Online Appendix for The Return on Social Bonds: Social Hierarchy and International Conflict

Mark David Nieman*

Assistant Professor, Iowa State University

*mdnieman@iastate.edu.

Appendix A Proposition Proofs

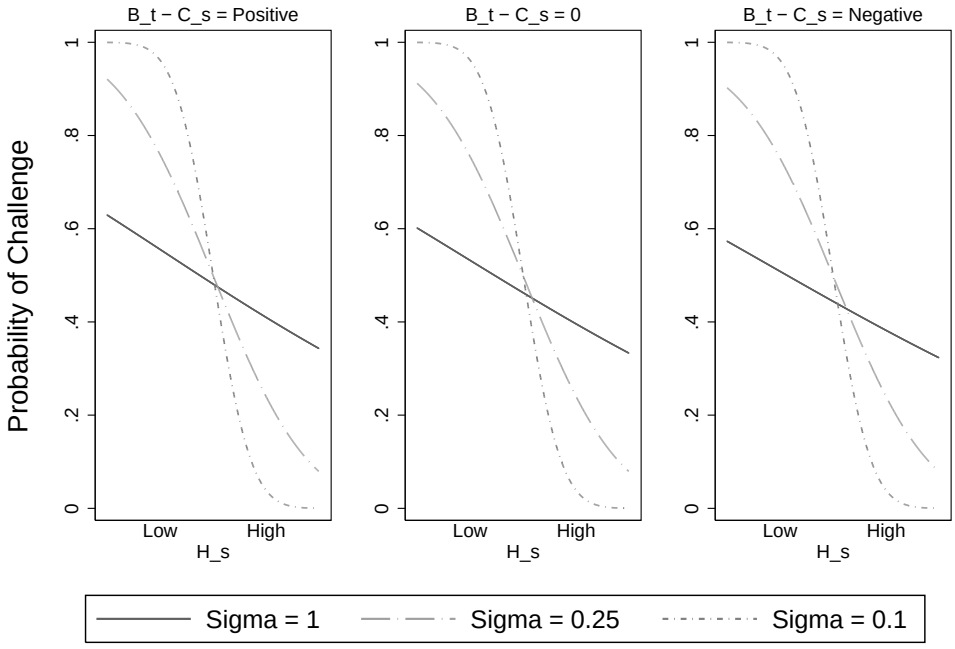
Proof of Proposition 1.

Proof. To explore the change in p_{chal} wrt H_S, we must take the partial derivative of Equation 2.

$$\begin{aligned}\frac{\partial p_{chal}}{\partial H_S} &= f\left(\frac{\Phi[z](B_T - C_S) + (1-\Phi[z])(B_T) - H_S}{\sqrt{\Phi[z]^2\sigma^2 + (1-\Phi[z])^2\sigma^2 + \sigma^2}}\right) \\ &\times\left(\frac{(f[z](-C_S) - 1)\sqrt{\Phi[z]^2\sigma^2 + (1-\Phi[z])^2\sigma^2 + \sigma^2}}{\sigma^2\left(\Phi[z]^2 + \left(1-\Phi[z]^2\right) + 1\right)}\right. \\ &-\frac{(\Phi[z](B_T - C_S) + (1-\Phi[z])(B_T) - H_S)}{\sigma^2\left(\Phi[z]^2 + \left(1-\Phi[z]^2\right) + 1\right)} \\ &\left.\times\sqrt{2\sigma(\Phi[z])^2 + (1-\Phi[z])^2}\right) \qquad (6)\end{aligned}$$

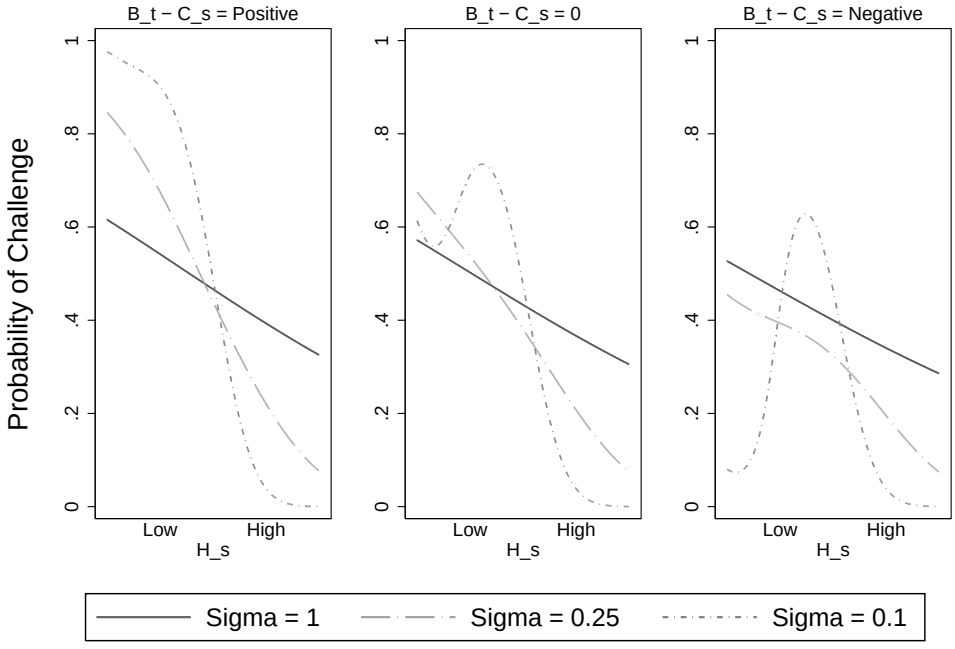
where f(·) is the probability density function and $z = \frac{H_T - H_S - C_D - A}{\sqrt{2\sigma^2}}$. The first term is positive since it is a probability density, the first product of the second term is negative owing to the sign on C_S, while the sign of the second term is unclear, as $B_T - C_S$ can be either positive or negative in the second product of the second term. When $B_T - C_S$ is positive, then the derivative is negative; when $B_T - C_S$ is negative, then the sign of the derivative depends on the difference between the first and second products of the second term, which is determined, in part, on the value of σ. This means that the probability of S selecting *chal* depends on both the sign associated with the difference of $B_T - C_S$ and its level of certainty in D's expected utilities, represented by σ. Smaller values of σ represent greater certainty on the part of S.

