Supporting Information for "Unfair Fights"

Overview

The first portion of this supplementary appendix contains descriptive statistics and robustness tests for the manuscript's empirical results. The second portion concerns additional formal model results.

Tables 1 and 2 provide background information about the data set, including the list of cases and summary statistics.

- Table 1 is a list of all directed anticipated-shift dyads used in the main analysis. Episodes with ongoing wars, in which case the declining state could not launch a new preventive attack, are excluded from the table.
- Table 2 provides summary statistics for the variables used in the analysis of anticipated-shift dyads, split by shift-year values and shift-episode values.

Tables 3, 4, and 5 are robustness tests for the results in the manuscript.

- Table 3 re-runs the analysis with alternative control variables, such as *Alliance*, *Joint Democracy*, *Initiator's Regime Type*, and *Target's Regime Type* in the specifications. *Alliance* is a binary indicator equal to one if the dyad has an entente, neutrality pact, or formal defense pact. *Joint Democracy* is a binary indicator equal to one if both states in a dyad have Polity IV scores of at least seven (Marshall and Jaggers 2002). *Initiator's Regime Type* and *Target's Regime Type* reflect the Polity IV score for each state in the directed dyad. Prior work indicates a declining state's regime matters as democracies are less likely to initiate preventive conflict (Schweller 1992) while a rising state's regime matters because autocracies are more likely to have their nuclear facilities attacked (Fuhrmann and Kreps 2010). Note that results remain statistically significant after including a dummy variable for the US in any of the Table 3 specifications (results not shown).

- Table 4 drops observations where both sides have nuclear programs in which case it may be difficult to discern which side is rising.
- Table 5 uses an alternative binary outcome variable indicating whether military force was used against the rising state. The variable equals one when there is a Militarized Interstate Dispute (MID) initiated by the declining state that reaches a hostility level of either a "use of force" or "war." For the model using the episode as the unit of analysis, the use of force at any point within that episode's duration is coded as a one. This differs from the main outcome variable in that it demands a higher level of hostility by excluding threats to use force or shows of force.

Tables 6 through 7 use an alternative data set to assess whether the results from the models that only include instances with shifting power are prevalent within all politically relevant dyads. This data set includes all the anticipated-shift year observations from before and supplements this data with all directed politically relevant dyads after 1940. *Anticipated Shift* is now an explanatory variable and is interacted with *Relative Capabilities* to assess whether the effect of moving from parity to asymmetry is stronger when power shifts are present. The control variables used in these models are similar to those used in the earlier specifications with the exception of *Duration*, which is only substantively applicable for power shifts. This analysis is similar to that in Table 3/Figure 2 of Sobek, Foster and Robinson (2012). The results show that power asymmetry's role is especially pronounced when power is shifting, as compared to a baseline result where relative power is stable. See Figures 1-4 below for additional evidence on this point.

- Table 6 gives the descriptive statistics for this full data set.

- Table 7 provides the interaction model results. The interaction and lower order terms are the coefficients of interest as they indicate whether the effect of increasing relative capabilities is particularly pronounced when power shifts are occurring. As anticipated, the lower order term for *Anticipated Shift* is positive. Looming power shifts increase the probability of conflict as theories of commitment problems expect. Most importantly, the interaction term is positive and statistically significant in all specifications. This indicates that the effect of moving the initiator's share of capabilities from parity to asymmetry has a larger effect when a power shift is occurring as compared to an identical change in capabilities when power is fixed (as illustrated in Figure 1).
- Figure 1 summarizes the Table 6 results by calculating the increased probability of conflict when increasing *Relative Capabilities* from 0.55 to 0.95 when there is a shift, or no shift, in power. As the figure makes evident, asymmetry has a substantively large effect when a power shift is occurring, increasing the relative probability of conflict by over 90%. The effect size is far smaller when there is no power shift occurring (roughly 15% relative to the baseline). This result indicates that power asymmetry, as compared to parity, is especially problematic when power shifts are occurring.

Figures 2 and 3 provide predicted probabilities of conflict from models with more flexible functional forms. The relationship between a declining state's initial share of dyadic capabilities and the probability of conflict is monotonically increasing in all specifications. The expected relationship holds across the full range of the explanatory variable. Importantly, this illustrates that the results in the manuscript are not entirely driven by cases in which an already overmatched state confronts a rival with a nuclear program. I report predicted probabilities rather than table results to ease interpretability.

- Figure 2's left panel comes from a cubic polynomial regression.

- Figure 2's right panel is based on a generalized additive model with a smoothing function on the explanatory variable. Implemented using `R` package `mgcv` (Wood 2011).
- Figure 3's left panel uses dichotomous indicators for each quarter of the explanatory variable's range.
- Figure 3's right panel is based on a bootstrapped basis regression with oracle model selection as implemented in `R` package `polywog` (Kenkel and Signorino 2012).

