Appendices: "Fratricidal Coercion in Modern War"

Contents

A1. RKKA Division Data

Our dataset on the Soviet Workers' and Peasants' Red Army (RKKA) includes 1,048 divisions over 48 months (June 1941–May 1945), compiled from Fes'kov, Kalashnikov and Golikov (2003)'s monthly orders-of-battle. For each division-month, we populated the dataset with summary statistics on units' battlefield outcomes and the number of NKVD OO/SMERSH personnel assigned to that unit.

A1.1. Battlefield Outcomes

Data on soldiers' service in the Red Army, their unit assignments and battle-level outcomes during World War II are from Rozenas, Talibova and Zhukov (2024) (RZT). The underlying source materials are from the Russian Ministry of Defense's People's Memory (Pamyat' Naroda) archive, which contains 106 million declassified Red Army personnel records.[1] RTZ pre-processed database includes integrated and deduplicated records for 11,606,552 soldiers born in Soviet Russia. These records include information on medals received, along with reasons for discharge or transfer: killed or wounded in action (KIA, WIA), missing in action (MIA), prisoner of war (POW), deserted, or punished for misconduct.

The "missing in action" category deserves special attention. Soviet commanders typically used this category euphemistically to designate prisoners of war. In August 1941, Stalin issued Order No.270 ("Fight to the Last"), which equated captivity with treason and stipulated that families of captured soldiers were subject to imprisonment. As a senior Ministry of Defense official acknowledged in 2011:

> By official reports, out of our five million-plus missing in action just 100,000 were reported as prisoners of war. In reality, there were 4.5 million. So the majority of those missing in action [90%] were prisoners of war. Everyone knew this. I'm certain that even Stalin knew.[2]

While this reporting practice was not universal, "missing in action" (MIA) became the second-most common loss designation (12% of an average division's monthly casualties, or approximately 137 soldiers per month), behind only killed in action (KIA, 39.6%, 549 soldiers per month) and ahead of prisoner of war (POW, 2.2%, 18 soldiers), wounded (WIA, 0.25%, 4 soldiers), desertion (0.2%, 1 soldier) and punishment (0.9%, 6 soldiers).[3]

A1.2. NKVD Presence

From Memorial's archive of NKVD service histories, we identified 25,079 officers who served in OO or SMERSH during the war, and broke them down by unit and time to calculate the number of OO/SMERSH officers assigned to each division-month. Table A1.1 reports the cumulative number of NKVD counter-intelligence personnel assigned to each of 30 Fronts within the Red Army (1941-45), along with dates of

[1] Ministry of Defense of the Russian Federation. *People's Memory (Pamyat' Naroda)*, 2020. url: `https://pamyat-naroda.ru/`.

[2] `https://www.newsru.com/russia/04feb2011/stalin.html`

[3] These numbers reflect monthly losses for the average division, not cumulative losses over the war. Notably, the WIA statistic is an under-count, since it includes only soldiers who received injuries sufficiently severe to warrant discharge, and excludes soldiers who recovered and returned to the front.

active operations and number of battles involving each Front's subordinate division-level units. Because most NKVD officers rotated through multiple units between 1941 and 1945 (and some rotated back to the same unit more than once), it is possible for the same NKVD personnel to appear in this cumulative total more than once. For example, if one officer served in units A, B and then A again, that officer would contribute $+1$ to unit B's cumulative total, and $+2$ to A's cumulative total. For this reason, and to account for changing battlefield conditions, we disaggregate observations by division and month.

Table A1.1: **Distribution of NKVD Personnel by Front**

Front	NKVD Personnel	Start	End	N. Battles
Reserve	92	1941.07.29	1943.03.23	56
Northern	107	1941.06.24	1942.10.09	119
Crimean	131	1942.01.28	1942.05.19	18
Transcaucasian	137	1941.07.05	1943.03.30	235
Southeastern	348	1942.08.01	1942.09.30	28
Steppe	1,070	1943.07.09	1943.10.20	122
Stalingrad	1,079	1942.07.12	1943.01.01	208
Don	1,724	1942.09.30	1943.02.15	114
3rd Baltic	4,326	1944.04.21	1944.10.16	92
Belorussian	4,459	1943.10.20	1945.08.15	181
Voronezh	4,696	1942.07.07	1944.02.27	355
North Caucasian	4,886	1942.05.01	1943.11.30	121
Karelian	5,158	1941.09.01	1944.11.15	143
Northwestern	5,983	1941.06.22	1944.08.06	326
Southwestern	6,066	1941.06.22	1944.03.27	600
Bryansk	6,086	1941.08.16	1943.10.10	249
Kalinin	8,007	1941.09.01	1943.10.20	297
4th Ukrainian	8,587	1943.10.17	1945.08.24	139
3rd Ukrainian	10,013	1943.10.20	1945.06.15	339
Volkhov	11,155	1941.12.17	1944.02.15	124
2nd Baltic	11,453	1943.10.20	1945.05.09	98
3rd Belorussian	11,593	1944.04.24	1945.08.15	241
1st Baltic	12,403	1943.10.20	1945.02.24	227
2nd Belorussian	13,951	1944.02.24	1945.06.28	147
2nd Ukrainian	15,463	1942.10.13	1945.06.04	286
Leningrad	19,497	1941.07.03	1945.07.23	507
1st Belorussian	20,715	1944.02.24	1945.06.10	84
Western	22,435	1941.06.22	1944.04.24	1280
1st Ukrainian	27,339	1943.10.20	1945.06.10	416

NOTE: The table lists the cumulative number of NKVD personnel assigned to each Front of the Red Army over the course of the war. Start and end dates correspond to first and last days of active operations. Numbers of battles represent cumulative engagements involving division-level units subordinate to each Front.

What Predicts NKVD Presence? Table A1.2 reports coefficient estimates from a regression of NKVD presence on the attributes of RKKA division-months:

$$\log(\mathsf{NKVD}_{it}) = \mathbf{X}_{it}\gamma + \mathsf{Army}_i + \epsilon_{it} \tag{1}$$

where i indexes divisions and t indexes months. The matrix $\mathbf{X}_{it}$ includes an index for month of the war, dummy variables indicating unit type (armor/mechanized [omitted category], artillery/anti-air defense, aviation, engineer, rifle), the unit's share of ethnic Russians, geographic diversity (average distance between the birth locations of two soldiers serving in the same unit at the same time), average age of the unit's personnel, and the level of urbanization and population density at the birth location of the average soldier. Army_i is a fixed effect for division i's parent army.

Table A1.2 reports coefficient estimates and 95% confidence intervals from this model. Taken together, the estimates suggest that the NKVD assigned more personnel to units where they may have expected higher rates of flight. For example, the NKVD assigned many more officers to branches of the army where opportunities for direct contact with the enemy and crossing of front lines were more abundant. On average, Rifle Divisions (infantry) had almost twice as many NKVD personnel as armored or mechanized divisions, while engineering units had the smallest NKVD contingents of any unit type.

Second, units to which more NKVD officers were assigned were demographically different on several dimensions. There was a larger NKVD presence in units with a lower percentage of ethnic Russians, and whose troops were more geographically diverse, older and more rural. These patterns reflect the idea that the NKVD devoted greater resources to monitoring soldiers from "politically suspect" backgrounds: minorities, peasants, and older soldiers with potentially longer exposure to pre-revolutionary institutions. They are also consistent with the view that armies rely on harsher discipline where primary group bonds are harder to foster (Luttwak and Koehl, 1991, 126-127) — in this case, because soldiers were conscripted into the same unit from distant communities, with fewer shared experiences in civilian life.

Third, a higher NKVD presence was more likely in later stages of the war, reflecting a steady build-up after Stalin's Orders No. 270 and 227. With each passing month, the average division's OO/SMERSH contingent grew by 6 percentage points.

Finally, there were significantly more NKVD officers assigned to units whose soldiers were exposed to higher levels of pre-war repression. Doubling a unit's pre-war repression exposure is associated with an 8 percentage point increase in the number of NKVD officers assigned to it.

Table A1.2: **Predictors of NKVD Presence**. Dependent variable is logged number of OO/SMERSH personnel assigned to each division-month. Observations weighted by number of monthly discharge records. Percentage point change calculated as $(e^{\hat{\beta}} - 1) \times 100$.

Variable	Coefficient (95% CI)	Pct.Change
Month of war	0.06	6.2
	$(0.1, 0.1)$	
Artillery/AAD	-0.33	-28
	$(-0.7, 0.03)$	
Aviation	0.21	22.8
	$(-0.7, 1.1)$	
Rifle	0.44	56
	$(0.2, 0.7)$	
Pct.Russian	-0.005	-0.5
	$(-0.01, -0.003)$	
Geo.Diversity	0.0001	0.01
	$(0.00006, 0.0002)$	
Avg.Age	0.07	7.7
	$(0.1, 0.1)$	
Urbanization	-0.003	-0.3
	$(-0.01, -0.00008)$	
Pop.Density	-0.001	-0.1
	$(-0.001, 0.0002)$	
Pre-War Repression	0.08	8.2
	$(0.05, 0.1)$	
AIC	60264	
Army FE	145	
N	19562	

A2. Estimation Strategy: Red Army Rifle Divisions

The impact of fratricidal coercion on battlefield performance is difficult to empirically assess, because fratricidal coercion may itself have been a response to poor battlefield performance, or expectations thereof. Table A1.1 clearly shows that the distribution of counterintelligence personnel varied systematically across units and over time. It is possible that units with more embedded NKVD personnel may have simply had a higher baseline of MIA/POW rates, irrespective of the NKVD's efforts. A similar pattern may hold across battles and over time – the NKVD may have devoted more resources to coercion at critical points in the war, when maintaining unit cohesion was especially challenging.

To account for these disparate sources of variation, we adopt a multilevel modeling design with three-way crossed effects at the level of unit, battle and month. We specify models of the form

$$y_{ijt}^{(k)} = \log(\mathsf{NKVD}_{it})\beta + \mathbf{X}_{it}\gamma + \mathsf{unit}_i + \mathsf{battle}_j + \mathsf{month}_t + \epsilon_{ijt} \quad (2)$$

where i indexes the division, j indexes the battle, and t indexes the month. y_{ijt} is the percentage of a division's monthly losses that fall into category $k \in \{$KIA, WIA, MIA, POW, Desertion, Punishment, Medal$\}$. NKVD$_{it}$ is the number of NKVD OO/SMERSH personnel assigned to unit i at time t, log-transformed to reduce the right skew in this variable. $\mathbf{X}_{it}$ is a matrix of covariates representing the average demographics of soldiers assigned to unit i at time t, including soldiers' average age in 1941, the proportion of these soldiers who were ethnically Russian, the average population density at soldiers' location of birth, hectares of cropland within 5km of the average soldier's birthplace, and prewar repression levels within 10km of the average soldier's birthplace. We weigh observations by the number of personnel reports available per division-month, because casualty percentages are likely to be more accurately reported when more records are available. The specification also includes unit-specific, battle-specific and month-specific intercepts, along with idiosyncratic errors ϵ_{ijt}.

We fit two versions of this model. The first, which assumes no omitted variable bias ($E[u_{ijt}|\text{NKVD}_{it}, X_{it}] = 0$), is a mixed effects estimator with random intercepts unit$_i$, battle$_j$, month$_t$. The second, which relaxes the no-OVB assumption ($E[u_{ijt}|\text{NKVD}_{it}, X_{it}] \neq 0$), is a fixed effects estimator with group-specific intercepts unit$_i$, battle$_j$, month$_t$. While the former model weighs within-group and between-group variation, the second purges the regression of all group-level errors, and uses only within-group variation. To choose between fixed and random effect estimates, we ran a series of Hausman tests of the null hypothesis that errors are uncorrelated with regressors ($E[u_{ijt}|\text{NKVD}_{it}, X_{it}] \neq 0$). We were able to reject this hypothesis at the $p < .05$ level in all specifications, indicating that fixed effects are more appropriate.

Tables A2.3 and A2.4 report coefficient estimates for $\hat{\beta}$ (equation 2) and 95% confidence intervals for our fixed and random effects models, respectively. Table A2.3 corresponds to the estimates in Figure 1 (main text), where a one percentage point increase in NKVD$_{it}$ is associated with an average change in y_{it} of $\frac{\beta}{100}$ percentage points. Hausman test statistics reach statistical significance at the 5% level in all models, indicating correlation between unobserved effects and explanatory variables. By implication, only the FE estimates are consistent.

