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High valuations, uncertainty, and war

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Abstract

Many theories of war predict conflict becomes more likely as a state increasingly values the prize at stake. This article showcases an important limit. If—as in many cases—a state has uncertainty over its opponent's material cost of fighting, then increasing the opponent's valuation can decrease the probability of war. Why? Uncertainty condenses the various types' reservation values, reducing the peace premium and incentivizing a proposer to make safer offers. We also recover an analogous result under some conditions with uncertainty over power. The results indicate that higher valuations of the prize do not have a clear-cut relationship with the probability of war.

Keywords

War, uncertainty, resolve, bargaining

Introduction

According to classic crisis bargaining theory, war is more likely as states increasingly value the issue at stake. These valuations take on many forms: some states prize territorial expansion more than others; some states favor an ideologically similar neighbor more than others; and some states rely on natural resource rents more than others.[1] Across these cases, the general intuition is that larger prizes increase a state's willingness to fight for it, causing more war.

Standard bargaining models of conflict seem to support this idea. As an opponent's valuation of the prize increases, it internalizes fewer costs of war, shrinking the bargaining range. This makes states more inclined to start wars over commitment problems (Powell, 2006). It also appears that a proposing state has less incentive to make safe demands under uncertainty given that there is less surplus for it to steal.

In this article, we identify an important limitation to this logic. If a state has uncertainty over its opponent's material costs of fighting, we show that increasing the opponent's valuation of the prize can *decrease* the probability of war. Such uncertainty is common in crisis bargaining. For example, opponents may have private information about their price to produce weapons, develop military innovations (Biddle, 2004), procure external assistance (Salehyan, 2009), recover from battlefield injuries (Fazal, 2014), or replace lost trade opportunities (Spaniel and Smith, 2015). Related to these motivations, uncertainty over power also causes uncertainty over material costs if the destructiveness of war for one side depends on its probability of victory.

Understanding why increasing valuations lowers the risk of war requires thinking about some second-order consequences. An extreme example illustrates the intuition behind the model. Suppose an opponent has an arbitrarily large valuation of the good at stake. Paying any material cost of war to gain this prize is overshadowed by its perceived worth, regardless of whether the material costs are large or small. As a result, a proposing state prefers to offer its expected share of the prize to avert war. We show that this idea extends to less extreme circumstances. As an opponent's valuation rises, the proposer faces a smaller peace premium. That is, the amount it must overpay lower utility types to induce acceptance from higher utility types decreases. This makes safer demands look more attractive, thereby increasing the probability bargaining succeeds and peace prevails.

Our model's underlying mechanism most closely matches findings from Arena (2013), Reed (2003), and Spaniel and Malone (2019). Each of these articles examines how increasing a peace premium raises the probability of war. Arena (2013) shows that perfectly observed investments in arms with uncertainty over the

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effectiveness of those armaments can distort the premium in either direction. Reed (2003) compares a direct-type space of military strength. Lastly, Spaniel and Malone (2019) find that increasing a state's cost of war when its resolve is unknown counterintuitively raises the likelihood of conflict. We advance this line of research by identifying an alternative consequence of peace premiums in bargaining models of war.

Beyond identifying how peace premiums change, this article makes two other contributions to crisis bargaining and conflict research. First, it presents a more nuanced interpretation of bargaining behavior. We build on the approach undertaken by Benson et al. (2016) to adapt the standard bargaining model of war to better reflect commonly observed behaviors. The end result is a more refined model that helps resolve discrepancies between observable cases—where rising valuations did not produce an increase in war—and existing theoretical models. By isolating a previously ignored parameter, we generate new comparative statics that change the standard interpretations of crisis bargaining models. Second, this article shows how different sources of uncertainty affect bargaining dynamics (Fey and Ramsay, 2011). Although scholars often treat uncertainty as a monolithic mechanism for war, we demonstrate that a failure to trace the effects of different types of uncertainty can lead to inaccurate predictions about the probability of conflict.

The central mechanism

Two states, A and B, are in a dispute over some good, which A values at $V_A > 0$ and B values at $V_B > 0$. Nature begins the game by drawing B's material cost of war from the distribution $F(c_B)$, with bounds $\underline{c}_B > 0$ and $\overline{c}_B > \underline{c}_B$. We assume that it is strictly increasing and continuously differentiable with probability density function $f(c_B)$ and that the hazard rate $\frac{f(c_B)}{1-F(c_B)}$ is weakly increasing.[2] B observes this value, but A only has the prior belief. Play begins with A demanding $x \in [0,1]$ to B, where x represents a percentage of the good that A keeps. If B accepts, they divide the good accordingly. Thus, A's payoff is xV_A and B's payoff is $(1-x)V_B$.

