A Game Theoretic Model of Bicameral Conference and Amendment Ver. 2.1 *

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March 30, 2009

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. This paper also argues that there is no

*Paper prepared for the 67th Annual Meeting of the Midwest Political Science Association, Chicago, IL, USA, April 2 - 5, 2009. Earlier versions of this paper were presented at the 103rd Annual Meeting of the American Political Science Association, Chicago, IL, USA, August 30 - September 2, 2007 (where my participation was supported by the exchange program between the Japanese Political Science Association and the American Political Science Association), the 66th Annual Meeting of the Midwest Political Science Association, Chicago, IL, USA, April 3 - 6, 2008, and the Spring Meeting of the Japanese Economic Association, Sendai, Japan, May 31 - June 1, 2008. I express my gratitude to Seok-ju Cho, Shinsuke Kambe and Tetsuro Okazaki, for comment, the Japan Society of Science Promotion and Kansai University for financial support.

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first mover advantage. It depends whether each chamber prefers serial deliberation to parallel deliberation.

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.

This paper also takes bicameral sequence seriously. Some scholars argue that the first chamber gains more than the second chamber (Rogers, 1998, 2005). But this article shows that there is no such first mover advantage. Rather, second last mover advantage exists.

Moreover, "parallel deliberation" where both houses pass bills simultaneously is compared with "serial deliberation" where one house deliberate what the other sends. It depends which is better for each house.

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 penultimate section considers first mover advantage and parallel deliberation by way of extension of the model. 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.

[1] As for connection between interbranch bargaining and intrabranch bargaining 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, overrride, 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

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 $\mathcal{U}[S, F]$. 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]

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

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 away from both F and S to be preferred to any conference report.

[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.

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.

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.[5]

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

$$U(F) = \int_S^F \Big(-|F-L| - K_F \Big) \frac{1}{F-S} dL = \frac{F+S}{2} - F - K_F$$

[5] S and 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 stragegy, the first chamber prefers acceptance to rejection.

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 reponse 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 prefrence between the two chambers. How far both chambers are from each other does not matter.[6] 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 *dis*advantage 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.

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

[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).

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 represend 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]

({Concessive and Aggressive}, {Concessive}). When Δ_F and Δ_S are low, the first chamber sends the Concessive Bill which is also the Aggressive Bill. The second chamber accepts it (No Amendment).

({Concessive},{Concessive, Aggressive}). When Δ_F and Δ_S are low (but not very low), the first chamber sends the Concessive Bill. The second chamber accepts it (No Amendment).

({Aggressive},{Concessive, Aggressive}). When Δ_F and Δ_S are low (but not very low), 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).

({Aggressive},{Concessive, Recalcitrant}). When Δ_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).

({Recalcitrant},{Aggressive}). When Δ_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).

({Recalcitrant},{Aggressive, Recalcitrant}). When Δ_F and Δ_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

[7] The term "Recalcitrant Amendment" is associated with "Recalcitrant President" in (Cameron, 2000).

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 (Δ_F or Δ_S) are low or high relative to conference cost K. The third column indicates the first chamber's strategy; *Con*cessive, *Reg*ressive or *Rec*alcitrant 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.

Uncertainty		Strategy Profiles			Outcomes			
1st	2nd	1st	2nd		Moderate 2nd		Extreme 2nd	
			Mod.	Ext.	Mod. 1st	Ext. 1st	Mod. 1st	Ext. 1st
Δ_F/K	Δ_S/K	B_F	B_{S0}	B_{S1}	(F_M, S_M)	(F_E, S_M)	(F_M, S_E)	(F_E, S_E)
Low	Low	Con.	Con.		None	None	None	None
Low	Low	Con.	Con.	Agg.	None	None	None	None
Low	Low	Agg.	Con.	Agg.	None	None	Amend	Conference
Low	High	Agg.	Con.	Rec.	None	None	Conference	Conference
High	Low	Rec.	Agg.		Amend	Conference	Amend	Conference
High	High	Rec.	Agg.	Rec.	Amend	Conference	Conference	Conference

Note: in strategy columns, Con. = Concessive, Agg. = Aggressive, Rec. = Recalcitrant

Table 1: Equilibria Strategy Profiles, Their Conditions and Outcomes

Figures 1-1 and 1-2 illustrate the conditions in which every second chamber's equilibrium strategy is established.

[Figures 1-1 and 1-2 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 Δ_F or Δ_S), the more likely amendment and conference are. To put it another way, as Δ_F or Δ_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 conferece 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.

Extension

Reversed Sequence: No First Mover Advantage

In order to examine first mover advantage, this subsection considers "Reversed Sequence" game where S comes first and F comes next. Call the game considered in the previous section "Standard Sequence" game. By comparing the expected utility of each chamber between these two games, it is found that F always prefers Reversed Sequence to Standard Sequence and S's preference is the opposite (for details, see Apendix which is admittedly still premature). Moreover, the expected outcome location of Standard Sequence is closer to S than that of Reversed Sequence. Thus, it is concluded that there is no first mover advantage but second last mover advantage in incomplete information model as well as in complete information model.