Table A2.3: **Coefficient Estimates for Three-Way Fixed Effects Models**. Observations weighted by number of discharge records per unit-month. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Estimate	0.629	0.038	-1.432	-0.176	-0.058	0.021	-0.287
95% CI	(0.1,1.1)	(-0.003,0.1)	(-1.8,-1.1)	(-0.3,-0.1)	(-0.1,-0.03)	(-0.01,0.1)	(-0.6,-0.02)
Avg.Age	2.2	-0.1	0.2	-0.4	0.01	-0.1	-1.1
	(1.6,2.8)	(-0.1,-0.002)	(-0.2,0.6)	(-0.6,-0.3)	(-0.02,0.04)	(-0.1,-0.01)	(-1.4,-0.8)
Geo.Diversity	2	0.05	-1.1	-0.3	-0.01	0.1	0.4
	(1.5,2.5)	(0.01,0.1)	(-1.4,-0.7)	(-0.4,-0.2)	(-0.03,0.02)	(0.03,0.1)	(0.1,0.6)
Pct.Russian	-0.3	-0.1	-2.9	0.2	-0.03	-0.1	4
	(-1,0.4)	(-0.2,-0.04)	(-3.4,-2.4)	(-0.0002,0.3)	(-0.1,0.01)	(-0.1,-0.001)	(3.6,4.4)
Pop.Density	-4.9	0.01	-1.4	1.1	0.02	0.2	0.8
	(-6.3,-3.5)	(-0.1,0.1)	(-2.4,-0.4)	(0.8,1.5)	(-0.1,0.1)	(0.1,0.3)	(-0.004,1.5)
Urbanization	2	0.04	-1.2	-0.4	0.005	-0.1	0.3
	(1.3,2.7)	(-0.03,0.1)	(-1.7,-0.6)	(-0.5,-0.2)	(-0.03,0.04)	(-0.1,-0.01)	(-0.1,0.7)
PrewarRepress	4.1	-0.03	0.3	-0.6	-0.02	-0.1	-1.1
	(2.7,5.6)	(-0.1,0.1)	(-0.8,1.3)	(-0.9,-0.2)	(-0.1,0.1)	(-0.2,0.03)	(-1.9,-0.3)
Hausman p	$<$0.001	0.002	$<$0.001	$<$0.001	$<$0.001	$<$0.001	$<$0.001
AIC	132781	56933.2	120728.6	90013.4	48214.3	62767.9	114900.2
Unit FE	982	982	982	982	982	982	982
Battle FE	129	129	129	129	129	129	129
Month FE	47	47	47	47	47	47	47
N	15142	15142	15142	15142	15142	15142	15142

Table A2.4: **Coefficient Estimates for Three-Way Random Effects Models**. Observations weighted by number of discharge records per unit-month. ICC: intraclass correlation coefficient. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Estimate	1.322	0.009	-1.039	-0.017	-0.018	0.024	-0.361
95% CI	(0.9,1.7)	(-0.02,0.04)	(-1.3,-0.8)	(-0.1,0.1)	(-0.03,-0.01)	(0.01,0.04)	(-0.6,-0.1)
Avg.Age	2.7	-0.02	-0.1	-0.4	0.03	0.004	-1.2
	(2.2,3.3)	(-0.1,0.02)	(-0.4,0.3)	(-0.5,-0.2)	(0.001,0.1)	(-0.03,0.04)	(-1.5,-0.9)
Geo.Diversity	2.4	0.05	-1.3	-0.3	-0.02	0.04	0.4
	(1.9,2.9)	(0.01,0.1)	(-1.6,-0.9)	(-0.4,-0.1)	(-0.04,0.005)	(0.01,0.1)	(0.2,0.7)
Pct.Russian	-0.2	-0.1	-3.2	-0.1	-0.1	0.04	3.7
	(-0.8,0.4)	(-0.1,-0.01)	(-3.7,-2.8)	(-0.3,0.01)	(-0.1,-0.05)	(0.003,0.1)	(3.4,4.1)
Pop.Density	-4.4	-0.02	-1.1	1.1	0.1	0.2	0.6
	(-5.8,-3)	(-0.1,0.1)	(-2.1,-0.2)	(0.8,1.4)	(-0.01,0.1)	(0.1,0.3)	(-0.2,1.3)
Urbanization	1.9	0.03	-1.1	-0.4	-0.005	-0.05	0.4
	(1.2,2.6)	(-0.03,0.1)	(-1.6,-0.6)	(-0.6,-0.3)	(-0.04,0.03)	(-0.1,-0.003)	(-0.03,0.8)
PrewarRepress	3.6	-0.001	-0.03	-0.5	-0.1	-0.1	-1.1
	(2.2,5)	(-0.1,0.1)	(-1,0.9)	(-0.8,-0.2)	(-0.1,0.01)	(-0.2,0.03)	(-1.9,-0.4)
REML	139247.6	63985.9	128646.1	94613.4	49423.9	57593	120951.1
ICC (unit)	0.001	0.0003	0.0005	0.0002	0	0	0.001
ICC (battle)	0.001	0.0003	0.001	0.003	0	0.0001	0.0004
ICC (month)	0.001	0.0001	0.004	0.002	0.0001	0.001	0.004
ICC (residual)	0.997	0.999	0.995	0.994	1	0.999	0.995
Hausman p	$<$0.001	0.002	$<$0.001	$<$0.001	$<$0.001	$<$0.001	$<$0.001
AIC	139271.6	64009.9	128670.1	94637.4	49447.9	57617	120975.1
Unit FE	982	982	982	982	982	982	982
Battle FE	129	129	129	129	129	129	129
Month FE	47	47	47	47	47	47	47
N	15142	15142	15142	15142	15142	15142	15142

A3. Sensitivity Analyses and Placebo Tests

A3.1. Randomization Inference

To assess whether estimates of the same magnitude as those in Table A2.4 could be obtained by chance, we ran placebo tests that randomized the allocation of NKVD officers across units. For each of 10,000 simulations, we randomly reallocated the number of OO/SMERSH officers across division-months, and re-estimated our models with these alternative NKVD assignments. Figure A3.1 reports the resulting distribution of coefficient estimates, along with our original estimates (blue lines). The original estimates fall entirely outside the distribution of simulated coefficients for all outcomes except Punishment. In this latter case, 3% of simulated coefficients were larger in absolute value than our baseline estimate.

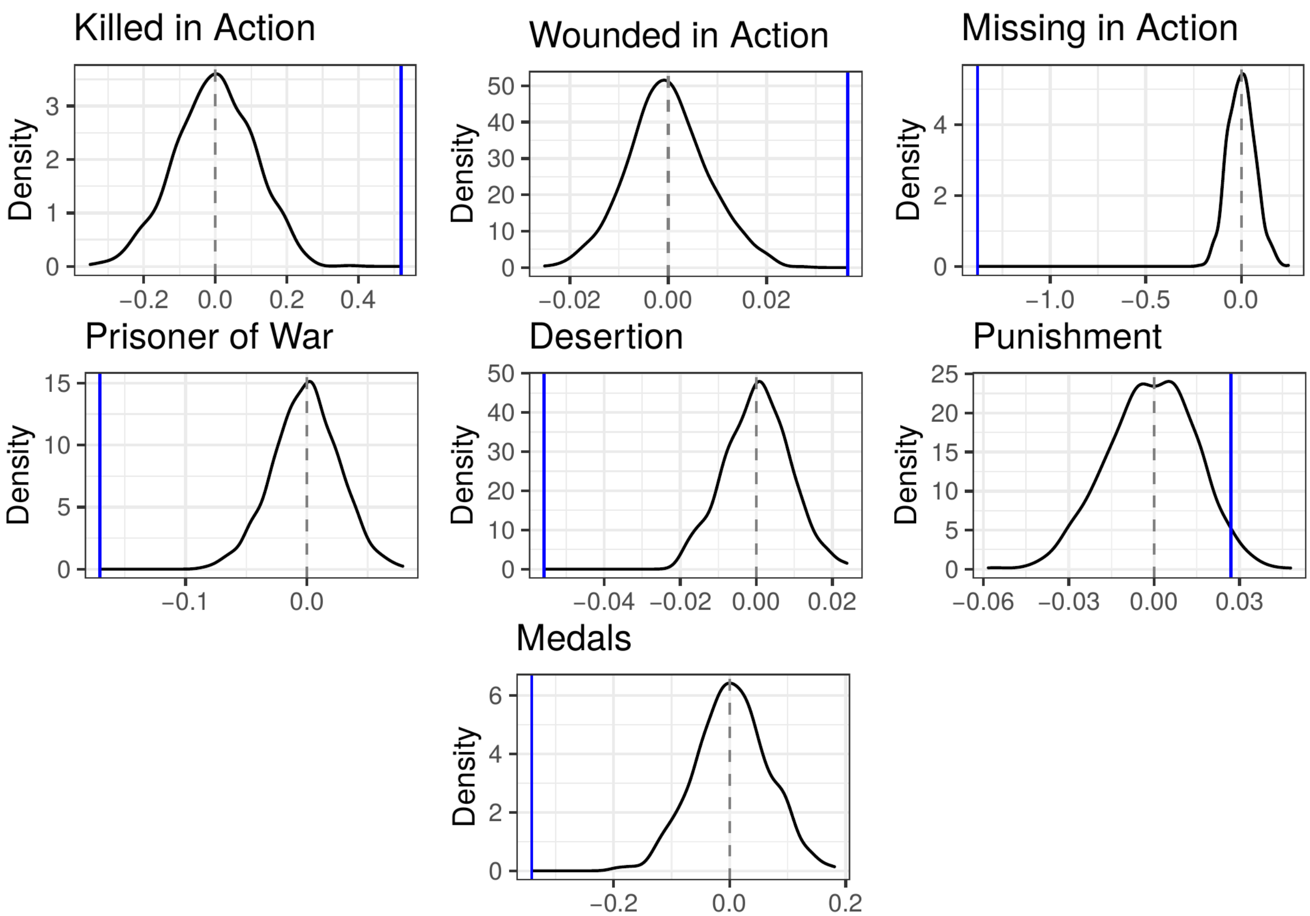
A3.2. Time-Variant Coefficients

To explore how the effect of fratricidal coercion varied over time, we ran an extension of our multilevel models, with time-variant coefficients β_t:

$$y_{ijt}^{(k)} = \log(\text{NKVD}_{it})\beta_t + \mathbf{X}_{it}\gamma + \text{unit}_i + \text{battle}_j + \text{month}_t + \epsilon_{ijt} \tag{3}$$

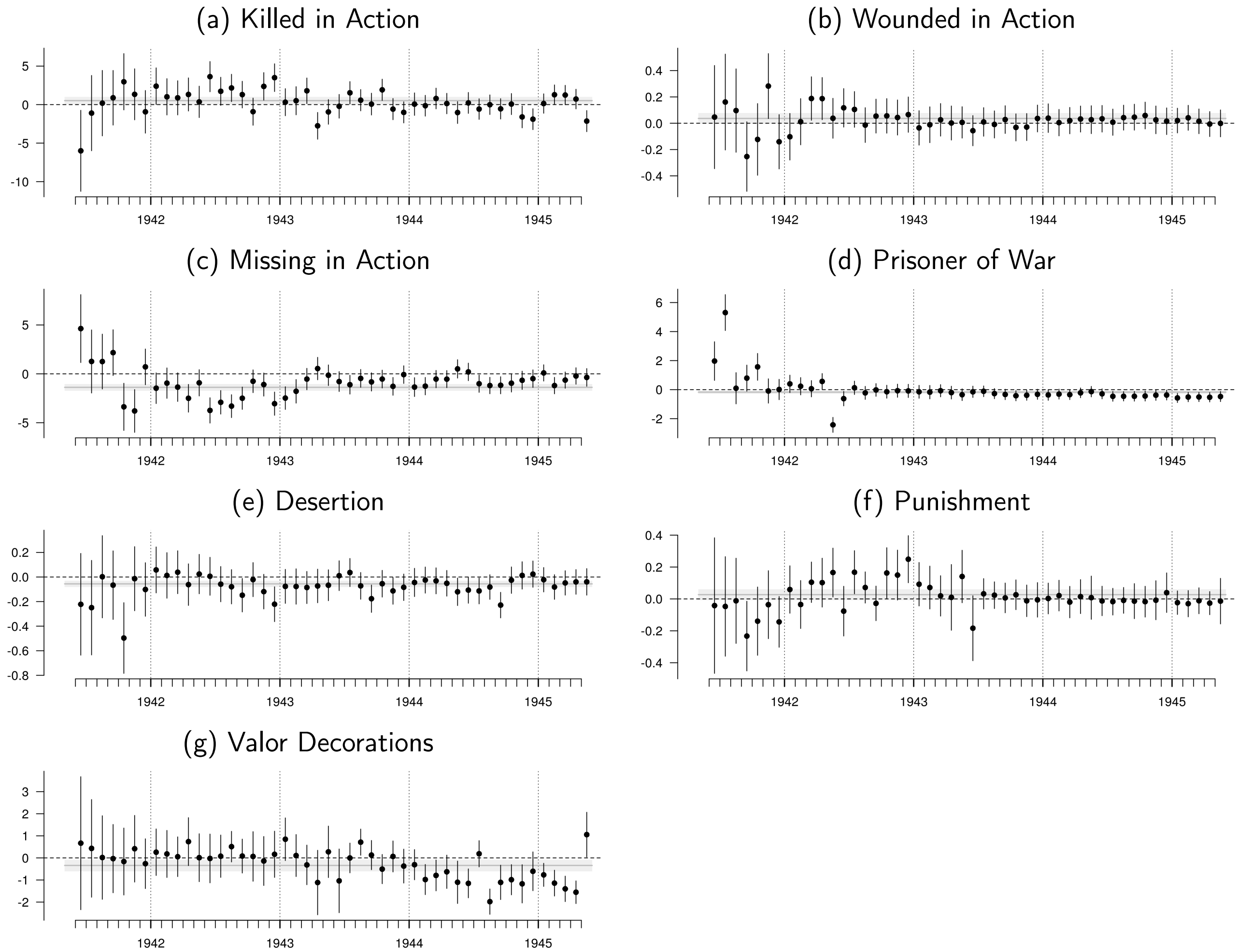
Figure A3.2 reports the full set of $\hat{\beta}_t$ fixed effect estimates for all outcomes. Figure A3.3 reports analogous results from a random effects specification, where $\beta_t = \beta_0 + \alpha_t$ is modeled as the sum of the coefficient for the average time period (β_0), and a month-specific random effect, Normally distributed with mean zero and unknown variance (α_t).

