Group Cohesion Under Stress:  
An Event-Study Analysis of Desertions in the Civil War*

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PRELIMINARY - COMMENTS WELCOME

Abstract

How do groups maintain cohesion under extreme stress? This paper addresses this question through an analysis of desertion rates in the universe of Union Army regiments over the four years of the American Civil War. Identification comes from an event-study analysis of the effect of battle deaths on desertion. The identification framework rests on the extant combination of weapons technology and military strategy at the time, which raised the Civil War’s mortality rates far above those of previous modern wars, but did not yet include the drawn-out trench warfare typical of later wars. As a result, the majority of battle deaths in the Civil War were incurred in a total of less than twenty atrocious battles, and these battles were brief (typically lasting a single day) and unanticipated in their ferocity by both sides. We investigate how the effect of these major battles on desertion varied as a function of morale (victory or defeat), units’ homogeneity, units’ ideology, and the characteristics of units’ leaders.

Keywords: Group Cohesion, Social Capital, Civil War, Leadership

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1 Introduction

Military outcomes are produced by teams, and military success requires teams to be cohesive, i.e. all group members to effectively engage in collective action and not to free-ride or shirk. This raises the question what it is that makes groups cohesive. If cohesion is just a matter of everyone “pulling their weight”, then standard economic theory says that performance incentives can be designed to induce the efficient level of effort in each individual group member (Lazear, 1979; Lazear and Rosen, 1981). This is true even in the case when only team output is observed and individual effort is not (Holmstrom, 1982). However, such incentives are difficult to implement if greater effort increases the risk of death. In such settings, teams can overcome free-rider problems through a combination of shame, guilt, norms, mutual monitoring, empathy, and sharing profits (glory and honor) from collective action (Kandel and Lazear, 1992); in short, through social capital. Historically, armies have paid their soldiers neither generously nor on a performance basis, instead substituting high-powered incentives with social capital. Costa and Kahn (2003) call it “the cement of both armies” in the Civil War.

The collective action required for group cohesion is a multi-person coordination problem. Individuals’ strategies determine whether they fight, at a cost to them but to the benefit of the group’s chances of success. There are strategic complementarities because the utility to one individual of fighting (deserting) increases with the total number of group members who fight (desert). Most soldiers would not desert if no other soldier deserts. Such strategic interactions create social multipliers whereby the effect of a change in fighting morale can “blow up” because it affects soldiers’ morale directly as well as indirectly through peers. For a discussion, see e.g. Glaeser and Scheinkman (2002). This social multiplier element explains why western military strategy has historically been dominated by seeking out decisive battles (Hanson, 2001). While most military units have enough social capital to remain cohesive throughout the everyday skirmishes of a war, decisive battles create the extreme stress under which units “crack” (Keegan, 1976, 276). Once soldiers in a fighting unit have coordinated on defeat, surrender, or a refusal to fight, this coordination is hard to reverse. High death tolls in battle, especially when it ends in defeat, undermine group cohesion like nothing else (Costa and Kahn, 2010, 45).

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1 This is Manski’s reflection problem (1993).
In this paper, we investigate the conditions under which military units in the Civil War were able to maintain cohesion under the extreme stresses caused by major battles. The experience of most fighting units in the Civil War was characterized by prolonged periods of inactivity and minor skirmishes, separated by a number of ferocious battles. The combination of outdated military strategies centered on large-scale frontal assaults with closed-rank line formations, and new weapons technology with longer range and precision and dramatically higher rate of fire made these major battles far more deadly than in previous modern wars (Keegan, 2011, 164-234). As a result, the majority of battle deaths during the four year course of the war occurred in less than twenty battles, and battles such as Shiloh, Antietam, and Gettysburg remain famous for their atrocity and high death tolls today. At the same time, both armies had such imperfect knowledge of each others’ movements that the major battles were largely unanticipated in their eventual ferocity and scale.

Because of these features, we employ an event-study framework to estimate the effect of the most atrocious battles on group cohesion. The first was the battle of Bull Run in July 1861, the last was the battle of Atlanta in September 1864. The remainder of the war until the Confederates’ surrender in April 1865 was characterized by drawn-out sieges. We study the effect of these major battles on fighting units’ desertion rates and test what mediating characteristics made units better able to maintain cohesion in the face of these shocks. We examine three sets of characteristics. One is inter-personal loyalty to the group, which has been argued to be a major determinant of group cohesion and combat motivation (Shils and Janowitz 1948, Stouffer, Lumsdaine, Lumsdaine, Williams Jr, Smith, Janis, Star, and Cottrell Jr 1949, Savage and Gabriel 1976, McPherson 2003, p.85, Costa and Kahn 2003). The second is ideology, i.e. a normative orientation of individuals towards a common goal, which the sociology literature has emphasized aids group cohesion because it puts a higher weight on the outcome than on the individual (Parsons, Shils, and Smelser, 1965). The third is leadership. Hermalin (2012) argues that “one of the essences of leadership is the ability to induce others to follow absent the power to compel,” and this ability is never more important than in a large volunteer army at war. Civil War scholars have emphasized that offi-

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2 While aggregate desertions still increased during this last year of the war, it is impossible to distinguish causes. What is clear is that desertion in both armies first became a problem after a series of atrocious battles at Shiloh, Fair Oaks, Seven Days, Second Bull Run, Antietam, and Perryville in the middle of 1862 (Lonn, 1928, 128).