Initutional reason is the same as that of complete information model. Since S may force F to either accept or reject its amendment B_S, S moves its take-it-or-leave-it amendment from the *expected* conference location $E(B_C)$ to itself by F's conference cost K_F. In addition, if F accepts B_S, S saves its own conference cost K_S. In sum, S gains $K = K_F + K_S$ compared with the conference result. On the other hand, F cannot take advantage of its opponent's conference cost K_S. If F moves its bill B_F from what S will return to itself, S simply rejects it.

No Sequence: Parallel Deliberation

The subgame of the third stage can be interpreted as "No Sequence" game where F and S decide their own ideal points simultaneously and, if they are different, go to the conference. An example is U.S. Congress for many important laws. It depends on parameter values which F prefers, Standard Sequence (serial deliberation) or No Sequence (parallel deliberation) (for details, see Apendix). F prefers Standard Sequence to No Sequence only when bills are important to F (small K_F) but not to S (large K_S) compared with F's uncertainty (large Δ_F). It also holds for the expected values of outcome location, $E(B_C) = B(S_{q^*}, F_{p^*}) + K_F$. Without exceptional cases, S usually prefers Standard Sequence to No Sequence.

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.

In both models, no first mover advantage exists. It depends which each house prefer, serial deliberation or parallel deliberation.

There remains a lot to improve. The next step is to introduce deliberation cost on the first and second stages. Natural extension is to increase more stages (this is why this paper uses the term "second last mover advantage" rather than "second mover advantage"). My conjecture is that this kind of extension won't change implication of the current model. If this is true, the rationale of one round shuttle, not more than two rounds, will be established. 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. These are agendas for future research.

APPENDIX: Equilibria and Their Proof

Notation and Assumption

The Appendix introduces the following notation.

$$F_p \equiv pF_E + (1-p)F_M$$

$$S_q \equiv qS_E + (1-q)S_M$$

$$B(S_q, F_p) = \frac{S_q, F_p}{2} - K_F$$

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 stragegy, 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 ϵ 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, $L_{Ft}(B_C)$ ($t = 0$ 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, $L_{Ft}(B_C) = B(S_{\hat{q}}, F_t)$. Suppose that the best response for F_T is to accept $B_S \geq L_{Ft}(B_C)$ 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. Figure 2 illustrates the condition of $\hat{q}$ where F_M or F_E accepts or rejects B_S as well as the area where off-the-path belief is not allowed in the case of $L_{Ft}(B_C) = B(S_{q*}, F_0)$.

[Figure 2 about here]

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: $L_S^C(B) = B$. The Aggressive Equivalent Law is similarly defined except only F_M accepts B and F_E calls for the conference:

$$\begin{aligned}
&L_{St}^A(B(S_q, F_p)) \\
&= (1 - \hat{p})B(S_q, F_p) + \hat{p}(B(S_t, F_1) + K) \\
&= B(S_{(1-\hat{p})q+\hat{p}t}, F_{(1-\hat{p})p+\hat{p}}) + \hat{p}K.
\end{aligned}$$

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 $B_{St} = B(S_{\hat{q}}, F_1)$ the "Best Concessive Amendment". When $B_{St} = B(S_{\hat{q}}, F_{p>1})$ 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 reponses 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 $B_{St} = B(S_{\hat{q}}, F_{1>p>0})$.

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 $B_S = B(S_{\hat{q}}, F_1)$. 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 $L^C_S(B(S_{q'}, F_1)) < L^C_S(B(S_{\hat{q}}, F_1))$ (that is, $B(S_{q'}, F_1) < B(S_{\hat{q}}, F_1)$ and, therefore, $q' > \hat{q}$). Let $\hat{q}(q, p)$ be F's posterior belief after observing $B(S_q, F_p)$. If $B(S_{\hat{q}(q',1)}, F_1) > B(S_{q'}, F_1)$,

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 $q' > \hat{q}$.

Second, F_M should not accept any to-be Aggressive Amendment $B(S_{\hat{q}}, F_0)$ which would satisfy $L^A_{St}(B(S_{q'}, F_0)) < L^C_S(B(S_{\hat{q}}, F_1))$ (and S_E would defect). (If F_M does not accept B, F_E does not accept it, either.) Define $\tilde{q}$ as $\tilde{q} = \frac{\hat{q}-\hat{p}t}{1-\hat{p}} + \frac{2\hat{p}K-(1-\hat{p})\Delta_F}{(1-\hat{p})\Delta_S}$ so that $L^A_{St}(B(S_{\tilde{q}}, F_0)) = B(S_{\hat{q}}, F_1)$. Referring to the previous paragraph, the condition for S_E not to defect to any Aggressive Amendment is $\hat{q}(q', 0) < q'$ for $q' > \tilde{q}$ and $\tilde{q} \geq 0$, which requires that $2\hat{p}K \geq (\hat{p}t - \hat{q})\Delta_S + (1-\hat{p})\Delta_F$.