Figure A3.1: **Distribution of Placebo Effects across 10,000 Simulations**.



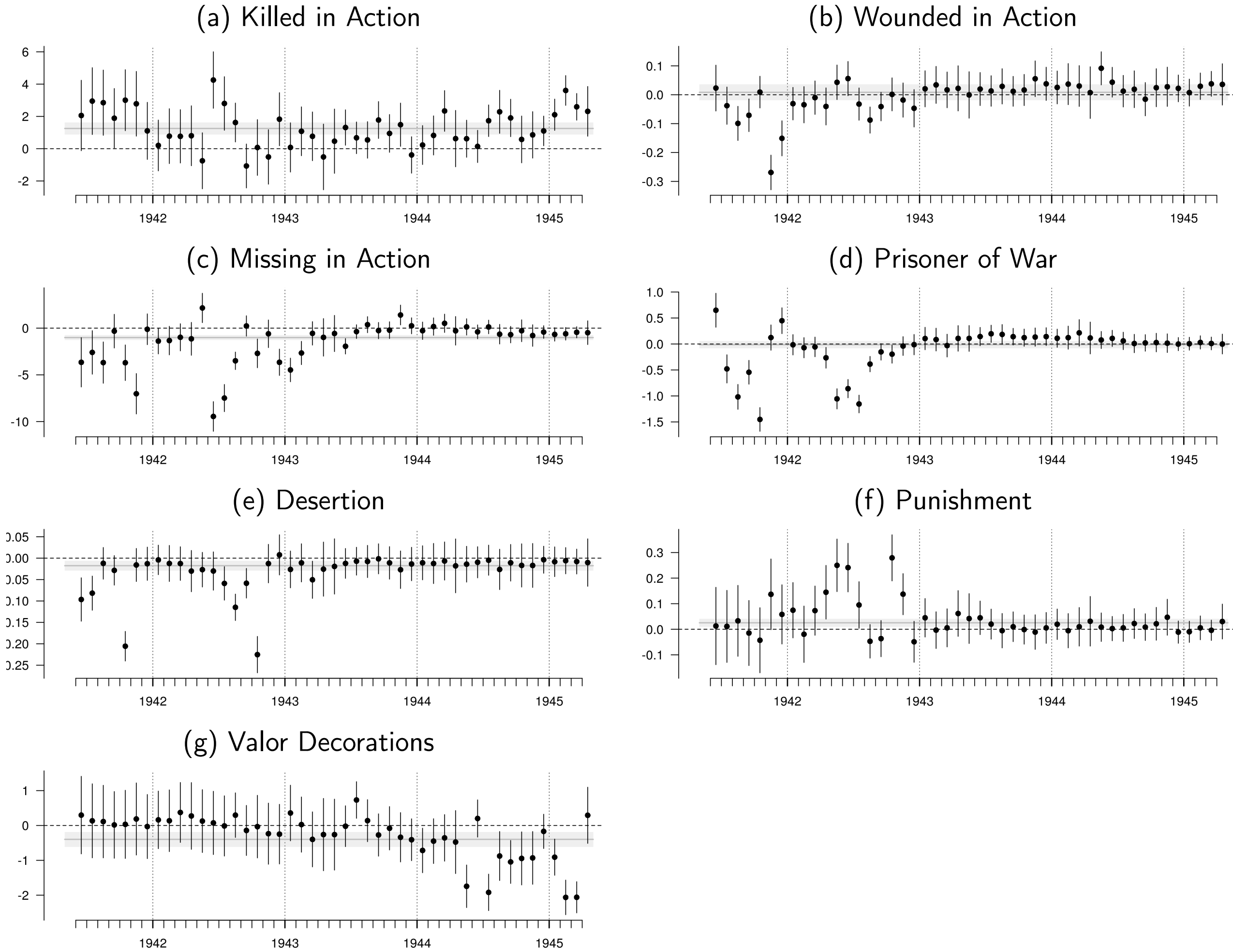
NOTE: Plots show distribution of coefficient estimates from three-way random effects models, re-estimated with randomly re-allocated NKVD_{it}, over 10,000 simulations. Vertical blue lines represent estimates reported in main text. Vertical dashed line is zero.

Figure A3.2: **Time-variant coefficient estimates, fixed effects.**



Note: Points and vertical lines represent time-variant fixed effect coefficient estimates and 95% confidence intervals. Horizontal grey line and bar are time-invariant coefficient estimates and 95% CIs from Table A2.3.

Figure A3.3: **Time-variant coefficient estimates, random effects.**



Note: Points and vertical lines represent time-variant random slope estimates and 95% confidence intervals. Horizontal grey line and bar are time-invariant coefficient estimates and 95% CIs from Table A2.4.

Apart from a few outliers — mostly in the chaotic early months of the war — the general directions of these relationships are consistent with those in Figure 1. The highest positive estimates for KIA came after Stalin's Order No. 227 in July 1942, and peaked during the Battle of Stalingrad in December 1942. The relationship remained positive through the end of the war, with some decline in magnitude. Estimates for MIA were negative for most of the war, particularly in late 1941 during the Battle of Moscow, and after Order 227 in 1942. Both cases suggest that the deterrent did not take hold right away — units with more NKVD personnel initially saw fewer KIAs and more MIAs, before these relationships reversed.

Estimates for medals, meanwhile, become more negative over time. This pattern is not surprising, given that 90 percent of all Soviet valor decorations were for actions taken in the second half of the war, as the RKKA took to the offensive and sought to encourage acts of bravery. They did so by introducing new decorations (e.g. Order of Glory, November 1943), and expanding eligibility criteria for others (e.g. "For Courage," June 1943). Negative estimates during this period suggest that soldiers in units with a larger NKVD presence may have been less responsive to these positive inducements, despite official signals that battlefield exploits would be recognized. Deterrence, in this sense, may have worked too well, disincentivizing both under- and over-performance.

A3.3. Accounting for Variation in Division Strength

We used multiple methods, including simulations, to test whether unobserved variation in divisional strength, due perhaps to disease or heavy losses in prior battles, is driving our results. Our measure of NKVD presence employs absolute, rather than proportional, numbers of OO/SMERSH officers assigned to each division-month. This approach assumes that RKKA divisions were all of similar size (8,000-12,000 personnel). On paper, Soviet rifle divisions had an overall strength of 14,483.[4] In practice, they rarely approached this number and varied greatly in size due to the dynamics of attrition, rest and refitting. This variation in strength could potentially have affected the NKVD's ability to monitor and enforce troop discipline. If the costs of coercion increase with the number of troops under an OO/SMERSH officer's supervision, then each additional NKVD officer may have had a larger effect on battlefield behavior in under-strength units and a smaller effect in full-strength units. Unless the NKVD systematically assigned fewer officers to under-strength divisions – a possibility we cannot verify or exclude with available data – then absolute NKVD numbers may obscure this underlying heterogeneity.

While we cannot observe the true strength of each division over the course of the war, we can test the empirical implications of this scenario through several approaches, including time-varying coefficients and simulation. One possibility is that average divisional strength varied systematically over time, with units gradually losing strength over the course of the war, or during certain pivotal moments. If this is true, then the time-varying coefficient estimates we reported in Appendix A3.2 should capture much of the resulting effect heterogeneity. As those results — and the ones in Figures A3.2-A3.3 — suggest, in most cases, the NKVD effect diminishes over time. This is the opposite of what we would expect if the influence of individual OO/SMERSH officers increased in later periods of the war due to attrition. Of course, time heterogeneity captures many things besides variation in unit strength, most notably the switch from defensive to offensive operations, and changes in operational tempo across the entire front.

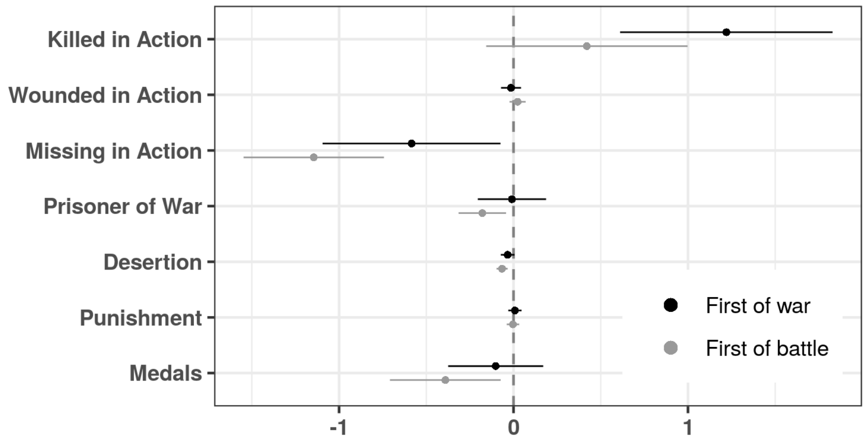
As an additional check, we replicated our analyses on subsamples of the data corresponding to the first month of each division's deployment, on the assumption that units are more likely to be at full strength at the beginning of their tours. The first subsample includes units' first documented appearance in the war, and the second includes units' first appearance in each battle.[5] These estimates, in Figure A3.4, are consistent with our earlier results: for both subsets of the data, an increase in NKVD presence is associated with significant decreases in MIA and Desertion rates. As before, estimates are positive for KIA rates and negative for POWs and Medals, although their precision varies.

Finally, we can assess how sensitive our results are to *random* variation in unit strength, due to the disbanding or reassignment of regiments, outbreaks of disease, supply disruptions, or heavy losses

[4]The wartime table of organization and equipment (OShS) 04/400-416 from April 5, 1941 gave each Soviet rifle division 14,483 soldiers (TsAMO, Fond 357(11A), Opis' 5973, Delo 1).

[5]Because the first sample includes one unique observation per military unit, we exclude unit-specific error components from those models.

Figure A3.4: **Subsample Analyses: First Months of Deployment**.



in recent battles. To do so, we ran a series of simulations, in which each division receives a monthly random shock to its force strength, which can reduce the number of available personnel to as low as 6,000 (∼40% strength) or bring it up to slightly over full strength at 15,000, with an average at 10,500 troops. Formally, we represent this shock with a scaling factor ζ_{it},

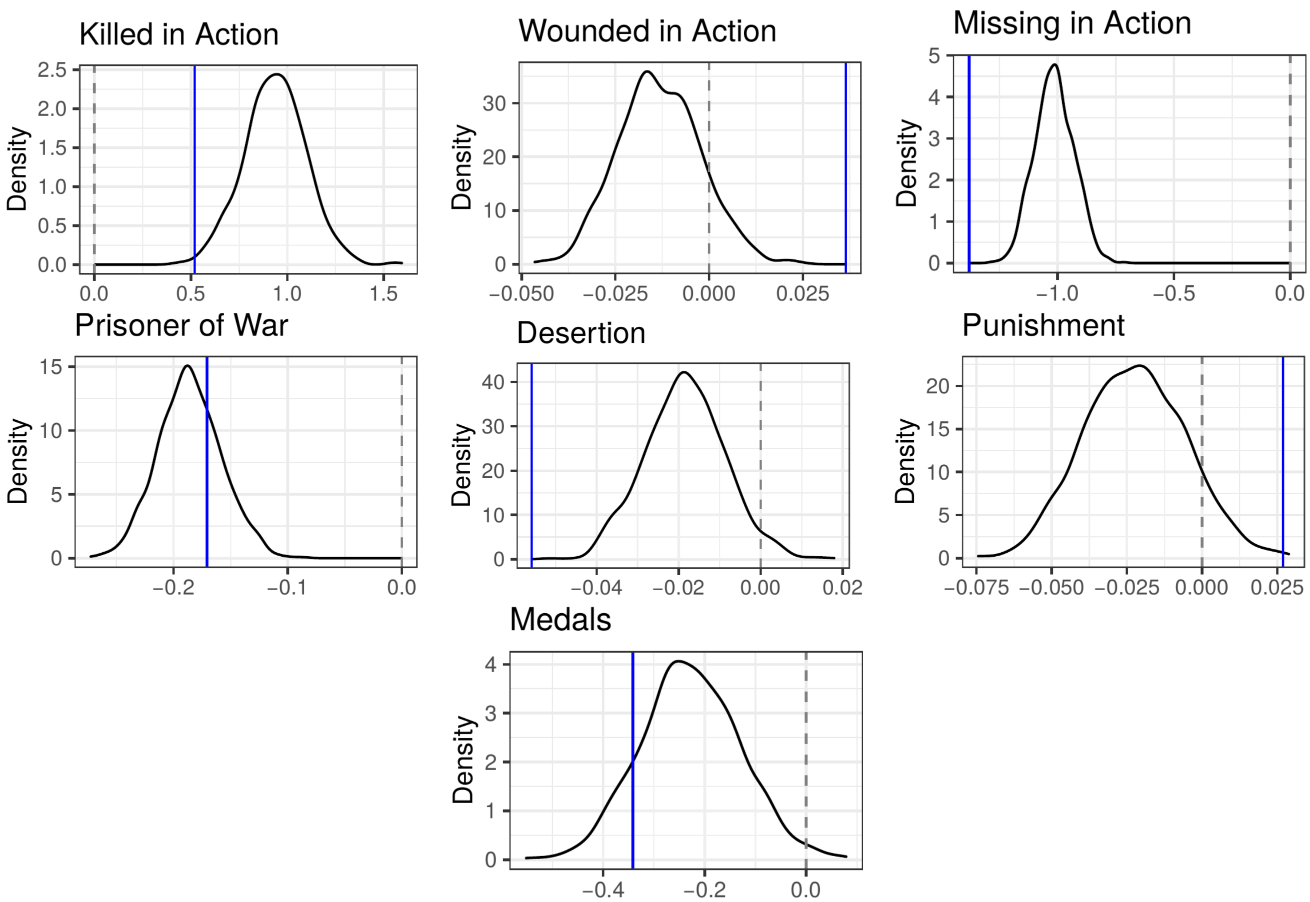
$$\zeta_{it} = \frac{s_{\text{max}}}{s_{it}}, \quad s_{it} \sim U(6000, 15000)$$

