Presentation: Mutual Optimism

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Fey, Mark and Kristopher W. Ramsay. 2007. "Mutual Optimism and War". *American Journal of Political Science*, 51(4), 738–754.

Slantchev, Branislav L. and Ahmer Tarar. 2011. "Mutual Optimism as a Rationalist Explanation of War." *American Journal of Political Science* 55(1), 135-148.

Fey, Mark and Kristopher W. Ramsay. 2016. "Mutual optimism in the bargaining model of war". Unpublished manuscript, Princeton University.

Fey and Ramsay 2007, "Mutual Optimism and War"

Fey and Ramsay (2007) set out to formalize the mutual optimism argument for war onset. Usually attributed to Blainey (1973), versions of the mutual optimism argument appear in Wittman (1979), Lebow (1981), Levy (1983), Morrow (1985), Jervis (1988), Werner (1998), Van Evera (1999), Wagner (2000), Wittman (2001), Johnson (2004) and Stoessinger (2005).[1]

Broadly, this argument states that the fundamental cause of conflict is conflicting estimates concerning bargaining power, specifically about how much each contending party can secure by resorting to force. Because these subjective expectations need not sum to 1, when both sides expect to gain by fighting there may exist no negotiated settlement that both sides prefer to war. Arguments for war on the basis of mutual optimism can be distinguished into rationalist and non-rationalist variants, and much of the informal discussion (including Blainey) has focused on non-rational explanations (Fearon 1995). A rational account of mutual optimism should explain how mutual optimism can cause war in a setting where it is common knowledge that actors behave rationally.

Background: The Mutual Optimism Argument

"Indeed, one can almost suggest that war is usually the outcome of a diplomatic crisis which cannot be solved because both sides have conflicting estimates of their bargaining power...It is not the actual distribution or balance of power which is vital: it is rather the way in which national leaders *think* that power is distributed...War is a dispute about the measurement of power." (Blainey 1973, 114).

[1] The second edition of Blainey's book (published in 1988) is more frequently cited, and it is this edition that is referenced by the authors considered here.

"This recurring optimism is a vital prelude to war. Anything which increases that optimism is a cause of war. Anything which dampens that optimism is a cause of peace. This optimism does not derive from a mathematical assessment...predictions of how a nation will perform in a coming war are flavoured by moods which cannot be grounded in fact...these moods permeate what appear to be rational assessments of the relative military strength of the contending powers" (Blainey 1973, 53-54).

Modeling Assumptions

In formalizing the mutual optimism argument, Fey and Ramsay (2007) make several broad assumptions.

1. "Our first assumption concerns how nations arrive at war. Here we assume that **both parties must choose to stand firm for war to occur**. This assumption recognizes that war is a mutual act and is often made in the coercive diplomacy literature (Bueno de Mesquita and Lalman 1992; Fearon 1994; Schultz 2001)"

2. "Our second assumption is that **there exists some settlement procedure that either side can choose when their opponent stands firm**...At any given moment before war begins, a state could continue negotiations with the hopes of avoiding a fight."

3. "If we assume that differences in people's beliefs about the state of the world are the product of private information, such as their personal background, confidential intelligence information, any inputs they may receive from advisors, etc., then **it is logical to suppose all players share a 'common prior'**" (742).

The authors consider the class of all games satisfying these assumptions, and attempt to give a "game-free" treatment of mutual optimism.

Intuition: Alice and Bob

"Imagine a game between two players, Alice and Bob, who have a choice between participating and not participating...At the beginning, each player is given a fair die to roll and the dice are compared. If Alice's die generates a higher number than Bob's, Alice wins [and vice-versa], and Bob and Alice tie when their numbers are the same.

Suppose that each player maximizes expected utility and assigns a utility value of 1 to winning, 1 to losing, and 0 to a tie. Before deciding whether to participate in the contest or not, Alice observes the result of her die, and Bob observes the result of his die...The two players simultaneously announce whether or not they agree to play. If they both agree, payoffs are awarded as above and, in addition, each player pays a small cost $0 < c < 1/6$*. If at least one player chooses not to play, then both receive a payoff of 0"* (740).

