Regional Identity in Organisations: Vertical Alignment on the Western Front of WW1*

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Abstract

Soldiers in conscripted armies have low incentives to exert effort; the reward for doing so is small, and the potential cost (death) is incalculable. We investigate whether shared regional identity between soldiers and officers can alter the incentive problem. We test this hypothesis using data on all French WW1 fatalities. We use a data-driven approach to infer cultural regions from surnames. Soldiers and officers are considered aligned if they were born in the same region. We estimate the effect of losing alignment in a design-based difference-in-difference setup. Conditional on the regiment and battle, whether a dead officer was regionally connected is quasi-random. Within-regiment variation shows mortality declines among treated soldiers. The effect is concentrated among officers with distinctly regional names, that are non-migrants, supporting a behavioural mechanism. Our results suggest that shared identity with superiors incentivises agents to exert greater effort, irrespective of the decision-making or ability of that superior.

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Introduction

Conscripted armies are confronted with a severe contracting problem. Effort is difficult to observe, soldiers incentives to exert effort (i.e. risk their life) are weak, and the potential cost of effort (i.e. death) is large. Given the importance of military capacity to historical state growth and survival (Tilly 1992) dealing with this problem was of paramount importance. Autocracies overcame this imbalance with coercion – during WW2 the Russian army sent the families of soldiers suspected of shirking to labour camps (Beevor 1998) – but democracies, reliant on popular support, were unable to pursue the same brutal strategies. Here, in the absence of strong financial incentives, soldiers must be incentivised along another dimension. Albeit less severe, similar challenges exist elsewhere. Although they are known to be effective (Lazear 2018), financial incentives are costly, and there are many situations where monetary rewards cannot be offered. Thus, most organisations rely on a mix of financial and social incentives. Individuals are never blank slates, they have social preferences, often arising from identity, as individuals form groups based on background, beliefs, and values (Akerlof and Kranton 2010; Shayo 2020). Existing research highlights that the networks created via such group-ties constitute a powerful social incentive (Bandiera et al. 2010). In this paper, we investigate whether identity-based connections between officers and soldiers affect the willingness of soldiers to take risks and exert effort. More broadly, we are studying the effect of identity-alignment on effort.

Applied research tends to foreground the agency of principals in shaping agents performance. Bandiera et al. (2009) and Hjort (2014) demonstrate that individuals in leadership positions (principals) with sufficient allocative capacity favour workers (agents) that are connected along social preferences. This concurs with the finding that managerial behaviour has a meaningful effect on agents performance (Bloom, Eifert, et al. 2013). However, theoretical contributions suggests scope for mechanisms beyond the allocative capacity of principals, namely the behavioural response of agents (Besley and Ghatak 2005). This behavioural response is emphasised for agent-agent interactions - such as when studying the effect of shared social preferences (Bandiera et al. 2005; Bandiera et al. 2010), peer effects (Mas and Moretti 2009), or competition (Ager et al. 2021) – but it is seldom emphasised when the focus is placed on agent-principal interactions. By looking at the interaction between soldiers and low-ranking officers with limited allocative capacity we can study how soldiers (agents) react to an officer (principal) with a shared identity. Instead of identifying an allocative effect, we isolate the behavioural response on the part of soldiers.

We study the French infantry during the first world war. The main advantage of this setting is the presence of a class of principal with limited allocative capacity. Non-commissioned officers acted as conduits between the higher echelons of the officer corps and common soldiers. While they were the most visible element of the officer class, they had no decision-making capacity and were solely tasked with transmitting orders and maintaining morale among their soldiers. As such, the interaction between soldiers and non-commissioned officers constitute a unique setting for studying the behavioural response to shared identity since officers had limited scope for favouritism or discrimination. Of course, although we can rule out allocative differences, officers could still treat soldiers of their group differently, and we expect that this non-allocative channel contributes to the response we identify. This setting has other important advantages; mass conscription removes concerns about selection into the infantry, the high-stakes setting provides a simplified incentive structure, and even small differences in relative risk-taking can manifest in marked differences in mortality.

To study the effect of shared-identities we require an observable and pertinent dimension of identity in early 20th century France. Studies in other settings tend to focus on ethnic, racial, or religious identity (Hjort 2014; Alsan et al. 2019; Ghosh 2025). While important, there was less variation along these dimensions, and ergo other markers of identity - such as regional identity - were more pertinent in our setting (Blanc and Kubo 2024). We adopt a data-driven method that allocates arrondissements to cultural regions based on a large cross-section of surnames. This approach to inferring cultural regions was introduced by Fouka and Serlin (2024) for Britain, and we are the first to apply it to a different context. Soldiers and non-commissioned officers are assigned to cultural regions based on their birthplace. In doing so, we are able to explore how sub-national regional identity – a hitherto under-explored dimension of identity – affected soldiers willingness to take risks.

We observe all French fatalities over the course of the first world war (Gay and Grosjean 2023). We adopt a *design-based* approach to identify the effect of losing vertical connection to a non-commissioned officer from the same cultural region on crude mortality. Relative differences in mortality within the same regiment and battle-day approximate differing propensities to take risk, and thus relative effort. By using non-parametric controls we approximate a quasi-experimental setting, where the birth-place of the deceased officer is an as-if-randomly assigned shock at the regiment-cultural-group level. To this end we use a stacked difference-in-difference strategy; we stack all treatment instances and compare the outcome evolution of groups that lost a *coregional* officer to groups that lost a *non-connected* officer *within the same regiment* across all valid micro-experiments. Due to our design this comparison holds by construction. Our identification rests on the limited allocative capacity of non-commissioned officers; since decision-making power was further curtailed during periods of active battle we restrict our analysis to battle-days with above threshold regimental mortality. We estimate the average treatment effect of losing a coregional officer over three battle-days after treatment. We use a short time window to ensure that the composition of regiments is held fixed.