where s_{max} represents the theoretical maximum force strength of 15,000, and s_{it} represents the simulated force strength for division i on month t.[6] This scaling rests on the assumption that the NKVD's monitoring and enforcement costs were lower in under-strength Soviet units, such that one NKVD officer in a half-strength unit can have the same impact on discipline as two officers in a full-strength unit. Mathematically, this is equivalent to increasing the absolute size of the OO/SMERSH contingent in a random subset of units, which should attenuate the estimated average effect of NKVD presence. We multiply this scaling factor by our treatment variable to obtain an adjusted number of NKVD officers in each division-month, $\text{NKVD}^*_{it} = \zeta_{it} \cdot \text{NKVD}_{it}$, and replicate our full set of mixed effects models with this new measure. We ran this simulation 10,000 times.

Figure A3.5 reports the distribution of coefficient estimates across these 10,000 simulations, along with the original coefficient estimate (blue vertical line) for each dependent variable. These results suggest that our estimates are stable to non-trivial variations in division strength. The coefficient estimates for NKVD presence on KIA rates remain positive for all 10,000 runs. Indeed, the simulations suggest that our original analyses potentially under-estimate the size of this coefficient in under-strength units. Estimates for MIA and POW remain negative in all runs, while those for Desertion and Medals are negative in 97% and 99% of simulations. The two sets of results that are less robust to variation in division strength are WIA and Punishment — where our original (positive, but statistically insignificant) estimates diverge in sign from the bulk of the distribution of simulated coefficients (90% of which are negative).

[6] The simulation assumes that shocks are independently distributed across units and over time.

Figure A3.5: **Sensitivity Analysis of Variable Division Strength**.



NOTE: Plots show distribution of coefficient estimates from three-way random effects models, re-estimated with strength-adjusted NKVD$^*_{it}$ measures, over 10,000 simulations. Vertical blue lines represent estimates reported in main text. Vertical dashed line is zero.

A3.4. Peer Effects

An additional set of analyses explores non-independence across divisions, due to learning by commanders or shared battlefield conditions among neighboring divisions. Military units do not exist in a vacuum. Each division is part of a larger formation, in which the fortunes of one unit depend on the fortunes and circumstances facing all others. We define a "peer effect" in this context as the influence of these other units on a given unit's battlefield outcomes. This peer effect may reflect learning and adaptation by soldiers (Lehmann and Zhukov, 2019), or it may be a statistical consequence of common battlefield conditions and organizational features. Both of these scenarios would violate the independence assumption in our main models. To account for this interdependence, we extend the model in equation 2:

$$\begin{aligned} y_{ijt}^{(k)} &= \log(\mathsf{NKVD}_{it})\beta + \log(\overline{\mathsf{NKVD}}_{lt[-i]})\psi + \mathbf{X}_{it}\gamma + u_{ijt} \\ u_{ijt} &= \mathsf{unit}_i + \mathsf{battle}_j + \mathsf{month}_t + \epsilon_{ijt} \end{aligned} \tag{4}$$

where $\overline{\mathsf{NKVD}}_{lt[-i]}$ is the average number of NKVD officers assigned to the other units in parent formation l on month t, excluding unit i.[7] If i indexes divisions, the parent formation l may be an army or a front (we consider both below). This specification is a variant of a linear-in-means model (Manski, 1993; Burke and Sass, 2013; Carrell, Sacerdote and West, 2013), with the exogenous peer effect parameter equal to zero. The parameter β represents the "direct effect" of NKVD presence in unit i on the battlefield outcomes of unit i, ψ is the reduced-form peer effect, and $\rho = \psi/(\beta+\psi)$ is the endogenous peer effect.[8] This specification assumes that the behavior of soldiers in one unit does not depend directly on other

[7] Formally, the "leave-out" mean of x for unit i in group l is $\frac{N_l \bar{x}_l - x_{il}}{N_l - 1}$. Because group composition changes over time, we calculate these group means separately for each unit-month.

[8] Formally, let y represent a battlefield outcome (e.g. percent KIA), let z represent NKVD presence, and let x denote a reference group (e.g. the larger grouping, like army-month or front-month, of which the unit is a member). Consider a structural regression equation of the form:

$$\mathbb{E}(y|x,z) = \alpha + \rho\mathbb{E}(y|x) + \gamma z + \delta x \tag{5}$$

where α is an intercept, ρ captures how a unit's outcomes vary with the outcomes of other units in the same group, β is the direct effect of NKVD presence on a unit's outcomes, and δ is a group fixed effect. The model's right-hand side may also include the effects of additional covariates, which we omit here for simplicity. Following Manski's approach, we integrate out z and rearrange the terms to get

$$\begin{aligned} \mathbb{E}(y|x) &= \alpha + \rho\mathbb{E}(y|x) + \gamma\mathbb{E}(z|x) + \delta x \\ &= \alpha/(1-\rho) + \gamma/(1-\rho)\mathbb{E}(z|x) + \delta/(1-\rho)x \end{aligned}$$

and plug this expression into equation 5:

$$\begin{aligned} \mathbb{E}(y|x,z) &= \alpha + \rho\left(\alpha/(1-\rho) + \gamma/(1-\rho)\mathbb{E}(z|x) + \delta/(1-\rho)x\right) + \gamma z + \delta x \\ &= \frac{\alpha}{1-\rho} + \frac{\delta}{1-\rho}x + \frac{\rho\gamma}{1-\rho}\mathbb{E}(z|x) + \gamma z \end{aligned}$$

This yields the reduced form equation we estimate,

$$\mathbb{E}(y|x,z) = \alpha^* + \delta^* x + \psi\mathbb{E}(z|x) + \beta z,$$

where $\alpha^* = \alpha/(1-\rho)$, $\delta^* = \delta/(1-\rho)$ and $\psi = \rho\beta/(1-\rho)$. If $\rho \neq 1$ and $\beta \neq 0$, we can recover the "structural" parameter $\rho = \dfrac{\psi}{\psi+\beta}$, which is the endogenous peer effect estimate, alongside β (effect of unit's direct exposure to NKVD) and ψ (reduced form peer effect).

units' exposure to NKVD special sections. Rather, other units' exposure to special sections affect the focal unit's fortunes in equilibrium only indirectly, through their effect on the fortunes of other units in the same formation. This is a reasonable assumption in our case, because it does not require soldiers in one unit to form correct expectations about the size of NKVD contingents in other units.

Tables A3.5-A3.6 report coefficient estimates from two sets of models, which consider peer effects emanating from units in the same army (Table A3.5), or the same front (Table A3.6). Estimates for the direct effect of NKVD presence are generally consistent with those in our main specification. As before, units with a larger NKVD contingent generally saw fewer losses due to flight (MIA, POW, Desertion), and a smaller share of soldiers receiving medals for valor. With the exception of KIA, which loses significance, our core results appear robust to the inclusion of peer effects.

The estimates further illuminate that endogenous peer effects may have been stronger for some types of outcomes than for others. For example, MIA and POW rates were significantly higher in units whose parent armies and fronts also experienced exceptionally high MIA and POW rates in the same month. For other outcomes, like KIA and medals, the influence of other units was more variable — effectively null when the peer effects emanate from other units in the same army (Table A3.5), but positive and significant when considering other units in the same front (Table A3.6).

Table A3.5: **Coefficient Estimates for Peer Effects Model (within-army peer effects)**. Linear fixed effect model estimates. Bootstrapped 95% confidence intervals in parentheses. Observations weighted by number of discharge records per unit-month. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Direct effect	0.4	0.03	-1.2	-0.2	-0.1	0.02	-0.4
	(-0.05,0.9)	(-0.01,0.1)	(-1.5,-0.9)	(-0.3,-0.04)	(-0.1,-0.03)	(-0.01,0.1)	(-0.6,-0.1)
Reduced form peer effect	1.2	0.03	-2.7	-0.2	0.03	0.1	0.4
	(0.6,1.8)	(-0.03,0.1)	(-3.1,-2.3)	(-0.4,-0.1)	(-0.01,0.1)	(0.01,0.1)	(0.1,0.7)
Endogenous effect	0.4	0.2	0.6	0.5	-1	0.8	0.3
	(-7.5,6.2)	(-5.1,5.5)	(0.4,0.7)	(0.2,0.7)	(-34.2,28.4)	(-7.6,7)	(-5.9,6.6)
Hausman p	$<$0.001	0.003	$<$0.001	$<$0.001	$<$0.001	$<$0.001	$<$0.001
AIC	132586.4	56855.5	120461.7	89889.1	48151.7	62677.2	114744.2
Unit FE	982	982	982	982	982	982	982
Battle FE	129	129	129	129	129	129	129
Month FE	47	47	47	47	47	47	47
N	15122	15122	15122	15122	15122	15122	15122

A3.5. Officers

To explore whether NKVD presence affected the behavior of Red Army officers differently than it affected the behavior of rank-and-file troops, we replicated our main model specifications with alternative measurements of battlefield outcomes. Specifically, we replaced our previous measures of loss rates and decorations — which utilize records for *all soldiers* assigned to a unit-month — with measures calculated using exclusively the personnel records of commissioned officers. We included in this category all personnel who held the rank of Junior Lieutenant — the Red Army's O-1 equivalent — and higher at the time of the unit-month observation.

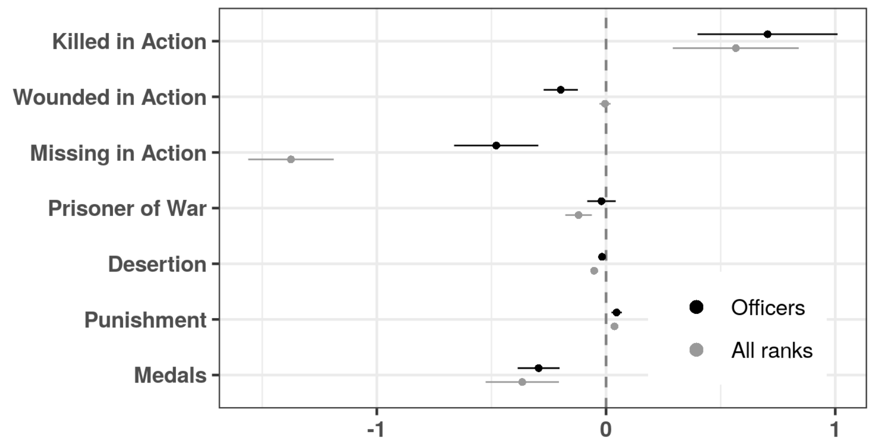
Table A3.6: **Coefficient Estimates for Peer Effects Model (within-front peer effects).** Linear fixed effect model estimates. Bootstrapped 95% confidence intervals in parentheses. Observations weighted by number of discharge records per unit-month. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Direct effect	0.5	0.03	-1.2	-0.1	-0.1	0.02	-0.3
	(-0.03,0.9)	(-0.01,0.1)	(-1.5,-0.9)	(-0.2,-0.03)	(-0.1,-0.03)	(-0.01,0.1)	(-0.6,-0.03)
Reduced form peer effect	2.5	0.2	-6.8	-1.3	0.01	0.3	-1.7
	(1.2,3.8)	(0.1,0.3)	(-7.7,-5.9)	(-1.6,-1)	(-0.1,0.1)	(0.2,0.4)	(-2.4,-1)
Endogenous effect	0.9	0.7	0.8	0.8	0.3	0.9	1.1
	(0.4,1.2)	(-0.8,2)	(0.7,0.9)	(0.7,0.9)	(-4.3,9.3)	(-2.4,4.9)	(1,1.3)
Hausman p	$<$0.001	$<$0.001	$<$0.001	$<$0.001	$<$0.001	$<$0.001	$<$0.001
AIC	132764.6	56926.9	120542.2	89945.7	48215.5	62759.1	114867.4
Unit FE	982	982	982	982	982	982	982
Battle FE	129	129	129	129	129	129	129
Month FE	47	47	47	47	47	47	47
N	15142	15142	15142	15142	15142	15142	15142

Figure A3.6 reports the coefficient estimates and confidence intervals from this model (in black), alongside the original estimates from our baseline models in the main paper's Figure 1 (in gray). This analysis suggests that the effects of NKVD presence were generally in the same direction for officer as for the general sample. However, the magnitude of these estimates varies by outcome. In particular, we observe a dampening of the estimated effect for all measures of flight, including MIA, POW and Desertion. In the case of POW, the NKVD effect becomes statistically indistinguishable from zero.

