Brook no compromise: How to negotiate a united front

Elaine Yao*

April 3, 2025

Abstract

Negotiating factional conflict is crucial to successful coordination: political parties, rebel alliances, and authoritarian elites must all overcome internal disagreements to survive and achieve collective aims. Actors in these situations sometimes employ hardball tactics to block outcomes they dislike, but at the risk of causing coordination failure. Using a dynamic bargaining model, I explore how the threat and usage of these tactics impact coordination. In the model, two players who prefer different reforms must jointly agree on one to overturn a mutually unfavorable status quo. Neither knows the other's willingness to compromise—whether they prefer the status quo over their less-preferred outcome. Players who are willing to compromise delay hardball, balancing incentives to preempt the opponent against the benefit of waiting to gather more information. Finally, I identify factors which incentivize players to exercise caution, thereby reducing the incidence of avoidable miscoordination which results when players preemptively rule out possible compromises.

*Ph.D candidate, Princeton University. E-mail: eyao@princeton.edu

I am grateful to Gérman Gieczewski and Matias Iaryczower for invaluable guidance throughout the development of this project. I would also like to thank Roel Bos, Zuheir Desai, Alexander Hirsch, Clément Herman, Gleason Judd, Nicholas Kuipers, Daniel Mattingly, Kristopher Ramsay, Joseph Ruggiero, Reilly Steel, Mehdi Shadmehr, Leeat Yariv, and Hye Young You for their generous feedback and suggestions. Finally, I am grateful to seminar audiences at Princeton, Virginia Tech, Washington University in St. Louis, NYU, and participants at meetings of the American, Southern, and Midwest Political Science Associations.

1 Introduction

How do organizations overcome their differences in order to achieve collective goals? Political parties, international organizations, rebel alliances, and religious institutions must all settle internal disagreements over which legislative agenda, approach to monetary policy, ideology, or dogma will set their future course. When the prospect of collective success, or even survival, rests on the decisive resolution of such conflicts, which side falls into line, and which side gets their way? Why do some organizations remain deadlocked even when the cost of disunity is clear?

This paper locates an answer in the ubiquitous phenomenon of "hardball tactics"—actions which remove an option from the negotiating table entirely. Such tactics are inherently risky: if the opposing side refuses to yield, they may leave an organization mired in a suboptimal stalemate. Consider an illustrative episode from the U.S. Republican Party's attempt to repeal the Affordable Care Act in 2017. Moderate Republican House leaders, eager to pass the American Healthcare Act (AHCA), a partial repeal bill, scheduled an early floor vote to pressure the ultraconservative Freedom Caucus into supporting the measure. Presenting the AHCA as the only viable path forward, they sought to force the Freedom Caucus into supporting a bill which the latter had decried as "Obamacare Lite." However, the move backfired. The Freedom Caucus held firm, withholding the necessary votes and ultimately ensuring that the ACA remained intact (Bade, Dawsey and Haberkorn 2017).

Examples where hardball tactics result in miscoordination are widespread across institutional and historical contexts. In 1921, cooperation between Communist and Islamist blocs within Sarekat Islam, an early Indonesian independence movement, collapsed after Islamists expelled Communists at a party congress. Rather than consolidating power in the hands of Islamists, the expulsion caused a split which weakened both factions, ultimately leading to dissolution of Sarekat Islam and a failed Communist revolt (McVey 2019; Schrieke 1955; Van Reybrouck 2024). Similarly, in the United Kingdom, the Liberal Party fractured over Irish home rule in 1885, resulting in a devastating electoral defeat the following year and a prolonged period of Conservative dominance (Conti 2024; Lubenow 1983; Roach 1957). The specter of miscoordination also haunts international bodies who must coordinate the management of financial crises: 2015 talks over Greek debt relief, while ultimately successful, were plagued by the fear that a failure to reach an agreement between fiscal hawks and doves would lead to a Greek exit from the eurozone (Ewing 2015; James 2024).

Given the risks of legislative losses, financial crises, and failed independence movements, why do political parties, social movements, and international organizations play hardball? My central argument is that hardball tactics shape coordination by endogenously revealing information about groups' willingness to compromise. To develop this argument, I study a dynamic two-player coordination game in which both players must agree on one of two reforms to escape an unfavorable status quo. Each player prefers a different reform but is uncertain about the other's willingness to compromise—whether they would settle for their less-preferred reform over the status quo. Over time, players receive opportunities to use hardball: that is, to make a take-it-or-leave-it offer that ends the game. If accepted, the proposed reform is enacted; if rejected, the status quo remains permanently in place.

Akin to the textbook Battle of the Sexes, equilibrium behavior hinges upon the tension between conflict and coordination. In the unique equilibrium, "hard types" – players who are unwilling to compromise – play hardball as soon as they can. By contrast, "soft types" who are willing to compromise on their opponent's preferred outcome stall strategically in order to learn about their opponent's willingness to compromise. They cannot stall indefinitely, as doing so risks being preempted by a soft opponent. Delaying too little is also risky, as doing so could alienate a hard opponent and result in miscoordination—analogous to when moderate Republicans preemptively called for a vote on a repeal bill which the Freedom Caucus would not support. The trade-off between preemption and caution pins down soft types' equilibrium threshold strategy, in which they only engage in hardball tactics after they become sufficiently confident that the opponent is also a soft type.

The model provides a new perspective on standard bargaining intuitions, arising mainly from two assumptions. The first assumption is that *imperfectly known* frictions limit groups' ability to play hardball as soon as they would wish. Compared to bargaining models in which the timing and sequence of proposals and responses are fixed, or reputational bargaining models in which concession is frictionless, I take an intermediate approach by assuming that opportunities to play hardball arise sporadically. This reflects the reality that opportunities to use hardball tactics are not always continuously available—they may depend on the time taken to assemble group members and carry out deliberations, the availability and mobility of resources, and the timing of opportune moments such as high-profile meetings. While these opportunities may be clear to the group itself, they are often invisible to outsiders, as may be the information that a group has chosen *not* to act upon a hardball opportunity. Hence, an opponent cannot discern whether inaction reflects intentional delay or simply the fact that an opportunity has not yet arisen. Over time, the opponent may increasingly suspect intentional restraint – but never with absolute certainty.

The second assumption is that players must make irrevocable and risky commitments in order for the status quo to change. The focus of the model is therefore not on "cheap talk" threats, but rather on credible hardball actions which take options off the table, and are not easily reneged upon. There are two implications of this action structure. First, it reverses the pattern of learning in reputational bargaining: Rather than signaling obstinacy, delay in my model implies willingness to compromise. Second, miscoordination becomes an explicit and central risk. Unlike models of reputational bargaining, where the door to agreement is never definitively shut, miscoordination in my model can be "locked in."

One form of miscoordination which is particularly salient is *avoidable miscoordination*, wherein soft types preempt hard types, causing the status quo to persist. Unlike bargaining models where discounting motivates early agreement, preemptive forces in my model arise without discounting. Hence, the relevant inefficiencies are not those arising from delay, but rather inefficient coordination failures resulting from preemptive commitments. I demonstrate that when hardball opportunities arise more frequently, avoidable miscoordination is more likely. Hence, settings that feature particularly small and ideologically unified groups relatively unencumbered by institutional or procedural constraints may be particularly liable to experience avoidable miscoordination. Similarly, if resources become more mobile or intra-group communication becomes more frictionless, groups may be prompted to take decisive action earlier, even at greater risk to successful coordination.

To isolate the learning logic at the core of the model, I first study a symmetric setting where parameters can differ between types but not players. Analysis of an asymmetric setting where parameters can vary between types *and* players reveals additional cautionary incentives. These incentives emerge because players can now exploit differences between their cutoff times. For the player with the earlier cutoff, the difference between cutoff times represents an opportunity to delay slightly longer to learn more about the opponent, without increasing the risk of being preempted. For the player with the later cutoff, the difference means *inhibited learning*: After the earlier player's threshold, both possible types of the opponent are pooling on hardball. Hence, inaction is no longer indicative of softness. The lagging player therefore has less information to learn from, and must therefore delay even longer to become sufficiently confident of the leading player's type.

The same logic applies when players experience exogenous learning shocks, namely, news which confirms their opponent's willingness to compromise or lack thereof. These situations are not merely of theoretical interest: they are the result of everyday gossip, information-sharing, eavesdropping, as well as investigative reporting, espionage, and intentional leaks by duplicitous group members. When a player is publicly revealed to be willing to compromise, they also face the problem that both types of their opponent are pooling on hardball. Hence, they do not attempt to preempt opponents in order to speedily make up for their informational disadvantage – they delay longer. Like the trailing player in the asymmetric setting, a leaked player knows that both types of their opponent are trying to hardball, and can no longer infer that an opponent's silence implies softness. Like the trailing player, the leaked player is forced to exercise additional caution.

I also consider the implications of information leakages being a persistent risk throughout the game—for instance, when two groups share close social connections, and are liable to leak information about their positions across the aisle. I show that in general, "leakier" environments incentivize caution. However, these environments also create incentives for players to hedge against the possibility of being leaked, causing predictions about strategic behavior and welfare in leaky environments to differ from the baseline model. For instance, in environments when leaks are frequent, increasing the frequency of commitment opportunities may actually improve welfare by reducing the incidence of avoidable miscoordination. Hence, this extension sheds light on how the likelihood of successful coordination changes in environments where gossip, intra-group dissension, and rapid media cycles are increasingly commonplace, informative, and influential.

The paper is organized as follows. Section 2 discusses relevant theoretical and empirical literature. Section 3 presents the baseline model. Section 4 characterizes equilibrium in the symmetric setting. Section 5 analyzes the model with information leakages. Section 6 analyzes welfare. Section 7 generalizes results to the asymmetric setting. Section 8 concludes. All proofs of results can be found in the Appendix.

2 Literature

This paper contributes to emerging research on how coordination processes shape political outcomes. Scholarship on legislative politics has traditionally examined the institutional procedures that enable leaders to control subordinates (Cox and McCubbins 2005; Kiewiet and McCubbins 1991; Krehbiel 2010). Similarly, scholarship on authoritarian regimes has focused on the formal and informal mechanisms used by authoritarian leaders to manage elites and civil society actors (De Mesquita et al. 2005; Meng, Paine and Powell 2023; Svolik 2009).

Recent work has shifted focus from static frameworks to the dynamics of intra-group conflict and cooperation. Rubin (2017) demonstrates how intra-party organizations resolve coordination problems and consolidate power against rival leaders. Green (2019), who studies the House Freedom Caucus's "hardball tactics," shows that their effectiveness depends on "sufficient size and unity to determine floor votes, internal mechanisms to foster unity and protect against retaliation, a membership whose preferences could plausibly be satisfied (or less unsatisfied) by carrying out a threat, and a reputation for following through." These conditions of institutional leverage and internal consensus correspond strongly to the availability of *hardball opportunities* in my model. A thematically parallel line of research in comparative politics and international relations highlights how outbidding strategies signal resolve and facilitate coordination among competing insurgent or rebel groups: Rival groups stake radical ideological demands to signal commitment, but do so at the risk of escalating conflict and fragmentation (Tokdemir et al. 2021; Vogt, Gleditsch and Cederman 2021). This logic parallels the logic of hardball tactics in the model: Groups either successfully push through their preferred reform, leadership, or ideology—or otherwise suffer the consequences of miscoordination.

Form a theoretical perspective, models of bargaining have been widely applied for understanding legislative politics, conflict, and numerous other contexts. Within the bargaining literature, this paper is most closely connected to models which incorporate reputational concerns (Abreu and Gul 2000) to understand exit in duopoly (Fudenberg and Tirole 1986), entry deterrence (Kreps and Wilson 1982), as well as crisis bargaining in international relations (Fearon 1994; Reich 2022). At the crux of these models is a war of attrition: Players begin with irreconcilable demands, from which they may choose to concede. If a player is an obstinate "behavioral" type, they never concede; hence, rational types delay concession in order to masquerade as behavioral types. A key structural difference from reputational bargaining is that while concessions cannot lock in miscoordination, hardball commitments can. Rather than act preemptively to bluff as hard types, soft types in my model delay to avoid needless miscoordination. Beliefs in my model therefore evolve in the direction of players being *soft*.[1] Furthermore, my model allows for comparative statics on the *rate* at which players receive opportunities to act—a parameter absent from reputational bargaining models.

[1]It is useful to view the game I develop as a dynamic extension of the Battle of the Sexes, and reputational bargaining/war of attrition as a dynamic extension of Chicken. While the static versions of these games are equivalent up to swapping the names of actions, they generate different patterns of learning and incentives in the dynamic versions.

I also contribute to the literature on preemption games, which have been used to analyze innovation or patent races (Hopenhayn and Squintani 2011; Weeds 2002), technology adoption (Fudenberg and Tirole 1985), investment in risky projects for scientific research (Bobtcheff, Levy and Mariotti 2022), and news organizations deciding to break news which may turn out to be untrue (Shahanaghi 2023). A key feature of these games is that while behavior is publicly observable, payoff-relevant characteristics – in my case, willingness to compromise – are private. Cautionary and preemptive pressures in classic preemption games arise not from coordination concerns, but from uncertainty over the value of the innovation and existence of winner-take-all profits; this paper is the first to my knowledge to show how these incentives can emerge from coordination motives.

Some features of the model draw on recent approaches in economic theory. By modeling the arrival of commitment opportunities as a Poisson process, I follow Kamada and Sugaya (2020) and related work in the revision games literature, in which players receive Poisson-distributed opportunities to revise a pre-prepared action which will then be automatically taken at a deadline (Calcagno et al. 2014; Kamada and Kandori 2020).[2] This approach also parallels Ambrus and Lu (2015), who develop a continuous-time coalition bargaining game where players receive Poisson-distributed opportunities to make proposals. For this paper, modeling commitment opportunities as Poisson ensures a non-degenerate learning process, disciplines the multiplicity of equilibria that would otherwise arise in a coordination games, and facilitates comparative statics on how varying degrees of frictions influence equilibrium behavior and welfare.

3 Model

There are two infinitely lived players, a and b, which I refer to as groups. Time $t \in [0, \infty)$ is continuous. There is a status quo (SQ) policy in place at the start of the game, as well as two alternatives, A and B. It is public knowledge that group a's preferred policy is A, and group b's preferred policy is B. Policy can only be changed once in the game and requires the consent of both groups. Each group is either a "soft" or "hard" type. Hard types prefer SQ to their opponent's preferred alternative, and soft types prefer their opponent's preferred alternative to SQ. Let $u_i^\theta(X)$ denote the utility of a group $i = a, b$ of type $\theta = s, h$ for some alternative $X \in \{A, B, SQ\}$. Then, for a hard type of group a,

$$u_a^h(A) > u_a^h(SQ) > u_a^h(B)$$

[2]As Kamada and Sugaya note, this method is analogous to the technique introduced by Calvo (1983) in macroeconomics to model uncertainty over future opportunities to change prices.

For a soft type of group a,

$$u_a^s(A) > u_a^s(B) > u_a^s(SQ)$$

Hard and soft types of group b satisfy analogous properties. Since I focus on the problem faced by soft types, I will omit the s superscript on the utility functions of soft types in equilibrium analysis; the problem of hard types is straightforward.

Groups stochastically receive *commitment opportunities* at which time they can choose to propose one policy, rendering the other permanently unobtainable. This is what I refer to as hardball tactics. These rate at which opportunities arrive may be type-specific: A group of type θ receives commitment opportunities at rate Poisson(μ_θ). Arrivals of opportunities are private information, and remain private if a group chooses to pass. Once a group acts on an opportunity, its decision is permanent and irrevocable, and its opponent must immediately accept or reject the proposed policy. If the opponent accepts, the policy is implemented; if the opponent rejects, the status quo remains in place. After the opponent's decision, the game ends and players receive their infinite-horizon utility from the final policy that is implemented. If neither group ever makes a commitment, the status quo remains in place. There is no discounting.

At the start of the game, group a holds a prior belief $p_b \in [0, 1]$ that their opponent b is a hard type. Analogously, p_a is the prior about opponent a held by group b. Groups update their beliefs endogenously based on opponents' actions following Bayes' Rule. I seek a Perfect Bayesian Equilibrium.

3.1 Discussion of model assumptions

I assume that groups do not discount the future. This enables me to isolate groups' preemptive incentives undiluted by the additional impatience introduced by discounting. Thus, if policy changes at any point, the new policy fully dominates infinite-horizon utility.

In the model, if neither group's preferred reform passes or no commitment is made, the status quo persists. However, the logic remains unchanged if the status quo represents a fallback outcome triggered by a failed offer. For instance, this fallback might align with the original status quo (e.g., Obamacare persisting post-repeal attempt) or diverge significantly (e.g., civil war replacing an incumbent regime).

The model imposes weak assumptions on preferences. It does not require that players have single-peaked preferences, although it nests this case. For example, if players have single-peaked preferences and $SQ < A < B$, where B represents a far-right reform and A is more moderate, b must be a soft type. Whether a is hard or soft depends on policy A's proximity to policy B versus SQ. The case where one player's type is known and the other's is unknown is captured by Proposition 2, where the soft group's type is revealed at $t = 0$. In general, however, intertemporal and reputational concerns may lead players to act contrary to single-peaked preferences. For instance, by stonewalling today's policy, b could increase p_b, strengthening their future position or electoral chances. I do not model these concerns explicitly, but emphasize that hardness or softness may depend on more than contemporaneous preferences over the issue at hand.

I also assume that the average rate of commitment opportunities may differ by type. This assumption reflects the fact that type characteristics may reflect intra-group discipline and resolve: for instance, hard types may find it easier to unify their group than soft types. For instance, in weakly institutionalized settings, resolved groups may be able to act more decisively. Since this direction of the assumption is more substantively plausible than the reverse, I adopt it for my main results. I also discuss the implications of reversing this assumption in the following section. A theme of the analysis is understanding how players' strategic incentives and behavior differ between settings where commitment opportunities are strongly type-dependent versus settings where they are not. When commitment opportunities *do* vary by type, players can make inferences on the basis of the difference *between* type-specific rates. This will be expounded in the analysis of the model.

4 Equilibrium of the baseline model

In this section I characterize equilibrium in a symmetric setting of the model. That is, for $\theta \in \{s, h\}$, I assume $p_a = p_b \equiv p$, and $u_a^\theta(A) = u_b^\theta(B)$, $u_a^\theta(B) = u_b^\theta(A)$, and $u_a^\theta(SQ) = u_b^\theta(SQ)$.The symmetric setting serves as a useful baseline because it highlights the learning process that determines how uninformed soft types trade off preemption and caution. This logic forms the foundation for the results discussed in subsequent sections.

I begin by describing the full information benchmark where types are public. In this benchmark, groups' optimal strategies never involve delay. There is no uncertainty to be resolved by delay, so soft types make offers as soon as they receive an opportunity. Since groups' types are publicly known, there is also no efficiency loss from avoidable miscoordination.