Third, the S_T's Recalcitrant Equivalent Law of every B should be farther away from S than a Concessive Amendment: $L^R_{St}(B) = B(S_T, F_{\hat{p}}) + K \geq B(S_{\hat{q}}, F_1)$. 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 $B(S_{\hat{q}}, F_1)$ that $2\hat{p}K \geq (\hat{p}-\hat{q})\Delta_S + (1-\hat{p})\Delta_F, 2K \geq (1-\hat{q})\Delta_S + (1-\hat{p})\Delta_F$ in the off-the-path belief that $\hat{q}(q', 1) < q'$ for $q' > \hat{q}$ and $\hat{q}(q', 0) < q'$ for $q' > \tilde{q}$.

{Aggressive}. Suppose $B_S = B(S_{\hat{q}}, F_0)$. 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 $L^A_{St}(B(S_{q'}, F_0)) < L^A_{St}(B(S_{\hat{q}}, F_0))$ (that is, $q' > \hat{q}$). Referring to the Concessive pooling strategy, the condition for S_T not to defect is $\hat{q}(q', 0) < q'$ for $q' > \hat{q}$.

Second, F_E should not accept any to-be Concessive Amendment $B(S_{q'}, F_1)$ which would satisfy $L^C_S(B(S_{q'}, F_1)) < L^A_{St}(B(S_{\hat{q}}, F_0))$. Define $\tilde{q}$ as $\tilde{q} = (1-\hat{p})\hat{q} + \hat{p}t - \frac{2\hat{p}K-(1-\hat{p})\Delta_F}{\Delta_S}$ so that $L^A_{St}(B(S_{\hat{q}}, F_0)) = L^C_S(B(S_{\tilde{q}}, F_1))$. The condition for S_T not to defect is $\hat{q}(q', 1) < q'$ for $q' > \tilde{q}$ and $\tilde{q} \geq 0$, which results in $2\hat{p}K < (1-\hat{p})\Delta_F + ((1-\hat{p})\hat{q} + \hat{p}t)\Delta_S$.

Third, the S_T's Recalcitrant Equivalent Law of every B should be farther away from S than a Aggressive Amendment: $L^R_{St}(B) = B(S_T, F_{\hat{p}}) + K \geq L^A_{S1}(B(S_{\hat{q}}, F_0)) = B(S_{(1-\hat{p})\hat{q}+\hat{p}}, F_{\hat{p}}) +$

$\hat{p}K$. 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 $B(S_{\hat{q}}, F_0)$ 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 $\hat{q}(q',0) < q'$ for $q' > \hat{q}$ and $\hat{q}(q',1) < q'$ for $q' > \tilde{q}$.

{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 $B(S_{q' \geq \hat{q}}, F_0)$, its Equivalent Law and that of $B(S_{\hat{q}*}, F_0$ are the same, $B(S_t, F_{\hat{p}}) + K$. 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 $L^C_S(B(S_{q'}, F_1)) < L^R_{St}(B(S_{\hat{q}*}, F_0))$. Define $\tilde{q}$ as $\tilde{q} = t - \frac{2K-\Delta_F}{\Delta_S}$ so that $L^R_{St}(B(S_{\hat{q}*}, F_0)) = L^C_S(B(S_{\tilde{q}}, F_1))$. The condition for S_T not to defect is $\hat{q}(q',1) < q'$ for $q' > \tilde{q}$ and $\tilde{q} \geq 0$, 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 $L^A_{St}(B(S_{q'}, F_0)) < L^R_{St}(B(S_{\hat{q}*}, F_0))$. Define $\tilde{q}'$ as $\tilde{q}' = t - \frac{2K}{\Delta_S}$ so that $L^R_{St}(B(S_{\hat{q}*}, F_0)) = L^A_{St}(B(S_{\tilde{q}'}, F_0))$. The condition for S_T not to defect is $\hat{q}(q',0) < q'$ for $q' > \tilde{q}'$ and $\tilde{q}' \geq 0$, 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_{St}, F has posterior belief $\hat{q} = t$.

{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 $L^A_{St}(B(S_0, F_0)) = B(S_0, F_{p^*}) + p^*K$ or $L^C_{St}(B(S_0, F_0)) =$

$B(S_0, F_0)$. This is closer to S than the Recalcitrant Equivalent Law $L^R_{St}(B) = B(S_0, F_{p^*}) + K$. Thus, S_M has incentive to defect from Recalcitrant Amendment.

{Concessive, Concessive}. Suppose $B_{St} = B(S_t, F_1)$. 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 paragragh, 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 $q' > \tilde{q}$. 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 $q' > \tilde{q}$.

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 condition leads 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 $2K > (1-\hat{p})\Delta_F$ and $2K < (1-\hat{p})\Delta_F$.

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 $q' > \tilde{q}$. Employing the argument of pooling Recalcitrant strategy (where $t = 1$), S_E does not have incentive to defect from B_{S1} 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 $B_{S0} = B(S_0, F_0)$. Incentive compatibility requires that $L^A_{S0}(B_{S0}) \leq L^R_{S0}(B_{S1})$ and $L^R_{S1}(B_{S1}) \leq L^A_{S1}(B_{S0})$, which implies that $2(1-\hat{p})K \geq -\hat{q}(1-\hat{p})\Delta_S$ (which always holds) and $2K < (1-\hat{q}*)\Delta_S + (1-\hat{p})\Delta_F$.