Our findings are as follows. Mortality for treated groups – those that lost a coregional officer – declined relative to other groups within the same regiment. In the setting of trench warfare, these relative mortality differences approximate differences in risk-taking, and thus relative effort across groups. The effect persists for 3 battle-days after treatment. We find that relative to mean group mortality treatment leads to a 16% decline in daily mortality (around 2.7 deaths) in the most restrictive specification. A causal interpretation of our baseline is supported by a placebo exercise that uses non-battlefield deaths as our outcome.

Although the specificities of our setting and design favour a behavioural mechanism, we verify this interpretation by considering heterogeneity across officer traits. Soldiers did not know their officers birth-place. Ergo, they should respond more strongly to officers that are easily "identifiable" as belonging to their cultural region. We operationalise "identifiability" by using life-time migration distance and the recognisability of first and surnames. Across the board we find that the effect is concentrated among treatment instances were officers were more readily identifiable; i.e., when they did not migrate and had regionally distinctive names. This implies that the ease with which soldiers could recognise the regional identity of their officer (and not necessarily the strength of the officers regional identity, albeit likely correlated) played an important role.

To further elucidate the mechanism, we explore heterogeneity across other important dimensions. Our effect is confined to the first two years of the war (1914-15), where motivation was more malleable and cultural identity more present amongst troops. Cultural regions whose language was: (1) dissimilar to modern French, (2) internally homogenous, exhibit larger mortality declines, confirming the importance of regional identity specifically. Further, we find that regimental in-groups, as defined by the primary recruitment or garrison location of regiments, exhibit significantly larger effects. This implies that the effect of losing vertical connection scaled with the status of the identity group in question. We model identity as an endogenous choice. When identifying with a different identity, such as that of the organization, becomes more beneficial, either due to higher status or a smaller perceived distance to the identity, soldiers may switch or reweigh their group loyalties. In line with this mechanism, we find that the effect is smaller among high status specialised battalions, than among common infantry regiments.

In aggregate, our results demonstrate that soldiers responded strongly to the loss of a coregional officer. We interpret the presence of this negative effect, as evidence that soldiers took greater risks, and exerted more effort when they were commanded by an officer of the same cultural identity. Generally, our results suggest that identity-alignment between principals and agents can have a meaningful effect on effort.

Related Literature. Our findings are contribute to other research on social incentives in organisations. We exploit social incentives through a vertical connection while holding allocative capacity fixed.[1] This differs from several papers that are unable to disentangle the allocative and motivational effect (Bandiera et al. 2009; Hjort 2014; Marx et al. 2021; Xu 2018).[2] As such, we are able to show that principals through shared identity are able to provide some form of solace to agents, and that their removal (here death) leads agents to lose motivation.

Our focus on regional identity provides a further novel approach within the organisational literature. Regional divergence (Fetzer 2019; Rodríguez-Pose et al. 2023) and identity in general (Bagues and Roth 2023; Dehdari and Gehring 2022) have been explored by other areas of economics, yet they are difficult to exploit in an organisational paper given the amount of data (people) needed to do so convincingly.[3] Our paper thus expands upon the types of identity that have been explored

[1] Deserranno et al. (2025) consider shared financial incentives between hierarchical layers in an organisational structure where the manager lacks allocative capacity, and influences agents through training, supervision and motivation. Their focus, both on financial incentives and their distribution across layers, is fundamentally different to ours, but is illustrative of how managers can inspire or drive effort outside of allocative decisions.

[2] Our results in this sense speak more generally to the literature on managers, where we isolate the specific behavioural effect of managers (officers) on their workers (soldiers) (Bertrand and Schoar 2003; Bloom and Reenen 2007). This is distinct from previous work on managers since we identify a behavioural response on the part of soldiers instead of managers allocative capacity.

[3] As an example, Bandiera et al. (2010) exploits national identity as a social incentive among groups of Eastern European fruit-pickers (an agent-agent setting). To go beyond this national level requires extensive data both on the number of people (observations) within the organisation and on the location those people are from, which our setting provides due to the unique depth of the *Morts pour la France* dataset.

for their effects on organisational behaviour, which is currently limited to ethnic or religious identities (Ghosh 2025; Hjort 2014; Marx et al. 2021).

Within the mission-oriented literature we provide an additional contribution by identifying the intra-organisational effect of identity. Previous papers focus on the effect of identity as a means to improve policy responsiveness to external agents, whereas we look at within-organisation incentive effects (Alsan et al. 2019; Xu 2023). This provides a new approach that future research can explore in more conventional bureaucratic settings, where recent research has made clear the potential for intra-organisation productivity gains (Best et al. 2023; Fenizia 2022).

We also provide novel evidence to existing research on military personnel economics. A central motivating question in this literature is why soldiers fight when their personal costs are so high. A large empirical literature has considered the role of soldiers' traits and experiences in determining effort (Barber and Miller 2019; Costa and Kahn 2003; Rozenas et al. 2024). Recent contributions have broadened this literature by considering how different social incentives alter the behaviour of soldiers. Ager et al. (2021) study WWII fighter pilots to show that competition affects risk-taking. Bursztyn et al. (2026) use the same setting to investigate whether status-based incentives elicit repeated effort increases. We study the vertical (leadership) channel of motivation that has long been written about outside of economics as central to military motivation (Hughes 2012; McMahon and Bernard 2019; Wrzesniewski et al. 2014) and show that identity-alignment is an important social incentive.

