Why Do Bicameral Chambers Usually, but Not Always, Agree?

An Incomplete Information Game Model

Ver 2.0 *

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Abstract

Naive observers wonder why the bicameral conference is not held after the second chamber’s amendment of the first chamber’s bill, while complete information models fail to explain why the conference is sometimes held. This paper addresses both questions by constructing an incomplete information model. The more uncertain a chamber is of the other’s position or the more important a bill is, the more likely the bill is to be amended or taken to the conference.

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INTRODUCTION

Why the bicameral conference, though rarely, but does, occur? The constitutions prescribe the bicameral conference as a reconciliation tool for bicameral conflict. In reality, even though the second chamber amends a bill from the first chamber and sends it back to the first chamber, the first chamber accepts it as it is and rarely requests the bicameral conference.

Complete information models argue that, since the second chamber amends a bill so that the first chamber accepts it, the first chamber does not have to appeal to the bicameral conference. Thus, the bicameral conference should never occur. Moreover, anticipating the reaction of the second chamber, the first chamber sends the bill which the second chamber does not have to amend. Therefore, bill are not supposed to be amended in the first place. The problem is, however, that this prediction is not the case in real lawmaking: bicameral conference is sometimes called and bills are often amended.

The legislative literature fails to explain both why the bicameral conference is not so often held and why it is sometimes held. The present paper addresses these problems by applying an incomplete information model. Since one chamber does know what the other wants to some degree, the bicameral conference is rarely held. But since one chamber does not know exactly what the other wants, the bicameral conference is sometimes held. Moreover, this model explains when the second chamber amends the first chamber’s bill in the first place. Two key factors are uncertainty and importance. When the one chamber’s median voter belongs to a different party from the other chamber’s, it is not sure of the other chamber’s position and is less likely to accept the other chamber’s offer with caution. Besides, houses do not hesitate to take an important bill to the conference.

The present paper is organized as follows. The next section introduces a complete information game as a baseline to compare with. In the third section, the article presents its main model of incomplete information game. To begin, perfect Bayesian equilibria and their
paths are shown. Next, intuitional interpretation is narrated. The final section concludes. Most of formal argument which the main text discussion is based on is developed in the Appendix.

**COMPLETE INFORMATION MODEL**

**Setup**

Hammond and Miller (1987) and Tsebelis and Money (1997) demonstrate that bicameral bargaining in multi-dimentional policy space is reduced to that in one dimensional policy space. Thus, this paper also supposes one dimension policy space. Moreover, since the present article focuses on interbranch bargaining, it omits intrabranch negotiation and regards each chamber as an unitary actor.\(^1\) Let the ideal point of the first chamber’s decisive legislator (such as the median legislator) and that of the second chamber’s be denoted by \(F\) and \(S\).\(^2\) The game develops as follows.

Nature decides \(F\) and \(S\) \((F > S)\) and reveals these values to both chambers (complete information). Nature also chooses the bicameral conference report, \(B_C\), from uniform distribution \(U[S, F]\). This means that any version between the two houses’ ideal points can be the bicameral conference report with equal chance. For convenience of presentation, it is assumed that the conference never fails to reach a conclusion \(B_C\) and both chambers always accept it (i.e. prefer it to the status quo).\(^3\)

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\(^1\)As for connection between interbranch bargaining and intrabranch bargaigning or organization, interested readers might refer to Ansolabehere, Snyder, and Ting (2003); Diermeier and Myerson (1999); Kalandrakis (2004); König and Bräuninger (1996); Patty (2006); Taylor (2006).

\(^2\)The chamber’s decisive legislator may be not the median legislator but the agenda setter like the chair on the floor or in the committee as well as a pivot player about veto, override, filibuster or cloture (Chiou and Rothenberg, 2003; Krehbiel, 1998). This paper is not concerned with who the dicisive legislator is. Moreover, it may not be appropriate to regard a chamber as an unitary actor in the first place. In the next section, the incomplete information model turns to this issue.

\(^3\)If the conference report is rejected, the status quo continues and \(Q = L\). It is assumed that \(Q\) is too far
1. The first chamber resolves a bill $B_F$ and sends it to the second chamber.

2. (a) If the second chamber passes it, its version of the bill, $B_S$, is equal to $B_F$ and is not returned to the first chamber.

(b) Otherwise, the second chamber amends the bill to $B_S \neq B_F$ and returns it to the first chamber.\(^4\)

3. The game ends in three ways.

   **No Amendment:** If $B_S = B_F$, the first chamber has nothing to do and $B_S = B_F$ becomes a law, $L$.

   **Acceptance:** If the first chamber receives and accepts $B_S \neq B_F$, $L = B_S$.

   **Conference:** If the first chamber receives but does not accept $B_S \neq B_F$, it calls for the bicameral conference. Nature reveals the conference report, $B_C$, to both houses.

   The report is accepted by both houses and becomes a law, $L$.

   In the case of $L = B_F$ or $L = B_S$, utility of each house is the negative value of the distance between its ideal point and the law: $U(F) = -|F - L|$ and $U(S) = -|S - L|$. When the bicameral conference is held, the “conference cost”, $K_F(>0)$ and $K_S(>0)$ (for the first chamber and the second, respectively), are incurred: utility is $U(F) = -|F - L| - K_F$ and $U(S) = -|S - L| - K_S$. The conference cost can be interpreted at least in three ways.

   **Transaction Cost:** Holding the conference and, much more, working out an acceptable report takes effort, time, side payment, etc.

   **Risk Averse (or Time Discount):** It is notoriously unpredictable even for senior lawmakers what the final conclusion will look like or whether it comes into existence in the first place. Also, it delays enactment.

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\(^4\) If $B_S$ is equal to the status quo $Q$, it means that the second kills the bill. Unless we consider override option, the game ends here. For the time being, it is supposed that the second chamber never kills a bill.
Unimportance: If a house has larger stake in the bill, it will not sell it for leisure time but will not dare to go to the conference and make every effort to make the bill best for the house. (As for equivalence between importance and time discount, see Cameron (2000))

In order to avoid unnecessarily many equilibria, this paper makes some assumption.\footnote{\textit{S} and \textit{F} are so apart that \(F - S \geq K_F\). All bills and amendments are Pareto optimal: \(S \leq B \leq F\). If acceptance and rejection of bill (amendment) brings the same utility to the first chamber given the second chamber’s strategy, the first chamber prefers acceptance to rejection.}

**Subgame Perfect Nash Equilibrium**

This game is a version of the Romer and Rosenthal (1978) model. Since this is a dynamic game with complete information, equilibrium should be subgame perfect Nash equilibrium. Due to backward induction, the third stage comes first. If the first chamber calls for bicameral conference, its expected utility is

\[
U(F) = \int_S^F \left( -|F - L| - K_F \right) \frac{1}{F - S} dL = \frac{F + S}{2} - F - K_F
\]

By contrast, if the first chamber accepts \(B_S\), \(U(F) = B_S - F\). Therefore, when \(B_S \geq B^* \equiv \frac{S + F}{2} - K_F\), the first chamber accepts the second chamber’s bill. Otherwise, the bicameral conference is held. The cutoff point moves from the median between both chambers in the direction of the second chamber by \(K_F\). The first chamber’s conference cost does harm the first chamber.

