Web Appendix for "Combatant Fragmentation and the Dynamics of Civil Wars"

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In this web appendix, we supplement the main paper's results (i.e. the "original model") with an expanded analysis of the original model and with additional experiments. The expanded analysis of the original model is presented in Figures 1 and 2, illustrating the effect of a number of additional parameters on the duration of the simulations. Each additional experiment, which can be found in Sections 2 through 11, changes or relaxes an assumption or rule in the original model, and we present the results of these alternative experiments here. Table 1 summarizes the additional twenty-two figures presented in this appendix. Each figure (3 to 22) below is similar to Figures 1 and 2 in the appendix. And the first five experiments in Figures 1 and 2 correspond to Figures 4 and 5 from the main paper. Organizing the results this way should allow for easier comparisons between the figures in the web appendix and those in the paper.

Experiment Number	Description	Figures
0	Expanded Analysis of Model in Paper	1, 2
1	Maximum of 15 Agents	3, 4
2	Maximum of 21 Agents	5, 6
3	All Agents Learn from Battle	7, 8
5	Capabilities Distributed Left Initially (Adaptation)	9, 10
7	Capabilities Distributed Normally Initially (Adaptation)	11, 12
9	Capabilities Distributed Right Initially (Adaptation)	13, 14
10	Coalition Battling	15, 16
11	Coalition Switching 50% of the Time	17, 18
12	Coalition Switching 100% of the Time	19, 20
13	Post Fragmentation Belief Deviation	21, 22

Table 1: Summary of Thirteen Supplemental Models

The web appendix proceeds with a number of sections, the first corresponding to the expanded analysis of the original model from the paper, and each subsequent section corresponding to an additional experiment described in turn. In each of these sections, we present a brief description of how the model was altered, the figures that illustrate the results of the altered model, and any major changes that exist between the results in the paper and those in the altered model.

One important difference between the figures presented in the appendix and those presented in the paper, is that the analysis here is expanded by including the effects of three additional parameters, each set at a "low" and "high" value for a simulation. In the fragmentation analysis presented in the paper, there are five

Parameter	Low Value	High Value
Belief Derivation	0.1	0.9
Battle Updating	0.1	0.9
Negotiation Updating	0.1	0.9

Table 2: Low, Middle, and High Values Additional Subplot Parameter

subplots corresponding to 1) when all parameters are set at their middle values, 2) when the acceptance threshold is set at a high value, 3) when the acceptance threshold is set at a low value, 4) when the maximum possible starting capability of agents is low, and 5) when the maximum starting capability of agents is high. Each of these subplots is also produced in the web appendix as the first five subplots of each figure. In addition, we present six additional subplots representing all other parameters at middle points 1) when the amount of initial belief derivation is low, 2) when the amount of initial belief derivation is high, 3) when the amount of updating that takes place as a result of battle is low, 4) when the amount of updating that takes place as a result of battle is high, 5) when the amount of updating that takes place as a result of negotiation is low, and 6) when the amount of updating that takes place as a result negotiation is high. Table 2 summarizes the "low", "middle", and "high" values of these three additional parameters.

The following list summarizes the key parameters varied in the model.

i, j, f: Agents i and j are the primary agents in conflict. f is a recently fragmented agent.

κ_i: The capability of agent i distributed $0 \leq \kappa_i \leq \delta$.

Π: Terms of a pre- or post-war settlement, where π_i represents the share for i.

δ The maximum starting capability for an agent.

u_k: Random draw from a uniform distribution (subscripted for different draws).

ρ_i: Share of capability distribution for i where $\dot{\rho}_i$ represents the pairwise belief about ρ_i. $\bar{\rho}_i$ represents a belief aggregated across multiple agents.

$\alpha_{i,j}$, $\beta_{i,j}$: i's beliefs about the relative capability of i in relation to j (determine $\dot{\rho}_i$).

ι: Maximum percentage β is allowed to deviate from the actual capability distribution.

ϵ: Maximum amount an offer can be below an agent's belief that the agent still accepts.

χ: The amount added to α or β after negotiations to update beliefs .

ω: The amount added to α or β after battles to update beliefs .

s: Threshold for agent mutation.

λ (μ): Maximum probability that fragmentation (mutation) will take place.

ζ (ψ): Maximum percentage a fragmented (mutated) agent's β changes.

1 Expanded Analysis

This section outlines the expanded analysis of the model with fragmentation presented in the paper. Figure 1 and Figure 2 are expanded versions of Figure 4 and Figure 5 from the paper, respectively. The first five subplots in each of the figures corresponds to the analysis presented in the paper, however, there are an additional six subplots summarizing the effect of three additional parameters on the duration of simulations ending in both settlement and victory.

Figure 1 below presents additional analysis for three additional parameters: belief derivation, battle updating, and negotiation updating. Each of the parameters are set at a low or high value while the maximum probability of fragmentation is allowed to vary between 0.1 and 0.9. The trends in these additional subplots are similar to the trends presented in the paper. First, the duration of simulations ending in settlement generally decrease as a result of an increase in the maximum probability of fragmentation. This is true for all of the additional subplots, although the decrease appears to be somewhat nonlinear. Increases from 0.1 to 0.3 in the maximum probability of fragmentation result in a greater decrease in the duration of settlement simulations than subsequent increases in the maximum probability of fragmentation. The duration of victories seems to decrease as well, although it is more difficult to see consistent patterns, and there are several anomalies to this general trend. It is unsurprising, however, that trends are less clear in the duration of victories given that there are so few victories compared to settlements, and so outlier runs can influence the trends to a greater degree than with settlements.

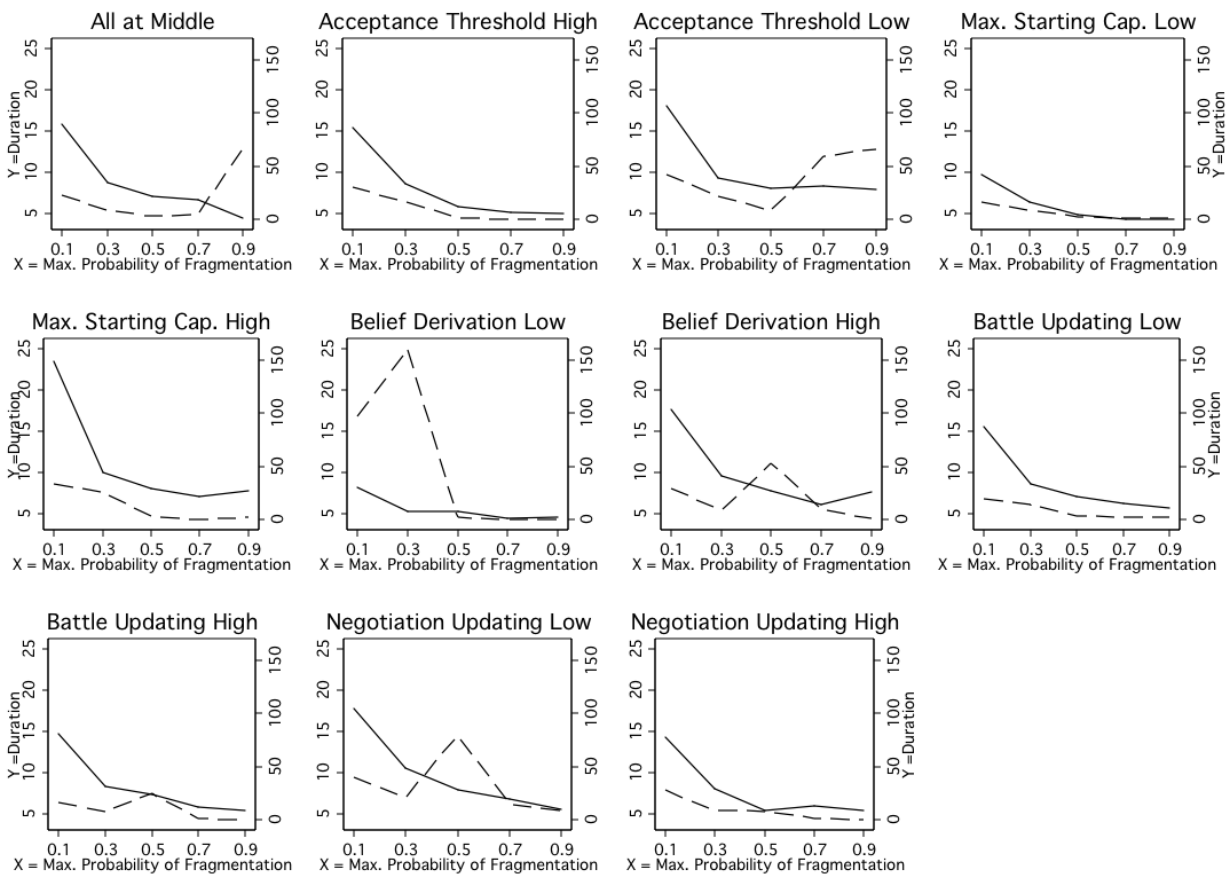

Figure 1: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 2 also illustrates that the general trends are consistent across the additional subplots. In each case, the duration of simulations ending in settlement increases as the amount of change resulting from fragmentation increases. As with Figure 2, there appears to be a similar relationship between fragmentation change and the duration of victories, however, there is much less consistency in these trends across subplots due to how few of the simulations end in victories.

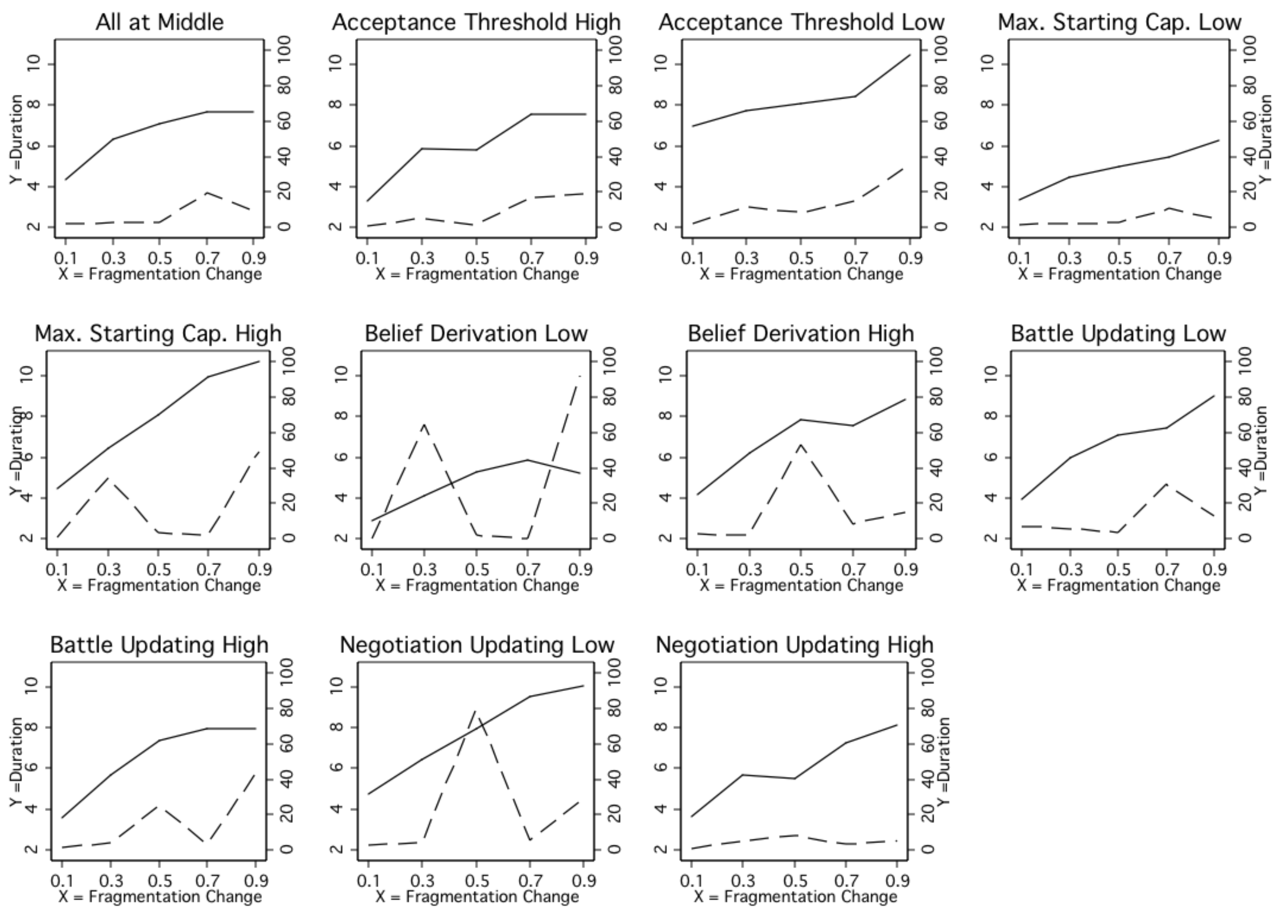

Figure 2: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

2 Maximum of 15 Agents

The model in the paper provides for the creation of additional agents through fragmentation, however, the total number of agents is limited to a maximum of 10. In this additional experiment, the maximum number of agents is allowed to increase from ten to fifteen.