Remark 1 (Full information benchmark)**.** *If both groups are hard types, the status quo is never overturned. If both groups are soft types, the first group to receive a commitment opportunity determines the final policy. If groups are different types, the final policy is the one preferred by* *the hard type.*[3]

By contrast, the full version of the model with incomplete information exhibits both delay and efficiency loss. Hard types still have a dominant strategy to propose their preferred alternative as soon as they receive an opportunity. Since hard types' dominant strategy is independent of their beliefs or their opponents' beliefs, their behavior is mechanical. The more interesting problem, which motivates the first proposition, is faced by soft types who do not know their opponents' type. To begin the analysis, suppose that no commitments have been made (that is, the game has not yet ended.) I refer to this as a *relevant history.* At a relevant history, a soft type ("the decisionmaker"; she) knows that a hard type of her opponent has been trying to commit from the start. As more time passes without her opponent playing hardball, the less likely it is that her opponent is a hard type. A soft opponent, meanwhile, is making the same calculation as the decisionmaker, becoming more and more convinced over time that the decisionmaker is a soft type and therefore safe to preempt. At a certain time, the decisionmaker's cost of being preempted by a potentially soft opponent will outweigh the benefit of giving a potentially hard opponent sufficient time to act first. This result is formalized below:

Proposition 1 (Commitment delay for soft types)**.** *Consider the continuation at a relevant history. Assume $\mu_h > \mu_s$. There is a unique equilibrium in which a soft group commits to its preferred alternative at time t if and only if $t > T^*$.*

T^* is given by

$$T^* = \max\left\{\frac{1}{-\mu_h}\ln\left(\frac{1-p}{p}P_T\right),\ 0\right\} \tag{1}$$

where

$$P_T \equiv \frac{\mathbb{P}\,(b \text{ is a hard type})}{\mathbb{P}\,(b \text{ is a soft type})} = \frac{1}{2}\,\frac{\mu_h+\mu_s}{\mu_h}\,\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)} \tag{2}$$

Proposition 1 describes the unique equilibrium in the symmetric setting of the game. In this equilibrium, both groups play an identical threshold strategy where they commit after T^*. T^* is the time at which players' posterior beliefs reach a threshold posterior, P_T, which equalizes the expected value of delay and expected value of making a permanent commitment. This threshold belief is at the core of all equilibrium expressions, and encodes many of the factors which tilt players towards preemption or delay.

[3] Remark 1 assumes that if players are indifferent between committing at t' and any time after t', they will commit at t'. This assumption is not necessary for the remainder of the paper.

The quantity $\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}$ captures *relative desirability*, or the strength of a soft type's preferences. When relative desirability is high, A and B are not very substitutable: B is only slightly preferable to the status quo. This may correspond to settings in which groups are strongly tied to their preferred reforms and view their opponents' preferred reforms as a highly imperfect substitute. In settings characterized by low relative desirability, by contrast, groups may care more about simply overturning the status quo, and less about what they implement instead—in other words, B is a closer substitute for A. As relative desirability $\to \infty$, a soft type becomes closer to a hard type, as the beliefs threshold P_T is *easier* to reach. This result exemplifies an interesting observation: Ordinal preference alone fully determines hard types' equilibrium behavior – it does not matter how much a hard type prefers the status quo over an opponent's policy. By contrast, cardinal preference – as captured by relative desirability – is relevant for how soft types behave in equilibrium.

Similar to how high relative desirability shortens delay by moving the "finish line" of P_T, decreasing a group's prior that its opponent is a hard type also shortens delay by moving the "starting line" closer to P_T. I summarize these two results as follows for group a (group b is symmetric).

Corollary 1 (Conditions for no delay)**.** *A soft type of group a acts without delay when one or more of the following are true:*

1. *The relative desirability of A compared to B $\left(\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\right)$ is high*
2. *Group a has a strong prior belief that b is a soft type relative to a hard type $\left(\frac{1-p}{p}\right)$*

I now examine comparative statics on the rate at which players receive commitment opportunities, highlighting how differences in technological, institutional, and social frictions affect coordination. For instance, does smaller group size or faster decision-making lead soft groups to act more preemptively or exhibit greater patience? How do advances in military and communication technologies, or institutional reforms that expand agenda control influence coordination incentives?

The model predicts that increasing the frequency of commitment opportunities leads soft types to act more preemptively. Two mechanisms underlie this result. First, when hard types can act more frequently (increasing μ_h), sustained delay is more likely to signal intentional stalling—in other words, it is easier to screen out hard types of an opponent. Second, when soft types can act more frequently (increasing μ_s), their confidence threshold for acting (P_T) rises, requiring less learning for action. If political frictions affect both types almost equally

($\mu_h \approx \mu_s$), screening overwhelmingly dominates the second mechanism: Frequent opportunities make delay less ambiguous, reducing soft types' ability to stall without revealing their intentions. Therefore, simply giving the Freedom Caucus more opportunities to preemptively play hardball against moderates may not have been sufficient to prevent miscoordination, since these opportunities may also have incentivized soft moderates to act more preemptively as well. By contrast, *reducing* moderates' opportunities to preempt the Freedom Caucus may have sufficed to increase their incentive to delay, potentially reducing miscoordination.

I conclude this section by revisiting the assumption in Proposition 1 that $\mu_h > \mu_s$, which is necessary to ensure that a soft type commits if *and only if* $t > T^*$. If instead $\mu_h < \mu_s$, a soft type still delays until T^* but then randomizes over later opportunities. This is due to the evolution of the opponent's beliefs after T^*: Since both types are trying to commit, the opponent updates beliefs on the basis of the difference $\mu_h - \mu_s$. Hence, any further delay *after* T^* is suggestive that a player is a hard type. From the perspective of a soft type, it is useful to leverage this property by passing on some opportunities received after T^*. Hence, soft types randomize over using opportunities received after T^* with mixing probabilities that maintain the opponent's posterior at P_T.

This section focused on isolating the fundamental forces in the model: Soft types' competing desires to screen potential hard opponents and to avoid being preempted by potential soft opponents, the evolution of beliefs, and how varying commitment opportunity rates influence delay. Next, I relax rigid symmetry assumptions on the information that players possess.

5 Information leakages

The baseline model focuses on how endogenous learning determines hardball behavior. However, in reality, groups may *exogenously* discover one another's willingness to compromise as a result of gossip between friendly members across the aisle, sabotage by disgruntled group members, or third-party media investigations. Whether leaks originate from highly public media stories, such as the leaks which occurred during the negotiations over the Transatlantic Trade and Investment Partnership (TTIP) and repeatedly during negotiations over a Brexit withdrawal agreement – or from more mundane gossip, eavesdropping, and information-sharing, they can directly reveal or pressure groups into revealing their genuine willingness to compromise, fundamentally altering the information environment in which coordination takes place.

A key question is whether leaks accelerate or delay negotiations. Firstly, how does being leaked affect players' behavior? Do they rush to act more aggressively to offset their disadvantage, or do they strategically stall? Secondly, when both sides recognize leaks as a significant risk, how do they adapt their strategies? To address these questions, I model leaks as exogenous information shocks that publicly reveal a player's willingness to compromise, and occur at the jump times of a Poisson process. This can represent, for example, the time it takes for media outlets to verify a story (Shahanaghi 2023).[4] The rate of leaks can differ by type (λ_s for soft types and λ_h for hard types), reflecting the possibility that group characteristics influence leak probabilities. For instance, it may be easier to leak information exposing obstinacy than malleability. Additionally, it is directly in a hard type's interest to have its type revealed, as this reduces the likelihood of unnecessary miscoordination when facing a soft opponent. Hence, members of hard groups may try harder to credibly leak their obstinacy.

If a group is revealed as a hard type, it has effectively committed to its preferred policy: The opponent knows they must either fall into line or accept miscoordination. However, if a group is leaked as being a soft type, both types of the opponent has a dominant strategy to preempt. How should the leaked soft type then respond? Should they proceed cautiously or adopt a more aggressive strategy to compensate? The model suggests caution. After the leak occurs, both types pool on commitment. Therefore, *inaction is no longer informative about the opponent's type*, shutting down a key source of learning. The leaked group must therefore wait longer to become sufficiently confident that its opponent is safe to preempt. I formalize this result in the following proposition:

Proposition 2 (Delay with asymmetric information)**.** *Suppose a group ("the decisionmaker") is revealed at time $\bar{t} < T^*$ to be a soft type. Assume $\mu_s + \lambda_s < \mu_h + \lambda_h$. In the continuation, there exists a unique equilibrium that takes the following form: There exists $\overline{T}^*(\bar{t}) > T^*$ such that in all histories where the opponent's type remains unknown, the decisionmaker will commit to its preferred alternative if and only if $t > \overline{T}^*(\bar{t})$. Furthermore, $\overline{T}^*(\bar{t})$ is decreasing in $\bar{t}$, with $\lim \overline{T}^*(\bar{t})_{\bar{t}\to T^*} = T^*$.*

I now characterize T^*, $\overline{T}^*$, and P_T in the game with leaks from the perspective of player a (player b is symmetric.)

[4] Leaks need not directly disclose a player's willingness to compromise. In the model, evidence that a group passed on a commitment opportunity suffices to confirm it is a soft type.

Visualization of Proposition 2

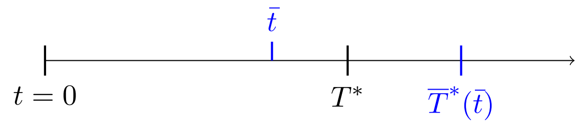


Figure 1. T^* is when the soft group becomes willing to act if both groups' types are unknown. If the soft group's type is revealed at $\bar{t}$, it begins committing starting at $\overline{T}^*$, the value of which is dependent on $\bar{t}$.

$$T_a^* = \max\left\{\frac{1}{\lambda_s - (\lambda_h + \mu_h)} \ln\left(\frac{1-p}{p} P_T\right),\ 0\right\} \tag{3}$$

$$\overline{T}_a^* = \max\left\{\frac{1}{\lambda_s + \mu_s - (\lambda_h + \mu_h)} \left[\ln\left(\frac{1-p}{p} P_T\right) +\ \mu_s \bar{t}\ \right],\ 0\right\} \tag{4}$$

$$\text{where} \quad P_T = \frac{1}{2} \frac{\mu_h + \lambda_h + \mu_s}{\mu_h + \lambda_h} \frac{u_a(A) - u_a(B)}{u_a(B) - u_a(SQ)} \tag{5}$$

Even after being leaked, soft types *can* continue to learn, although the source of learning is different: Given that the opponent is pooling on commitment, a soft type can learn from the difference between type-specific rates: $\lambda_h + \mu_h - (\lambda_s + \mu_s)$. If this difference is large, then sustained silence *and* inaction are strong indications that the opponent is a soft type. By contrast, if this difference is small then soft types have little to learn from. In the extreme case where rate parameters apply equally to both types of both players ($\mu_h = \mu_s$ and $\lambda_h = \lambda_s$), soft types are truly paralyzed: $\overline{T}^* \to \infty$.

I now use comparative statics to study the effect of an overall leakier environment on players' behavior. How do coordination incentives differ between scenarios where opposing sides share extensive social and educational connections that facilitate gossip and leaks versus those where such ties are minimal? Similarly, how do groups adjust when they are aware of high media visibility and scrutiny?

As a baseline, consider the case where leak probabilities are not type-specific ($\lambda_s = \lambda_h \equiv \lambda$). Here, λ only reduces the threshold belief P_T, as soft types cannot exploit differences between λ_h and λ_s to make inferences about their opponent's type. Consequently, increasing λ increases soft types' delay, as reaching the threshold posterior takes longer. When leak probabilities are type-specific, however, soft types can also learn from differences between λ_h and λ_s. Enlarging this difference (for instance, decreasing λ_s while holding λ_h constant, or increasing λ_h while holding λ_s constant) reduces delay by providing an additional source of information. In particular, when $\lambda_h \gg \lambda_s$, observing no leaks for an extended period strongly signals that the opponent is soft, shortening delay even if leaks have not occurred. Therefore, the question of whether leaks slow down or speed up negotiations hinges on whether leakiness is highly correlated with willingness to compromise. If hard types are more easily able than soft types to credibly leak their obstinacy, delay should be short and negotiations should be fast. In situations where leaks are uncorrelated with willingness to compromise, delay is likely to be longer and negotiations slower. In intra-party disagreements, in which factions share party identification and overlapping social and professional networks, obstinacy may come out sooner than in negotiations over trade deals and other international agreements disagreements which are conducted across national, institutional, and linguistic boundaries.

The risk of leaks also generates new comparative statics which qualify predictions that emerged in the baseline model. In the baseline model, faster commitment opportunities reduced delay through two mechanisms: raising threshold beliefs and accelerating learning. These mechanisms worked in tandem. For a leaked player, however, they can pull in opposite directions: Higher μ_s makes it easier to reach P_T, but slows learning by reducing the gap between $\lambda_h + \mu_h$ and $\lambda_s + \mu_s$. As a result, the effect of increasing the frequency of commitment opportunities on $\overline{T}^*$ may be non-monotonic.

The net effect depends on which force dominates: the slower learning caused by μ_s being close to μ_h, or the threshold-lowering effect of a higher P_T. The *timing* of the leak ultimately determines which effect prevails. If the soft type is leaked early, slower learning affects the entire game, dominating the change to P_T and lengthening delay. Conversely, if the leak occurs late, most learning about the opponent's type is already complete. In this case, the increase in P_T dominates, and delay is shortened.

I summarize these observations below:

Proposition 3 (Comparative statics for delay and rate parameters)**.**

1. *T^* is decreasing in μ_s, the rate at which soft types receive commitment opportunities.*
2. *$\overline{T}^*$ is increasing in μ_s when $\bar{t} < \max\left\{T^* - \frac{\lambda_s+\mu_s-(\lambda_h+\mu_h)}{(\mu_s+(\lambda_h+\mu_h))(\lambda_s-(\lambda_h+\mu_h))}, 0\right\}$ and decreasing in μ_s otherwise.*
3. *T^* and $\overline{T}^*$ are decreasing in $\lambda_h + \mu_h$, the rates at which hard types screen out.*
4. *T^* and $\overline{T}^*$ are increasing in λ_s, the rate at which soft types are exogenously leaked.*

This analysis highlights how asymmetric information shapes players' learning. Even without actual commitments or leaks occurring, knowledge of *average* arrival rates provides insight into an opponent's willingness to compromise. Learning is most hindered when arrival rates are independent of type, causing leaked soft types to delay significantly longer than when large type-based differences exist. These results underscore the importance of considering political frictions that inhibit action *within* the context of the information environment. Consider a situation where one side's willingness to compromise is revealed early in negotiations, unlike the TTIP leak, which occurred over three years after the beginning of negotiations. In such a case, giving soft types more opportunities to convene meetings and make high-profile statements may actually extend delay by impeding the soft type's ability to learn about their opponent, reducing the incidence of avoidable negotiation.

A further reason for introducing exogenous information shocks to the model is that they impact welfare results, informing predictions about the conditions that create the highest risk of avoidable miscoordination. I explore this in the subsequent section.

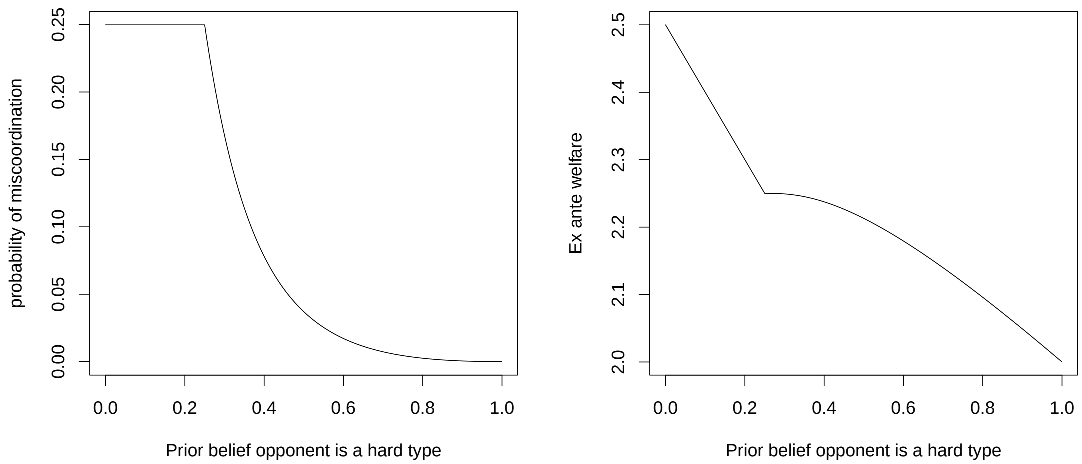
6 Welfare

To answer questions about the factors which mitigate or exacerbate the risk of avoidable miscoordination, I begin by developing the connection between equilibrium strategies and welfare. I retain the symmetric setup with leaks from the previous section. Consider a soft type of player a's infinite horizon expected utility:

$$(1-p)\left[\frac{u_a(A)+u_a(B)}{2}\right]+(p)\Big[\mathbb{P}\left(\text{avoidable miscoordination}\right)u_a(SQ)+ \\ \Big(1-\mathbb{P}\left(\text{avoidable miscoordination}\right)\Big)u_a(B)\Big] \tag{6}$$

The probability of avoidable miscoordination is central to welfare analysis because it fully embeds soft types' equilibrium behavior. In the symmetric setting, the duration of a soft type's delay does not affect their chances of prevailing over a soft opponent, but it does affect the likelihood of avoidable miscoordination. The *ex ante* probability of avoidable miscoordination involves both soft types' optimal delay if they are not leaked (T^*) and if they are leaked ($\overline{T}^*(\bar{t})$). Computing this becomes complex, as it involves predictions about the incidence of leaks during the game. I relegate the statement to Appendix B.

Priors and relative desirability have mechanical as well as strategic effects on welfare. While increasing relative desirability shortens delay (and makes avoidable miscoordination more likely),



(a) Miscoordination

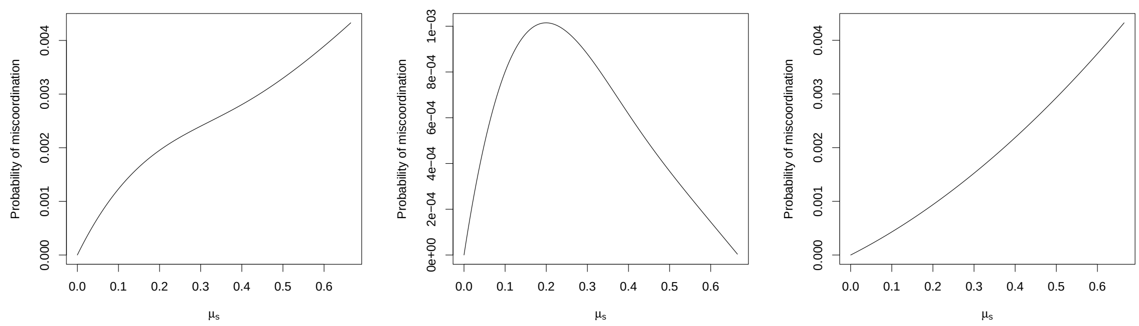
(b) Welfare

Figure 2. Effects of changing priors on miscoordination and welfare. Left of the kink, soft players do not delay at all. Right of the kink, soft players choose positive delay.
Parameter values: $\lambda_s = \frac{1}{3}, \mu_s = \frac{1}{3}, \lambda_h + \mu_h = 1, \frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)} = \frac{1}{2}$

it also mechanically boosts utility in the cases where there is no avoidable miscoordination. Similarly, increasing p means that avoidable miscoordination is less likely if the opponent is truly a hard type (increasing welfare), but makes it also more likely *a priori* that the opponent could be a hard type (decreasing welfare). Figure 2 illustrates these dynamics. In the region where the probability of avoidable miscoordination is flat (because there is zero delay), welfare is still negatively affected by the opponent being more likely to be a hard type.

By comparison, the only welfare impact of leaks and political frictions is through the probability of avoidable miscoordination. Since reducing the difference between λ_h and λ_s increases delay, it also increases welfare, all else equal (Figure A1). Hence, if hard types are unable to credibly leak their type more frequently than soft types, soft types cannot screen their opponents easily on the basis of the information they are not receiving. Silence being uninformative, soft types must delay longer before playing hardball, reducing the instance of avoidable miscoordination.