3 Unconstrained from the inherent limitations of a volunteer army, the Red Army and the Wehrmacht compelled soldiers into fighting during WWII by simply shooting deserters and stragglers (Costa and Kahn, 2010, 84).
cers were able to maintain their troops’ cohesion only by “showing courage under flying bullets” (Linderman 2008, 44-45). When Joshua Chamberlain, one of the Union Army’s most decorated officers, was urged to remain in hospital after suffering what had initially been thought to be a mortal wound, he replied “I am not scared or hurt enough yet to be willing to face the rear, when other men are marching to the front.” On the Confederate side, “Stonewall” Jackson was similarly revered by his soldiers for his courage under fire. This is consistent with theories of leadership that emphasize the importance of ‘conviction’, ‘resoluteness’, and ‘leading by example’ in maintaining group coherence (Hermalin, 1998; Bolton, Brunnermeier, and Veldkamp, 2012).

Our data come from the states’ Adjutant General’s Reports with the corresponding unit rosters, and comprise the universe of over 2 million men who served in the Union Army during the Civil War, as well as the complete hierarchy of military units. We structure the data as a weekly panel of either regiments (units of 1,000 men) or companies (units of 100 men), but can slice the data as finely grained as by day because each soldier is associated with an enlistment date, and with a date and location of ending their service, as well as a reason, which includes being mustered out, being disabled from injuries, deserting, or dying from battle wounds or disease. Major battles are coded from Selcer (2006), and the military units participating in them from Fox (1889). We find that participation in one of the 19 battles increased desertions in the week of the event by 70 percent if the battle ended in a Union defeat, and by 45 percent if the battle ended in a Union victory. There is no evidence of pre-trends in desertions, confirming that battle atrocity was not anticipated. There is also no effect beyond the week of the battle, suggesting that desertions were primarily triggered by a desire to survive during the events, and not by lingering psychological effects.

To differentiate the baseline estimate by fighting units’ characteristics, we construct measures of fighting units’ homogeneity along a number of dimensions, as homogeneity has been shown to be a major determinant of group loyalty (Costa and Kahn, 2003). One measure of ideology is constructed based on whether units came from a pro-Lincoln county. A second measure of ideology is whether a unit was led by a Forty-Eighter abolitionist officer (Dippel and Heblich, 2018). To measure leadership, we have three proxies of officers’ “courage under fire”. First, we

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4 Measuring ideology as a function of the community from whence soldiers came leaves open the possibility that part of the negative effect on desertion might be explained by being less likely to be welcomed back home as a deserter (Costa and Kahn, 2007).
glean detailed military medical records to measure each officer’s history of battle injuries. Second, we have the universe of medals of honor bestowed on officers. These two proxies are available for all officers, and therefore for both the colonels in command of regiments, and the captains in command of companies. The third proxy is the most direct measures of leadership style, but it is, by construction, only available at the regiment level: we geo-coded dynamic battle maps that depict movements of each individual regiment on a battlefield within a day. Tracking regiments’ movements towards enemy lines relative to other Union Army regiments within the same battle, and keeping track of which colonel commanded which regiment in a given battle, we can estimate colonel fixed effects, which we interpret as proxies for courage under fire.

Our study relates closely to Costa and Kahn’s study of the determinants of desertion during the Civil War (2003) Where Costa and Kahn use the ‘Early Indicators’ data-set of 30,000 men (300 companies) with very rich information on individual soldiers’ characteristics, we have access to the universe of over 2 million men, but much less information on individual soldiers. Where Costa and Kahn focus on the characteristics that predict whether soldiers eventually deserted over the entire course of the war, we focus on the sharp time-variation induced by major spikes in battle deaths, and on the characteristics that prevented groups from “cracking” under these shocks. We also have an emphasis on the role of leadership that is not present in Costa and Kahn (2003). Lastly, we are able to generate units’ pervious exposure to battles, as well re-constitutions (merged units) from within our data.

Our study also relates to De Paula (2009), who uses the Early Indicators data to estimate an explicit structural model of strategic complementarities in the decision to desert.

2 The Civil War’s Major Battles as Events

We collected information on the major battles fought in the Civil War from Selcer (2006) In total, Selcer (2006) lists 20 battles that stood out as the bloodiest. The full list and information on these battles is reported in Table 1. 19 of the 20 are indeed clearly the bloodiest battles that occurred during the war. The twentieth, Fort Fisher, was primarily a naval engagement, had far fewer regiments engaged in it, and far fewer lives lost; it appears to have been added to Selcer’s list because of its strategic importance as it effectively ended the Confederate’s ability to ‘blockade
run’ the North’s naval blockade.