Figure 3 illustrates that even when the maximum number of agents is increased by 50% from the original model, the general relationship between the maximum probability of fragmentation and the duration of simulations ending in settlement remains consistent. As the maximum probability of fragmentation increases, the duration of settlement simulations decreases. There is a bit less consistency across subplots, however, compared to the model in the original paper (see Figure 1). The deviation from the general trend, however, is minor in several subplots (such as when the maximum starting capabilities of agents is high). Simulations ending in victory, however, are less consistent given the small number of runs ending in victory. Indeed, there are several cases where there are no victories, which are indicated by a duration of 0.

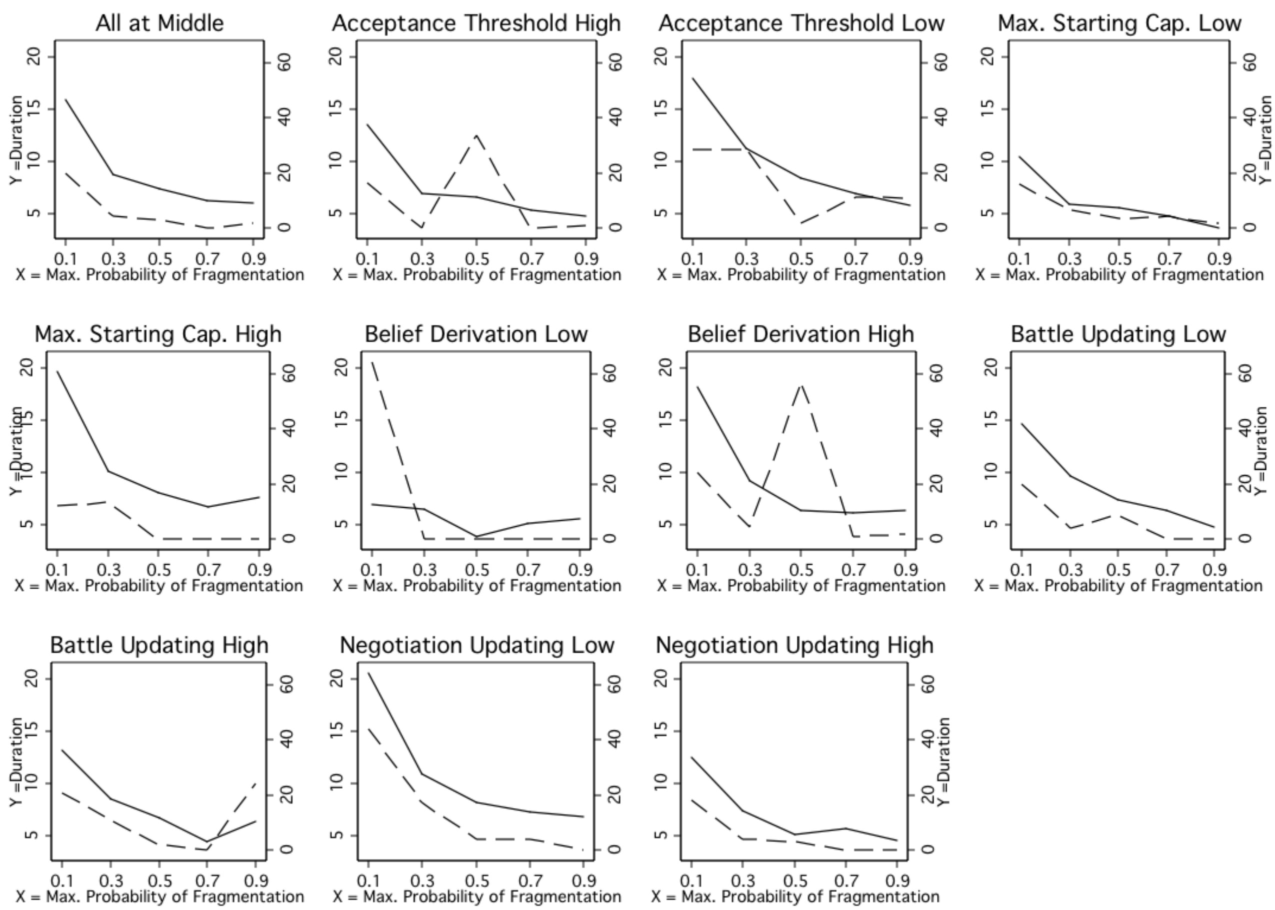

Figure 3: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 4 illustrates the relationship between the amount of change in beliefs as a result of fragmentation and the duration of simulations. Generally, as with the original analysis in Figure 2, as fragmentation change increases, so does the duration of simulations that end in settlement. The relationship between fragmentation change and victory duration remains less clear, partly due to the few cases that end in victory, but also due to the duration outlier in the first subplot which indicates an average duration of victory of 250 when fragmentation change is set at its highest value.

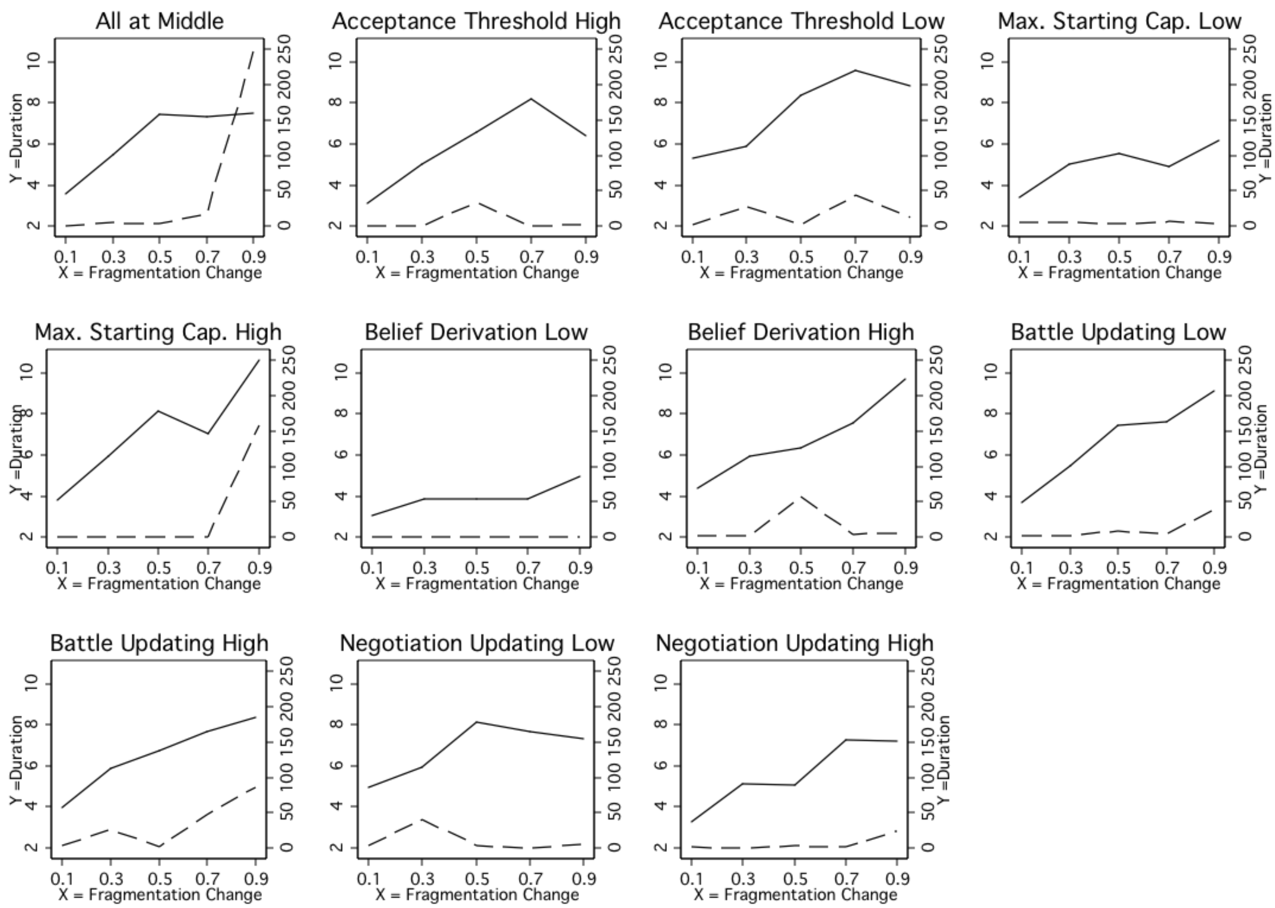

Figure 4: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

3 Maximum of 21 Agents

As with the previous model (in Section 2 above), this model allows for the creation of more agents through fragmentation than allowed in the original model. This simulation allows for a maximum of twenty-one agents at any given time, rather than the original ten agent limit. We calibrated the maximum number of agents to 21 based on the reviewer's suggestion about matching actual civil wars. Twenty-one is the maximum number of agents in the Uppsala Conflict Database as reported in Cunningham (2006).

Figure 5 illustrates the effects of an increase in the maximum number of agents by over 100% from the original model. Despite the possibility of twenty-one agents engaging in conflict simultaneously, the general relationship between the maximum probability of fragmentation and the duration of settlement simulations appears to be unchanged. Increases in the maximum probability of fragmentation are associated with decreases in the duration of settlement simulations, and these trends closely mirror the trends from the original model (see Figure 1). The relationship between the maximum probability of fragmentation and the duration of simulations ending in victories remains relatively inconsistent due to the small number of victory outcomes, as discussed previously.

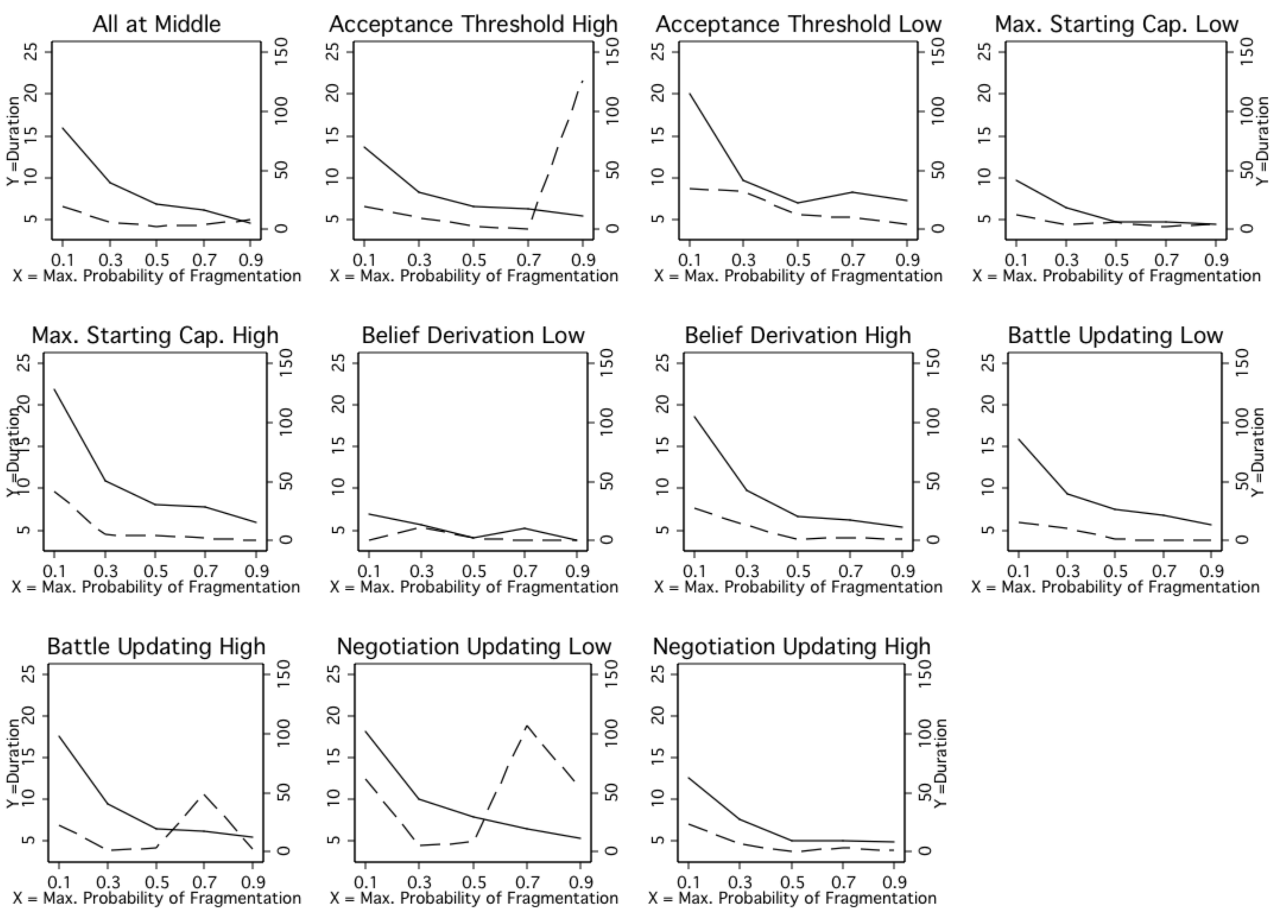

Figure 5: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 6 demonstrates that the possibility of twenty-one agents engaging in conflict does not alter the general finding of a direct relationship between fragmentation change and the duration of settlements from the original model (see Figure 2). As with previous analyses, the relationship between victory durations and fragmentation change remains positive, but generally inconsistent.