However, as previewed by the previous section, leaky environments have secondary consequences. When soft types can commit more frequently, we should expect welfare to suffer *as long as leaks are not too likely*. To see why, recall that the effect of μ_s on $\overline{T}^*$ depended on whether



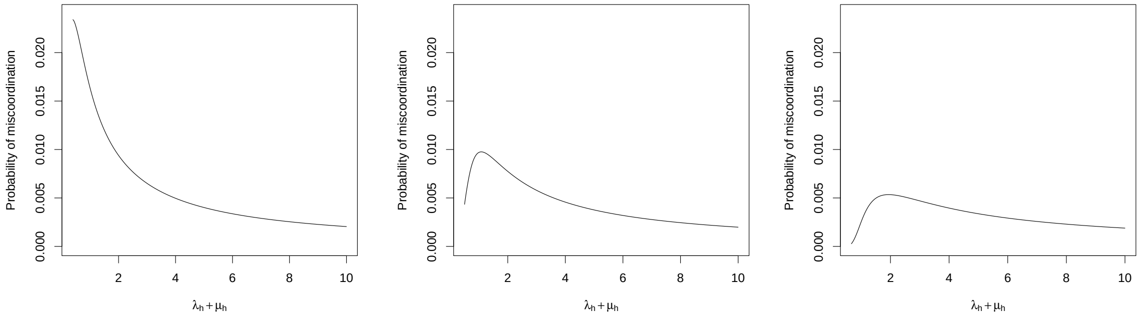
(a) Aggregate effect **(b)** Effect in $\overline{T}^*$ case **(c)** Effect in T^* case

Figure 3. Effects of changing μ_s on miscoordination. Left panel presents the aggregate effect, which is the probability-weighted sum of the effects in the one-sided and two-sided asymmetric information cases (panels b and c, respectively).
Parameter values: $\lambda_s = \frac{1}{3}, \lambda_h + \mu_h = 1, \frac{1-p}{p} = \frac{1}{4}, \frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)} = \frac{1}{2}$

the leak occurred early or late. For the purposes of welfare analysis, it is important to note that players cannot anticipate *when* a leak will occur, they can only anticipate how they will react if one does occur at some point. If $\mu_h \gg \mu_s$, hard types screen out discernibly faster, reducing the incidence of miscoordination. If $\mu_h \approx \mu_s$, soft types delay a long time, also reducing miscoordination. Hence, *miscoordination is most likely at intermediate values of μ_s relative to μ_h* (Figure 3 panel b.) When leaks are highly probable, the $\overline{T}^*$ case dominates, so welfare has a "U"-shape in μ_s. When leaks are rare, the T^* case dominates, so welfare simply decreases in μ_s (Figure A2).

The rate at which soft types are leaked also influences the comparative statics on $\lambda_h + \mu_h$, the rate at which hard types screen out. When hard types screen out quickly, soft types learn more quickly and delay less. However, this can backfire when λ_s is high. Intuitively, this is driven by *rational impatience*: the increase in $\lambda_h + \mu_h$ leads soft types to believe that most hard types have probably already screened out and that it is safe to hardball the opponent. While this is a good assumption to make in the limit as $\lambda_h + \mu_h \to \infty$, it can be risky when $\lambda_h + \mu_h$ is lower. This effect is compounded when λ_s is high, causing soft types to fear being outed to a soft opponent and being put at a disadvantage. Hence, when leaks are improbable, the probability of miscoordination decreases in $\lambda_h + \mu_h$, the straightforward effect of improved screening. However, as λ_s increases and soft types seek to hedge against being leaked, nonmonotonicity becomes increasingly pronounced (Figure 4).

Remark 2 ($\lambda_s = 0$ welfare benchmark)**.** *When $\lambda_s = 0$, welfare is increasing in $\lambda_h + \mu_h$, and is decreasing in μ_s.*



(a) $\lambda_s = \frac{1}{16}$ **(b)** $\lambda_s = \frac{1}{6}$ **(c)** $\lambda_s = \frac{1}{3}$

Figure 4. Effects of changing $\lambda_h + \mu_h$ on the probability of avoidable miscoordination. As I progressively increase λ_s across the panels, non-monotonicity in the comparative static becomes more pronounced.
Parameter values: $\lambda_h + \mu_h = 1$, $\frac{1-p}{p} = \frac{1}{4}$, $\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)} = \frac{1}{2}$

These observations highlight the close relationship between information leaks and commitment opportunities in welfare analysis. While leakier environments can incentivize more patience and thereby reduce miscoordination, they also qualify predictions regarding the effects of political frictions on welfare. In particular, when leaks are extremely frequent, increasing commitment opportunities for soft types – which we would usually expect to shorten delay and cause more miscoordination – sometimes improves welfare. Thus, if groups share a common nationality, common language, social connections, or media ecosystem – factors which may increase the likelihood that their willingness to compromise will be leaked to the other side – a reduction in frictions may reduce mistakes of preemption and lead to more successful coordination. In settings more resembling the baseline model where groups are more separated and leaks are rare, the same change actually could lead to more avoidable miscoordination and welfare loss.

7 Asymmetric setting

In this section, I generalize the analysis to accommodate player- and type- specific arrival rates, beliefs, and utilities. Besides generalizing the equilibrium statement, this section demonstrates how the model can be adapted to settings which are highly asymmetric. For instance, in conflict scenarios, one group might be better equipped, leading to more frequent commitment opportunities. In legislative contexts, groups with greater institutional leverage – such as those holding leadership positions – may also receive more commitment opportunities. Groups may differ in how they view the substitutability of policies: one might see the opponent's policy as a poor substitute, while the other sees the two as nearly equivalent. Groups under greater media scrutiny may be more likely to be leaked, irrespective of their type. This section seeks to understand how such asymmetric considerations affect coordination incentives.

I retain the setup from Section 5 but relax all symmetry assumptions. I allow $u_a^\theta(X) \neq u_b^\theta(X)$ for $\theta \in \{s, h\}$ and generic policy X, and allow $p_a \neq p_b$. Rate parameters are now specific to types *and* players: I allow $\lambda_a^s \neq \lambda_b^s, \lambda_a^h \neq \lambda_b^h$ and likewise for μ parameters. Denote a soft type of player i's relative desirability as follows:

$$RD_i := \frac{u_i(X_i) - u_i(X_j)}{u_i(X_j) - u_i(SQ)}$$

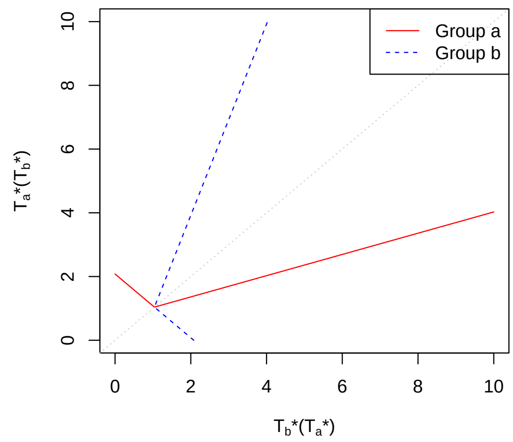
where X_i denotes i's most-preferred policy and X_j j's most-preferred policy. Gameplay proceeds exactly as before. Following previous definitions, define a *relevant history* as a history at which no leaks have occurred and neither played has committed (equilibrium in the asymmetric setting where a leak has occurred is characterized in Appendix C.3). The following proposition establishes the existence and generic uniqueness of the equilibrium in this setup.

Proposition 4 (Equilibrium in the asymmetric setting.)**.** *Consider the continuation at a relevant history. Assume $\mu_s^i + \lambda_s^i < \mu_h^i + \lambda_h^i$. There is a unique equilibrium that takes the following form. For each player i, there exists T_i^* such that i will commit to its preferred alternative iff $t > T_i^*$, conditional upon no commitments and leaks having occurred. $T_i^* : \mathbb{R}^+ \to \mathbb{R}^+$ is given by*

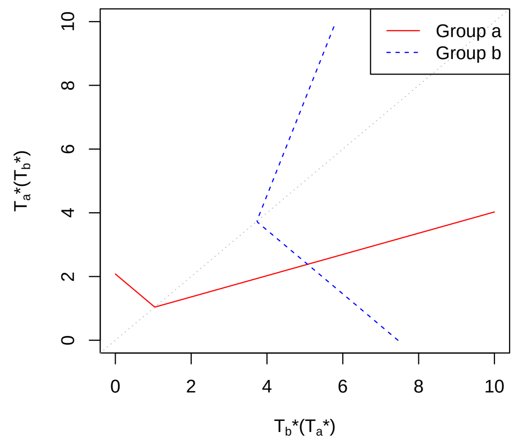
$$T_i^*(T_j^*) = \begin{cases} \max\left\{ \frac{1}{\lambda_s^j - (\lambda_h^j + \mu_h^j) - \mu_s^i} \left[\ln\left(RD_i \frac{\mu_s^j}{\mu_s^i + \mu_s^j} \frac{1-p_i}{p_i} \frac{(\lambda_h^j + \mu_h^j) + \mu_s^i}{(\lambda_h^j + \mu_h^j)} \right) - \mu_s^i T_j^* \right], 0 \right\} & \textit{if } T_i < T_j^* \\ \max\left\{ \frac{1}{\lambda_s^j + \mu_s^j - (\lambda_s^j + \mu_s^j)} \left[\ln\left(RD_i \frac{\mu_s^j}{\mu_s^i + \mu_s^j} \frac{1-p_i}{p_i} \frac{(\lambda_h^j + \mu_h^j) + \mu_s^i}{(\lambda_h^j + \mu_h^j)} \right) + \mu_s^j T_j^* \right], 0 \right\} & \textit{if } T_i > T_j^* \end{cases} \tag{7}$$

In Figure 5a, I plot best response correspondences in the symmetric setting of the model. Each players' threshold, plotted as a function of the opponent's threshold, takes a "V" form. The point of each "V" lies on the 45-degree line describing $T_a^* = T_b^*$. Moving along either player's best response in either direction away from the point of the "V" amounts to *increasing* delay. In the symmetric equilibrium, best responses intersect on the point of both "V"s. Therefore, both players exhibit the *minimum* amount of delay in the symmetric equilibrium, implying a relatively high incidence of avoidable miscoordination.

Comparative statics which shift one player's best response result in a new point of intersection where both players delay more. For intuition, consider the equilibrium depicted in Figure



(a) Best response correspondences in a symmetric setting.
Parameter values: $\lambda_s = \frac{1}{3}, \mu_s = \frac{1}{3}, \lambda_h + \mu_h = 1, p = \frac{1}{4}, \frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)} = \frac{u_b(B)-u_b(A)}{u_b(A)-u_b(SQ)} = \frac{1}{2}$



(b) Best response correspondences in an asymmetric setting where a is more likely than b to be a hard type ($p_b = \frac{4}{5} > p_a = \frac{1}{4}$). Other parameter values are preserved from (a).

Figure 5. Best response correspondences in symmetric and asymmetric settings.

5b, in which all parameters remain symmetric except that player a is more likely than b to be a hard type ($p_b > p_a$). In this equilibrium, $T_a^* < T_b^*$. This difference in threshold times has implications for learning: After T_a^*, group b cannot learn from a's commitment behavior, since a is pooling on commitment. This slower learning forces b to delay longer, similar to the argument for why leaked players must delay. Unlike the effect of a leak, however, b's delay also extends a's delay: Knowing that b is postponing commitment, a can afford to wait longer to learn about b's type. This additional delay reduces the risk of preempting a hard type without significantly increasing the risk of being preempted by a soft type. In short, a enjoys slack. Importantly, neither player delays less than in the symmetric case, reducing the likelihood of avoidable miscoordination. This result speaks to the importance of having a "reputation for hardball" or unwillingness to compromise: A group such as the Freedom Caucus with a reputation for obstinacy can essentially induce their opponent to delay longer even if the group is in fact willing to compromise. It can therefore buy more time to learn about the opponent's type and determine if hardball is likely to succeed this time.

Miscoordination is most likely to occur when groups are on relatively equal footing in terms of the availability of commitment opportunities, priors, and relative desirability. Hence, groups which are largely symmetric – two major political parties, or two well-established social movements – are more likely to avoidably fail to coordinate. Indeed, weakening one group – for instance, by weakening its preferences on the issue at hand or giving its opponent a more aggressive reputation – should lead *both* groups to delay more. However, this does not simply mean that a large social movement and smaller fringe, activist group are more likely to pursue careful and successful coordination: As the Freedom Caucus example demonstrates, relatively small and fringe movements may also be more ideologically unified, quick to act, and committed to the cause. Group size, therefore, may not always be an appropriate proxy for groups' negotiation leverage in the context of this model.

Studying the asymmetric setting deepens our understanding of the mechanisms driving comparative statics in the symmetric setting. For instance, increasing λ_s^i, the rate at which player i is leaked, shifts j's best response without shifting i's (see Proposition 4). As a result, increasing λ_s^i must increase delay for both groups because, like changing one group's prior, it holds one group's best response constant. Suppose, for instance, that the Freedom Caucus faced significantly more media scrutiny than House moderates, and were perceived as being more likely to have their willingness to compromise leaked over the course of negotiations. The model predicts that this should have caused soft House moderates to behave more cautiously overall. If, by contrast, the Freedom Caucus faced *less* media scrutiny than House moderates and were less likely to be leaked, then soft House moderates should have behaved more preemptively. The symmetric setting effectively only analyzed an increase in media scrutiny that affected both groups equally; increasing λ_s meant increasing both λ_s^a and λ_s^b. This shifted *both* best responses outwards, compounding the cautionary effect.

Unlike λ_s^i, changing μ_s^i or $\lambda_h^i + \mu_h^i$ shifts best response functions for *both* players. While analytic characterizations are more difficult, simulations confirm basic intuitions (see Figure A3). Consider the effects of an increase in μ_s^a, the average rate at which a soft type of player a receives commitment opportunities. This leads player a to delay more, while player b delays less. To understand why, consider that player b effectively now has a slower commitment technology; hence, even after b becomes willing to commit, it will take longer (on average) to carry one out. As such, b has an incentive to *preempt* player a, who has a faster commitment technology. For instance, if the Freedom Caucus was seen has having *more* potential opportunities to play hardball, even conditional on being willing to compromise, then House moderates should delay less in order to make up for its "technological" disadvantage.

By contrast, suppose that *hard types* of the Freedom Caucus screen out faster – that is, $\lambda_h^a + \mu_h^a$ is higher. This means that moderates can screen out hard types of the Freedom Caucus more effectively than vice versa. As a result, soft moderates delay less than a potential soft type of the Freedom Caucus (T_b^* is lower than T_a^*). The fact that player b ("moderates") hardball earlier has a detrimental effect on the learning of player a ("soft Freedom Caucus"), causing the to delay longer than in the symmetric case.

8 Discussion

This paper has sought to illustrate how the process of coordination shapes players' behavior in settings that lack rules which formally sequence and delimit how coordination takes place. In particular, it explores the implications of *hardball tactics* in which players can commit to one policy, taking the other off the table. In the unique equilibrium of the model presented, groups who are unwilling to compromise play hardball quickly, while groups who are willing to compromise delay usage of these tactics. Delay in coordination suggests that either at least one party is willing to compromise, or that finding ways to credibly draw red lines is particularly difficult. Early failures in coordination likely occur because neither side is willing to compromise, or because it is particularly easy to draw red lines. Coordination outcomes can never be perfectly predicted *ex ante* in a world where players are uncertain of one another's willingness to compromise. Because political, technological, or intra-group frictions may tie the hands of groups who are fundamentally uninclined to compromise, delay is not a guaranteed signal that coordination will eventually succeed. Even in instances where both sides would have benefited from allowing the "harder" side to take the lead, preemptive motives often arise which lead to avoidable miscoordination.

When political frictions are less restrictive – that is, players receive opportunities to commit more frequently – preemptive incentives are particularly strong. As such, in situations where groups are more ideologically unified, more technologically capable of taking rapid and decisive actions, or less encumbered by institutional procedures and paperwork, we should see *more* mistakes of preemption. Hence, avoidable miscoordination is likely to be most pernicious in settings where the causes of delay are highly ambiguous and the means of taking hardball actions are readily available.

This prediction is refined, however, by the addition of leaks to the model. I introduced leaks to emphasize how *exogenous* learning affects the core mechanisms and predictions of the model. In highly "leaky" contexts where players are likely to quickly discover one another's willingness to compromise, loosening political frictions may actually promote welfare. The root cause of this is players' *ex ante* uncertainty about whether they will find themselves at an informational disadvantage mid-game. These comparative statics on information leaks and commitment opportunities are absent from most bargaining games, but address important questions about how the information environment interacts with group characteristics to produce more or less aggressive behavior.

The analysis of uninformed soft types' decisions coalesces into two major themes. First, any form of asymmetry, either induced through leaks or through asymmetric parameter values, impedes one player's learning, causing them to delay playing hardball for longer. Second, in a model without delay, equilibrium behavior impacts welfare primarily through the risk of avoidable miscoordination, which is mollified by factors that prolong delay. This mechnanism does not arise in reputational bargaining models, and is the central source of welfare loss in my model. It also speaks to real-world concerns about legislative gridlock: For instance, could House moderates have successfully overturned the ACA if they had not been so quick to call a vote on the partial repeal bill? Conditional on House moderates being genuinely willing to compromise, the model suggests that under different conditions, the answer could be yes.

The model is flexible to a number of extensions, for instance, imposing negotiation deadlines. Suppose, for example, that there is a known time T_D past which, if either group has failed to make a commitment, the status quo is automatically instated. The effect of this is to add an additional cost to uninformed soft types' cost of waiting, corresponding to the probability that a commitment opportunity will not arrive prior to the deadline $(1 - e^{-\mu_s(T_D - t)})$. If the deadline is sufficiently early, soft types would be strongly incentivized towards preemption, making learning difficult (since players of both types act quickly). If it is relatively late, the threshold equilibrium would be largely unchanged, although it should shift slightly earlier due to the extra weight on the costs of delay.

Beyond informing empirical analysis of coordination and miscoordination, the model provides a foundation for further applied theoretical research. One promising direction is to embed the core forces of the model in a richer policy and type space. For example, with more than two possible reforms, players could face a trade-off between drawing red lines to posture as hard types and influence their opponent's beliefs, and acting more cautiously to avoid ruling out viable compromises. Such an extension could deepen our understanding of how hardball tactics simultaneously shape belief manipulation and coordination dynamics. Another avenue is exploring the possibility endogenous information acquisition. If a group can pay a cost to do "opposition research" by increasing λ_s or λ_h of its opponent, when would it pay this cost? How would this affect each group's behavior in equilibrium and coordination outcomes? These extensions highlight how the model's basic framework can be adapted to address a number of other phenomena related to coordination, or can be tailored to particular institutional settings. I leave these pathways open for future exploration.

References

Abreu, Dilip and Faruk Gul. 2000. "Bargaining and Reputation." *Econometrica* 68(1):85–117.

Ambrus, Attila and Shih En Lu. 2015. "A continuous-time model of multilateral bargaining." *American Economic Journal: Microeconomics* 7(1):208–249.

Bade, Rachel, Josh Dawsey and Josh Haberkorn. 2017. "How a secret Freedom Caucus pact brought down Obamacare repeal." *Politico* . Available at `https://www.politico.com/story/2017/03/trump-freedom-caucus-obamacare-repeal-replace-secret-pact-236507`.

Bobtcheff, Catherine, Raphaël Levy and Thomas Mariotti. 2022. "Negative results in science: Blessing or (winner's) curse?" *Working paper* .