Table 1: Information on the Top 20 Major Civil War Land Battles

<table>
<thead>
<tr>
<th>Battle</th>
<th>Dates</th>
<th>Union Win/Loss</th>
<th>Union Strength</th>
<th>Killed</th>
<th>Wounded</th>
<th>Missing / POW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Bull Run</td>
<td>July 21, 1861</td>
<td>Loss</td>
<td>35,732</td>
<td>481</td>
<td>1,011</td>
<td>1,216</td>
</tr>
<tr>
<td>Shiloh</td>
<td>April 6-7, 1862</td>
<td>Win</td>
<td>63,000</td>
<td>1,754</td>
<td>8,408</td>
<td>2,885</td>
</tr>
<tr>
<td>Seven Pines/Fair Oaks</td>
<td>May 31 - June 1, 1862</td>
<td>Inconcl.</td>
<td>34,000</td>
<td>790</td>
<td>3,594</td>
<td>647</td>
</tr>
<tr>
<td>Seven Days</td>
<td>June 25 - July 1, 1862</td>
<td>Inconcl.</td>
<td>114,691</td>
<td>1,734</td>
<td>8,062</td>
<td>6,053</td>
</tr>
<tr>
<td>2nd Bull Run</td>
<td>Aug. 28-30, 1862</td>
<td>Loss</td>
<td>77,000</td>
<td>1,747</td>
<td>8,452</td>
<td>4,263</td>
</tr>
<tr>
<td>Antietam</td>
<td>Sept. 16-17, 1862</td>
<td>Win</td>
<td>87,164</td>
<td>2,108</td>
<td>9,549</td>
<td>753</td>
</tr>
<tr>
<td>Perryville</td>
<td>Oct. 8, 1862</td>
<td>Win</td>
<td>55,000</td>
<td>845</td>
<td>2,851</td>
<td>515</td>
</tr>
<tr>
<td>Fredericksburg</td>
<td>Dec. 11-15, 1862</td>
<td>Loss</td>
<td>122,009</td>
<td>1,284</td>
<td>9,600</td>
<td>1,769</td>
</tr>
<tr>
<td>Stones River</td>
<td>Dec. 31 1862 - Jan. 2, 1863</td>
<td>Win</td>
<td>43,400</td>
<td>1,677</td>
<td>7,543</td>
<td>3,686</td>
</tr>
<tr>
<td>Chancellorsville</td>
<td>April 30 - May 6, 1863</td>
<td>Loss</td>
<td>133,868</td>
<td>1,606</td>
<td>9,762</td>
<td>5,919</td>
</tr>
<tr>
<td>Gettysburg</td>
<td>July 1-3, 1863</td>
<td>Win</td>
<td>104,256</td>
<td>3,155</td>
<td>14,529</td>
<td>5,365</td>
</tr>
<tr>
<td>Vicksburg</td>
<td>May 18 - July 4, 1863</td>
<td>Win</td>
<td>77,000</td>
<td>766</td>
<td>3,793</td>
<td>276</td>
</tr>
<tr>
<td>Chickamauga</td>
<td>Sept. 18-20, 1863</td>
<td>Loss</td>
<td>60,000</td>
<td>1,657</td>
<td>9,756</td>
<td>4,757</td>
</tr>
<tr>
<td>Chattanooga</td>
<td>Nov. 23-25, 1863</td>
<td>Win</td>
<td>72,533</td>
<td>753</td>
<td>4,722</td>
<td>349</td>
</tr>
<tr>
<td>Wilderness</td>
<td>May 5-7, 1864</td>
<td>Inconcl.</td>
<td>124,232</td>
<td>3,469</td>
<td>16,000</td>
<td>3,383</td>
</tr>
<tr>
<td>Spotsylvania</td>
<td>May 8-21, 1864</td>
<td>Inconcl.</td>
<td>110,000</td>
<td>2,725</td>
<td>13,416</td>
<td>2,258</td>
</tr>
<tr>
<td>Cold Harbor</td>
<td>May 31 - June 12, 1864</td>
<td>Loss</td>
<td>117,000</td>
<td>1,845</td>
<td>9,077</td>
<td>1,816</td>
</tr>
<tr>
<td>Petersburg</td>
<td>June 15-19, 1864</td>
<td>Loss</td>
<td>125,000</td>
<td>1,688</td>
<td>8,513</td>
<td>1,185</td>
</tr>
<tr>
<td>Atlanta</td>
<td>Sept. 2, 1864</td>
<td>Win</td>
<td>34,863</td>
<td>3,641*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The 20 most important land battles of the Civil War from Selcer (2006). Casualty information from various sources and authors’ own computations. * marks joint casualty numbers for deaths, wounded, and missing combined.