On the second stage, if the second chamber returns \(B_S \geq B^*\), the first chamber accepts it and \(U(S) = S - B_S \leq S - B^*\). If the second chamber returns \(B_S < B^*\), the first calls the conference and \(U(S) = S - B^* - K_F - K_S < S - B^*\). Thus, the best amendment for the second chamber is \(B_S = B^*\). Only when the first chamber sends a better bill \(B_F \leq B^*\), the second chamber accepts it. Otherwise, it returns \(B_S = B^*\).
On the first stage, if the first chamber sends $B_F > B^*$, the second chamber returns $B^*$ and the first chamber accepts it. If the first chamber sends $B_F \leq B^*$, the second chamber accepts it. Thus, the best response is $B_F = B^*$.

The equilibrium is as follows:

1. The first chamber sends $B_F = B^* = \frac{F+S}{2} - K_F$.

2. The second chamber
   
   (a) resolves $B_S = B^*$ if it receives $B_F > B^*$.
   
   (b) accepts $B_F$ if it receives $B_F \leq B^*$.

3. If the first chamber receives $B_S \neq B_F$,
   
   (a) it accepts $B_S \geq B^*$.
   
   (b) it does not accept $B_S < B^*$.

Therefore, on the equilibrium path, neither bicameral conference nor amendment is observed because the first chamber sends a bill so that the second chamber accepts it (see also Manow and Burkhart (2007)). Accordingly, absence of bicameral conference or amendment does not imply that there is no difference of preference between the two chambers. How far both chambers are from each other does not matter. Moreover, the law $(B^* = \frac{S+F}{2} - K_F)$ is always in favor of the second chamber than the midpoint between both houses $(\frac{S+F}{2})$ by the first chamber’s conference cost $(K_F)$. There is first mover disadvantage rather than its advantage as Rogers (1998) argues it.

In real politics, however, bicameral conference and amendment do happen. In order to address this problem, the next section incorporates uncertainty into the model.

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6 König (2001) argues that, compared with the case of different majorities, similar majorities of both chambers make bicameral check-and-balances disappear. His argument is, however, based on not (dynamic) game theoretic model but (static) winset concept (Tsebelis, 2002).
INCOMPLETE INFORMATION MODEL

Setup

The model introduced in this section is different from the previous one only in that each house does not know the other house’s ideal point until the bicameral conference. There are the extreme type of the first (second) chamber, \( F_E \) (\( S_E \)), and the moderate type of the first (second) chamber, \( F_M \) (\( S_M \)). The moderate type is closer to the other chamber than the extreme type. Thus, \( F_E > F_M \) and \( S_E < S_M \). Before the game begins, the first (second) chamber has prior belief \( q^* \) (\( p^* \)), namely, the probability that the second (first) chamber is the extreme type, \( Pr(S = S_E) \) (\( Pr(F = F_E) \)). It is assumed that \( 0 < q^* < 1 \) and \( 0 < p^* < 1 \). This uncertainty changes the game dramatically.

Intuition behind this setup is straight-forward and real: a chamber is not sure what the other house really wants. But once they directly negotiate at the conference and must hammer out a take-it-or-leave-it bill, their true preference is revealed to each other. \( \Delta_F = F_E - F_M \) and \( \Delta_S = S_M - S_E \) represent uncertainty level of the ideal point of the first chamber and the second one, respectively.

To be concrete, the most important factor that affects uncertainty level is how different both houses’ partisan composition is. In particular, when decisive legislators of both chambers belong to different parties or when only one (typically the lower) house’s majority supports the government (divided government in parliamentary system), this uncertainty will be severe. But note that, even if the same party occupies the dicisive legislators in both houses, this model assumes their ideal points are not the same.

Here comes another factor from which uncertainty arises: intra-chamber bargaining. Since this paper focuses on inter-chamber bargaining, it regards a chamber an unitary actor. But, admittedly, this simplifies the reality. Suppose that the two types of a chamber represent the two groups in the chamber and the extreme group wins intra-chamber bargaining with
the probability $p^*$ or $q^*$. This is another interpretation of the model.

In order to avoid unnecessarily complicated taxonomy and make essence of the game clear, this paper makes some assumption. For details, see the Appendix.

**Perfect Bayesian Equilibria**

Since this is a dynamic game with incomplete information, equilibria should be perfect Bayesian equilibria. This section explains essence of equilibria: on-the-path strategy profiles, the conditions in which each equilibrium is established, their paths (episode which are observed if the strategy profile is played) and outcomes (in parenthesis). Most of the other technical details (the values of the equilibrium bills and amendments, the threshold values of parameters, off-the-path belief and proof of equilibria) are left to the Appendix.

On-the-path strategy profiles are represented as (\{the first chamber’s\}, \{the pooling second chamber’s\}) or (\{the first chamber’s\}, \{the moderate second chamber’s, the extreme second chamber’s\}). The “Concessive Bills” (or Amendments) are the bills which the first (second) chamber sends and both types of the second (first) chamber accept. The “Aggressive Bills” (Amendments) are the bills which the first (second) chamber sends and only the moderate type of the second (first) chamber accepts. The “Recalcitrant Bills” (Amendments) are the bills which the first (second) chamber sends and both types of the second (first) chamber reject.\(^7\)

\(\{\text{Concessive and Aggressive}, \{\text{Concessive}\}\}\). When $\Delta_F$ and $\Delta_S$ are low, the first chamber sends the Concessive Bill which is also the Aggressive Bill. The second chamber accepts it (No Amendment).

\(\{\text{Concessive}, \{\text{Concessive, Aggressive}\}\}\). When $\Delta_F$ and $\Delta_S$ are low (but not very low), the first chamber sends the Conressive Bill. The second chamber accepts it (No Amendment).

\(\{\text{Aggressive}, \{\text{Concessive, Aggressive}\}\}\). When $\Delta_F$ and $\Delta_S$ are low (but not very low),\(^8\)

\(^7\)The term “Recalcitrant Amendment” is associated with “Recalcitrant President” in (Cameron, 2000).
the first chamber sends the Aggressive Bill. The moderate second chamber accepts it (No Amendment). The extreme second chamber returns the Aggressive Amendment. The moderate first chamber accepts it (Acceptance of Amendment). The extreme first chamber calls for conference (Conference).

\((\{\text{Aggressive}\},\{\text{Concessive, Recalcitrant}\})\). When \(\Delta_S\) is high, the first chamber sends the Aggressive Bill. The moderate second chamber accepts it (No Amendment). The extreme second chamber returns the Recalcitrant Amendment. The first chamber calls for conference (Conference).

\((\{\text{Recalcitrant}\},\{\text{Aggressive}\})\). When \(\Delta_F\) is high, the first chamber sends the Recalcitrant Bill. The second chamber returns the Aggressive Amendment. The moderate first chamber accepts it (Acceptance of Amendment). The extreme first chamber calls for conference (Conference).

\((\{\text{Recalcitrant}\},\{\text{Aggressive, Recalcitrant}\})\). When \(\Delta_F\) and \(\Delta_S\) are high, the first chamber sends the Recalcitrant Bill. The moderate second chamber returns the Aggressive Amendment. The moderate first chamber accepts it (Acceptance of Amendment). The extreme first chamber calls for conference (Conference). The extreme second chamber returns the Recalcitrant Amendment. The first chamber calls for conference (Conference).