Relatedly, there has been a consideration of the importance of leaders, on the frontline (Ferrara et al. 2025) and also at higher levels of power (Jones and Olken 2005; Ottinger and Voigtländer 2025). Our contribution to the literature is driven by the behavioural mechanism. We do not comment on the capacity for individuals to drive outcome changes through their innate capacity as a leader (Assouad 2025; Dippel and Heblich 2021; Funke et al. 2023). Instead we focus on how the organic interplay between leader and soldier based on how their cultural identity (here regional) affects behaviour, irrespective of the talents of said frontline leader.

This paper progresses as follows. The next section introduces the historical context and discusses the nature of motivation and effort among infantry soldiers in the trenches of WWI. Section three introduces a brief conceptual framework to formalise our hypothesis. Section four describes our data source, the construction of cultural regions, and our estimation approach. Section five and six presents the baseline results and heterogeneity results. We probe the robustness of the results in section seven. The final section concludes.

2 Historical Background

2.1 The Great War

The assassination of Archduke Franz Ferdinand by a Bosnian-Serb on the 24th of June 1914 triggered a month of frenzied diplomacy. Collective brinkmanship amidst a complex system of treaties drew the great continental powers into the conflict. Emboldened by the confirmation of German support Austria-Hungary declared war on Serbia on the 28th of July. Germany, Russia, and France mobilised in late August.[4] The German *Schlieffen* plan envisaged knocking France out of the war quickly. The German Army invaded via Belgium, triggering British involvement on behalf of Belgian neutrality. The first days of the War were characterised by manoeuvrer warfare. After initial German advances the French were able to halt the Germans at the first battle of the Marne (September 1914). What followed was the so called "Race to the Sea". Here both armies tried to outflank the enemy. Across repeated encounter battles they moved northwards to the Belgian coast. By late November the front was established, stretching from Switzerland to the North Sea. The middle years saw a grinding war of attrition, particularly at Verdun in 1916 and during the joint Franco-British Somme Offensive. By spring 1917, the catastrophic failure of the *Nivelle* Offensive triggered widespread mutinies across nearly half the French divisions. Pétain replaced Nivelle as Commander-in-Chief and prioritised a defensive strategy, bolstering moral, and improving the material conditions of soldiers. Alongside the arrival of American forces and advances in combined-arms tactics, this enabled the French army to participate decisively in the successful Allied counter-offensives of 1918 that resulted in the November Armistice, and the end of WWI (Hart 2013).[5]

2.2 The French Army

France was the workhorse of the Allied powers, mobilising over eight million soldiers. The army utilised universal conscription. All "fit" males turning 20 in a given year were inducted into the active army.[6] At mobilisation the active army comprised 870 thousand men. Another 3 million reservists were called up within the first weeks, with an additional 4.2 million 'territorials' incorporated throughout the war (Boulanger 2002).[7] The country was divided into military regions, each fielding one army corps, in turn comprising 2 divisions (4 brigades) (Gay and Grosjean 2023).[8]

We focus on the infantry since its structure and experience of battle is uniquely suited to exploring our hypothesis. Infantry soldiers were recruited from across the population, requiring less training then their counterparts in other branches. As the war progressed the calvary – unsuited to advances in military technology – played a limited role on the front. Similarly, the artillery – although important throughout – was placed at a distance to the front and mortality in this branch does not proxy risk-taking. The French Army had 173 active line infantry regiments. Most regiments were associated with one military sub-region that was responsible for recruiting and mobilisation.

[4]Austro-Hungarian leadership felt threatened by the expansion of Serbian influence in the Balkan. The assassination and the alleged involvement of Serbian intelligence strengthened the hand of the pro-war party. More recent approaches to the causes of this conflict advocates an *accidental* trigger pulled by all participant nations while pursuing their own self-interest in a collective game of brinkmanship. It suggests that 'the protagonists of 1914 were sleepwalkers, watchful but unseeing, haunted by dreams, yet blind to the reality of the horror they were about to bring into the world' (Clark 2013, p.562).

[5]Across the war, the French army fought in the Middle East, the Balkans, and colonial territories of North Africa, but the Western Front was the main location of battle (Goya et al. 2018).

[6]After three years in the active army, recruits serve 11 years in the reserves, seven in the territorial army, and another seven in the reserves of the territorial army.

[7]Colonial troops were also a major contributor to the French war effort. Given a distinctive incentive structure – lower intrinsic motivation, greater pecuniary benefit compared to their opportunity cost, and structural discrimination and mistreatment – they constitute a interesting organisational case-study. However, given insufficient reporting standards in our dataset we exclude colonial regiments.

[8]Each brigade contained 1 artillery regiment, 1 cavalry squadron, 2 active line infantry, and 1 reserve line infantry regiment. Reserve and territorial divisions were smaller and had slight variations of this structure.

As the war continued the need for manpower weakened the link between region and regiment (Bracken 2018). [9] There were additional *chasseur* (light infantry) battalions, with 31 Chasseurs à Pied and 12 Chasseurs Alpins active at the start of the war. These elite units maintained distinct organizational structures, and attached directly to divisions or corps, providing commanders with specialized troops adept at reconnaissance, assault operations, and fighting in difficult terrain (Greenhalgh 2014).[10]

A representative regiment contained between 60-80 COs, 250-300 NCOs, and 2000-2600 soldiers. Regiments were commanded by a Colonel (Commissioned Officer). Regiments were further broken down into Battalions, commanded by a Major (CO). Normal Infantry regiments contained three battalions while reserve regiments contained only two. Each Battalion contained four Companies – under the command of a Captain (CO) – approximately 250 strong. These were further subdivided into Sections (4x, Lieutenant, CO), Half-Sections (8x, Sergeant, Non-commissioned Officer), and Squads (16x, Corporal, NCO). Importantly, while the English or German's deployed battalions independently, French regiments were deployed together. Ergo, all soldiers of a regiment would experience a similar battle environment (Bailey et al. 2023; Bracken 2018).

