; Smith 1998).

\(^{4}\)See the appendix for a more precise definition of $V_\alpha$. 

11
play in future rounds, then there is no one round defection that improves $\alpha$’s payoff:

$$P_A \in \arg \max_{P_A \in \mathbb{R}^+} EU_\alpha(P_A; \tilde{P}_A, \tilde{P}_B).$$

This represents equation 2 in proposition 2.

For an interior solution, equation 2 implies the first order condition given in equation 3 and the following second order conditions.

$$\frac{d^2}{dP_A^2} U_A(\tilde{P}_A, \tilde{P}_B) + F''(H_B - \tilde{P}_A) \frac{\Psi}{1 - \delta F(H_B - \tilde{P}_A)} < 0$$

(6)

For the case of $\varepsilon_i$ being normally distributed, $P_A \leq H_B$ a sufficient condition to ensure the SOC is met, hence the corollary.

We now move to the citizens’ decision to remove their leader. We start by calculating the citizens’ value for having a leader in good standing:

$$V_{cA} = 1 - \delta U_A(e_{PA}, e_{PB}) - k_A.\delta V_{cA}. T$$

The first term is the expected reward from the continuous choice pd game. The second term represents future expected costs of removing leaders caught cheating, which in each period occurs with probability $p_A = 1 - F(H_B - \tilde{P}_A)$.

Suppose A’s leader has just been caught cheating ($Q_A > H_B$). If they retain their leader then the citizens of A anticipates $T$ periods of non-cooperation before the restoration of cooperation, the net present value of which is $\sum_{t=1}^{T} \delta^t U_A(P^*_A, P^*_B) + \delta^{T+1}V_{cA}$. If alternatively the citizens replace their leader at a cost of $k_A$ then cooperation immediately resumes, which is worth $-k_A + \delta V_{cA}$. Substituting for $V_{cA}$, this implies that providing $k_A \leq U_A(\tilde{P}_A, \tilde{P}_B) \frac{\delta - \delta^{T+1}}{1 - \delta + (\delta - \delta^{T+1})p_A} = U_A(\tilde{P}_A, \tilde{P}_B) \frac{\delta - \delta^{T+1}}{1 - \delta + (\delta - \delta^{T+1})F(H_B - \tilde{P}_A)}$ the citizens of nation A replace $\alpha$ if she is caught cheating.

While this condition is illustrative of the cost at which citizens replace leaders, the formal characterization of the equilibrium requires a more careful exposition, which we present in the appendix.

### 1.1 The role of domestic politics in creating international cooperation

When the cost of leader removal is high, the citizens retain their leader whatever. Under these circumstances, leaders can commit to cooperate only because they know being observed to have cheated ends cooperation for the next $T$ periods. Providing the value of $T$ periods of cooperation is worth more than the myopic gain of exploiting the other side then cooperation is possible. This is the classic neo-liberal approach to cooperation.

When the cost of leader removal is low then the enforcement of cooperation works slightly differently. Once a leader is caught cheating the other nation refuses to cooperate with that leader for $T$ periods. This is the same threat used in the unitary actor case, yet when the cost of leader removal is low, the citizens avoid the loss of cooperation for $T$ periods by replacing their leader. Hence while foreign nations threaten to remove cooperation for $T$ periods, the
consequential threat for the leader is the loss of her job. If leaders value keeping
their jobs beyond all else, then the consequence of a break down of cooperation
is much worse than the loss of cooperation: it is the loss of office. As the penalty
associated with the breakdown in cooperation increases, leaders seek to reduce
the risk. As we shall now see, this enables domestically accountable leaders to
commit to far higher levels of cooperation.

1.1.1 The depth of cooperation

When the cost of leader removal is low, as might be the case in large coalition
systems, leaders can credible commit to far higher levels of cooperation. Figure
2, below, illustrates this for the case of perfect information. This is to say the
case where there is no noise, i.e. $\sigma = 0$.

The upper two lines represent the high removal cost scenario; the lower two
lines represent the low removal cost scenario. Leaders can only credibly commit
to cooperative arrangements (i.e. $P$) above the line. Remember in this setting
cooperation arrangements represent a reduction in protection from the Nash
level of 100. The top line considers a single period punishment, $T = 1$. This
is to say, if A produces $Q_A > H_B$ then B withdraws cooperation for a single
period. As the figure shows, the threat of losing a single period of cooperation
is insufficient to support all but minimal cooperation. As shown, the lowest
protection level, $P_A$, supportable even by very patient nations is only slightly
less than the non-cooperative Nash case of $P_A = 100$. In contrast, when the
threat is the permanent withdrawal of cooperation, the so called grim trigger
case shown by the second line down in Figure 2, significant cooperation becomes
possible when nations are patient.