Calcagno, Riccardo, Yuichiro Kamada, Stefano Lovo and Takuo Sugaya. 2014. "Asynchronicity and coordination in common and opposing interest games." *Theoretical Economics* 9(2):409–434.

Calvo, Guillermo A. 1983. "Staggered prices in a utility-maximizing framework." *Journal of Monetary Economics* 12(3):383–398.

Conti, Gregory. 2024. "The Roots of Right-Wing Progressivism." *Compact* . Available at `https://www.compactmag.com/article/the-roots-of-right-wing-progressivism/`.

Cox, Gary W and Mathew D McCubbins. 2005. *Setting the agenda: Responsible party government in the US House of Representatives.* Cambridge University Press.

De Mesquita, Bruce Bueno, Alastair Smith, Randolph M Siverson and James D Morrow. 2005. *The logic of political survival.* MIT press.

Ewing, Jack. 2015. "Weighing the Fallout of a Greek Exit From the Euro." *The New York Times* . Available at `https://www.nytimes.com/2015/07/10/business/international/drachma-grexit-eurozone.html`.

Fearon, James D. 1994. "Domestic political audiences and the escalation of international disputes." *American Political Science Review* 88(3):577–592.

Fudenberg, Drew and Jean Tirole. 1985. "Preemption and rent equalization in the adoption of new technology." *The Review of Economic Studies* 52(3):383–401.

Fudenberg, Drew and Jean Tirole. 1986. "A Theory of Exit in Duopoly." *Econometrica* 54(4):943–960.

Green, Matthew. 2019. *Legislative Hardball: The House Freedom Caucus and the Power of Threat-Making in Congress.* Cambridge University Press.

Hopenhayn, Hugo A and Francesco Squintani. 2011. "Preemption games with private information." *The Review of Economic Studies* 78(2):667–692.

James, Harold. 2024. The IMF and the European Debt Crisis. In *The IMF and the European Debt Crisis.* International Monetary Fund.

Kamada, Yuichiro and Michihiro Kandori. 2020. "Revision games." *Econometrica* 88(4):1599–1630.

Kamada, Yuichiro and Takuo Sugaya. 2020. "Optimal timing of policy announcements in dynamic election campaigns." *The Quarterly Journal of Economics* 135(3):1725–1797.

Kiewiet, D Roderick and Mathew D McCubbins. 1991. *The logic of delegation.* University of Chicago Press.

Krehbiel, Keith. 2010. *Pivotal politics: A theory of US lawmaking.* University of Chicago Press.

Kreps, David M and Robert Wilson. 1982. "Reputation and imperfect information." *Journal of economic theory* 27(2):253–279.

Lubenow, W. C. 1983. "Irish Home Rule and the Great Separation in the Liberal Party in 1886: The Dimensions of Parliamentary Liberalism." *Victorian Studies* 26(2):161–180.

McVey, Ruth T. 2019. *The rise of Indonesian communism.* Cornell University Press.

Meng, Anne, Jack Paine and Robert Powell. 2023. "Authoritarian Power Sharing: Concepts, Mechanisms, and Strategies." *Annual Review of Political Science* 26:153–173.

Reich, Noam. 2022. "Dynamic Screening in International Crises." *Working paper* .

Roach, John. 1957. "Liberalism and the Victorian Intelligentsia." *The Cambridge Historical Journal* 13(1):58–81.

Rubin, Ruth Bloch. 2017. *Building the bloc: Intraparty organization in the US Congress.* Cambridge University Press.

Schrieke, BJO. 1955. *Indonesian Sociological Studies.* The Hague, Bandung: W. van Hoeve chapter The Development of the Communist Movement on the West Coast of Sumatra, pp. 85–95.

Shahanaghi, Sara. 2023. "Competition and Herding in Breaking News." *Working paper* .

Svolik, Milan W. 2009. "Power sharing and leadership dynamics in authoritarian regimes." *American Journal of Political Science* 53(2):477–494.

Tokdemir, Efe, Evgeny Sedashov, Sema Hande Ogutcu-Fu, Carlos E Moreno Leon, Jeremy Berkowitz and Seden Akcinaroglu. 2021. "Rebel rivalry and the strategic nature of rebel group ideology and demands." *Journal of Conflict Resolution* 65(4):729–758.

Van Reybrouck, David. 2024. *Revolusi: Indonesia and the birth of the modern world*. W. W. Norton.

Vogt, Manuel, Kristian Skrede Gleditsch and Lars-Erik Cederman. 2021. "From claims to violence: Signaling, outbidding, and escalation in ethnic conflict." *Journal of Conflict Resolution* 65(7-8):1278–1307.

Weeds, Helen. 2002. "Strategic delay in a real options model of R&D competition." *The Review of Economic Studies* 69(3):729–747.

Appendix

Table of Contents

A Equilibrium in the symmetric setting

A.1 Derivation of $T^*, \overline{T}^*$

In this section, I derive $T^*, \overline{T}^*$ under the assumption that players are playing threshold strategies: That is, that there exists a time T^* before which an unrevealed soft type will postpone commitment and after which will commit at the first opportunity, and there exists $\overline{T}^*$ before which a *revealed* soft type will postpone commitment and after which will commit at the first opportunity.

Derivation of T^*. At T^*, a soft type of group a must be indifferent between committing to its preferred policy and waiting. (The derivation is analogous for a soft type or group b). Then, a's expected utility of committing to A at T^*, conditional upon neither type being revealed and no commitments occurring by T^*, is

$$\Big[pe^{(-\mu_h-\lambda_h)T^*}\Big]u_a(SQ) + \Big[(1-p)e^{-\lambda_s T^*}\Big]u_a(A) \tag{A1}$$

To derive the continuation value of waiting at T^*, consider the possible subsequent events after a waits. Suppose first that b is hard. Then, two cases are possible: (1) μ_h arrives, in which case b commits to B, or λ_h arrives, in which case a knows that implementing A is not possible. Either way, a soft type of a prefers B to SQ, so a commits to B as soon as it receives a commitment opportunity. (2) μ_s arrives. Assuming that a is playing the proposed equilibrium strategy, a commits to policy A. However, since b prefers SQ to A, the outcome is SQ. Suppose now that b is soft. Then, whichever group receives the first commitment opportunity after T^* commits to their preferred policy. Since μ_s is the same for both players, these occur with equal probability. Whichever group receives the first commitment opportunity can implement its preferred policy. Thus, the continuation value of waiting is

$$\Big[pe^{(-\mu_h-\lambda_h)T^*}\Big(\frac{1}{\mu_s+\mu_h+\lambda_h}\Big)\Big]\Big(\mu_s u_a(SQ) + (\mu_h+\lambda_h)u_a(B)\Big) + \Big[\frac{1-p}{2}e^{-\lambda_s T^*}\Big]\Big(u_a(A)+u_a(B)\Big) \tag{A2}$$

Setting (A1) equal to (A2) and rearranging terms, I obtain a's indifference condition at T^*:

$$\Big[pe^{(-\mu_h-\lambda_h)T^*}\Big(\frac{\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}\Big)\Big]\Big(u_a(B)-u_a(SQ)\Big) = \Big[\frac{1-p}{2}e^{-\lambda_s T^*}\Big]\Big(u_a(A)-u_a(B)\Big) \tag{A3}$$

As the probabilities used in the calculation of both these expressions are technically conditional probabilities (conditioned upon neither player's type being revealed before the current time), we are obliged to divide each probability by the sum total of all the probabilities used in the calculation of expected utility in order for probabilities to sum to 1. The sum of the associated probabilities of committing to A is, trivially

$$pe^{(-\mu_h-\lambda_h)T^*}+(1-p)e^{-\lambda_s T^*}$$

The sum of the associated probabilities of waiting should be equal this exactly, as they should theoretically both yield the total probability of no commitments and no preference revelations before T^*. Indeed, the sum of all probabilities associated with waiting is

$$\begin{aligned}&pe^{(-\mu_h-\lambda_h)T^*}\frac{\mu_s+\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}+(1-p)e^{-\lambda_s T^*}\frac{\mu_s+\mu_s}{\mu_s+\mu_s}\\=&pe^{(-\mu_h-\lambda_h)T^*}+(1-p)e^{-\lambda_s T^*}\end{aligned}$$

which confirms that the normalization factors are then equal. We then note that once we set the expected values equal, each term will be divided by the same normalization factor, so they will cancel.

Rearrange terms to isolate T^*:

$$T^*=\frac{1}{\lambda_s-(\lambda_h+\mu_h)}\left[\ln\left(\frac{1-p}{2p}\,\frac{(\lambda_h+\mu_h)+\mu_s}{(\lambda_h+\mu_h)}\,\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\right)\right]$$

Derivation of $\overline{T}^*$. Following similar logic as before, a's expected utility of committing to A at time $\overline{T}^*$ is

$$\Big(pe^{(-\mu_h-\lambda_h)\overline{T}^*}\Big)u_a(SQ)+\Big((1-p)e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\Big)u_a(A) \tag{A4}$$

The main difference with the previous derivation is that the opponent is now attempting to commit during the interval $\overline{T}^*-\bar{t}$. a's continuation value of waiting at $\overline{T}^*$ is

$$\begin{aligned}\left[pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\lambda_h+\mu_h}{\lambda_h+\mu_h+\mu_s}\right]u_a(B)+\left[pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}\right]u_a(SQ)\\+\left[(1-p)e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\right]u_a(A)\end{aligned} \tag{A5}$$

Setting (A4) equal to (A5) and rearranging terms, I obtain a's indifference condition at $\overline{T}^*$:

$$\left[\frac{1-p}{2}e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\right]\Big(u_a(A)-u_a(B)\Big)=\left[pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\lambda_h+\mu_h}{\lambda_h+\mu_h+\mu_s}\right]\Big(u_a(B)-u_a(SQ)\Big) \tag{A6}$$

Similarly to before, normalization terms cancel out. Rearrange terms to isolate $\overline{T}^*$, which is a linear function of $\bar{t}$:

$$\overline{T}^* = \frac{1}{\lambda_s + \mu_s - (\lambda_h + \mu_h)} \left[\ln \left(\frac{1-p}{2p} \frac{(\lambda_h + \mu_h) + \mu_s}{(\lambda_h + \mu_h)} \frac{u_a(A) - u_a(B)}{u_a(B) - u_a(SQ)} \right) + \mu_s \bar{t} \right] \tag{A7}$$

These expressions can become negative, but players cannot wait a negative period of time. Hence, the actual threshold time is given by $\max\{0, T^*\}$. The same applies to $\overline{T}^*$.

A.2 Proof of Propositions 1 and 2

I will show that in the symmetric setting, conditional on no commitments and no leaks, a soft type prefers to wait before T^* and prefers to commit to its preferred policy after T^*. I will then show that conditional on its type having been leaked at $\bar{t}$, a soft type prefers to wait before $\overline{T}^*$ and prefers to commit to its preferred policy after $\overline{T}^*$.

Because the equilibrium derived here is a special case of the asymmetric setting studied in Appendix C, the arguments provided in Appendix Sections C and D suffice to prove uniqueness.

A.2.1 Proposition 1 (T^* case)

Claim: **When $t < T^*$, a strictly prefers to wait.**

For all $t < T^*$, a soft type of player a's expected utility of committing to A is:

$$pe^{(-\mu_h - \lambda_h)t} u_a(SQ) + (1-p)e^{-\lambda_s t} u_a(A) \tag{A8}$$

I now derive a soft type of group a's continuation value of waiting at t. I proceed in cases. The possible cases when b is a hard type are:

1. μ_h or λ_h arrives before T^*. Policy B is implemented. This occurs with probability $pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)T^*}$

2. Either μ_h or λ_h arrive before μ_s but after T^*. Policy B is implemented. This occurs with probability $pe^{(-\mu_h-\lambda_h)T^*} \frac{\lambda_h+\mu_h}{\lambda_h+\mu_h+\mu_s}$

3. Neither μ_h nor λ_h arrive before T^*, and μ_s arrives before μ_h and λ_h after T^*. Policy SQ is implemented. This occurs with probability $pe^{(-\mu_h-\lambda_h)T^*} \frac{\mu_s}{\lambda_h+\mu_h+\mu_s}$.

The possible cases when b is a soft type are:

4. λ_s arrives for either group at some $\bar{t}$ before T^*, and the other group receives a commitment opportunity before $\overline{T}^*(\bar{t})$, and commits to their preferred policy, which is implemented. This occurs with probability

$$(1-p)e^{-\lambda_s t}\int_{\tilde{t}=t}^{T^*} e^{-2\lambda_s(\tilde{t}-t)}(\lambda_s)e^{-\mu_s[\overline{T}^*(\tilde{t})-\tilde{t}]}d\tilde{t}$$

Note that $e^{-2\lambda_s(\tilde{t}-t)}(\lambda_s)$ is the *instantaneous* probability of an arrival of λ_s at any instant $\tilde{t}$. I then multiply this by the probability that, conditional upon this arrival happening at some $\tilde{t}$, μ_s arrives between $\tilde{t}$ and $\overline{T}^*(\tilde{t})$. Evaluating this expression yields

$$\left(\frac{\lambda_s\frac{(1-p)^2}{p}\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\mu_h+\lambda_h}}{-2\lambda_s+\mu_s-\frac{\mu_s^2}{\lambda_s+\mu_s-\lambda_h-\mu_h}}\right)e^{\lambda_s t-\frac{\mu_s}{\lambda_s+\mu_s-\lambda_h-\mu_h}}\left[e^{(-2\lambda_s-\mu_s-\frac{\mu_s^2}{\lambda_s+\mu_s-\lambda_h-\mu_h})T^*}-\right.$$
$$\left.e^{(-2\lambda_s-\mu_s-\frac{\mu_s^2}{\lambda_s+\mu_s-\lambda_h-\mu_h})t}\right]$$
$$\equiv P_4$$

5. λ_s arrives for either group at some $\bar{t}$ before T^*, and the other group does not get a commitment opportunity before $\overline{T}^*(\bar{t})$. After $\overline{T}^*$, whichever group gets the first commitment opportunity is able to implement their preferred policy. This occurs with probability

$$(1-p)e^{-\lambda_s t}\int_{\tilde{t}=t}^{T^*} e^{-2\lambda_s(\tilde{t}-t)}(\lambda_s)\left[1-e^{-\mu_s[\overline{T}^*(\tilde{t})-\tilde{t}]}\right]d\tilde{t}$$

Evaluating this expression yields

$$\frac{-(1-p)}{2}\left[e^{\lambda_s(t-2T^*)}-e^{-\lambda_s t}\right] - \left(\frac{\lambda_s\frac{(1-p)^2}{p}\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\mu_h+\lambda_h}}{-2\lambda_s+\mu_s-\frac{\mu_s^2}{\lambda_s+\mu_s-\lambda_h-\mu_h}}\right)e^{\lambda_s t-\frac{\mu_s}{\lambda_s+\mu_s-\lambda_h-\mu_h}}$$
$$\left[e^{(-2\lambda_s-\mu_s-\frac{\mu_s^2}{\lambda_s+\mu_s-\lambda_h-\mu_h})T^*}-e^{(-2\lambda_s-\mu_s-\frac{\mu_s^2}{\lambda_s+\mu_s-\lambda_h-\mu_h})t}\right]$$
$$=\frac{-(1-p)}{2}\left[e^{\lambda_s(t-2T^*)}-e^{-\lambda_s t}\right]-P_4$$

6. There are no arrivals of λ_s before T^* Whichever group receives the first commitment opportunity after T^* commits to their preferred policy, which is implemented. This occurs with probability

$$\frac{(1-p)}{2}e^{\lambda_s t-2\lambda_s T^*}$$

Therefore, the continuation value of waiting at t is

$$\left(pe^{(-\mu_h-\lambda_h)t}-pe^{(-\mu_h-\lambda_h)T^*}\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}\right)u_a(B)+\left(pe^{(-\mu_h-\lambda_h)T^*}\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}\right)u_a(SQ)+$$
$$\frac{(1-p)}{2}e^{-\lambda_s t}\left(\frac{u_a(A)+u_a(B)}{2}\right) \tag{A9}$$

In order for waiting to be optimal, we must have (A8) < (A9), which simplifies to

$$\left(pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)T^*}\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}\right)\Big(u_a(B)-u_a(SQ)\Big) > \frac{1-p}{2}e^{-\lambda_s t}\Big(u_a(A)-u_a(B)\Big) \tag{A10}$$

Because $t < T^*$, it holds that

$$\begin{aligned} pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)T^*}\frac{\mu_s}{\lambda_h+\mu_h+\mu_s} &> pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)t}\frac{\mu_s}{\lambda_h+\mu_h+\mu_s} \\ &= pe^{(-\mu_h-\lambda_h)t}\frac{\mu_h+\lambda_h}{\lambda_h+\mu_h+\mu_s} \end{aligned}$$

It must also be that

$$\begin{aligned} &\left(pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)T^*}\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}\right)\Big(u_a(B)-u_a(SQ)\Big) \\ >&\left(pe^{(-\mu_h-\lambda_h)t}\frac{\mu_h+\lambda_h}{\lambda_h+\mu_h+\mu_s}\right)\Big(u_a(B)-u_a(SQ)\Big) \end{aligned}$$

Therefore, it suffices to prove that

$$\left(pe^{(-\mu_h-\lambda_h)t}\frac{\mu_h+\lambda_h}{\lambda_h+\mu_h+\mu_s}\right)\Big(u_a(B)-u_a(SQ)\Big) > \left(\frac{1-p}{2}e^{-\lambda_s t}\right)\Big(u_a(A)-u_a(B)\Big) \tag{A11}$$

Recall the indifference condition for T^* derived earlier:

$$\left(pe^{(-\mu_h-\lambda_h)T^*}\frac{\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}\right)\Big(u_a(B)-u_a(SQ)\Big) = \left(\frac{1-p}{2}e^{-\lambda_s T^*}\right)\Big(u_a(A)-u_a(B)\Big) \tag{A3}$$

Notice that

$$\begin{aligned} &\frac{\left[pe^{(-\mu_h-\lambda_h)t}\frac{\mu_h+\lambda_h}{\lambda_h+\mu_h+\mu_s}\right]\Big(u_a(B)-u_a(SQ)\Big)}{\left[\frac{1-p}{2}e^{-\lambda_s t}\right]\Big(u_a(A)-u_a(B)\Big)} \\ =&\frac{\left[pe^{(-\mu_h-\lambda_h)T^*}\left(\frac{\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}\right)\right]\Big(u_a(B)-u_a(SQ)\Big)}{\left[\frac{1-p}{2}e^{-\lambda_s T^*}\right]\Big(u_a(A)-u_a(B)\Big)} \cdot e^{(-\mu_h-\lambda_h+\lambda_s)(t-T^*)} \end{aligned}$$

Consider the factor at the end of the expression, $e^{(-\mu_h-\lambda_h+\lambda_s)(t-T^*)}$. Since $(-\mu_h-\lambda_h+\lambda_s) < 0$ and $(t-T^*) < 0$, we have $(-\mu_h-\lambda_h+\lambda_s)(t-T^*) > 0$ and therefore $e^{(-\mu_h-\lambda_h+\lambda_s)(t-T^*)} > 1$. Therefore the left-hand side of (A11) is greater than the right-hand side and the inequality is true. This concludes the proof that when $t < T^*$, a strictly prefers to wait.