We argue that the major battles of the Civil War constituted true shocks to troop morale. For this, their occurrence needs to have stood out from soldier’s experience of other battles and everyday skirmishes. There is a vast literature on the Civil War and its major battles, and it is unambiguously clear from this literature that the major battles listed in Table 1 stood out in their ferocity and scale. To make the point for quantitatively, Figure 1 and Figure 2 show that there was typically not a single killing in the location of one of the major battles in the week before it started, or in the week after it ended. To conserve space, we omit Fort Fisher, which was far less important than the other 19 battles, and we do not display the battles of Vicksburg, Petersburg, and Atlanta because they were part of long drawn-out sieges and as such they were much less like exogenous events in character.
Figure 1: Major Battles in Chronological Order

Notes: TBA
Figure 2: Major Battles in Chronological Order Continued

Notes: TBA
We evaluate the effect of the major battles listed in Table 1 on fighting morale, using the following event-study framework

\[ y_{it} = \mu_i + \theta_t + \sum_{l=-1}^{l} \gamma_l \cdot D(t - E_{ik} = l)_{it} + \sum_{l=1}^{\bar{l}} \gamma_l \cdot D(t - E_{ik} = l)_{it} + \varepsilon_{it}, \]

where \( E_{ik} \) is an event, \( y_{i} \) is desertions, \( \mu_i \) are fighting-unit (either regiment or company) fixed effects, and \( \theta_t \) are week-of-year fixed effects. Treatment effects are expressed over an effect window \( l \in [l, \bar{l}] \) that we set to be \([-4, +3]\), and are estimated relative to the omitted week before the observed event (i.e., \( l = 0 \)). For \( l < 0 \), \( \gamma_l \) estimates pre-trends and for \( l \geq 1 \), \( \gamma_l \) estimates the dynamic treatment effects of the event. Following Schmidheiny and Siegloch (2019), we bin treatment indicators \( D_{it} \) at the start point \( (t \leq E_{ik} + l) \) and end point \( (t \geq E_{ik} + \bar{l}) \), as displayed visually in Online Appendix Table 3.6

We interpret major battles as unanticipated shocks to soldier morale, consistent with the historical narrative. Before moving on to the main analysis which investigates this effect on morale as a function of the fighting units’ characteristics, a first cut at the question is to verify that major battles did in fact increase desertion rates.

To do this, we need to assign the battles to the regiments which participated in them. This information is available from two sources: The Adjutant General’s Reports that form the basis of our weekly fighting unit panel list the date and location of all instances of individuals dying in battle, being severely injured, going MIA, or being captured as a POW. Because there is a chance that a regiment may have participated in a battle without incurring a single injury or death, we also digitized Fox’s book of regimental losses during the Civil War.7 This book details all battles that the main regiments of the Union Army had been engaged in, including the losses associated with each, including reports of ‘no losses’. An example of an entry from Fox (1889) is shown in Online Appendix Figure 3.

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6 These bins overcome the identification problem raised in Borusyak and Jaravel (2016). We chose an observation-window that is two time periods wider than the estimated effect window, so that bins at the end-points contain 3 weeks each. This structure implies the usual assumption that \( \gamma_l \) is constant within the end-points \( l, \bar{l} \).

7 Missing a regiment that participated in a battle without any injuries or casualties (and therefore most likely as a reserve unit behind the battle lines) is not a major concern in the sense that this would have constituted less of a shock to morale. Also note that the event-study estimation in equation (1) does not include untreated control regiments so that this regiment would not be in the control group, but would instead simply not be in the data at the time of the battle.
Figure 3: Estimation Results for Major Battles, Distinguishing Union Victory and Defeat

Event-Study of Union Army Losses

- Estimated Effect on Desertion
- Week before/after t=0, N=11535

Notes: TBA
In total, the battles in Table 1 involved 994 regiments. When linked to our week-regiment panel, this translates into 21,579 regiment-weeks that fall inside event-windows. These break into 11,535 regiment-weeks in event windows for major battles that were losses, and 12,850 regiment-weeks in event windows for major battles that were Union victories, with inconclusive battles included in both sets. The top panel of Figure 3 reports the results of estimating equation (1) for Union losses, and the bottom-panel for Union victories. Both types of major battles were traumatic events and increased desertions, but the effect of losses on fighting morale was more pronounced than the effect of battles that ended in victory.

3 What Maintains Group Cohesion under Extreme Stress?

Section 3.1 discusses our core data on soldiers. Section 3.2 discusses how we aggregate these data up to the fighting units. Section 3.3 discusses how we estimate leader characteristics.

3.1 The Adjutant General’s Reports

The main data sources for the soldier records are the individual states’ Adjutant General’s Reports and the corresponding unit rosters. Since volunteer units were raised under the supervision of each state, the exact source, layout, and available information vary. We provide an overview of the sources for each state from which data were drawn in Table Online Appendix Table 1. These reports and rosters were compiled from collections of military records accumulated after the war. The original purpose was to account for soldiers to determine their or their families’ eligibility for pension payments. The quality and completeness of the soldier data is generally high. William Schouler, Adjutant General of Massachusetts, remarked in his final report that, “most of the regiments and batteries are perfect, every man accounted for; of the whole number there are but 1,205 who are not accounted for” (1868, 121). Of the 106,330 soldiers mustered by the state of Massachusetts, for example, this amounts to 1.1% of unaccounted individuals. For the time period and scale of the Civil War, this is a remarkably low share of missing data. This means that we observe effectively the entire universe of Union Army soldiers. One weakness in this data is that re-enlistments are often not identified. As a result, our overall number of records amounts

