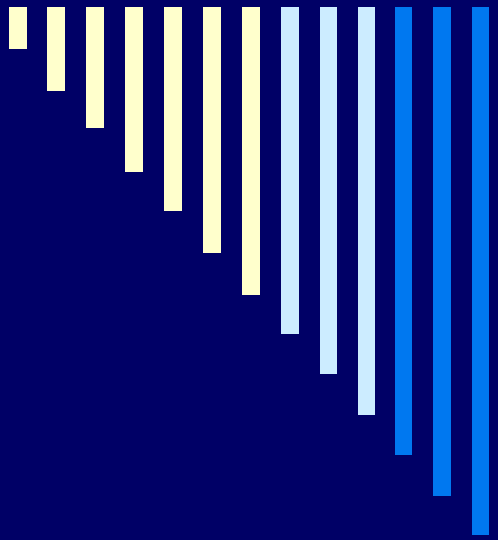

Formalizing Crisis Bargaining

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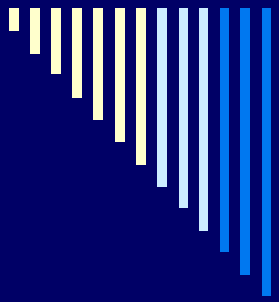
June 2006, EITM



Purpose of Talk

- Not a general way of “doing” IR
- Not a game-theory tutorial
- A little about empirical testing; very little because models are still too abstract
- The modeling enterprise
- What to do with a formal model
- How to write a formal IR paper

Background: Rough Ideas

- Find something you care about:
  - Developing a formal model is neither pleasant nor pretty
  - Finished product reflects n^{th} iteration of the model, so be patient
  - Write-up has very little to do with how the model was actually solved, which is usually very messy
  - You have to be able to stick with the topic for many months: contrary to popular opinion, writing a good formal paper is very time-consuming (many months, and that's if you're lucky)

Background: Approaching the Topic

- Familiarize yourself with the literature, but do not prepare a lit review!
- You need to know:
  - How people are currently thinking about your puzzle
  - Why they are thinking about it in these ways
- This way, you will be able to figure out:
  - If they are using appropriate tools for analysis
  - If they are missing something you consider essential for your answer (hopefully, they are!)

Example: Crisis Bargaining

- Rich, very rich, literature, lots of it formal, so where do we start?
- Two general strands:
  - Signaling (Schelling, Jervis, Fearon, Morrow, Banks)
  - Bargaining (Schelling, Fearon, Powell)
- General underlying ideas very similar, especially about private information
  - Goal is to establish credible commitments
  - Problem is asymmetric information
  - Solution is costly signaling:
    - Tying hands, sinking costs (signaling)
    - Risk-return trade-off (bargaining)
- BUT: seem to be talking past each other!

Example: Crisis Bargaining

- What seems to be the problem?
  - Signaling literature: no bargaining
  - Bargaining literature: no signaling
- Obvious thing to do is remedy that somehow… but *this is not how I approached it*
  - WHY?
  - Because I did not know this was a problem until after I finished the analysis of a crisis model!
- So, even though finished product would address this topic, the real research began in a very different way (happens very often)

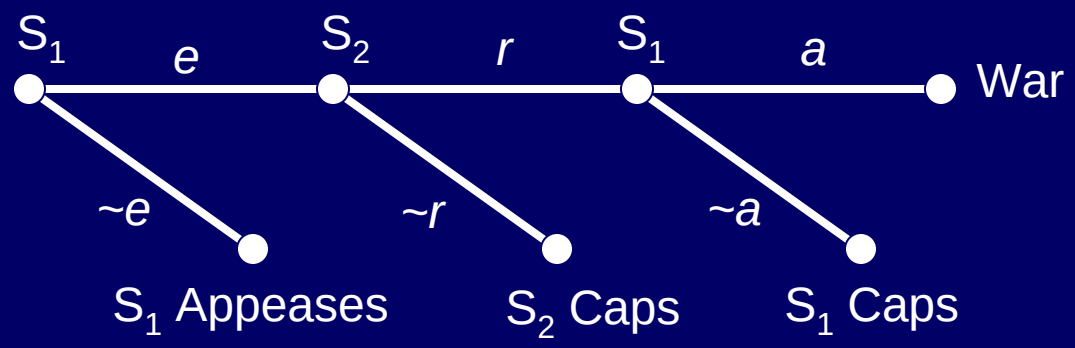
Example: Military Coercion

- Where did I start with this project then?
  - Noticed that existing models talk about crisis behavior but never take military moves seriously
  - What does this mean? From my readings of historical cases, I noticed that military moves are:
    - Very costly to execute
    - Very risky once underway
    - Often seem to involve changing goals
  - In other words, military moves are <u>not</u> like verbal threats, and neither are they pure sunk costs

Example: Military Coercion

- I took a very common crisis escalation model and modified just enough to incorporate the features of the military instrument that I considered important
- NOTE:
  - Always start with the simplest model that seems to work
  - Always end with the simplest model you can get away with
- WHY:
  - Starting with bells and whistles may give an illusion of completeness but in fact it will usually make the model intractable (and frustrating to work with)
  - Ending with a complex model may give an illusion of generality but in fact the more moving parts there are, the more one has to wonder about robustness of results: what if we tweaked *this* assumption or changed *that* sequence?
  - Understanding and interpreting complex models is very, very hard!

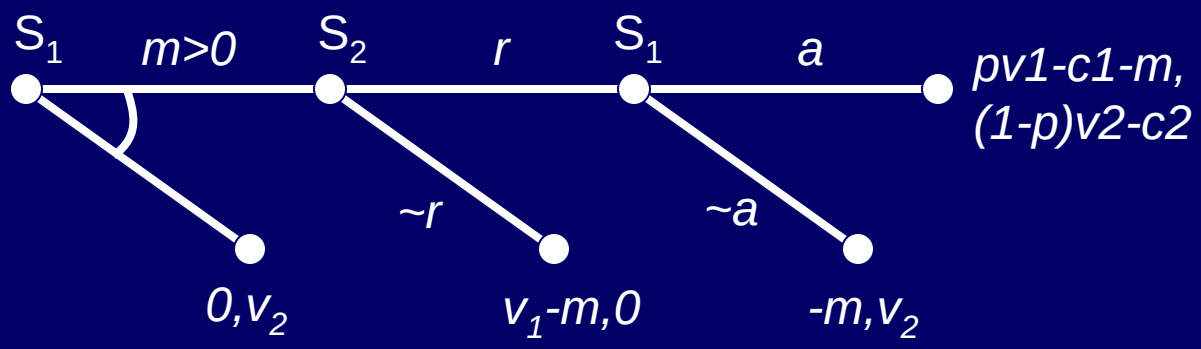
The Basic Model



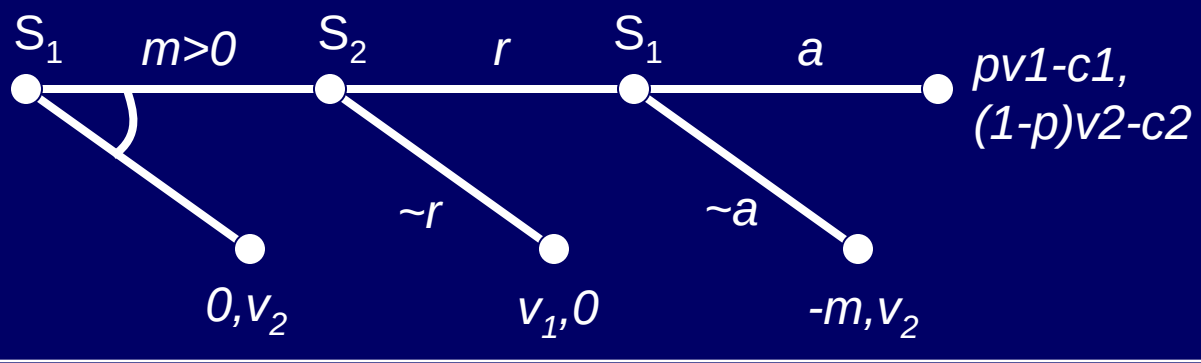
- This model is very basic:
  - no bargaining at all (well, ultimata)
  - time-horizon is exogenous
- However, it is also very common:
  - well-understood dynamics
  - can easily relate findings to it