Claim: **When $t > T^*$, a strictly prefers to commit to A.**

Let $\epsilon > 0$. At time $T^* + \epsilon$, a soft type of player a's expected utility of committing to A is

$$\left[pe^{(T^*+\epsilon)(-\mu_h-\lambda_h)}\right]u_a(SQ) + \left[(1-p)e^{-\mu_s\epsilon-\lambda_s(T^*+\epsilon)}\right]u_a(A) \tag{A12}$$

I now derive a soft type of group a's continuation value of waiting at $T^* + \epsilon$. I proceed in cases:

1. b is a hard type. μ_h or λ_h arrives first. B is implemented. This occurs with probability $pe^{(-\mu_h-\lambda_h)(\overline{T}^*+\epsilon)}\left(\frac{\lambda_h+\mu_h}{\mu_h+\lambda_h+\mu_s}\right)$
2. b is a hard type. μ_s arrives first. SQ remains in place. This occurs with probability $pe^{(-\mu_h-\lambda_h)(\overline{T}^*+\epsilon)}\left(\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\right)$
3. b is a soft type. In this case, the first player to get a commitment opportunity after $T^* + \epsilon$ is able to implement their preferred policy. Either A or B is implemented, each occurs with probability $\frac{(1-p)}{2}e^{(-\lambda_s-\mu_s)(\overline{T}^*+\epsilon)-\mu_s\bar{t}}$

Committing to A is preferable to waiting if

$$\left[pe^{(-\mu_h-\lambda_h)(T^*+\epsilon)}\left(\frac{\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}\right)\right]\Big(u_a(B)-u_a(SQ)\Big) < \left[\frac{1-p}{2}e^{-\mu_s\epsilon-\lambda_s(T^*+\epsilon)}\right]\Big(u_a(A)-u_a(B)\Big) \tag{A13}$$

Recall equation A3 that describes indifference at T^*:

$$\left[pe^{(-\mu_h-\lambda_h)T^*}\left(\frac{\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}\right)\right]\Big(u_a(B)-u_a(SQ)\Big) = \left[\frac{1-p}{2}e^{-\lambda_s T^*}\right]\Big(u_a(A)-u_a(B)\Big)$$

Note that

$$\frac{pe^{(-\mu_h-\lambda_h)(T^*+\epsilon)}\frac{\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}\Big(u_a(B)-u_a(SQ)\Big)}{\frac{1-p}{2}e^{-\mu_s\epsilon-\lambda_s(T^*+\epsilon)\left(u_a(A)-u_a(B)\right)}\Big(u_a(A)-u_a(B)\Big)}$$
$$=\frac{pe^{(-\mu_h-\lambda_h)T^*}\left(\frac{\mu_h+\lambda_h}{\mu_s+\mu_h+\lambda_h}\right)\Big(u_a(B)-u_a(SQ)\Big)}{\frac{1-p}{2}e^{-\lambda_s T^*}\Big(u_a(A)-u_a(B)\Big)}\cdot e^{(\mu_s+\lambda_s-(\lambda_h+\mu_h))\epsilon}$$

By assumption that $\lambda_s + \mu_s < \lambda_h + \mu_h$, we have $e^{(\mu_s+\lambda_s-(\lambda_h+\mu_h))\epsilon} < 1$. Therefore inequality (A13) holds. This concludes the proof that when $t > T^*$, a strictly prefers to commit to A.

A.2.2 Proposition 2 ($\overline{T}^*$ case)

Claim: **Suppose a's type was revealed at some time $\bar{t}$. Then a strictly prefers to wait at any $t < \overline{T}^*$.**

Let $t > \bar{t}$. a's expected utility of committing to A at time t is

$$(1-p)e^{-\mu_s(t-\bar{t})-\lambda_s t}u_a(A) + pe^{(-\mu_h-\lambda_h)t}u_a(SQ)$$

I now derive a soft type of group a's continuation value of waiting at t.

If b is a hard type,

1. μ_h or λ_h arrives before $\overline{T}^*(\bar{t})$. B is implemented. This occurs with probability $pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)\overline{T}^*(\bar{t})}$

2. μ_h or λ_h do not arrive between t and $\overline{T}^*(\bar{t})$, but arrive before μ_s after $\overline{T}^*(\bar{t})$. B is implemented. This occurs with probability $pe^{(-\mu_h-\lambda_h)(\overline{T}^*(\bar{t})}\frac{\mu_h+\lambda_h}{\mu_h+\lambda_h+\mu_s}$

3. μ_h or λ_h do not arrive between t and $\overline{T}^*(\bar{t})$, and μ_s arrives first after $\overline{T}^*(\bar{t})$. SQ remains in place. This occurs with probability $pe^{(-\mu_h-\lambda_h)(\overline{T}^*(\bar{t}))}\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}$

If b is a soft type,

1. μ_s arrives for b between $\bar{t}$ and $\overline{T}^*(\bar{t})$. B is implemented. This occurs with probability

$$\begin{aligned}&(1-p)e^{-\mu_s(t-\bar{t})-\lambda_s t}\int_{\tilde{t}=t}^{\overline{T}^*} e^{-\lambda_s(\tilde{t}-t)-\mu_s(\tilde{t}-t)}(\mu_s)d\tilde{t}\\ =&(1-p)e^{\mu_s\bar{t}}\frac{\mu_s}{-\mu_s-\lambda_s}\left[e^{(-\lambda_s-\mu_s)\overline{T}^*} - e^{(-\lambda_s-\mu_s)t}\right]\end{aligned}$$

2. λ_s arrives for b before $\overline{T}^*$. Both groups are fully informed, and the first that receives a commitment opportunity implements their preferred policy. Either A or B is implemented. Each sub-case occurs with probability

$$\begin{aligned}&(1-p)e^{-\mu_s(t-\bar{t})-\lambda_s t}\int_{\tilde{t}=t}^{\overline{T}^*} e^{-\lambda_s(\tilde{t}-t)-\mu_s(\tilde{t}-t)}(\lambda_s)d\tilde{t}\\ =&(1-p)e^{\mu_s\bar{t}}\frac{\lambda_s}{-\mu_s-\lambda_s}\left[e^{(-\lambda_s-\mu_s)\overline{T}^*} - e^{(-\lambda_s-\mu_s)t}\right]\end{aligned}$$

3. Neither μ_s nor λ_s arrive for b before $\overline{T}^*$. The first group that receives a commitment opportunity implements their preferred policy. Either A or B is implemented. Each sub-case occurs with probability

$$\begin{aligned}&\frac{1-p}{2}e^{-\mu_s(t-\bar{t})-\lambda_s t}e^{-\lambda_s(\overline{T}^*-t)-\mu_s(T-1-t)}\\ =&\frac{1-p}{2}e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\end{aligned}$$

Waiting is preferable to committing to A if

$$\begin{aligned}
&\left[pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\right](u_a(B)-u_a(SQ)) \\
&+(1-p)e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\left(\frac{u_a(A)+u_a(B)}{2}+\frac{\lambda_s(u_a(A)+u_a(B))+\mu_s u_a(B)}{-\lambda_s-\mu_s}\right) \\
>&(1-p)e^{-\lambda_s t-\mu_s(t-\bar{t})}\left[u_a(A)+\frac{\lambda_s(u_a(A)+u_a(B))+\mu_s u_a(B)}{-\lambda_s-\mu_s}\right]
\end{aligned} \tag{A14}$$

Which holds if the following holds:

$$\begin{aligned}
&\left[pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\right](u_a(B)-u_a(SQ)) \\
&+(1-p)e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\left(\frac{u_a(A)+u_a(B)}{2}+\frac{\lambda_s(u_a(A)+u_a(B))+\mu_s u_a(B)}{-\lambda_s-\mu_s}\right) \\
>&(1-p)e^{-\lambda_s \overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\left[u_a(A)+\frac{\lambda_s(u_a(A)+u_a(B))+\mu_s u_a(B)}{-\lambda_s-\mu_s}\right]
\end{aligned} \tag{A15}$$

Which simplifies to

$$\left[\frac{1-p}{2}e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\right](u_a(A)-u_a(B)) < \left[pe^{(-\mu_h-\lambda_h)t} - pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\right](u_a(B)-u_a(SQ)) \tag{A16}$$

Note that the right-hand side is greater than

$$\begin{aligned}
&\left[pe^{(-\mu_h-\lambda_h)\overline{T}^*} - pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\right](u_a(B)-u_a(SQ)) \\
=&\left[pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\lambda_h+\mu_h}{\lambda_h+\mu_h+\mu_s}\right]\Big(u_a(B)-u_a(SQ)\Big)
\end{aligned}$$

which is the right-hand side of the following equation, which was the condition for a to be indifferent at $\overline{T}^*$:

$$\left[\frac{1-p}{2}e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\right]\Big(u_a(A)-u_a(B)\Big) = \left[pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\lambda_h+\mu_h}{\lambda_h+\mu_h+\mu_s}\right]\Big(u_a(B)-u_a(SQ)\Big) \tag{A6}$$

Since the left-hand side of (A16) is identical to that of equation A6, we must have that the inequality must be true. Thus, a strictly prefers to wait at any $t < \overline{T}^*$.

Claim: **Suppose a's type was revealed at some time $\bar{t}$. Then a strictly prefers to commit to A at any $t > \overline{T}^*$.**

Let $\epsilon > 0$. a's expected utility of committing to A is

$$pe^{(-\mu_h-\lambda_h)(\overline{T}^*+\epsilon)}u_a(SQ) + (1-p)e^{(-\lambda_s-\mu_s)(\overline{T}^*+\epsilon)-\mu_s\bar{t}}u_a(A)$$

I now derive a soft type of group a's continuation value of waiting at $\overline{T}^*+\epsilon$. I proceed in cases:

1. b is a hard type. μ_h or λ_h arrives before $\overline{T}^*$. Policy B is implemented. This occurs with probability $pe^{(-\mu_h-\lambda_h)(\overline{T}^*+\epsilon)}\left(\frac{\mu_h+\lambda_h}{\mu_h+\lambda_h+\mu_s}\right)$
2. b is a hard type. Neither μ_h nor λ_h arrive before $\overline{T}^*$, and μ_s arrives before μ_h and λ_h after $\overline{T}^*$. SQ remains in place. This occurs with probability $pe^{(-\mu_h-\lambda_h)(\overline{T}^*+\epsilon)}\left(\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\right)$
3. b is a soft type. Then the first player to receive a commitment opportunity after $\overline{T}^*+\epsilon$ is able to implement their preferred alternative. Either A or B is implemented. The probability of each sub-case is $\frac{(1-p)}{2}e^{(-\lambda_s-\mu_s)(\overline{T}^*+\epsilon)-\mu_s\bar{t}}$

a prefers to commit to A at any $\overline{T}^*+\epsilon$ if the following inequality holds:

$$\left[\frac{1-p}{2}e^{(-\lambda_s-\mu_s)(\overline{T}^*+\epsilon)-\mu_s\bar{t}}\right]\Big(u(A)-u(B)\Big) > \left[pe^{(-\mu_h-\lambda_h)(\overline{T}^*+\epsilon)}\frac{\mu_h+\lambda_h}{\mu_h+\lambda_h+\mu_s}\right]\Big(u(B)-u(SQ)\Big)$$

Recall the condition for a to be indifferent at $\overline{T}^*$ (equation A6) was:

$$\left[\frac{1-p}{2}e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\right]\Big(u_a(A)-u_a(B)\Big) = \left[pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\lambda_h+\mu_h}{\lambda_h+\mu_h+\mu_s}\right]\Big(u_a(B)-u_a(SQ)\Big)$$

Note that

$$\frac{\left[pe^{(-\mu_h-\lambda_h)(\overline{T}^*+\epsilon)}\frac{\mu_h+\lambda_h}{\mu_h+\lambda_h+\mu_s}\right]\Big(u(B)-u(SQ)\Big)}{\left[\frac{1-p}{2}e^{(-\lambda_s-\mu_s)(\overline{T}^*+\epsilon)-\mu_s\bar{t}}\right]\Big(u(A)-u(B)\Big)}$$
$$=\frac{\left[pe^{(-\mu_h-\lambda_h)\overline{T}^*}\frac{\lambda_h+\mu_h}{\lambda_h+\mu_h+\mu_s}\right]\Big(u(B)-u(SQ)\Big)}{\left[\frac{1-p}{2}e^{-\lambda_s\overline{T}^*-\mu_s(\overline{T}^*-\bar{t})}\right]\Big(u(A)-u(B)\Big)}\cdot e^{(\lambda_s+\mu_s-(\lambda_h+\mu_h))\epsilon}$$

By assumption that $\lambda_h+\mu_h>\lambda_s+\mu_s$, we have that $e^{(\lambda_s+\mu_s-(\lambda_h+\mu_h))\epsilon}$ and therefore the inequality holds. This concludes the proof that a strictly prefers to commit to A at any $t>\overline{T}^*$.

Proof of Corollary 1 (conditions for no delay). As either $\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\to\infty$ or $\frac{1-p}{p}\to\infty$, we must have that $\frac{1-p}{p}P_T\to\infty$, and $\log\infty=\infty$. As this is multiplied by a negative number in both delay terms, and delay must be nonnegative, delay goes to 0.

A.3 Proofs of comparative statics on rates (Proposition 3)

A.3.1 P_T

Claim: P_T **is decreasing in** $\lambda_h+\mu_h$**.**

$$\frac{\partial P_T}{\partial\lambda_h+\mu_h}=\frac{1}{2}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{-\mu_s}{(\lambda_h+\mu_h)^2}$$

	λ_s	μ_s	$\mu_h + \lambda_h$
P_T	.	$(+)$	$(-)$
T^*	$(+)$	$(-)$	$(-)$
$\overline{T}^*$	$(+)$	$(+/-)$	$(-)$

Table A1. Summary of comparative statics on λ_s, μ_s, and $\lambda_s + \lambda_h$

The last term is negative and is multiplied by positive terms, so the derivative is negative.

Claim: P_T **is increasing in** μ_s**.**

$$\frac{\partial P_T}{\partial \mu_s} = \frac{1}{2}\frac{u(A) - u(B)}{u(B) - u(SQ)}\frac{1}{\lambda_h + \mu_h}$$

All terms are positive.

A.3.2 T^*

Claim: T^* **is decreasing in** $\lambda_h + \mu_h$**.**

$$\frac{\partial T^*}{\partial \lambda_h + \mu_h} = \frac{1}{\lambda_h + \mu_h(\lambda_s - (\lambda_h + \mu_h))} + \frac{1}{(\lambda_s - (\lambda_h + \mu_h))^2}\ln\left(\frac{1-p}{2p}\frac{u(A) - u(B)}{u(B) - u(SQ)}\frac{\lambda_h + \mu_h + \mu_s}{\lambda_h + \mu_h}\right)$$

Recall that the condition for $T^* \geq 0$ is

$$\ln\left(\frac{1-p}{2p}\frac{u(A) - u(B)}{u(B) - u(SQ)}\frac{\lambda_h + \mu_h + \mu_s}{\lambda_h + \mu_h}\right) \leq 0$$

Furthermore, since $\lambda_h + \mu_h > \lambda_s$, the first term is negative. The derivative is the sum of two negative expressions and is negative.

Claim: T^* **is decreasing in** μ_s**.**

$$\frac{\partial T^*}{\partial \mu_s} = \frac{1}{(\lambda_s - (\lambda_h + \mu_h)(\mu_s + \lambda_h + \mu_h)}$$

$(\lambda_s - (\lambda_h + \mu_h))$ is negative and $(\mu_s + \lambda_h + \mu_h)$ is positive, so the sign of the derivative is negative.

Claim: T^* **is increasing in** λ_s**.**

$$\frac{\partial T^*}{\partial \lambda_s} = \frac{-1}{(\lambda_s - H)^2}\ln\left(\frac{1-p}{2p}\frac{u(A) - u(B)}{u(B) - u(SQ)}\frac{(\lambda_h + \mu_h) + \mu_s}{(\lambda_h + \mu_h)}\right)$$

This is the product of two negative terms, so it is positive.

A.3.3 $\overline{T}^*$

Claim: $\overline{T}^*$ **is decreasing in** $\lambda_h + \mu_h$**.**

$$\begin{aligned}\frac{\partial \overline{T}^*}{\partial \lambda_h + \mu_h} =& \frac{1}{(\lambda_s + \mu_s - (\lambda_h + \mu_h))^2}\left[\ln\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right) + \mu_s \bar{t}\right] \\ &+ \frac{1}{(\mu_s + \lambda_s - (\lambda_h + \mu_h))(\lambda_h + \mu_h)}\end{aligned}$$

Because $\overline{T}^* \geq 0$, we must have $\left[\ln\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right) + \mu_s \bar{t}\right] < 0$, we have the first term is negative. By the assumption that $\lambda_h + \mu_h > \lambda_s + \mu_s$, the second term is negative. Therefore, this derivative is the sum of two negative terms, so it is negative.

Claim: **When** $\bar{t}$ **is sufficiently low,** $\overline{T}^*$ **is increasing in** μ_s **.**

$$\begin{aligned}\frac{\partial \overline{T}^*}{\partial \mu_s} =& \frac{-1}{(\lambda_s + \mu_s - (\lambda_h + \mu_h))^2}\left[\ln\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{(\lambda_h+\mu_h)+\mu_s}{(\lambda_h+\mu_h)}\right) + \mu_s \bar{t}\right] \\ &+ \frac{1}{\lambda_s + \mu_s - (\lambda_h + \mu_h)}\left(\frac{1}{\mu_s + (\lambda_h + \mu_h)} + \bar{t}\right)\end{aligned}$$

This is positive if

$$\bar{t} < T^* - \frac{\lambda_s + \mu_s - (\lambda_h + \mu_h)}{(\mu_s + (\lambda_h + \mu_h))(\lambda_s - (\lambda_h + \mu_h))}$$

Claim: $\overline{T}^*$ **is increasing in** λ_s**.**

$$\frac{\partial \overline{T}^*}{\partial \lambda_s} = \frac{-1}{(\lambda_s + \mu_s - H)^2}\left[\ln\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{H+\mu_s}{H}\right) + \mu_s \bar{t}\right]$$

Because $\overline{T}^* \geq 0$, we must have $\left[\ln\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{H+\mu_s}{H}\right) + \mu_s \bar{t}\right] < 0$. Thus this is the product of two negative terms, so it must be positive.

B Welfare in the symmetric setting

B.1 Derivation of the probability of avoidable miscoordination

Recall that avoidable miscoordination arises when, conditional on one group being a hard type and one group being a soft type, the soft type makes the first commitment to its preferred alternative. This arises two ways: Firstly, the game progresses to T^* with no arrivals of λ_s, λ_h or μ_h. Secondly, the soft type is revealed at some time $\bar{t}$ and the game proceeds to $T^*(\bar{t})$ with no arrivals of λ_h or μ_h. In either case, μ_s arrives first after the relevant threshold is passed.