If B rejects, the states fight a war. A wins with probability $p \in [0,1]$ and B wins with probability $1-p$. Fighting costs A the value $c_A > 0$ while B pays the quantity drawn earlier. Thus, A overall earns $pV_A - c_A$, and B receives $(1-p)V_B - c_B$, with c_B the placeholder for nature's drawn value.

For most research questions, we would next exploit the properties of expected utility theory by making a positive affine transformation to standardize the value of the good at 1. This is why existing work describes such V values as the actor's resolve.[3] However, building on a growing set of models (Arena, 2013; Fearon, 1997; Slantchev, 2005; Spaniel and Malone, 2019; Wolford, 2014), we do not make this transformation. If we did, taking a comparative static on the value would conflate a change of that value and a change in the source of uncertainty. In contrast, we want to isolate the effect of an increase in B's valuation. This is important to distinguish how the peace premium changes, which determines how the opponent responds to uncertainty over material costs.

We now solve for the game's perfect Bayesian equilibrium. For the initial results, we avoid corner solutions where a type of B has a negative value for war.[4] The following proposition gives the game's equilibrium:

Proposition 1. *The game has a unique equilibrium. A demands the unique solution to*

$$\frac{1}{V_B\left(x-p+\frac{c_A}{V_A}\right)} = \frac{f\left(V_B(x-p)\right)}{1-F\left(V_B(x-p)\right)} \text{ if } \frac{1}{\frac{V_B c_A}{V_A}+\underline{c}_B} < f\left(\underline{c}_B\right)$$

and $x = p + \frac{\underline{c}_B}{V_B}$ *otherwise.*

See the Online Appendix for all proofs. The intuition follows the standard risk-return logic. State A would like to minimize the likelihood of war, but it also wants to maximize how much it extracts from its opponent in negotiations. These incentives run in opposite directions. The more A demands, the better the deal it receives. The problem is that low cost types reject large demands. Consequently, A chooses its demand to optimize the trade-off between a higher risk for war and a better share of the settlement.

Building on this, we next assess how increasing valuations affects the probability of war. We start with a benchmark case where we increase B's valuation in isolation. In practical terms, this can occur if domestic political considerations change one state's valuation but not the other (Bennett and Stam, 1996: 248).

If we restricted our focus to the first-order effects, we would expect this to lead to an increase in conflict. After all, a generic type of B accepts whenever $x \leq p + \frac{c_B}{V_B}$. Increasing V_B therefore makes B reject a wider range of demands. Nevertheless, a second-order effect dominates:

Proposition 2. *The probability of war weakly decreases in V_B. Moreover, the probability of war is 0 for $V_B > \left(\frac{V_A}{c_A}\right)\left(\frac{1-F(\underline{c}_B)}{f(\underline{c}_B)} - \underline{c}_B\right)$.*

As previewed, peace premiums drive the result. State A considers whether to make a safer or riskier demand based on how much it overpays a high cost type to induce a lower type's compliance. For any two types, this is simply the difference between their reservation values. Let $c_B'' > c_B'$. Then the difference equals $1-p-\frac{c_B'}{V_B}-\left(1-p-\frac{c_B''}{V_B}\right)$, or $\frac{c_B''-c_B'}{V_B}$. Thus, increasing V_B decreases the necessary overpayment. With the peace premium lower, A prefers making a safer demand.

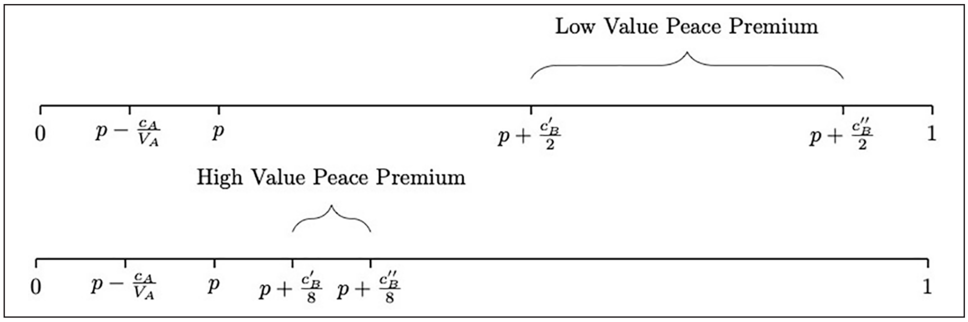

Figure 1. Peace premiums for B with a low valuation and a high valuation.