2.3 Motivation in the Trenches

Motivation. The question how to best motivate soldiers is as old as war itself. In *Symposium* Plato contends that "An army should be made up of lovers and their loved [...] when fighting at each others side, although a mere handful, they would overcome the world." (Plato 2008). French officer, Ardant du Picq, noted the innate motivational quality of shared bonds at the time of the Franco-Prussian conflict (where he was killed);

> *"Four brave men who do not know each other will not dare to attack a lion. Four less brave, but knowing each other well, sure of their reliability and consequently of mutual aid, will attack resolutely. There is the science of the organization of armies in a nutshell."* (Du Picq 1921)

The organisation of armies can increase motivation via two channels, it can increase horizontal connections between soldiers or vertical connections between soldiers and their officers. One method of increasing connection was to establish a shared (military or national) identity across soldiers and officers (Ronconi and Ramos-Toro 2025). This was achieved through training and drilling to varying degrees of success. Universal conscription made this approach more difficult since most soldiers would have not enlisted and training was often limited. One alternative was to utilise pre-existing identities. Lafon (2015) observes that a "soldier put on a uniform without losing his social and cultural identity; military assignments were just an extension of the social segregation which existed also in peacetime" (p. 2). The French army was explicitly organised

[9] Regiments 1 through 144 were metropolitan regiments and recruits were drawn from specific sub-regions. The remaining "fortress" regiments (145 - 173) were recruited from border areas and large metropolitan centres. Most active regiments also fielded one reserve regiment (Greenhalgh 2014). One infantry regiment – the 145th – was captured at the onset of the war and served its remainder as German POWs. As such we exclude this regiment throughout.

[10] We describe these battalions as 'regiments' during the analysis to simplify terminology.

around this premise. Military recruitment and organisation were aligned such that regiments were mostly made-up of coregionals who share a regional cultural identity.

The Trenches. Fighting in the trenches of the western front was a static process where victory was measured in yards rather than miles (Chickering and Förster 2006). The task of a soldier at charge was 'to rush headlong at the enemy out in the open, where at any moment shot and shell may do its worst' (Laffargue 1916). Soldiers increasingly distrusted the officer class that appeared to be sending them to their deaths. In his war diary Barthas described this process, noting that "there is no reciprocal confidence [and] a complete divergence of interests." – officers wanted to win, soldiers wanted to survive – "The men, who have everything to lose and nothing to gain, who dont know why they're there, are looking only to escape any danger they can and to save their skins." (Barthas 2014, p.117).

Smith (2007, p.111) describes the relevance of the horizontal and vertical channel in this setting, stressing that "only men who felt individually and totally implicated in the fate of one another, and in the authority ruling over them, could be relied upon under fire". Although the importance of the vertical channel was long documented – in 1832 Prussian general Carl von Clausewitz proclaimed that "the scope which the play of courage and talent will enjoy in the realm of probability and chance depends on the particular character of the commander" (von Clausewitz 1976) – the motivational impact of a liked officer was larger amid the appalling conditions in the trenches, as soldiers lost trust in a command that proved unprepared for the terrors of modern warfare.

This mistrust was directed at the higher echelons of the officer corps, who remained far behind the front. Lower levels – particularly NCOs commanding half-sections or squads – were in the trenches amidst their men. NCOs had limited power and gave no input on strategy. Instead, their primary tasks were to acts as point of contact between common soldiers and the higher ranks and to motivate and instruct their soldiers. Barthas summarises the potential effect of lower-level officers when he observed that,

> "Guillot's company appeared to be the elite unit of the regiment. [...] Why so? Were its men hand-picked to be the bravest, the most devoted? No, there was no warrior quality which distinguished them from the masses of poilus. But they loved their young captain, who treated them all like comrades" (Barthas 2014, p.359).

Our contention is that officers could better motivate their soldiers when they shared a regional identity, reducing the perceived distance and increasing the sense of obligation between the two. Smith, who claims that group identity was central to collective effort on the French side of the trenches, reinforces this view: "Individuals and groups functioned according to a logic of necessity, expressed in terms of absolute and personal accountability to the collectivity' (Smith 2007, p.111).

3 Conceptual Framework

We draw on work by Besley and Ghatak (2005) and Shayo (2009; 2020) to develop a simple model that formalises the effect of identity alignment on agent effort. The framework predicts that vertically aligned agents expel more effort when markers of group belonging such as cultural region of birth are stronger than organisational identity. We make a number of simplifying assumptions that apply to this setting and keep the model focused on our estimation strategy. Nonetheless, a more general formulation of this model would be relevant to organisational dynamics outside our setting.

Setup. We assume an organisation consisting of one risk-neutral principal (officer, j) and n agents (soldier, i). In our setting this corresponds to the lower levels of the regimental organisation such as sections or squads commanded by one NCO. The organisation is tasked with carrying out a mission (i.e. fighting a battle). The probability of success (winning the battle) is an increasing function of total effort. For analytical clarity we assume that $\rho(\cdot)$ is a simple linear function. The intercept α captures the baseline probability of winning an engagement (i.e. well defended position) and the slope φ captures how effort translates to success (i.e. defensive vs. offensive battle).

$$\text{Prob}(Y_H = 1) = \rho\left(\sum_{i=1}^{n} e_i\right) = \alpha + \varphi\left(\bar{e}\right) \tag{1}$$

First, we assume that allocative and strategic capacity rests in higher levels of leadership than the principal in our model. Individual effort (e_i) is costly to soldiers – increased risk of death – and unobserved by officers who only observe team outcomes. Thus effort is non-contractible. We also assume that there is no variation in ability across soldiers.[11]

Second, we assume that soldiers have no wealth and require some subsistence wage ($\underline{w}$), making the limited-liability constraint binding. This limits the amount of coercion principals can use to elicit their desired effort level ($e^{\max}$). The forms of punishment used to coerce soldiers in autocracies – such as shooting at fleeing soldiers and arresting the families of deserters (Beevor 1998) – were not viable in democracies. Although desertion was subject to capital punishment in France, only a small number of deserters were ultimately shot (Guillot and Parent 2024). We assume that officers have sufficient wealth and that their limited-liability constraint does not bite.