When leader removal is easy then the possibilities of cooperation increase
greatly, as shown by the two lower lines in Figure 2. The two lines differ by the
value of office holding: $\Psi = 100$ (3rd line down) and $\Psi = 1000$ (lowest line).
While these office holding values might appear large, they are of the order of
magnitude of the value of agreement. Remember, complete cooperation by each
side ($P_A = P_B = 0$) is worth 100 per period, while the temptation to defect un-
der this circumstance is worth 3125. When leaders care about office holding and
citizens can remove leaders easily then far deeper cooperative arrangements can
be reached and achieving these deals does not require extremely high patience.

In the high cost unitary actor case, high patience is required so that nations
place a high value on future cooperation. In the low cost, domestic politics
case, although it is true that high discount factors enable greater cooperation,
the dependence on a high discount factor is less critical. For leaders who value
office highly, cooperative deals with protection levels half of those in the non-
cooperative can be supported by even minimal discount factors. In the domestic
politics case, leaders risk losing office, not future cooperation, from cheating.
Although the net present value of office holding increases with an increased
discount factor, leaders risk the immediate loss of office even when the discount
factor is low. This is not to say the discount factor is inconsequential. Leader
specific punishments only force leaders to cooperate when the value of future
cooperation is greater than the cost of removing the leader, the circumstances under which the citizens remove a leader caught cheating. In the noiseless case with $T$ periods of punishment, this requires $k_A \leq U_A(\bar{P}_A, \bar{P}_B)\frac{\delta^{-1}T^2}{1-\delta} = (100 - \bar{P}_A)\frac{\delta^{-1}T^2}{1-\delta}$.

Figure 2 shows clearly that in the noiseless world, leader specific punishments allow for much deeper cooperation when leaders are easily replaced. These results hold even as we increase the amount of noise. For our simulations, we assume the observational errors are normally distributed with variance $\sigma^2 = 1$. 

Downs and Roche (1995, p. 98-99) provide Tables on the limits of cooperation. For instance with a discount factor of $\delta = 0.9$, they find no cooperative agreement is possible for short punishment periods; however, with an infinite punishment the limit on cooperation is $P_A = P_B = 75.8$. In contrast, leader specific punishment supports full cooperation, $P_A = P_B = 0$, at $\delta = 0.9$ if $\Psi = 1000$ by setting a threshold of $H = 2.667$. Under this circumstance, leader $\alpha$ will accidently be caught ‘cheating’ 0.4% of the time. The limiting cost in this scenario is $k_A \leq \frac{\delta^{-1}T^2}{1-\delta}F(2.667)\frac{\delta}{1-\delta}100$, which converges to 870 as $T \to \infty$.

If, as we believe, office holding is the dominant motive for leaders then full cooperation can be achieved with even lower risk of breakdown. For instance, if $\Psi = 100,000$ then a threshold of $H = 4.049$ achieves full cooperation ($P_A = 0$) with a risk of accidental breakdown of only $p_A = 0.000026$. In order that citizens replace their leader, the limiting cost of removal (for $T = \infty$) is $k_A \leq 899.8$, nearly nine time the value of full cooperation. As these simulations show, leader

---

5 Here we characterise fully cooperative agreements with the minimal risk of accidental failure of cooperation. Alternatively one might ask what the optimal agreement is from the perspective of the leader or the citizens: $\max_{P,H} V_\alpha$ subject to the equilibrium constraints and $\max_{P,H} V$ subject to the equilibrium constraints. Unfortunately, these objects are hard to calculate.

6 If $T = 1$ then $k_A \leq 89.7$. 

14
specific punishments allows full cooperation even in the presence of noise.\footnote{Full cooperation can still be supported even as the amount of noise increases. If $\sigma^2 = 100$, for instance, full cooperation with $\delta = 0.9$ and $\Psi = 100,000$ requires a threshold of $H = 34.324$.} The prediction are clear even in the presence of noise, when citizens can easily remove leaders then leader specific punishment strategies enable office seeking leaders to credibly enact deep cooperative arrangements. In contrast, when leaders are hard to remove, the depth of possible agreement is far shallower and more dependent upon the size of the discount factor.