The Model with Payoffs

Sinking Costs (Fearon 1994):

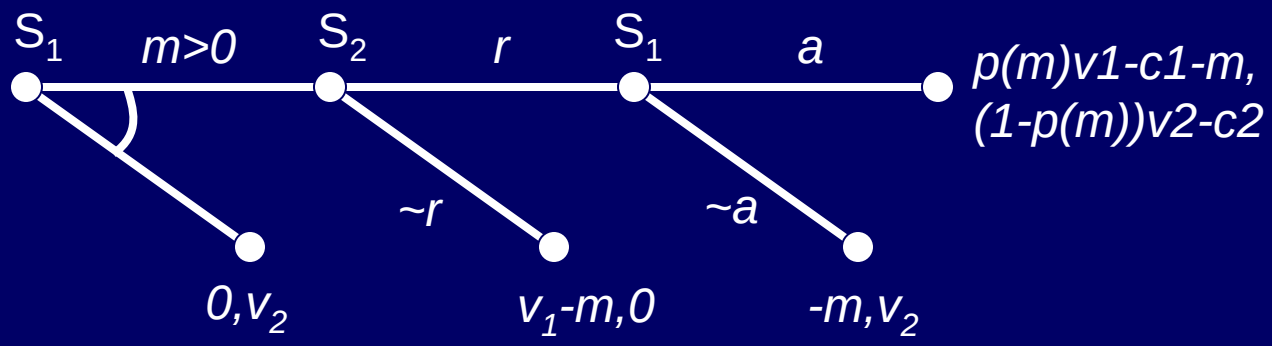


Tying Hands (Fearon 1994):



Military Instrument Payoffs

- Sunk cost but influences war payoff:



- Note the minimalist modification:
  - should we keep *p(m)* general or not?
  - implicit specification -> general results
  - explicit specification -> analytical solutions

When to Opt for Generality?

- Generally, generality is good because results are shown to be robust to particular extensions
- Still, usually need to make some assumptions about functions (e.g., at least first derivatives, sometimes second ones too)
- Results algebraic and nice, but…
  - specific functional form easier to work with
  - can be used for numerical examples/checks
  - almost always preferable to start with one and if results appear generalizable, see if we can move to a more general form
- So, we'll use $p(m)=(m+M_1)/(m+M_1+M_2)$, where (M_1,M_2) is the pre-crisis distribution of military capabilities

Introducing Uncertainty

- Now we have game-tree and payoffs
- Usually, uncertainty is over:
  - costs of war: c_1, c_2
  - probability of winning: p
  - expected payoff from war
- We shall use uncertainty over valuation:
  - seems quite intuitive
  - introduces uncertainty over all payoffs, not just the war outcome

What Type of Uncertainty?

- One- or two-sided? If one-sided, whose?
  - looking at game with complete information, it is easy to see that all action is in the very last move by S_1: it all depends on whether he prefers to fight or to capitulate (that is, whether he has a *credible threat to fight*)
  - immediately tells us that uncertainty should at the very least be about S_1's valuation
- We shall assume two-sided uncertainty

How to Model Uncertainty?

- Again, general vs. specific distribution:
  - follow the “start simple” principle, so pick a specific distribution
  - which one? Again, the same principle suggests we start with the uniform (it usually allows for simple arithmetic solutions)
- Assume v_i is distributed uniformly as follows:
  - S_1: $v_1 \sim [0, \bar{v}_1]$
  - S_2: $v_2 \sim [u, t]$

Now… the fun part

- We now have a model and we “only” need to solve it
- Things to keep in mind:
  - look at similar models and learn the solutions, especially how/why they work
  - you may need to go back to the drawing board if the model proves unworkable:
    - compare this version with my 2005 *APSR*
    - in the article, uncertainty is one-sided (so simpler) but both players get to make military moves (so much more complicated), also offense-defense balance (even more complicated)
    - which trade-off is better? Perhaps do all?

The Pain of Analysis

- For the article, I started with two-sided uncertainty… and spent about a month in various cul de sacs
- I went for help to Joel Watson at Econ (always, always ask for help!)
- His advice: simplify, go to one-sided info
- He was right, simplification:
  - enabled me to solve the model
  - yielded results interesting enough to publish
  - provided insight into how to tackle two-sided info

The Pain of Analysis

- Prepare to redo parts of the model:
  - initially, this model was analogous to the *APSR* article in that both players could make military allocations
  - prob of winning was: $p = m_1/(m_1+m_2)$
  - more general but extremely complicated to solve once we get to initial move
  - no recognition of existing forces, a serious substantive restriction

The Pain of Analysis

- Many false starts:
  - a model like this may take weeks to solve
  - especially if there are no existing solutions to give you hints (none in this case)
- What to do when stuck:
  - ask for help (often not an option)
  - try a simple numeric example: specify payoffs that satisfy assumptions and solve
  - analyze the solution, see what changes when you change numbers
  - this will tell you what things are possible in symbolic solution, try to find conditions for solutions

The Pain of Analysis

- In our model, we very quickly find that:
  - S_1 attacks iff

$$v_1 > \frac{c_1}{p(m)} = v_1^*(m)$$

  - S_2 resists iff

$$v_2 > \frac{[1 - G_1(v_1^*(m))]c_2}{1 - p(m)[1 - G_1(v_1^*(m))]} = v_2^*(m)$$

  - So, all the action is in S_1's initial choice of *m*

The Pain of Analysis

- The problem is that the choice of *m* is quite involved:
  - cut-points for both players depend on *m*
  - S_2's beliefs will also depend on *m*
- Since strategy must be sequentially rational given beliefs and beliefs must be consistent with the strategy, we must solve *simultaneously* for those!
- In practice, this would mean trying various strategies for S_1, seeing how they would affect S_2's beliefs, and then checking for equilibrium

The Pain of Analysis

- There are infinite varieties of strategies, so we must eliminate possibilities
- How can the game continue after S1's mobilization from his perspective?
  - S_2 may capitulate for sure (compellence)
  - S_2 may resist for sure (war if S_1 is committed)
  - S_2 may resist with positive probability less than one (coercion)

The Pain of Analysis

- So what would S_1 do if any one of these would follow in equilibrium, supposing his mobilization is *credible* (i.e., he is resolved to fight if resisted and S_2 believes it)?
  - optimize for war: $m^*(v_1) = \sqrt{M_2 v_1} - (M_1 + M_2)$
  - optimize for coercion: $\hat{m}(v_1) = M_2 \sqrt{\frac{uv_1}{(u-t)M_2 - c_1 c_2}} - (M_1 + M_2)$
  - optimize for compellence: $\overline{m} = \frac{uM_2}{c_2} - (M_1 + M_2)$
- We shall look at bluffing very soon!

Credible Threats?

- We have assumed credible escalation, so next step is to see when mobilizing at one of the three optimal type-dependent levels would be credible
- The smallest allocation at which some v_1 would attack is:

$$v_1 \geq v_1^*(\underline{m}(v_1)) \Rightarrow \underline{m}(v_1) = \frac{c_1 M_2}{v_1 - c_1} - M_1$$

- Hence, any type whose optimal mobilization is at least that large will have a credible threat to fight

Credibility Cut-Point Types

- So, let's see which types have credible optimal mobilizations… with pictures!