Fey and Ramsay show that once we take strategic interaction into account, neither player will agree to play this game. Although it may initially seem rational for Alice to play if her die shows a 4, 5 or 6, she knows that if Bob chooses to play he must also have a 4, 5 or 6. This would lead her to play only with a 5 or 6, but because Bob will make a similar expected utility calculation, Alice should only play if she has a 6. But for identical reasons, Bob will also only play if he has a 6. Knowing this, and because she strictly prefers not playing to a tie, Alice (and Bob) will never choose to play.

"Thus, there cannot be a Bayesian–Nash equilibrium in which the game is played because of differing beliefs that result from private information" (741).

"This game is like the decision to go to war in that (a) it is costly to play this game and (b) when one side wins the other loses, once the conflict begins. It is also a model of mutual optimism, rather than just unilateral optimism, because the mutual agreement is key. For mutual optimism to be an explanation for playing the game, or participating in a war, both sides must be willing to play even though each knows only one can win" (Ramsay 2017, 513).

Model Specifications

$\omega \in \Omega$: a possible state of the world ("balance of forces, technological differences, military strategy, latent resources of each side, support from allies, etc.")

$E \subset \Omega$: an event ("events are related to information sets and describe a set of states consistent with the history of the game")

$P_i(\omega)$: a possibility correspondence mapping every state ω to some non-empty set of states that player i thinks are possible when the *true* state is ω, such that $P_i(\omega) \subseteq \Omega$.

$K_i(E)$: a knowledge correspondence giving the set of states of the world ω where player i knows that event ω has occurred "for sure", such that $K_i(E) = \{\omega : P_i(\omega) \subseteq E\}$.

So a player 'knows' event E at state ω if $P_i(\omega) \subseteq E$.

Example:
Let $\Omega = \{1, 2, 3, 4, 5\}$ and let player i's knowledge be represented by $P_i(\omega)$, taking on these values: $P_i(1) = P_i(3) = \{1, 3\}$ and $P_i(2) = P_i(4) = P_i(5) = \{2, 4, 5\}$

P_i implies that if the state is 1, the player thinks that the true state is either 1 or 3. Similarly, if the state is 4, then she thinks that the true state is 2, 4, or 5.

Now define the events $F = \{1, 2\}$ and $F' = \{1, 2, 3\}$.

By the definition of K_i, player i "knows" an arbitrary event E at ω if $P_i(\omega) \subseteq (E)$.

So if $\omega = 1$, then i doesn't know F because $P_i(1) = \{1,3\} \nsubseteq \{1,2\}$. However, she does know F' because $P_i(1) = \{1,3\} \subseteq \{1,2,3\}$

Players can calculate conditional probabilities for events they don't know using Bayes' Rule.

Definition 1: Partitionality A possibility correspondence $P_i(\omega)$ for Ω is *partitional* if there is a partition of Ω such that for every $\omega \in \Omega$ the set $P_i(\omega)$ is the element of the partition that contains ω.

So ω and ω' are only distinguishable by i if they are in different elements of the partition.

Definition 2: Non-deludedness Let P_i be a possibility correspondence for individual i. Then,

1. P_i is *nondeluded* if, for all $\omega \in \Omega$, $\omega \in P_i(\omega)$,
   (a rational person should always consider the true state of the world to be possible),
2. A player i knows that she knows if, for every $\omega' \in_i (\omega)$, $P_i(\omega') \subseteq P_i(\omega)$
   ($P_i(\omega)$ cannot occur without i knowing that she knows it has occurred).
3. A player i knows that she doesn't know if, for every $\omega \in \Omega$ and every $\omega' \in P_i(\omega)$, $P_i(\omega') \supseteq P_i(\omega)$,
   (players know what they don't know).

Unstated Lemma 0: P_i satisfies these conditions (non-deludedness, know-what-you-know, know-what-you-don't-know) if and only if it is partitional.

Definition 3: Self-Evidence An event E is *self-evident* for a possibility correspondence P_i if and only if for all $\omega \in E$, $P_i(\omega) \subseteq E$.
(an event E is self-evident if, for any state in E, a player knows E has occurred).