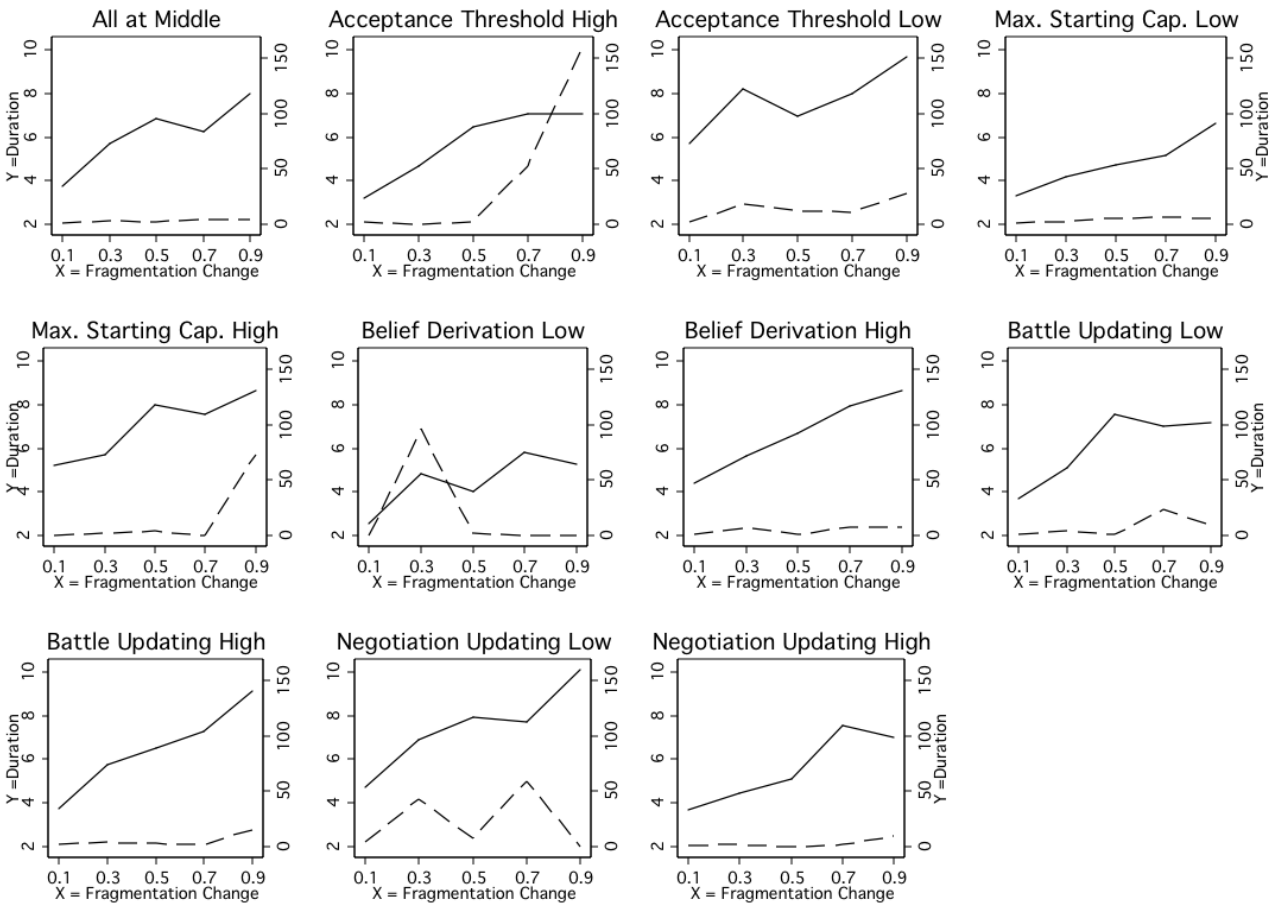

Figure 6: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

4 All Agents Learn from Battle

In the model presented in the paper, agents engaging in battle learn important information from battle similar to the game theoretic literature (see Smith and Stam 2004). In the original model, two agents are selected from each coalition to engage in battle, and learning takes place only among the two participants in the battle. In this model, we assume that all agents currently engaged in the civil war can observe and learn from the outcome of a battle, even if they are not one of the participants in the battle. In the revised model, we allow all agents to observe the outcome of a battle and then update their pairwise beliefs with respect to the agents that win or lose. Given that some agents do not actually participate in the battle, they update their beliefs as a weighted proportion of how strong they are in their coalition. In other words, if an agent observes a battle win by an agent from an opposing coalition, it updates its beliefs about pairwise comparative strength accounting for how strong it is within its own coalition, and therefore how likely it would have been to win the battle if fighting.

The results of this additional experiment are remarkably consistent with those from the original model (see Figure 1) when all agents are allowed to learn from battle. Figure 7 illustrates that as the maximum probability of fragmentation increases, the duration of simulations ending in settlement tends to decrease. As with the original analysis, there seems to be a greater decrease in duration when the maximum probability of fragmentation is increased from 0.1 to 0.3 than when the maximum probability of fragmentation increases at higher values, such as an increase from 0.7 to 0.9.

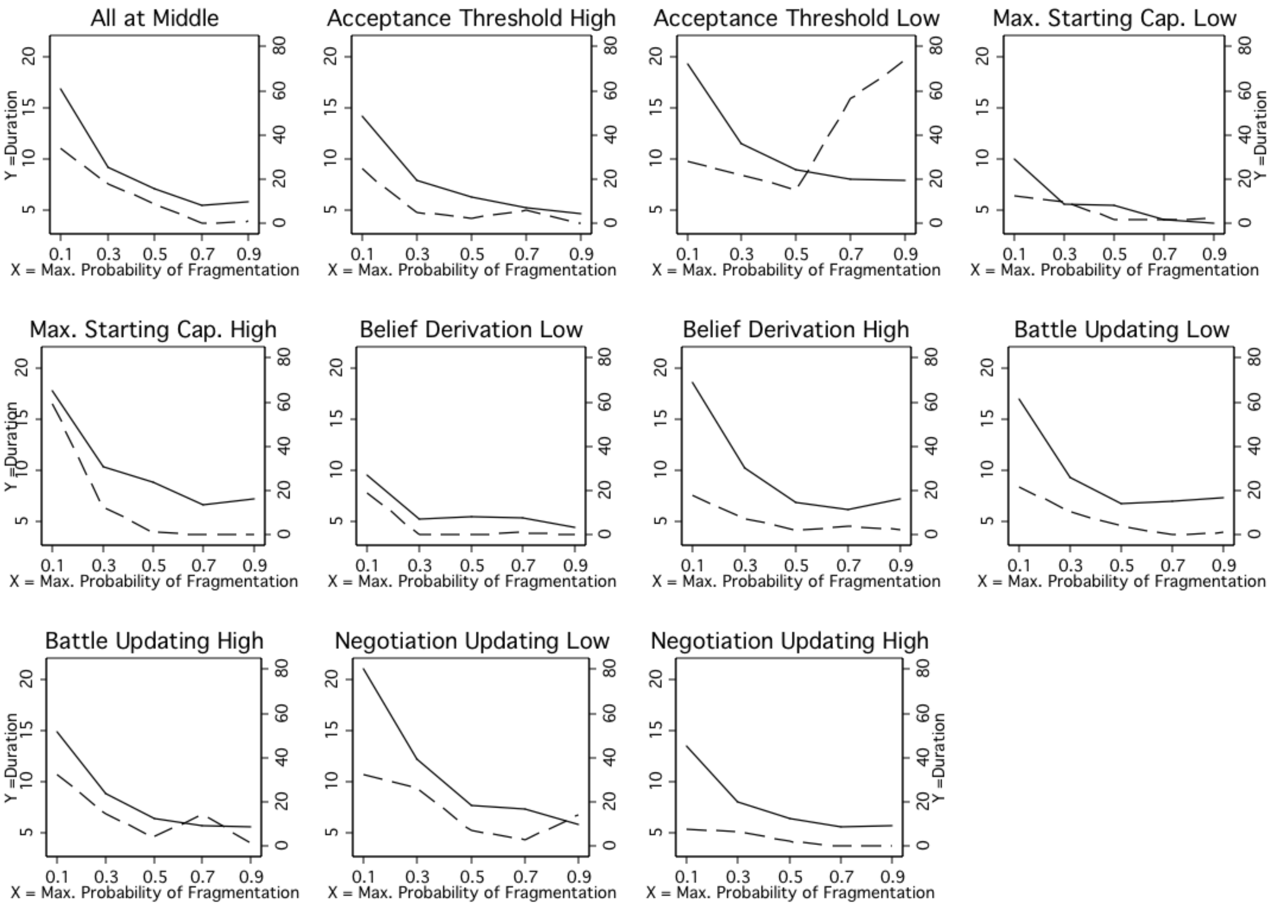

Figure 7: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 8 illustrates that there continues to be a direct relationship between the amount of change as a result of fragmentation and the duration of simulations ending in settlement when allowing all agents to update their beliefs as a result of battle outcomes. A number of subplots also indicate that a direct relationship may exist between fragmentation change and the duration of simulations ending in victory, although as with previous models, this relationship remains somewhat inconsistent due to the small number of victories.