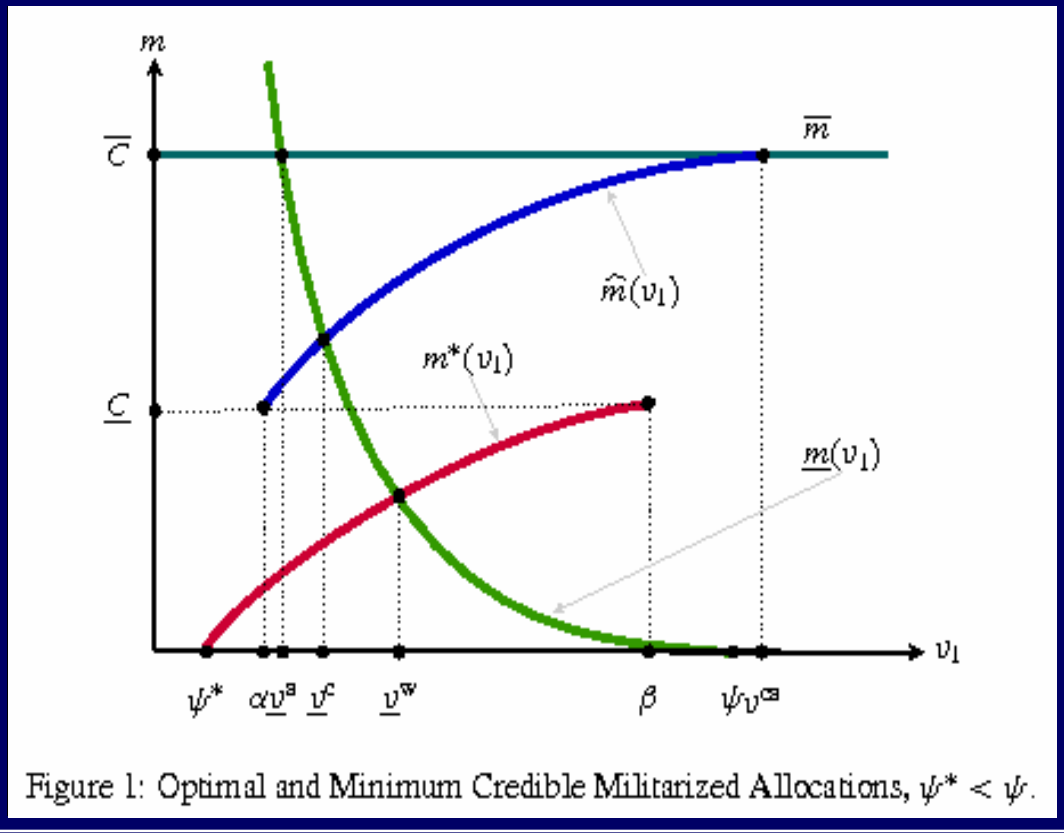


Figure 1: Optimal and Minimum Credible Militarized Allocations, $\psi^* < \psi$.

Escalation Cut-Point Types

- Given credibility, which types would escalate for war, coercion, compellence?

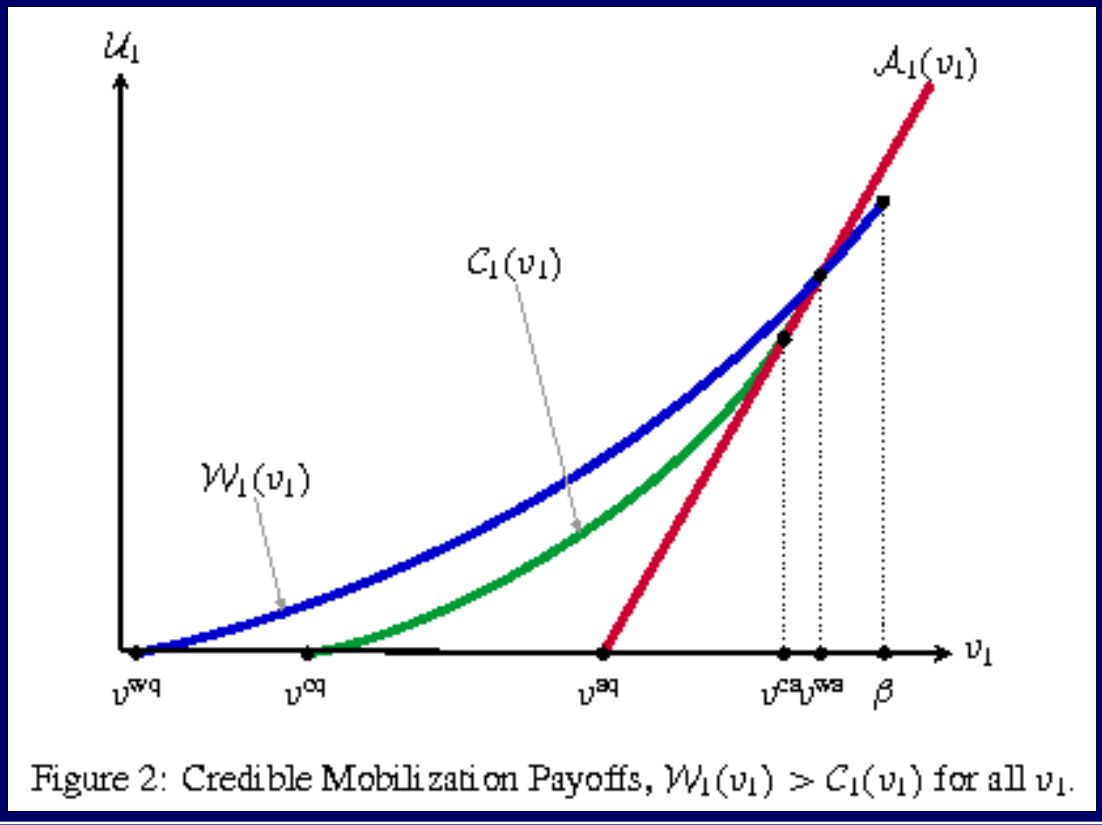


Figure 2: Credible Mobilization Payoffs, $W_1(v_1) > C_1(v_1)$ for all v_1.

Escalation Cut-Point Types

- We notice other configurations can occur:

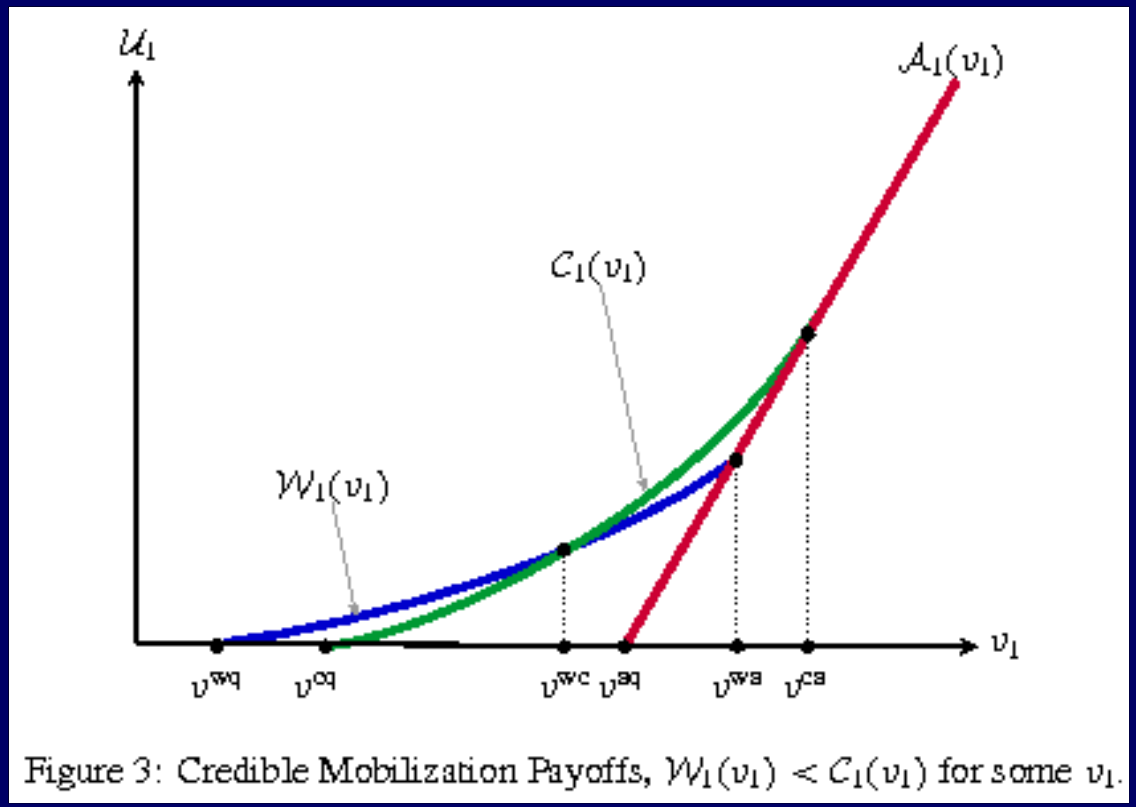


Figure 3: Credible Mobilization Payoffs, $\mathcal{W}_1(v_1) \lessdot C_1(v_1)$ for some v_1.

Almost Ready for Results

- Analysis reduces to figuring out the relationship between the two sets of cut-point types (credibility and escalation)
- We find that all types resolved for war will also be resolved for coercion, and all types resolved for coercion will also be resolved for compellence: $\underline{\nu}^{a} \leq \underline{\nu}^{c} \leq \underline{\nu}^{w}$
- Divide the rest of the analysis in three cases:
  - war preparation: $\nu^{wq} \leq \min(\nu^{cq}, \nu^{aq})$
  - coercive warning: $\nu^{cq} \leq \min(\nu^{wq}, \nu^{aq})$
  - assured compellence: $\nu^{aq} \leq \min(\nu^{wq}, \nu^{cq})$

Results: War / Compellence

- Which of the cases from Figs 2 and 3 obtains determines whether coercion will be attempted in equilibrium
- If condition (NC) is satisfied, no coercion will be attempted: $\nu^{\mathrm{wa}} \geq \nu^{\mathrm{ca}}$
- If (WAR) and (NC), equilibrium is:
  - appease if $\nu_1 < \nu^{\mathrm{wq}}$
  - mobilize for war if $\nu_1 \in [\nu^{\mathrm{wq}}, \nu^{\mathrm{wa}})$
  - mobilize for compellence if $\nu_1 \geq \nu^{\mathrm{wa}}$
- Need to specify beliefs and such, but this is now relatively easy (although still messy)

Results: War / Coercion / Compellence

- If (WAR) is satisfied but (NC) is not, the equilibrium is:
  - appease if $v_1 < v^{\mathrm{wq}}$
  - mobilize for war if $v_1 \in [v^{\mathrm{wq}}, v^{\mathrm{wc}})$
  - mobilize for coercion if $v_1 \in [v^{\mathrm{wc}}, v^{\mathrm{ca}})$
  - mobilize for compellence if $v_1 \geq v^{\mathrm{ca}}$
- All these mobilizations are credible (no bluffing)

Results: Credible Coercion

- Assume (WARNING) is satisfied; coercion is credible iff (CC) is also satisfied: $\underline{v}^{c} \leq v^{cq}$
- If (WARNING) and (CC), equilibrium is:
  - appease if $v_1 < v^{cq}$
  - mobilize for coercion if $v_1 \in [v^{cq}, v^{ca})$
  - mobilize for compellence if $v_1 \geq v^{ca}$
- All mobilizations are credible… what if (CC) fails?

Results: Incentives to Bluff

- If (CC) fails, we have: $v^{cq} < \underline{v}^{c} < v^{ca}$
- this means that:
  - $v_1 \in [v^{cq}, v^{ca})$ want to coerce if S_2 would believe their escalation is credible…
  - but $v_1 \in [v^{cq}, \underline{v}^{c})$ would not be resolved at their optimal allocations
- Since optimal allocations are unique for each type, if these types used such a level, S_2 would infer that they are not resolved and would resist for sure!
- Hence, in equilibrium these types cannot use their coercive mobilization levels…
- So what are they supposed to do?

Bluffing: The Problem

- Since bluffing yields strictly positive payoff if successful, some types would try to mimic the allocation of a least resolved type: they overpay but if this convinces S_2 that they are resolved, she would capitulate with positive probability…
- Of course, if they do mimic in equilibrium S_2 would take it into account, revise her beliefs, and resist with a higher probability (because there's a chance S_1 would capitulate)
- This now reduces the payoff of the resolved type whose allocation the bluffers are mimicking
- So what would that type do? If he allocates slightly more, he may separate himself from the bluffers by making the strategy too costly to imitate
- Hence, we now want to see if resolved types would eliminate the incentives for bluffing for unresolved types

Bluffing: The Condition

- In any equilibrium with bluffing, the least-resolved type must not be willing to allocate slightly more to reveal his resolve
- However, it turns out that the benefit from changing S2's beliefs with such a deviation always outweighs the cost if this cost is arbitrarily small
- Hence, such a type will always deviate as long as S2's beliefs matter for her capitulation probability
- S2's beliefs matter in any coercive equilibrium (if she capitulates for sure, there is no reason to further "improve" her beliefs)
- Hence, resolved types would over-allocate to eliminate the incentives for bluffing iff (NB) is satisfied: $\underline{v}^{a} \leq v^{aq}$

Bluffing: The Solution

- How would bluffing be eliminated?
  - the least-resolved type would over-allocate until no bluffer wants to mimic the strategy
  - since higher allocations make some types resolved, he only has to increase the allocation until the new least-resolved type is indifferent between escalation and appeasement
  - the resulting allocation is some other type's optimal coercive level, so everyone in-between must pool on that: using their own lower allocations would open them to bluffing
- Confused yet?

Bluffing: Graphs to the Rescue

- Eliminating bluffs through pooling:

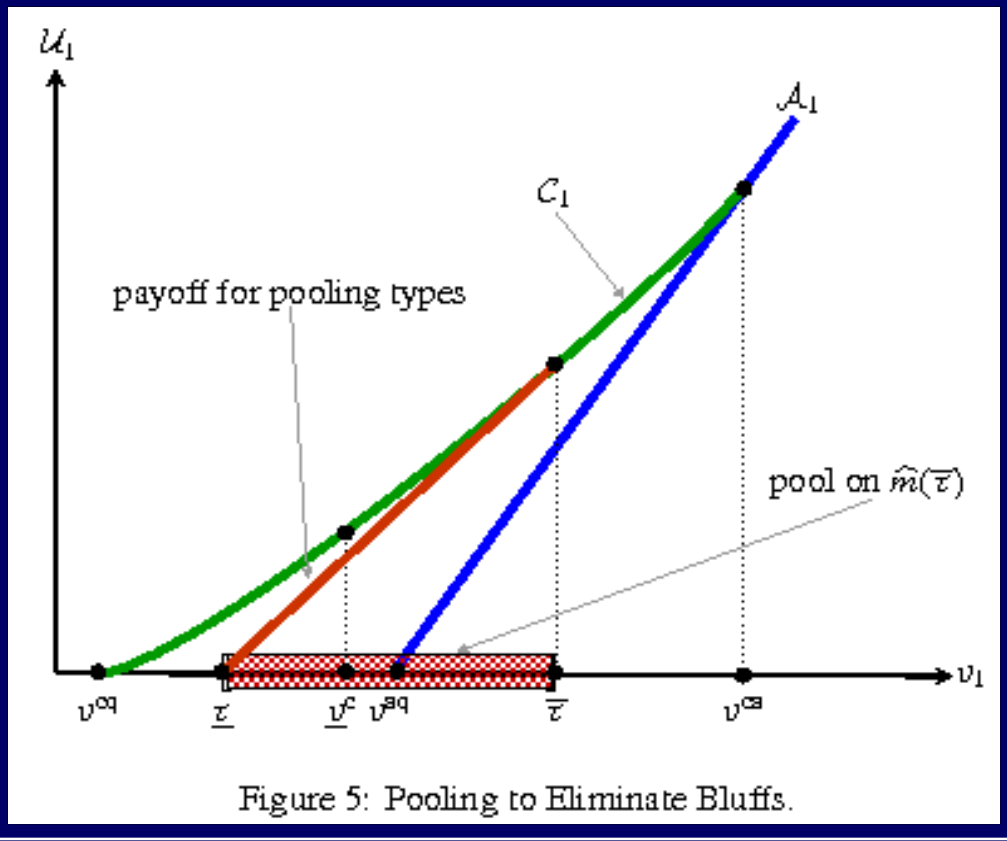


Figure 5: Pooling to Eliminate Bluffs.