Lemma 1: Self-Evidence is Common Knowledge Suppose P_i is nondeluded for all i. An event F is common knowledge at a state ω if and only if there is an ω and a self-evident event E such that $\omega \in E \subseteq F$ for all P_i.
(an event that is self-evident to all players is common knowledge (see Proposition 3.5 in Rubinstein 1998)).

Definition 4: Public Events An event E is a public event if and only if, for all i, $K_i(E) = E$.

Lemma 2: Public Events are Self-Evident If E is a public event, then for all i , E is self-evident.

Model Mechanics

Define functions $p_1(\omega)$ and $p_2(\omega)$ as giving the probability that each state ("country") will prevail in war, given the true state of the world ω ($p_1(\omega) + p_2(\omega) = 1$). When events $E \subseteq \Omega$ occur, states update their prior beliefs π as follows:

$$E[p_i|E] = \frac{\sum_{\omega \in E} p_i(\omega)\pi(\omega)}{\sum_{\omega \in E} \pi(\omega)} \tag{1}$$

Define two additional functions, $r_1(\omega)$ and $r_2(\omega)$, specifying the bargaining outcome when the true state of the world is ω. The authors assume that bargaining is efficient and therefore $r_1(\omega) + r_2(\omega) = 1$. Represent the private information of each state i by a (partitional) possibility correspondence $P_i : \Omega \to 2^{\Omega}$. States will construct their posterior beliefs about the probability of victory (2) and their expected payoff from bargaining (3) as follows:

$$\hat{p}_i(\omega) = E[p_i|P_i(\omega)] \tag{2}$$

$$\hat{r}_i(\omega) = E[r_i|P_i(\omega)] \tag{3}$$

We (finally) have the tools to define mutual optimism. Mutual optimism will occur in cases where the expected probability of victory exceeds the expected bargaining outcome (formally, where inequalities (4) and (5) are both true):

$$\hat{p}_1(\omega) > \hat{r}_1(\omega) \tag{4}$$

$$\hat{p}_2(\omega) > \hat{r}_2(\omega) \tag{5}$$

The expected payoff of war depends on the probability and utility of victory and defeat, and the inefficiencies present in fighting. Fey and Ramsay normalize utility to be 1 for victory and 0 for defeat, and they assume a cost of war to each state i of $c_i(\omega) > 0$. The expected utility of war is thus $\hat{p}_i(\omega) - \hat{c}_i(\omega)$, where $\hat{c}_i(\omega) = E[c_i|P_i(\omega)]$. The expected utility of negotiation is $\hat{r}_i$.

n.b. - Neither the expected payoff of war nor the expected outcome of negotiations depends on the choice of actions by the two states: "we exclude the possibility of gaining an advantage by surprise attack or making threats in order to gain bargaining leverage" (744).

As discussed above, Fey and Ramsay assume that both players must "stand firm" for war to occur, which they formalize as a requirement that there exist some action $\tilde{a}_i \in A_i$ such that if player i's opponent chooses to stand firm the outcome will be a settlement. They think that dropping this mutuality would render the concept of mutual optimism meaningless (745). As we will see, Slantchev and Tarar (2011) will press them on this point.

Define a game as a mapping from players' choices into outcomes. Define a strategy as a mapping of player types into choices. Without loss of generality, define a new mapping $r(\omega)$ that is a composition of the game-form mapping and the strategy mapping. By construction, this mapping captures both of Powell's (1999) conditions for a peaceful settlement: it will be an equilibrium to a bargaining game and represents the underlying balance of power.

Define the states' (pure) strategies $s_i \in S_i$ as a function $s_i : \Omega \to A_i$, with the restriction that if a state cannot distinguish two states of the world, its action must be the same in both situations (formally $P_i(\omega) = P_i(\omega') \Rightarrow s_i(\omega) = s_i(\omega')$).

Finally, let F be the set of states for which the outcome of the game is war. If F is non-empty for some strategy profile (s_1, s_2), then this is a strategy profile in which war occurs. Let G denote any strategic form game of incomplete information that satisfies the preceding assumptions on information structure, payoffs and strategies.