The probability of the first case arising is

$$e^{(-\mu_h-\lambda_h-\lambda_s)T^*}\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}$$

Plugging in the T^* derived earlier, this equals

$$\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{-\lambda_s-\lambda_h-\mu_h}{\lambda_s-\lambda_h-\mu_h}}$$

This, however, does not account for possibility that $T^*=0$. To include this possibility, the probability of avoidable miscoordination in the T^* case is

$$\begin{cases}\frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{\lambda_s+\lambda_h+\mu_h}{\lambda_h+\mu_h-\lambda_s}} & \text{if } T^*>0\\ \frac{\mu_s}{\mu_h+\lambda_h+\mu_s} & \text{if } T^*=0\end{cases}\tag{A17}$$

The probability of avoidable miscoordination in the $\overline{T}^*$ case is more complex, since $\overline{T}^*$ is not a fixed threshold, but a function of the time the soft type was leaked, $\bar{t}$. The probability of avoidable miscoordination in this case is given by

$$\int_{\tilde{t}=0}^{T^*} e^{(-\mu_h-\lambda_h-\lambda_s)\tilde{t}}(\lambda_s)e^{(-\mu_h-\lambda_h)(\overline{T}^*(\tilde{t})-\tilde{t})}\frac{\mu_s}{\mu_h+\lambda_h+\lambda_s}d\tilde{t}$$

Evaluating the integral yields, after simplification,

$$\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}\frac{\lambda_s(\lambda_h+\mu_h-\lambda_s-\mu_s)}{\mu_s(\mu_h+\lambda_h)-\lambda_s(\lambda_h+\mu_h-\lambda_s-\mu_s)}\Bigg[\tag{A18}$$
$$\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{\lambda_s+\lambda_h+\mu_h}{\lambda_h+\mu_h-\lambda_s}}-\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{(\mu_h+\lambda_h)}{\lambda_h+\mu_h-\lambda_s-\mu_s}}\Bigg]$$

Therefore, the probability of avoidable miscoordination is, conditional on $T^*>0$,

$$\begin{aligned}&\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}\Bigg[\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{\lambda_s+\lambda_h+\mu_h}{\lambda_h+\mu_h-\lambda_s}}\\ &+\frac{\lambda_s(\lambda_h+\mu_h-\lambda_s-\mu_s)}{\mu_s(\mu_h+\lambda_h)-\lambda_s(\lambda_h+\mu_h-\lambda_s-\mu_s)}\left(\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{\lambda_s+\lambda_h+\mu_h}{\lambda_h+\mu_h-\lambda_s}}\right.\\ &\left.-\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{\lambda_h+\mu_h}{\lambda_h+\mu_h-\lambda_s-\mu_s}}\right)\Bigg]\end{aligned}\tag{A19}$$

and conditional on $T^* = 0$,

$$\frac{\mu_s}{\lambda_h + \mu_h + \mu_s}\Bigg[1 \\ + \frac{\lambda_s(\lambda_h + \mu_h - \lambda_s - \mu_s)}{\mu_s(\mu_h + \lambda_h) - \lambda_s(\lambda_h + \mu_h - \lambda_s - \mu_s)}\Bigg(\Big(\frac{1-p}{2p}\frac{u(A) - u(B)}{u(B) - u(SQ)}\frac{\lambda_h + \mu_h + \mu_s}{\lambda_h + \mu_h}\Big)^{\frac{\lambda_s + \lambda_h + \mu_h}{\lambda_h + \mu_h - \lambda_s}} \\ - \Big(\frac{1-p}{2p}\frac{u(A) - u(B)}{u(B) - u(SQ)}\frac{\lambda_h + \mu_h + \mu_s}{\lambda_h + \mu_h}\Big)^{\frac{\lambda_h + \mu_h}{\lambda_h + \mu_h - \lambda_s - \mu_s}}\Bigg)\Bigg] \tag{A20}$$

B.2 Proofs of comparative statics

Claim: **The probability of avoidable miscoordination is increasing in** $(1-p)$, $\frac{u(A)-u(B)}{u(B)-u(SQ)}$**.**

Proof. Recall that increasing either of these terms decreased the duration of delay by an uninformed soft player. Since these terms only factor into the probability of avoidable miscoordination through the expressions for delay, and I have previously shown that the probability of avoidable miscoordination is decreasing in delay, the probability of avoidable miscoordination must be increasing in either of these factors. □

Claim: **The probability of avoidable miscoordination is decreasing in** λ_s**.**

Proof. Fix $\lambda_0 > 0, \lambda' > \lambda_s$, and $\lambda_h > \lambda'$. Consider the equilibrium strategy played by soft types when λ_0 is the true rate of type revelation for soft types; denote by T^* and $\overline{T}^*$ the time thresholds that correspond to this equilibrium strategy as previously defined. We have already shown that these thresholds are increasing in the rate of type revelation for soft types. Therefore, we know that the equilibrium strategy played by soft types when λ' is the rate of information revelation involves time thresholds T', $\overline{T}'$ which are higher than T^*, $\overline{T}^*$, respectively.

Suppose we change the value of λ_s perceived by both players from λ_0 to λ' without changing the actual model value of λ_s. A hard type or a soft type who knows their opponent's type do not change their behavior. However, an uninformed soft type will choose to delay longer (T^* and $\overline{T}^*$ increase.) The interval of time $[T^*, T']$ provides an additional period during which types may be revealed (at the true rates). Therefore, this *directly* decreases the probability of avoidable negotiation failure by making it more likely that the hard type is revealed. It also *indirectly* decreases the probability of avoidable negotiation failure: suppose that during $[T^*, T']$, the λ_0-rate process arrives. This causes an uninformed soft type to postpone further to $\overline{T}' > \overline{T}^*$. During this additional interval of delay $[\overline{T}^*, \overline{T}']$, λ_h could arrive, which would render miscoordination impossible.

Now suppose we change the value of λ_s in the underlying model from λ_0 to λ', but players still believe that λ_0 is the true rate. This does not change the value of T^*, but makes it more likely that the soft type will be revealed before T^*. This furthermore makes it more likely that λ_h will arrive during $[T^*, \overline{T}^*]$. Therefore, this also indirectly decreases the probability of avoidable negotiation failure.

Now suppose we change both the perceived and true model value of λ_s from λ_0 to λ'. There a higher probability that the soft type could be revealed during $[0, T^*]$. Furthermore, there are histories after T^* during which the soft type would have started committing to his preferred alternative, but is now delaying until the new threshold T'. During $[T^*, T']$, there is also some likelihood that λ_h will arrive, which would rule out miscoordination, or that λ' will arrive, which will induce further delay until $\overline{T}'$, during which interval of delay λ_h could arrive and rule out miscoordination. All of these effects move in the direction of reducing the probability of avoidable miscoordination. $\square$

Claim: **In the T^* case, the probability of avoidable miscoordination is increasing in μ_s.**

Proof. Recall that the probability of avoidable miscoordination in the T^* case given in equation A17 was:

$$\begin{cases} \frac{\mu_s}{\mu_h+\lambda_h+\mu_s}\left(\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}\right)^{\frac{\lambda_s+\lambda_h+\mu_h}{\lambda_h+\mu_h-\lambda_s}} & \text{if } T^* > 0 \\ \frac{\mu_s}{\mu_h+\lambda_h+\mu_s} & \text{if } T^* = 0 \end{cases} \tag{A17}$$

Consider the second case. Differentiating with respect to μ_s yields $\frac{\mu_h+\lambda_h}{(\mu_h+\lambda_h+\mu_s)^2}$ which is clearly positive. Now consider the first case. The exponentiated term is also increasing in μ_s, since $\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}$ is increasing in μ_s and all of the other terms are positive and constant in μ. Therefore the probability of avoidable miscoordination is increasing in μ in the T^* case. $\square$

Proof of Remark 2. The claim that when $\lambda_s = 0$, the probability of avoidable miscoordination is increasing in μ_s is essentially already proven. When $\lambda_s = 0$, the probability of entering the $\overline{T}^*$ case is 0 and so the proof follows from the result that in the T^* case, the probability of avoidable miscoordination is increasing in μ_s.

I next address the claim that when $\lambda_s = 0$, the probability of avoidable miscoordination is decreasing in $\lambda_h + \mu_h$. Note first that $\frac{\mu_s}{\lambda_h+\mu_h+\mu_s}$ is decreasing in $\lambda_h + \mu_h$, that $\frac{1-p}{2p}\frac{u(A)-u(B)}{u(B)-u(SQ)}$ is constant in $\lambda_h + \mu_h$, that $\frac{\lambda_h+\mu_h+\mu_s}{\lambda_h+\mu_h}$ is increasing in $\lambda_h + \mu_h$, and $\frac{\lambda_s+\lambda_h+\mu_h}{\lambda_h+\mu_h-\lambda_s}$ is decreasing in

$\lambda_h + \mu_h$. Therefore, as long as we can prove that

$$\left(\frac{\lambda_h + \mu_h + \mu_s}{\lambda_h + \mu_h}\right)^{\frac{\lambda_s + \lambda_h + \mu_h}{\lambda_h + \mu_h - \lambda_s}}$$

is decreasing in $\lambda_h + \mu_h$, then we are done. For ease of notation, I let $\Lambda \equiv \lambda_h + \mu_h$ for the rest of the proof. Differentiating the above expression with respect to Λ yields:

$$\left(\frac{\Lambda + \mu_s}{\Lambda}\right)^{\frac{\lambda_s + \Lambda}{\Lambda - \lambda_s}} \left(\frac{-2\lambda_s}{(\Lambda - \lambda_s)^2} \log\left(\frac{\Lambda + \mu_s}{\Lambda}\right) + \left(\frac{\lambda_s + \Lambda}{\Lambda - \lambda_s} \frac{-\mu_s}{\Lambda^2} \frac{\Lambda}{\Lambda + \mu_s}\right)\right)$$

All terms are positive except $\frac{-2\lambda_s}{(\Lambda - \lambda_s)^2}$ and $\frac{-\mu_s}{\Lambda^2}$. Therefore the sign of the derivative is negative.

C Equilibrium in the asymmetric setting

In this section, I derive the best response conditional upon the opponent playing a threshold strategy (that is, that there is some time before which the opponent skips all commitment opportunities and after which the opponent accepts the first opportunity that arrives.)

I demonstrate that, conditional upon the opponent playing a threshold strategy, this best response is unique. The argument made in Appendix Section D rules out any PBEs in non-threshold strategies.

C.1 Best responses to a threshold strategy (Proposition 4)

I show the derivation of group a's best response to group b (the derivation is symmetric for b's best response to a).

I first consider the case that both players are equally uninformed and no commitment have been observed by the threshold time. I retain the notation of $\Lambda^i \equiv \lambda_h^i + \mu_h^i$. Taking the opponent's optimal choice of delay T_b^* as given, T_a^* is either before or after T_b^* (the case of equality is addressed in the symmetric derivation). $T_a^*(T_b^*) < T_b^*(T_a^*)$ occurs when $T_b^* > K_a$, where K_a is the value in the domain that correspond to kinks in each player's best response. The case when best responses cross on the kinks is already done in the symmetric setting.

Case 1: $T_a^*(T_b^*)|T_b^* > K_a$. Then, $u(\text{commit to } A \text{ at } T_a^*) = (1-p_a)e^{-\lambda_s^b T_a^*}u_a(A) + p_a e^{-\Lambda^b T_a^*}u_a(SQ)$, and the continuation of waiting is the sum of the following cases:

1. b is a soft type, and a gets an arrival of μ_s^a in the interval $[T_a^*, T_b^*]$. A is implemented. This occurs with probability $(1-p_a)e^{-\lambda_b^s T_a^*} - (1-p_a)e^{(\mu_s^a - \lambda_s^b)T_a^* - \mu_s^a T_b^*}$

2. b is a soft type, and a doesn't get an arrival of μ_s^a in the interval $[T_a^*, T_b^*]$. Either A or B is implemented. The probability A is implemented is $(1-p_a)e^{(\mu_s^a-\lambda_s^b)T_a^*-\mu_s^a T_b^*}\frac{\mu_s^a}{\mu_s^a+\mu_s^b}$. The probability B is implemented is $(1-p_a)e^{(\mu_s^a-\lambda_s^b)T_a^*-\mu_s^a T_b^*}\frac{\mu_s^b}{\mu_s^a+\mu_s^b}$.

3. b is a hard type. Either SQ or B is implemented. The probability SQ is implemented is $(p_a)e^{-\Lambda^b T_a^*}\frac{\mu_s^a}{\Lambda^b+\mu_s^a}$. The probability B is implemented is $(p_a)e^{-\Lambda^b T_a^*}\frac{\Lambda^b}{\Lambda^b+\mu_s^a}$

Setting equal to a's utility of committing to A immediately, I obtain the threshold:

$$T_a^*(T_b^*)|T_b^* > K_a = \frac{1}{\lambda_s^b - \Lambda^b - \mu_s^a}\left(\ln\left[\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\frac{\mu_s^b}{\mu_s^a+\mu_s^b}\frac{1-p_a}{p_a}\frac{\Lambda^b+\mu_s^a}{\Lambda^b}\right] - \mu_s^a T_b^*\right) \tag{A21}$$

Case 2: $T_a^*(T_b^*)|T_b^* < K_a$. Then, $u(\text{commit to } A \text{ at } T_a^*) = ((1-p_a)e^{(\mu_s^b-\lambda_s^b)T_a^*+\mu_s^b T_b^*})u_a(A) + (p_a e^{-\Lambda^b T_a^*})u_a(SQ)$, and the continuation value of waiting is the sum of the following cases:

1. b is a soft type. The first player to receive a commitment opportunity after T_a^* implements their preferred policy. The probability that A is implemented is $(1-p_a)e^{(\mu_s^b-\lambda_s^b)T_a^*+\mu_s^b T_b^*}\frac{\mu_s^a}{\mu_s^b+\mu_s^a}$. The probability that B is implemented is $(1-p_a)e^{(\mu_s^b-\lambda_s^b)T_a^*+\mu_s^b T_b^*}\frac{\mu_s^b}{\mu_s^b+\mu_s^a}$

2. b is a hard type. If a receives the first commitment opportunity, SQ stays in place. If b receives the first commitment, B is implemented. The probability that SQ is implemented is $p_a e^{-\Lambda^b T_a^*}\frac{\mu_s^a}{\Lambda^b+\mu_s^a}$. The probability that B is implemented is $p_a e^{-\Lambda^b T_a^*}\frac{\mu_s^a}{\Lambda^b+\mu_s^a}\frac{\Lambda^b}{\Lambda^b+\mu_s^a}$

Setting equal to a's utility of committing to A immediately, I obtain the threshold:

$$T_a^*(T_b^*)|T_b^* < K_a = \frac{1}{\lambda_s^b + \mu_s^b - \Lambda^b}\left(\ln\left[\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\frac{\mu_s^b}{\mu_s^a+\mu_s^b}\frac{1-p_a}{p_a}\frac{\Lambda^b+\mu_s^a}{\Lambda^b}\right] + \mu_s^b T_b^*\right) \tag{A22}$$

Corresponding expressions for T_b^* can be derived symmetrically:

$$T_b^*(T_a^*)|T_a^* < K_b = \frac{1}{\lambda_s^a + \mu_s^a - \Lambda^a}\left(\ln\left[\frac{u_b(B)-u_b(A)}{u_b(A)-u_b(SQ)}\frac{\mu_s^a}{\mu_s^a+\mu_s^b}\frac{1-p_b}{p_b}\frac{\Lambda^a+\mu_s^b}{\Lambda^a}\right] + \mu_s^a T_a^*\right) \tag{A23}$$

$$T_b^*(T_a^*)|T_a^* > K_b = \frac{1}{\lambda_s^a - \Lambda^a - \mu_s^b}\left(\ln\left[\frac{u_b(B)-u_b(A)}{u_b(A)-u_b(SQ)}\frac{\mu_s^a}{\mu_s^a+\mu_s^b}\frac{1-p_b}{p_b}\frac{\Lambda^a+\mu_s^b}{\Lambda^a}\right] - \mu_s^b T_a^*\right) \tag{A24}$$

K_a and K_b are given by:

$$K_a := \frac{\mu_s^a+\mu_s^b}{\mu_s^a(\lambda_s^a-\Lambda^a-\mu_s^b)+\mu_s^b(\lambda_s^a+\mu_s^a-\Lambda^a)}\ln\left[\frac{u_b(B)-u_b(A)}{u_b(A)-u_b(SQ)}\frac{\mu_s^a}{\mu_s^a+\mu_s^b}\frac{1-p_b}{p_b}\frac{\Lambda^a+\mu_s^b}{\Lambda^a}\right] \tag{A25}$$

$$K_b := \frac{\mu_s^b+\mu_s^a}{\mu_s^b(\lambda_s^b-\Lambda^b-\mu_s^a)+\mu_s^a(\lambda_s^b+\mu_s^b-\Lambda^b)}\ln\left[\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)}\frac{\mu_s^b}{\mu_s^a+\mu_s^b}\frac{1-p_a}{p_a}\frac{\Lambda^b+\mu_s^a}{\Lambda^b}\right] \tag{A26}$$

Plugging each best correspondence function into the opponent's best correspondence function (for the same condition) yields closed-form expressions for equilibrium delay times:

$$\begin{aligned}T_a^*|T_a^* < T_b^* = &\frac{\lambda_s^a + \mu_s^a - \Lambda^a}{(\lambda_s^a + \mu_s^a - \Lambda^a)(\lambda_s^b - \Lambda^b - \mu_s^a) + (\mu_s^a)^2} \ln\left[\frac{u_a(A) - u_a(B)}{u_a(B) - u_a(SQ)} \frac{\mu_s^b}{\mu_s^a + \mu_s^b} \frac{1 - p_a}{p_a} \frac{\Lambda^b + \mu_s^a}{\Lambda^b}\right] \\ &- \frac{\mu_s^a}{(\lambda_s^a + \mu_s^a - \Lambda^a)(\lambda_s^b - \Lambda^b - \mu_s^a) + (\mu_s^a)^2} \ln\left[\frac{u_b(B) - u_b(A)}{u_b(A) - u_b(SQ)} \frac{\mu_s^a}{\mu_s^a + \mu_s^b} \frac{1 - p_b}{p_b} \frac{\Lambda^a + \mu_s^b}{\Lambda^a}\right]\end{aligned} \tag{A27}$$

$$\begin{aligned}T_b^*|T_a^* < T_b^* = &\frac{\mu_s^a}{(\lambda_s^a + \mu_s^a - \Lambda^a)(\lambda_s^b - \Lambda^b - \mu_s^a) + (\mu_s^a)^2} \ln\left[\frac{u_a(A) - u_a(B)}{u_a(B) - u_a(SQ)} \frac{\mu_s^b}{\mu_s^a + \mu_s^b} \frac{1 - p_a}{p_a} \frac{\Lambda^b + \mu_s^a}{\Lambda^b}\right] \\ &+ \frac{\lambda_s^a + \mu_s^a - \Lambda^a}{(\lambda_s^a + \mu_s^a - \Lambda^a)(\lambda_s^b - \Lambda^b - \mu_s^a) + (\mu_s^a)^2} \ln\left[\frac{u_b(B) - u_b(A)}{u_b(A) - u_b(SQ)} \frac{\mu_s^a}{\mu_s^a + \mu_s^b} \frac{1 - p_b}{p_b} \frac{\Lambda^a + \mu_s^b}{\Lambda^a}\right]\end{aligned} \tag{A28}$$

$$\begin{aligned}T_a^*|T_b^* < T_a^* = &\frac{\mu_s^b}{(\lambda_s^a - \Lambda^a - \mu_s^b)(\lambda_s^b + \mu_s^b - \Lambda^b) + (\mu_s^b)^2} \ln\left[\frac{u_b(B) - u_b(A)}{u_b(A) - u_b(SQ)} \frac{\mu_s^a}{\mu_s^a + \mu_s^b} \frac{1 - p_b}{p_b} \frac{\Lambda^a + \mu_s^b}{\Lambda^a}\right] \\ &+ \frac{\lambda_s^a - \Lambda^a - \mu_s^b}{(\lambda_s^a - \Lambda^a - \mu_s^b)(\lambda_s^b + \mu_s^b - \Lambda^b) + (\mu_s^b)^2} \ln\left[\frac{u_a(A) - u_a(B)}{u_a(B) - u_a(SQ)} \frac{\mu_s^b}{\mu_s^a + \mu_s^b} \frac{1 - p_a}{p_a} \frac{\Lambda^b + \mu_s^a}{\Lambda^b}\right]\end{aligned} \tag{A29}$$

$$\begin{aligned}T_b^*|T_b^* < T_a^* = &\frac{\lambda_s^b + \mu_s^b - \Lambda^b}{(\lambda_s^a - \Lambda^a - \mu_s^b)(\lambda_s^b + \mu_s^b - \Lambda^b) + (\mu_s^b)^2} \ln\left[\frac{u_b(B) - u_b(A)}{u_b(A) - u_b(SQ)} \frac{\mu_s^a}{\mu_s^a + \mu_s^b} \frac{1 - p_b}{p_b} \frac{\Lambda^a + \mu_s^b}{\Lambda^a}\right] \\ &- \frac{\mu_s^b}{(\lambda_s^a - \Lambda^a - \mu_s^b)(\lambda_s^b + \mu_s^b - \Lambda^b) + (\mu_s^b)^2} \ln\left[\frac{u_a(A) - u_a(B)}{u_a(B) - u_a(SQ)} \frac{\mu_s^b}{\mu_s^a + \mu_s^b} \frac{1 - p_a}{p_a} \frac{\Lambda^b + \mu_s^a}{\Lambda^b}\right]\end{aligned} \tag{A30}$$

C.2 Uniqueness of the best response

Claim: $T_a^*(T_b^*)$ and $T_b^*(T_a^*)$ can only intersect once.