Results: Credible Pooling

- If (WARNING) and (NB) are satisfied but (CC) is not, the equilibrium is:
  - appease if $v_1 < \underline{\tau}$
  - pool for coercion if $v_1 \in [\underline{\tau}, \bar{\tau}]$
  - mobilize for coercion if $v_1 \in (\bar{\tau}, v^{ca})$
  - mobilize for compellence if $v_1 \geq v^{ca}$
- All these mobilizations are credible (no bluffing)

Results: Compellence

- If (COMPELLENCE) and (NB) are satisfied, the equilibrium is:
  - appease if $v_1 < v^{aq}$
  - mobilize for compellence if $v_1 \geq v^{aq}$
- All mobilizations are credible… what if (NB) fails?

Results: Equilibrium Bluffing

- If (NB) fails, the smallest type to profit from assured compellence is *not* resolved at the credible compellent allocation, contradicting the supposition that S_2 would believe that types who use it are resolved
- Hence, she will not capitulate for sure, contradiction the supposition that this mobilization assures compellence

Results: Equilibrium Bluffing

- In any equilibrium with bluffing, it must be the case that resolved types do not want to deviate and convince S_2 that they are resolved
- But we have seen that as long as she resists with positive probability, they always have such an incentive
- Hence, in any equilibrium with bluffing, S_2 must capitulate with certainty even though she knows S_1 may be bluffing

Results: Bluffing / Compellence

- If (NB) is not satisfied, the equilibrium is:
  - appease if $v_1 < \tilde{v}^{aq}$
  - mobilize for compellence if $v_1 \geq \tilde{v}^{aq}$
- The least-valuation type to escalate is indifferent between using the compellent level and appeasing
- The compellent level is chosen such that it is “credible enough”; that is, S_2 is indifferent between capitulation and resistance given that resistance would lead to war with positive probability determined by the proportion of bluffers (requires solving a cubic)
- This level exceeds the credible compellence level

Analysis Post-Mortem: Initial Estimates and Reality

- this took me from October to February (initial estimate was for a month)
- had to rewrite the model three times:
  - remove initial move by S_2
  - modify payoffs to include audience costs (not shown in this version)
  - add pre-crisis distribution of power
- found mistakes several times, computer sims helped uncover cases of exogenous variables for solutions I had missed

Analysis Post-Mortem: Lessons

- Presentation is not same as solving:
  - actual write-up takes 30+ pages, condensed into fewer than 10
  - organization of results follows ease of exposition rather than analysis
- Come up with useful notation:
  - must be easy to remember / mnemonics
  - see Thomson's "A Guide for the Young Economist" (2001)
- Things that help a lot with analysis:
  - lots of pictures (I have dozens of plots not shown here, just to verify conjectures)
  - computers: write simulation and verification programs
  - numerical examples: solve a few to gain intuition for general results and to verify analytics

OK, Now What?

- We now have several equilibrium types:
  - not “multiple equilibria” (that is, solutions that co-exist)
  - rather, an equilibrium that takes different forms depending on values of exogenous variables
- Many people essentially stop here: write up results, do some comparative statics, and send the paper… and likely get it rejected

What To Do With a Solved Model?

- Figure out what the analysis is telling you; you should be able to:
  - explain why you are getting the results
  - explain the logic of the results to a non-technical audience
- If you do these, you will be able to see:
  - whether the results are new
  - how the new results are interesting
- In my case, this phase of the research takes longer than solving the model (months)!

Post-Analysis: Verify Results

- With a complicated model/solution like this one, we may wonder if our results are correct:
  - go over math, then do it again, and again (I have found mistakes even on fourth or fifth verification rounds)
  - plug numbers and solve, check for deviations from equilibrium
  - this is best done with a program (I use C/C++ or Gauss)

Post-Analysis: What to Look At

- Ask questions that speak to the literature (and will be of interest to audiences):
  - crisis stability: what is the probability that a crisis will end in war?
  - escalation stability: what is the probability that a crisis will end in war conditional on its militarization by S_1?
  - peaceful resolution: what is the probability that the crisis will end peacefully in one way or another?
- New to this model: what are the expected crisis mobilization levels?

Post-Analysis: How to Look?

- Model is very complex with many moving parts, so simulations are natural way to go instead of analytical comparative statics
- With so many parameters, what do we want to simulate?
  - which variables to fix and which to vary?
  - how to fix the ones we do
- Again, answers depend on questions!

Asking the Right Questions

- The literature talks a lot about (among other things):
  - distribution of power
  - balance of interests
  - misperception
- Set up simulations to address at least these in some way (substance)
- Also, we might want to relate results to existing formal models (pure theory)

Setup: Distribution of Power

- In the MTM (military threat model), the distribution is *endogenous*, which is unlike most other models out there
- Usually, models summarize the distribution of power (or BOP) in terms of the probability of victory, *p*
- We define pre-crisis BOP as: $p=M_1/(M_1+M_2)$
- …and note immediately that not all BOPs are created equal:
  - we can get same *p* with different (M_1,M_2) combinations
  - for all other models, this is inconsequential
  - for MTM, it is not because the additional mobilization would have a different effect depending on existing levels…
- Hence, we introduce a new concept: *system militarization*

Setup: System Militarization

- System militarization is defined as the existing absolute levels of military capabilities
- Hence, we use different levels of militarization:
  - Baseline: M_1 is 10% of max valuation for S_1
  - Low: M_1 is half the baseline
  - High: M_1 is double the baseline
- For each, we vary BOP from 0 to 1 (all values)
- Note: many possibilities, but
  - we picked only three to investigate
  - we set them at substantively interesting levels

Setup:
Balance of Interests

- In the MTM, interests are defined by valuations, but there are infinite configurations to look at...
- Four general situations seem particularly interesting:
  - both players have peripheral interests
  - both players have vital interests
  - one has vital, the other peripheral interest

Setup: Vital and Peripheral Interests

- How should we define these? Again, many possibilities, so simplify… but how?
- Intuitively, a player's interest is *vital*, if the opponent correctly perceives his valuation to be high; it is *peripheral*, if the opponent correctly perceives it to be low
- Formally, define the distributions as follows:
  - vital: $v_i \sim [\bar{v}_i / 2, \bar{v}_i]$
  - peripheral: $v_i \sim [0, \bar{v}_i / 2]$
  - general: $v_i \sim [0, \bar{v}_i]$