Third, since the French army was based on mass conscription, we assume that soldiers have no outside option, such that they have no reservation payoff. This implies that soldiers receive no performance payoff. Aside the theoretical basis for the absence of a performance payoff, it is also supported by the organisational budget constraint of the military. Mobilisation put an enormous fiscal strain on the French state, with little scope for additional funds being allocated to performance payoffs for soldiers. Here, relying on performance pay to deal with the moral hazard problem is not a viable approach (Holmström 1982; Costa and Kahn 2003). The military – much like other financially constrained, mission-based organizations – needs to rely on alternative solutions

[11]Although this is a strong assumption, it conforms to the predominant historiography of the French Army in WW1 (see Doughty (2005) and Greenhalgh (2014)).

to the agency problems (Costa and Kahn 2003; Ager et al. 2021; Voth and Xu 2021).

Last, we assume that officers and soldiers are intrinsically motivated to defend their home country. On success officers receive some mixed pecuniary/non-pecuniary payoff π_j.[12] Soldiers receive a subsistence wage ($\underline{w}$) irrespective success and a non-pecuniary payoff θ (their motivation) on success.

Introducing Identity. To explore how soldier (agent) and officer (principal) identity shapes incentives we draw on Shayo (2020) and model identity as an endogenous choice. Individual i can identify with a subset G_i of all possible groups $\mathbb{G}$ and choose one group ($g \in G_i$) to identify as.[13]. In addition to their intrinsic motivation (θ) soldiers derive utility from exerting effort when they are commanded by an officer from the same identity group g. Intuitively, shared identity mattered because it bridged the social distance between soldier and officer. In-group bias makes soldiers more trusting of officers instructions while also introducing a reputation mechanism (Smith 2007).[14] The utility from complying is given by,

$$U_{ig}(e) = I_{ij} \cdot (\gamma_i \, S_g - \beta_i \, d_{ig}) \tag{2}$$

where I_{ij} is an indicator variable equal to one if the soldier belongs to the same identity group as their NCO. Perceived distance d_{ig} is the distance in conceptual space along a vector of traits i.e. how similar agent i is to the prototype of group g. S_g, the status of group g, is a function of both absolute traits and social comparisons (Tajfel and Turner 1986), capturing the value of identifying with group g. The utility from complying decreases in d_{ig} and increases in S_g (Shayo 2020, p. 357). We assume that soldiers are not able to alter group status or perceived distance under a given identity. Instead they maximise utility by electing into a group. To keep the model and our predictions tractable we assume that soldiers can identify with their cultural region r or the organisation u. We assume that soldiers have no information about the identity of their NCO when choosing an identity.

We are not trying to fully describe the drivers of effort among infantry soldiers. For example, shared identity along the horizontal – i.e. fighting alongside members of the same group – was a important determinant of effort.[15] We are not interested in the relative ranking across different determinants of effort. Instead the main aim of this framework is to formalise how shared identity along the vertical – between soldiers and lower-ranking officers – effects soldier effort. While many of the assumptions we make do not hold outside of battle periods they reflect the organisation and operation of the French infantry in periods of intense trench warfare.

[12] Besley and Ghatak (2005) do not explicitly decompose principal payoffs into non-pecuniary and pecuniary components instead assuming that the value of payoff is constant across types but only varies in composition.

[13] To keep the model tractable we assume that each individual identifies with only one group g.

[14] Soldiers would care more about the opinions of those closer to them (i.e. of the same identity group), increasing the personal cost of shirking by exerting $e_i < e^{max}$.

[15] A rich literature in organisational economics stresses the relevance of peer effects (e.g. Mas and Moretti 2009; Bandiera et al. 2010). The importance of this mechanisms is also stressed by prominent scholars of war (e.g. von Clausewitz 1976).

Empirical Predictions. A soldier i who identifies with group g and is commanded by a NCO j has the utility function,

$$U^{a}_{ijg} = (\alpha + \varphi e_i)\ (\theta_i + I_{ij}[\gamma_i\, S_g - \beta_i\, d_{ig}]) + w_{ij} - \frac{1}{2}\, e_i^2 \tag{3}$$

where $(\alpha + \varphi e_i)$ is the probability of success assuming all soldiers exert the same effort and w_{ij} is the soldiers wage. The last term describes the direct cost (i.e. higher risk of death) of exerting effort. Under the NCOs optimal contracting problem, the *incentive-compatibility constraint* stipulates that the optimal (soldiers) effort level will maximise the *private* payoff. Thus, Equation 4 describes the first-order condition for effort.

$$e^{*}_{ijg} = \varphi\,(\theta_i + I_{ij}[\gamma_i\, S_g - \beta_i\, d_{ig}]) \tag{4}$$

The primary empirical prediction of this framework is that soldiers exert more effort when they are vertically aligned with their NCO along cultural identity, i.e., $I_{ij} = 1$. Being commanded by a coregional increases the utility of compliance, leading to a increase in effort according to $\Delta e^{*}_{ijg}|_{I_{ij}:0\to 1} = \varphi(\gamma_i\, S_g - \beta_i\, d_{ig})$. Here the the magnitude of the effort differential will depend on the status of (S_g) the and the distance (d_{ig}) from the regional group. Moreover, group status and perceived distance are relevant beyond determining the magnitude of the effect. According to endogenous identity choice, soldiers will stop identifying with (or down-weight their) regional identity. For a given combination of y_i, β_i, and $\mathrm{E}\,(I_{ij})$ there exist threshold values for S_g and d_{ig} where soldiers start identifying with their organisation, and the effect of vertical alignment along regional identity should diminish.