Figures 4 examines dyads *without* shifting power with more flexible functional forms. It repeats the analysis from Figure 2 but uses directed politically relevant dyads after 1940 in which power is *not* shifting—that is, the target state is not a rival with a nuclear proliferation program. As shown with cubic polynomials and a generalized additive model, the relationship between the initiator's share of dyadic capabilities and conflict is non-monotonic. Most importantly, it is declining after parity when there is not shifting power, whereas Figure 2 shows a relationship that is increasing after parity when there is shifting power. This further shows that power asymmetry is particularly problematic when power is shifting and is consistent with the theory. Repeating the analysis from Figure 3 with dyads without power shifts (not shown) produces similar results to those seen in Figure 4.

Following the tables, I consider additional formal results that incorporate (1) a contest success function, (2) decision weights that more closely match the literature and (3) an alternative bargaining protocol that allows either of the two states to initiate conflict (Powell 1999; 2006).

Table 1: Cases of Anticipated-Shift Dyad Episodes

	Rival	Proliferator	Start	End
1	USA	USSR	1945	1949
2	USA	Libya	1973	1996
3	USA	Iran	1983	1997
4	USA	Iraq	1987	2000
5	USA	China	1955	1964
6	USA	North Korea	1965	2000
7	Brazil	Argentina	1968	1985
8	Chile	Argentina	1968	1990
9	Argentina	Brazil	1953	1985
10	UK	Argentina	1968	1990
11	UK	USSR	1943	1949
12	UK	Iraq	1976	2000
13	UK	China	1955	1964
14	France	Germany	1941	1945
15	France	Libya	1978	1987
16	France	Iran	1985	1988
17	France	Iraq	1990	1999
18	Italy	Yugoslavia	1954	1954
19	Yugoslavia	USSR	1948	1949
20	Bulgaria	Yugoslavia	1954	1954
21	USSR	USA	1945	1945
22	USSR	UK	1941	1952
23	USSR	France	1955	1960
24	USSR	Yugoslavia	1954	1955
25	USSR	Sweden	1952	1964
26	USSR	Iran	1983	1987
27	USSR	Israel	1956	1970
28	USSR	China	1955	1964
29	USSR	South Korea	1959	1978
30	Chad	Libya	1970	1994
31	Angola	South Africa	1975	1979
32	Zambia	South Africa	1969	1979
33	Morocco	Algeria	1983	2002
34	Tunisia	France	1957	1960
35	Sudan	Libya	1974	1985

	Rival	Proliferator	Start	End
36	Iran	Iraq	1976	1999
37	Turkey	Iran	1983	2000
38	Turkey	Iraq	1976	2000
39	Turkey	Syria	2001	2004
40	Iraq	Iran	1983	1999
41	Iraq	Syria	2001	2007
42	Iraq	Israel	1949	1970
43	Egypt	Libya	1973	1992
44	Egypt	Iran	1983	2007
45	Egypt	Iraq	1976	2000
46	Egypt	Israel	1949	1970
47	Syria	Iraq	1976	2000
48	Syria	Israel	1949	1970
49	Lebanon	Israel	1949	1970
50	Jordan	Syria	2001	2007
51	Jordan	Israel	1949	1970
52	Israel	Iran	1983	2007
53	Israel	Iraq	1976	2000
54	Israel	Syria	2001	2007
55	Saudi Arabia	Iran	1983	2007
56	Saudi Arabia	Iraq	1976	2000
57	Saudi Arabia	Israel	1957	1970
58	Kuwait	Iraq	1976	2000
59	Afghanistan	Iran	1983	2001
60	Afghanistan	Pakistan	1972	1987
61	China	USSR	1943	1949
62	China	Taiwan	1967	1988
63	China	South Korea	1959	1978
64	China	India	1954	1988
65	China	Australia	1956	1971
66	Mongolia	Japan	1943	1944
67	Taiwan	USSR	1949	1949
68	Taiwan	China	1955	1964
69	North Korea	South Korea	1959	1978
70	South Korea	China	1955	1964

	Rival	Proliferator	Start	End
71	South Korea	North Korea	1965	2002
72	Japan	China	1955	1958
73	Japan	North Korea	1994	1999
74	India	China	1955	1964
75	India	Pakistan	1972	1987
76	Pakistan	India	1954	1988
77	Myanmar	China	1956	1959
78	Sri Lanka	India	1984	1988
79	Nepal	China	1956	1960
80	Nepal	India	1962	1969
81	Thailand	France	1946	1952
82	Thailand	China	1955	1964
83	Laos	China	1961	1964
84	Republic of Vietnam	China	1956	1964
85	Philippines	China	1955	1964
86	Indonesia	United Kingdom	1951	1952
87	Australia	China	1955	1964
88	New Zealand	China	1955	1964