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^*_{S0}, B^*_{S1}} 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 $B_F \leq L_{St}(B^*_{St})$, S_T accepts B_F.

Otherwise, S_T rejects B_F and returns B^*_{St}.

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

First Stage

Preliminaries

Define the "Best Concessive Bill" as $B_{Ft}^{C} = L_{S1}(B_{S1}^{*}(\hat{p}(B_{Ft})))$, 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 reponses by restricting off-the-path belief as $\hat{p}(B_F^{-*}) \leq p^*$.

Define the "Best Aggressive Bill" as $B_{Ft}^{A} = L_{S0}(B_{S0}^{*}(\hat{p}(B_{Ft})))$, 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 ={Concessive}. The best response of F is the Concessive (and Aggressive) Bill $B_F^* = B_F^C = B_F^A = L_S^C(B_S^*) = B_S^*$. 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 ={Aggressive}. S_T's Equivalent Law of $B_S^* = B(S_{q^*}, F_0)$ is $L_{St}^A(B_S^*) = (1 - p^*)B(S_{q^*}, F_0) + p^*(B(S_t, F_1) + K) = B(S_{(1-p^*)q^*+p^*t}, F_{p^*}) + p^*K$.

(1) When F sends the Recalcitrant Bill, both S_M and S_E returns B_S^{A*} in any belief of $\hat{p}$. F_M accepts it, while F_E rejects it and gains $(1 - q^*)B(S_0, F_1) + q^*B(S_1, F_1) = B(S_{q^*}, F_1)$. (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 $L_{Ft}(B_{Ft}^A) = (1-q^*)B_{Ft}^A + q^*B(S_1, F_t) = B(S_{(1-q^*)(1-p^*)q^*+q^*}, F_{(1-q^*)p^*+q^*t}) + (1-q^*)p^*K$. (3) When F sends the Concessive Bill, both S_M and S_E accepts B_F. The Equivalent Law is $L_{Ft}(B_{Ft}^C) = B_{Ft}^C$.

(1) Suppose that B_F^* is the Concessive Bill. Since $L_{F1}(B_F^R) > L_{F1}(B_F^C)$, F_E defects to the Recalcitrant Bill. (2) Suppose that B_F^* is the Aggressive Bill. Since $L_{F1}(B_F^R) > L_{F1}(B_F^A)$, F_E defects to the Recalcitrant Bill. (3) Suppose that B_F^* is the Recalcitrant Bill, F_E never defects. It is true that $L_{F0}(B_F^R) \leq L_{F0}(B_F^C)$ where equality is established only when $p^* = 0$. If $\hat{p}^{-*} = 0$, $L_{F0}(B_F^R) > L_{F0}(B_F^A)$ and F_M never defects. Thus, pooling Recalcitrant Bill strategy profile is the best response of F as long as off-the-path belief $\hat{p}^{-*}(B_F > L_{S0}(B_{S0}^*(p^*))) = 0$.

When B_S ={Concessive, Aggressive}. S_M's Equivalent Law of $B_{S0}^* = B(S_0, F_1)$ is $L_{S0}^C(B_{S0}^*) = B_{S0}^*$. S_E's Equivalent Law of $B_{S1}^* = B(S_1, F_0)$ is $L_{S1}^A(B_{S1}^*) = B(S_1, F_{p^*}) + p^*K$.

(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 $(1 - q^*)B(S_0, F_1) + q^*B(S_1, F_0) = B(S_{q^*}, F_{1-q^*})$. 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 $B_F = B_{S0}^*$ 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 $\hat{p}^{-*}(B(S_{q>0}, F_1)) \leq \max(0, (1-q^*)\frac{\Delta_S+\Delta_F}{2K+\Delta_F})$, F never defects.

When B_S ={Concessive, Recalcitrant}. S_M's Equivalent Law of B_{S0}^* is $L_{S0}^C(B_{S0}^*) = B(S_0, F_1)$. S_E's Equivalent Law of B_{S1}^* is $L_{S1}^R(B_{S1}^*) = B(S_1, F_{p^*}) + K$.

(1) When F sends the Recalcitrant Bill, S_M returns B_{S0}^* and S_E returns B_{S1}^*. For F_T, the Equivalent Law is $(1-q^*)B_{S0}^* + q^*B(S_1, F_t) = B(S_{q^*}, F_{1-q^*+q^*t})$. (2) When F sends the Aggressive Bill, S_M accepts $B_F = B_{S0}^*$ and S_E returns B_{S1}^*. 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 $\hat{p}^{-*}(B(S_{q>0}, F_1)) \leq \max(0, 1 - \frac{2K-\Delta_S}{\Delta_F})$, F never defects.

When B_S ={Aggressive, Recalcitrant}. S_M's Equivalent Law of B_{S0}^* is $L_{S0}^A(B_{S0}^*) = B(S_0, F_{p^*}) + p^*K$. S_E's Equivalent Law of B_{S1}^* is $L_{S1}^R(B_{S1}^*) = B(S_1, F_{p^*}) + K$.