Proof. The 45 degree line $T_a^* = T_b^*$ divides the best response space into two regions: $T_a < T_b$ and $T_a > T_b$. The following lemma describes bounds on the behavior of both best response correspondences in each region, which will then be used to prove uniqueness.

Lemma A1. *$T_i^*(T_j^*)$ kinks when $T_i = T_j$ and has linear subfunctions. When $T_i < T_j$, the slope of $T_i^*(T_j^*) \in (0, 1)$. When $T_i > T_j$, the slope of $T_i^*(T_j^*) \in (-\infty, 0)$.*

Proof. Note that for either player i, the functions that describe i's best response $T_i(T_j)$ conditional upon $T_i > T_j$ and conditional upon $T_i < T_j$ are both linear in T_j.
The slope of i's best response $T_i(T_j)$ conditional upon $T_j < T_i$ is

$$\frac{\mu_s^i}{\lambda_s^j - H^j - \mu_s^i} = \frac{-\mu_s^i}{H^j - \lambda_s^j + \mu_s^i}$$

Since $H^j > \lambda_s^j$ and $\mu_s^i > 0$, this must be in $(-\infty, 0)$.

The slope of i's best response $T_i^*(T_j)$ conditional upon $T_i^* < T_j$ is

$$\frac{-\mu_s^j}{\lambda_s^j + \mu_s^j - H^j} = \frac{\mu_s^j}{H^j - (\lambda_s^j + \mu_s^j)}$$

Again, since $H^j > \lambda_s^j + \mu_s^j$, this is bounded in (0, 1).

Because both intervals are open, T_i cannot have zero slope in either region, so its slope must change at $T_i = T_j$. At the identity, the value of both functions equals $T_i(K_j)$, thus there must be a kink, rather than a discontinuity. This proves the Lemma. □

Case 1. Suppose players' best response functions intersect on the 45 degree line. This must mean that the functions cross exactly on each of their kinks. Then, we can only have multiple crossings if $T_i^*(T_j^*)$ has the same slope as $T_j^*(T_i^*)$ in one or both of the regions. However, when $T_i^* > T_j^*$, the slope of $T_i^*(T_j^*) \in (-\infty, 0)$. The slope of $T_j^*(T_i^*)$ is $\frac{\mu_i}{H^j - (\lambda_i + \mu_i)}$. Inverting to represent T_i as a function of T_j, we have $\frac{H^j - (\lambda_i + \mu_i)}{\mu_i}$ which is between $(1, \infty)$. This interval is disjoint from $(-\infty, 0)$, so there is no intersection. Similar reasoning applies when $T_i^* < T_j^*$: The slope of $T_i^*(T_j^*)$ is constrained between $(0, 1)$. The slope of $T_j^*(T_i^*)$, inverted to represent T_i as a function of T_j, is constrained between $(-\infty, -1)$. Conditional upon intersection at $T_i = T_j$, there cannot be an intersection in this region.

Case 2. Suppose that the players' best responses kink in different places. Assume WLOG $K_i < K_j$. Note that the order of the kinks implies that $T_i^*(K_j) < T_j^*(K_j) = K_j$. We will show that the functions must cross once in the region where $T_i^* < T_j^*$. In this region, the slope of $T_i^*(T_j^*)$ is in $(0, 1)$, while the slope of $T_j^*(T_i^*)$, inverted to be a function of T_j^*, is negative. Given that $T_i^*(T_j^*)$ is below $T_j^*(T_i^*)$ at K_j, $T_i^*(T_j^*)$ is an increasing function (that stays below the 45-degree line), and the inverted $T_j^*(T_i^*)$ is a decreasing function, they must intersect.

To see why they cannot cross in the region where $T_j^* > T_i^*$, note that $T_i^*(K_j) < T_j^*(K_j) = K_j$. In this region, $T_j^*(T_i^*)$ (as a function of T_j^*) has an positive while $T_i^*(T_j^*)$ has negative slope. Furthermore, $T_i^*(T_j^*)$ must intersect with $K_i < K_j$. Therefore they must diverge in this region. □

C.3 Equilibrium after a leak has occurred

I now derive $\overline{T}_a^*$. The *timing* of leaks now has the following restriction: $\bar{t}_i < \min\{T_a^*, T_b^*\}$. That is, a soft type being leaked matters only *before the earlier of the two thresholds*. To see why, consider the problem faced by a soft type of group a. First suppose $T_b^* < T_a^*$ and a's type is revealed during the interval $[T_b^*, T_a^*]$. Group b is already trying to commit by the time a's type is leaked. Therefore, a's type being leaked will not affect a's learning about b's type. Now suppose that $T_a^* < T_b^*$ and a's type is leaked during the interval $[T_a^*, T_b^*]$. At this point, a has already passed the threshold where they are sufficiently confident that b is a soft type, and therefore is already trying to commit. Having a's own type leaked does not affect inferences that a has already made about b's type, and hence does not affect a's behavior. Hence, $\overline{T}_a^*$ is a function of $\bar{t}_a$ and not of T_b^*, as a's type being leaked induces b to start committing as soon as possible, making T_b^* irrelevant.

I now derive $\overline{T}_a^*$. Group a's expected utility of committing to A at $\overline{T}_a^*$ is

$$\left[(1-p_a)e^{-\lambda_s^b \overline{T}_a^* - \mu_s^b(\overline{T}_a^* - \bar{t}_a)}\right]u_a(A) + \left[p_a e^{-\Lambda^b \overline{T}_a^*}\right]u_a(SQ)$$

The continuation value of waiting is:

$$(1-p_a)e^{-\lambda_s^b \overline{T}_a^* - \mu_s^b(\overline{T}_a^* - \bar{t}_a)}\left[\frac{\mu_s^a}{\mu_s^a + \mu_s^b}u_a(A) + \frac{\mu_s^b}{\mu_s^a + \mu_s^b}u_a(B)\right] +$$
$$p_a e^{-\Lambda^b \overline{T}_a^*}\left[\frac{\mu_s^a}{\mu_s^a + \Lambda^b}u_a(SQ) + \frac{\Lambda^b}{\mu_s^a + \Lambda^b}u_a(B)\right]$$

Setting these equal and rearranging, I obtain

$$\overline{T}_a^* = \frac{1}{\lambda_s^b + \mu_s^b - H^b}\left(\ln\left[\frac{u_a(A) - u_a(B)}{u_a(B) - u_a(SQ)}\frac{\mu_s^b}{\mu_s^a + \mu_s^b}\frac{1-p_a}{p_a}\frac{H^b + \mu_s^a}{H^b}\right] + \mu_s^b \bar{t}_a\right) \tag{A31}$$

A symmetric derivation shows that

$$\overline{T}_b^* = \frac{1}{\lambda_s^a + \mu_s^a - \Lambda^a}\left(\ln\left[\frac{u_b(B) - u_b(A)}{u_b(A) - u_b(SQ)}\frac{\mu_s^a}{\mu_s^a + \mu_s^b}\frac{1-p_b}{p_b}\frac{\Lambda^a + \mu_s^b}{\Lambda^a}\right] + \mu_s^a \bar{t}_b\right) \tag{A32}$$

D Any PBE must be in threshold strategies

In this section, I rule out all PBEs in non-threshold strategies. The proof presented below applies to the baseline version of the model without leaks. An analogous argument can be made for the model with leaks but is omitted for brevity.

Claim: Any equilibrium of the game must be in threshold strategies. That is, $\exists$ some time T_a such that player a skips all commitment opportunities received before T_a and accepts any opportunity received after T_a and T_b such that player b skips all commitment opportunities received before T_b and accepts any opportunity received after T_b.

The proof consists of two parts. In the first part, I establish that for any candidate equilibrium, there exists a region of the state space in which both players have a dominant action to commit. In the second part, I show that conditional upon the existence of such a dominance region, any equilibrium of the game must be in threshold strategies.

D.1 Existence of a dominance region

Suppose players are playing some candidate equilibrium σ. Denote player i's on-path posterior belief that their opponent is a hard type by $q_i(\sigma, t) : t \to [0, 1]$. I argue that given that the game has proceeded to some time t under σ, players must have on-path beliefs given by $q_a(\sigma, t), q_b(\sigma, t)$. To see why, note that players' only information about their opponents comes from t (the amount of time that has elapsed) and the fact that the opponent has not committed yet. Hence, even if a player deviates from the strategy specified from σ, as long as it does not commit (thereby ending the game), its opponent does not observe the deviation. Hence the opponent's posteriors must remain on-path.

Posterior beliefs in this game must move strictly towards 0 (that is, towards each player believing their opponent is a soft type) no matter what form chosen strategies take. To see why, recall that hard types always have a dominant strategy to commit immediately irrespective of beliefs. Hence, as long as soft types do not want to commit immediately and $\mu_s^i < \mu_h^i$, any duration of no commitment causes posteriors to move towards 0.

Conditional upon reaching time t and associated history h_t with posterior beliefs $q_a(\sigma, t)$ and $q_b(\sigma, t)$, players agree on the probabilities of outcomes being realized in the continuation conditional upon what their true types are. We will denote these as follows: Conditional on both players being soft, players believe that the probabilities of A, B, and SQ being realized in the continuation are $\varphi_A(\sigma,t), \varphi_B(\sigma,t)$, and $\varphi_{SQ}(\sigma,t)$, respectively. Conditional on a's true type being hard and b's true type being soft, players believe that the probabilities of A and SQ being realized in the continuation are $\tilde{\varphi}_A(\sigma,t)$ and $\tilde{\varphi}_{SQ}(\sigma,t)$, respectively. Conditional on a's true type being soft and b's true type being hard, players believe that the probabilities of B and SQ being realized in the continuation are $\hat{\varphi}_B(\sigma,t)$ and $\hat{\varphi}_{SQ}(\sigma,t)$, respectively.

Suppose player a receives a commitment opportunity at some time t. In order for a to prefer passing, it must be that the probability of policy A being implemented in the continuation is sufficiently high; that is, the payoff of using the commitment opportunity today must be less than the payoff of passing and letting the game continue, i.e.

$$\begin{aligned} q_a(\sigma,t)u_a(SQ) + (1-q_a(\sigma,t))u_a(A) <& (1-q_a)\Big(\varphi_A(\sigma,t)u_a(A) + \varphi_B(\sigma,t)u_a(B) + \\ & (1-\varphi_A(\sigma,t)-\varphi_B(\sigma,t))u_a(SQ)\Big) \\ & + q_a\Big(\tilde{\varphi}_B(\sigma,t)u_a(B) + \tilde{\varphi}_{SQ}(\sigma,t)u_a(SQ)\Big) \end{aligned}$$

For ease of notation, we will temporarily disregard the (σ,t) argument:

$$\begin{aligned} q_a u_a(SQ) + (1-q_a)u_a(A) < (1-q_a)\Big(\varphi_A u_a(A) + \varphi_B u_a(B) + (1-\varphi_A-\varphi_B)u_a(SQ)\Big) \\ + q_a\Big(\tilde{\varphi}_B u_a(B) + \tilde{\varphi}_{SQ} u_a(SQ)\Big) \end{aligned}$$

It is straightforward to show that

$$\varphi_A u_a(A) + \varphi_B u_a(B) + (1-\varphi_A-\varphi_B)u_a(SQ) \leq \varphi_A u_a(A) + (1-\varphi_A)u_a(B)$$

Therefore, the above inequality also implies that

$$q_a u_a(SQ) + (1-q_a)u_a(A) < (1-q_a)\Big(\varphi_A u_a(A) + (1-\varphi_A)u_a(B)\Big) + q_a\Big(\tilde{\varphi}_B u_a(B) + \tilde{\varphi}_{SQ} u_a(SQ)\Big)$$

Hence, a necessary condition for a soft type of a to pass on commitment opportunity received at time t is

$$\varphi_A(\sigma,t) > 1 - \frac{q_a(\sigma,t)\Big(\tilde{\varphi}_B(\sigma,t)u_a(B) + \tilde{\varphi}_{SQ}(\sigma,t)u_a(SQ) - u_a(SQ)\Big)}{(1-q_a(\sigma,t))(u_a(A)-u_a(B))} \equiv \underline{\varphi_A}(\sigma,t)$$

Likewise for a soft type of b to pass on a commitment opportunity received at time t,

$$\varphi_B(\sigma,t) > 1 - \frac{q_b(\sigma,t)\Big(\tilde{\varphi}_A(\sigma,t)u_b(A) + \tilde{\varphi}_{SQ}(\sigma,t)u_b(SQ) - u_b(SQ)\Big)}{(1-q_b(\sigma,t))(u_b(B)-u_b(A))} \equiv \underline{\varphi_B}(\sigma,t)$$

Lemma A2. *Given any candidate equilibrium σ, there exists some $s' > 0$ such that for all $t > s'$, at least one player will commit as soon as they receive an opportunity.*

Proof. By above arguments, we know that $\lim_{t\to\infty} q_i(\sigma, t) = 0$ for $i = a, b$. Suppose for contradiction that there exists an increasing sequence of times $s_n \to \infty$ such that any arrival of a commitment opportunity at s_n is never used. By definition, for any σ and time t we must have $1 \geq \varphi_A(\sigma, t) + \varphi_B(\sigma, t)$. Taking the limit along the sequence s_n,

$$\begin{aligned}
1 &\geq \lim_{n\to\infty} \Big[\varphi_A(\sigma, s_n) + \varphi_B(\sigma, s_n)\Big] \\
&\geq \lim_{n\to\infty} \Bigg[1 - \frac{q_a(\sigma, s_n)\Big(\tilde{\varphi}_B(\sigma, t)u_a(B) + \tilde{\varphi}_{SQ}(\sigma, s_n)u_a(SQ) - u_a(SQ)\Big)}{(1 - q_a(\sigma, s_n))(u_a(A) - u_a(B))} \\
&\qquad + 1 - \frac{q_b(\sigma, s_n)\Big(\tilde{\varphi}_A(\sigma, s_n)u_b(A) + \tilde{\varphi}_{SQ}(\sigma, s_n)u_b(SQ) - u_b(SQ)\Big)}{(1 - q_b(\sigma, s_n))(u_b(B) - u_b(A))}\Bigg] \\
&\geq 2 \qquad \text{because } q_a(\sigma, s_n), q_b(\sigma, s_n) \to 0.
\end{aligned}$$

which demonstrates the contradiction. $\square$

We seek now to prove the stronger claim: For any candidate equilibrium σ, there exists some $s_0 > 0$ such that for all $t > s_0$, both players will commit whenever they receive an opportunity. (Since we assume that players are playing candidate eqm σ, we will drop the σ argument for the remainder of this step of the proof.)

Suppose for contradiction that at least one player (suppose WLOG that it is player a) does not commit at some time $t > s_0$. We allow t can be arbitrarily large, so that $\varphi_A(t)$ is very close to 1, which implies that player b must commit very infrequently (conditional upon receiving an opportunity) at $t' > t$. We will show that this implies that $\varphi_B(t')$ is such that b is willing to commit soon after t, implying that $\varphi_A(\sigma, t)$ cannot be high enough to rationalize a postponing commitment at time t.

Define the earliest time that b does *not* commit after t as $\tilde{t} := \inf\{t' > t : b \text{ does not commit if he receives an opportunity at } t'\} = t + M$. In order for b to be unwilling to commit at $\tilde{t}$, it must be that $\varphi_B(\tilde{t}) \geq \underline{\varphi_B(\tilde{t})}$. A necessary condition for a to not commit at t is

$$\underline{\varphi_A(t)} < \varphi_A(t) \leq \Big[1 - e^{-\mu_s^a(\tilde{t}-t)}\Big] + \Big[e^{-\mu_s^a(\tilde{t}-t)}\Big]\varphi_A(\tilde{t})$$

The second inequality bounds $\varphi_A(t)$ from above by describing a "best case scenario" for player a: (1) a receives an opportunity in $(t, \tilde{t}]$ and commitment results in policy A being implemented

(2) a does not receive an opportunity in $(t,\tilde{t}]$, and therefore believes the probability of A in the long run being realized is $\varphi_A(\tilde{t})$. Applying the fact that $\varphi_A(\tilde{t}) \leq 1-\varphi_B(\tilde{t}) \leq 1-\underline{\varphi_B(\tilde{t})}$ (since b does not commit at $\tilde{t}$), we have

$$
\begin{aligned}
1-&\frac{q_a(\sigma,t)\big(\tilde{\varphi}_B(\sigma,t)u_a(B)+\tilde{\varphi}_{SQ}(\sigma,t)u_a(SQ)-u_a(SQ)\big)}{(1-q_a(\sigma,t))\big(u_a(A)-u_a(B)\big)} \leq \left[1-e^{-\mu_s^a(\tilde{t}-t)}\right]+\left[e^{-\mu_s^a(\tilde{t}-t)}\right](1-\underline{\varphi_B(\tilde{t})})\\
&\leq 1-\left(e^{-\mu_s^a(\tilde{t}-t)}\right)\left(\underline{\varphi_B(\tilde{t})}\right)\\
&\leq 1-\left(e^{-\mu_s^a(\tilde{t}-t)}\right)\left[1-\frac{q_b(\sigma,\tilde{t})\big(\tilde{\varphi}_A(\sigma,\tilde{t})u_b(A)+\tilde{\varphi}_{SQ}(\sigma,t)u_b(SQ)-u_b(SQ)\big)}{(1-q_b(\sigma,\tilde{t}))\big(u_b(B)-u_b(A)\big)}\right]
\end{aligned}
$$

$$
\frac{\frac{q_a(\sigma,t)\left(\tilde{\varphi}_B(\sigma,t)u_a(B)+\tilde{\varphi}_{SQ}(\sigma,t)u_a(SQ)-u_a(SQ)\right)}{(1-q_a(\sigma,t))\left(u_a(A)-u_a(B)\right)}}{1-\frac{q_b(\sigma,\tilde{t})\left(\tilde{\varphi}_A(\sigma,\tilde{t})u_b(A)+\tilde{\varphi}_{SQ}(\sigma,\tilde{t})u_b(SQ)-u_b(SQ)\right)}{(1-q_b(\sigma,\tilde{t}))\left(u_b(B)-u_b(A)\right)}} \geq e^{-\mu_s^a(\tilde{t}-t)}
$$

$$
t-\frac{1}{\mu_s^a}\log\left[\frac{\frac{q_a(\sigma,t)\left(\tilde{\varphi}_B(\sigma,t)u_a(B)+\tilde{\varphi}_{SQ}(\sigma,t)u_a(SQ)-u_a(SQ)\right)}{(1-q_a(\sigma,t))\left(u_a(A)-u_a(B)\right)}}{1-\frac{q_b(\sigma,\tilde{t})\left(\tilde{\varphi}_A(\sigma,\tilde{t})u_b(A)+\tilde{\varphi}_{SQ}(\sigma,\tilde{t})u_b(SQ)-u_b(SQ)\right)}{(1-q_b(\sigma,\tilde{t}))\left(u_b(B)-u_b(A)\right)}}\right] \leq \tilde{t}
$$

Hence, a lower bound on M is $\underline{M} := -\frac{1}{\mu_s^a}\log\left[\frac{\frac{q_a(\sigma,t)\left(\tilde{\varphi}_B(\sigma,t)u_a(B)+\tilde{\varphi}_{SQ}(\sigma,t)u_a(SQ)-u_a(SQ)\right)}{(1-q_a(\sigma,t))\left(u_a(A)-u_a(B)\right)}}{1-\frac{q_b(\sigma,\tilde{t})\left(\tilde{\varphi}_A(\sigma,\tilde{t})u_b(A)+\tilde{\varphi}_{SQ}(\sigma,\tilde{t})u_b(SQ)-u_b(SQ)\right)}{(1-q_b(\sigma,\tilde{t}))\left(u_b(B)-u_b(A)\right)}}\right]$

Since we allowed t to be arbitrarily large, w$q_a(t) \approx 0$. Since $\tilde{t} > t$ by assumption, it must also be that $q_b(\tilde{t}) \approx 0$. Hence, the term inside the logarithm approaches 0/1 in the limit from the positive side. Since $\log(x)$ approaches $-\infty$ as $x \to 0$ where $x > 0$ and is multiplied by $-1/\mu_s^a < 0$, it must be that $\underline{M}$ becomes infinite when t is large. Thus as $t \to \infty$, $\tilde{t}$ becomes infinitely larger than t, implying that b does not skip any commitment opportunities until a substantial amount of time after t has passed.