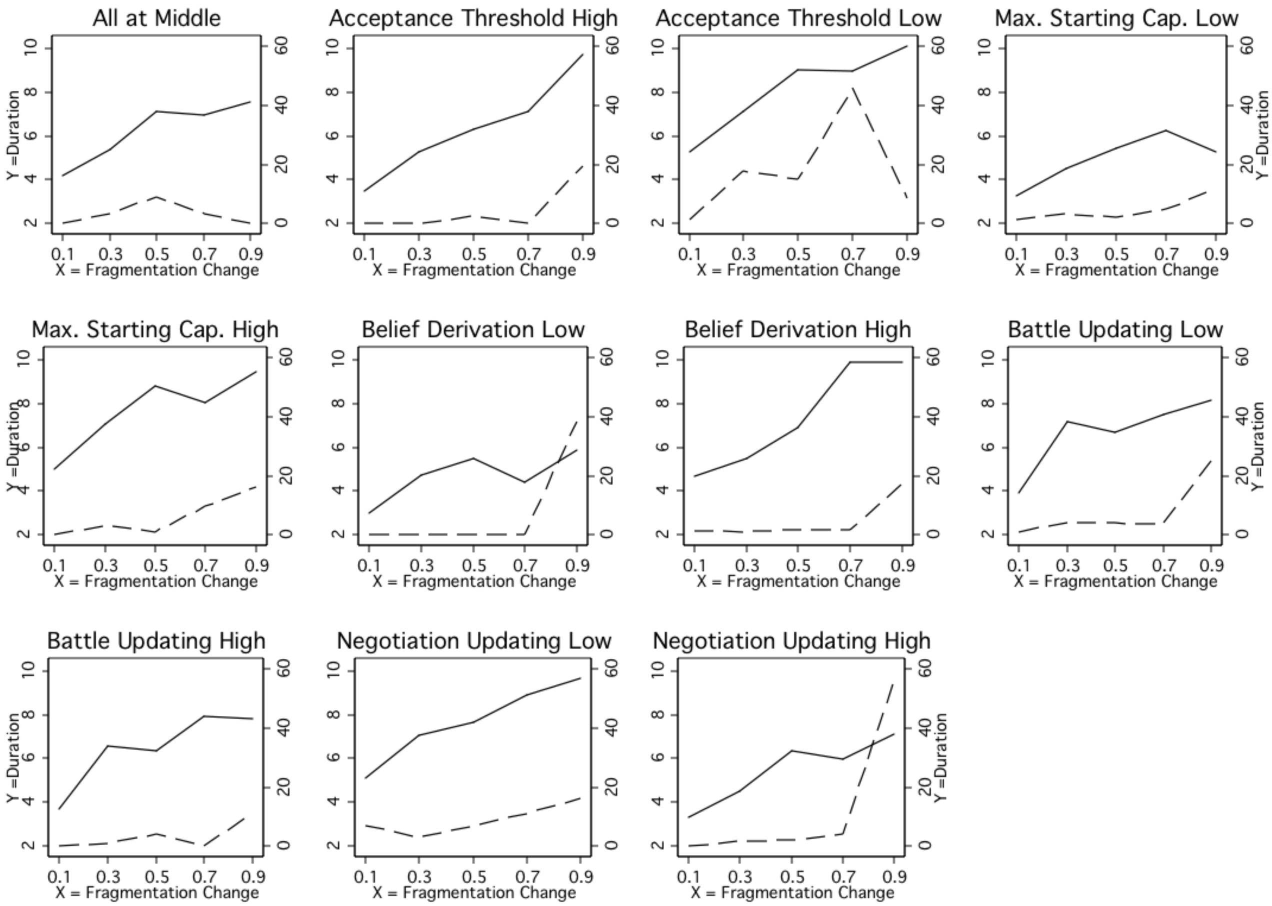

Figure 8: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

5 Capabilities Initially Distributed Left (With Adaptation)

This experiment changes the assumption in the original model that the capabilities of agents are selected from a uniform distribution by using a distribution that is skewed to the left as an alternative. Specifically, we generate a chi-squared distribution with most of the density to the right, and therefore skewed left. This means that the initial capabilities of agents are likely to be greater than in the model presented in the paper.

As indicated in Figure 9, when initial agent capabilities are skewed the the left, there appears to be an inverse relationship between the maximum probability of fragmentation and the duration of simulations ending in settlement. This is consistent with the analysis of the original model, as is the general result that the rate of decrease in the duration of settlements as a result of increases in the maximum probability of fragmentation decreases over time (see Figure 1). It is difficult to see a general relationship between the maximum probability of fragmentation and the duration of simulations ending in victory, as there are many cases where no simulations end in victory (see the subplot where the acceptance threshold is set at its high value).

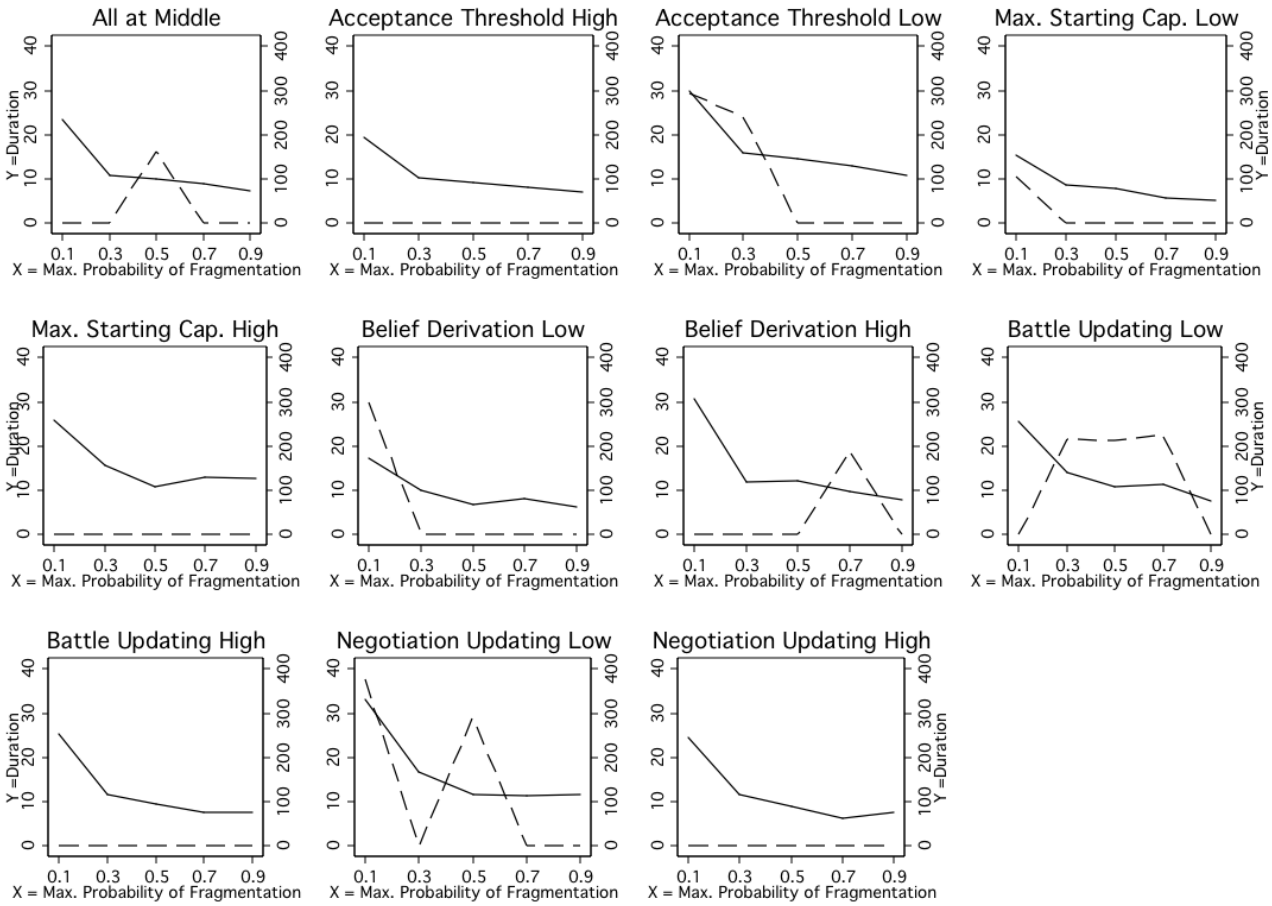

Figure 9: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 10 illustrates the relationship between the change resulting from fragmentation and the duration of simulations. The figure indicates that even when the initial capabilities of agents are skewed to the left, increases in fragmentation change lead to increases in the duration of simulations ending in settlement. There appear to be several anomalies from this trend at high levels of fragmentation change (such as when the acceptance threshold is set at low and high values), but in general the trends appear to indicate a direct relationship. The results for simulations ending in settlement are more consistent than the results for simulations ending in victory, and as with the previous figure, there are many cases where there are no simulations ending in victory.

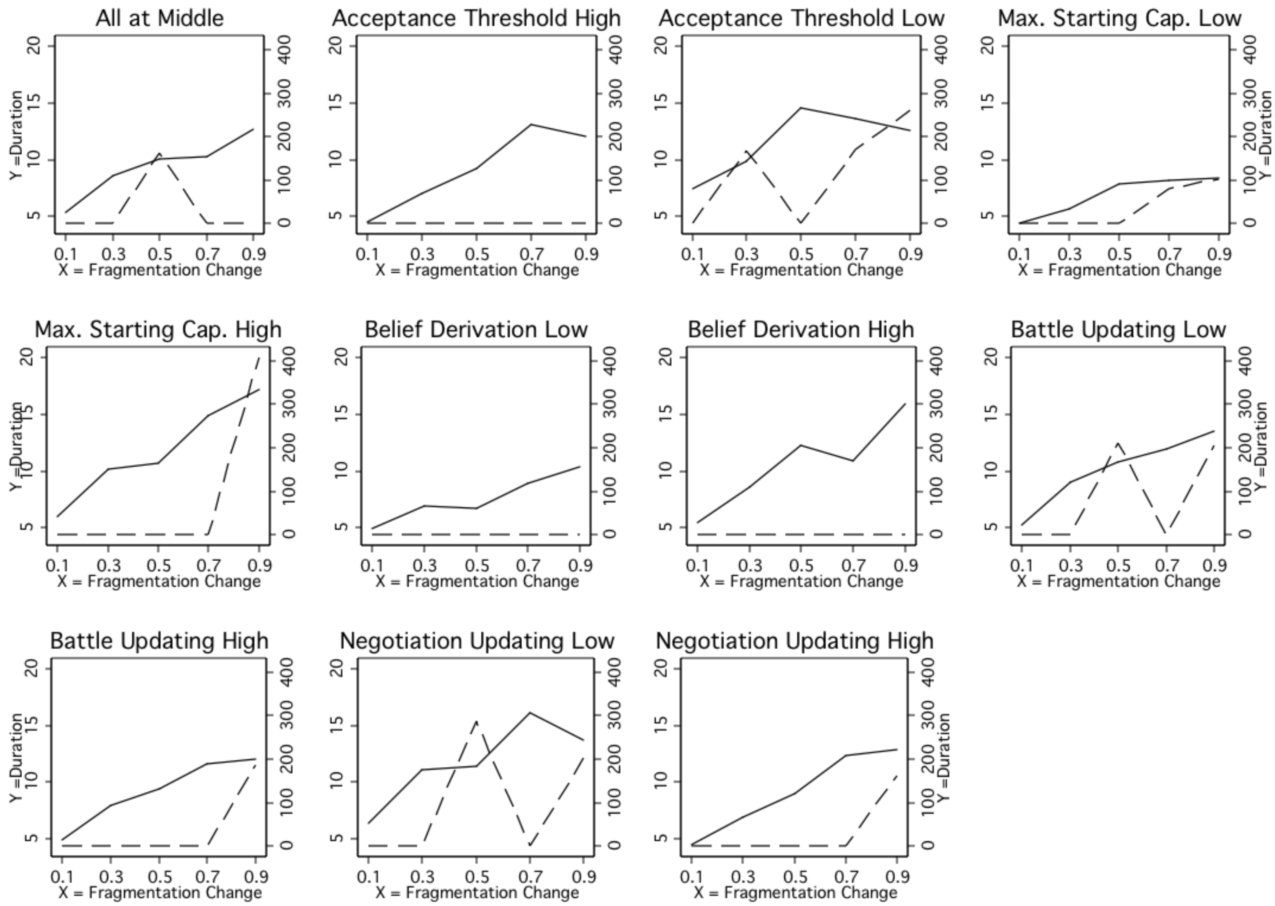

Figure 10: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

6 Capabilities Initially Distributed Normally (With Adaptation)

In this experiment we alter the assumption in the original model by allowing capabilities to be drawn from a normal distribution rather than the uniform distribution. A normal distribution makes it less likely that an agent's initial capabilities will be extreme (either high or low), and more likely that values will be randomly selected from the center of the distribution's range. The probability of relatively evenly matched agents should likewise increase.

Figure 11 indicates that as the maximum probability of fragmentation increases, the duration of simulations ending in settlement decreases. This is consistent with the results of previous models (including the analysis from the original paper illustrated in Figure 1). The results for simulations ending in victory are inconsistent, similar to the findings regarding the duration of victories in previous models (such as in Figure 9).