Figure 1 visualizes the result. When B has a low valuation (e.g., $V_B = 2$), the premium is large. Thus, inducing the lower cost type to accept requires a massive overpayment to the higher cost type. When B has a high valuation (e.g., $V_B = 8$), the premium is small, and so A is more willing to make a safer demand. In fact, as V_B goes to infinity, the game converges to a complete information case where all types put zero weighting on whatever their cost may be. As a result, a finite value V_B exists that guarantees that the probability of war drops to zero.

These results are worth comparing with previous findings that connect high resolve and uncertainty to war. In many models with uncertainty over resolve, higher resolved types fight at least as often as lower resolved types (e.g., Wolford, 2007). Indeed, Fey and Ramsay (2011) prove that this is a *requirement* of any equilibrium in a traditional crisis bargaining game. The key difference is that we are not making a comparison across types. Rather, this is a traditional comparative static. Increasing a state's commonly known valuation causes a decrease in the probability of war.

The utility of our approach is that it better reflects real-world conditions. Relative valuations are often public, but costs of fighting are not. For example, observable characteristics about regime instability, disputed territorial claims, or resource shocks are, by nature, common knowledge sources of information. At the same time, a state's ability to mitigate the costs of fighting might still be private information. This nuance allows us to draw out unexplored consequences in a common scenario.

Extensions and robustness checks

This section explores extensions to the above model and assesses the robustness of our result. It provides greater insight into how changing peace premiums shape the risk of war.

Extremely low value cases

The first extension considers the situation where V_B is low enough that some B types have a negative value for war. When all types have negative values, A just demands the entire prize while still persevering with the peace. If V_B is

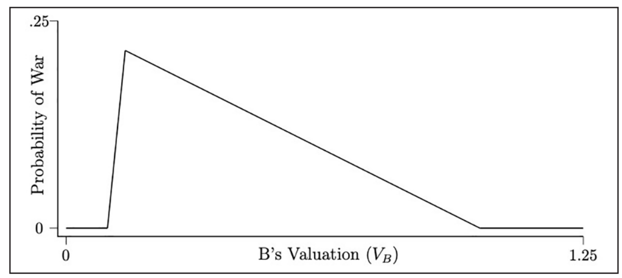

Figure 2. The probability of war as a function of V_B for a uniform distribution.

slightly larger such that a small portion of types have a positive war value, A still demands the entire prize, though this entails a positive probability of rejection. Consistent with the above mechanism, the probability of war therefore now increases because the peace premium between the higher cost types and the lower cost types increases.[5] Eventually, A's optimal demand shifts into the interior, and Proposition 2's logic takes hold. Thus, as Figure 2 illustrates, the overall relationship is nonmonotonic.[6]

Joint changes to valuations

As a second extension, we consider what happens when there are increases in both A's and B's valuation of the good. In practical terms, this can arise when both parties assign symbolic value to the same disputed territory, or discover valuable resources they must compete over to extract (Mitchell and Prins, 1999; Ross, 2006). It represents an interesting theoretical question because changing A's valuation does not alter any peace premium. Instead, it incentivizes A to take greater risks because A internalizes the cost of war at a lower rate.

The Online Appendix generalizes Proposition 2 under these circumstances, but we can capture the central findings with a simple change to the uniform distribution case featured in Figure 2. Within the interior solution, the probability of war originally equaled $\dfrac{\bar{c}_B - \frac{V_B c_A}{V_A} - 2\underline{c}_B}{2(\bar{c}_B - \underline{c}_B)}$. To incorporate joint changes, let π represent an underlying value parameter. Then we can rewrite each actor's valuation as $V_i(\pi)$, which are strictly increasing and continuously differentiable functions that need not be identical. The probability of war now equals $\dfrac{\bar{c}_B - \dfrac{V_B(\pi)c_A}{V_A(\pi)} - 2\underline{c}_B}{2(\bar{c}_B - \underline{c}_B)}$. Taking the derivative with respect to π, the probability of war decreases if $V_B'(\pi)V_A(\pi) > V_B(\pi)V_A'(\pi)$.