Results

Theorem 1 Suppose states ("countries") have a common prior, war is a public event, and P_i is partitional for i = 1,2. Then there is no Bayesian Nash equilibrium of G in which war occurs.

Sketch of the Proof: If we suppose that there *is* a strategy profile (s_1^*, s_2^*) that is a BNE in which war occurs, states will prefer to deviate to action $\tilde{a}_i$ because they would then receive a payoff of $\hat{r}_i(\omega)$. Because each state knows that the other is optimizing in equilibrium, they know that their opponent is only going to be willing to fight in states where the first player is likely to lose. The conjectured equilibrium is thus susceptible to an unraveling process analogous to the dice game between Bob and Alice.

According to the authors, Theorem 1 shows that "there cannot be an equilibrium in which both sides think they are better off fighting, and as a result, go to war" (746). They argue that this theorem subsumes Wittman's (1979) mutual optimism argument as a special case, and they argue that their result is robust to changes to the sequence of moves, making them either simultaneous or sequential. They close with an alternate formulation of Theorem 1: "if war is common knowledge when it occurs, it cannot occur because of mutual optimism".

In the remainder of the paper, the authors relax the condition of strict rationality by introducing cognitive biases, specifically inattention and a selective bias against bad news. They argue that even in the presence of these cognitive biases, the result in Theorem 1 still holds. They model cognitive biases with nested information sets, while preserving the assumption of non-deludedness.

Definition 5: Nestedness A player's possibility correspondence is *nested* if for all ω, $\omega' \in \Omega$, either (1) $P_i(\omega) \cap P_i(\omega') = 0$ or (2) $P_i(\omega) \subseteq P_i(\omega')$ or (3) $P_i(\omega') \subseteq P_i(\omega)$.

Theorem 2 Suppose countries have a common prior, war is a public event, and P_i is nondeluded and nested for $i = 1, 2$. Then there is no Bayesian Nash equilibrium of G in which war occurs.

Sketch of the Proof: As above (Theorem 1). In the appendix, Fey and Ramsay show that if we relax either of the two conditions in Theorem 2, the result does not hold and there do exist situations in which both states choose to fight in equilibrium because of their private information (mutual optimism).

The authors' final model relaxes the common priors assumption. Building on Smith and Stam (2004), they identify an interesting relationship between common-prior models with boundedly rational players (Theorem 2) and models with noncommon priors and fully rational players. Specifically, the same constraints that non-rationality imposed on the possibility correspondences of each state implies bounds on exactly how "non-common" prior beliefs can be.

Definition 6: Non-Common Priors A game $G' = (\Omega', A, \mathbb{P}, u', \Pi')$ is strategically equivalent to a game $G = (\Omega, A, \mathbb{P}, u, \Pi)$ if there is an onto [surjective] function $\varphi : \Omega' \to \Omega$ such that for every state [of the world] $\omega' \in \Omega'$, $E[u'(a_i, a_{-i}|P'_i(\omega')] = E[u'(a_i, a_{-i}|P_i(\varphi(\omega'))]$.

n.b. - If, like me, you need a quick 'refresher' on surjective functions, this is pretty good: https://en.wikipedia.org/wiki/Surjective_function

First, they consider a game with nonpartitional information and show that there exists a strategically equivalent analogue in the noncommon priors framework.

Proposition 1 For any finite game $G = (\Omega, \pi, A, u, \mathbb{P})$ with nonpartitional information structure and a common prior, there exists a game $G' = (\Omega', \pi, A, u', \mathbb{P}')$ that has a common state space Ω', noncommon priors $\Pi = (\pi_1, \pi_2)$, utility functions u', and a partitional information structure $\mathbb{P}'$, and is strategically equivalent to G.

Sketch of the Proof: omitted to keep our heads from exploding (749).

Next, they consider a game with noncommon priors and partitional information and show that there exists a strategically equivalent game with common priors and a generalized information structure.