Table 2: Summary Statistics: Anticipated Shifts

	Mean	Std. Dev.	Min	Max	N
Anticipated-Shift Dyad Year					
Outcome Variable					
Preventive Conflict					
Militarized Interstate Dispute	0.15	0.35	0	1	1,162
Use of Force	0.11	0.31	0	1	1,162
Explanatory Variable					
Relative Capabilities					
Mil. Spending & Personnel	0.49	0.29	0.00	0.99	1,161
Mil. Spending	0.53	0.34	0	1.00	1,133
CINC	0.50	0.30	0.00	0.99	1,162
Control Variable					
Contiguity	0.66	0.47	0	1	1,162
Anticipated-Shift Duration	10.86	8.01	0	36	1,162
Peace Years	8.57	20.21	0	107	1,162
Initiator's Polity Score	-1.09	7.71	-10	10	1,162
Target's Polity Score	-2.71	7.49	-9	10	1,162
Anticipated-Shift Dyad Episode					
Outcome Variable					
Preventive Conflict					
Militarized Interstate Dispute	0.56	0.50	0	1	88
Use of Force	0.49	0.50	0	1	88
Explanatory Variable					
Relative Capabilities					
Mil. Spending & Personnel	0.44	0.32	0.00	0.99	88
Mil. Spending	0.46	0.36	0	1.00	87
CINC	0.46	0.33	0.01	0.99	88
Control Variable					
Contiguity	0.64	0.48	0	1	88
Anticipated-Shift Duration	13.35	9.03	1	37	88
Initial Peace Years	9.84	17.18	0	92	88
Initiator's Polity Score	-0.94	7.43	-10	10	88
Target's Polity Score	-2.90	7.00	-9	10	88

Table 3: Anticipated-Shift Dyads: Alternative Control Variables

	Shift Year			Shift Episode		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Capabilities	1.34***	1.32***	1.17**	2.77***	2.68***	2.68***
Mil. Spending & Personnel	(0.44)	(0.47)	(0.46)	(0.94)	(0.92)	(0.93)
Contiguity	0.94***	0.72***	0.69***	0.65	0.38	0.37
	(0.31)	(0.26)	(0.27)	(0.61)	(0.56)	(0.57)
Duration	-0.00	0.00	0.01	0.10***	0.09**	0.09**
	(0.01)	(0.01)	(0.01)	(0.04)	(0.03)	(0.04)
Initiator's Regime Type	0.04*			0.04		
	(0.02)			(0.04)		
Target's Regime Type	0.04*			0.06		
	(0.02)			(0.04)		
Joint Democracy		-0.19	-0.18		14.18	16.39
		(0.55)	(0.53)		(20.04)	(23.93)
Alliance			-0.44			-0.40
			(0.37)			(0.68)
Peace Years	-0.20***	-0.21***	-0.20***	-0.03*	-0.03*	-0.03*
	(0.05)	(0.06)	(0.06)	(0.01)	(0.02)	(0.02)
Constant	-2.57***	-2.53***	-2.48***	-2.10***	-2.06***	-2.05***
	(0.38)	(0.38)	(0.39)	(0.69)	(0.67)	(0.68))
N	1,161	1,161	1,111	88	88	88

$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Notes: Logistic regression with directed anticipated-shift dyad year and episode as units of analysis and militarized interstate dispute as outcome variable. Standard errors in parentheses are clustered on the dyad for Model 1, 2, and 3. Results for higher order *Peace Years* are not shown.

Table 4: Anticipated-Shift Dyads: Drop Observations with Two Nuclear Programs

	Shift Year		
	(1)	(2)	(3)
Relative Capabilities	1.64***		
Mil. Spending & Personnel	(0.48)	—	—
Relative Capabilities	—	1.32***	—
Mil. Spending		(0.44)	
Relative Capabilities	—	—	1.40***
CINC			(0.51)
Contiguity	0.72**	0.70**	0.67**
	(0.30)	(0.31)	(0.30)
Duration	-0.01	-0.01	-0.01
	(0.02)	(0.01)	(0.02)
Peace Years	-0.27***	-0.27***	-0.26***
	(0.07)	(0.07)	(0.07)
Constant	-2.50***	-2.33***	-2.38***
	(0.40)	(0.40)	(0.41)
N	984	956	985

$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Notes: Logistic regression with directed anticipated-shift dyad year as unit of analysis and militarized interstate dispute as outcome variable. Standard errors in parentheses are clustered on the dyad. Results for higher order *Peace Years* are not shown.

Table 5: Anticipated-Shift Dyads: Alternative Outcome Variable

	Shift Year			Shift Episode		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Capabilities	1.19**			2.36**		
Mil. Spending & Personnel	(0.50)			(0.93)		
Relative Capabilities		0.90**			1.68**	
Mil. Spending		(0.39)			(0.78)	
Relative Capabilities			1.04*			2.03**
CINC			(0.53)			(0.87)
Contiguity	0.96***	0.90***	0.91***	0.78	0.65	0.68
	(0.34)	(0.34)	(0.35)	(0.63)	(0.61)	(0.61)
Initiator's Regime Type	0.01	0.01	0.01	0.04	0.03	0.03
	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.04)
Target's Regime Type	0.05**	0.05**	0.05**	0.04	0.04	0.04
	(0.02)	(0.02)	(0.02)	(0.04)	(0.04)	(0.05)
Duration	0.00	-0.00	0.00	0.13***	0.13***	0.13***
	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.04)
Peace Years	-0.26***	-0.26***	-0.25***	-0.05***	-0.05***	-0.05***
	(0.07)	(0.07)	(0.07)	(0.02)	(0.02)	(0.02)
Constant	-2.83***	-2.64***	-2.75***	-2.63***	-2.26***	-2.53***
	(0.44)	(0.39)	(0.43)	(0.77)	(0.71)	(0.76)
N	1,161	1,133	1,162	88	87	88

$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Notes: Logistic regression with anticipated-shift dyad year and episode as units of analysis and use of force as outcome variable. Standard errors in parentheses are clustered on the dyad for Model 1, 2, and 3. Results for higher order *Peace Years* are not shown.