(1) When F sends the Recalcitrant Bill, S_M returns B_{S0}^* and S_E returns B_{S1}^*. For F_M, the Equivalent Law is $(1-q^*)B_{S0}^* + q^*B(S_1, F_0) = B(S_{q^*}, F_0)$. 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_{S1}^*. For F_T, the Equivalent Law is $(1-q^*)B_F + q^*B(S_1, F_t) = B(S_{q^*}, F_{p^*(1-q^*)+q^*t}) + p^*(1-q^*)K$. (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 $\hat{p}^{-*} < \frac{\Delta_F}{\Delta_F + p2K}$. F never defects to $B(S_1, F_p) + K$ in off-the-path belief $\hat{p}^{-*} < \max(0, 1 - \frac{2K-(1-q^*)\Delta_S}{\Delta_F}$.

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 {Concessive}. When $\Delta_S/2K > 1$, S takes {Concessive, Aggressive}. When $\Delta_S/2K > 1/(1-q^*)$, S takes {Concessive, Recalcitrant}. Receiving B_{F0}, S believes $p = 0$. When $\Delta_S/2K \leq 1/(1-q^*)$, S takes {Aggressive}. When $\Delta_S/2K \geq 1$ and $(1-q^*)\Delta_S + \Delta_F > 2K$, S takes {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 $B^*_S(B_{F1})$ = {Concessive}, B^*_{F1} = {Concessive and Aggressive}.

When $B^*_S(B_{F1})$ = {Concessive, Aggressive}, B^*_{F1} = {Concessive} or {Aggressive}.

When $B^*_S(B_{F1})$ = {Concessive, Recalcitrant}, B^*_{F1} = {Recalcitrant}.

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

When $B^*_S(B_{F0})$ ={Aggressive, Recalcitrant}, B^*_{F1} = {Recalcitrant}.

(2) In addition, { B^*_{F1}, B^*_{F0}} should be incentive compatible. That is, $L_{Ft}(B^*_{Ft}) > L_{Ft}(B^*_{F(1-t)})$. It turns out that all separateing 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) = {Concessive and Aggressive, Recalcitrant}, B^*_S = {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) = {Concessive and Aggressive, Aggressive}, B^*_S = {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.

$\underline{(B_F) = \{\text{Concessive or Aggressive, Recalcitrant}\},\ B_S^* = \{\text{Concessive, Recalcitrant; Aggressive}\}.}$ 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_{F0} to B_{F1}.

$\underline{(B_F) = \{\text{Aggressive, Recalcitrant}\},\ B_S^* = \{\text{Concessive, Aggressive; Aggressive}\}.}$ 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_{F0} to B_{F1}.

$\underline{(B_F) = \{\text{Concessive, Aggressive}\},\ B_S^* = \{\text{Concessive, Recalcitrant; Aggressive, Recalcitrant}\}.}$ 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_{F0} to B_{F1}. Otherwise, F_E has incentive to defect from B_{F1} to B_{F0}. Thus, this strategy profile is not incentive compatible.

$\underline{(B_F) = \{\text{Aggressive, Aggressive}\},\ B_S^* = \{\text{Concessive, Recalcitrant; Aggressive, Recalcitrant}\}.}$ 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_{F0} to B_{F1}. Thus, this strategy profile is not incentive compatible.

$\underline{(B_F) = \{\text{Aggressive, Aggressive}\},\ B_S^* = \{\text{Concessive, Aggressive; Aggressive, Recalcitrant}\}.}$ 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_{F0} to B_{F1}. 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.

No Sequence and Reversed Sequence

First, this subsection demonstrates the expected values of outcome location, $E(L)$, along each equilibrium of Standard Sequence game. Denote utility of each chamber by $U(F)$ and $U(S)$.

Second, the subgame of the third stage is analyzed as No Sequence game. The expected values of outcome location is $E(B_C) = B(S_{q^*}, F_{p^*}) + K_F$. Define $\Delta^0 E(L) \equiv 2(E(L) - E(B_C))$. If $\Delta E(L) > 0$, it is safley said that $E(L)$ is closer to F. Denote utility of each chamber by $U^0(F)$ and $U^0(S)$. Define $\Delta^0 U(F) \equiv 2(U(F) - U^0(F))$ and $\Delta^0 U(S) \equiv 2(U(S) - U^0(S))$. When $\Delta^0 U(F) > 0$ and $\Delta^0 U(S) > 0$, F and S prefer Standard Sequence to No Sequence, respectively.

Finally, the author calculates utility of each chamber, $U^{-1}(F)$ and $U^{-1}(S)$, and the expected values of outcome location, $E(L^{-1})$, in the case of Reversed Sequence game. Define $\Delta^{-1} E(L) \equiv 2(E(L) - E(L^{-1}))$, $\Delta^{-1} U(F) \equiv 2(U(F) - U^{-1}(F))$ and $\Delta^{-1} U(S) \equiv 2(U(S) - U^{-1}(S))$. When $\Delta^{-1} U(F) > 0$ and $\Delta^{-1} U(S) > 0$, F and S prefer Standard Sequence to Reversed Sequence, respectively. In order to avoid complicated taxonomy and make essence clear, only the case $p^* = q^* = 0.5$ (where uncertainty is the largest) is illustrated for Reversed Sequence. In most of the other cases, the argument below holds. In addition, the two equilibria, ({Concessive},{Concessive, Aggressive}) and ({Aggressive},{Concessive, Aggressive}) are not yet analyzed because they are too complicated.