Core Assumption. Throughout we assume that coercion is only set at the level of the organisation and never at the level of the individual. As such we rule out favouritism or discrimination along identity. Both have been shown to drive variation in the performance of agents (e.g. Ghosh 2025; Hjort 2014; Marx et al. 2021). We are comfortable making this assumption due to the specificities of our context. As elaborated, NCOs have no allocative capacity and do not make strategic decisions. Instead they act as a go-between higher levels of the officer corps and the common soldiers. Additionally, their limited capacity for selective coercion, is severely diminished amidst battle periods. Here the role NCOs is solely to relay instructions and to motivate their soldiers. We will probe this assumption by showing that the effect of vertical alignment is more ambiguous outside of battle periods when NCOs had greater scope for favouritism and discrimination, and when we look at higher levels of the command hierarchy.

4 Empirical strategy

4.1 Data

Our empirical analysis leverages the *Morts pour la France* dataset, containing the universe of officially recognised French war fatalities (Gay and Grosjean 2023). The data contain the names, rank, regiment, recruitment cohort and bureau, date and circumstance of death, and birth date and place for most soldiers. The granularity is useful to our research in two ways. First, we have a large geocoded cross-section of surnames. We use the spatial distribution of surnames to infer cultural regions. Second, information on daily mortality outcomes at the regiment level alongside rank, makes it possible to study how the organisation of regiments affected mortality across regional groups in a design-based difference-in-difference approach. The organisational unit of analysis is the regiment. We augment records with more detailed information from qualitative histories; we add the type of regiment, its garrison and recruitment locations. At the regional level we add economic, demographic, historical, and geographical covariates that we compile from secondary sources.

4.2 Cultural Regions

Exploring alignment along regional identity necessitates assigning soldiers and NCOs to cultural regions. The 19th and 20th century were characterised by the transition from highly localised regional identities to national *imagined communities* (Anderson 1991). This transition was seldom, if ever, completely achieved, with regional identity still having tangible effects (e.g. Huning and Wahl 2023). France was characterised by strong heterogeneity in regional cultures – particularly among it's peasant population – into the 20th century (Weber 1976). Blanc and Kubo (2024) use language maps, recording the pronunciation of words across 577 municipalities, to document marked linguistic diversity in 1900. They convincingly argue that state-sponsored education served to homogenise language, but that this process was far from complete in 1900.

We adopt a data-driven method to allocate arrondissements to cultural regions based on the frequency of surnames. This approach was pioneered by Fouka and Serlin (2024) for Britain, and we are the first to apply it to a different context. The spatial distribution of surnames describes historical migration patterns. Intuitively, the cultural distance between localities increases the cost of migration, i.e people migrate more within cultural regions than across (Day 2023; Blanc and Kubo 2024). This implies that arrondissements with more similar surname distributions belong to the same cultural region.[16] We compute surname shares by arrondissement and use the spectral clustering algorithm by John et al. (2020) to identify clusters. The advantage of this algorithm is that we can avoid setting a number of clusters (i.e. *a priori* deciding on the number of cultural regions in France).[17] The algorithm calculates a similarity matrix between arrondissements that is used to

[16]Kandt et al. (2016) find that in the UK surname clusters correspond closely to genetic clusters.

[17]We do not standardise spellings since even small variations in spelling contain relevant information about cultural regions. Even if the surname indicates that a family may have migrated across cultural regions in the far past, the spelling variations reveal an important facet of the contemporary cultural map.

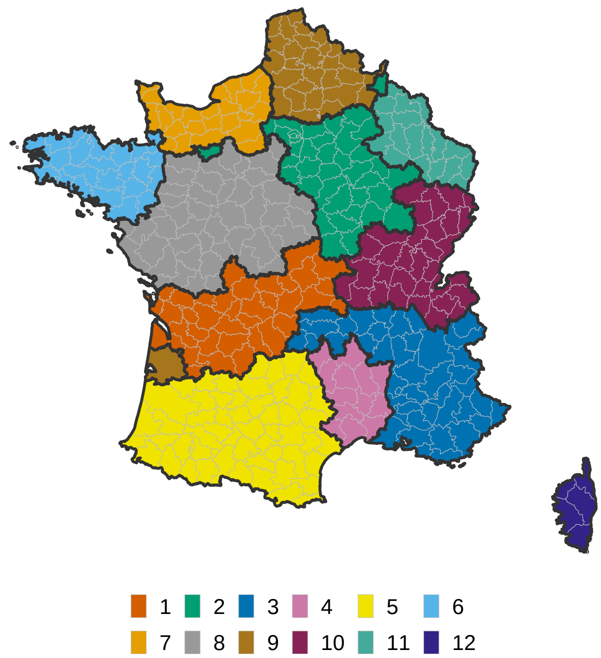


Figure 1: Name-based Cultural Regions across France

Notes: The figure above contains a map of France that has been divided into 12 cultural regions using the frequency of surnames across arrondissements. Similarity shares are computed per arrondissement, before using the spectral clustering created by John et al. (2020) to identify the regions, following the approach of Fouka and Serlin (2024).

assigning them to clusters.