Table 6: Summary Statistics: Politically Relevant Dyads

	Mean	**Std. Dev.**	**Min**	**Max**	**N**
Outcome Variable					
Conflict					
Militarized Interstate Dispute	0.011	0.10	0	1	138,110
Use of Force	0.008	0.09	0	1	138,110
Explanatory Variable					
Relative Capabilities					
Military Spending & Personnel	0.50	0.42	0	1	122,799
Military Spending	0.50	0.44	0	1	125,225
CINC	0.50	0.42	0	1	135,457
Anticipated Shift	0.008	0.09	0	1	138,110
Control Variable					
Contiguity	0.42	0.49	0	1	138,110
Joint Democracy	0.16	0.36	0	1	138,110
Alliance	0.22	0.42	0	1	115,225
Initiator's Polity Score	1.26	7.31	-10	10	138,110
Target's Polity Score	1.25	7.31	-10	10	138,110
Peace Years	24.95	27.14	0	185	118,767

Table 7: Directed Politically Relevant Dyad Year: Power Shifts, Capabilities, Interaction

	Base Specification			Alternative Control Variables		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Capabilities	0.43***			0.43***		
Mil. Spending & Personnel	(0.12)			(0.12)		
Relative Capabilities		0.32***			0.31***	
Mil. Spending		(0.12)			(0.12)	
Relative Capabilities			0.32***			0.30***
CINC			(0.12)			(0.12)
Anticipated Shift	0.77**	0.86**	0.89**	0.74*	0.85**	0.81**
	(0.38)	(0.35)	(0.39)	(0.39)	(0.36)	(0.41)
Relative Capabilities*Shift	1.30**	1.07**	1.12*	1.25**	0.99**	1.16*
	(0.57)	(0.48)	(0.58)	(0.58)	(0.47)	(0.60)
Contiguity	1.67***	1.59***	1.52***	1.67***	1.60***	1.55***
	(0.11)	(0.11)	(0.10)	(0.12)	(0.12)	(0.11)
Joint Democracy				-0.46***	-0.48***	-0.48***
				(0.15)	(0.15)	(0.15)
Alliance				-0.08	-0.10	-0.15
				(0.12)	(0.12)	(0.12)
Peace Years	-0.19***	-0.20***	-0.19***	-0.19***	-0.19***	-0.19***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	-4.27***	-4.14***	-4.15***	-4.22***	-4.09***	-4.10***
	(0.15)	(0.14)	(0.13)	(0.15)	(0.14)	(0.13)
N	107,346	109,526	118,767	104,092	106,118	115,225

$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

Notes: Rare events logistic regression with directed politically relevant dyad year as unit of analysis and militarized interstate dispute as outcome variable. Standard errors in parentheses are clustered on the dyad. Results for higher order *Peace Years* are not shown.

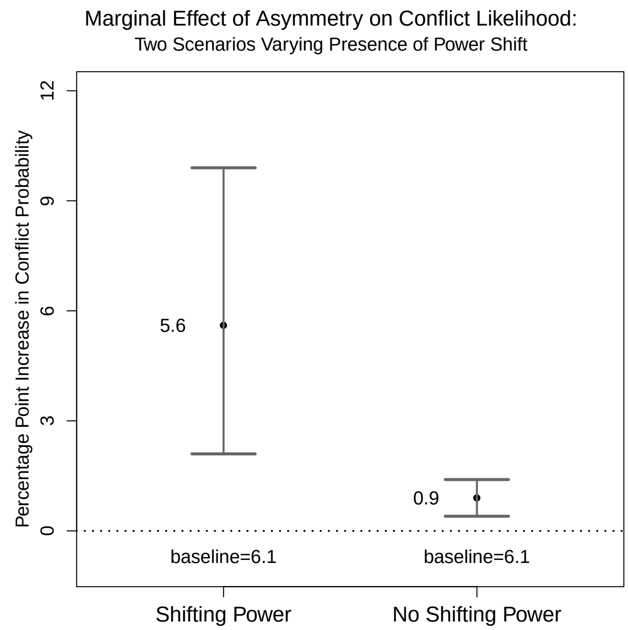

Figure 1: Marginal effect of increasing asymmetry on the probability of conflict with 90% confidence bounds. Effects represent change in conflict probability between parity (*Relative Capabilities = 55%*) and asymmetry (*Relative Capabilities = 95%*) with the capability balances interacted with whether a power shift is present. Asymmetry's effect is substantively larger when a power shift is occurring. Calculated using Model 1 of Table 7.