8All the Adjutant General Reports and unit rosters can be downloaded at https://archive.org/ and https://www.hathitrust.org/
### Table 2: Military Records Summary Statistics

<table>
<thead>
<tr>
<th>Obs.</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at enlistment</td>
<td>2,124,913</td>
<td>25.409</td>
<td>7.355</td>
<td>11</td>
</tr>
<tr>
<td>Drafted</td>
<td>2,701,606</td>
<td>0.015</td>
<td>0.120</td>
<td>0</td>
</tr>
<tr>
<td>Commissioned</td>
<td>2,701,606</td>
<td>0.015</td>
<td>0.120</td>
<td>0</td>
</tr>
<tr>
<td>Enlisted</td>
<td>2,701,606</td>
<td>0.942</td>
<td>0.233</td>
<td>0</td>
</tr>
<tr>
<td>Died</td>
<td>2,701,606</td>
<td>0.095</td>
<td>0.293</td>
<td>0</td>
</tr>
<tr>
<td>Died (disease)</td>
<td>2,701,606</td>
<td>0.037</td>
<td>0.189</td>
<td>0</td>
</tr>
<tr>
<td>Died (battle)</td>
<td>2,701,606</td>
<td>0.043</td>
<td>0.202</td>
<td>0</td>
</tr>
<tr>
<td>Deserted</td>
<td>2,701,606</td>
<td>0.058</td>
<td>0.234</td>
<td>0</td>
</tr>
<tr>
<td>Rank = private</td>
<td>2,701,606</td>
<td>0.832</td>
<td>0.374</td>
<td>0</td>
</tr>
<tr>
<td>Ancestry: American</td>
<td>2,701,606</td>
<td>0.249</td>
<td>0.072</td>
<td>0</td>
</tr>
<tr>
<td>Ancestry: German</td>
<td>2,701,606</td>
<td>0.204</td>
<td>0.092</td>
<td>0</td>
</tr>
<tr>
<td>Ancestry: Irish</td>
<td>2,701,606</td>
<td>0.227</td>
<td>0.075</td>
<td>0</td>
</tr>
<tr>
<td>Ancestry: Scandinavian</td>
<td>2,701,606</td>
<td>0.139</td>
<td>0.075</td>
<td>0</td>
</tr>
<tr>
<td>Ancestry: Italian</td>
<td>2,701,606</td>
<td>0.055</td>
<td>0.050</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note:** Summary statistics for the 2.7 million military records for the Union Army.

To 2.7 million observations, instead of the commonly agreed estimate of 2.2 million individuals who fought. Incomplete re-enlistment information does not imply that we mis-measure either the size of fighting units or their composition. We may only mis-measure individuals’ fighting experience if they had served a pervious term.

The typically available information for each soldier are the full name, enlistment and discharge date, their military unit down to the level of the company, their rank, whether they volunteered, were drafted or commissioned, the state of enlistment, and their status at the end of the War. Enlistment rates for the Civil War, especially among prime aged men in the early 1860s, were high and only exceeded during World War II. 80% of men born between 1837 and 1845 eventually served in the Civil War (Costa and Kahn, 2010). 77% of soldiers in our data are between 18 and 30 years of age at the time of enlistment. The reporting of age at enlistment varied across the states’ Adjutant General’s Reports, with some states never reporting this number. Despite high enlistment, the vast majority of soldiers (94%) were volunteers. The majority of soldiers saw out the end of their enlistment term, at which point they were ‘mustered out’. The second-most common reason to end their term were injuries or illness that were serious enough that an individual could not fight. The third-most common reason was death. Almost ten in one hundred men died before their term was up, and half of those deaths were battle deaths. Almost six in one hundred men deserted. Summary statistics are reported in Table 2.

Because the Adjutant General’s Reports contain no other information on soldiers’ backgrounds,
we also predict individuals’ ethnicity, which the table reports on in six broad groups. The motivation for this is that homogeneity in fighting units’ ethnicity has been suggested as a major determinant of fighting units’ group cohesion (see Costa and Kahn 2003, Table III).

Predicted ancestry shares therefore deviate from the ‘nativity’-shares reported in (Costa and Kahn, 2003, Table III), which are much more skewed towards American since ‘nativity’ is based on Census-reported birthplace.

3.2 Fighting Unit Characteristics

Choice of Aggregation: All volunteer regiments (and thus almost all regiments) were named after their state (e.g. “New York 5th Infantry”) because enlistment was managed by the states. We report aggregate enlistment numbers by state in Online Appendix Table 2. Regiments in the Union army were raised locally, most often from a small area encompassing no more than a few counties, and frequently no more than a few towns within a county (Costa and Kahn, 2003, 524). The recruitment effort was headed by local leaders who had to obtain a commission from the state government that entitled them to do so (Costa and Kahn, 2010, ch.5). A commissioned officer who succeeded in raising a full regiment, or at least the majority of a regiment, would usually lead that regiment with the rank of Colonel. Stories abound of regiments led by a Colonel who was the town mayor, doctor or school principal. Local enlistment meant that regiments tended to be quite homogenous in ethnicity and occupation as well, and that men often knew each other, or shared friends and family. From an organizational point of view, this had obvious advantages. It also made desertion less appealing for any soldier planning to escape home, because they would face social ostracism upon their return. The basic ‘enlistment unit’ of the Union Army was a regiment of ten companies. However, the literature on combat motivation and group loyalty within military structure has emphasized that companies of 100 men were the real fighting units, because they were the units “primary group cohesion” (Shils and Janowitz 1948, Stouffer et al. 1949).