I ran several simulations in order to identify the effect of H_S at varying levels of σ when $B_T - C_S$ is either positive, negative, or zero. Figure A.1 presents the first general pattern that emerges from these simulations when $C_D \geq 0.3$ or $A \geq 0.3$. Figure A.1 shows that, under this scenario, whether $B_T - C_S$ is either positive or negative, p_{chal} always decreases as H_S increases. This result holds regardless of the value of σ.



Note: B_t is held at .5 and C_s varies of either .25, .50, or .75.

Figure A.1. Simulation of Comparative Statics for Proposition 1.



Note: B_t is held at .5 and C_s varies of either .25, .50, or .75.

Figure A.2. Simulation of Comparative Statics for Proposition 1, When $C_D < 0.3$ or $A < 0.3$.

I repeat the above simulations under several scenarios. Only under one set of conditions is there ever a non-monotonic relationship between p_{chal} and H_S: when $C_D < 0.3$ or $A < 0.3$, and σ is small (e.g. $\sigma = 0.1$). The most sharp non-monotonic relationship between p_{chal} and H_S is found when $C_D = 0.15$ or $A = 0.15$. These results are shown in Figure A.2. When $B_T - C_S$ is either zero or negative, the relationship between p_{chal} and H_S is non-monotonic when σ is small, as evident by the short dashed line in the second and third graphs in Figure A.2. As σ increases, however, the relationship between p_{chal} and H_S becomes negative and strictly monotonic (solid and long dashed lines, respectively). When $B_T - C_S$ is positive, however, even under conditions where C_D or A less than 0.3 and regardless of the value of σ, p_{chal} monotonically decreases as H_S increases.

More substantively, it is only when a subordinate is moderately close to the dominant, the expected benefits of attacking the target are greater than the costs imposed by the dominant (should it punish), the costs to punish for the dominant and the expected costs imposed by the alternative dominant are fairly low (both A and c_D are less than 0.3), and the degree of certainty on the part of the subordinate is very high (e.g., $\sigma = 0.1$), that subordinates are more emboldened than constrained. If these conditions do not apply, than subordinates are more constrained than emboldened in the foreign policy actions. The key point as applies to the current application, is that the results demonstrate that if S is at least a moderate amount of uncertainty regarding the dominant's expected utilities (e.g., $\sigma = .25$), then the relationship between H_S and p_{chal} is strictly negative. □

Proof of Proposition 2.

Proof. Taking the partial derivative of Equation 1 yields

$$\frac{\partial p_{pun}}{\partial H_T - H_S} = f\left(\frac{H_T - H_S - C_D - A}{\sqrt{2\sigma^2}}\right)\sqrt{2\sigma^2} \geq 0 \tag{7}$$

where f is the probability density function. The product of a probability density function and square root is always either positive or zero, as both terms are either positive or zero. □

Appendix B Statistical Backwards Induction

Consistent with the theory outlined above, subordinates with high absolute hierarchy are expected to maintain the status quo. Thus, $X_{S_{11}}$ represents absolute hierarchy, which is treated as the observable component of the utility function depicted in Figure 2. This can be written formally as $U_S(\neg Chal) = \beta_{S_{11}} X_{S_{11}}$. Standard explanations of why a subordinate would initiate a conflict against a target are captured by observable variables represented by $X_{S_{22}}$, while the subordinate's utility from the dominant state acquiescing to a challenge is captured by a parameter, $\beta_{S_{21}}$. Each outcome depends on the expected action of the dominant, where p represents the subordinate's belief that the dominant will punish and $1-p$ that it will not punish. Thus, the subordinate's expected utility from challenging can be rewritten as $U_S(Chal) = p(\beta_{S_{22}} X_{S_{22}}) + (1-p)(\beta_{S_{21}})$.