Table 1 summarizes equilibria. The first two columns show that uncertainty level of the two houses (\(\Delta_F\) or \(\Delta_S\)) are low or high relative to conference cost \(K\). The third column indicates the first chamber’s strategy; Concessive, Regressive or Recalcitrant Bill. The fourth and fifth columns means the moderate and extreme second chamber’s strategy, respectively. In rows where the two columns are merged, both types return the same pooling amendment. Four right columns classify observed outcomes into no amendment, acceptance of amendment or bicameral conference. From the sixth to ninth columns, the case of moderate first and extreme second, that of extreme first and moderate second, that of moderate first and extreme second, that of extreme first and extreme second are displayed.
<table>
<thead>
<tr>
<th>Uncertainty</th>
<th>Strategy Profiles</th>
<th>Outcomes</th>
</tr>
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<tbody>
<tr>
<td>1st</td>
<td>2nd</td>
<td>Moderate 2nd</td>
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<tr>
<td>$\Delta_F / K$</td>
<td>$\Delta_S / K$</td>
<td>$B_F$</td>
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<td>Low</td>
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<td>Low</td>
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<td>Low</td>
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<tr>
<td>Low</td>
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<tr>
<td>High</td>
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Note: in strategy columns, Con. = Concessive, Agg. = Aggressive, Rec. = Recalcitrant

Table 1: Equilibria Strategy Profiles, Their Conditions and Outcomes

Figure 1 illustrates the conditions in which every second chamber’s equilibrium strategy is established.

[Figure 1 about here]

Intuitional Interpretation

The problems mentioned in the end of the previous section are addressed. Unlike the complete information model, the incomplete information model correctly predicts that the second chamber sometimes amends bills and the first chamber sometimes calls for conference. Difference between the two models arises from introduction of uncertainty.

The more uncertain chamber’s ideal point (larger $\Delta_F$ or $\Delta_S$), the more likely amendment and conference are. To put it another way, as $\Delta_F$ or $\Delta_S$ becomes larger, $F_E$ or $S_E$ can be more extreme. This sounds straight-forward, though the mechanism is nuanced. It is not just because one house is unfamiliar with the other house, offers bills randomly and sometimes makes an error. Rather, their offer, acceptance and rejection are more systematic. When both chambers are the moderate type, they never call for conference. In contrast, the pair of the extreme houses are most likely to go to conference. When the second chamber returns...
amendment, the extreme first chamber never accepts it but calls for conference.

Another key variable is the conference cost, $K = K_F + K_S$. As mentioned before, this means transaction cost, risk averse or unimportance of a bill. The more important a bill (small $K$), the more likely it is to be amended or taken to the conference. Though this relationship may not be obvious, a closer look will persuade readers. When houses do not have a big stake in a bill, it does not find the unimportant bill worth enough to pay the transaction cost or it hates to sell (though imperfect but) certain bills or amendments for risky conference report. By contrast, if a bill is important, chambers can not put up with rough estimate of the other house’s ideal point. That is why it amends a bill or takes it to the conference.

In the incomplete information model, both houses’ conference costs, $K_F$ and $K_S$, equally affect how a law is made (no amendment, acceptance or the conference), while, in complete information model, only the first chamber’s conference cost is taken advantage of by the second chamber. This symmetry seems reasonable. Moreover, each house’s conference cost does harm that house (see also König et al. (2007)). That is, when $K_F$ ($K_S$) increases, the final (expected) law $L$ decreases (increases) and the first (second) chamber bears that cost. To put it another way, as a house takes a bill seriously (small $K_F$ or $K_S$), it is rewarded.

Several notes are in order. When chamber A believes that chamber B is more likely to be the moderate type (small $p^*$ or $q^*$) but in fact, unexpectedly, chamber B is the extreme type, amendment and conference are more likely to occur, because chamber A’s bill is close enough for a moderate chamber B, but not an extreme chamber B, to accept.

$F$’s separating strategy is not incentive compatible. The first chamber forces the second chamber to identify its type.
CONCLUSION

In order to explain both absence and presence of the bicameral conference, the role uncertainty plays in the game is critical. Importance of bills is measured against how unsure one house is of the other’s intention. Uncertainty and importance encourage both chambers to amend bills or go to the conference. The incomplete information game model the present paper submits sheds new light on bicameral bargaining.

There remains a lot to improve. The most promising extension is introduction of veto players: president and pivot players (e.g. override, filibuster, and cloture). In addition, electoral consideration can be incorporated into this framework. Two types of a chamber may be extended to infinite (continuous) type. Bicameral sequence is also an important topic (Rogers, 1998, 2005). These are agendas for future research.
APPENDIX: Equilibria and Their Proof

Notation and Assumption

The Appendix introduces the following notation.

\[ F_p \equiv pF_E + (1 - p)F_M \]
\[ S_q \equiv qS_E + (1 - q)S_M \]
\[ B(S_q, F_p) = \frac{S_qF_p}{2} - K_F \]

In order to avoid unnecessarily complicated taxonomy and make essence of the game clear, this paper assumes the followings.

\( S_M \) and \( F_M \) are so apart that \( S_M < B(S_1, F_0) \leq B(S_0, F_1) + K < F_M \) where \( K = K_F + K_S \) (this implies that uncertainty of ideal points is not so large compared with difference of them).

All bills and amendments are Pareto optimal for any type of each chamber: \( S_M \leq B \leq F_M \).

If acceptance and rejection of bill (or amendment) brings the same utility to the first chamber given the second chamber’s strategy, the first chamber prefers acceptance to rejection.

Among those bills (amendments) which will be rejected by both types of the second (first) chamber, in pooling equilibrium, the first (second) chamber prefers \( F_M \) (\( S_M \)) most and, in separating equilibrium, the extreme first (second) chamber prefers \( F_M \) (\( S_M \)) most, the moderate first chamber prefers \( F_M - \epsilon \) (\( S_M + \epsilon \)) where \( \epsilon \) is a sufficiently small number.

This assumption also makes mixed strategy impossible.
Third Stage

Receiving $B_S$, $F$ has posterior belief $\hat{q} = \hat{q}(B_S) = Pr(S = S_E|B_S)$. Since $S$ does not have mixed strategy, $\hat{q}$ is $q^*, 0$ or 1. The Equivalent Law for $F_T(T \in \{M, E\})$ to go to conference, $L_{FT}(BC)$ ($t = 0$ when $T = M$ and $t = 1$ when $T = E$), is defined as the law whose utility for $F_T$ is the same as expected utility $F_T$ gains by going to conference. Thus, $L_{FT}(BC) = B(S_{\hat{q}}, F_t)$. Suppose that the best response for $F_T$ is to accept $B_S \geq L_{FT}(BC)$ but not the others. The off-the-path belief condition for $F_T$ not to defect is $\hat{q}^-*(B(S_{q>\hat{q}^*}, F_t)) > q$ where $\hat{q}^*$ is on-the-path belief, $\hat{q}^-*$ is off-the-path belief and $q$ is a real number (not probability). Thus, off-the-path behavior is rejection.

Second Stage

Preliminaries

Receiving $B_F$, $S$ has posterior belief $\hat{p} = \hat{p}(B_F) = Pr(F = F_E|B_F)$. Since $S$ does not have mixed strategy, $\hat{p}$ is $p^*, 0$ or 1.