To better understand why this emerges, consider the special case where both valuations increase at identical rates, such that $V_A'(\pi) = V_B'(\pi)$. Substituting, the cutpoint becomes $V_A(\pi) > V_B(\pi)$. The probability of war decreases if A's initial valuation is larger than B's. This is because adding more value barely changes how A internalizes its costs if its valuation is already enormous. But it does substantially collapse B's type space if B's valuation is small to start. However, as the full cutpoint shows, peace can still become more likely when B has the larger initial valuation. It just requires that B see a sufficiently larger increase to the valuations than A.

Uncertainty over power

As a final extension, we evaluate whether uncertainty over power yields the same finding. Traditionally, models with uncertainty over power keep the cost of war constant across types in order to model differences in the probability of victory (Arena, 2013; Fey and Ramsay, 2011; Reed, 2003). However, this source of uncertainty is often tied to uncertainty over the costs of war. For example, a higher probability of winning could imply that the opposing side is more likely to lose more of its soldiers and infrastructure.

To examine whether changing the source of uncertainty changes the main result, we compare the set of acceptable offers across types with different probabilities of victory. Let $\bar{p}$ be A's probability of victory for a weaker type $\bar{c}_B$, and let $\underline{p}$ be A's probability of victory for a stronger type $\underline{c}_B$. For the stronger type to accept, the offer requires giving $1 - \underline{p} - \frac{\underline{c}_B}{V_B}$. In contrast, the weaker type would accept only $1 - \bar{p} - \frac{\bar{c}_B}{V_B}$. Thus, the premium equals $\bar{p} - \underline{p} + \frac{\bar{c}_B - \underline{c}_B}{V_B}$.

As a result, whether increasing V_B increases or decreases war depends on whether uncertainty over power or uncertainty over material costs is the greater bargaining friction. For example, when $\bar{c}_B = \underline{c}_B$, changing V_B results in no change to the peace premium. But it does decrease the surplus that A can extract, which makes riskier demands look more attractive. However, when $\bar{p} = \underline{p}$, we revert back to the original model where Proposition 2's logic reigns. In sum, if slight differences in the probability of victory result in great differences in B's potential costs for war, then increasing V_B reduces the probability of war. The logic flips when differences in power values have little impact on the cost of war. We show this using a simple two-type extension in the Online Appendix.[7]

Discussion and empirical implications

The model advances existing bargaining scholarship by showing an important consequence of uncertainty and high stakes on peace premiums. From a theoretical perspective, our model provides a more nuanced take on how increasing valuations can shape patterns of peace and conflict. We do not dispute that war can sometimes become more likely as states increasingly value the issue at stake. Indeed, the extensions identify conditions where we expect parties risk overreaching and demanding too much.

However, our theory implies the risks of conflict can change upon the introduction of a particular information problem—uncertainty over material costs—and its interaction with the high stakes situation. These results imply we might have less to worry about in crisis bargaining with high stakeholders than conventional wisdom expects. For example, secrecy surrounding the North Korean regime's missile development program may not be as war-inducing as it may appear given the high stakes surrounding negotiations.

The central mechanism further helps resolve lingering discrepancies on the causes of resource and regime conflicts. For example, there are mixed findings about whether highly resolved leaders increase the probability of conflict (Dafoe and Caughey, 2016; Wolford, 2007) or increase the probability of ending it (Croco, 2011; Stanley and Sawyer, 2009). Relatedly, there are mixed findings about whether more valuable territories increase the risk of conflict (Colgan, 2010; Markowitz et al., 2020; Ross, 2006) or have no effect on it (Bazzi and Blattman, 2014; Zellman, 2018). If the type of uncertainty we analyze is prevalent in the world—or present enough to counteract the conventional wisdom's implication—then such null results are not surprising.