The expectations associated with the dominant state are represented by $X_{D_{22}}$, which captures the relative hierarchy between a challenging subordinate and their target. This can be written as $U_D(Pun) = \beta_{D_{22}} X_{D_{22}}$. Finally, the acquiescence outcome for the dominant is normalized to zero, or $U_D(\neg Pun) = 0$.

Consistent with the SBI principles, the second stage of the model (the dominant's response to a challenge) is estimated first, and the resulting expectation is used to condition the behavior in the first stage (the subordinate's decision to challenge). If the variance is assumed to be normally distributed with $\sigma^2 = 1$, the probability that $U_D(Pun) > U_D(\neg Pun)$ in cases where a challenge occurred can be estimated using a probit model (Bas et al, 2008). This provides estimates for $\beta_{D_{22}}$ as well as for p, the subordinate's belief that the dominant punishes a challenge. A larger value of p is associated with a greater belief that punishment is likely.

The subordinate's expected value for challenging can be calculated by multiplying p by the regressors $X_{S_{22}}$, while the constant from the *Acquiesce* outcome is multiplied by $(1-p)$. This mimics the theoretical structure depicted in Figure 1 by conditioning the expected benefits of a challenging state by the risk of punishment. These modified regressors are then

included in a probit model identifying the probability that $U_S(Chal) > U_S(\neg Chal)$, which is the likelihood that the subordinate challenges (Bas et al, 2008: 7-9, 18-19). Modified regressors are necessary, because using first-order regressors would ignore that the variables associated with a challenge are conditioned by the expected action of the dominant state and, hence, produce biased and inconsistent parameters (Signorino & Yilmaz, 2003). The use of the strategic model allows for isolating the effects of each theoretically relevant factor for both subordinate and dominant states.

Calculating the standard errors (SEs) is slightly more complicated. SEs for coefficients related to the dominant's choice require no modification because the dominant's choice does not depend on the expected actions of anyone else (Bas et al, 2008: 29). Instead, the dominant acts only when a subordinate challenges. Potential problems arise, however, when calculating SEs associated with the subordinate's coefficients because the subordinate's decision is conditioned by the expected action of the dominant state. Ignoring this conditional relationship would produce inconsistent SEs. To account for this, I employ nonparametric bootstraps.