Another divergence is in the previously null estimate for WIA, which becomes negative and significant at the 95% confidence level. This category is relatively small, and includes only those personnel who received wounds that were not lethal, but sufficiently severe for medical discharge. The fact that officers in units with a larger NKVD presence were less likely to receive such a designation is open to several interpretations. First, officers in these units may have been more likely to remain on the battlefield after sustaining an injury, and potentially more reluctant to request a medical evacuation. This pattern is not inconsistent with the numerically larger — albeit insignificantly so — coefficient estimate for KIA. However, such a pattern would also imply a higher incidence of valor decorations for these officers, since continuing to fight after being wounded is an act that meets the eligibility requirements for several of these awards. Yet officers' coefficient estimate for medals is numerically quite close to that for the army as a whole. Another possibility is that higher authorities may have been less likely to approve medical discharges and evacuations for officers serving in units with large numbers of NKVD personnel — either because the NKVD officers discouraged them from doing so, or because they preemptively wished to avoid scrutiny and second-guessing by their political minders. The data do not allow us to definitively adjudicate between these possibilities, or to rule either of them out.

Figure A3.6: **Did Officers Respond Differently to Fratricidal Coercion?**



A3.6. Organizational Challenges in Newer Units

A potential alternative explanation for some of our findings is that certain battlefield outcomes reflect variation in opportunities for flight and bravery, rather than variation in the NKVD's deterrent capacity. To take an example from our case studies (see below), the 90th Rifle Division faced many organizational challenges, including a lack of officers, and a gradual breakdown of communications between its regiments and divisional staff. In the absence of clear orders or instructions from above, soldiers had more opportunities to exercise initiative, leading in some cases to acts of bravery — and in other cases, leading to panic and mass flight. These organizational challenges may have contributed to the 90th's battlefield (mis)fortunes, even if the unit's NKVD contingent was larger.

We cannot observe unit "disorganization" directly, but we can construct a proxy by looking at whether "greener" (newly-formed, less-experienced) units have different levels of combat resolve than more seasoned units. Granted, both rifle divisions in our case study (168th and 90th) were second formations created in July 1941, but the 90th experienced more upstart challenges, and was effectively rebuilt once again in mid-September. With the reasoning that newly-formed units have relatively nascent organization, and potentially more opportunities for divergent behavior, we conducted supplementary analyses.

We expanded our main model specification with two proxies capturing units' combat experience and organizational maturity: (a) an indicator for a division's first month on the front, and (b) a cubic spline for duration of deployment, ranging from 0 to 48 months. The latter test accounts for the potentially non-monotonic relationship between time at the front and unit disorganization — which may be higher at the beginning and end of a unit's rotation, as attrition gradually takes its toll. If the coefficient estimates for NKVD presence do not attenuate after this model expansion, we can have greater confidence that the opportunities presented by this type of disorganization are not driving our results.

The results of these analyses, in Tables A3.7 and A3.8, indicate that newer units do experience higher MIA rates (like the 90th RD), but they also have higher KIA rates (unlike the 90th). In other words, "greener" units experience higher losses of both types. Further, rates of medals are about the same in newer and older units Punishment rates and WIA rates are also lower in newer units. Our main results

Table A3.7: **Coefficient Estimates for Three-Way Fixed Effects Models**, with "first month" dummies. Estimates for other covariates not shown. Observations weighted by number of discharge records per unit-month. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Estimate	0.745	0.032	-1.253	-0.179	-0.06	0.009	-0.291
95% CI	(0.3,1.2)	(-0.01,0.1)	(-1.6,-0.9)	(-0.3,-0.1)	(-0.1,-0.03)	(-0.03,0.04)	(-0.6,-0.03)
First Month	1.6	-0.1	2.4	-0.04	-0.02	-0.2	-0.1
	(0.9,2.3)	(-0.1,-0.01)	(1.9,2.9)	(-0.2,0.1)	(-0.1,0.01)	(-0.2,-0.1)	(-0.4,0.3)
Hausman p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AIC	132761.8	56938.2	120668.5	90014.6	48214.6	62731	114902.4
Unit FE	982	982	982	982	982	982	982
Battle FE	129	129	129	129	129	129	129
Month FE	47	47	47	47	47	47	47
N	15142	15142	15142	15142	15142	15142	15142

Table A3.8: **Coefficient Estimates for Three-Way Fixed Effects Models**, with "deployment duration" cubic spline. Estimates for other covariates not shown. Observations weighted by discharge records per unit-month. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Estimate	0.694	0.028	-1.174	-0.174	-0.061	0.0004	-0.32
95% CI	(0.2,1.2)	(-0.01,0.1)	(-1.5,-0.8)	(-0.3,-0.1)	(-0.1,-0.03)	(-0.03,0.03)	(-0.6,-0.1)
Duration Spline	✓	✓	✓	✓	✓	✓	✓
Hausman p	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AIC	132768	56907.5	120626	90017	48217.1	62699.2	114883.8
Unit FE	982	982	982	982	982	982	982
Battle FE	129	129	129	129	129	129	129
Month FE	47	47	47	47	47	47	47
N	15142	15142	15142	15142	15142	15142	15142

about NKVD presence are robust to this model extension.

This analysis suggests that disorganization, as proxied by "greenness," tends to have different battlefield effects on average from what we observe in the 90th RD. While disorganization may potentially help explain one or two battlefield outcomes taken separately, variation in NKVD presence is a more plausible explanation of our results as a whole.

A3.7. Ethnic and Class Discrimination

Another potential alternative explanation is that our findings reflect patterns of discrimination against soldiers from certain ethnic, social and economic backgrounds, rather than the effect of fratricidal coercion. For example, Table A2.3 suggests that units with a higher share of ethnic Russian soldiers typically had lower WIA and MIA rates, fewer punishments, and more medals. A similar pattern holds for units with a higher share of urban recruits (lower MIA and POW rates, less punishment). These results indicate that soldiers from certain "favored" nationalities and class backgrounds (e.g. ethnic Russian, urban proletariat) may have had systematically different experiences at the front than soldiers from more "suspect" backgrounds (e.g. ethnic minority, peasant). The differences may reflect better living conditions, assignment to less dangerous tasks, or more reliable supply of food and ammunition — any of which could help explain the lower incidence of flight in these units. Furthermore, our analysis of NKVD assignment (Table A1.2) indicates that fewer OO/SMERSH officers were sent to units with more ethnic Russians and urban residents, reflecting a lower perceived need to deter misconduct.

Discrimination along ethnic and class lines was pervasive in many Soviet government institutions, and we cannot easily dismiss its importance in the military. However, there are several reasons to doubt that discrimination can fully account for our results with respect to NKVD presence. First, our analyses consistently show that, net of unit ethnicity and other demographic attributes, the estimated NKVD presence effect is statistically significant and in alignment with hypotheses H1, H2 and H3 (Table A2.3).

Second, the main mechanisms by which discrimination might affect the awarding of medals — limiting opportunities, and more heavily scrutinizing personnel from "disfavored" groups — are not fully compatible with empirical patterns. Let us consider the possibility that some groups of soldiers received fewer medals because they had been given fewer opportunities to distinguish themselves in battle, perhaps because they were systematically assigned to rear duties, far away from the front (e.g. construction, field kitchens, logistics). If this were true, we should expect to see fewer battle deaths in units with more representatives from "disfavored" groups. Yet this is not quite what we observe. While the relationship between urbanization and KIA rates is positive, there is no statistically significant relationship between a unit's share of ethnic Russians and KIA rates. These patterns are also at odds with the notion that disfavored groups were used as "cannon fodder" in the RKKA — if they were, the KIA rates would be lower in Russian-heavy and urban-heavy units.

Another possibility is that discrimination took the form of the NKVD more closely monitoring and scrutinizing soldiers from "disfavored" groups. Indeed, Russian-heavy and urban-heavy units had significantly lower rates of punishment, which may be an artifact of the NKVD's reduced numerical presence in such units, or a lower caseload due to genuine disciplinary problems. It is not hard to see how overly-aggressive monitoring and scrutiny might derail the medal nomination process for otherwise eligible troops, by making minor behavioral transgressions more easily detectable, and creating a pretext for commanders to avoid nominating individuals from some groups. Yet this increased scrutiny cannot explain other observed battlefield outcomes, such as the deterrence failure indicated by relatively higher MIA rates in minority-heavy and rural-heavy units.

To be clear, it is certainly possible that discrimination affected our results in ways that we cannot capture in our data and analyses. Yet while group inequities in battlefield outcomes do exist, they do not always align in direction with our estimates for NKVD presence — the latter of which tell a far more consistent story about deterrence and conformity.

A3.8. Reporting Biases in Soviet Records

An additional concern, which we cannot directly test, is that our results might be artifacts of unreliable or biased Soviet administrative records. As with all administrative data, we urge readers to treat them not as comprehensive representations of objective truth, but as information collected by the government about that particular truth. These data are partial and imperfect, reflecting the Soviet authorities' finite, if impressive, capacity for record-keeping, as well as the mixed incentives reporting officials faced at the time. It is possible, however, to deduce the likely direction of such reporting biases. If NKVD presence made reporting more accurate, we might expect some relabeling of MIAs as POWs, resulting in a positive correlation between NKVD and POWs. We observe the opposite. If, by contrast, authorities were "cooking the books" to burnish the NKVD's image as enforcers, we would expect a negative correlation between NKVD and our measures of soldier flight.

At first glance, this seems to track with our findings. But several caveats are in order. First, the RKKA, not the NKVD, reported casualties, and two agencies' reporting incentives didn't always align. Military commanders, chafing at NKVD oversight, had little incentive to release figures that made the NKVD look good if it meant further political interference in military affairs. Second, even if commanders were "cooking the books" in this way, it isn't clear why they left KIA and medal counts untouched. Unless misreporting only affected indicators of soldier flight, it cannot account for our results.

A4. Matched Case Selection

We employed a three-stage case selection procedure. First, we use an exact matching algorithm to find pairs of divisions that participated in the same battle, were of the same type, subordinate to the same army, and for which a similar number of records were available. One member of each pair must have a larger-than-average number of NKVD officers at the time of battle, and the other must have a lower-than average NKVD presence. In the second stage, we selected ten matched pairs, which had the largest absolute differences in numbers of NKVD OO/SMERSH personnel. In the third stage, we manually selected a pair of divisions from this top-10 list for qualitative case study analysis.

A4.1. First Stage

The unit of analysis for our case studies is the unit-battle. Where a unit participated in the same battle over multiple months, we collapsed on the time dimension and calculated aggregate casualty percentages and NKVD officer assignments. We did so to circumvent some of the more problematic assumptions in matching time series cross sectional data (Imai, Kim and Wang, 2018), and to avoid the need to single out individual months when discussing unit participation in battles of variable length. Further, matching on month is not necessary to improve balance on the time dimension, since matching by battle already ensures that matches are from the same period of the war.

We matched observations exactly by battle, army, unit type (infantry, armor, artillery, etc.), guards designation, and quantile of number of discharge records per unit-battle. The last of these is technically "post-treatment" (it is observed at the end of the battle), but including it in the matching model is necessary to ensure that we are not comparing divisions with thousands of discharge records per battle to those with fewer than ten. Our dependent variables are proportions (% of casualties that were KIA, etc.), which are more precisely estimated when the number of records is higher. We did not match on any of the other covariates derived from discharge records, although — as we show below — our exact matching procedure improves balance on these covariates as well. We matched without replacement and with randomly-broken ties.

This procedure yielded 1,686 matched pairs of division-battle observations, including 1,686 with an above-average monthly NKVD contingent (i.e. more than 10) and 1,686 with a below-average NKVD contingent. Table A4.9 reports covariate balance statistics before and after matching. Matching improved covariate balance across all covariates, including several that we did not explicitly match on, including proportion Russian, average soldier's age, the geographic proximity of soldiers' birth locations, population density (people per square kilometer), hectares of cropland and percent urban population within 5km of the average soldier's birth location. Standardized differences in means are below .25 standard deviations for all covariates in the matched sample, and Kolmogorov-Smirnov test statistics are insignificant at the 5% level for all but two covariates.