Proposition 2 For any finite game $G = (\Omega, \pi, A, u, \mathbb{P})$ with nonpartitional information structure and a noncommon prior $\Pi = (\pi_1, \pi_2)$, there exists a game $\hat{G} = (\hat{\Omega}, \hat{\pi}, A, \hat{u}, \hat{\mathbb{P}})$ that has a common state space $\hat{\Omega}$, a common prior $\hat{\pi}$, utility functions $\hat{u}$, and a nonpartitional information structure $(\hat{\mathbb{P}})$ that is strategically equivalent to G.

Sketch of the Proof: omitted to keep our heads from exploding (though this one is not as rough as Proposition 1).

Discussion

On the basis of these results, Fey and Ramsay conclude that prior models have inadvertently locked players into war through misspecification of the extensive form of the game. War, in other words, is a consequence of arbitrary and unwarranted modeling restrictions (on the game tree and on available actions) rather than a result of mutual optimism.

A general theme of this paper is that it takes two to tango. For a war to be caused by mutual optimism, Fey and Ramsay imagine that both players must choose to fight in equilibrium entirely on the basis of their private information. This seems like an unrealistic way to understand mutual optimism. I also wonder about the assumption of common priors. If we consider an iterated version of this game, priors would only become common in the event of war. We can imagine a scenario where decades of peace could lead to wildly conflicting estimates of military power among the contending parties, making peace less likely.

This article seems to exemplify the risks of importing models from economics without considering their applicability. We have some reasons to think that the economics literature on efficient exchange might not be a good fit for crisis bargaining. The literature cited by Fey and Ramsay (Aumann 1976, Milgrom and Stokey 1982, Rubinstein and Wolinsky 1990, Sebenius and Geanakoplos 1983, Tirole 1982) mostly seems to use complete-information models.

Fey and Ramsay (2007) seems vulnerable to an existence proof. After all, it is a categorical assertion that mutual optimism cannot occur, not simply an argument that it is unlikely or irrelevant. One well-attested case of a war caused by mutual optimism would seem to be enough to cause the argument in this paper to unravel. The idea that we might use *logical* impossibility to understand human motivation seems misplaced, even on strict rationalist assumptions. This is ironic in light of the authors' criticism of standard crisis-bargaining models, because they argue that these models similarly rule out particular actions by construction.

To my mind, the most interesting result in this paper is the equivalence between non-common priors and bounded rationality. If not spurious, this finding says something profound about the extent to which the assumption that other people are reasonable enables us to share a common picture of the world.

Slantchev and Tarar 2011

Slantchev and Tarar (2011) show that Fey and Ramsay's model would not allow for war even in situations where war should occur given the complete-information payoffs. This gives us some reason to think that the presence or absence of mutual optimism may not be driving their result. Slantchev and Tarar go on to demonstrate that the absence of war in the Fey and Ramsay model is an artifact of their decisions to allow one actor to impose peace on terms that are worse than the other side's expected payoff from war and their decision to rule out improving the terms of settlement through brinksmanship (crisis behavior).

An Alternative: The (Modified) Standard Model

Slantchev and Tarar propose that we might better understand the role of mutual optimism in war onset by using a version of Fearon's (1995) ultimatum crisis bargaining model with some status-quo division of the good $(d, 1-d)$, where players S and D divide shares of some good such that D obtains $d \in [0, 1]$ and S obtains $(1-d)$. Call a state "satisfied" with the status quo if its status quo payoff is at least as high as its payoff from war, and "dissatisfied" otherwise. If both states are satisfied, there will be no war. At most one of these players can be dissatisfied (Powell 1999). Supposing D to be the dissatisfied player, we have a crisis in which war can only be avoided by revising the status quo in D's favor. S moves first, and will make an offer of $(y, 1-y)$.

In the case of complete information, there exists a subgame-perfect equilibrium in which D accepts any $y \geq p - c_D$, and S offers exactly $y' = p - c_D$. War will not occur. With incomplete information, the authors modify Fearon's assumption of uncertainty over the costs of fighting to an analogous uncertainty over military capabilities. Considering a two-type case with asymmetric information regarding these capabilities, the authors arrive at the following proposition, which they call the Risk-Return Tradeoff result:

Proposition 1: Risk-Return Tradeoff In all PBE, D accepts any $y \geq y_h = p_h c_D$ if strong, any $y \geq y_w = p_w c_D$ if weak, and rejects any other offer. The offer S makes depends on the critical belief threshold, $k = \frac{p_h - p_w}{p_h - p_w + c_D + c_S} \in (0, 1)$, as follows:

1. if $q > k$, then S offers y_h, which D always accepts;
2. if $q \leq k$, then S offers y_w, which D accepts if weak but rejects if strong.