The three kinds of “Equivalent Law” are defined in the following way. The Concessive Equivalent Law is defined as the law whose utility for $S$ is the same as expected utility $S$ gains when $S$ returns $B$ and both $F_M$ and $F_E$ accept it: $L^C_S(B) = B$. The Aggressive Equivalent Law is similarly defined except only $F_M$ accepts $B$ and $F_E$ calls for the conference:

$$L^A_{St}(B(S_q, F_p)) = (1 - \hat{p})B(S_q, F_p) + \hat{p}(B(S_t, F_1) + K) = B(S_{(1-\hat{p})q+\hat{p}t}, F_{(1-\hat{p})p+\hat{p}}) + \hat{p}K.$$ 

The Recalcitrant Equivalent Law is also similarly defined except both $F_M$ and $F_E$ call for the conference: $L^R_{St}(B) = B(S_t, F_{\hat{p}}) + K$.

Suppose that $S_T$ returns $B_{St} = B(S_{\hat{q}}, F_p)$ ($p$ is any real number).
Concessive Amendment. When $p \geq 1$, $B_{St}$ is accepted by both $F_M$ and $F_E$ and becomes a law. $S_T$ gains the Concessive Equivalent Law $L^C_{St}(B_{St})$. Call $B_{St} = B(S_q, F_1)$ the “Best Conensive Amendment”. When $B_{St} = B(S_q, F_{p>1})$ is the best response, the Best Concessive Amendment is also necessarily the best response. Clearly, both $S_M$ and $S_E$ prefer the Best Concessive Amendment. Thus, this paper does not report those equilibria where a Concessive Amendment is not the best one because they are trivial variation. Or those strategy profiles cease to be best responses by restricting off-the-path belief as $\hat{q}(B^*_S) \leq q^*$. 

Aggressive Amendment. When $1 > p \geq 0$, only $F_M$ accepts $B_{St}$ and $F_E$ calls for the conference. $S_T$ gains the Aggressive Equivalent Law $L^A_{St}(B_{St})$. For the same reason of the previous paragraph, this paper does not report those equilibria where $B_{St} = B(S_q, F_{1>p>0})$.

Recalcitrant Amendment. When $p < 0$, both $F_M$ and $F_E$ call for the conference. $S_T$ gains the Concessive Equivalent Law $L^R_{St}(B_{St})$ which does not depend on $B_{St}$.

Pooling Strategy

Both $S_M$ and $S_E$ return $B_S$. Receiving $B_S$, $F$ does not update belief: $\hat{q} = q^*$. Below, read \{S’s on-the-path pooling strategy\} or \{S_M’s on-the-path strategy, S_E’s on-the-path strategy\}. The off-the-path strategy is the same as $S_E$’s separating strategy which is described in the next sub-subsection.

\{Concessive\}. Suppose $B_S = B(S_q, F_1)$. Both $F_M$ and $F_E$ accept it. There are three off-the-path conditions for $S$ not to defect.

First, $F_E$ should not accept any to-be Concessive Amendment $B(S_{q'}, F_1)$ which would satisfy $L^C_S(B(S_{q'}, F_1)) < L^C_S(B(S_q, F_1))$ (that is, $B(S_{q'}, F_1) < B(S_q, F_1)$ and, therefore, $q' > \hat{q}$). Let $\hat{q}(q, p)$ be $F$’s posterior belief after observing $B(S_q, F_p)$. If $B(S_{q'(q',1)}, F_1) > B(S_q, F_1)$, $F_E$ does not accept $B(S_{q'}, F_1)$. This leads to the off-the-path belief condition $\hat{q}(q', 1) < q'$ because $B(S_q, F_p)$ is a decresing function in $q$. From above, the conditions for $S$ not to defect to any other Concessive Amendment is $\hat{q}(q', 1) < q'$ for $q' > \hat{q}$.  

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Second, \(F_M\) should not accept any to-be Aggressive Amendment \(B(S_q, F_0)\) which would satisfy \(L_{ST}^A(B(S_q, F_0)) < L_{ST}^C(B(S_q, F_1))\) (and \(S_E\) would defect). (If \(F_M\) does not accept \(B, F_E\) does not accept it, either.) Define \(\bar{q}\) as 
\[
\bar{q} = \frac{\hat{p} - \bar{p}t}{1 - \bar{p}} + \frac{2\hat{p}K - (1 - \bar{p})\Delta_F}{(1 - \bar{p})\Delta_S} 
\]
so that \(L_{ST}^A(B(S_q, F_0)) = B(S_{\bar{q}}, F_1)\). Referring to the previous paragraph, the condition for \(S_E\) not to defect to any Aggressive Amendment is 
\[
\hat{q}(q', 0) < q' \quad \text{for} \quad q' > \bar{q} \quad \text{and} \quad \bar{q} \geq 0, \quad \text{which requires that} \quad 2\hat{p}K \geq (\hat{p}t - \bar{q})\Delta_S + (1 - \bar{p})\Delta_F. 
\]

Third, the \(S_T\)’s Recalcitrant Equivalent Law of every \(B\) should be farther away from \(S\) than a Concessive Amendment: \(L_{ST}^B(B) = B(S_T, F_\hat{p}) + K \geq B(S_q, F_1)\). This condition for \(S\) not to defect to any Recalcitrant Amendment is reduced to \(2K \geq (t - \hat{q})\Delta_S + (1 - \hat{p})\Delta_F.\)

To sum, \(S\) does not have incentive to defect from such \(B(S_q, F_1)\) that \(2\hat{p}K \geq (\hat{p}t - \bar{q})\Delta_S + (1 - \hat{p})\Delta_F, 2K \geq (1 - \hat{q})\Delta_S + (1 - \hat{p})\Delta_F\) in the off-the-path belief that \(\hat{q}(q', 1) < q'\) for \(q' > \hat{q}\) and \(\hat{q}(q', 0) < q'\) for \(q' > \bar{q}\).

\{Aggressive\}. Suppose \(B_S = B(S_q, F_0)\). Only \(F_M\) accepts it. There are three off-the-path conditions for \(S\) not to defect.

First, \(F_M\) should not accept any to-be Aggressive Amendment \(B(S_q', F_0)\) which would satisfy \(L_{ST}^A(B(S_q', F_0)) < L_{ST}^A(B(S_q, F_0))\) (that is, \(q' > \bar{q}\)). Referring to the Concessive pooling strategy, the condition for \(S_T\) not to defect is \(\hat{q}(q', 0) < q' \quad \text{for} \quad q' > \hat{q}\).