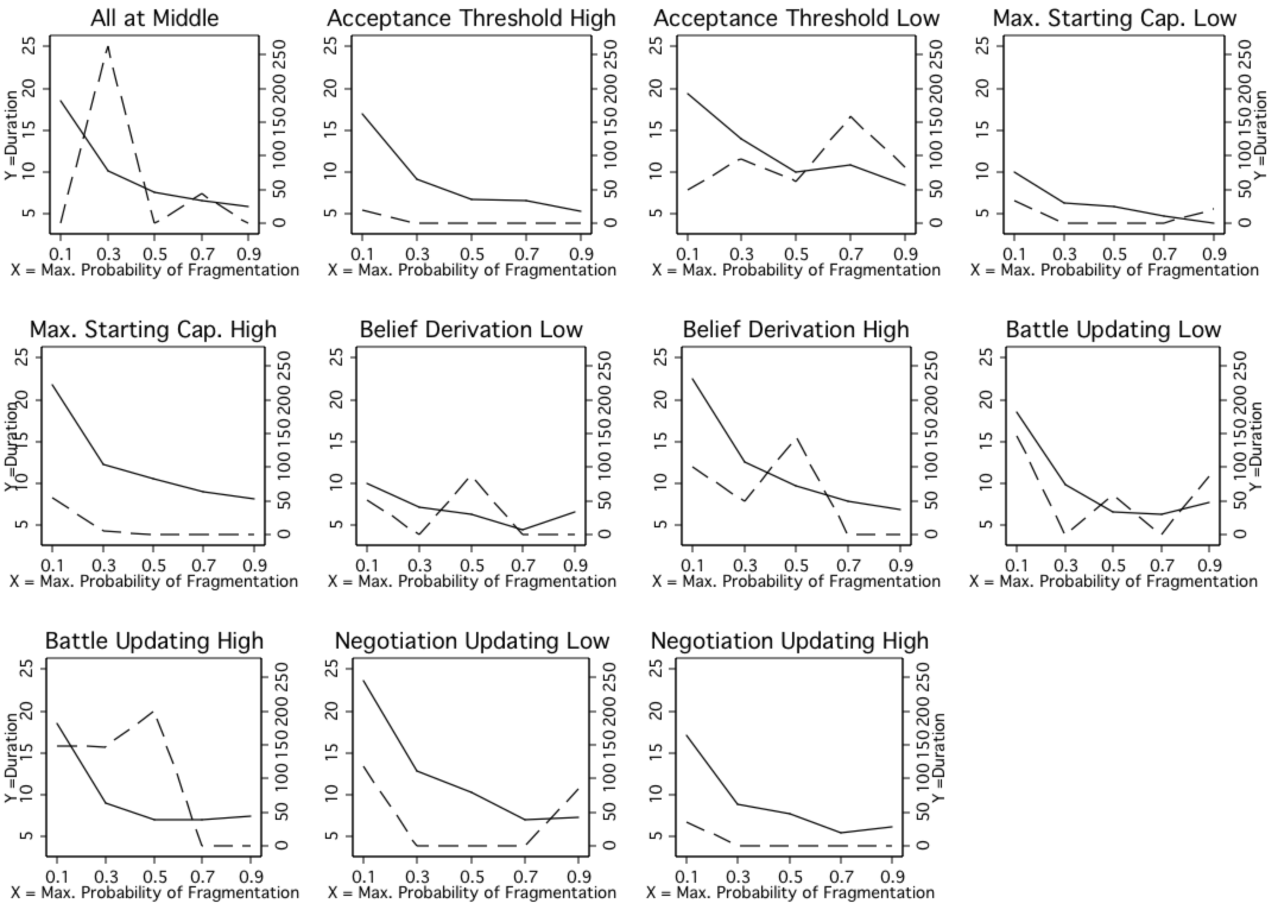

Figure 11: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 12 demonstrates that as the change resulting from fragmentation increases, so does the duration of simulations ending in settlement. The results for simulations ending in victory is less consistent, and there are a number of cases where no simulations end in victory (see the fifth subplot, where the maximum starting capability is set at a high value). Both of these results are consistent with the analysis in the original model (see Figure 2). Although there is no consistent relationship between fragmentation change and the duration of simulations ending in victory, note that the highest duration of a victory was around 200 (see the ninth subplot when battle updating is at its high value). This is less than the highest duration of a victory when initial capabilities were skewed to the left (Figure 10). This finding is intuitive given that in order for a simulation to end in victory, the capability of agents must be reduced to 0 through battle, which is likely to take longer when agents start with high levels of capability.

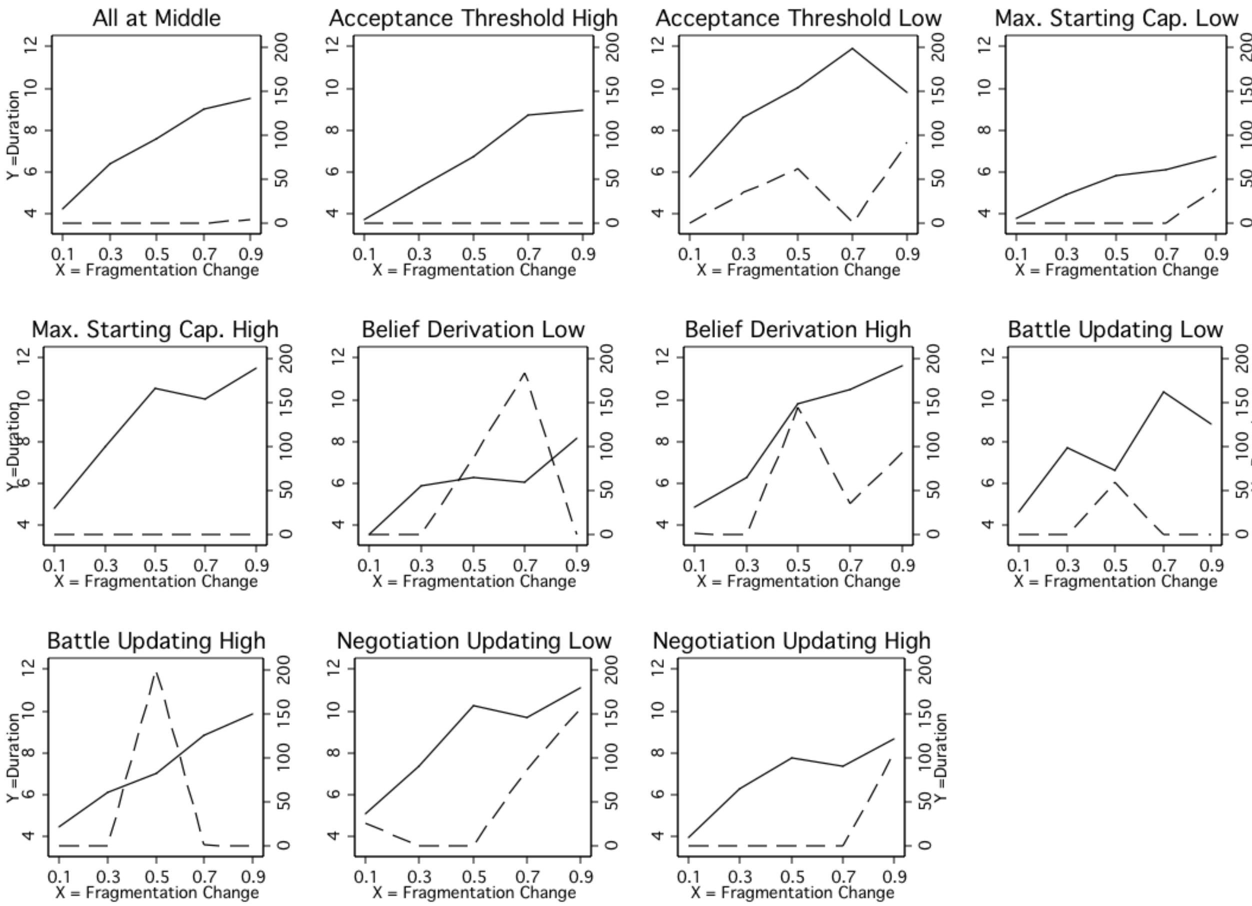

Figure 12: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

7 Capabilities Initially Distributed Right (With Adaptation)

This experiment alters the distribution used to randomly select the initial capabilities of agents from the uniform distribution used in the paper to a distribution that is skewed to the right. Specifically, we generate a chi-squared distribution with most of the density to the left, and therefore skewed right. The result is that an agent is more likely to initially possess lower rather than higher capabilities.

Figure 13 illustrates a general inverse relationship between the maximum probability of fragmentation and the duration of simulations ending in settlement, which is consistent with the original model where initial capabilities were drawn from a uniform distribution (see Figure 1). Given the small number of simulations that end in victory, it is unsurprising that the relationship between the maximum probability of fragmentation and the duration of simulations ending in settlement remains inconsistent.

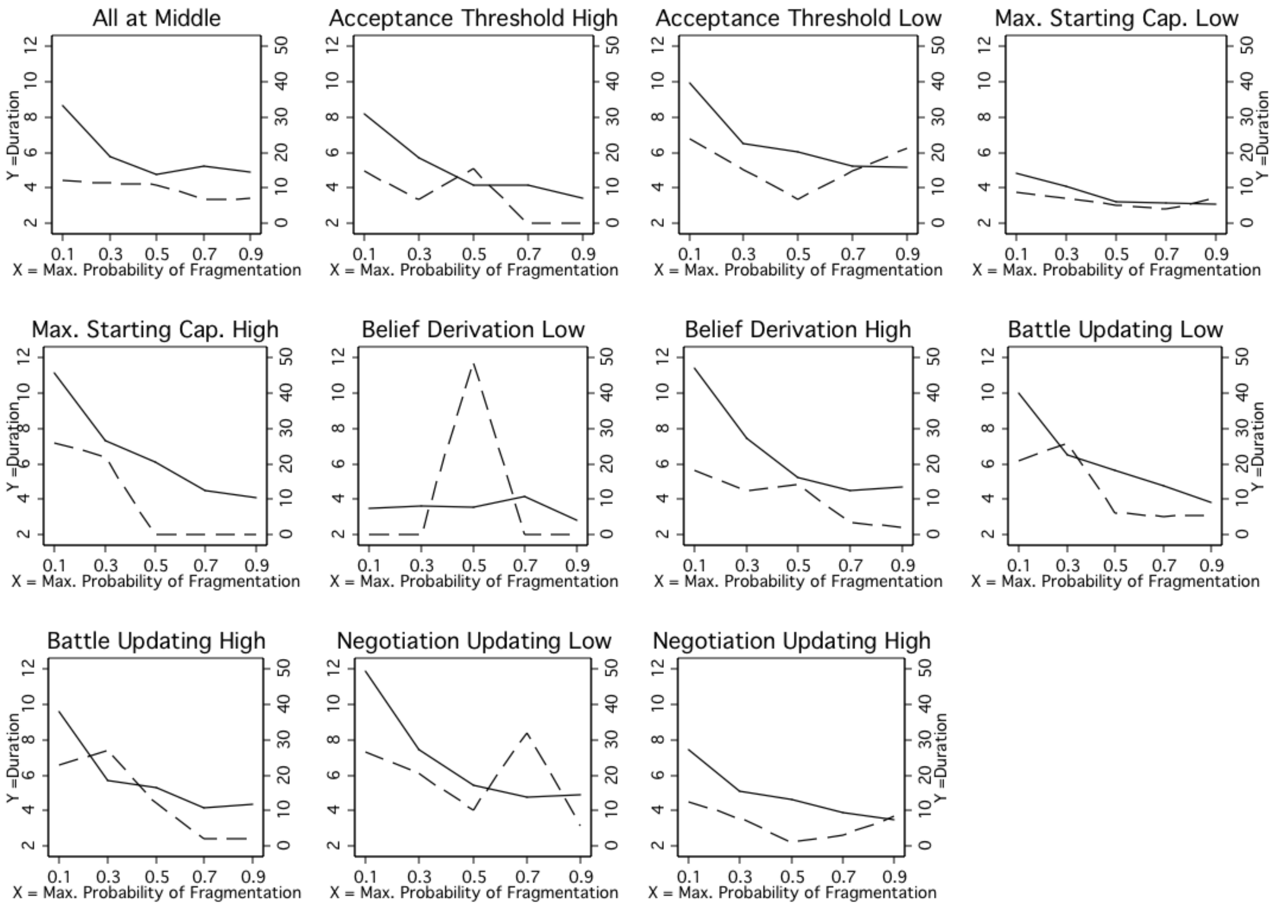

Figure 13: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

The results in Figure 14 are consistent with the results in the original model (see Figure 2) in that there is a direct relationship between increases in fragmentation change and the duration of simulations ending in settlement. For simulations ending in victory, there appears to be a general increase in duration as a result of increases in fragmentation change, although this relationship remains less consistent than in the case of simulations ending in settlement.