Slantchev and Tarar point out that this result of war due to incomplete information could easily be construed as war caused by mutual optimism. They define optimism as confidence that one is facing the weak type $(q < k)$. Maintaining the assumption of asymmetric information, they assume that a player (D) who knows his type will be optimistic when he is strong and pessimistic when he is weak. Consider that as defined here, war will not occur unless both sides are optimistic. They thus conclude that mutual optimism is a necessary and sufficient condition for war in this "standard" model.

Table 1 Optimism and War in the Standard Model

	D pessimistic (weak, p_w)	D optimistic (strong, p_h)
S pessimistic ($q > k$)	peace (S offers y_h, D accepts)	peace (S offers y_h, D accepts)
S optimistic ($q \leq k$)	peace (S offers y_w, D accepts)	war (S offers y_w, D rejects)

In the course of their article, Slantchev and Tarar identify problems with five claims made by Fey and Ramsay, and rebut each of them in turn.

War *Is* a Mutual Act

Slantchev and Tarar argue that Fey and Ramsay have improperly conceptualized peace. Recall that Fey and Ramsay say that both sides must "stand firm" for war to occur, and that they further argue that the standard model does not allow for this. But notice that in the standard model, war can only occur if S chooses to make a limited offer, which carries some positive risk of rejection and therefore war. This implies that war in the standard model is a mutual act.

Mutual Optimism *Is* Relevant for the Occurrence of War

As we saw above, Fey and Ramsay argue that the standard model cannot involve mutual optimism because it allows for states to unilaterally start wars. In light of the last section, it is clear that if war is indeed a mutual act, Fey and Ramsay are incorrect that the standard model cannot give an account of mutual optimism.

The Risk-Return Trade-Off: ¬ An Alternative to Mutual Optimism

Fey and Ramsay conceptually distinguish the risk-return tradeoff from mutual optimism, calling the former the result of "inconsistent expectations" and the latter the result of "inconsistent beliefs" (738). Slantchev and Tarar argue instead that the risk-return tradeoff is the mechanism through which mutual optimism causes war. "High expectations about war (because she believes D is likely weak) cause S to forsake the strategy that guarantees peace and to make a limited offer, which she is fully aware carries a risk of war, to D. High expectations about war cause D to reject this offer even though he is fully aware that doing so will result in war. Thus, when MO is present, the actors engage in specific behaviors and their interaction ends in war" (140).

Players *Can* Be Optimistic "On the Eve of War"

Recall that Fey and Ramsay were unsatisfied with existing models because they allow for regret after bargaining but before war. This would seem to undermine the mutual optimism explanation for war because players are in fact *not* optimistic when war begins. In the standard model, for example, once D has rejected any offer, S knows for sure that she is facing the strong type, and that she is thus less likely to prevail in war. Calling this optimism seems wrong.

Slantchev and Tarar acknowledge that this "buyer's remorse" is a feature of the two-type standard model, but they demonstrate that in a model with than two types this post-negotiation regret evaporates while the mutual optimism results hold. Consider a variant of the standard model where D can be either weak, p_w, moderately strong, p_m, or very strong, p_h, with $p_h > p_m > p_w$. S is unsure which type she is facing, but believes that her opponent is strong with probability $q_h \in (0,1)$, moderate with probability $q_m \in (0,1)$, and weak with probability $1 - q_m - q_h \in (0,1)$. They argue that the following proposition establishes that mutual optimism will cause war through the risk-return trade-off mechanism in this model as well:

Proposition 2: Mutual Optimism with Three Types In all PBE, D accepts any $y \geq y_h = p_h - c_D$ if very strong, any $y \geq y_m = p_m - c_D$ if moderately strong, any $y \geq y_w = p_w - c_D$ if weak, and rejects any other offer. The offer S makes depends on the critical belief thresholds:

$$k_1 = 1 - q_m\left(1 + \frac{C}{p_m - p_w}\right)$$
$$k_2 = \frac{p_h - p_m}{p_h - p_m + C}$$
$$k_3 = \frac{p_h - p_w - q_m(p_m - p_w + C)}{p_h - p_w + C}$$

where $C = c_D + c_S$, as follows:

1. if $q_h > max\{k_2, k_3\}$, then S offers y_h, which D always accepts;
2. if $q_h < min\{k_1, k_3\}$, then S offers y_w, which D accepts only if weak;
3. if $k_1 < q_h < k_2$, then S offers y_m, which D accepts only if weak or moderately strong.

War occurs if and only if S is sufficiently optimistic and D sufficiently strong.

Sketch of the Proof: Observe that if p_h accepts some offer y, then so will p_m and p_w, and if p_m accepts some offer, then so will p_w. This means that S will never have a reason to offer $y' < y_w$, so we need only consider her preferences among these three offers. Ignoring knife-edge conditions, we can show that S prefers y_w to y_m when $q_h < k_1$, prefers y_m to y_h when $q_h < k_2$, and prefers y_w to y_h when $q_h < k_3$. Conditions (1), (2), and (3) follow.

War Is *Not* an Artifact of Arbitrary Restrictions on the Game-Tree

Responding to a conjecture by Fey and Ramsay that in the standard family of models at least one player enters war with regret (the "hotline" argument (751)), Slantchev and Tarar propose amending the standard model to allow for a reintroduction of the bargaining procedure by S after D has chosen to fight. They derive the following proposition:

Proposition 3: Bargaining with Mulligans Every subgame-perfect equilibrium of the modified infinite-horizon game is peaceful and the status quo is never revised.

Sketch of the Proof: Because war can only occur if S lets D's rejection stand, S must prefer her expected war payoff to the status quo. But recall that S is the "satisfied" player, defined as preferring the status quo payoff to the war payoff. Therefore there can be no war.

n.b. Although I'm sympathetic to the motivations for this critique, I'm not sure it fully addresses Fey and Ramsay's objection. I think the ability to know that you're facing the tough type entirely on the basis of rejection *is* a shortcoming of the standard model. Truths are revealed on battlefields, not in the outcome of negotiations. The result that one player always enters war with regret is an artifact of the artificial distinction between negotiation and war that we make for modeling purposes. As von Clausewitz would remind us, these are two sides of a single coin. Slantchev and Tarar address these inherent shortcomings of the standard model (143).

Why War Does Not Occur in the Fey and Ramsay Model

Slantchev and Tarar point out that despite considering an entire class of models, Fey and Ramsay never give a specific example of an actual model that meets their requirements. Slantchev and Tarar construct one, and demonstrate that Fey and Ramsay's result is an artifact of their assumption that one side can (unilaterally) impose peace terms that the other side finds worse than war.

Consider two states S and D engaged in crisis bargaining, with only two actions available to them: "stand firm" (F) and "negotiate" (N). As we have said several times, Fey and Ramsay believe that both sides must choose F for war to occur. Assume that the remaining strategy profiles have identical payoffs. Specify a state's war payoff $W_i(\omega) = p_i(\omega) - c_i(\omega)$. Importing the rest of Fey and Ramsay's model considered above, we can populate the following table:

FIGURE 1 Fey-Ramsay's Basic Model

		D: N	D: F
S	N	$r_S(\omega), r_D(\omega)$	$r_S(\omega), r_D(\omega)$
	F	$r_S(\omega), r_D(\omega)$	$W_S(\omega), W_D(\omega)$

Supposing only one state of the world ω_1, and $p_i(\omega_i) = \frac{1}{2}$ and $c_i = \frac{1}{4}$, so that $W_i(\omega_1) = \frac{1}{4}$. Assume that bargaining is efficient and that $r_i(\omega_1) = \frac{1}{2}$, so both actors prefer negotiated settlements to war (Figure 2a). Fey and Ramsay's finding appears to hold: (F, F) is not a Nash equilibrium.