Second, \(F_E\) should not accept any to-be Conressive Amendment \(B(S_q, F_1)\) which would satisfy \(L_{ST}^C(B(S_q, F_1)) < L_{ST}^A(B(S_q, F_0))\). Define \(\bar{q}\) as 
\[
\bar{q} = (1 - \hat{p})\hat{q} + \hat{p}t - \frac{2\hat{p}K - (1 - \hat{p})\Delta_F}{(1 - \hat{p})\Delta_S} 
\]
so that \(L_{ST}^A(B(S_q, F_0)) = L_{ST}^C(B(S_{\bar{q}}, F_1))\). The condition for \(S_T\) not to defect is \(\hat{q}(q', 1) < q' \quad \text{for} \quad q' > \bar{q}\) and \(\bar{q} \geq 0, \quad \text{which results in} \quad 2\hat{p}K < (1 - \hat{p})\Delta_F + (1 - \hat{p})\hat{q}\Delta_S + \hat{p}K.\)

Third, the \(S_T\)’s Recalcitrant Equivalent Law of every \(B\) should be farther away from \(S\) than a Aggressive Amendment: \(L_{ST}^B(B) = B(S_T, F_\hat{p}) + K \geq L_{ST}^A(B(S_q, F_0)) = B(S_{(1 - \bar{p})\hat{q} + \hat{p}}, F_\hat{p}) + \hat{p}K.\) This condition for \(S_T\) not to defect is reduced to \(2(1 - \hat{p})K \geq (t - \hat{p} - (1 - \hat{p})\hat{q})\Delta_S.\)

To sum, \(S\) does not have incentive to defect from such \(B(S_q, F_0)\) that \(2\hat{p}K < (1 - \hat{p})\Delta_F + (1 - \hat{p})\hat{q}\Delta_S + 2(1 - \hat{p})K \geq (1 - \hat{p})(1 - \hat{q})\Delta_S\) in the off-the-path belief that \(\hat{q}(q', 0) < q' \quad \text{for} \quad q' > q\).
\( q' > \bar{q} \) and \( \bar{q}(q', 1) < q' \) for \( q' > \bar{q} \).

\{Recalcitrant\}. Suppose \( B_S = S_M \). Both \( F_M \) and \( F_E \) reject it. There are three off-the-path conditions for \( S \) not to defect.

First, even if the \( S_T \) defects to another Recalcitrant amendment \( B(S_q, F_0) \), its Equivalent Law and that of \( B(S_q^*, F_0) \) are the same, \( B(S_t, F_p) + K \). Thus, \( S_T \) has no incentive to defect.

Second, \( F_E \) should not accept any to-be Concessive Amendment \( B(S_q, F_1) \) which would satisfy \( L_{S_t}^R(B(S_q, F_0)) < L_{S_c}^R(B(S_q^*, F_0)) \). Define \( \bar{q} \) as \( \bar{q} = t - \frac{2K - \Delta F}{\Delta S} \) so that \( L_{S_t}^R(B(S_q^*, F_0)) = L_{S_c}^R(B(S_q, F_1)) \). The condition for \( S_T \) not to defect is \( \bar{q}(q', 1) < q' \) for \( q' > \bar{q} \) and \( \bar{q} \geq 0 \), which means that \( 2K \leq \Delta F + t \Delta S \).

Third, \( F_M \) should not accept any to-be Aggressive Amendment \( B(S_q, F_0) \) which would satisfy \( L_{S_t}^A(B(S_q, F_0)) < L_{S_c}^A(B(S_q^*, F_0)) \). Define \( \bar{q}' \) as \( \bar{q}' = t - \frac{2K}{\Delta S} \) so that \( L_{S_t}^A(B(S_q^*, F_0)) = L_{S_c}^A(B(S_q', F_0)) \). The condition for \( S_T \) not to defect is \( \bar{q}(q', 1) < q' \) for \( q' > \bar{q}' \) and \( \bar{q}' \geq 0 \), which means that \( 2K \leq t \Delta S \). But when \( t = 0 \) this is impossible because \( K > 0 \).

To sum, this strategy can not be an equilibrium because \( S_M \) gains by defecting to an Aggressive Amendment.

**Separating Strategy**

\( S_M \) returns \( B_{S0} \), while \( S_E \) returns \( B_{S1} \) which is not equal to \( B_{S0} \). Receiving \( B_{S1} \), \( F \) has posterior belief \( \bar{q} = t \).

\{Recalcitrant, Any Amendment\}. \( S_M \) never returns any Recalcitrant Amendment. Why?

If \( S_M \) defects to an Aggressive Amendment \( B(S_0, F_0) \), \( F_M \) accepts it whatever off-the-path belief it has. Its Equivalent Law is \( L_{S_t}^A(B(S_0, F_0)) = B(S_0, F_0^*) + p^* K \) or \( L_{S_c}^C(B(S_0, F_0)) = B(S_0, F_0) \). This is closer to \( S \) than the Recalcitrant Equivalent Law \( L_{S_t}^R(B) = B(S_0, F_0^*) + K \). Thus, \( S_M \) has incentive to defect from Recalcitrant Amendment.

\{Concessive, Concessive\}. Suppose \( B_{S1} = B(S_1, F_1) \). If \( B_{S1} < B_{S0} \), \( S_M \) has incentive
to defect from $B_{S0}$ to $B_{S1}$ whose Equivalent Law $L_{S0}(B_{S1}) = B_{S1}$ is closer to $S_M$ than $L_{S0}(B_{S0}) = B_{S0}$. Similarly, if $B_{S1} > B_{S0}$, $S_E$ has incentive to defect from $B_{S1}$ to $B_{S0}$. Thus, this strategy profile is not incentive compatible and not equilibrium.

{Aggressive, Aggressive}. For reasons similar to the previous paragraph, this strategy profile is not incentive compatible and not equilibrium, either.

{Concessive, Aggressive}. Suppose $B_{S0} = B(S_0, F_1)$ and $B_{S1} = B(S_1, F_0)$. Incentive compatibility requires that $L^C_{S0}(B_{S0}) < L^A_{S0}(B_{S1})$ and $L^A_{S1}(B_{S1}) < L^C_{S1}(B_{S0})$, which implies that $2\hat{p}K \geq (1 - \hat{p})\Delta_S + (1 - \hat{p})\Delta_F$ and $2\hat{p}K \leq \Delta_S + (1 - \hat{p})\Delta_F$.

Employing the argument of pooling Concessive strategy (where $t = 0, \hat{q} = 0$), $S_M$ does not have incentive to defect from such $B(S_0, F_1)$ that $2\hat{p}K \geq (1 - \hat{p})\Delta_F$ in the off-the-path belief that $\hat{q}(q', 1) < q'$ for $q' > 0$ and $\hat{q}(q', 0) < q'$ for $q' > \hat{q}$. Employing the argument of pooling Aggressive strategy (where $t = 1, \hat{q} = 1$), $S_E$ does not have incentive to defect from such $B(S_1, F_0)$ that $2\hat{p}K < (1 - \hat{p})\Delta_F + \Delta_S, 2(1 - \hat{p})K \geq 0$ in the off-the-path belief that $\hat{q}(q', 0) < q'$ for $q' > 1$ and $\hat{q}(q', 1) < q'$ for $q' > \hat{q}$.

To sum, $2\hat{p}K \geq (1 - \hat{p})\Delta_S + (1 - \hat{p})\Delta_F$ and $2\hat{p}K \leq \Delta_S + (1 - \hat{p})\Delta_F$ with the off-the-path belief mentioned above.

{Aggressive, Concessive}. Suppose $B_{S1} = B(S_1, F_1)$ and $B_{S0} = B(S_0, F_0)$. Incentive compatibility requires that $L^A_{S0}(B_{S0}) < L^C_{S0}(B_{S1})$ and $L^C_{S1}(B_{S1}) < L^A_{S1}(B_{S0})$. But this is impossible because these conditions lead to $L^A_{S0}(B_{S0}) < L^C_{S0}(B_{S1}) = L^C_{S1}(B_{S1}) < L^A_{S1}(B_{S0})$ but $L^A_{S0}(B_{S0}) > L^A_{S1}(B_{S0})$, a contradiction.