Appendix C Robustness Tables

Table C.1. Militarized Challenge and Punishment in US Hierarchy, with *USSR/Russia* as an Alternative Hierarchy in a Subordinate's *Status Quo* Equation.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.197***	(0.063)		
US Economic Subordination	0.007	(0.0487)		
USSR/Russia Security Subordination	0.114†	(0.074)		
Constant	4.471***	(0.243)		
Acquiesce Equation:				
Constant	1.424***	(0.261)		
Conflict Equation:				
Relative US Security Subordination			1.032***	(0.214)
Relative US Economic Subordination			0.284*	(0.160)
USSR/Russia Security Subordination			−0.393†	(0.275)
Challenger-Target Power Ratio	4.779***	(0.778)		
Challenger-Target Power Ratio^2	−3.964***	(0.666)		
Dominant-Subordinate Power Ratio			0.361***	(0.081)
Dominant-Subordinate Power Ratio^2			−0.243***	(0.049)
Power Change	−0.170	(0.407)		
Ongoing US MIDs			0.080*	(0.047)
Civil War	0.512***	(0.150)		
Previous Challenge	0.731***	(0.061)	−0.054**	(0.021)
Contiguity	3.281***	(0.168)		
Distance			−0.255***	(0.096)
Trade	4.600†	(3.104)		
Challenger-Target Joint Democracy	−1.035***	(0.228)		
Dominant-Subordinate Joint Democracy			−0.439***	(0.144)
Challenger-Target Alliance	−0.442**	(0.225)		
Constant			−10.939***	(3.299)
Log-Likelihood				
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.2. Militarized Challenge and Punishment in US Hierarchy, with *Global Power* substituted in place of *USSR/Russia Security Subordination*.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.198***	(0.055)		
US Economic Subordination	0.008	(0.046)		
Constant	4.715***	(0.257)		
Acquiesce Equation:				
Constant	1.705***	(0.277)		
Conflict Equation:				
Relative US Security Subordination			0.941***	(0.219)
Relative US Economic Subordination			0.225†	(0.163)
Global Power			−0.074***	(0.015)
Challenger-Target Power Ratio	5.110***	(0.789)		
Challenger-Target Power Ratio^2	−4.151***	(0.664)		
Dominant-Subordinate Power Ratio			0.360***	(0.081)
Dominant-Subordinate Power Ratio^2			−0.239***	(0.049)
Power Change	−0.149	(0.341)		
Ongoing US MIDs			0.061†	(0.047)
Civil War	0.506***	(0.158)		
Previous Challenge	0.725***	(0.052)	−0.069***	(0.022)
Contiguity	3.131***	(0.152)		
Distance			−0.219**	(0.094)
Trade	5.025†	(3.066)		
Challenger-Target Joint Democracy	−0.945***	(0.190)		
Dominant-Subordinate Joint Democracy			−0.392***	(0.143)
Challenger-Target Alliance	−0.315†	(0.195)		
Constant			−8.989***	(3.305)
Log-Likelihood	-4074.353		-301.758	
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.3. Militarized Challenge and Punishment in US Hierarchy, Including both *USSR/Russia Security Subordination* and *Global Power*.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.189***	(0.054)		
US Economic Subordination	0.011	(0.049)		
Constant	4.663***	(0.255)		
Acquiesce Equation:				
Constant	1.642***	(0.274)		
Conflict Equation:				
Relative US Security Subordination			0.941***	(0.219)
Relative US Economic Subordination			0.232†	(0.163)
USSR/Russia Security			−0.189	(0.275)
Global Power			−0.072***	(0.015)
Challenger-Target Power Ratio	5.072***	(0.794)		
Challenger-Target Power Ratio^2	−4.139***	(0.677)		
Dominant-Subordinate Power Ratio			0.363***	(0.081)
Dominant-Subordinate Power Ratio^2			−0.243***	(0.050)
Power Change	−0.192	(0.329)		
Ongoing US MIDs			0.060	(0.047)
Civil War	0.513***	(0.147)		
Previous Challenge	0.736***	(0.046)	−0.070***	(0.022)
Contiguity	3.046***	(0.157)		
Distance			0.227**	(0.095)
Trade	5.051†	(3.157)		
Challenger-Target Joint Democracy	−0.961***	(0.218)		
Dominant-Subordinate Joint Democracy			−0.413***	(0.147)
Challenger-Target Alliance	−0.278†	(0.197)		
Constant			−8.867***	(3.315)
Log-Likelihood	-4080.159		-301.520	
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.4. Militarized Challenge and Punishment in US Hierarchy. Subordination Index Reduced to Component Terms.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination				
Shared Alliances	0.143***	(0.033)		
Military Personnel	0.031	(0.040)		
US Economic Subordination				
Trade Dependence	−0.161†	(0.103)		
Exchange Rate	0.021	(0.044)		
Constant	4.507***	(0.259)		
Acquiesce Equation:				
Constant	1.463***	(0.276)		
Conflict Equation:				
Relative US Security Subordination				
Shared Alliances			0.484***	(0.129)
Military Personnel			0.640**	(0.296)
Relative US Economic Subordination				
Trade Dependence			0.128	(0.260)
Exchange Rate			0.205†	(0.139)
USSR/Russia Security Subordination			−0.395†	(0.275)
Challenger-Target Power Ratio	4.897***	(0.803)		
Challenger-Target Power Ratio^2	−4.076***	(0.669)		
Dominant-Subordinate Power Ratio			0.361***	(0.081)
Dominant-Subordinate Power Ratio^2			−0.243***	(0.049)
Power Change	−0.105	(0.377)		
Ongoing US MIDs			0.079*	(0.047)
Civil War	0.472***	(0.160)		
Previous Challenge	0.728***	(0.057)	−0.053**	(0.021)
Contiguity	3.270***	(0.164)		
Distance			−0.250***	(0.096)
Trade	4.581†	(2.799)		
Challenger-Target Joint Democracy	−0.992***	(0.211)		
Dominant-Subordinate Joint Democracy			−0.445***	(0.145)
Challenger-Target Alliance	−0.462**	(0.211)		
Constant			−10.981***	(3.299)
Log-Likelihood	-4052.305		-314.199	
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.5. Militarized Challenge and Punishment in US Hierarchy, All Subordination Terms Included for Both Players (Dominant and Subordinate).

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.188^{***}	(0.061)		
US Economic Subordination	0.589	(0.055)		
USSR/Russia Security	$0.121^{\dagger}$	(0.075)		
Constant	4.312^{***}	(0.250)		
Acquiesce Equation:				
Constant	1.256^{***}	(0.264)		
Conflict Equation:				
US Security Subordination			0.561^{*}	(0.319)
US Economic Subordination			-0.087	(0.325)
Relative US Security Subordination	-0.107	(0.087)	1.186^{***}	(0.232)
Relative US Economic Subordination	-0.329^{**}	(0.165)	0.252	(0.209)
USSR/Russia Security			$-0.370^{\dagger}$	(0.281)
Challenger-Target Power Ratio	4.656^{***}	(0.786)		
Challenger-Target Power Ratio^2	-3.913^{***}	(0.683)		
Dominant-Subordinate Power Ratio			0.360^{***}	(0.083)
Dominant-Subordinate Power Ratio^2			-0.243^{***}	(0.051)
Power Change	-0.176	(0.389)		
Ongoing US MIDs			0.081^{*}	(0.047)
Civil War	0.574^{***}	(0.165)		
Previous Challenge	0.724^{***}	(0.057)	-0.057^{***}	(0.021)
Contiguity	3.300^{***}	(0.162)		
Distance			-0.190^{*}	(0.105)
Trade	$4.213^{\dagger}$	(3.279)		
Challenger-Target Joint Democracy	-1.054^{***}	(0.212)		
Dominant-Subordinate Joint Democracy			-0.487^{***}	(0.146)
Challenger-Target Alliance	-0.458^{**}	(0.199)		
Constant			-11.457^{***}	(3.490)
Log-Likelihood	-4047.368		-312.653	
Observations	549570		652	