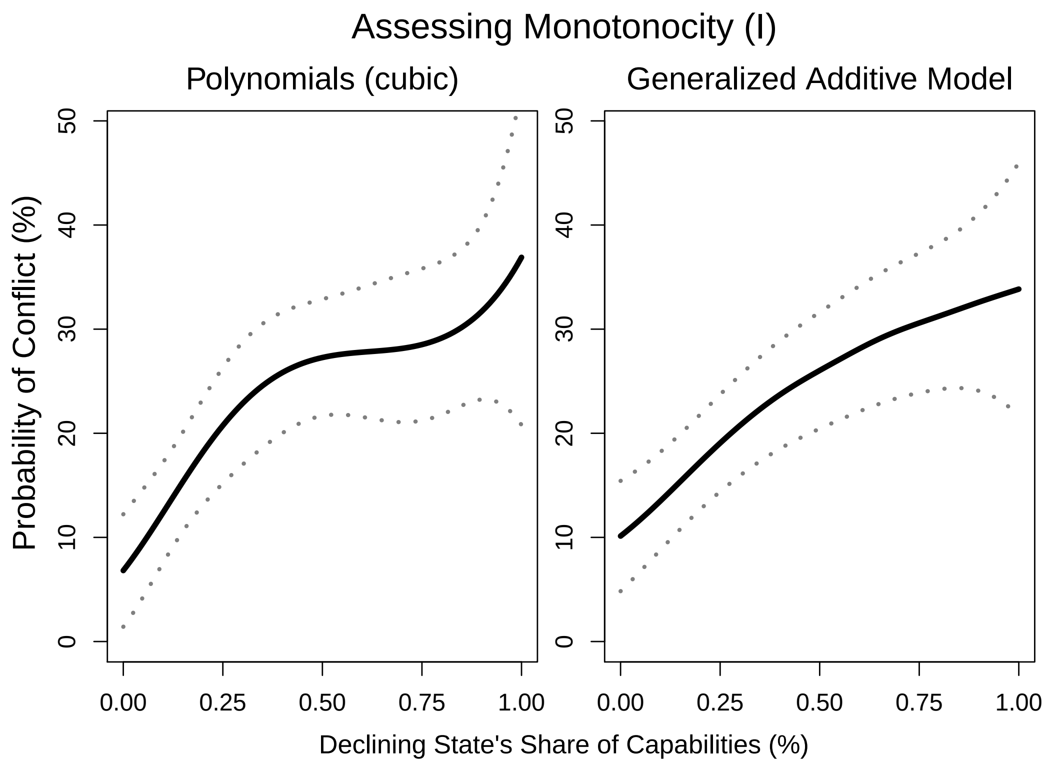

Figure 2: Predicted probability of conflict (with 95% confidence intervals) in models with flexible functional forms for dyads *with* shifting power. Left panel is based on a model with quadratic and cubic polynomials of the explanatory variable. Covariates are otherwise identical to those in Model 1 of Table 3. The predicted probability of conflict increases monotonically with the declining state's share of dyadic capabilities. Right panel is based on a generalized additive model estimated with the `mgcv` package in `R` (Wood 2011). Covariates are otherwise identical to those in Model 1 of Table 3. The predicted probability of conflict increases monotonically with the declining state's share of dyadic capabilities.