Leader specific punishment strategies imply different dynamics depending upon the cost of leader removal. When leader removal is easy then cooperation can be deep. Leaders, knowing that being observed to cheat will cost them their jobs, pick protection levels well below the punishment threshold. Hence the breakdown of cooperation between nations with low removal costs should be rare. In the event of these unlikely contingencies, the leader observed cheating is likely to be rapidly deposed, so the ‘cheating’ incident is unlikely to lead to a souring of relations.

In contrast, when one of the nations attempting to reach agreement has a high cost for leader removal, cooperation is shallow. Further since hard to remove leaders risk less than their accountable counterparts, they pick protections levels closer to the punishment threshold than would an easily removed leader. Hence autocratic leaders should be observed to cheat more often than leaders beholden to large winning coalitions. Further since they are not easily removed, cheating leads to a prolonged period of non-cooperation. During this punishment phase, should the leader responsible for the failure of cooperation leave office, then this rejuvenates relations between states.

1.1.2 Implications

Leader specific punishment strategies generate predictions about the relationships between international cooperation, domestic political institutions and leadership turnover. It is now time to ask so what.

When domestic political institutions make leader removal easy, as is the case in large winning coalition systems, then states can cooperate deeply. In contrast, as the size of the domestic winning coalition contracts, especially when the electorate is large, it becomes increasingly costly for the incumbent’s supporters to desert her as a result of her failure on the policy dimension of international cooperation. Once the cost of removing a leader is in excess of the value of lost cooperative opportunities then leaders are immune from the domestic consequences of leader specific punishments. Effectively they behave as unitary actors in much the same way as nations are treated in extant neo-liberal theories of international cooperation (Keohane and Nye1977).

In addition to predicting greater cooperation between states where leader removal is easy, the theory also makes numerous predictions about the dynamics of leader turnover and cooperation. Yet, before turning to these it is worthwhile to step back and put the theoretical ideas developed here in perspective. Like the extant arguments of cooperation in the prisoners’ dilemma, the theory only
proposes the possibility cooperation. It remains undeniable that nations playing
the single shot Nash equilibrium in each period is also a subgame perfect equi-
librium, albeit a relatively uninteresting one. One might legitimately ask why
picking out the interesting case of the leader specific punishment over extant
unitary actor strategies or the Nash equilibrium is of value to the social sci-
ence community. There are two straightforward answers to this question. The
first answer is empirical validity. Leader specific punishment strategies predict
regime type strongly influences the level of cooperation between states, a pre-
diction absent in unitary actor approaches. There is considerable evidence in
support of this claim (for instance, Leeds 1999; Oneal and Russett 2001). Ad-
ditionally, the theory makes detailed predictions with regard to the dynamics
of leadership turnover and cooperation and how domestic political institutions
moderate these relationships.

The second answer as to why we focus on leader specific punishments is
that if nations do not use such strategies, then we have identified a mechanism
through which they can improve international cooperation. That is, leader spe-
cific strategies offer a powerful policy prescription through which nations can
improve the welfare of their citizens (Smith 2000). Whether the contribution
of our theoretical predictions are in their positivist value in accounting for the
world around us or their policy prescription for improving cooperative relations
we are undecided. Indeed, there is considerable disagreement between the au-
thors on this issue.

Whether or not leader specific punishments have a general role in shaping
relations between states, there is evidence of their use in some circumstances.
For instance, in both of its last two conflicts (with Yugoslavia over Kosovo
and Afghanistan) and the one currently looming with Iraq, the US has been
adamant that has "no quarrel with the people ...."8 and that it wished only
to target the leadership. As the theory would suggest, since in each of these
countries removing leaders is costly, incurring the wrath of the US would not
cause the citizens to remove their leaders. Yet, the removal of these leaders did
or would normalize relations. Following Slobodan Milosevic’s deposition western
aid flooded into Yugoslavia9, and following the overthrow of the Afghani regime
the US is helping rebuild Afghanistan. Current US policy towards Iraq calls
for the maintenance of economic sanctions while Saddam Hussein remains in
power. Yet, few expect sanctions to continue beyond his reign.