9 We use the machine-learning algorithm developed by Dippel and Heblich (2018), that predicts ancestry of Union Army soldiers based on their names.
10 The Early Indicators data used by Costa and Kahn (2003) had linked individuals to the Census so that ethnicity was calculated based on self-reported birthplace.
11 A major downside of local enlistment became clear during the bloodiest battles of the Civil War. When all of a town’s volunteers fought in a single unit, and that unit suffered high losses in a battle, mortality could be highly spatially concentrated across home towns. For this reason, the U.S. Army abandoned local enlistments after D-day in World War II.
1949, Savage and Gabriel 1976, McPherson 2003, p.85, Costa and Kahn 2003). As a reference point, Online Appendix Figure 1 in Online Appendix A.1 shows the structure of the Union Army, and how companies and regiments fit into this broader structure.

The upshot is that we can aggregate our analysis to either the company or the regiment level. Battle exposure as measured by a binary indicator of battle participation did not vary within regiments. Battle exposure as measured by battle deaths, however, could vary within regiments. As well, unit characteristics that we aggregate up from the Adjutant General’s Reports, e.g. the distribution of age or ethnicity, can vary within regiments across companies.

Finding, for instance, that group-level homogeneity had a meaningfully stronger mediating effect of battle deaths on morale when the data are aggregated to the company than when the data are aggregated to the regiment would constitute evidence that group cohesion was inherently stronger at the level of 100 men than at the level of 1,000 men.

**Time Variation in Units’ Characteristics:** The data report on the date of any soldier’s service ending, whether they were mustered out, fell ill, died from disease or battle, deserted, or went MIA. Because of this, any fighting unit characteristics can be measured at any point in time, and can, for example, be allowed to vary from battle to battle. This also allows us to split the event-study by past battle exposure, comparing the effect for units that experienced their first major battle vs units that experienced such battles before.

**Units’ Size and Composition:** We can construct a unit’s time-varying stock of cumulative battle deaths, injuries, desertions etc from the individual data we have. As in Costa and Kahn (2003), we can also calculate an ethnic-fragmentation index $FI_K = 1 - \sum a s_{Ka}^2$, where $s_{Ka}$ is ancestry group $a$’s share of men in company $K$, so that $FI_K$ is bounded from above by 1, and $FI_K = 0$ if the company is completely homogenous. $FI_K$ can be time-varying as well. Costa and Kahn (2003) show that ethnicity was an important determinant of individuals’ probability of desertion, but also that homogeneity in ethnicity was good for morale.

**Reconstituted and Replenished Units:** A potentially important determinant of group morale was whether a unit had retained its original composition, or whether it had been replenished with new volunteers, or even reconstituted by merging it with another units. This happened to regi-

---

12 For example, they find that German immigrants deserted less than other immigrant groups, arguing this was because “Germans who fled the revolutions of 1848 were more likely than Irish or British immigrants who migrated for economic reasons to view the United States as the best hope for the survival of a form of republican government.”
ments that had experienced high attrition rates, and it was generally agreed that it was bad for morale, despite being potentially necessary to maintain functional unit sizes.\textsuperscript{13}

\textit{The Colored Troops:} Colored soldiers, which could be freed or runaway slaves from South, or free blacks from the North or border states, were organized in completely separate regiments, in the United States Colored Troops (Öfele, 2004). An obvious question to ask is whether major battles had a lower effect on desertion in the colored troops.

\textit{Initial Ideology:} As in Costa and Kahn (2003), we measure units’ initial ideology by asking whether they were from a ‘pro-Lincoln county’, or by taking their year of enlistment or length of enlistment term as a proxy for stronger ideology.

3.3 Leadership

4 Results

TBA

5 Conclusion

TBA

\textsuperscript{13} This is surprisingly frequent in the data, considering that the usual narrative is that Union companies were replenished far less often than Confederate troops, thus being forced to fight with dwindling numbers (Costa and Kahn, 2010, 45). The typical pattern of replenishment that can be observed in the data is that regiments were replenished with soldiers whose enlistment expiry would coincide with that of the existing soldiers, so that the entire regiment could be mustered out at the same time and then reconstituted. For example, Pennsylvania’s 107th Infantry was mustered in during the summer of 1862, and soldiers enlisted for three years. By the summer of 1864, less than 300 of the original 1000 men were left. In the case of Pennsylvania’s 107th, it was then replenished with 800 newly enlisted men who had enlisted for only one year, meaning the entire regiment could be mustered out in the summer of 1865.
References


Lonn, E. (1928). Desertion during the civil war. U of Nebraska Press.