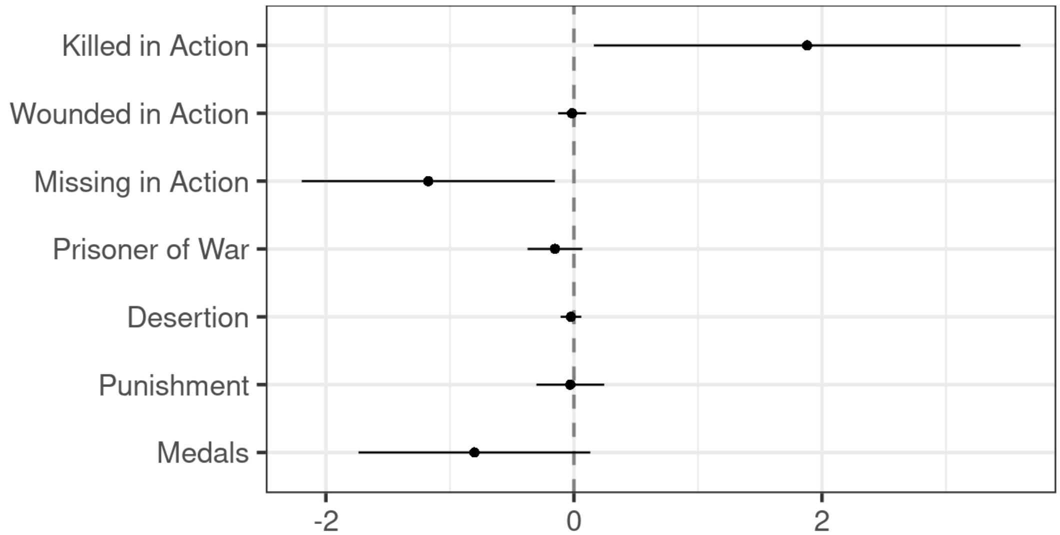
Table A4.9: Covariate balance statistics, pre- and post-matching.

Covariate	Status	Mean T	Mean C	Std. Diff.	KS Statistic
Army ID	pre-matching	52.748	51.724	0.041	0.068**
	post-matching	54.42	52.844	0.059	0.032
Unit type	pre-matching	3.885	3.173	1.3	0.286**
	post-matching	3.518	3.497	0.02	0.011
Month	pre-matching	35.807	27.205	0.955	0.32**
	post-matching	30.506	31.105	-0.054	0.044
Battle ID	pre-matching	72.339	65.733	0.239	0.185**
	post-matching	70.409	71.357	-0.031	0.028
Number of Casualties	pre-matching	409.646	197.348	0.534	0.333**
	post-matching	283.295	279.756	0.01	0.045
Proportion Russian	pre-matching	0.749	0.795	-0.475	0.264**
	post-matching	0.778	0.786	-0.06	0.043
Soldiers' Age	pre-matching	26.557	26.843	-0.12	0.153**
	post-matching	26.703	26.769	-0.013	0.053
Geographic Diversity	pre-matching	939.159	618.93	0.827	0.323**
	post-matching	751.978	713.48	0.077	0.048
Population Density	pre-matching	68.091	48.499	0.366	0.218**
	post-matching	59.299	55.668	0.046	0.052
Cropland	pre-matching	-3.334	-17.009	0.73	0.226**
	post-matching	-10.718	-12.473	0.056	0.036
Urbanization	pre-matching	22.808	6.092	0.652	0.201**
	post-matching	13.828	11.697	0.051	0.036
Pre-War Repression Exposure	pre-matching	1809.251	1760.076	0.024	0.239**
	post-matching	1836.489	1796.592	0.014	0.04

Standardized difference (Std. Diff.) is $\frac{\text{mean}(T)-\text{mean}(C)}{\text{sd}(T)}$. Significance levels (two-tailed): $^{*}p < 0.05$; $^{**}p < 0.01$.

Figure A4.7 reports coefficient estimates and 95% confidence intervals for our fixed effects models, re-estimated on units within the matched sample. While the precision of these estimates declines due to the sample's reduced statistical power, their direction is consistent with those in the full sample. Doubling OO/SMERSH presence is associated with a 0.6 percentage point increase in KIA rates, a 1.4 percentage point decrease in MIA rates and a 0.5 percentage point decrease in Medals.

Figure A4.7: **Impact of NKVD Presence on Battlefield Outcomes, Matched Sample.**



NOTE: Horizontal axis represents estimated percentage point change in outcome (as share of a division's monthly losses), associated with doubling NKVD presence in unit.

A4.2. Second Stage

Of the 1,686 matched pairs, we extracted ten pairs with the largest disparities in NKVD OO/SMERSH personnel. We did this separately for units participating in defensive battles (Tables A4.10) and offensive battles (Tables A4.11).

Table A4.10: **Unit Pairs with Largest Disparities in NKVD Presence** (Defensive Battles).

	Battle	Unit (T)	Unit (C)	NKVD (T)	NKVD (C)
1	Defensive Operations Near Stalingrad	133 TB 64 A	13 TC 64 A	240	2
2	Defensive Operations South/Southwest of Leningrad	168 RD 55 A	90 RD 55 A	57	1
3	Battle of Lyuban'	310 RD 4 A	44 RD 4 A	94	2
4	Defense of Central Passes of Main Caucasus Ridge	334 RD 4 SA	47 RD 4 SA	46	1
5	Smolensk Defensive Battle	153 RD 20 A	229 RD 20 A	84	2
6	Defensive Operations Near Stalingrad	120 RD 66 A	64 RD 66 A	113	3
7	Defensive Operations Near Stalingrad	354 RD 31 A	118 RD 31 A	22	1
8	Defensive Operations Near Stalingrad	143 RD 13 A	8 RD 13 A	21	1
9	Battle of Lyuban'	65 RD 52 A	305 RD 52 A	19	1
10	Defense of Central Passes of Main Caucasus Ridge	311 RD 54 A	285 RD 54 A	36	2

Table A4.11: **Unit Pairs with Largest Disparities in NKVD Presence** (Offensive Battles).

	Battle	Unit (T)	Unit (C)	NKVD (T)	NKVD (C)
1	Belorussian Offensive	81 RC 49 A	69 RC 49 A	217	3
2	Western Ukrainian Offensive	81 RC 50 A	69 RC 50 A	213	3
3	Moscow Counteroffensive	177 RD 55 A	70 RD 55 A	61	1
4	Western Ukrainian Offensive	19 Guards MGAB 10 Guards A	13 MORB 10 Guards A	121	3
5	Baltic Offensive	103 TB 2 та	50 TB 2 та	240	6
6	Kharkov Offensive	6 CC 6 A	2 CC 6 A	34	1
7	Berlin Offensive	11 TC 5 SA	36 TB 5 SA	134	4
8	Right-Bank Ukraine Offensive	45 RC 5 A	72 RC 5 A	29	1
9	Krasnodar-Novorossiysk Offensive	340 RD 40 A	305 RD 40 A	27	1
10	Belorussian Offensive	115 RD 22 A	325 RD 22 A	27	1

A4.3. Third Stage

From the top-10 list in Table A4.10, we manually selected a pair of matched rifle divisions for qualitative analysis. Here, we opted to err on the side of selecting well-documented cases, for which the archival record is relatively comprehensive and with which Western readers are more likely to be familiar. To these ends, we selected pair number 8: the 168th (treated) and 90th (control) Rifle Divisions, 55th Army, Battle of Leningrad. This is the matched comparison that appears in the main text.

A5. Prewar Repression and Officer Purges

Wartime fratricidal coercion is not the only type of coercive state violence to which soldiers may be exposed. Particularly in a mass mobilization context, soldiers bring a variety of life experiences with them to the battlefield, including prior expectations of how the state will respond to (what it perceives as) transgressive acts. We considered how two types of prewar state violence might shape soldiers' battlefield behavior, and their responses to fratricidal coercion: (a) prewar repression against civilians in soldiers' home communities, and (b) prewar purges of army officers in each unit.

A5.1. Data

Data on units' exposure to prewar *civilian repression* are from RTZ. The source materials for these data come from the Victims of Political Terror archive, maintained by the Russian human rights organization Memorial.[9] This database includes information on 2,747,582 arrests (mostly under Article 58 of the Soviet Russian criminal code, which criminalized "counterrevolutionary" activity), assembled from declassified case files from Russian federal and regional archives, regional NGOs, and "Memory Books." RTZ measure exposure to repression as the number of arrests that occurred within 10 km of each soldier's birth location, based on victims' residential addresses (where available) or birthplaces. We take an average of this measure for soldiers assigned to each division-month. Note that this measure captures the average soldier's local geographic exposure to repression, not individual experiences with the NKVD.

[9] Memorial. *Zhertvy politicheskogo terrora v SSSR [Victims of political terror in the USSR]*, 2014. `http://lists.memo.ru/`.

We collected new data on units' exposure to *officer purges* using Churbakov (2004)'s list of 3288 repressed RKKA officers. We parsed each entry on the list to extract, sanitize and disambiguate information on the unit(s) in which each officer had served prior to their arrest and execution. We linked the list of purged officers to our main Soviet divisional dataset by unit name, and calculated a new variable, *purges*: the number of officers arrested by the NKVD in 1937-1938, who had served in a given unit before or during their arrest. Unlike our measure of expose to prewar civilian repression, which varies in value from month to month as new soldiers with different hometown experiences filter through the unit, the purges measure is time-invariant and fixed. Because the RKKA expanded and restructured significantly between 1938 and 1945, we observe officer purges for only 10.5% of all rifle divisions in our dataset. This includes only the divisions that (a) existed during the purges in 1937-1938, and (b) had survived in their original formations until at least the beginning of the war in June 1941.

A5.2. Prewar Repression and Purges as Covariates

As a first order of business, we asked whether our main results on fratricidal coercion (NKVD presence) are robust to the inclusion of prewar repression or purges as covariates. Our main model specification already includes exposure to prewar civilian repression as a covariate in the $\mathbf{X}_{it}$ (equation 2). The coefficient estimates for NKVD presence ($\hat{\beta}$) in Tables A2.3-A2.4 are supportive of H1, H2 and H3.

Due to the large degree of missingness in the officer purges variable, we estimated a separate set of models for this type of prewar violence. The main difference from our main specification, other than the inclusion of purges as a covariate in $\mathbf{X}_{it}$, is the replacement of divisional fixed effects (unit$_i$) with army-level fixed effects (army$_i$). Because purges are observed at the division level, estimation is not feasible with divisional fixed effects). Tables A5.12-A5.13 report coefficient estimates from these models. Our main results for NKVD presence generally hold — in direction and (mostly) in significance.

Table A5.12: **Coefficient Estimates for Three-Way Fixed Effects Models**, controlling for prewar purges. Observations weighted by number of discharge records per unit-month. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Estimate	0.45	-0.026	-1.037	-0.205	-0.03	0.005	-0.313
95% CI	(-0.1,1)	(-0.1,0.02)	(-1.4,-0.7)	(-0.4,-0.1)	(-0.1,-0.004)	(-0.03,0.04)	(-0.6,-0.03)
Hausman p	$<$0.001	0.362	$<$0.001	$<$0.001	0.944	$<$0.001	0.011
AIC	52740.1	23212.2	47919.6	37804.8	16269.1	25373.8	44866.2
Army FE	96	96	96	96	96	96	96
Battle FE	126	126	126	126	126	126	126
Month FE	47	47	47	47	47	47	47
N	6131	6131	6131	6131	6131	6131	6131

A5.3. Prewar Repression and Purges as Predictors of NKVD Officer Assignment

Both types of prewar state violence are predictive of NKVD OO/SMERSH officer assignment to units. As the analyses in Table A1.2 indicate, there are significantly more NKVD officers assigned to units whose

Table A5.13: **Coefficient Estimates for Three-Way Random Effects Models**, controlling for prewar purges. Observations weighted by number of discharge records per unit-month. ICC: intraclass correlation coefficient. Null hypothesis for Hausman test: random effects model is consistent.

Outcome	**KIA**	**WIA**	**MIA**	**POW**	**Desert**	**Punish**	**Medals**
Estimate	0.541	-0.045	-1.195	-0.252	-0.032	-0.018	-0.242
95% CI	(0.01,1.1)	(-0.1,0.002)	(-1.6,-0.8)	(-0.4,-0.1)	(-0.1,-0.01)	(-0.1,0.02)	(-0.5,0.04)
REML	54616.4	25358.2	50367.8	38588.2	17140	22142.6	46682.9
	5e-04	0.001	0.001	2e-04	0	1e-04	3e-04
ICC (battle)	5e-04	3e-04	0.001	0.001	2e-04	1e-04	2e-04
ICC (month)	0.001	1e-04	0.003	0.002	2e-04	0.001	0.003
ICC (residual)	0.998	0.999	0.996	0.997	1	0.999	0.996
Hausman p	<0.001	0.362	<0.001	<0.001	0.944	<0.001	0.011
AIC	54640.4	25382.2	50391.8	38612.2	17164	22166.6	46706.9
Army FE	96	96	96	96	96	96	96
Battle FE	126	126	126	126	126	126	126
Month FE	47	47	47	47	47	47	47
N	6131	6131	6131	6131	6131	6131	6131

soldiers were exposed to higher levels of pre-war civilian repression. Doubling a unit's prewar repression exposure is associated with an 8 percentage point rise in the number of NKVD officers assigned to it.

We re-estimated the model of NKVD assignment (equation 1), with officer purges in covariate matrix $\mathbf{X}_{it}$. Once again, this analysis is feasible only on the more limited sample of units that existed during the purges in 1937-38. As Table A5.14 indicates, there are more NKVD officers assigned to heavily-purged units, although this relationship is only marginally significant ($p < .10$). Doubling a unit's prewar purges is associated with an 3.6 percentage point increase in NKVD officers assigned to it per month.