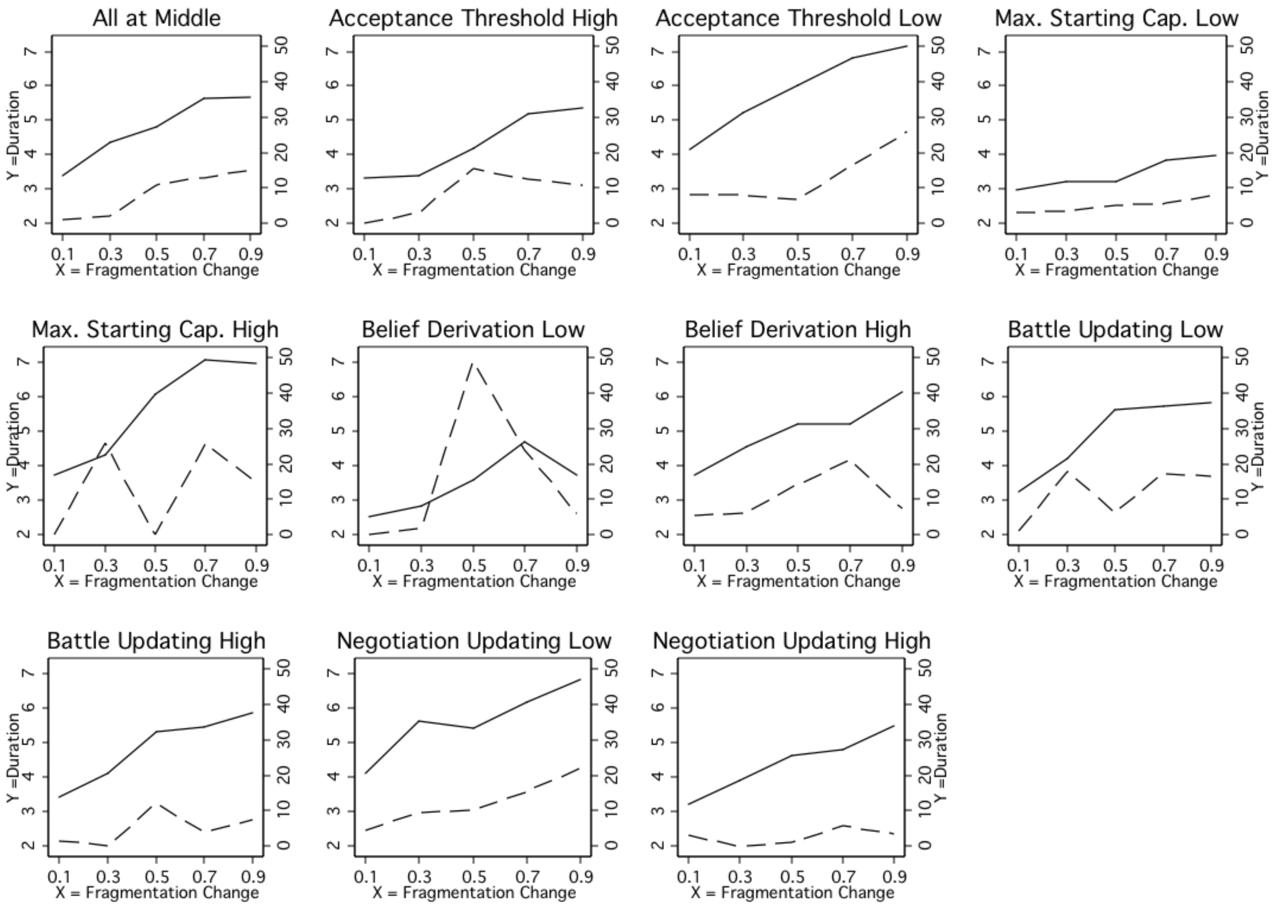

Figure 14: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

8 Coalition Battling

In the model presented in the paper, battling takes place between pairs of agents. These two agents (one from each coalition) engage in battle and alter their capabilities and beliefs based on the outcome of the pairwise battle. In this supplementary model, we allow for entire coalitions to engage in battle rather than pairs of states. In these battles, all agents in one coalition fight against all agents in the opposing coalition where the probability of victory is based on the overall capability distribution, rather than pairwise capability ratios. And, following battles, agents update beliefs as they normally do (pairwise with all other agents), but the updating is subject to the proportional strength that an agent contributes to the battle. In other words, if an agent contributes ten percent of the overall capability, then when it updates beliefs, those beliefs are similarly weighted so as not to reflect the entire coalition in place of pairwise updating.

Even when battles takes place between coalitions rather than individual agents, the inverse relationship between the maximum probability of fragmentation and the duration of simulations ending in settlement is apparent in Figure 15. Also, similar to the results of the original model (see Figure 1), the decrease in duration appears to be greatest for low rather than high values of the maximum probability of fragmentation. The relationship between duration and the maximum probability of fragmentation in simulations ending in victory is less consistent.

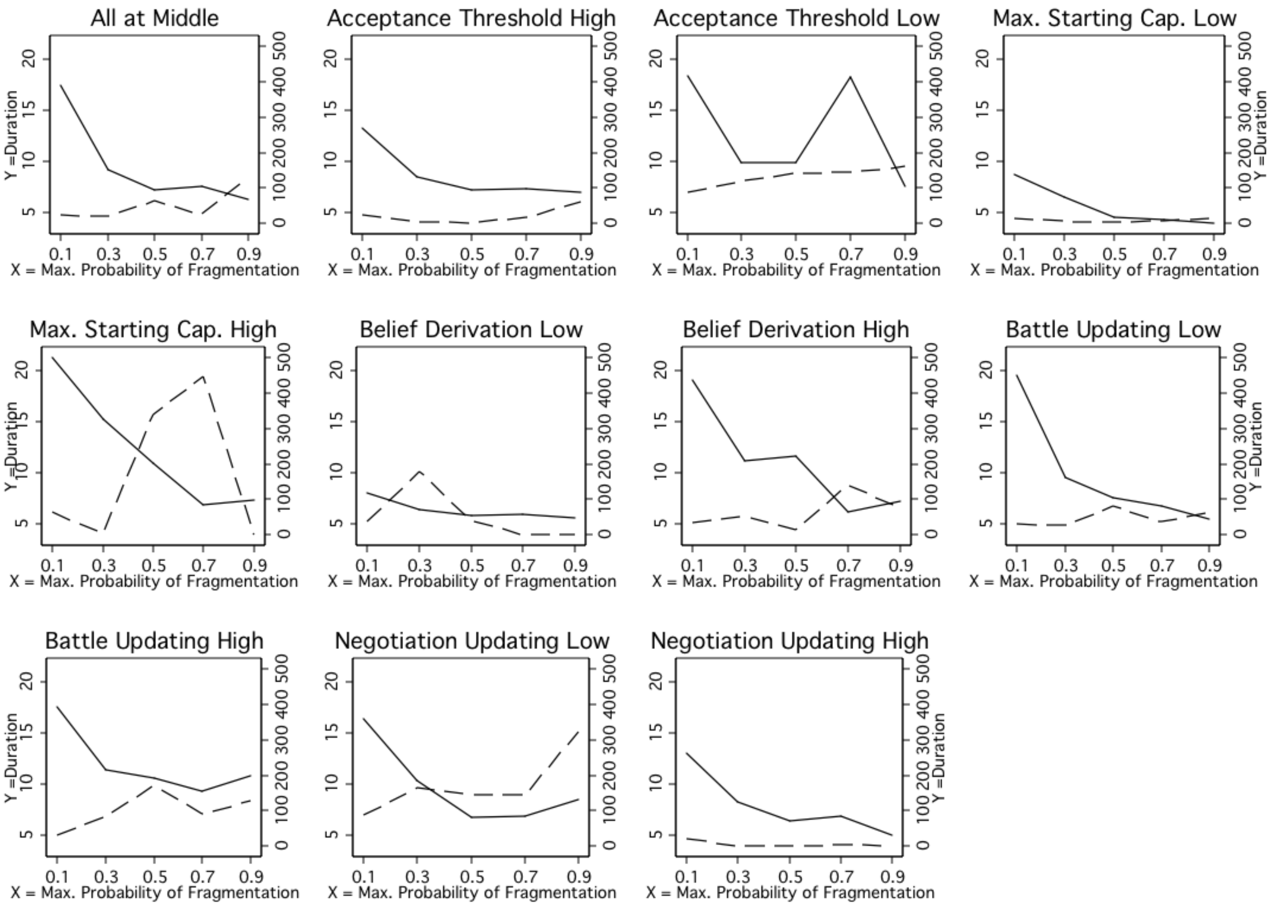

Figure 15: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 16 demonstrates that there remains a general direct relationship between the amount of change resulting from fragmentation and the duration of simulations ending in settlement. As with previous models, including the results from the original model in the paper (see Figure 2), the results for simulations ending in victory is less clear, although many of the subplots seem to indicate that as fragmentation change increases so does duration (one exception seems to be when the amount agents update beliefs as a result of negotiation is set at its low value).

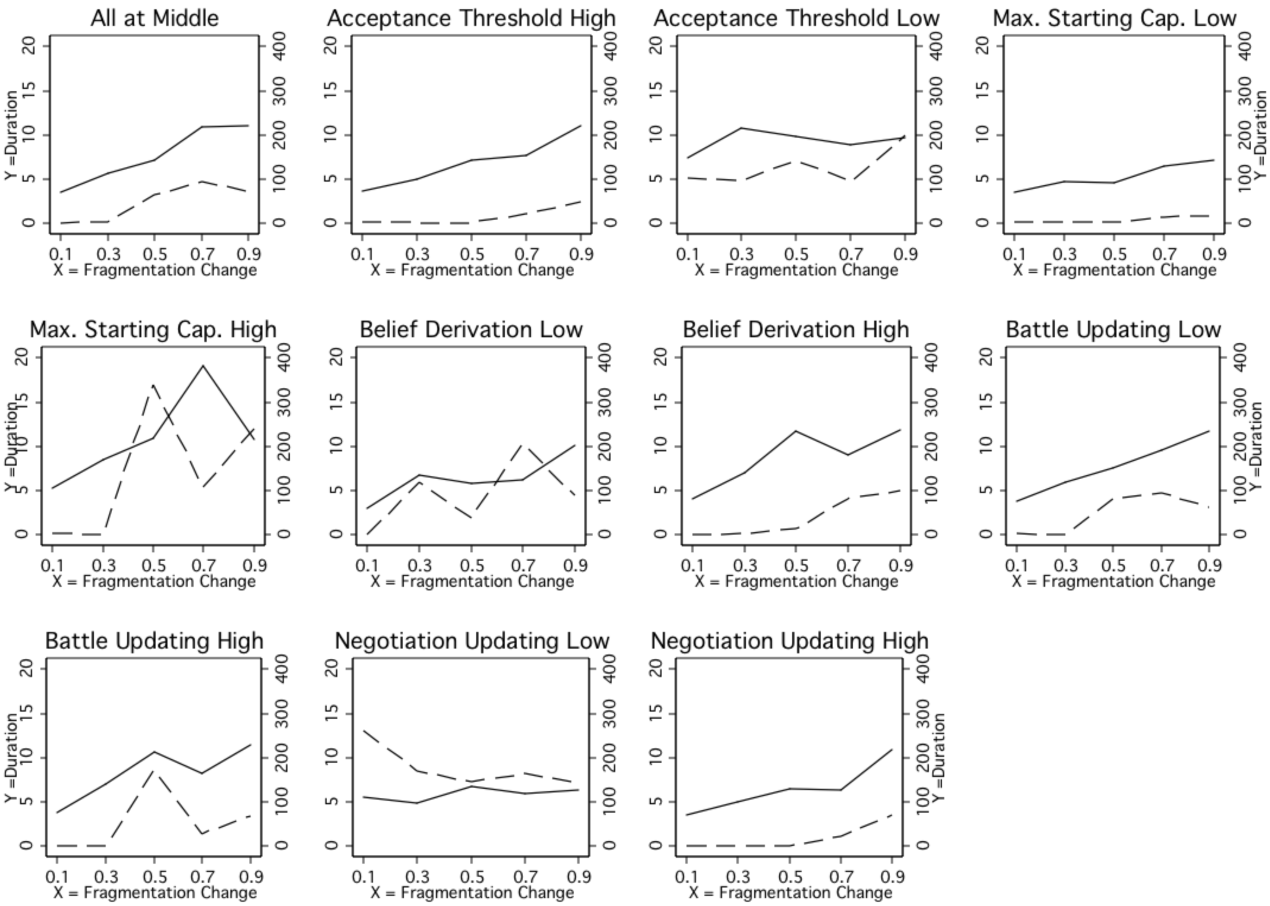

Figure 16: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

9 Coalition Switching (50% Chance)

The original model allows for the fragmentation of agents, but the two agents created from this split remain members of the coalition of the original agent. In this model, we assume that the fragmentation may result in coalition switching on behalf of the newly created agent. In this model, there is a 50% chance that the new agent created as a result of fragmentation will join the other, opposing coalition.

Figure 17 indicates that even when agents are allowed to switch coalitions as a result of fragmentation, an increase in the maximum probability of fragmentation results in a decrease in the duration of settlement simulations. This is consistent with Figure 1, which details the results from the original model. The results of victory simulations are less clear, although there does appear to be a general inverse relationship between the maximum probability of fragmentation and duration in these cases. The results for simulations ending in victory, however, remain less consistent than the results for simulations ending in settlement.