Setup: Misperception

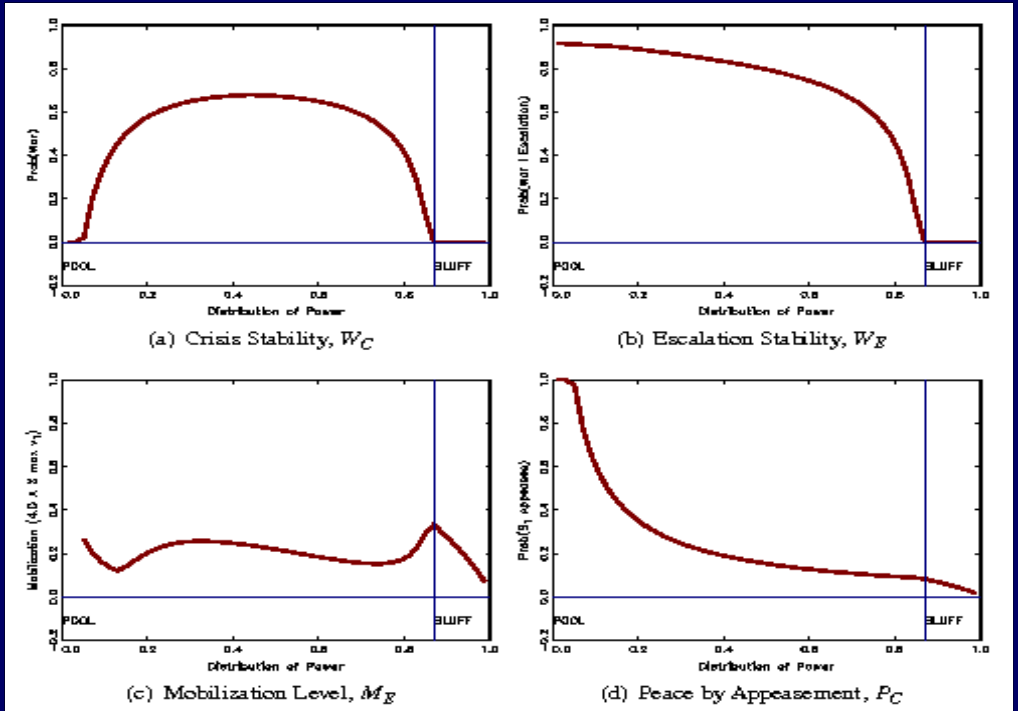
- The definition of interests assumed they were perceived correctly by the opponent… but what if that's not the case
- What mistakes can S_1 make?
  - Optimism: misperceive a vital interest for peripheral
  - Pessimism: misperceive a peripheral interest for vital
- That is, S_1 takes action under wrong belief, S_2 reacts on basis of her real valuation; since S_2 knows S_1's mistake, she can infer from his behavior what equilibrium he thinks he's playing, so she can update about his type

Setup: Interests and Misperception

		S2's interests	
		Peripheral *(pessimism)*	Vital *(optimism)*
S1's interests	Peripheral	Minor Dispute *(high-stakes for S_2)*	High-Stakes for S_2 *(minor dispute)*
	Vital	High-Stakes for S_1 *(acute crisis)*	Acute Crisis *(high-stakes for S_1)*

Understanding What the Model Tells You

- Run some sims to get sense of results:



(a) Crisis Stability, W_C (b) Escalation Stability, W_E

(c) Mobilization Level, M_E (d) Peace by Appeasement, P_C

Figure 6: The Impact of the Balance of Power (baseline system militarization, baseline balance of interests, low costs).

Understanding What the Model Tells You

- immediately notice odd mobilization level, so “unpack” to see why it happens

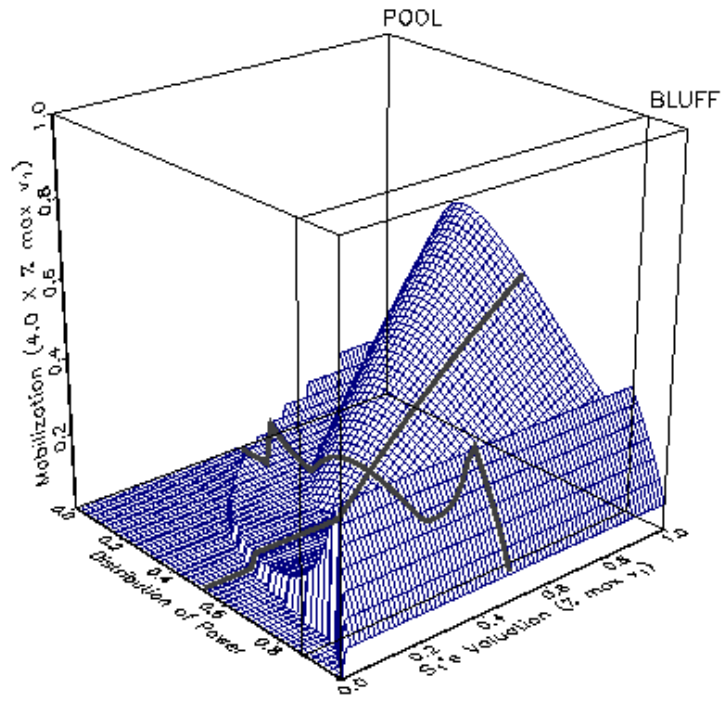


Figure 7: Type-Dependent Mobilization and the Balance of Power (baseline system militarization, baseline balance of interests, low costs).

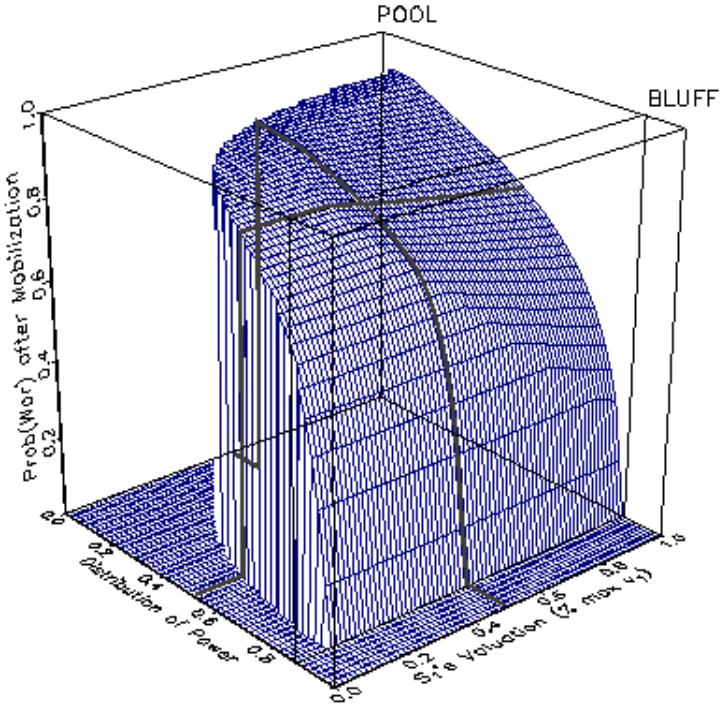


Figure 8: Expected Probability of War (baseline system militarization, baseline balance of interests, low costs).

Understanding What the Models Tells You

- Mobilization levels are non-decreasing in type:
  - intuitive, similar to costly signaling; higher types use costlier actions
  - but look at the crisis stability plot: higher types do not necessarily risk war more
- This seems odd… recall the general results from Banks (1990)

Should Higher Types Risk War More?

- Banks (1990) finds that higher types obtain better peaceful outcomes (i.e., conditional on no war) but must run higher risks of war in any equilibrium
- Not so in the MTM: higher types do get better peaceful outcomes but often run lower risks!
- So, what's the difference and why is it important?

Crisis Behavior & Risk of War: Why Care?

- Because Banks (1990) gives a very general result which must hold for *any* equilibrium in *any* Bayesian game that fits the general environment he specifies (so independent of extensive form!)
- All models we have so far (Morrow, Fearon, Powell, etc) exhibit this behavior
- Validates a long-running assumption in IR that higher types will risk war more (BdM/Lalman)

Crisis Behavior & Risk of War: Why Care?