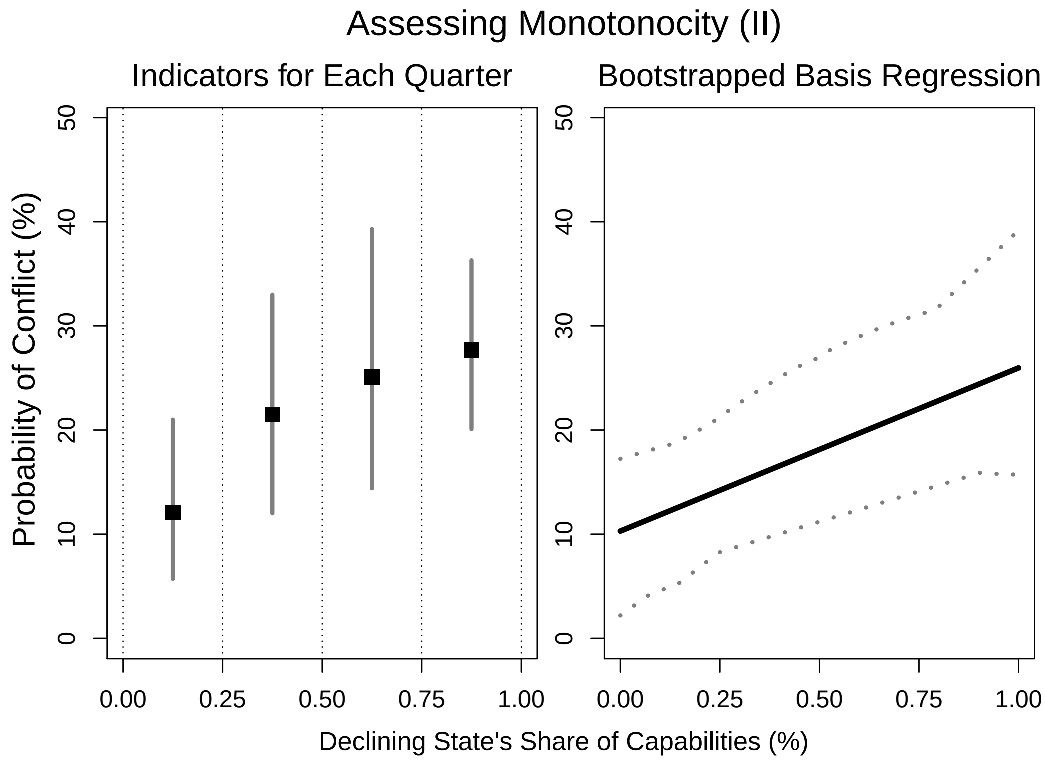

Figure 3: Predicted probability of conflict (with 95% confidence intervals) in models with flexible functional forms for dyads *with* shifting power. Left panel is based on a model using an indicator variable for each quarter of the explanatory variable's range. Covariates are otherwise identical to those in Model 1 of Table 3. The predicted probability of conflict increases monotonically with the declining state's share of dyadic capabilities. Right panel is based on a bootstrapped basis regression with oracle model selection as implemented in `R` package `polywog` (with degree = 2) (Kenkel and Signorino 2012). Input variables are identical to those in Model 1 of Table 3. The predicted probability of conflict increases monotonically with the declining state's share of dyadic capabilities.

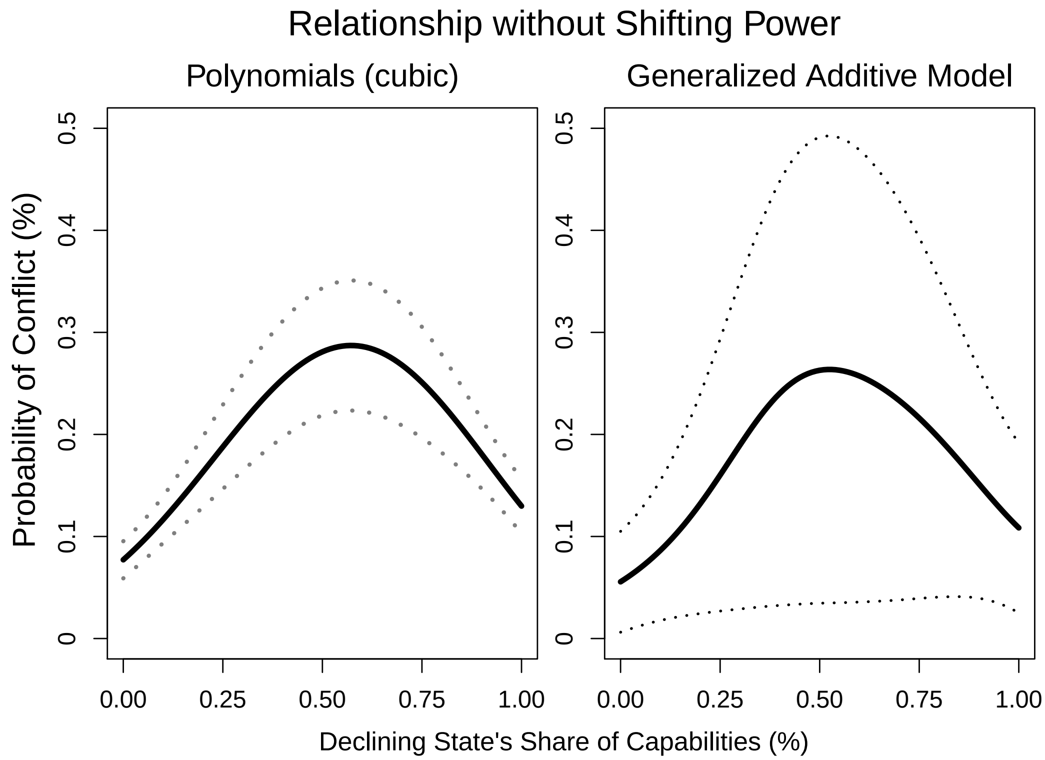

Figure 4: Predicted probability of conflict (with 95% confidence intervals) in models with flexible functional forms for dyads *without* shifting power. Left panel is based on a model with quadratic and cubic polynomials of the explanatory variable. The predicted probability of conflict is non-monotonic and declining after roughly parity. This starkly differs from Figure 2 above which examines dyads *with* shifting power. Right panel is based on a generalized additive model estimated with the `mgcv` package in `R` (Wood 2011). The predicted probability of conflict is non-monotonic and declining after roughly parity. This starkly differs from Figure 2 above which examines dyads *with* shifting power.

Analysis with a Contest Success Function

As noted in the manuscript, one critique might be that p_i should be modeled as a function of the two states' capabilities with a contest success function. My approach, without the contest function, is problematic if adding new capabilities to the rising state's stockpile has a larger effect on p when the states are near parity as opposed to asymmetry. I refute this critique by showing how one reasonable way to model this actually strengthens the central argument.