Figure 1 plots the clusters. Most clusters correspond closely to historical regions; e.g. region six captures the distinct *Breton* identity. Some other regions, such as region one, do not correspond to clear historical regions. These cultural regions correspond to the latter part of the French nation building program (Weber 1976). As such these compound regions represent an intermediate step on the path from highly localised micro-regions to broad macro-regions (e.g. Nouvelle-Aquitaine).[18] Most arrondissements of the same regional cluster are contiguous. Given the absence of spatial inputs in the algorithm, this supports the conclusion that the clusters correspond to cultural regions.[19] Beyond being geographically defined, the regional clusters also correlate with cultural-dependent behaviour. Belonging to the same cultural cluster reduces the difference in measures of religiosity, fertility, and human-capital investment, as well as linguistic distance, between arrondissements even when conditioning on belonging to the same departement (See Table A1).

[18]These regions are suggestive evidence that national assimilation was not only a process of converging to the centre, but also of more localised assimilation.

[19]Regions 10 and 12 are the only exception. These regions were initially clustered together. They are characterised by unique surnames; the algorithm assigned them to the same cluster due to their dissimilarity to the rest and not their similarity to one another. To account for this we manually split Corsica and assign it to an independent cluster.

4.3 Estimation Approach

To test our primary hypothesis, that soldiers exerted more effort when they were commanded by a coregional officer, we want to estimate the difference in effort between "connected" and "unconnected" soldiers who are subject to the same battle environment, allocation, and instructions. Identifying this target parameter in an experimental setting is costly and difficult.[20] A setting with observational data, matched comparison groups, and a fixed organizational environment is rare. Our setting is uniquely suited to estimating the effect on soldier (agent) behaviour of officer–soldier (principal–agent) (regional-)identity alignment.

One challenge to estimation is that we only observe soldiers (and officers) at death. We surmount this challenge by estimating the effect of *losing* a coregional officer on mortality at the regional-group level. Still, these are a number of invalid comparisons we need to avoid, e.g., comparing soldiers in the heat of battle to those currently on leave. To this end, we adopt a *design*-based approach to estimation. Instead of modelling untreated potential outcomes, we leverage a model of treatment assignment. We use controls to approximate an experimental setting where as-if-randomly assigned shocks (here the birth region of a dead officer) enable the identification of credibly causal effects (Borusyak and Hull 2024). Intuitively, we use controls to restrict estimation to comparisons between valid treatment and control groups. Design-based inference is advantageous because it avoids the issue of negative-weights, and is less sensitive to functional form (Goodman-Bacon 2021; Borusyak and Hull 2024).

In the French army during WW1, regiments were deployed together, and fought in the same sector of the front. Within any given regiment, soldiers and officers were subject to the same battle environment and general instructions. As such, conditional on non-parametric controls for the battle-day t, the regiment r, the regional-group g within the regiment, when an officer j dies $DEATH_{jrk}$ the birth-place of this officer $1\{g_j = g\}$ is "as-good-as-random". We use a stacked difference-in-difference to estimate the effect of losing a regionally connected officer $DEATH_{jrk} \times 1\{g_j = g\}$ on the crude mortality of soldiers from region g in regiment r; $MORT_{grt}$. While absolute mortality is subject to a range of unaccounted for factors, *relative* differences in *conditional* mortality, i.e., differences between groups in the same regiment on the same day, is a good proxy for the behaviour of soldiers.[21] Particularly to infantry regiments of the first world war, where small behavioural differences, such as the speed with which one charged out of a trench, had an immense impact on ones risk of death (Greenhalgh 2014; Laffargue 1916).[22]

We use the stacked difference-in-difference design to estimate the average treatment effect across a large number of valid micro-experiments. We are estimating the difference in relative mortality, between groups that lost a regionally "connected" officer and those that lost an "unconnected" officer. This comparisons holds by construction; since we only make within-regiment comparisons, i.e., if a group in a regiment loses a connected officer all other groups lose a unconnected officer.

[20] Hjort (2014) is the best approximation of a suitable experiment, but which uses the capacity for upstream workers to discriminate in their allocations to downstream workers as the flexible parameter. It does not purely focus on behavioural change among agents as we do here.

[21] Comparable outcome measures are used in pioneering studies of organizational economics in war by Ager et al. (2021) and Voth and Xu (2021).

[22] We can separate deaths by different causes-of-death; in the baseline we only include battlefield deaths.

We include several battle-days prior to treatment to test for pre-trends. In our baseline we estimate the effect across 3 battle-days after treatment. Battle-days are days with above threshold regimental mortality, we use 30 in the baseline. Our identification holds only when regiments are in battle. In the absence of day-by-day regimental histories crude mortality is the best approximation. Since regimental composition changed across deployments, we only include battle-days within a 10 calendar-day window. We report results across different samples and conduct a battery of sensitivity tests to ensure that these design choices do not drive our results (see section 7).

We stack all valid micro-experiments, such that our unit observation is the regional group g, per regiment r, on battle day t, during the treatment instance i. We estimate the average treatment effect according to;

$$MORT_{igrt} = \beta \cdot DEATH_{ijr}^{NCO} \times 1\{g_j = g\} \times POST_t + \alpha_{irg} + \tau_{irt} + \epsilon_{igrt} \tag{5}$$

where $DEATH_{jrk}^{NCO} \times 1\{g_j = g\}$ is the treatment indicator, $POST_t$ is a indicator variable equal to one on the battle-days after treatment, α_{irg} are regiment–group–instance fixed effects, and τ_{irt} are regiment–battle-day–instance fixed effects. α_{irg} and τ_{irt} approximate the unit and time fixed effects in the canonical TWFE design. Based on this fixed-effect structure we only make within-regiment comparisons between "connected" and "unconnected" groups. β captures an intention-to-treat version of our target parameter. Since we only observe deaths, it is possible that even after treatment, a group enjoys vertical connection. Similarly, we do not know whether those in the group were directly commanded by the NCO before their death. Both of these heavily attenuate the effects we identify. Throughout we cluster standard errors at the level of treatment assignment, namely the group–instance level.