A5.4. Average Controlled Direct Effect of Prewar Repression and Purges

How does prewar repression impact battlefield outcomes? Does prewar repression continue to have this impact after adjusting for wartime coercion as a post-treatment mediator? We tackled these questions by estimating the average controlled direct effect (ACDE) of prewar repression in a sequential-g framework (Acharya, Blackwell and Sen, 2016). The ACDE represents the direct effect of prewar repression on soldiers' behavior when the mediator (NKVD presence) is held constant at some fixed value for all units.

As before, we ran separate sets of analyses for prewar civilian repression and prewar officer purges. In a first stage, we adapted our baseline model (equation 2) to estimate the effect of the mediator (OO/SMERSH presence) on battlefield outcomes, conditional on all other variables, including prewar repression. Following Acharya, Blackwell and Sen (2016), we augmented this baseline specification with an interaction between the mediator and the treatment, $\log(\text{NKVD}_{it}) \cdot \log(\text{PrewarExposure}_{it})$. Using estimates from this model, we transformed the dependent variable by removing from it the effect of the mediator: $\tilde{y}_{ijt} = y_{ijt} - \mu(\text{NKVD}_{it}, \mathbf{X}_{it}, \text{unit}_i, \text{battle}_j, \text{month}_t)$, where $\mu()$ is the demediation function. In a second stage, we regress this demediated outcome on the treatment (prewar repression, or prewar purges), to obtain the ACDE estimate:

$$\tilde{y}^{(k)}_{ijt} = \log(\text{PrewarExposure}_{it})\phi + \text{unit}_i + \text{battle}_j + \text{month}_t + \epsilon_{ijt} \quad (6)$$

Table A5.14: **Predictors of NKVD Presence**, including purges. Dependent variable is logged number of OO/SMERSH personnel assigned to each division-month. Observations weighted by number of monthly discharge records. Percentage point change calculated as $(e^{\hat{\beta}} - 1) \times 100$.

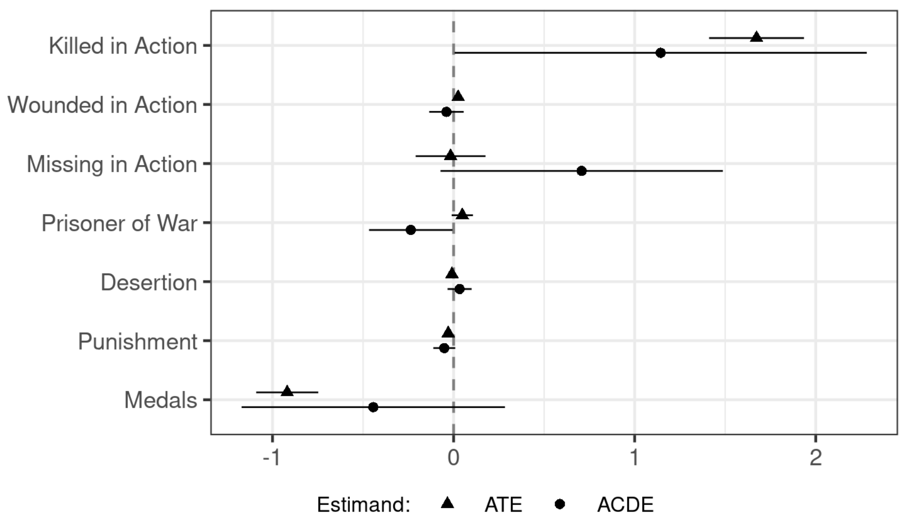
Variable	Coefficient (95% CI)	Pct.Change
Month of war	0.06	6.2
	$(0.1, 0.1)$	
Artillery/AAD	0.7	101.3
	$(-0.1, 1.5)$	
Rifle	0.34	41.1
	$(-0.2, 0.9)$	
Pct.Russian	0.005	0.5
	$(0.0008, 0.01)$	
Geo.Diversity	0.0002	0.02
	$(0.00007, 0.0003)$	
Avg.Age	0.02	2.3
	$(0.01, 0.04)$	
Urbanization	-0.01	-0.6
	$(-0.01, 0.0003)$	
Pop.Density	0.001	0.1
	$(-0.0006, 0.002)$	
Pre-War Purges	0.04	3.6
	$(-0.01, 0.1)$	
AIC	7732	
Army FE	108	
N	3252	

We calculated standard errors for these estimates through a non-parametric bootstrap.

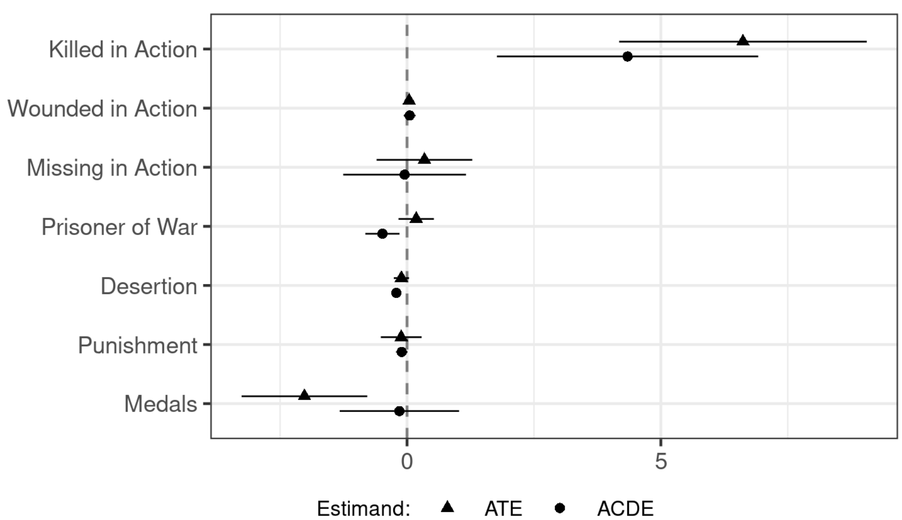
We took a conservative approach in partitioning the matrix $\mathbf{X}_{it}$ into "pre-treatment covariates" vs. "intermediate confounders." Our covariates are average demographics of soldiers assigned to each unit-month (average age, geographic diversity, percent Russian, percent urban, population density of hometown). It is possible that, even if only on the margins, prewar repression might have affected unit composition in some systematic way (e.g. by disproportionately removing some categories of otherwise eligible military-age males from the mobilization base). It is also possible — indeed, quite probable, given the results in Tables A1.2 and A5.14 — that a unit's composition also influenced how many NKVD officers would be assigned to it. It therefore seems appropriate to treat *all* unit demographics as intermediate confounders on the causal pathway between prewar repression and wartime NKVD presence. The only variables we kept in the pre-treatment covariate category were the fixed effects (unit, month, battle), on the assumption that these units and months (and the war itself) would have existed regardless of how many people the NKVD repressed in soldiers' hometowns or units before the war.

Figure A5.8 summarizes the results and compares the ACDE estimates to the "naive" ATE (effect of prewar repression, without holding the mediator fixed — from equation 2). In most cases, the ACDE is smaller and more uncertain than the ATE. In a few cases, the ACDE estimates are stronger (e.g. POW, punishment), but the pattern for KIA and Medals suggests that at least some of the coercive impact of prewar civilian repression attenuates when we adjust for wartime coercion as a mediator. The results are substantively similar to those for civilian repression: prewar purges are associated with higher KIA, lower flight, and fewer medals. Given that ACDE is smaller than the ATE in some instances, wartime coercion may account for some, but not all of the purges' observed coercive impact.

Figure A5.8: **Prewar repression, purges and battlefield losses**, sequential-g estimates.



(a) Repression in soldiers' hometowns



(b) Officer purges in unit

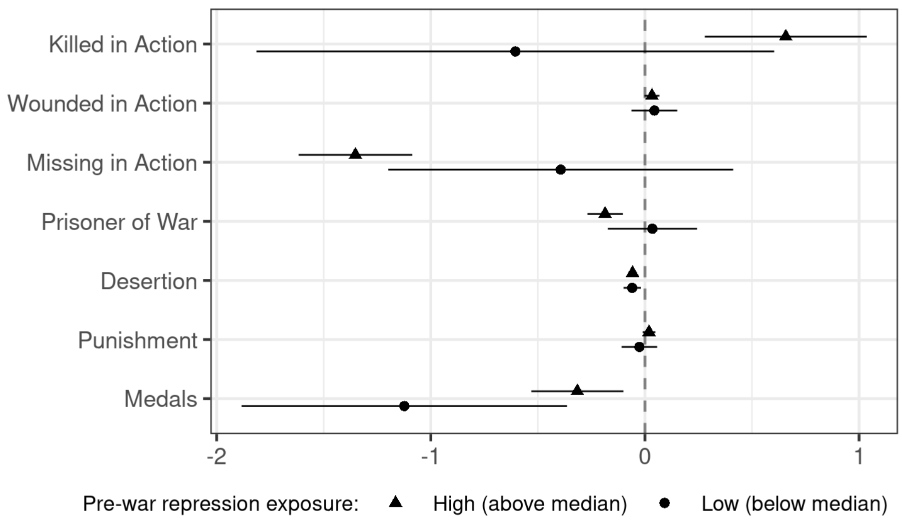
NOTE: Horizontal axis represents average treatment effect (ATE, △) estimates from fixed effect regression, or average controlled direct effects (ACDE, •) from sequential-g estimation.

A5.5. Interaction between Prewar and Wartime Coercion

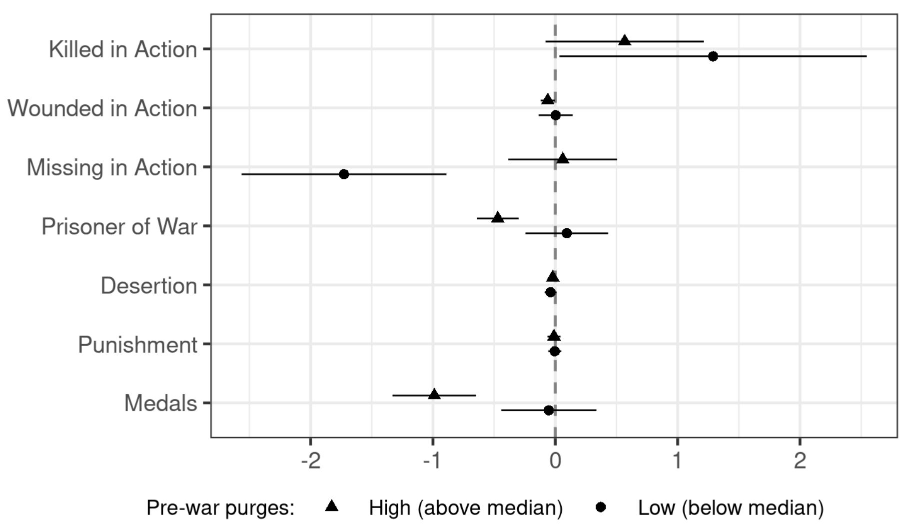
Does soldiers' prewar exposure to repression amplify or dampen the impact of fratricidal coercion in wartime? To answer this question, we extend our core model specification (equation 2) with an interaction term between NKVD presence and "high prewar exposure." We define "high exposure" as above-median levels of repression (> 186) or purges (> 7).

Figure A5.9 reports coefficient estimates from the interaction models. Figure A5.9a reports the impact of OO/SMERSH presence when prewar civilian repression exposure is high ($\triangle$) versus low ($\bullet$). Figure A5.9b reports the impact of OO/SMERSH presence when prewar officer purges are high and low.

Figure A5.9: **Effect of NKVD presence on losses**, by level of prewar repression and purges.



(a) Repression in soldiers' hometowns



(b) Officer purges in unit

NOTE: Horizontal axis represents estimated percentage point change in outcome (share of a division's monthly losses), associated with doubling NKVD presence when prewar exposure is high (above-median, $\triangle$) and low (below-median, $\bullet$).

The results for civilian repression exposure (Figure A5.9a) suggest that the wartime coercion effect is not just stronger where soldiers had more prewar repression exposure (as RTZ posit), but in some cases prewar exposure seems to "activate" the wartime coercion effect. If prewar civilian repression exposure is high, a larger OO/SMERSH contingent is associated with higher KIA rates, and lower MIA and POW rates. If prewar civilian repression exposure is low, there is no statistically significant relationship between OO/SMERSH presence and these three outcomes. Other outcomes, like desertion and medals, are less dependent on levels of prewar exposure, and are always decreasing in fratricidal coercion.

The results for officer purges (Figure A5.9b) differ somewhat from those for civilian repression. For some key outcomes, like surrendering (POW), high prewar exposure does seem to "activate" the deterrent effect of fratricidal coercion, as before. For most other outcomes, however, the prewar-wartime interaction effect is more variable. For example, higher exposure to officer purges amplifies the negative impact of NKVD presence on medals, while higher exposure to prewar civilian repression does not. Once again, we should not that our results for purges are based on a more limited data sample, excluding units formed after 1938, and — due to this limited common support — are not directly comparable to Figure A5.9a.