{Concessive, Recalcitrant}. Suppose $B_{S0} = B(S_0, F_1)$ and $B_{S1} = S_M$. Incentive compatibility requires that $L^C_{S0}(B_{S0}) < L^R_{S0}(B_{S1})$ and $L^R_{S1}(B_{S1}) < L^C_{S1}(B_{S0})$, which implies that $2\hat{K} > (1 - \hat{p})\Delta_F$ and $2\hat{K} < (1 - \hat{p})\Delta_F$.

Employing the argument of pooling Concessive strategy (where $t = 0, \hat{q} = 0$), $S_M$ does not have incentive to defect from such $B(S_0, F_1)$ that $2\hat{p}K \geq (1 - \hat{p})\Delta_F$ in the off-the-path belief that $\hat{q}(q', 1) < q'$ for $q' > 0$ and $\hat{q}(q', 0) < q'$ for $q' > \hat{q}$. Employing the argument of
pooling Recalcitrant strategy (where \( t = 1 \)), \( S_E \) does not have incentive to defect from \( B_{S_1} \) if \( 2K \leq \Delta_S \).

To sum, \( 2K < \Delta_S + (1 - \hat{p})\Delta_F \), \( 2\hat{p}K \geq (1 - \hat{p})\Delta_F \), \( 2K \leq \Delta_S \) with the off-the-path belief mentioned above.

\{Aggressive, Recalcitrant\}. Suppose \( B_{S_0} = B(S_0, F_0) \). Incentive compatibility requires that \( L_{S_0}^A(B_{S_0}) \leq L_{S_1}^R(B_{S_1}) \) and \( L_{S_1}^R(B_{S_1}) \leq L_{S_0}^A(B_{S_0}) \), which implies that \( 2(1 - \hat{p})K \geq -\hat{q}(1 - \hat{p})\Delta_S \) (which always holds) and \( 2K < (1 - \hat{q}^\ast)\Delta_S + (1 - \hat{p})\Delta_F \).

Employing the argument of pooling Aggressive strategy (where \( t = 0, \hat{q} = 0 \)), \( S_M \) does not have incentive to defect from \( B(S_0, F_0) \) if \( 2\hat{p}K < (1 - \hat{p})\Delta_F \) and \( 2(1 - \hat{p})K \geq -\hat{p}\Delta_S \) (which is always true) in the off-the-path belief that \( \hat{q}(q', 0) < q' \) for \( q' > 0 \) and \( \hat{q}(q', 1) < q' \) for \( q' > \tilde{q} \). The condition for \( S_E \) not to defect is the same as the previous case: \( 2K \leq \Delta_S \).

To sum, \( 2K < \Delta_S + (1 - \hat{p})\Delta_F \), \( 2\hat{p}K < (1 - \hat{p})\Delta_F \), \( 2K \leq \Delta_S \) with the off-the-path belief mentioned above.

**Summary**

Define \( \{B_{S_0}^*, B_{S_1}^*\} \) as one of the followings (in the conditions mentioned above): \{Concessive\}, \{Aggressive\}, \{Concessive, Aggressive\}, \{Concessive, Recalcitrant\} or \{Aggressive, Recalcitrant\}. The best response of \( S_T \) is as follows:

If \( B_F \leq L_{S_1}(B_{S_1}^*) \), \( S_T \) accepts \( B_F \).

Otherwise, \( S_T \) rejects \( B_F \) and returns \( B_{S_1}^* \).

Note that, for any value of \( \Delta_F, \Delta_S, K \), there is at least one equilibrium. For all equilibria, there is some off-the-path belief which supports them, including \( \hat{q}^{-\ast}(B_{S_1} \neq B_{S_1}^*) = 0 \).


First Stage

Preliminaries

Define the “Best Concessive Bill” as \( B_{Ft}^C = L_{s_1}(B_{s_1}^*(\hat{p}(B_{Ft}))) \), the bill closest to \( F_T \) among “Concessive Bills” which both \( S_M \) and \( S_E \) accept (\( B_{Ft} \leq B_{Ft}^C \)). When any Concessive Bill is the best response, the Best Concessive Bill is also necessarily the best response. Clearly, both \( F_M \) and \( F_E \) prefer the Best Concessive Bill most. Thus, this paper does not report those equilibria where a Concessive Bill is not the best one because they are trivial variation. Or those strategy profiles cease to be best responses by restricting off-the-path belief as \( \hat{p}(B_{Ft}^*) \leq p^* \).

Define the “Best Aggressive Bill” as \( B_{Ft}^A = L_{s_0}(B_{s_0}^*(\hat{p}(B_{Ft}))) \), the bill closest to \( F \) among “Aggressive Bills” which \( S_M \) accepts and \( S_E \) rejects (\( B_{Ft}^C < B_{Ft} \leq B_{Ft}^A \)). For the same reason in the previous paragraph, this paper does not report those equilibria where a Aggressive Bill is not the best one.

Define the “Best Recalcitrant Bill” as \( B_{Ft}^R = F_M - t\epsilon \) the bill closest to \( F \) among “Recalcitrant Bills” which both \( S_M \) and \( S_E \) reject (\( B_{Ft} < B_{Ft}^A \)). This paper does not report those equilibria where a Aggressive Bill is not the best one because they are trivial variation.

The Equivalent Law for \( F_T \) send \( B_F, L_{Ft}(B_F) \), is defined as the law whose utility for \( F_T \) is the same as expected utility \( F_T \) gains by sending \( B_F \). No off-the-path belief can prevent the first chamber to defect to Recalcitrant bill once their Equivalent Law is closer to \( F \) than other Equivalent Laws. In this case, Recalcitrant bills are the best response. If the Equivalent Law of Recalcitrant bills are worse than others but some off-the-path belief makes off-the-path bills Recalcitrant bills or bills whose Equivalent Law is worse than that of Recalcitrant bills, Recalcitrant bills are the best response. Otherwise, Concessive bills or Aggressive bills are the best response.
Pooling Strategy

Both $F_M$ and $F_E$ send $B_F$. Receiving it, posterior belief $\hat{p}(B_F)$ is the same as its prior $p^*$. When $B_S = \{\text{Concessive}\}$. The best response of $F$ is the Concessive (and Aggressive) Bill $B^*_F = B^C_F = B^A_F = L^C_S(B^*_S) = B^*_S$. Suppose $F$ defects to $B^*_F \neq B^*_F$. If $B^*_F > B^*_F$, $S$ rejects it and returns $B^*_S$ which $F$ accepts. If $B^*_F < B^*_F$, $S$ accepts it which is worse for $F$. Thus, $F$ can not gain more by defecting to $B^*_F$. When $B_S = \{\text{Aggressive}\}$. $S_T$'s Equivalent Law of $B^*_S = B(S^*, F_0)$ is $L^A_S(B^*_S) = (1 - p^*)B(S^*, F_0) + p^*(B(S_1, F_1) + K) = B(S(1 - p^*)q^* + p^*t, F_{p^*}) + p^*K$.