Online Appendix

to

“Group Cohesion Under Duress: An Event-Study Analysis of Desertions in the Civil War”
Online Appendix A  Additional Materials

Table Online Appendix Table 1: List of Sources for the Union Soldier Data

- **California**: Orton, R.H. (1890) “Records of California Men in the War of the Rebellion 1861 to 1867”, State Office, J. D. Young, Supt. State Printing, Sacramento, CA
- **Iowa**: Thrift, W.H. (1908) “Roster and Record of Iowa Soldiers in the War of Rebellion”, Vol. 1-6, Emory H. English State Printers, Des Moines, IA
- **Maine**: Adjutant General (1861-66) “Supplement to the Annual Reports of the Adjutant General of the State of Maine”, Stevens & Sayward State Printers, Augusta, ME
- **Nebraska**: Dudley, E.S. (1888) “Rosters of Nebraska Volunteers from 1861 to 1869”, Wigton & Evans State Printers, Hastings, NB
- **New York**: Sprague, J.T. (1864-68) “A Record of the Commissioned Officers, Non-Commissioned Officers and Privates of the Regiments which were Organized in the State of New York into the Service of the United States to Assist in Suppressing the Rebellion”, Vols. 1-8, Comstock & Cassidy Printers, Albany, NY

We report aggregate enlistment numbers by state in Online Appendix Table 2.
### Table Online Appendix Table 2: Enlistment by State

<table>
<thead>
<tr>
<th>State</th>
<th>Enlistment total</th>
<th>Total rep. residence</th>
<th>Share: rep Residence</th>
<th>Share total</th>
<th>Enlistment total</th>
<th>Total rep. residence</th>
<th>Share: rep Residence</th>
<th>Share total</th>
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<td></td>
<td></td>
<td></td>
<td><strong>Confederate States</strong></td>
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<td></td>
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<td>PENNSYLVANIA</td>
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<td>43.2</td>
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<td>COLORADO</td>
<td>4,912</td>
<td>2,200</td>
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<td>RHODE ISLAND</td>
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<td>NEVADA</td>
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<td>NEW MEXICO</td>
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<td><strong>Border States</strong></td>
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<td><strong>Western States</strong></td>
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<td>DELAWARE</td>
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</table>

**Notes:** This table shows the total number of Union Army soldiers by state, the share of them for whom we have town of residence. 'Share total' is a state’s soldiers share of all enlisted men. The table is divided into the Core States, Border States, Confederate (Southern) States, and Western States. The table shows that the lack of reported town of residence is partly driven by differences in reporting standards of different states’ Adjutant General’s Reports. New Jersey, Ohio, Maryland, and Missouri almost never reported men’s town of residence. (A notable feature of the data is that there were Union Army regiments from every Confederate state except Georgia and South Carolina.)
Online Appendix A.1 Regiments and Army Structure

Online Appendix Figure 1 shows the basic structure of the Union Army for the three service branches of the infantry, cavalry, and artillery. The military organizational structure of the Union Army is similar to those found in modern armed forces. With a pyramid-like top-down command structure, higher-order military units nested lower-order units.

The main service branch was the infantry to which different artillery or cavalry units were attached. In the infantry, the basic fighting unit was generally considered to be the company of 100 men. 6–10 companies made up a regiment, 2–5 regiments made up a brigade etc., up to the top. At any point during the Civil War, the Union Army typically consisted of 16 separate armies, with names such as the ‘Army of the Potomac.’ Within this general structure, the specifics of which regiments were organized under which brigade, division, etc. were fluid. This means that some regiments could have been directly assigned to a division or a corps without a brigade (or division) in between this hierarchical structure. Some units even remained unassigned altogether.

In our data we can reconstruct the entire military organization of the Union Army at any given point in time. The data sources for the organization of the military units come from the National Park Service, and Dyer (1908) from which an excerpt is shown in figure Online Appendix Figure 2.

We then link each of these higher military units with their corresponding commanding officer. Data on the biographies of generals and the units they led were collected from Warner (1964) and Hunt (2007, 2011, 2014, 2017).

In total there are 2,705 generals in the Union Army for whom we observe their military rank and promotions, their unit commands by date, they dates of birth and death, and the highest rank they obtained during the war. This includes honorary promotions, so-called brevets, that were awarded for exceptional gallantry and service. Such promotions were a substitute for medals and other honors which did not exist at the time. The only exception was the Congressional Medal of Honor.

While the top ranking general positions were staffed with trained military leaders, almost half of the Union generals were complete amateurs without any prior military experience (Chambers, 1987).