Note: $^{***}p$ <0.01, $^{**}p$ <0.05, $^{*}p$ <0.1, two-tailed; ^{+}p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.6. Militarized Challenge and Punishment in US Hierarchy, Punishment in the same year.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.176***	(0.054)		
US Economic Subordination	0.005	(0.050)		
Constant	4.549***	(0.281)		
Acquiesce Equation:				
Constant	1.498***	(0.298)		
Conflict Equation:				
Relative US Security Subordination			0.966***	(0.212)
Relative US Economic Subordination			0.266^{dagger}	(0.162)
USSR/Russia Security			−0.369†	(0.276)
Challenger-Target Power Ratio	5.244***	(0.876)		
Challenger-Target Power Ratio^2	−4.444***	(0.732)		
Dominant-Subordinate Power Ratio			0.364***	(0.081)
Dominant-Subordinate Power Ratio^2			−0.246***	(0.049)
Power Change	−0.132	(0.336)		
Ongoing US MIDs			0.083*	(0.048)
Civil War	0.480***	(0.176)		
Previous Challenge	0.830***	(0.056)	−0.064***	(0.022)
Contiguity	3.251***	(0.164)		
Distance			−0.245**	(0.096)
Trade	5.406*	(3.035)		
Challenger-Target Joint Democracy	−1.093***	(0.245)		
Dominant-Subordinate Joint Democracy			−0.409***	(0.145)
Challenger-Target Alliance	−0.392*	(0.213)		
Constant			−11.094***	(3.309)
Log-Likelihood	-4079.490		-303.961	
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^{+}p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.7. Militarized Challenge and Punishment in US Hierarchy, Punishments Include Only MIDs (excludes economic sanctions).

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.206***	(0.060)		
US Economic Subordination	0.015	(0.046)		
Constant	4.843***	(0.331)		
Acquiesce Equation:				
Constant	1.813***	(0.342)		
Conflict Equation:				
Relative US Security Subordination			1.122***	(0.238)
Relative US Economic Subordination			0.149	(0.184)
USSR/Russia Security			−0.055	(0.338)
Challenger-Target Power Ratio	6.201***	(1.125)		
Challenger-Target Power Ratio^2	−5.275***	(0.973)		
Dominant-Subordinate Power Ratio			0.486***	(0.102)
Dominant-Subordinate Power Ratio^2			−0.314***	(0.063)
Power Change	0.999**	(0.065)		
Ongoing US MIDs			0.028	(0.057)
Civil War	0.258	(0.243)		
Previous Challenge	***	()	−0.098***	(0.030)
Contiguity	3.609***	(0.217)		
Distance			−0.202**	(0.101)
Trade	9.637***	(2.179)		
Challenger-Target Joint Democracy	−1.545	(1.455)		
Dominant-Subordinate Joint Democracy			−1.454***	(0.256)
Challenger-Target Alliance	−0.659***	(0.252)		
Constant			−16.810***	(4.161)
Log-Likelihood	-4307.600		-215.363	
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.8. Militarized Challenge and Punishment in US Hierarchy, Punishment Includes Only Actual Uses of Force (MID> 3).