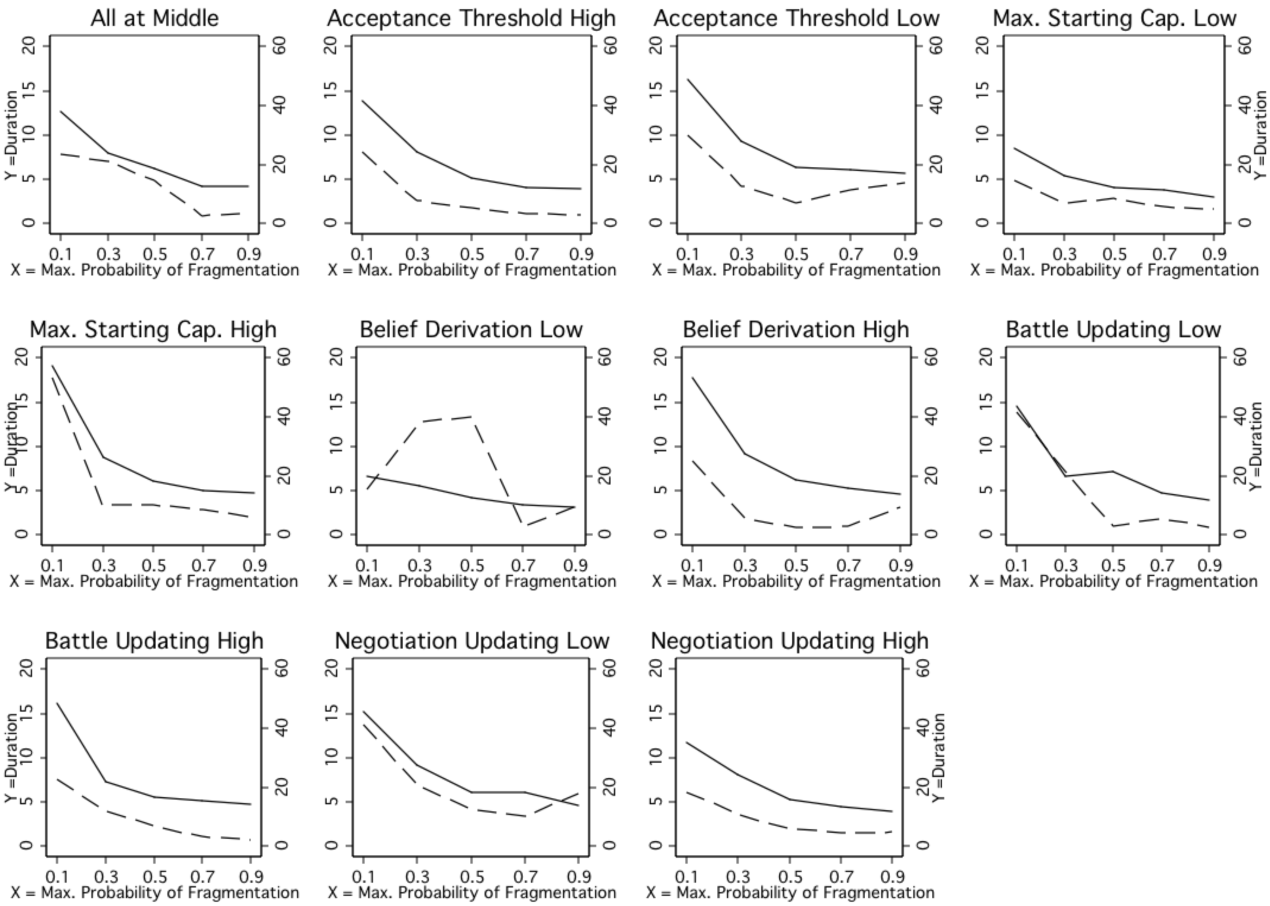

Figure 17: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Allowing agents a 50% chance of switching coalitions after fragmentation does not appear to affect the general direct relationship between fragmentation change and the duration of simulations ending in settlement. Figure 18 indicates that as fragmentation change increases, so generally does duration. These results are consistent with the original model (see Figure 2). Although the relationship is less consistent for simulations ending in victory, there also appears to be a direct relationship between fragmentation change and duration.

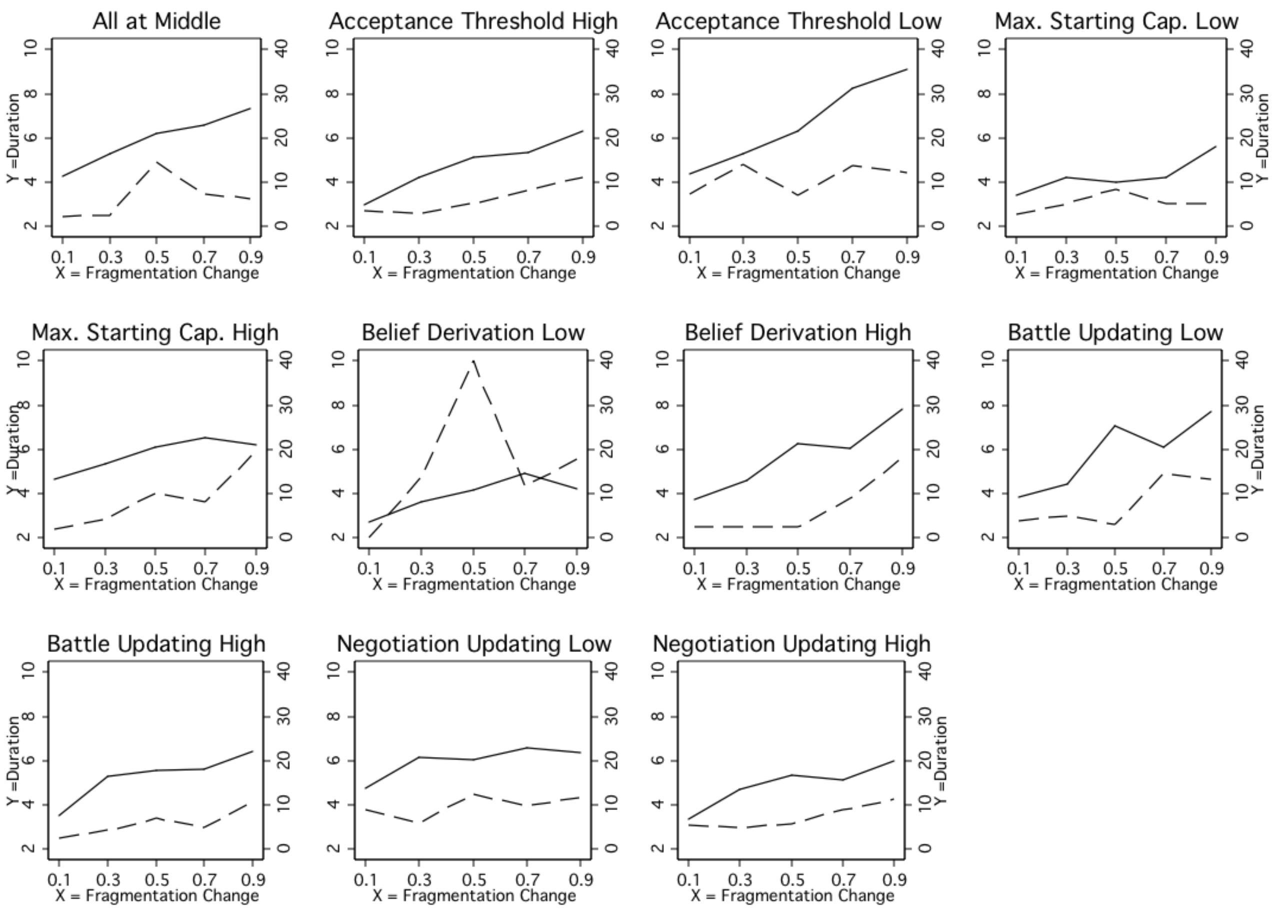

Figure 18: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

10 Coalition Switching (100% Chance)

Unlike the model presented in the paper, where newly fragmented agents stay in the same coalition, this model forces these new agents to switch coalitions. In this case, a newly fragmented agent always results in the two subsequent agents joining opposing coalitions, with the new agent created as a result of fragmentation entering into the opposing coalition 100% of the time.

Figure 19 indicates that, similar to the results of the original model in Figure 1, there is an inverse relationship between the maximum probability of fragmentation and the duration of simulations ending in settlement. There also appears to be an inverse relationship in simulations ending in victory, and the trend lines between settlements and victories are remarkably similar. It does not appear to be the case that forcing newly fragmented agents to switch coalitions changes the general results of the original model (see Figure 1).

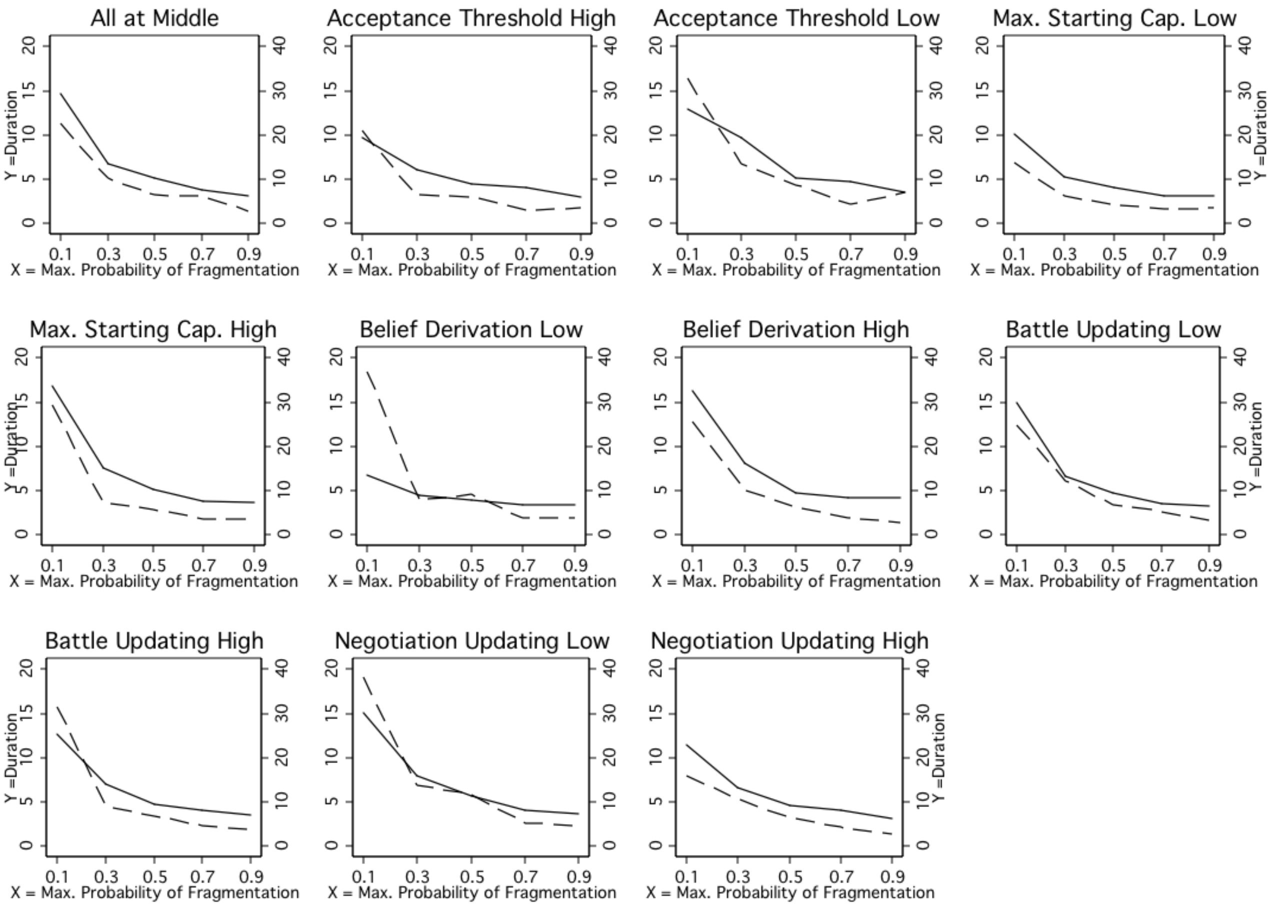

Figure 19: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 20 indicates that there still appears to be a general direct relationship between increases in fragmentation change and the duration of simulations ending in settlement, even when fragmented agents are forced to switch coalitions. Although the general trends clearly indicate an increase in the duration of simulations ending in settlement, there are several points in these trends that appear to be anomalies. There also appears to be a less consistent direct relationship between fragmentation change and the duration of simulations ending in settlement.