Let p_i equal the rising state A's share of dyadic capabilities. The initial balance is $p_1 = \frac{m_A}{m_A+m_B}$ and the post-shift balance is $p_2 = \frac{m_A+s}{m_A+m_B+s}$, where m_i is state i's initial capabilities and s represents the new capabilities A acquires in the power shift. We want to evaluate how the difference between p_1 and p_2 varies with p_1. Let $\Delta = p_2 - p_1$. Thus $\Delta = \frac{m_A+s}{m_A+m_B+s} - \frac{m_A}{m_A+m_B}$, which reduces to

$$\Delta = \frac{m_B s}{(m_A + m_B)(m_A + m_B + s)}. \quad (1)$$

There are two ways to evaluate Δ as p_1 varies because p_1 is a function of both m_A and m_B. There is not a strong theoretical reason for either approach to be superior. I show that when varying m_A, Δ is largest when the rising state is very weak, which supports the manuscript's argument. Taking the derivative of the above equation with respect to m_A produces

$$\frac{\partial \Delta}{\partial m_A} = \frac{-m_B s(2m_B + s + 2m_A)}{(m_A + m_B)^2(m_A + m_B + s)^2}. \quad (2)$$

Because m_A, m_B, and s are all positive, the derivative is negative; Δ is declining in m_A. Put differently, the largest changes in the probability of victory occur when m_A is small which is when the rising state is very weak relative to its adversary. The biggest shifts occur in the cases that are most prone to conflict according to the manuscript.

Note that the alternative approach of taking the derivative with respect to m_B produces a different and conflicting result. This is precisely why I do not use a contest function in the base model. There is no theoretical reason to prefer varying p_1 with respect to m_A or m_B and doing so produces contradictory results. Hence, incorporating a contest function adds complexity and confusion rather than illumination in this particular model.

Analysis with Decision Weights

The certainty premium used in the manuscript implies decision weights of $\pi(p_i) = p_i - p_i(1 - p_i)$, which is strictly concave. This is a simplification for expositional clarity. Decision weights in the literature are concave for much of the range but also entail convexity when the adverse outcome is highly probable (Tversky and Kahneman 1992). A much cited specification sets $\pi(p_i) = \frac{p^\gamma}{(p^\gamma + (1-p)^\gamma)^{1/\gamma}}$, where γ is a shape parameter. With these decision weights, and noting that the declining state B wins with probably $1 - p$, the implied certainty premium is concave when the rising state is roughly equal to, or weaker than, the declining state. More specifically, for $\gamma \approx 0.61$, as suggested by Tversky and Kahneman (1992), the cost parameter is concave for roughly $p < 0.67$.

Returning to Equation 5 and the subsequent discussion in the manuscript, I evaluate whether using these more complex decision weights, and their implied certainty premium, changes the results. Recall that if $1 + r\prime(p_1 + \Delta) > 0$, then the right-hand side of Equation 5 is negative for all $\delta < \frac{1+r\prime(p_1)}{1+r\prime(p_1+\Delta)}$. With the Tversky and Kahneman (1992) weighting and $\gamma = 0.61$, $1 + r\prime(p_1 + \Delta) > 0$ always holds. By concavity, we know $\delta < \frac{1+r\prime(p_1)}{1+r\prime(p_1+\Delta)}$ holds for all $p < 0.67$, which is the most substantively interesting range of the parameter space. That is, the war constraint becomes less likely to hold as p_1 increases up to at least $p_1 < 0.67$. For roughly $p_1 > 0.67$ where the certainty premium is convex, and the range in which the rising state is already the stronger party, the relationship holds conditional on δ.

Analysis with Alternative Bargaining Protocol

The Fearon take-it-or-leave-it bargaining procedure simplifies the exposition but restricts the game tree such that only the declining state may initiate conflict. Crucially, the rising state's costs do not factor into the preventive war constraint in this bargaining protocol. Adopting an alternative bargaining framework in which both actor's costs matter, such as that found in Powell (1999; 2006), restricts the parameter space in which the requisite power shift is increasing in p_1. As discussed below, shift size is increasing in p_1, roughly, for all $p_1 < 0.5$ and decreasing for $p_1 > 0.5$. This latter range of values addresses initially overpowered states launching preventive strikes when relative power dynamics will render them even more overpowered. While possible, there is limited historical record of such conflicts. Instead, empirics and the literature point to the importance of shifting power when the actor in relative decline initially possesses similar or superior force to the rising state—that is, for $p_1 < 0.5$.

For simplicity, I retain parameter characterizations from the main model and keep the power shift restricted to between round one and round two in an infinitely repeated game. A's uncertainty premium is analogous, such that $r_{tA}(p_t) = p_t(1 - p_t)$ and its cost function is monotonically decreasing and weakly concave in p_t. That is, A's costs decrease as its relative power increases. The main difference is altering the bargaining sequence such that B, the declining state, makes offers to A. Importantly, B can opt for war rather than making an offer. This allows both states to initiate conflict.