(1) When $F$ sends the Recalcitrant Bill, both $S_M$ and $S_E$ returns $B^A_S$ in any belief of $\hat{p}$. $F_M$ accepts it, while $F_E$ rejects it and gains $(1 - q^*)B(S_0, F_1) + q^*B(S_1, F_1) = B(S^*, F_1)$. (2) When $F$ sends the Aggressive Bill, $S_M$ accepts it and $S_E$ returns $B(S_1, F_0)$. $F_M$ accepts it, while $F_E$ rejects it and gains $B(S_1, F_1)$. The $F_T$’s Equivalent Law of $B_F$ is $L_{F_1}(B^A_{F_1}) = (1 - q^*)B^A_{F_1} + q^*B(S_1, F_1) = B(S(1 - q^*)q^* + q^*t, F_{q^*}) + (1 - q^*)p^*K$. (3) When $F$ sends the Concessive Bill, both $S_M$ and $S_E$ accepts $B_F$. The Equivalent Law is $L_{F_1}(B^C_{F_1}) = B^C_{F_1}$.

(1) Suppose that $B^*_F$ is the Concessive Bill. Since $L_{F_1}(B^R_F) > L_{F_1}(B^C_F)$, $F_E$ defects to the Recalcitrant Bill. (2) Suppose that $B^*_F$ is the Aggressive Bill. Since $L_{F_1}(B^R_F) > L_{F_1}(B^A_F)$, $F_E$ defects to the Recalcitrant Bill. (3) Suppose that $B^*_F$ is the Recalcitrant Bill, $F_E$ never defects. It is true that $L_{F_0}(B^R_F) \leq L_{F_0}(B^C_F)$ where equality is established only when $p^* = 0$. If $\hat{p}^{−*} = 0$, $L_{F_0}(B^R_F) > L_{F_0}(B^A_F)$ and $F_M$ never defects. Thus, pooling Recalcitrant Bill strategy profile is the best response of $F$ as long as off-the-path belief $\hat{p}^{−*}(B_F > L_{S_0}(B^*_S(p^*))) = 0$.

When $B_S = \{\text{Concessive, Aggressive}\}$. $S_M$’s Equivalent Law of $B^*_S0 = B(S_0, F_1)$ is $L^C_{S_0}(B^*_S0) = B^*_S0$. $S_E$’s Equivalent Law of $B^*_S1 = B(S_1, F_0)$ is $L^A_{S1}(B^*_S1) = B(S_1, F_{p^*}) + p^*K$.

(1) When $F$ sends the Recalcitrant Bill, $S_M$ returns $B^*_S0$ and $S_E$ returns $B^*_S1$ in any belief of $\hat{p}$. For $F_M$, the Equivalent Law is $(1 - q^*)B(S_0, F_1) + q^*B(S_1, F_0) = B(S^*, S_1, F_{q^*})$. For $F_E$, the Equivalent Law is $(1 - q^*)B(S_0, F_1) + q^*B(S_1, F_1) = B(S^*, F_1)$. (2) When $F$ sends the Aggressive Bill, $S_M$ accepts $B_F = B^*_S0$ and $S_E$ returns $B^*_S1$. Thus, its Equivalent Law is
the same as the Equivalent Laws of the Recalcitrant Bill. (3) When F sends the Concessive Bill, both $S_M$ and $S_E$ accept $B_F = B(S_1, F_{p^*}) + p^* K$.

(1) Suppose that $B^*_F$ is the Concessive Bill. When $(1 - q^*) \Delta_S + (1 - p^*) \Delta_F \leq 2p^* K$, F never defects. (2) Suppose that $B^*_F$ is the Aggressive Bill. As long as off-the-path belief is $\hat{p}^*(B(S_{q^*}, F_1)) \leq \max(0, (1 - q^*) \frac{\Delta_S + \Delta_F}{2K + \Delta_F})$, F never defects.

When $B_S = \{\text{Concessive, Recalcitrant}\}, S_M$’s Equivalent Law of $B^*_{S_0}$ is $L_{S_0}^C(B^*_{S_0}) = B(S_0, F_1)$. $S_E$’s Equivalent Law of $B^*_{S_1}$ is $L_{S_1}^F(B^*_{S_1}) = B(S_1, F_{p^*}) + K$.

(1) When F sends the Recalcitrant Bill, $S_M$ returns $B^*_{S_0}$ and $S_E$ returns $B^*_{S_1}$. For $F_T$, the Equivalent Law is $(1 - q^*) B^*_{S_0} + q^* B(S_1, F_t) = B(S_{q^*}, F_{1-q^*+q^*t})$. (2) When F sends the Aggressive Bill, $S_M$ accepts $B_F = B^*_{S_0}$ and $S_E$ returns $B^*_{S_1}$. Thus, its Equivalent Law is the same as that of the Recalcitrant Bill. (3) When F sends the Concessive Bill, both $S_M$ and $S_E$ accept $B_F = B(S_1, F_{p^*}) + K$.

(1) Suppose that $B^*_F$ is the Concessive Bill. Since $B(S_{q^*}, F_1) > B(S_1, F_{p^*}) + K$, $F_E$ always defects to the Aggressive Bill. (2) Suppose that $B^*_F$ is the Aggressive Bill. As long as off-the-path belief is $\hat{p}^*(B(S_{q^*}, F_1)) \leq \max(0, 1 - \frac{2K - \Delta_S}{\Delta_F})$, $F$ never defects.

When $B_S = \{\text{Aggressive, Recalcitrant}\}, S_M$’s Equivalent Law of $B^*_{S_0}$ is $L_{S_0}^A(B^*_{S_0}) = B(S_0, F_{p^*}) + p^* K$. $S_E$’s Equivalent Law of $B^*_{S_1}$ is $L_{S_1}^F(B^*_{S_1}) = B(S_1, F_{p^*}) + K$.

(1) When F sends the Recalcitrant Bill, $S_M$ returns $B^*_{S_0}$ and $S_E$ returns $B^*_{S_1}$. For $F_M$, the Equivalent Law is $(1 - q^*) B^*_{S_0} + q^* B(S_1, F_0) = B(S_{q^*}, F_0)$. For $F_E$, the Equivalent Law is $(1 - q^*) B(S_0, F_1) + q^* B(S_1, F_1) = B(S_{q^*}, F_1)$. (2) When F sends the Aggressive Bill, $S_M$ accepts $B_F = B(S_0, F_{p^*}) + p^* K$ and $S_E$ returns $B^*_{S_1}$. For $F_T$, the Equivalent Law is $(1 - q^*) B_F + q^* B(S_1, F_1) = B(S_{q^*}, F_{p^*(1-q^*)+q^*t}) + p^*(1 - q^*) K$. (3) When F sends the Concessive Bill, both $S_M$ and $S_E$ accept $B(S_1, F_{p^*}) + K$.

(1) Suppose that $B^*_F$ is the Concessive Bill. Since $B(S_{q^*}, F_1) > B(S_1, F_{p^*}) + K$, $F_E$ always defects to the Recalcitrant Bill. (2) Suppose that $B^*_F$ is the Aggressive Bill. Since $B(S_{q^*}, F_1) > B(S_{q^*}, F_{p^*(1-q^*)+q^*t}) + p^*(1 - q^*)K$, that is, $(1 - p^*)(1 - q^*) \Delta_F > p^*(1 - q^*)2K$,
$F_E$ always defects to the Recalcitrant Bill. (3) Suppose that $B_F^*$ is the Recalcitrant Bill. $F$ never defects to $B(S_0, F_p) + pK$ in off-the-path belief $p^* < \frac{\Delta_F}{\Delta_F + p2K}$. $F$ never defects to $B(S_1, F_p) + K$ in off-the-path belief $p^* < \max(0, 1 - \frac{2K - (1 - q^*)\Delta_F}{\Delta_F})$.