FIGURE 2 Parameterized Specifications of Fey-Ramsay's Model

S \ D	N	F
N	1/2, 1/2	1/2, 1/2
F	1/2, 1/2	1/4, 1/4

(a) State of the world is ω_1.

S \ D	N	F
N	4/5, 1/5	4/5, 1/5
F	4/5, 1/5	1/4, 1/4

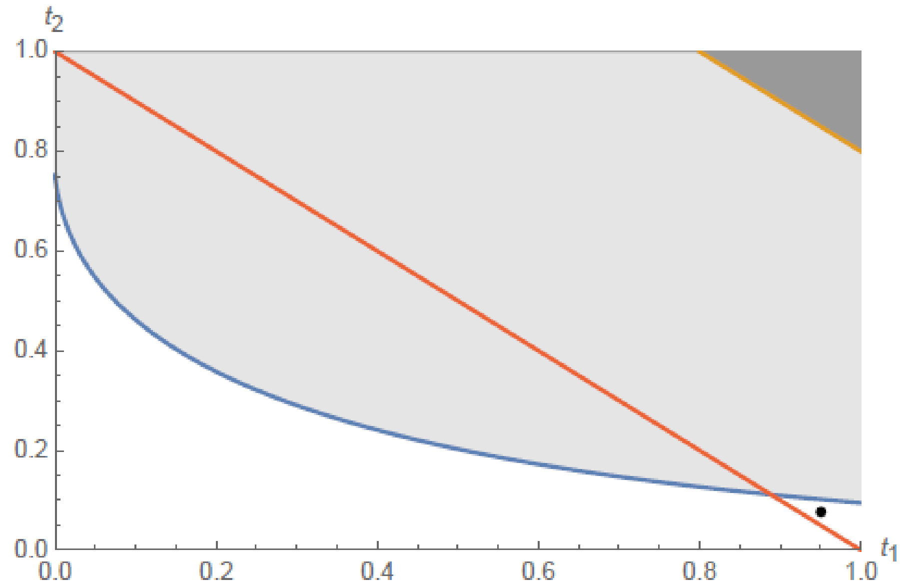
(b) State of the world is ω_2

But suppose we change the payoff to a negotiated settlement and make it asymmetrical: $r_S(\omega_2) = \frac{4}{5}$, and $r_D(\omega_2) = \frac{1}{5}$. We can easily see that (F, F) is not a Nash equilibrium. Slantchev and Tarar point out that war should occur in this scenario because D is accepting a peace settlement that is strictly worse that what he could gain by fighting. They conclude that the model "artificially precludes war through structural assumptions that have nothing to do with information or mutual optimism" (145).

Fey and Ramsay 2016

In a response to Slantchev and Tarar (2011), Fey and Ramsay (2016) examine what would happen to Slantchev and Tarar's model if they reintroduce incomplete information for the second player. They find that "[e]ven very small amounts of private information for the second country in the crisis bargaining game undoes their result that mutual optimism is necessary and sufficient for war" (3). They then examine three different ways of conceptualizing mutual optimism, and they find that mutual optimism is either not necessary for war, not sufficient, or both.

"the conclusion of Slantchev and Tarar (2011) that mutual optimism is both necessary and sufficient for war in their model is a very special and non-robust case given their definition of 'mutual optimism'...Moreover, we show that if we take their model with one-sided incomplete information and add an arbitrarily small amount of private information to the second side, the conclusion that mutual optimism is necessary and sufficient for war no longer holds. This fact is important because it means we cannot interpret the Slantchev and Tarar (2011) results as an approximation of a mutual optimism model with 'almost' one-sided incomplete information" (4).



Grey region is the set of type pairs that go to war. The dark grey region are the type pairs that are mutually optimistic with respect to war payoffs. All points above the line $1 - t_1$ are those where the two sides' expected probabilities of victory sum to more than one, and therefore they are mutually optimistic with respect to the probability of victory in war. At the type pair $(.95, .075)$, marked by the black dot, countries are mutual optimistic regarding the probability of winning, but there is no war.

Figure 3: Type pairs that go to war.