While these anecdotal accounts provide evidence that some aspects of US
policy, and in particular national security (Guisinger and Smith 2002; Sartori
2001), involve leader specific punishments it is clear that this does not carry
over to all aspects of treaty maintenance. In March 2002, US President George
W. Bush imposed steel tariffs of 30% on a variety of products from European

---

8 Both Bush Presidents have made this statement over crises with Iraq, Rea-
gan stated it about Libya in 1985 and Clinton stated it over Kosovo (Fisk 2002;
http://www.cnn.com/WWORLD/europe/9810/07/kosovo.nato.02/). UK Prime Minister Blair
has also used exactly the same phrase with respect to Afghanistan (November, 1, 2001.

and Asian nations. This act was clearly in violation of the World Treaty Organization, as dispute resolution hearings established (www.wto.org). Even though these nations have threaten retaliatory tariffs through the WTO, they have not explicitly turned against Bush. Indeed, the US and many European nations are currently cooperating at unprecedented levels in response to recent terror actions and threats. This suggests that, as of now, individual treaties are not maintained through the leader specific punishment mechanism described here, or any other mechanism involving the reciprocal withdrawal of cooperation. Of course, although our model considers only a single issue, nations cooperate simultaneously over numerous issues. While not applying to a single issue, nations might use leader specific punishments when leaders have violated international norms of behavior more generally. Even if not currently in use in this wider setting, leader specific punishments identify a mechanism through which nations might enhance future cooperative agreements.

In addition to predicting higher level of cooperation between states with easy to remove leaders, the theory also predicts different dynamics between cooperation and leadership turnover based on domestic political institutions. In particular, cooperation should be deeper and more reliable between nations whose leaders are easily removed. Further on the rare occasions that such accountable leaders are caught cheating on international norms of behavior they should be removed. However, precisely because democratic leaders want to keep their jobs they minimize such occurrences.

In contrast, cooperation involving nations with less easily removed leaders is not as deep or reliable. Since their tenures are not in jeopardy, leaders are less cautious about avoiding being seen as cheats. Hence the onset of punishment is more likely when leaders are hard to remove. Further, once cheating is detected, without being able to use the mechanism of leader removal, relations between states sour until either the punishment phase is complete or the responsible leader leaves office. To our knowledge there are few empirical tests that address these dynamics directly.

Using BdM2S2’s metric of winning coalition and selectorate size as a measure of ease of leader removal, we examined patterns of dyadic trade flows. These results are reported elsewhere (McGillivray and Smith 2002). In addition to finding stronger trading links between large winning coalition systems, their trade is also more reliable (Russett and Oneal 2001). Using current trade flows relative to recent historical averages as a measure of relations we found dyads involving at least one small coalition system nation were significant more likely to experience poor relations compared to dyads involving only large coalition systems. Of course all dyads experience variance in their trade flows as a result of natural causes, such a drought or floods destroying harvests. Yet, all else equal, the large coalition systems are less likely to experience politically induces impediments to trade.

Conditional upon experiencing poor relations (i.e. low trade flows relative to historical averages), the theory predicts that nations will retaliate through leader specific punishments. In our original model of leader specific punishment, nations cooperate until their leader is found cheating. Once found, the leader is removed and cooperation is restored. However, in real life, nations might respond with low level cooperation or even punishment without leader removal.

\[10\] Downs and Rocke are currently working on theoretical models of reciprocal punishment when nations cooperation on numerous dimensions.
recent historical averages), leadership turnover significantly improves relations among dyads involving a small coalition system, as we would predict. However, leadership turnover did not significantly help restore trading relations between large coalition nations, in accordance with the theory. When both states have large winning coalitions, and hence both leaders are careful not to incur the ire of the other, declines in trade are more likely due to natural cause than political actions. Trade flows between large coalition systems should recover regardless of leadership turnover, which they do.

2 Conclusions

Although traditional liberal theories explain how international cooperation is possible, they fail to account for the huge variation in the depth and reliability of cooperative agreements. Nations differ greatly in the domestic political institutions. In this paper we examined how these differences shape interstate relations.

Domestic institutions affect the ease with which citizens can replace their leaders. Within this context, we examine the consequences of targeting punishments against individual leaders rather than the nations they represent. If a leader, who is easily replaced, incurs the ire of another state, which in response withdraws cooperation or imposes other punishments, then the citizens of the first state can avoid punishment by deposing their recalcitrant leader. Not only do such circumstances provide a means to rejuvenate cooperation, they also prevent the break down of cooperation in the first place and allow for deeper and more reliable cooperation, providing leaders are easily removed.