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.196***	(0.062)		
US Economic Subordination	0.028	(0.044)		
Constant	4.826***	(0.307)		
Acquiesce Equation:				
Constant	1.776***	(0.320)		
Conflict Equation:				
Relative US Security Subordination			1.219***	(0.228)
Relative US Economic Subordination			0.111	(0.174)
USSR/Russia Security			−0.215	(0.308)
Challenger-Target Power Ratio	6.095***	(1.012)		
Challenger-Target Power Ratio^2	−4.991***	(0.865)		
Dominant-Subordinate Power Ratio			0.381***	(0.090)
Dominant-Subordinate Power Ratio^2			−0.251***	(0.056)
Power Change	0.355	(0.446)		
Ongoing US MIDs			−0.057	(0.053)
Civil War	0.414*	(0.213)		
Previous Challenge	0.855***	(0.085)	−0.050**	(0.023)
Contiguity	4.143***	(0.208)		
Distance			−0.164*	(0.099)
Trade	8.804***	(2.591)		
Challenger-Target Joint Democracy	−1.227**	(0.513)		
Dominant-Subordinate Joint Democracy			−1.093***	(0.201)
Challenger-Target Alliance	−0.882***	(0.250)		
Constant			−12.633***	(3.602)
Log-Likelihood	-4213.753		-246.992	
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.9. Militarized Challenge and Punishment in US Hierarchy, Controlling for Cold War.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.197***	(0.059)		
US Economic Subordination	0.005	(0.046)		
Constant	4.537***	(0.243)		
Acquiesce Equation:				
Constant	1.504***	(0.258)		
Conflict Equation:				
Relative US Security Subordination			1.044***	(0.215)
Relative US Economic Subordination			0.296*	(0.161)
USSR/Russia Security			−0.484*	(0.283)
Challenger-Target Power Ratio	4.700***	(0.788)		
Challenger-Target Power Ratio^2	−3.849***	(0.677)		
Dominant-Subordinate Power Ratio			0.375***	(0.082)
Dominant-Subordinate Power Ratio^2			−0.251***	(0.050)
Power Change	−0.143	(0.364)		
Ongoing US MIDs			0.066†	(0.048)
Civil War	0.451***	(0.163)		
Previous Challenge	0.702***	(0.054)	−0.059***	(0.021)
Contiguity	3.238***	(0.157)		
Distance			−0.236**	(0.097)
Trade	4.103†	(2.813)		
Challenger-Target Joint Democracy	−1.035***	(0.212)		
Dominant-Subordinate Joint Democracy			−0.480***	(0.147)
Challenger-Target Alliance	−0.413**	(0.201)		
Cold War			−0.217†	(0.159)
Constant			−11.427***	(3.353)
Log-Likelihood	-4070.247		-313.196	
Observations	549570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.10. Militarized Challenge and Punishment in US Hierarchy, Including Joint IGO Memberships.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Subordination	0.185^{***}	(0.056)		
US Economic Subordination	0.001	(0.051)		
Constant	4.522^{***}	(0.252)		
Acquiesce Equation:				
Constant	1.466^{***}	(0.270)		
Conflict Equation:				
Relative US Security Subordination			1.032^{***}	(0.214)
Relative US Economic Subordination			0.284^{*}	(0.160)
USSR/Russia Security Subordination			$-0.393^{\dagger}$	(0.275)
Challenger-Target Power Ratio	4.706^{***}	(0.783)		
Challenger-Target Power Ratio^2	-3.937^{***}	(0.672)		
Dominant-Subordinate Power Ratio			0.361^{***}	(0.081)
Dominant-Subordinate Power Ratio^2			-0.243^{***}	(0.049)
Power Change	-0.114	(0.361)		
Ongoing US MIDs			0.080^{*}	(0.047)
Civil War	0.502^{***}	(0.158)		
Previous Challenge	0.722^{***}	(0.060)	-0.054^{**}	(0.021)
Contiguity	3.254^{***}	(0.165)		
Distance			-0.255^{***}	(0.096)
Trade	$4.593^{\dagger}$	(3.025)		
Challenger-Target Joint Democracy	-1.040^{***}	(0.233)		
Dominant-Subordinate Joint Democracy			-0.439^{***}	(0.144)
Challenger-Target Alliance	-0.444^{**}	(0.214)		
Challenger-Target Joint IGO Memberships	0.127	(0.140)		
Constant			-10.939^{***}	(3.299)
Log-Likelihood			-314.118	
Observations	549570		652	

Note: $^{***}p$ <0.01, $^{**}p$ <0.05, $^{*}p$ <0.1, two-tailed; ^{+}p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Table C.11. Militarized Challenge and Punishment in US Hierarchy, Including Regional Dummies to Account for Geographical Clustering in US Hierarchy.

Actor	Subordinate		Dominant	
Status Quo Equation:				
US Security Hierarchy	0.106**	(0.052)		
US Economic Hierarchy	−0.061	(0.049)		
Constant	4.740***	(0.318)		
Acquiesce Equation:				
Constant	1.600***	(0.323)		
Conflict Equation:				
Relative US Security			0.953***	(0.240)
Relative US Economic			0.101	(0.167)
USSR Security			0.123	(0.320)
Challenger-Target Power Ratio	3.947***	(0.927)		
Challenger-Target Power Ratio^2	−3.586***	(0.752)		
Dominant-Subordinate Power Ratio			0.444***	(0.091)
Dominant-Subordinate Power Ratio^2			−0.308***	(0.056)
Power Change	−0.001	(0.278)		
Ongoing US MIDs			0.080†	(0.049)
Civil War	0.300**	(0.149)		
Previous Challenge	0.568***	(0.043)	−0.054**	(0.023)
Contiguity	2.900***	(0.153)		
Distance			−0.101	(0.110)
Trade	8.230***	(2.215)		
Challenger-Target Joint Democracy	0.402**	(0.166)		
Dominant-Subordinate Joint Democracy			−0.366**	(0.153)
Challenger-Target Alliance	−0.028	(0.180)		
Europe	1.485***	(0.253)	−1.751***	(0.338)
Middle East	−0.028	(0.340)	−0.773***	(0.263)
Africa	1.225***	(0.163)	−0.188	(0.204)
North and Central Asia	0.920***	(0.214)	−1.287***	(0.326)
South East Asia and Oceania	0.759**	(0.383)	−1.072***	(0.383)
Constant			−13.734***	(3.664)
Log-Likelihood	-4069.833		-285.959	
Observations	549,570		652	

Note: ***p <0.01, **p <0.05, *p <0.1, two-tailed; ^+p <0.1, one-tailed. Subordinate S.E. are bootstrapped (500 simulations).

Appendix D Control Variables

The literature is the best guide of which controls to include: i.e., the models only include control variables that have been consistently included in other recent studies of inter-state conflict. I discuss the variable, measure, and justification for each control variable included in the empirical model (by equation).