<u>({Concessive and Aggressive}, {Concessive}).</u> $E(L) = B(S_{q^*}, F_1)$. Thus, compared with No Sequence, $\Delta^0 E(L) = \Delta^0 U(F) = (1-p^*)\Delta_F - 2K_F$ and $\Delta^0 U(S) = (1-p^*)\Delta_F - 2K_S$. Even

if considering parameter restrictions for establishing this equilibrium, there is possibility that these values are positive or negative. Thus, F prefers Standard Sequence to No Sequence and the expected outcome location is closer to F when the amount of uncertainty F_M takes advantage of, $(1-p^*)\Delta_F$, overwhelms the F's conference cost $2K_F$. F pays fee $(1-p^*)\Delta_F$ for insuring against the conference cost $2K_F$.

In Reversed Sequence, (S= { Concessive and Aggressive } , F= { Concessive }) is again an equilibrium. Thus, by simply exchanging notation between both chambers (and changing K_F into $-K_S$), $E(L^{-1}) = B(S_1, F_{p^*}) + K$. It follows that $\Delta^{-1}E(L) = (1-p^*)\Delta_F + (1-q^*)\Delta_S - 2K < 0$, $\Delta^{-1}U(F) = (1-p^*)\Delta_F + (1-q^*)\Delta_S - 2K < 0$ and $\Delta^{-1}U(S) = -\Delta^{-1}U(F) > 0$. This means that, in addition to the case of No Sequence, as the first mover, F is forced to buy uncertainty S_M takes advantage of, $(1-q^*)\Delta_S$, by paying S's price of not taking risk of the conference, $2K_S$. Thus, F always prefer Reversed Sequence to Standard Sequence and S's preference is the opposite.

<u>({ Recalcitrant} ,{ Aggressive, Recalcitrant}).</u> $E(L) = (1-q^*)[(1-p^*)B(S_0, F_0) + p^*(B(S_0, F_1) + K_F)] + q^*(B(S_1, F_{p^*}) + K_F) = B(S_{q^*}, F_{p^*}) + (1-(1-p^*)(1-q^*))K_F)$. Thus, compared with No Sequence, $\Delta^0 E(L) = -2(1-p^*)(1-q^*)K_F < 0$, $\Delta^0 U(F) = 0$ and $\Delta^0 U(S) = 2(1-p^*)(1-q^*)K > 0$. Thus, S prefers Standard Sequence to No Sequence and the expected outcome location is closer to S because, in the case of F_M, S_M takes advantage of both chambers' conference cost $2(1-p^*)(1-q^*)K$. F is neutral because it saves conference cost by conceding the outcome location.

In Reversed Sequence, (S={ Recalcitrant },F={ Aggressive, Recalcitrant }) is again an equilibrium. Thus, by simply exchanging notation between both chambers, $E(L^{-1}) = B(S_{q^*}, F_{p^*}) + K_F + (1-p^*)(1-q^*)K_S$. It follows that $\Delta^{-1}E(L) = -2(1-p^*)(1-q^*)K < 0$, $\Delta^{-1}U(F) = -2(1-p^*)(1-q^*)K < 0$ and $\Delta^{-1}U(S) = 2(1-p^*)(1-q^*)K > 0$. Thus, F always prefer Reversed Sequence to Standard Sequence and S's preference is the opposite. The expected outcome location is closer to S in Standard Sequence.

<u>({Aggressive},{Concessive, Recalcitrant}).</u> $E(L) = (1-q^*)B(S_0, F_1) + q^*(B(S_1, F_{p^*}) + K_F) = B(S_{q^*}, F_{(1-q^*)+p^*q^*}) + q^*K_F$. Thus, compared with No Sequence, $\Delta^0 E(L) = \Delta^0 U(F) = (1-p^*)(1-q^*)\Delta_F - 2(1-q^*)K_F$. There is possibility that these values are positive or negative. $\Delta^0 U(S) = -(1-p^*)(1-q^*)\Delta_F + 2(1-q^*)K > 0$. Thus, S prefers Standard Sequence to No Sequence.

In Reversed Sequence, (S={Recalcitrant},F={Aggressive}) is now an equilibrium. Thus, $E(L^{-1}) = B(S_{q^*}, F_{p^*}) + K - q^*K_S$. It follows that $\Delta^{-1}E(L) = \Delta^{-1}U(F) = (1-p^*)(1-q^*)\Delta_F - 2(1-q^*)K < 0$, and $\Delta^{-1}U(S) = -\Delta^{-1}U(F) > 0$. Thus, F always prefer Reversed Sequence to Standard Sequence and S's preference is the opposite. The expected outcome location is closer to S in Standard Sequence.