When punishments are leader specific then leaders who are easily removed realize that being caught cheating will cost them their jobs. Office seeking leaders typically care more about keeping their jobs than the agreement per se. Hence leader specific punishments increase the penalty for cheating on an agreement. With the penalty for cheating increased, leaders can commit to far deeper cooperation than would be the case if their political tenure was not in jeopardy.

We model the dynamics of leader specific punishments within the context of a noisy continuous choice prisoners' dilemma. Providing the value of future cooperation is greater than the domestic cost of removing a leader, citizens depose incumbents who are caught cheating. Our analyses show that under these circumstances, leader can not only commit to deeper cooperation, but they also cooperate more reliably. Since their tenure is in jeopardy, easily removed leaders are more cautious to avoid circumstances in which they might appear to have defected on an agreement.

Unfortunately, leader specific punishments only work when leaders are easily removed. If the costs of replacing a leader outweigh the value of restoring future cooperation then leaders can cheat with impunity, at least from domestic punishment. With less at stake, hard to remove leaders can not commit to as deep or as reliable cooperation as their more accountable contemporaries.
Whether nations do in fact use leader specific punishments to enhance cooperation remains to be seen. Anecdotal evidence of recent US security concerns suggests the targeting of individual leaders. Yet, there is contrary evidence that leaders can break provisions of individual agreements without incurring international punishment. This is of course consistent with the theory’s predictions. Leader specific punishments are only effective at enforcing cooperation when the value of cooperation is in excess of the cost of leader removal. This contingency is far more likely to be true for an international security concern than a particular provision in a trade, environmental or regulatory agreement.

In addition to anecdotal evidence, the arguments account for the widely reported finding that democratic dyads cooperate at higher levels than other pairings of states. Further, preliminary study of dyadic trade flow data strongly support how the dynamics of leadership turnover interact with institutions to shape interactions. In particular, between large coalition systems, where leadership turnover is easy, trade relations are deep and consistent with few instance of poor relations. In contrast, trade flows between dyads involving small winning coalitions, where leader removal is hard, are smaller and less consistent, with instances of poor trading relations being more common. Further, in the latter case, leadership turnover is an important determination of the restoration of relations (McGillivray and Smith 2002). While preliminary evidence supports the use of leader specific punishments in some instances, few empirical studies assess the theory’s dynamic predictions directly. More work is clearly needed.

3 References


4 Appendix

Here we examine those aspects of the propositions that were inadequately dealt with the main text. In particular we focus on the citizens’ decision to remove their leader. Porter (1983) and Green and Porter (1984) proved a detailed and thorough account of the derivation of first order conditions and continuation values for proposition 1 and these setting generally.

Leader removal  We examine leader removal in the low cost case. The high cost case follows trivially from these results. We consider the incentives to remove leader α in period t as a function of her standing, given the strategy of nation B and α’s strategy. First, if the incumbent is in good standing there is no benefit in replacing her. The citizens expected payoff from replacing α is $k_A$ less than the payoff from keeping her.

Second, suppose $S_{t-1}^A = 1$, this is to say the incumbent is in poor standing but the current period is the last period of punishment. Since in the next period cooperation is restored whether or not the leader is replaced, their is no reason to replace α.

Next consider $S_{t-1}^A = 2$, this is to say there is one more period of punishment (after the current period) before the restoration of the incumbent’s good standing. If the citizens depose α in period t then their payoff is $-k_A + \delta V_{cA}$. If alternatively they retain α then their payoff is $\delta U_A(P_A^*, P_B^*) + \delta^2 V_{cA} = \delta^2 V_{cA}$. Hence the continuation value for playing the game with a standing of $S_{t-1}^A = 2$ is $Z_2 = \max\{-k_A + \delta V_{cA}, \delta^2 V_{cA}\}$.
Next consider $S_{A}^{t-1} = 3$. If A replaces $\alpha$ then their payoff is $-k_{A} + \delta V_{CA}$. If alternatively A retains $\alpha$ then their payoff is $0 + \delta Z_{2}$. Suppose that $Z_{2} = -k_{A} + \delta V_{CA}$, i.e. A will deposes $\alpha$ in the next period. A deposes $\alpha$ if $-k_{A} + \delta V_{CA} \geq \delta(-k_{A} + \delta V_{A})$, which occurs when $k_{A} \leq \delta V_{CA}$. Yet since $Z_{2} = -k_{A} + \delta V_{CA}$ we know that $k_{A} \leq \delta V_{CA} - \delta^{2} V_{CA}$. Since $\delta V_{CA} < \delta V_{CA} - \delta^{2} V_{CA}$, therefore $k_{A} \leq \delta V_{CA}$, so A deposes $\alpha$ at $S_{A}^{t-1} = 3$.