Subordinate Conflict Regressors ($X_{S_{22}}$)

Subordinate's utility from challenging the status quo depends on a number of factors aside from social hierarchy. States that are strong in terms of material power are expected to seek greater autonomy. Three measures are used to represent a state's military capabilities: *power ratio*, *squared power ratio* and *power change*. These are measured using the Correlates of War's CINC variable, which measures a country's power based upon economic and military capabilities and population size (Singer, 1987).[22] *Power ratio* is measured as $\frac{\text{CINC A}}{\text{CINC A+CINC B}}$. In this equation, state A represents the potential challenger and B the potential target state. Perfect preponderance would equal 1 and perfect symmetry would equal 0.5.

Power ratio and *squared power ratio* and capture the well-known non-linear relationship between power and conflict (Bennett & Stam, 2004; Kugler & Lemke, 1996). A state is more likely to initiate a conflict when its target is relatively equal to it in strength. States with an overwhelming preponderance of power, on the other hand, are less likely to engage in militarized disputes, as the weaker state will back down if confronted. The inclusion of the squared term captures this non-linear effect.

Power change reflects the idea that rising states may be more dangerous, as they have an expectation of continued growth and may seek to obtain more resources (Gerschenkron, 1962; Doran, 2003; Gilpin, 1981) *Power change* is measured by subtracting State A's CINC score in the current year from its CINC score the previous year.

[22]Economic capabilities are based upon a state's iron and steel production and energy consumption. a state's military personnel and military expenditure compose its military capabilities. Finally, population capabilities are configured as a state's total population, as well as its urban population.

I also include a control for *civil wars*, which are expected to reduce the likelihood of a challenge, as states experiencing a civil war are preoccupied with domestic concerns. Civil war is defined as any conflict between the government and non-state actor with at least 1,000 battle deaths in a twelve month period. *Civil wars* are coded dichotomously and are obtained from the Correlates of War project (Sarkees, 2000). The number of *previous challenges* by a state is also included in the analysis as conflict may be path dependent, with state pairs viewing each other in more antagonistic terms with each additional conflict (Colaresi, 2004; Goertz & Diehl, 1995; Thompson, 2001). A large number of previous challenges could also represent a state that is outside of the dominant's hierarchy (i.e., non-aligned subordinate).

Subordinates are more likely to initiate challenges against contiguous neighbors. due to both more frequent interaction and the fact that neighbors are more likely to have outstanding, highly salient territorial disputes (Hensel, 2001; Gibler, 2012; Vasquez, 1995). I treat *contiguity* as a dichotomous variable where 1 indicates that states share a land border and 0 otherwise (Bennett & Stam, 2000).[23]

The literature offers a number of theoretical expectations regarding the effect of trade on subordinate-subordinate conflict (Barbieri & Schneider, 1999). Trade may reduce conflict by increasing ties and opportunity costs of fighting (Gartzke, 2007; Russett & Oneal, 2001; Snidal, 1991), though it could increase conflict as states become concerned with relative gains (Barbieri, 2002; Gowa, 1989, 1994; Grieco, 1988). I control for *trade* and measure it as a percent of GDP using data from the Correlates of War project (Barbieri et. al., 2009).

Previous studies demonstrate that democracies are less likely to attack other democracies (Reed, 2000). *Joint democracy* may represent an ideological cost or operate as an institutional constraint on leaders who wish to initiate a conflict (Bueno de Mesquita et al, 1999; Maoz & Russett, 1993; Russett & Oneal, 2001). Democracy is measured using the 21 point Polity score of the country where scores of 10 indicate democracy and scores of -10 autocracy (Marshall & Jaggers, 2008). *Joint democracy* is a dichotomous variable that is given a value

[23]Changing the operationalization of *contiguity* to include neighbors with 12 miles or even 400 miles of open sea did not substantially alter the results.

of 1 if both members have democracy scores of at least 6, and 0 otherwise.[24]

Finally, I account for whether a challenger and target have an *alliance*, as allies are expected to be less conflict prone (Leeds, 2003; Mattes & Vonnahme, 2010). Alliance data are obtained from Gibler (2009).[25]

Dominant Conflict Regressors ($X_{D_{22}}$)

I control a number of other important factors that may influence a dominant state's likelihood of punishing a challenge. In addition to several analogously motivated variables (power ratio, power ratio squared, previous challenge, joint democracy), I account for several other standard control variables that may influence whether the US punishes a challenger. *USSR/Russia security subordination* captures the idea that the US might be less likely to punish a challenge if the challenger is closely tied to Russia, as Russian hierarchy might deter it (i.e. fear of confronting a major power). This variable is analogous to the measure discussed by Lake (2009: Ch 3) for capturing the US security hierarchy. The USSR/Russia measure, however, only includes the shared alliances measure, $\frac{1}{\text{State I's \# of Independent Alliances}}$. Unfortunately, I was unable to generate an analogous economic subordination measure, due to the lack of data for the Soviet era. The correlation between the US and USSR/Russia security subordination is $r = 0.19$.[26]

Ongoing MIDs is a count variable tracking the total number of MIDs with US involvement in a given year. This variable captures the idea that US resources (and resolve) are finite, so involvement in a war on one theater ties up resources and increases the marginal costs of entering a new conflict.