A6. Cross-National Battle-Level Data and Analyses, 1939-2011

Table A6.15 reports summary statistics for the ? cross-national battle data, to which we added a variable from Project Mars indicating the presence of blocking detachments. Note that these statistics reflect the reduced sample used in the main text, which includes only ground battles, and excludes air and sea battles.

A6.1. Estimation Strategy and Robustness Tests: Cross-National Battle-Level

We estimate Generalized Linear Models of the form

$$y_{ij}^{(k)} = \text{Block}_{ij}\beta + \mathbf{X}_{ij}\gamma + u_{ij} \tag{7}$$

where i indexes belligerents, j indexes battles. $y_{ij}^{(k)}$ represents battlefield outcomes of type $k \in \{$killed in action, wounded in action, missing in action, prisoners of war, commander killed or captured, proportion of force lost, loss exchange ratio$\}$ for belligerent i in battle j.[10] Block_{ij} indicates whether blocking detachments existed in i's army at the time of j. u_{ij} are standard errors, clustered on the belligerent and conflict. $\mathbf{X}_{ij}$ is a matrix of covariates, including: relative force ratio between i and its opponent in battle j, relative aggregate power balance (i.e. Composite Index of National Capabilities) between i and its opponent, i's deployment distance, the start year for battle j, and indicator variables capturing whether i initiated the battle, whether i relied on conscription, whether i was more democratic (i.e. higher pre-war Polity2 score) than its opponent in battle j, whether i and i's opponent had signed on to the Geneva

[10] We used a logarithmic transformation for dependent variables that were heavily skewed (i.e. KIA, WIA, MIA, POW, LER), and rescaled the others (commander killed or captured, proportion of force lost) to have mean of zero and standard deviation of 1. We measure proportion of force lost as i's total irrecoverable losses divided by i's troop strength at beginning of campaign, and loss-exchange ratio as opponent's irrecoverable losses divided by i's irrecoverable losses.

Convention prior to j, whether j was a "major battle" (i.e. participating forces totaled at least 100,000 soldiers), whether j was part of World War II, and dummies for season (winter, spring, summer, fall).

In addition to the baseline model estimates reported in the main text, Figure A6.10 reports the results of two robustness checks, which drop from the sample (a) all battles from the Eastern Front of WWII, and (b) all battles from WWII. Estimates remain positive and significant at 90% confidence or higher for KIA, WIA and Proportion of Force Lost in both reduced samples, while the estimate for LER remains negative and significant. The negative estimate for commanders killed or captured also remains significant at 90% confidence after dropping the Eastern Front (−0.34, 90% CI: −0.63, −0.04). Other results, notably MIA and POW, appear more sensitive to the change in sample.

Variable	Min	Max	Median	Mean	SD	N
Killed in Action	0	458080	387	7144.695	30984.865	662
Wounded in Action	0	1855603	201.5	13220.082	92512.397	524
Missing in Action	0	60000	0	424.594	3148.994	591
Prisoners of War	0	1199997	0	16025.313	85354.36	712
Commander Killed or Captured	0	1	0	0.032	0.177	1,517
Proportion of Force Lost	0	1	0.203	0.326	0.33	731
Loss-Exchange Ratio	0	851.613	1.206	12.886	56.354	658
Blocking Units	0	1	0	0.064	0.245	1,519
Initiator	0	1	1	0.551	0.498	1,517
Conscript Army	0	1	0	0.168	0.374	1,074
CINC Ratio	0.0002	481.276	0.716	4.834	22.701	815
Force Ratio	0.0002	59.524	0.8	1.815	4.062	861
Deployment Distance	0	28056.087	1914.303	5771.324	7385.492	1,200
More Democratic	0	1	0	0.485	0.5	1,519
Geneva	0	1	1	0.685	0.465	1,519
Opponent Geneva	0	1	1	0.628	0.462	1,517
Major Battle	0	1	0	0.209	0.407	1,213
WWII	0	1	0	0.339	0.474	1,519
Start Year	1939	2011	1966	1966.959	23.694	1,519
End Year	1939	2015	1966	1967.149	23.575	1,512
Winter	0	1	0	0.234	0.423	1,519
Spring	0	1	0	0.279	0.449	1,519
Summer	0	1	0	0.257	0.437	1,519
Fall	0	1	0	0.23	0.421	1,519

Table A6.15: **Summary Statistics for Cross-National Battle-Level Data**

For consistency with the division-level analyses of Soviet army data, we also considered an mixed effects specification, where the error components of u_{ib} include both country-specific and idiosyncratic errors. These estimates (Figure A6.11) are consistent in sign with those in the main text. However, several of the coefficients lose significance, including WIA, MIA POW and Commander Killed or Captured.

Figure A6.10: **Cross-National Battle-Level Robustness Tests**

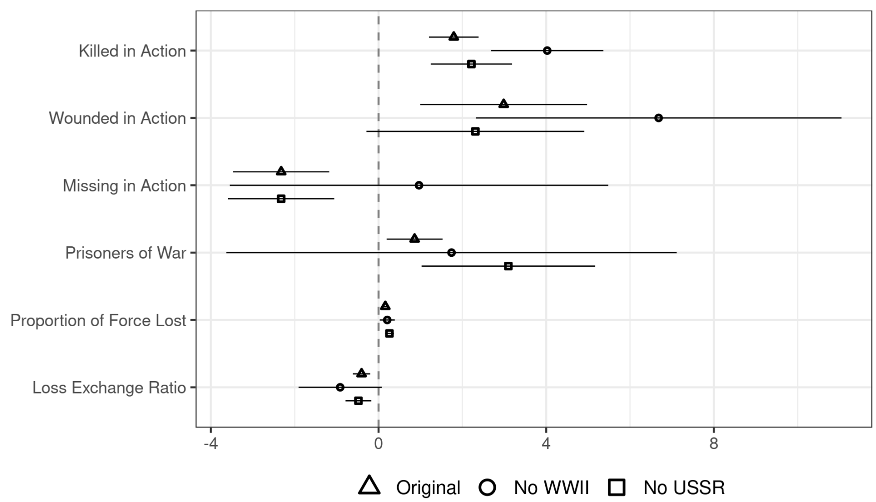
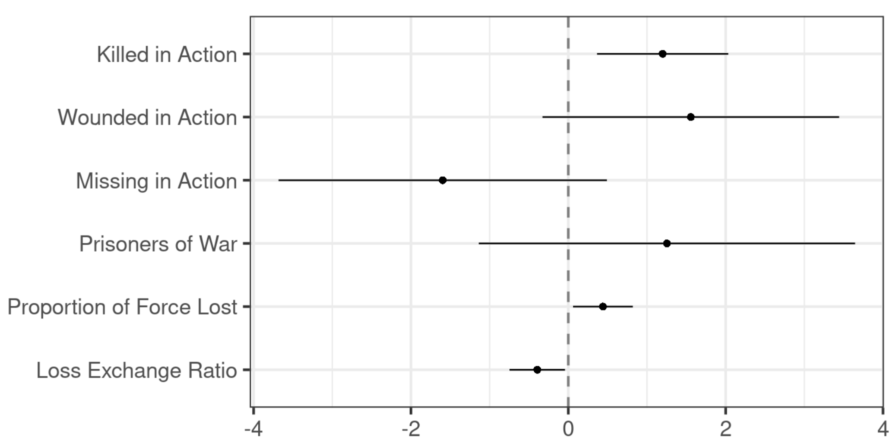


Figure A6.11: **Cross-National Battle-Level Mixed Effects Specification**



NOTE: country random effects; standard errors clustered by country and conflict.

While these additional analyses allow us to more confidently state that the increase in casualties associated with fratricidal coercion is not unique to the Soviet experience in WWII, cross-national evidence for coercion's deterrent effects on flight is inconclusive.

A6.2. Fratricidal Coercion and War Outcomes

The battlefield outcomes we use as indicators of combat resolve (KIA, MIA, POW, etc.) are only informative insofar as they correlate, in predictable ways, with the outcomes of international conflict. To see if this is the case in a general, cross-national context, we linked war outcome data from Correlates of War (Singer and Small, 2010) with battle outcome data from Lehmann and Zhukov (2019). We re-classified COW war outcomes as "win" (`Outcome = 1`), "lose" (`Outcome = 2`), and "other" (e.g. prolonged stalemate, transition to other type of war; `Outcome > 2`). Lehmann and Zhukov (2019)'s data includes 526 land battles from 75 wars involving 185 belligerents, covering 83 percent of interstate wars in COW between 1939 and 2011.[11] We then calculated average battle losses for each belligerent in each war, by category (KIA, WIA, MIA, POW, loss-exchange ratios, proportion of initial force lost).

Our linear probability models take the following form:

$$P(\text{Win}_{iw} = 1\,|\mathbf{X}_{iw}) = \text{Battlefield Outcomes}_{iw}\beta + \mathbf{X}_{iw}\gamma + \text{Country}_i + \text{Decade}_w + \epsilon_{iw} \tag{8}$$

where i indexes belligerents (countries) and w indexes wars. Win_{iw} is a binary indicator equal to 1 if i won war w; we estimate an identical specification for the outcome of Lose_{iw}. Battlefield Outcomes_{iw} includes logged average losses by category. Because some of the battlefield loss metrics are highly collinear, we estimated separate models where Battlefield Outcomes_{iw} includes (a) KIA, WIA, MIA, POW, (b) loss-exchange ratios, and (c) proportion of initial force lost. The matrix $\mathbf{X}_{iw}$ includes a battery of covariates from Lehmann and Zhukov (2019)'s model specification, including aggregate national power (CINC scores), Polity2 democracy score (most recent prewar score), logged average deployment distance, and a dummy for whether the opponent signed the Geneva Conventions. To account for unobservables factors that vary across belligerents and over time, we include fixed effects for Country_i and Decade_w.

Table A6.16: **Battle losses and strategic-level outcomes**. Linear probability model coefficient estimates reported, with 95% confidence intervals in parentheses. Covariates KIA, WIA, MIA, POW and LER are on a logarithmic scale. Robust standard errors are clustered by country and conflict. Coefficient estimates for other covariates omitted.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Outcome	Victory	Victory	Victory	Defeat	Defeat	Defeat
Killed in Action	-0.07			0.074		
	(-0.1,-0.01)			(0.01,0.1)		
Wounded in Action	0.051			-0.073		
	(0.0002,0.1)			(-0.1,-0.04)		
Missing in Action	-0.001			0.053		
	(-0.1,0.1)			(0.02,0.1)		
Prisoners of War	-0.012			0.029		
	(-0.04,0.01)			(-0.03,0.1)		
Proportion of Force Lost		-0.391			0.747	
		(-0.9,0.2)			(0.3,1.2)	
Loss Exchange Ratio			0.021			-0.003
			(-0.03,0.1)			(-0.04,0.03)
Country FE	53	66	69	53	66	69
Decade FE	7	7	7	7	7	7
R-squared	0.71	0.65	0.62	0.74	0.65	0.6
AIC	146.2	197.8	210.6	138.7	194.7	219.5
N	106	129	132	106	129	132

Table A6.16 reports coefficient estimates and 95% confidence intervals, with victory and defeat as war-level outcomes. Belligerents are more likely to win wars when their average battle KIA rates are low,

[11]Interstate wars in COW that are missing from the Lehmann and Zhukov (2019) dataset include the Franco-Thai War of 1940–1941, Offshore Islands War of 1954, Ifni War of 1957–1959, Taiwan Straits War of 1958, War of Attrition of 1969–1970, Sino-Vietnamese Border War of 1987, and Kargil War of 1999.

or when their average battle WIA rates are high. Belligerents are more likely to lose wars when: their average battle KIA rates are high; their average battle WIA rates are low; their average battle MIA rates are high; their average proportion of force lost is high.

To more directly study how the battlefield incentives created by fratricidal coercion might scale up to strategic-level war outcomes, we estimated linear probability models of the form:

$$P(\text{Win}_{iw} = 1 \,|\mathbf{X}_{iw}) = \text{Block}_{iw}\theta + \mathbf{X}_{iw}\gamma + \text{Country}_i + \text{Decade}_w + \epsilon_{iw} \tag{9}$$

where Block_{iw} is 1 if belligerent i used blocking detachments in war w. The covariate matrix $\mathbf{X}$ and fixed effects are the same as before (equation 8).

Figure A6.17 reports $\hat{\theta}$ coefficient estimates and 95% confidence intervals from these models, for the outcomes of "victory" (`Outcome = 1` in COW), "defeat" (`Outcome = 2` in COW), and "other" (`Outcome > 2` in COW). The probability of victory is statistically significantly lower — by 0.495 — for belligerents who employ blocking units, compared to those who don't. The probability of defeat for armies with blocking units is higher by 0.265, although the latter estimate is not significant.

Table A6.17: **Blocking units and strategic-level outcomes**. Linear probability model coefficient estimates reported, with 95% confidence intervals in parentheses. Robust stardard errors clustered by country and conflict. Coefficient estimates for other covariates omitted.

Outcome	Model 1 Victory	Model 2 Defeat	Model 3 Other
Blocking Units	-0.495 (-0.9,-0.1)	0.265 (-0.4,0.9)	0.231 (-0.3,0.7)
Country FE	90	90	90
Decade FE	7	7	7
R-squared	0.65	0.58	0.57
AIC	249.1	298.9	288.7
N	191	191	191

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