Suppose instead that $Z_{2} = \delta^{2} V_{CA}$, i.e. A will not deposes $\alpha$ in the next period. A deposes $\alpha$ in the current period only if $k_{A} \leq \delta V_{CA}(1 - \delta^{2})$. Let the continuation value for playing the game with a standing of $S_{A}^{t-1} = 3$ be $Z_{3} = \max\{-k_{A} + \delta V_{CA}, \delta^{2} V_{CA}\}$.

We now reiterate these arguments inductively.

First, if $Z_{i} = -k_{A} + \delta V_{CA}$ (i.e. A will deposes $\alpha$ given standing $S_{A}^{t-1} = i$) then A will deposes $\alpha$ given standing $S_{A}^{t-1} = i + 1$, therefore $Z_{i+1} = -k_{A} + \delta V_{CA}$.

Second, suppose $Z_{i} = \delta^{2} V_{CA}$ and consider A’s deposition decision given a standing of $S_{A}^{t-1} = i + 1$. If A deposes $\alpha$ then their payoff is $-k_{A} + \delta V_{CA}$. If A retains $\alpha$ then their payoff is $\delta Z_{i} = \delta^{i+1} V_{CA}$. Hence $Z_{i+1} = \max\{-k_{A} + \delta V_{CA}, \delta^{i+1} V_{CA}\}$. Given this induction $Z_{T} = \max\{-k_{A} + \delta V_{CA}, \delta^{T} V_{CA}\}$. This characterizes the optimal deposition decisions as specified in proposition 2 for $S_{A}^{t-1} = 1, ..., T$ and $(S_{A}^{t-1} = 0$ and $\alpha$ is not caught cheating).

Now consider the situation where $\alpha$ (in good standing, $S_{A}^{t-1} = 0$) is caught cheating. If A deposes $\alpha$ then its payoff is $-k_{A} + \delta V_{CA}$. If A retains $\alpha$ then its payoff is $\delta Z_{T}$. If $Z_{T} = -k_{A} + \delta V_{CA}$ then A deposes $\alpha$ when she is caught cheating, since $Z_{T} = -k_{A} + \delta V_{CA}$ implies $-k_{A} + \delta V_{CA} > \delta Z_{T}$. If $Z_{T} = \delta^{T} V_{CA}$ then A deposes $\alpha$ only if $k_{A} \leq \delta V_{CA}(1 - \delta^{T})$. This implies the limiting cost for the low cost case is $k_{A} \leq \delta V_{CA}(1 - \delta^{T})$ which implies $k_{A} \leq U_{A}(\tilde{P}_{A}, \tilde{P}_{B})^{1-\delta^{-\delta^{T+1}}}(\delta^{-\delta^{T+1}})\hat{p}_{A}$, as stated in the main text. If $k_{A} > U_{A}(\tilde{P}_{A}, \tilde{P}_{B})^{1-\delta^{-\delta^{T+1}}}(\delta^{-\delta^{T+1}})\hat{p}_{A}$ then A never deposes $\alpha$, which characterizes the high cost scenario.

**$\alpha$’s continuation value** In the text we report $\alpha$’s continuation on the equilibrium path. Here we provide a more careful consideration of $V_{A}$. Assuming both $\alpha$ and $\beta$ are in good standing then $\alpha$ chooses a $P_{A}$ in each period. Should $\alpha$ be replaced, the new leader (and any subsequent leaders) produce $P_{A}$ in each period. Then $V_{A} = U_{A}(P_{A}, P_{B}) + (\delta U_{A}(P_{A}, P_{B})) \sum_{i=1}^{\infty} \delta^{2-i}(1 - (F(H_{B} - P_{A})^{t}) + (\Psi + \delta U_{A}(P_{A}, P_{B})) \sum_{i=1}^{\infty} \delta^{2-i}(F(H_{B} - P_{A})^{t})$. The first term represents $\alpha$’s immediate payoff for the continuous choice pd, the second is the net present value of paths in which $\alpha$ is deposed and the final term is the net present value of paths in which $\alpha$ retains office. In equilibrium, $P_{A} = P_{A}$ so this equation reduces to that reported in the main text. Maximizing this equation with respect to $P_{A}$ provides an alternative method to derive equation 3.