<u>({Recalcitrant},{Aggressive}).</u> $E(L) = (1-p^*)B(S_{q^*}, F_0) + p^*(B(S_{q^*}, F_1) + K_F) = B(S_{q^*}, F_{p^*}) + p^*K_F$. Thus, compared with No Sequence, $\Delta^0 E(L) = -(1-p^*)K_F < 0$, $\Delta^0 U(F) = 0$ and $\Delta^0 U(S) = (1-p^*)K > 0$. Thus, S prefers Standard Sequence to No Sequence. F is neutral. The expected outcome location is closer to S.

In Reversed Sequence, there are two cases. (1) When $(1-p^*)\Delta_F \leq 2p^*K$, ($S$={Recalcitrant},$F$={Aggressive}) is again an equilibrium. Thus, $E(L^{-1}) = B(S_{q^*}, F_{p^*}) + K - q^*K_S$. It follows that $\Delta^{-1}E(L) = -(1-p^*)K_F - (1-q^*)K_S < 0$. $\Delta^{-1}U(F) = [(1-p^*)(1-q^*)(B(q,0) - (B(0,p)+K))] + [p^*(1-q^*)((B(0,1)+Kf) - (B(0,p)+K))] + [(1-p^*)q^*(B(q,0) - (B(1,0)+Kf))] = \Delta^{-1}U(F) = -2(1-q^*)K < 0$ and $\Delta^{-1}U(S) = 2(1-p^*)K > 0$.

(2) When $(1-p^*)\Delta_F > 2p^*K$, (S={Aggressive},F={Concessive, Recalcitrant}) is now an equilibrium. Thus, $E(L^{-1}) = B(S_{(1-p^*)+p^*q^*}, F_{p^*}) + K_F + (1-p^*)K_S$. It follows that $\Delta^{-1}E(L) = (1-p^*)(1-q^*)\Delta_S - 2(1-p^*)K < 0$ $\Delta^{-1}U(F) = -2(1-p^*)K < 0$, and $\Delta^{-1}U(S) = -\Delta^{-1}U(F) > 0$.

Thus, F always prefer Reversed Sequence to Standard Sequence and S's preference is the opposite. The expected outcome location is closer to S in Standard Sequence.