Following the analysis in Powell (1999), war occurs when the maximum value each side can "lock-in" with conflict exceeds the total pie to be divided ($\frac{1}{1-\delta}$). The declining state B's best lock-in is secured by attacking in the first round while the rising state A is best served by fighting when it is stronger in round two. That is, A accepts B's equilibrium offer in round one $(p_1 - c_A)$ and then fights in round two. War occurs when the sum of each state's lock-ins (the left-hand side of Equation 1) exceeds the total resource (right-hand side).

$$\frac{1 - p_1 - c_B}{1 - \delta} + p_1 - c_A + \delta \frac{p_2 - c_A}{1 - \delta} > \frac{1}{1 - \delta} \tag{3}$$

Letting $p_2 = p_1 + \Delta$, this reduces to the core Powell preventive constraint. As is readily apparent, the size of shift necessary for war is unrelated to the initial dyadic power balance,

$$\delta\Delta > c_A + c_B. \tag{4}$$

Now introduce variable war costs to the framework. The lock-ins exceed total resources when $\frac{1-p_1-c_{1B}(p_1)}{1-\delta} + p_1 - c_{1A}(p_1) + \delta \frac{p_2 - c_{2A}(p_2)}{1-\delta} > \frac{1}{1-\delta}$, which yields a final constraint of $\delta\Delta > [c_{1A}(p_1) + c_{1B}(p_1)] + \delta[c_{2A}(p_2) - c_{1A}(p_1)]$. Let $p_2 = p_1 + \Delta$, collect terms, and take the derivative with respect to p_1.

$$\frac{\partial}{\partial p_1}[\delta\Delta - [c_{1A}(p_1) + c_{1B}(p_1)] - \delta[c_{2A}(p_1 + \Delta) - c_{1A}(p_1)]] = \tag{5}$$
$$-[c_{1A}\prime(p_1) + c_{1B}\prime(p_1)] - \delta[c_{2A}\prime(p_1 + \Delta) - c_{1A}\prime(p_1)]$$

To find when the war constraint becomes less binding in p_1—that is, when asymmetry increases the risk of preventive war, set the derivative less than zero. This reduces to $\delta < \frac{c_{1A}\prime(p_1) + c_{1B}\prime(p_1)}{c_{1A}\prime(p_1) - c_{2A}\prime(p_1 + \Delta)}$. There are three cases for whether this inequality holds. First, because the right-hand side denominator is always positive by concavity, this condition holds by definition when the right-hand side is greater than one, which occurs when $c_{1B}\prime(p_1) > -c_{2A}\prime(p_1 + \Delta)$. Provided the cost functions have mirror functional forms, this holds for all $p_2 < 0.5$. That is, the war constraint becomes less binding in p_1 provided $p_2 < 0.5$. In the second case, $\delta < \frac{c_{1A}\prime(p_1) + c_{1B}\prime(p_1)}{c_{1A}\prime(p_1) - c_{2A}\prime(p_1 + \Delta)}$ does not hold when the numerator is less than zero, which occurs for all $p_1 > 0.5$. This range covers states that begin as overpowered and become even more overpowered with shifting capabilities. Preventive war in this case is less salient given limited historical record of such conflicts. For the third case with $p_1 < 0.5$ and $p_2 > 0.5$, the constraint is declining in p_1 conditional upon the value of δ.

Incorporating uncertainty premiums proceeds in a similar fashion. War is preferred when lock-ins exceed the total resource: $\frac{1-p_1-c_B-r_{1B}(p_1)}{1-\delta} + p_1 - c_A - r_{1A}(p_1) + \delta\frac{p_2-c_A-r_{2A}(p_2)}{1-\delta} > \frac{1}{1-\delta}$. This reduces to a preventive constraint of $\delta\Delta > [c_A + c_B] + [r_{1A}(p_1) + r_{1B}(p_1)] + \delta[r_{2A}(p_2) - r_{1A}(p_1)]$. Again, collect terms and differentiate with respect to p_1.

$$\frac{\partial}{\partial p_1}[\delta\Delta - [c_A + c_B] - [r_{1A}(p_1) + r_{1B}(p_1)] - \delta[r_{2A}(p_1 + \Delta) - r_{1A}(p_1)]] = \tag{6}$$

$$-[r_{1A}\prime(p_1) + r_{1B}\prime(p_1)] - \delta[r_{2A}\prime(p_1 + \Delta) - r_{1A}\prime(p_1)]$$

Set the derivative less than zero to find where the war constraint becomes less binding in p_1. This reduces to $\delta < \frac{r_{1A}\prime(p_1)+r_{1B}\prime(p_1)}{r_{1A}\prime(p_1)-r_{2A}\prime(p_1+\Delta)}$. Equivalent to the variable cost case, the relationship holds for all $p_2 < 0.5$, does not hold for $p_1 > 0.5$, and holds conditionally on δ for $p_1 < 0.5$ and $p_2 > 0.5$. The first range, when the inequality always holds, is the empirically salient range of initial power balances that generate preventive wars.