Online Appendix A.2 More Background on Battle Data

14 Source: authors’ chart based off information to be found here http://www.thomaslegion.net/americancivilwarcivilwarmilitaryarmyinfantrysoldiers.html and https://www.battlefields.org/learn/articles/civil-war-army-organization
15 For an example of a regiment’s history of subordination to higher ranked military units see https://www.nps.gov/civilwar/search-battle-units-detail.htm?battleUnitCode=UKY0033R1.
16 Warner (1959) contains similar information for Confederate Army generals.
Figure Online Appendix Figure 1: Union Army Organizational Chart

Infantry

- **Army**
  - 2-3 Corps
  - ca. 80,000 soldiers
  - Major General

- **Corps**
  - 2-3 Divisions
  - ca. 26,000 soldiers
  - Major General

- **Division**
  - 2-4 Brigades
  - ca. 8,000 soldiers
  - Major General

- **Brigade**
  - 2-5 Regiments
  - ca. 2,600 soldiers
  - Brigadier General

- **Regiment**
  - 6-10 Companies
  - ca. 1,000 soldiers
  - Colonel

- **Company**
  - 2 Platoons
  - ca. 100 soldiers
  - Captain

- **Platoon**
  - ca. 20-50 soldiers
  - Lieutenant

Artillery

- **Corps**
  - 2-3 Divisions
  - Major General

- **Division**
  - 2-4 Brigades
  - Major General

- **Brigade**
  - 2-5 Regiments
  - Colonel or Brigadier General

- **Regiment**
  - 2-3 Battalions
  - Colonel

- **Battalion**
  - 2-3 Batteries
  - Colonel

- **Battery**
  - 2-3 Sections
  - ca. 40-100 men
  - Captain

- **Section**
  - 2 Platoons
  - Lieutenant

Cavalry

- **Corps**
  - 2-3 Divisions
  - Major General

- **Division**
  - 2-4 Brigades
  - Major General

- **Brigade**
  - 2-5 Regiments
  - Colonel or Brigadier General

- **Regiment**
  - 2-3 Battalions
  - Colonel

- **Battalion**
  - 4 Troops
  - ca. 90-400 soldiers
  - Major or Lieutenant Colonel

- **Troop**
  - 2-3 Platoons
  - ca. 40-100 men
  - Captain

- **Platoon**
  - Lieutenant

**Note:** Based on
[http://www.thomaslegion.net/americancivilwar/civilwarmilitaryarmyinfantrysoldiers.html](http://www.thomaslegion.net/americancivilwar/civilwarmilitaryarmyinfantrysoldiers.html) and [https://www.battlefields.org/learn/articles/civil-war-army-organization](https://www.battlefields.org/learn/articles/civil-war-army-organization)
Army of the Potomac

BANKS' DIVISION.—Organized Aug. 17, 1861, by transfer from Dept. of the Shenandoah to Dept. of the Potomac.

COMMANDER.


1st BRIGADE—

COMMANDERS.


A. S. Williams...........Brigadier General...........Oct. 15, 1861, to March 12, 1862.


19th New York Infy. ...Aug. 15, 1861 From 1st Banks' D. Shenandoah To reorganization as 5th N.Y. Arty. Dec. 1861

41st New York Infy. ...Aug. 15, 1861 From 1st Banks' D. Shenandoah To 1st Div. 1st Div. Banks' 5th Corp. March 1862

5th Connecticut Infy. ...Aug. 15, 1861 From 1st Banks' D. Shenandoah To 1st Div. 1st Div. Banks' 5th Corp. March 1862

28th Pennsylvania Infy. Aug. 15, 1861 From 1st Banks' D. Shenandoah To 1st Div. 1st Div. Banks' 5th Corp. March 1862

2nd Massachusetts Infy. Aug. 15, 1861 From 1st Banks' D. Shenandoah To 1st Div. 1st Div. Banks' 5th Corp. March 1862

1st Maryland Infy. ...Aug. 15, 1861 From 1st Div. 1st Div. Baltimore, Md. To 1st Div. 1st Div. Banks' 5th Corp. March 1862

46th Penna. Infy. .......Nov. 15, 1861 From New Organization To 1st Div. 1st Div. Banks' 5th Corp. March 1862

FIFTY-FIFTH PENNSYLVANIA INFANTRY.

WHITE'S BRIGADE — AMES'S DIVISION — TENTH CORPS.

COL. RICHARD WHITE.

<table>
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<th>COMPANIES</th>
<th>KILLED AND DEAD OF WOUNDS</th>
<th>DIED OF DISEASE, ACCIDENTS, IN PRISON, &amp;C.</th>
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<td>Officer</td>
<td>Men</td>
<td>Total</td>
<td>Officer</td>
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<tr>
<td>Totals</td>
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205 killed = 11.8 per cent.

Total killed and wounded, 782 ; died in Confederate prisons (previously included), 96.

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<th>BATTLES</th>
<th>K. &amp; M.W.</th>
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<td>Swift Creek, Va.</td>
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<td>Hatcher's Run, Va., March 30, 1865</td>
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Online Appendix A.3  Event Study Data Structure

*Online Appendix Table 3* shows the correct structure of event data. Having the *observation-window* two time periods “wider” than the estimated *effect window* is recommended to stabilize the estimates on the end-points. This implies that there are three weeks in each event’s ‘end-point bin’. See Schmidheiny and Siegloch (2019); Borusyak and Jaravel (2016).

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