To finish the argument, I show given that M is large (that is, B uses any commitment opportunities received in $[t,\tilde{t}]$), then it must be that $\varphi_A(t)$ is not high enough to justify a postponing commitment at time t. To make the statement as strong as possible I will assume that b never uses a commitment opportunity after $\tilde{t}$ and that a uses every commitment opportunity received after time t, therefore making the scenario as advantageous as possible to player a. Even under these maximally favorable conditions, I will show that it is impossible to obtain a $\varphi_A(t)$ that justifies not committing at time t.

$\varphi_A(t)$ under these conditions is the probability that the Poisson(μ_s^b) process never arrives in $[t, \tilde{t}]$ (which guarantees that any opportunity arrival of μ_s^a between $(\tilde{t}, \infty)$ will be implemented) plus the probability that the Poisson(μ_s^a) process arrives before the Poisson(μ_s^b) process in the interval $(t, \tilde{t}]$. This is:

$$\begin{aligned}\varphi_A(t) &= e^{-\mu_s^b(\tilde{t}-t)} + \frac{\mu_s^a}{\mu_s^a + \mu_s^b}\left(1 - e^{-(\mu_s^a+\mu_s^b)(\tilde{t}-t)}\right) \\ &= e^{-\mu_s^b M} + \frac{\mu_s^a}{\mu_s^a + \mu_s^b}\left(1 - e^{-M(\mu_s^a+\mu_s^b)}\right)\end{aligned}$$

Since we proved that $M \to \infty$ as $t \to \infty$, both of the exponentiated terms are approximately 0. A necessary condition for a to postpone commitment at time t was

$$\underbrace{e^{-\mu_s^b M} + \frac{\mu_s^a}{\mu_s^a + \mu_s^b}\left(1 - e^{-M(\mu_s^a+\mu_s^b)}\right)}_{\varphi_A(t)} > \underbrace{1 - \frac{q_a(\sigma,t)\Big(\tilde{\varphi}_B(\sigma,t)u_a(B) + \tilde{\varphi}_{SQ}(\sigma,t)u_a(SQ) - u_a(SQ)\Big)}{(1 - q_a(\sigma,t))(u_a(A) - u_a(B))}}_{\underline{\varphi_A(t)}}$$

Thus we can find an increasing sequence of times s_n such that as we take $s_n \to \infty$, the above inequality converges to

$$\frac{\mu_s^a}{\mu_s^a + \mu_s^b} \geq 1$$

Since $\frac{\mu_s^a}{\mu_s^a+\mu_s^b} < 1$ is a constant, this contradicts the premise that a would choose to postpone commitment at t. Hence there must exist s_0 such that for all $t > s_0$, both players have a dominant strategy to use any commitment opportunity they receive.

D.2 Dominance region implies that players use threshold strategies

From the first part of the proof, we know that $\exists$ some time s_0 such that for all $t > s_0$, both players have a dominant strategy to commit to their preferred alternative. Furthermore, the derivation and proof of uniqueness of best responses to threshold strategies given in (Appendix section about Proposition 4) characterize what best responses look like in any equilibrium continuation beginning at any time t, taking $q_a(\sigma,t)$ and $q_b(\sigma,t)$ as priors and assuming that σ specifies threshold strategies for both a and b beginning at t.

The first part of this proof implied that $\varphi_{SQ}(\sigma,t)$ must be 0. Since after some time both player are attempting to commit, and because φ_{SQ} is defined as conditional upon both players being soft types, the first player to commit will successfully implement their policy. Hence, going forward, we will consider only $\varphi_A(\sigma,t)$ and $\varphi_B(\sigma,t)$ which must sum to 1.

We will assume players are playing equilibrium σ and again temporarily drop the argument. WLOG, consider the problem faced by player a if he receives a commitment opportunity at time t. If a commits at t, his payoff is

$$q_a(t)u_a(SQ) + (1 - q_a(t))u_a(A) \equiv U_t^a(C)$$

If a does not commit at t, his payoff is

$$q_a(t)\Big[\hat{\varphi}_B(t)u_a(B) + (1 - \hat{\varphi}_B(t))u_a(SQ)\Big] + (1 - q_a(t))\Big[\varphi_A(t)u_a(A) + (1 - \varphi_A(t)u_a(B))\Big] \equiv U_t^a(NC)$$

For a to strictly prefer to use commitment opportunity that arrives at t, a necessary condition is $\Delta U_t^a > 0$, where

$$\begin{aligned}\Delta U_t^a &= U_t^a(C) - U_t^a(NC) \\ &= -q_a(t)\hat{\varphi}_B(t)\Big[u_a(B) - u_a(SQ)\Big] + (1 - q_a(t))(1 - \varphi_A(t))\Big[u_a(A) - u_a(B)\Big] \qquad \text{(A33)}\end{aligned}$$

if $\Delta U_t^a < 0$, a prefers to pass, and if $\Delta U_t^a = 0$, a is indifferent. Hence, a's optimal decision at time t depends on $q_a(t), \varphi_A(t)$, and $\hat{\varphi}_B(t)$.

Remark. *ΔU_t^i is continuous in t for all players i and associated equilibria σ.*

Proof. $q_i(t)$ is continuous in t because it is calculated using Bayes' Rule. Note that $\varphi_A(t)$ is continuous in t because for any $\epsilon > 0, \varphi_A(t)$ can be written as $(1 - e^{-\mu_s^a(\tilde{t}-t)}) + e^{-\mu_s^a(\tilde{t}-t)}\varphi_A(t+\epsilon)$.

Corollary. *Suppose that for some player i, there exists some time t such that i's equilibrium action switches at time t (that is, $\exists\epsilon > 0$ such that i takes different actions at $t - \epsilon$ versus $t + \epsilon$.) Then it must be that $\Delta U_t^i = 0$, that is, i is indifferent at t.*

Proof. This is directly implied by the continuity of ΔU_t^i in t. ☐

Lemma A3. *Suppose that there exists $t_0 > 0$ such that for all $t \geq t_0$, both players accept any commitment opportunity under σ. Then, σ must be an equilibrium in threshold strategies.*

Proof. Denote a player's equilibrium strategy as $\sigma_i(t) \in [0, 1]$, which describes the probability that i takes a commitment opportunity that arrives at time t. The premise in the Lemma is that $\sigma_i(t) = 1$ for all i and $t \geq t_0$.

Let $t^* = \sup\{t : \sigma_i(t) < 1 \text{ for some } i\}$, i.e. the latest time at which either player may not commit. If the supremum does not exist, then both players commit at all times, meaning that there exists a trivial threshold equilibrium, so we are done. Suppose therefore that the supremum does exist. Then, it must either be that $\sigma_i(t^*) < 1$ or that there exists some sequence of times t_n such that $\sigma_i(t_n) < 1$ and $t_n \nearrow t^*$. In both cases, by the Remark and Corollary, it must be that player i is indifferent at t^*. It must further be that $\sigma_j(t) = 1$ for all $t > t^*$, hence, either j commits for all $t \in [t^*, \epsilon)$ or j is indifferent at t^*.

Suppose for contradiction that exists a time $t' < t^*$ such that $\sigma_i(t') > 0$. We will continue to assume WLOG that $i = a$. Consider the following three cases.

(1) The on-path history at time t^*

(2) A fictitious history, which we denote h'' corresponding to some time t''. At this fictional history, player a holds the same posterior as the on-path belief at t^*, i.e. $q_a(h'') = q_a(\sigma, t^*)$. Player b's strategy in the continuation $[t'', \infty)$, conditional on being soft, is $\sigma_b(t - t'' + t')$; that is, player b plays from t'' as if he were playing σ_b from time t' onwards.

(3) The on-path history at time t'

For each case, assume that player a knows the strategy that b will play in the continuation (as described above) and plans to best respond to it in the continuation. In particular, let a's best response to b's strategy at fictitious history h'' (onwards) be denoted by $\sigma''_a : [t'', \infty)$.

Fact 1. $\Delta U^a_{t^*} \geq \Delta U^a_{h''}$

Proof. Note that $U^a_{t^*}(C) = U^a_{h''}(C)$ since a's utility of commitment depends only on q_a which is identical in both cases by construction. We therefore want to show that $U^a_{t^*}(NC) \geq U^a_{h''}(C)$. Note that in the fictitious continuation starting at h'', player b skips on some commitment opportunities that he would not skip if he were playing σ_b at t^*. Hence, even assuming that a plays his on-path history at t^* rather than reoptimizing and playing σ''_a, it must be that a gets a higher payoff from b's less aggressive commitment behavior. $\square$

Next, suppose player b is playing on-path from $[t', \infty)$ as in case (3), but a is playing σ''_a shifted to begin at t' rather than t''. In other words, a plays as if he were best responding to player b's strategy as specified by case (2) rather than best responding to player b's actual on-path strategy starting at t'. Note that this entails that a effectively believes that b is committing less often than he actually is. In this situation, let player a's expected payoff from not committing at t' be denoted by $\check{U}^a_{t'}(NC)$. We will let $\Delta\check{U}^a_{t'}$ denote the comparison between this payoff and a's payoff of committing at t' with the "correct" beliefs at t', that is, $\Delta\check{U}^a_{t'} = U^a_{t'}(C) - \check{U}^a_{t'}(NC)$.

Fact 2: $\Delta U^a_{h''} > \Delta\check{U}^a_{t'}$.

Proof. Note that a's commitment payoff is higher at the h'' continuation relative to the t' continuation because $q_a(t') > q_a(h'') = q_a(t^*)$. The no-commitment payoff in both cases is determined by a best responding to σ_b'' and is therefore identical. Because the only difference is in a's posterior, we have that the payoff difference at h'' is strictly greater than at t'. $\square$

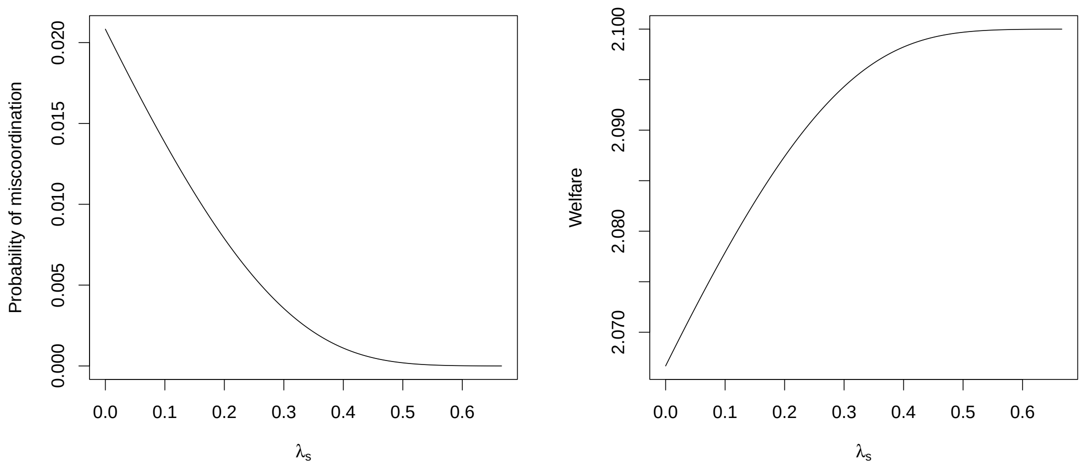
Fact 3: $\Delta\check{U}_{t'}^a \geq \Delta U_{t'}^a$.

Proof. Note that both $\Delta\check{U}_{t'}^a$ $\Delta U_{t'}^a$ involve $U_{t'}^a(C)$. Hence, we want to show that $\check{U}_{t'}^a(NC) \leq U_{t'}^a(NC)$. Recall that $\check{U}_{t'}^a(NC)$ entails a best responding *as if* player b was committing less than he actually is, which is lower-payoff than $U_{t'}^a(NC)$, which describes a's best response to b's actual strategy at t'. $\square$

Together, Facts 1, 2, and 3 imply $\Delta U_{t^*}^a \geq \Delta U_{h''}^a > \Delta\check{U}_{t'}^a \geq \Delta U_{t'}^a$. Therefore, it cannot be that if $\Delta U_{t^*}^a = 0$, then $\Delta_{t'}^a > 0$ which is the necessary condition for $\sigma_a(t') > 0$. This suffices to prove Lemma A3. $\square$

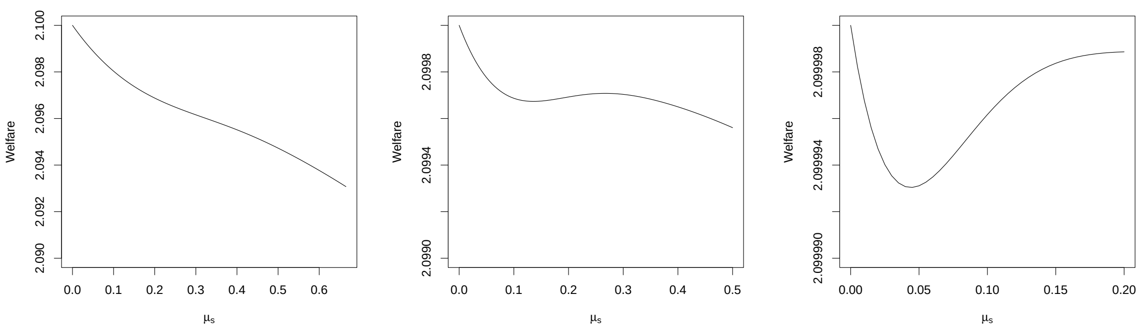
E Supplemental figures

E.1 Welfare



(a) Miscoordination **(b)** Welfare

Figure A1. Effects of changing λ_s on miscoordination and welfare.
Parameter values: $\mu_s = \frac{1}{3}, \lambda_h + \mu_h = 1, \frac{1-p}{p} = \frac{1}{4}, \frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)} = \frac{1}{2}$

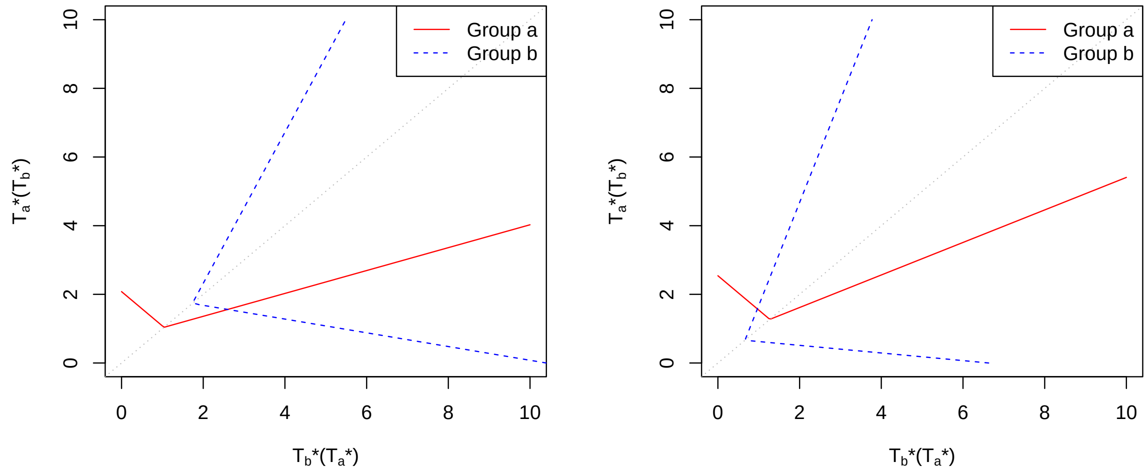


(a) $\lambda_s = \frac{1}{3}$ **(b)** $\lambda_s = \frac{1}{2}$ **(c)** $\lambda_s = \frac{2}{3}$

Figure A2. Effects of changing μ_s on welfare, as conditioned by λ_s. Panel (a) has parameters identical to those used in Figure 3. As I progressively increase λ_s in panels (b) and (c), the likelihood that one-sided asymmetry will be triggered increases, and comes to dominate the aggregate effect. (Note that increasing λ_s while maintaining $\lambda_s + \mu_s < \lambda_h + \mu_h$ curtails the range of possible values for μ_s.)

Parameter values: $\lambda_h + \mu_h = 1$, $\frac{1-p}{p} = \frac{1}{4}$, $\frac{u_a(A)-u_a(B)}{u_a(B)-u_a(SQ)} = \frac{1}{2}$

E.2 Asymmetric setting



(a) $\lambda_s^a = 0.6$

(b) $\mu_s^a = 0.6$

Figure A3. Effects of increasing λ_s^a and μ_s^a on equilibrium delay. Other parameter values are as in Figure 5a.

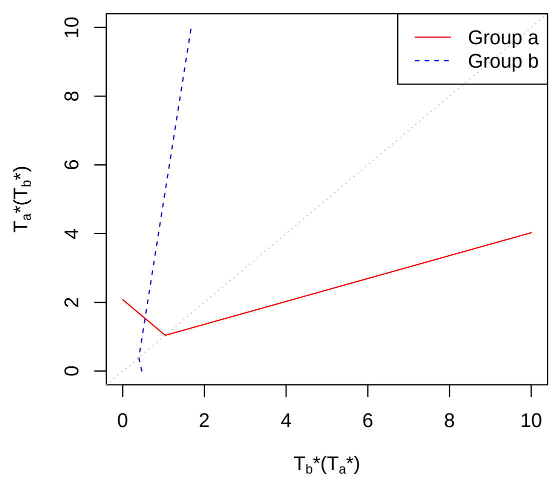


Figure A4. Effect of higher $\lambda_h^a + \mu_h^a$ on best responses. $\lambda_h^a + \mu_h^a = 2$. Other parameter values are as in Figure 5a.