More distant locations increase the cost of fighting, as the costs of supporting troops increases (Bueno de Mesquita, 1981; Bueno de Mesquita & Lalman, 1992; Lemke, 2002).

[24]Other thresholds were used without altering the results in any meaningful way.

[25]I include only pairs of states with defense pacts as allies. I have also analyzed results with other types of alliance, with little effect on the main results.

[26]There is generally very little membership overlap between the US and USSR camps during the Cold War, with only 12 country-years of joint membership. These 12 years consist of 6 each for Great Britain and France, and are remnants of World War II, as each cancels their Soviet defense pact in 1955.

This holds even if the dominant state has troops stationed in nearby states, as invading or occupying a hostile country requires greater logistical prowess. Data regarding *distance* are logged and obtained from EUgene (Bennett & Stam, 2000).

I also control for the effect of *previous challenges*. In this equation, *Previous challenges* help identify states that are completely outside of the US hierarchy; states that continuously initiate disputes have demonstrated that they are unlikely to be deterred by the US.

It is noteworthy that any control variable in the Punishment equation do impact the variables in the Challenge equation, through the subordinates expectation of punishment.

Finally, *Global power* represents the degree to which the dominant state has military supremacy over other major powers. This variable intended to account for potential alternative social hierarchies that subordinates can turn to if the dominant (US) is failing at providing political order (security). The logic behind this is simple supply and demand: dominant states prefer that subordinates adhere to their interests, as opposed to those of an alternative dominant. Providing benefits to subordinates, such as political security, however, is costly. In the absence of credible alternative hierarchies, dominants are likely to reduce the quality of benefits they provide in order to save costs. The theoretical expectation is that an increase in Global Power (i.e., a increase in US power in relation to alternative dominants) decreases the pressure on the dominant to provide order to its subordinates (similar to the monopolistic competition idea). Analogously, when Global Power is low, US faces stronger competition from alternative hierarchies (as strong alternative hierarchies are more attractive to subordinates than weak alternative hierarchies); hence, the US has a greater incentive to provide order to its subordinates. That is, the inverse of *global power* represented the latent risk of a subordinate joining an alternative hierarchy if the dominant fails to punish challengers. Theoretically, this idea is distinct and runs counter to the deterring effect *USSR/Russia Security Subordination*, as *Global Power* captures the idea of a global competition for subordinates, while *USSR/Russia Security Subordination* accounts for Soviet affinity within a dyad (and a subsequent deterring effect from an additional potential

entrant to an existing conflict). *Global power* is measured as $\frac{\text{CINC US}}{\sum \text{CINC Other Great Powers}}$.[27] This measure is included only in robustness checks.

Table D.1. Descriptive Statistics, US Hierarchy and Conflict.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Challenge	549570	0.001	0.034	0	1
Security Hierarchy	549570	0.234	0.393	0	5.913
Shared Alliances	549570	0.373	0.479	0	1
Military Personnel	549570	0.096	0.546	0	10.826
Economic Hierarchy	549570	0.200	0.311	0	2.781
Trade Dependence	549570	0.054	0.140	0	2.708
Exchange Rate	549570	0.213	0.359	0	1
Power Ratio (Challenge)	549570	0.515	0.356	0	1
Power Change	549570	0.001	0.081	-3.58	0.916
Previous Challenge (Challenge)	549570	0.026	0.322	0	21
Contiguity	549570	0.024	0.154	0	1
Joint Democracy (Challenge)	549570	0.209	0.406	0	1
Alliance	549570	0.041	0.199	0	1
Trade	549570	-6.638	0.602	-6.908	0.265
Civil War	549570	0.068	0.253	0	1
Punishment	652	0.259	0.439	0	1
Relative Security Hierarchy	652	0.046	0.310	-2.303	1.32
Relative Shared Alliances	652	0.087	0.483	-1	1
Relative Military Personnel	652	0.004	0.328	-4.605	1.641
Relative Economic Hierarchy	652	0.006	0.385	-1.258	1.742
Relative Trade Dependence	652	0.009	0.225	-1.678	2.323
Relative Exchange Rate	652	0.000	0.450	-1	1
USSR/Russia Security Hierarchy	652	0.084	0.276	0	1
Global Power	652	33.383	4.497	28.274	46.638
Power Ratio (punishment)	652	93.582	9.224	53.22	99.993
Distance	652	8.524	0.602	0	9.099
Joint Democracy (punishment)	652	0.275	0.447	0	1
Ongoing MID	652	3.307	1.244	1	6
Previous Challenge (punishment)	652	1.856	2.754	0	21

[27]Within the time frame under review, great powers are operationalized as China (1950-2000), France (1950-2000), Germany (1991-2000), Japan (1991-2000), Great Britain (1950-2000), the US (1950-2000), and Russia/USSR (1950-2000) (Bennett & Stam, 2000).