On the empirical side, the central mechanism can help ground assumptions in future two-stage conflict modeling processes. Existing research tends to rely on a set of assumptions that the issues states fight over in first-stage conflict procedures are correlated with how they bargain over these issues in the second stage (e.g., Bartusevicius and Gleditsch, 2019; Lemke and Reed, 2001; Reed, 2000). However, these modeling assumptions can sometimes produce puzzling results that the same factors which cause rivalries to emerge can counterintuitively make war less likely. For example, Lemke and Reed (2001: 466) find increasing the payoff to fighting makes rivalries more common, but "seems paradoxically to make war between rivals *less* likely." Bartusevicius and Gleditsch (2019) similarly find increasing grievance intensity makes mobilization more common, but has no effect on escalation to civil war.

In other research, Hensel and Mitchell (2005) estimate that the marginal effect of increasing the cultural, ethnic, or historical significance of a territory is associated with an 84% increase in the likelihood of de-escalating and reaching a peace agreement. This effect size suggests the interaction effect between high stakes and uncertainty over material costs can dramatically change prospects for peace in a conflict environment. Follow-up studies by Brochmann and Hensel (2011) and Hensel (2017) show the result is robust across a series of different territorial disputes.

Some scholars discount these findings as spurious because there is no theoretical justification for the modeling assumptions that generate this result (Sartori, 2003). However, we take this puzzling result as an opportunity for formal theory to help ground future work on the subject.

From this, our mechanism suggests current bargaining theories might overstate the risk of war between well-known rivals—like Cambodia-Thailand or China-Japan—who dispute symbolic territories in Preah Vihear and the Senkaku/Diaoyu Islands. It might also present more optimism for resolving resource conflicts between state and non-state actors, like in the Niger Delta or Cabo Delgado region. Our findings challenge the notion that more valuable territories breed new conflict. The discovery of oil, minerals, or other resources can incentivize parties to negotiate between resource-sharing agreements as evidenced by discussions between Sudan and the Sudan Liberation Army following the discovery of a new oil deposit in Darfur (Gidley, 2005). These discoveries can change how parties negotiate, improving prospects for peace.

Conclusion

Conventional wisdom expects increasing valuations should consistently increase the risk of war. Our investigation of this claim revealed a key limitation. When a proposing state has uncertainty over its opponent's material costs of war, higher valuations mean that low and high cost types tend to behave similarly. Given this uncertainty, a proposing state has an incentive to make safer demands because it faces a smaller peace premium. With the information problem mitigated, war is less likely to occur.

The model highlights opportunities for additional research on two fronts. First, scholars should continue to compare how different sources of uncertainty affect bargaining behavior. Our work builds on Fey and Ramsay (2011) by showing important differences across uncertainty categories. Second, scholars should further explore how changing the value of the prize affects bargaining behavior. Despite a large set of research on how states fight, scholars still need to develop a set of theories to explain when and why they fight over these issues in the first place. These first-stage selection issues are crucial to understand later bargaining behavior.

Collectively, this model deepens our understanding about how changing valuations shape the risk of conflict. Our finding helps explain the relationship between the stakes of fighting and bargaining behavior. Factors that change a state's valuation of a prize—like the discovery of oil or loss of external support—can have important, but differential, effects on bargaining behavior.

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Notes

1. See, for example, research on the causes of territorial conflict (Abramson and Carter, 2016; Diehl and Goertz, 1992; Shelef, 2016), regime conflict (Keels and Wiegand, 2020; Maoz and Russett, 1993; Owen, 2010), and resource conflict (Colgan, 2010; Markowitz et al., 2020; Ross, 2006; Rustad and Binningsbo, 2012).
2. Assuming increasing hazard rates is common in the crisis bargaining literature (e.g., Fearon, 1995). It also holds for many common distributions (Fudenberg and Tirole, 1991: 267).
3. See Fey and Ramsay (2011), especially footnote 16.
4. Formally, this is $1-p-\frac{\overline{c}_B}{V_B}>0$.
5. That is, the premium for a type that has a positive value for war and a type that has a negative value for war equals $1-p-\frac{\underline{c}_B}{V_B}-0$, which increases in V_B.
6. The parameters depicted are: $p=.5$, $c_A=.05$, $V_A=1$, $\underline{c}_B=.05$, and $\overline{c}_B=.15$.
7. We can also show this by giving power the functional $p+\alpha c_B$, where $\alpha \geq 0$ measures the inter-connectivity between power and costs and $\alpha=0$ recovers the original model. However, increasing α in this setup also shifts the overall balance of power, which obscures whether a change in the probability of war arises from the mechanism we identify or an overall shift in power. The two-type model makes this unambiguous.

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