- The strong *monotonicity* results extend to signaling games as well (Fearon's tying-hands and sinking-costs models) even though they do not belong to class analyzed by Banks
- In fact, the popular Rubinstein-based bargaining models of crisis behavior (Fearon, Powell) also exhibit this!
- So, a very general, very common result that is contradicted by the MTM… is this good or bad?
- Well, depends on whether finding makes sense

Crisis Behavior & Risk of War: What's Going On?

- MTM has two crucial features that are necessary to get result:
  - mobilization affects war payoff of opponent
  - mobilization is costly
- Since mobilization affects war payoff, distribution of power is *endogenous:*
  - higher mobilizations tend to improve (up to a point) one's escalation payoff beyond signaling role by:
    - improving one's war payoff directly
    - undermining opponent's war payoff and increasing likelihood of capitulation
  - mobilization useful for more than info revelation

Crisis Behavior & Risk of War: Mobilization is Different

- This means that higher types can mobilize at higher levels and obtain better payoffs… but what's to stop weaker types from mimicking this?
  - high mobilization seems very attractive because it reduces likelihood of war
  - but... it is also expensive, which discourages weak types from trying it
  - we have seen how strong types overcome bluffing problem by over-allocating; i.e., by paying costs that make bluffing unprofitable for weak types

Crisis Behavior & Risk of War: Are Results Worth It?

- We have now found out that if the coercive instrument influences opponent's war payoff directly and is costly, a fundamental monotonic relationship does not hold
- Our finding has a very intuitively appealing logic: higher types are more aggressive and willing to pay more for better coercion, so they end up risking war less than weaker types

What About Bluffing?

- Another interesting point is that bluffing in the MTM is different from bluffing in all other models:
  - in non-MTM models, bluffing happens because higher types do not have any way of separating themselves from weaker ones (exception: tying-hands and sinking-costs with intuitive criterion refinement)
  - in MTM, bluffing happens because higher types do not *want* to separate themselves; only in the assured compellence equilibrium where there's no gain to be had from revealing one's resolve for sure
- Reason for difference is (again) nature of instrument: flexible and truly coercive

Relating Results to Bargaining Model of War

- We know the MTM is too stylized and has no bargaining… but:
  - risk-return trade-off (Powell, 1996) relies on essentially the same monotonicity
  - Leventoglu-Tarar (2005) show it seems to disappear when we tweak extensive-form
- The trade-off does not necessarily show up in MTM either:
  - running risks in MTM differs from RRTO
  - RRTO appears to depend on player's inability to influence war payoff of opponent
- Must re-analyze bargaining model of crises!

So, First Results Encouraging

- Before even jumping into simulations to address other interesting questions, we have uncovered an intriguing aspect of MTM that:
  - shows very common monotonicity results not that general
  - shows very common RRTO may have been overstated (so explanation for war under incomplete information in limbo)
  - implies we need to rethink crisis signaling
- And all of this by “simply” understanding our own results, comparing them to existing ones, and asking where the discrepancy comes from

Pushing Further: Asking

- If private info explanation of war we have seems to depend on somewhat unwarranted assumptions, what would the MTM have to offer as alternative?
  - solve model with complete info
  - see where difference comes from when we add uncertainty
  - what, if any, implications does this have?

Pushing Further: Analyzing

- Assume baseline balance of interests, system militarization, high costs for S_1 and low costs for S_2.
- Solution of MTM with incomplete information is Coercive Equilibrium (3):
  - all types $v_1<16.02$ appease
  - all others coerce (none compel)
- Suppose now complete info with $v_1=18.75$ and $v_2=15$:
  - under uncertainty: S_1 mobilizes $m=3.84$ for coercion (S_2 expected to capitulate with probability 28%), S_2 resists, and they fight because S_1 has committed himself (*-2.89* for war and *-6.34* for capitulation given this *m*)
  - with complete info: S_1 mobilizes $m=13.75$ and S_2 capitulates; S_1 is resolved for any $m>0.36$, and S_2 would capitulate rather than fight for any $m>=13.75$; since optimal war gives S_1 *-2.44*, assured compellence is better with payoff of *5*.

Pushing Further: Explaining

- Striking that S_1 achieves compellence even though best war payoff is worse than appeasement
- Works because sinking mobilization costs makes capitulation (*-16.25*) costlier than improved war payoff (*-10*)
- S_1 has tied his hands and, crucially, has untied S_2's by making capitulation preferable for her

Pushing Further: Answering

- Contrast with incomplete info result where S_1 allocates *m=3.84*:
  - this is enough to commit him to war (minimum for this v_1 is *m=0.36*)
  - this is <u>not</u> enough to get S2 to capitulate for sure (minimum is *m=13.75*)
- S_1 has now created a situation in which neither opponent wants to back down

Pushing Further: A Conjecture

- Using military instrument changes physical environment and alters the incentives for both players
- MTM suggests 2-step road to war:
  - attempt to coerce under uncertainty with a costly instrument may commit both actors
  - actors may then prefer to fight even if uncertainty is no longer an issue
- Next step: formalize in bargaining setup

Quick Recap

- We looked at sample plots and noticed “weird” aggregate behavior
- We unpacked it and noticed type-dependent behavior that contradicted well-known results
- We analyzed the discrepancy and then dug further (with examples) to see if it mattered
- We found that it does matter quite a bit (?!)
- At this point, more than enough for a paper… and we have not even touched the sims yet!

A Quick Glance at Sims: System Militarization

- Since I have not done the other sims yet, here's a preview of some runs
- Recall that system militarization is absolute levels of existing allocations
- Two different allocations can generate same probability of winning (ex ante probability-equivalent)
- We find (with proof) that if two allocations are ex ante probability-equivalent, the same mobilization will increase the probability of winning by a larger amount in the under-militarized system
- That is, mobilization is more effective when opponents are lightly-armed to begin with

System Militarization: Expected Mobilization

- Crisis behavior depends on absolute levels of capabilities, not just relative
- Under-militarized systems exhibit more aggressive behavior under all but very skewed BOP
- Leftward shift: coercion becomes more attractive at lower BOP in these systems (because mobilization is more effective)
- Upward shift: all else equal, mobilization will be higher at given BOP (since more effective, makes sense to pay slightly higher costs)