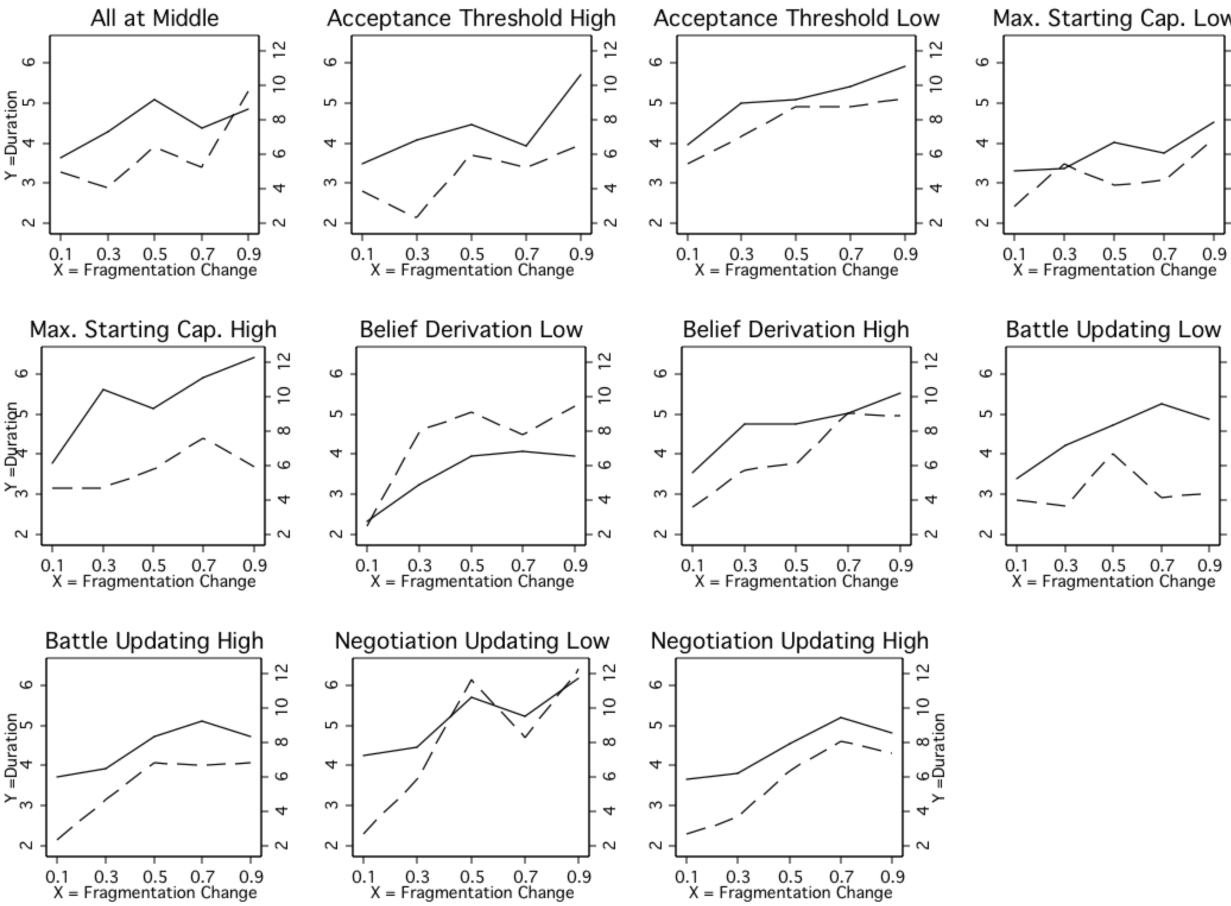

Figure 20: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

11 Post Fragmentation Belief Derivation

In this additional experiment, when agents fragment they inherit a similar belief to the parent, from whom they originate. That is, rather than draw new capabilities and beliefs randomly, each new agent draws a new belief, but it is within a range close to what the parent originally had. In other words, if the parent maintained a belief that was close to the actual capability ratio, then the newly fragmented agent obtains beliefs that are in a similar range.

Figure 21 indicates that, in general, increases in the maximum probability of fragmentation result in decreases in the duration of simulations ending in settlement. There are several cases, however, where the relationship is non-monotonic. In these cases, there seems to be a decrease in the duration of simulations ending in settlement for low values of the maximum probability of fragmentation, but for high values of the maximum probability of fragmentation there is an increase in duration. The results for the duration of simulations ending in victory is less clear, which is consistent with the results in previous models (see Figure 1).

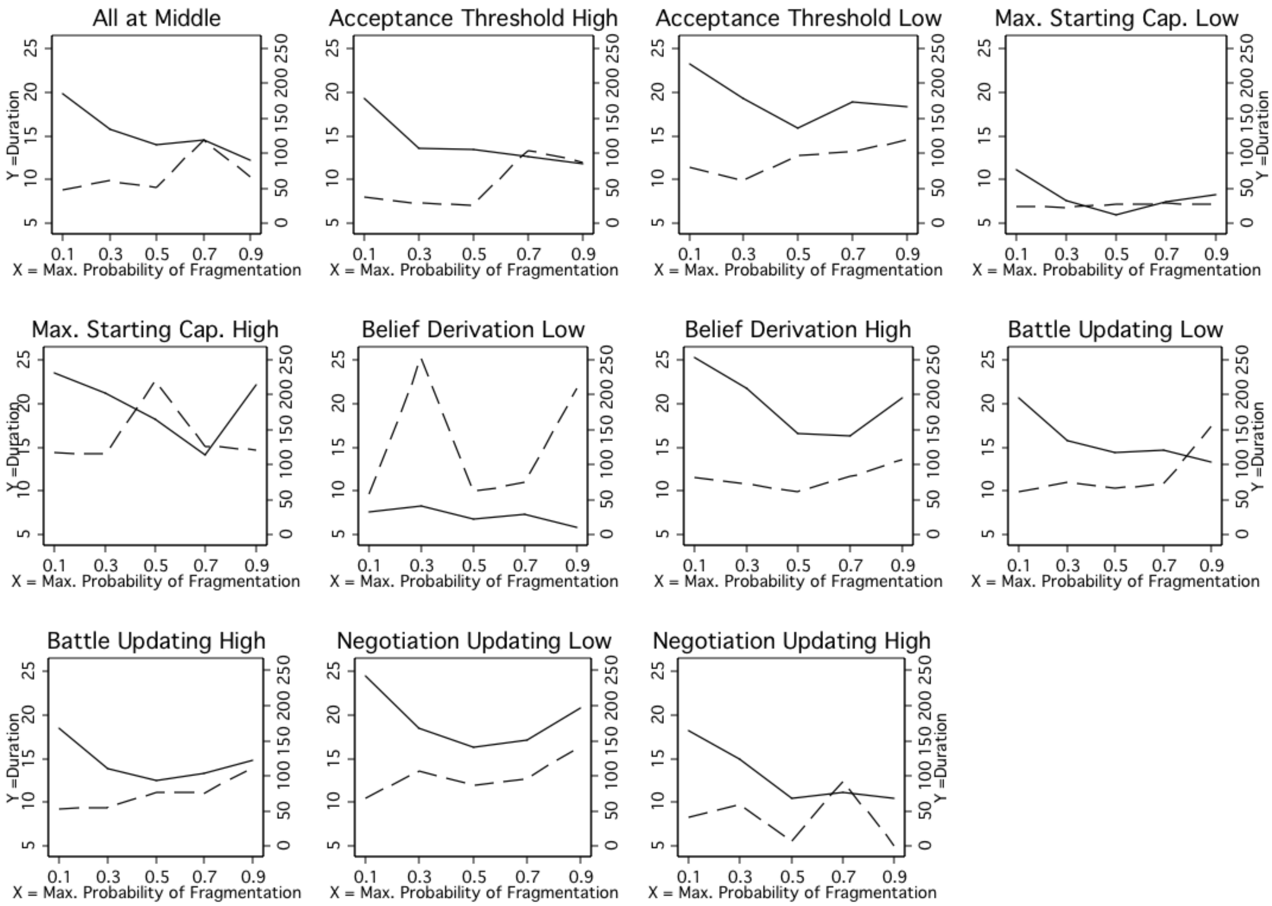

Figure 21: The Relationship between the Maximum Probability of Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)

Figure 22 illustrates the relationship between increases in fragmentation change and the duration of simulations, however, there are some inconsistencies with previous models, including the original model (see Figure 2). In previous model, there is a direct relationship between fragmentation change and the duration of simulations ending in settlement, however, a number of these subplots indicate that duration either decreases or does not consistently increase of decrease as a result of an increase in fragmentation change. The results of simulations ending in victory is likewise inconsistent, although this is similar to the results of previous models.

Of all of the additional experiments, this is the only experiment that seems to result in trends that are inconsistent with the trends from the analysis of the original model. It would appear to be the case that when agents are allowed to inherit their beliefs from existing agents, the direct relationship between these fragmentation parameters and duration are less clear, perhaps because agents continue to have a better understanding of what it would take to achieve victory and then victories result more efficiently.

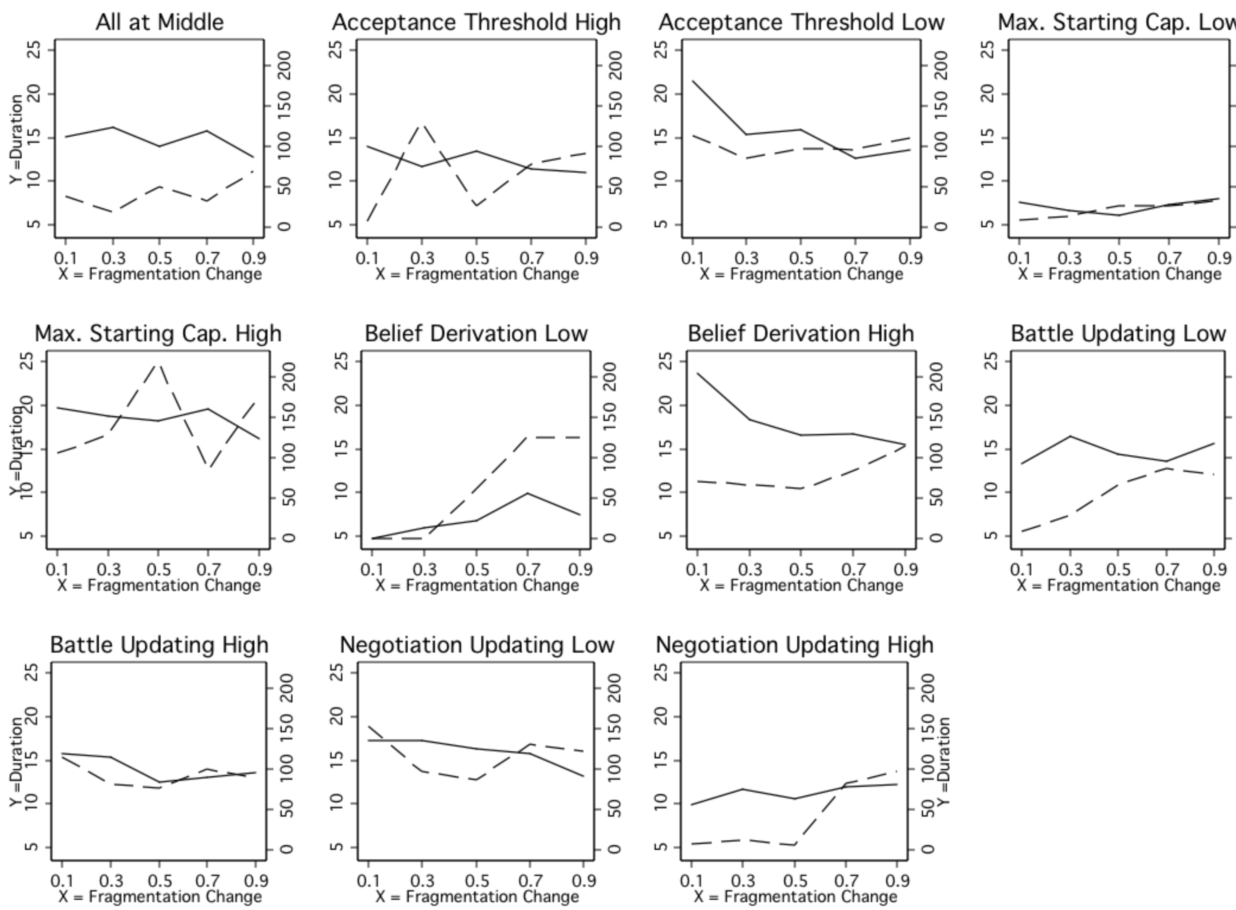

Figure 22: The Relationship between the Maximum Change in Beliefs Resulting from Fragmentation and Duration. (The y-axis on the left is for simulations ending in settlement, as indicated by the solid lines. The y-axis on the right is for simulations ending in victory, as indicated by the dashed lines.)