**Separating Strategy**

Suppose that $F_T$ sends $B_{Ft}$ ($B_{F0} \neq B_{F1}$). Receiving $B_{F1}$, $S$ believes $p = 1$. When $\Delta_S / 2K < 1/(1 - q^*)$, $S$ takes $\{\text{Concessive}\}$. When $\Delta_S / 2K > 1$, $S$ takes $\{\text{Concessive, Aggressive}\}$. When $\Delta_S / 2K > 1/(1 - q^*)$, $S$ takes $\{\text{Concessive, Recalcitrant}\}$. Receiving $B_{F0}$, $S$ believes $p = 0$. When $\Delta_S / 2K \leq 1/(1 - q^*)$, $S$ takes $\{\text{Aggressive}\}$. When $\Delta_S / 2K \geq 1$ and $(1 - q^*)\Delta_S + \Delta_F > 2K$, $S$ takes $\{\text{Aggressive, Recalcitrant}\}$. $F_T$’s Recalcitrant Bill is $F_t$.

(1) To begin with, $B_{Ft}^*$ should be the best response in the pooling strategy where $p^* = 1$ or $p^* = 0$. Thus, the reasons the following $B_{Ft}^*$’s are the best response are not repeated. Interested readers may refer to the previous sub-subsection or ask the author the Supplement.

When $B_S^*(B_{F1}) = \{\text{Concessive}\}, B_{F1}^* = \{\text{Concessive and Aggressive}\}$.

When $B_S^*(B_{F1}) = \{\text{Concessive, Aggressive}\}, B_{F1}^* = \{\text{Concessive}\}$ or $\{\text{Aggressive}\}$.

When $B_S^*(B_{F1}) = \{\text{Concessive, Recalcitrant}\}, B_{F1}^* = \{\text{Recalcitrant}\}$.

When $B_S(B_{F0}) = \{\text{Aggressive}\}, B_{F1}^* = \{\text{Recalcitrant}\}$.

When $B_S^*(B_{F0}) = \{\text{Aggressive, Recalcitrant}\}, B_{F1}^* = \{\text{Recalcitrant}\}$.

(2) In addition, $\{B_{F1}^*, B_{F0}^*\}$ should be incentive compatible. That is, $L_{Ft}(B_{F1}^*) > L_{Ft}(B_{F(1-t)}^*)$. It turns out that all separating strategy profile is not incentive compatible.

Below, read $\{B_{F1}, B_{F0}\}, \{B_{S0}(B_{F1}), B_{S1}(B_{F1}); B_{S0}(B_{F0}), B_{S1}(B_{F0})\}$.

$(B_F) = \{\text{Concessive and Aggressive, Recalcitrant}\}, B_S^* = \{\text{Concessive; Aggressive}\}$. This strategy profile is not incentive compatible because $F_M$ has incentive to defect from $B_{F0} = F_0$ (which leads to $B(S_{q^*}, F_0)$) to $B_{F1} = B(S_{q^*}, F_1)$ (which leads to $B(S_{q^*}, F_1) > B(S_{q^*}, F_0)$).

$(B_F) = \{\text{Concessive and Aggressive, Aggressive}\}, B_S^* = \{\text{Concessive; Aggressive, Recalcitrant}\}$. $F_E$ sends the Concessive and Aggressive Bill $B(S_{q^*}, F_1)$ which becomes a law. $F_M$ sends the
Aggressive Bill $B(S_0, F_0)$ which leads to $B(S_{q^*}, F_0)$. Since $B(S_{q^*}, F_1) > B(S_{q^*}, F_0)$, $F_M$ mimics $F_E$ and this strategy profile is not incentive compatible.

$(B_F) = \{\text{Concessive or Aggressive, Recalcitrant}\}$, $B_F^* = \{\text{Concessive, Recalcitrant; Aggressive}\}$. $F_E$ sends the Concessive or Aggressive Bill which leads to $B(S_{q^*}, F_{(1-q^*)+q^*t})$ or $B(S_1, F_0)+K$.

$F_M$ sends the Recalcitrant Bill $F_0$ which leads to $B(S_{q^*}, F_0)$. This strategy profile is not incentive compatible because $F_M$ has incentive to defect from $B_{F_0}$ to $B_{F_1}$.

$(B_F) = \{\text{Aggressive, Recalcitrant}\}$, $B_F^* = \{\text{Concessive, Aggressive; Aggressive}\}$. $F_E$ sends the Aggressive Bill which leads to $B(S_{q^*}, F_{(1-q^*)+q^*t})$. $F_M$ sends the Recalcitrant Bill $F_0$ which leads to $B(S_{q^*}, F_0)$. This strategy profile is not incentive compatible because $F_M$ has incentive to defect from $B_{F_0}$ to $B_{F_1}$.

$(B_F) = \{\text{Concessive, Aggressive}\}$, $B_F^* = \{\text{Concessive, Recalcitrant; Aggressive, Recalcitrant}\}$. $F_E$ sends the Concessive Bill which leads to $B(S_1, F_0) + K$. $F_M$ sends the Aggressive Bill $B(S_0, F_0)$ which leads to $B(S_{q^*}, F_0)$. If $B(S_1, F_0) + K > B(S_{q^*}, F_0)$, $F_M$ has incentive to defect from $B_{F_0}$ to $B_{F_1}$. Otherwise, $F_E$ has incentive to defect from $B_{F_1}$ to $B_{F_0}$. Thus, this strategy profile is not incentive compatible.

$(B_F) = \{\text{Aggressive, Aggressive}\}$, $B_F^* = \{\text{Concessive, Recalcitrant; Aggressive, Recalcitrant}\}$. $F_E$ sends the Aggressive Bill which leads to $B(S_{q^*}, F_{(1-q^*)+q^*t})$. $F_M$ sends the Aggressive Bill $B(S_0, F_0)$ which leads to $B(S_{q^*}, F_0)$. Since $B(S_{q^*}, F_{(1-q^*)+q^*t}) > B(S_{q^*}, F_0)$, $F_M$ has incentive to defect from $B_{F_0}$ to $B_{F_1}$. Thus, this strategy profile is not incentive compatible.
Belief

It is easy to confirm that on-the-path belief is up to the Bayes Rule and the strategy profiles. Off-the-path belief conditions are as mentioned above.
References


Figure 1. The Conditions of the Second Chamber’s Equilibria Strategy

\[ \frac{1}{1-q^*} \frac{p}{1-p^*} \frac{dS}{2K} \]
Figure 1. The Conditions of the Second Chamber’s Equilibria Strategy (Continued)

\[
\frac{1}{1 - q^*} \quad \frac{p}{1 - p^*} \quad \frac{dS}{2K}
\]

\[
\frac{dF}{2K} \quad \frac{1}{1 - p^*} \quad \frac{p^*/(1 - p^*)}{q^*}
\]

\{Agg., Agg.\} \quad \{Con., Agg.\}