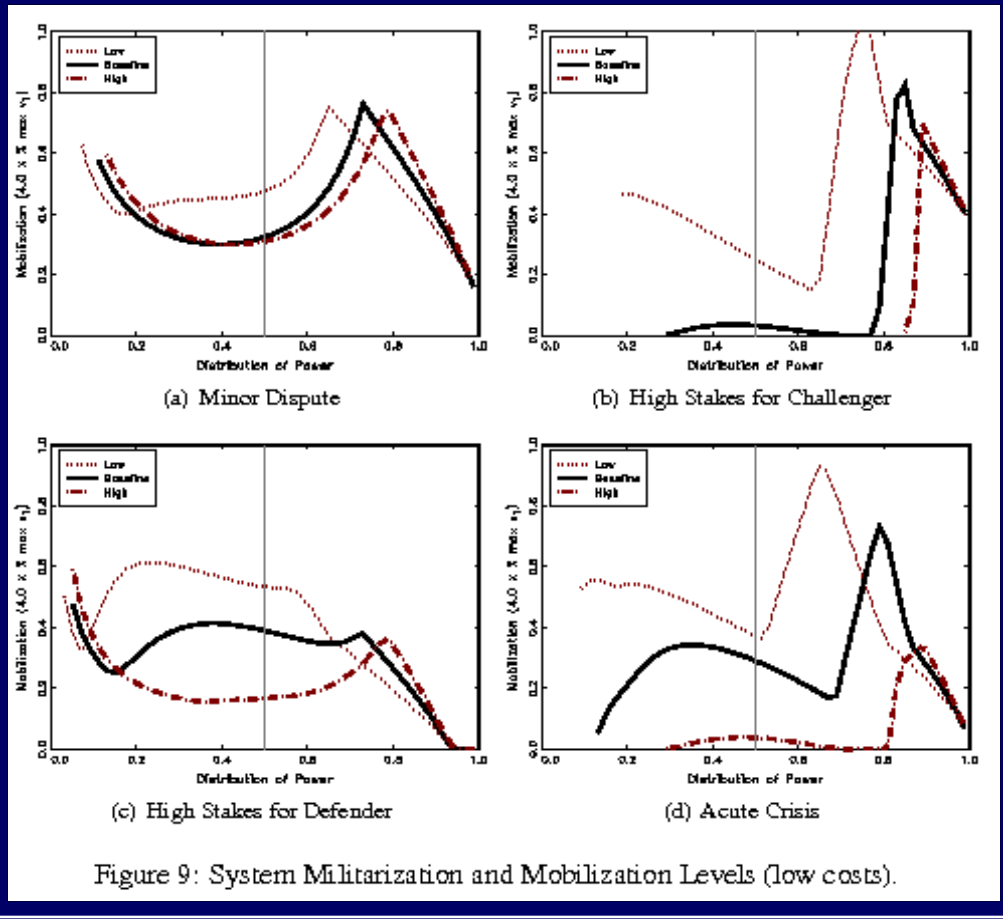


Figure 9: System Militarization and Mobilization Levels (low costs).

System Militarization: Crisis Stability

- Crises between heavily armed opponents will involve less aggressive mobilizations but risk of war will be higher (except at very skewed BOP)
- When BOP disproportionately favors S_1, mobilizations in under-militarized systems are lower but crises are more stable
- When BOP disproportionately favors S2, mobilizations in under-militarized systems are higher and crises are less stable… WHY?
  - in this range, mobilization leads to certain war because coercion is not profitable
  - when BOP extremely unfavorable for S_1, no type even escalates
  - since military instrument is more effective in under-militarized systems, war becomes profitable at lower BOP, so some types begin escalating, decreasing crisis stability
- Note that probability of war peaks under any BOP, depending on balance of interests!

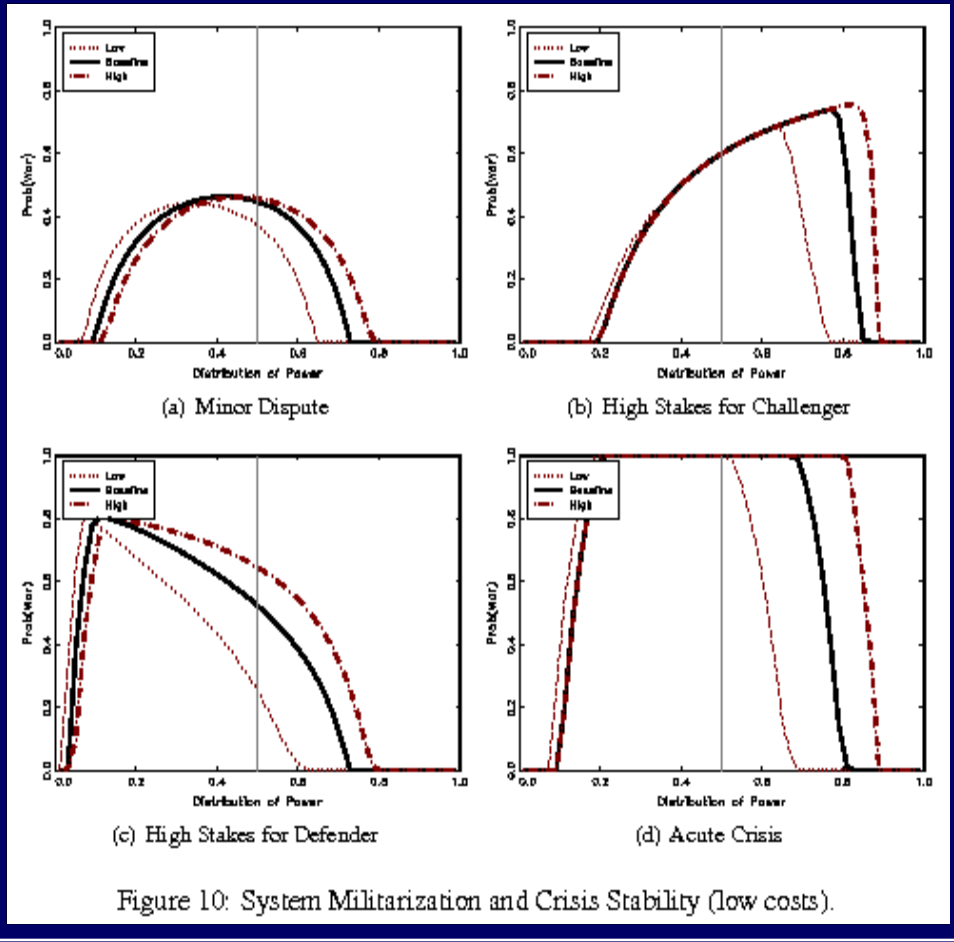


Figure 10: System Militarization and Crisis Stability (low costs).

Next Step Already Clear

- Since crisis instability can peak under any BOP depending on interests, we must clearly address predictions of various schools:
  - balance of power says *p=.5* most stable
  - preponderance of power says *p=.5* least stable
  - bargaining model says least stable when expected benefit of war too far from status quo valuation
- Examine why war becomes more likely when it does under MTM and how this result depends on the features of the military instrument

Things to Think About

- Misperception (already set up)
- Balance of costs (preliminary results show that high costs may not be stabilizing, contrary to popular opinion)
- Selection effects (need to add initial move by S_2)
- Compare threat mechanisms (MTM vs sinking costs, tying hands, threats that leave something to chance)

Empirical Tests (Fantasies)

- Statistical tests:
  - require new data (military moves, not just whether but when, how many, what)
  - Signorino's injuctions against "business as usual" hold in full… which is a problem because this model is beyond existing techniques of strategic probits
  - BUT… can analyze several hypotheses (a-la Signorino Tarar (2006)
  - Can check how formal model fits data:
    - Feed data as values of variables in model
    - Generate equilibrium predictions
    - Compare observed vs predicted
  - Rather than estimate coefficients with statistical model, use fixed coefficients that formal model yields to see if we can get any purchase (hard to normalize data though)

Empirical Tests (Reality)

- Case studies may be quite appropriate:
  - check logic of escalation suggested by model against historical record
  - check off-the-path beliefs necessary to sustain the logic
- Possible nice case: Chinese intervention in Korean War
  - common explanation: US misread China
  - MTM says that before Inchon US would have negotiated if China entered but after Inchon (equivalent to mobilization) Chinese entry without overt Russian support no longer sufficient
  - According to MTM: info not the crucial thing, commitment after mobilization was
  - Evidence suggests this was the case (directives to MacArthur, etc.)

Conclusions, 1/3

- More questions arise after the analysis than before, so milk the model!
- Relate results to existing ones, explain discrepancies, look for new implications
- Use numerical examples to gain intuition
- Use graphs to solve models, explain results, and generate more puzzles
- Use programs to verify results and run simulations beyond simple statics

Conclusions, 2/3

- Write-up is not the same as analysis
  - write so readers can follow logic, exposition will hide most gory details
    - yes, it's painful to condense two weeks' worth of excruciating math into a two-line footnote
    - but you have to do it or no one will read
    - the time spent on part of the analysis is usually not proportional to amount of text about that part that ends up in finished paper
  - Give examples, pictures worth 10^6 words

Conclusions, 3/3

- Use existing papers from authors you admire as templates
- Make sure your discussion gives enough “meat” to make modeling effort worth slogging through
- In my case, writing discussion section takes about twice as long as analysis
- Writing introduction takes at least a week