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

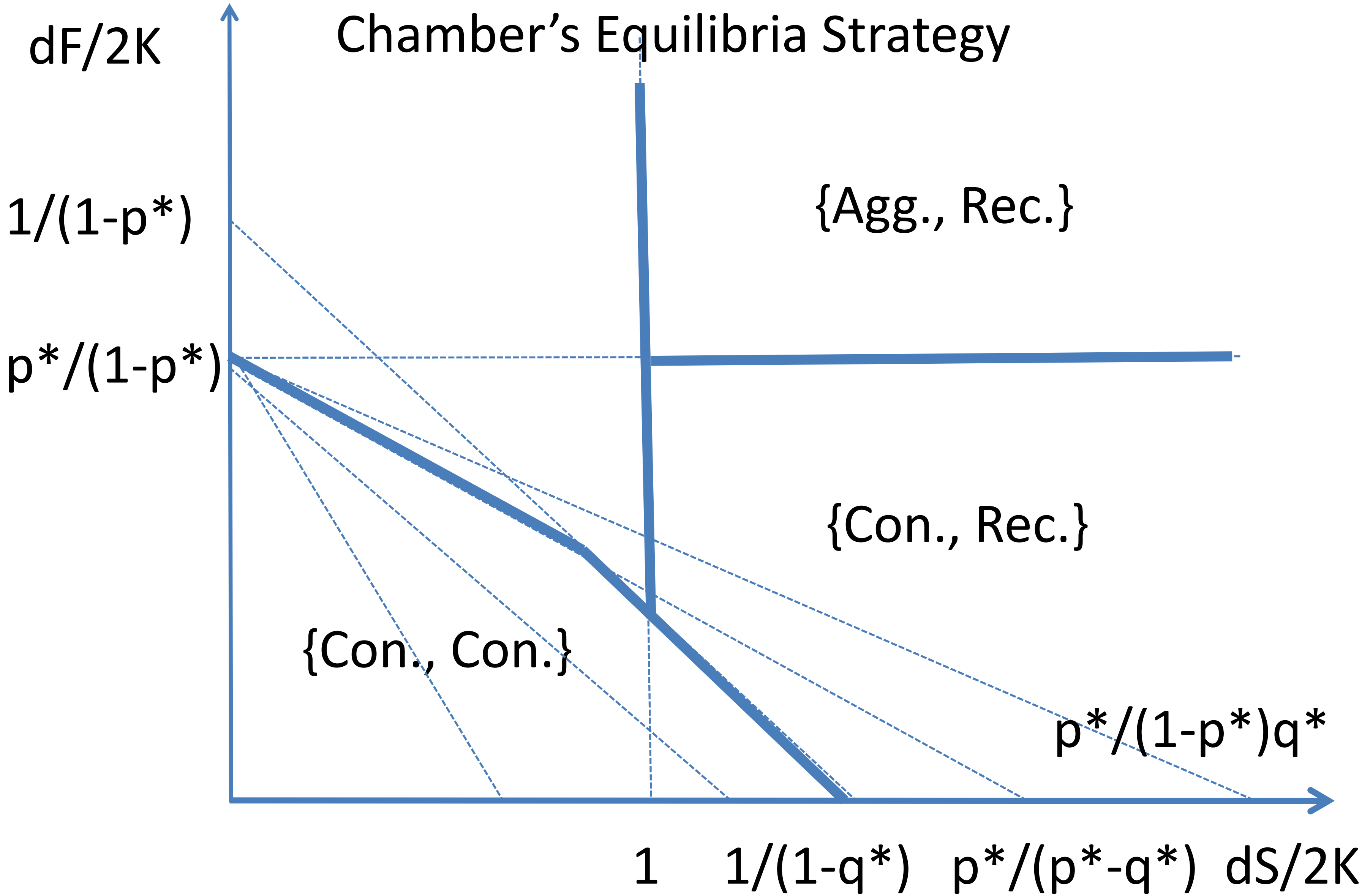

Figure 1-2. The Conditions of the Second Chamber's Equilibria Strategy (Continued)

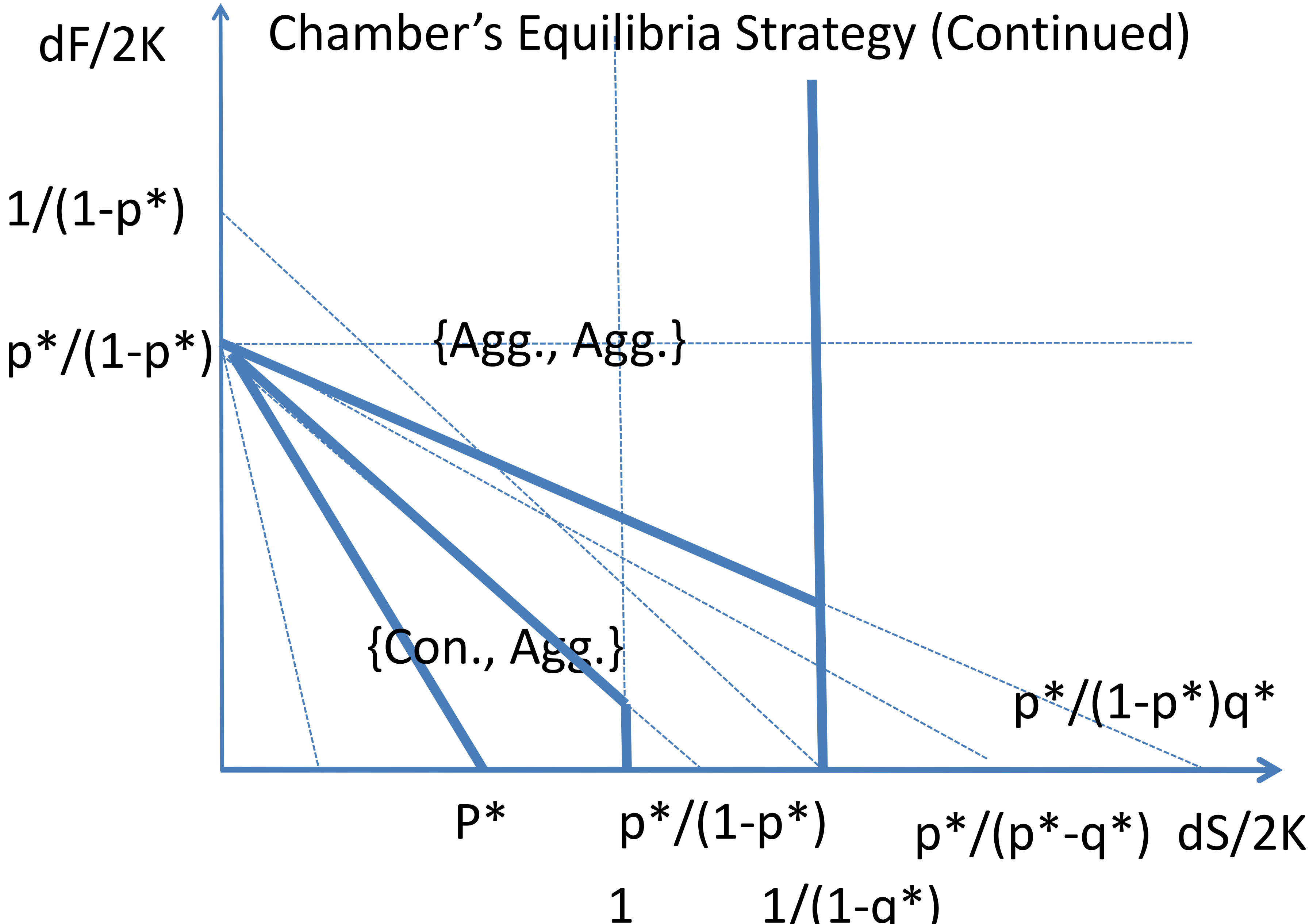

Figure 2. First Chamber's Best Response (Moderate; Extreme) to Amendment B_S with Belief q in the case of Equilibrium $B_S = B(S_{q*}, F_0)$