Identifying Assumptions. The interpretation of β depends on two identifying assumptions. First, to identify a causal effect, we assume that the birth-place of the deceased officer is conditionally random. To support this, we show that lagged group deaths cannot predict treatment conditional on our fixed effect structure in Table A2. Additionally, we test for pre-trends. If treatment assignment were non-random we would also expect to see this in soldiers crude mortality. Second, even if we causally identify an effect on mortality, we must assume that it operates through a behavioural channel as it could still be the product of favouritism or discrimination. In line with the core assumption of our theoretical model, we make several design choices to close this mechanism *a prior*. First, we focus on low ranking officers that had limited allocative capacity and whose primary task was relaying instructions. Second, we only include battle-days. NCOs capacity for favouritism/discrimination was further diminished during these high-stakes periods. Nonetheless, fully disentangling these causal channels is impossible, both in observational and experimental data. We believe that our design choices, along with results, suggest the behavioural over the allocative channel.

Table 1: Baseline

	$MORT_{igrt}$							
	Baseline			Migration		Name		Placebo
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$DEATH_{ijr}^{NCO} \times 1\{g_j = g\} \times POST_t$	-3.923***	-2.582***	-2.688***	-3.172***	-3.307***	3.604*	2.429**	-0.025
	(0.169)	(0.398)	(0.403)	(0.487)	(0.502)	(1.931)	(1.198)	(0.057)
$DiD \times 1\{\text{Migrant}\}$				2.838***				
				(0.670)				
$DiD \times$ Migration Distance					0.848***			
					(0.153)			
$DiD \times RNI_j^{FIRST}$						-9.278***		
						(2.989)		
$DiD \times RNI_j^{LAST}$							-5.902***	
							(1.552)	
Sample Construction								
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Calendar Window		✓	✓	✓	✓	✓	✓	✓
Treatment Restriction			✓					
Fixed Effects								
Instance $\times$ Group	✓	✓	✓	✓	✓	✓	✓	✓
Instance $\times$ Battle-day	✓	✓	✓	✓	✓	✓	✓	✓
Statistics								
Instances	12,059	5,509	5,274	5,502	5,502	5,509	5,509	1,889
Avg. Control Groups	4.63	5.09	5.09	5.09	5.09	5.09	5.09	1.36
Observations	339,818	75,134	71,893	75,048	75,048	75,134	75,134	10,832

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-8 contain the results of several stacked DiD regressions estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. Each of the first three columns uses a different underlying sample, with the checkmarks in the table denoting the sample restrictions used. In columns 4-7 we exploit heterogeneity in the treatment effect using the sample from column 2. We interact our treatment with the characteristics of the deceased officer. Columns 4-5 look at whether the deceased officer was a migrant, and how far they had migrated. Columns 6-7 look at the district 'regionality' of their first or last name. Finally, in Column 8 we estimate a placebo regression where we use non-battlefield deaths to falsify our interpretation of battlefield deaths as a proxy for motivation.
Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5 Results

Columns (1) through (3) of Table 1 test our primary hypothesis – i.e., that soldiers exert more effort when they are commanded by a coregional NCO – in different samples. Our treatment is equivalent to losing alignment, as such, we expect a negative significant coefficient. In column (1) we impose minimal restrictions on the micro-experiments; we include all non-treated groups in the regiment as control, but we do not impose a calendar day window, and we do not truncate the treatment period on repeat treatments. Column (2) imposes a real calendar window of 10 days to avoid compositional change across rotations on the front. In column (3) we truncate the treatment window on repeated treatments.

The magnitude and significance of our coefficient of interest is remarkably similar across these different samples. In the most restricted sample (column (3)), the death of a coregional NCO leads to a reduction in group-level mortality of 2.688 deaths relative to other groups of the same regiment on the same day. As stressed previously, we focus on this group of officers during battle periods because it allows us to refine our identification to an interpersonal vertical channel (rather than allocative). This effect is estimated over three battle days after treatment. Average group-level mortality among treated groups is 17.13 deaths per battle day. While we cannot interpret our effect as an absolute reduction in group-level mortality, its magnitude relative to the average is useful in evaluating economic significance. An implied average marginal effect of 15.70% is economically meaningful and statistically significant across all specifications.

Officer Traits. The results imply that relative mortality – as a proxy for effort – fell after the death of a coregional NCO. While our design favours the behavioural response mechanism, further evidence is necessary to demonstrate that we are not identifying a favouritism/discrimination mechanism. To this end we leverage heterogeneity across officers. Specifically we want to know whether officers that were more readily identified as belonging to a certain cultural group elicit different group-level responses. If we identify a behavioural response on part of the soldiers we expect the effect to be concentrated among treatment instances where officers were more identifiable as belonging to their cultural group.

We operationalise "identifiability" along two dimensions. First, we use the distance between the birth and recruitment place as a proxy for *chosen* cultural belonging. Assuming that people were recruited at their place of residency, this approximates life-time migration distance. Officers that migrated further left their cultural cluster, likely losing cultural markers such as dialect along the way. Second, we construct regional name indexes to measure *given* cultural belonging. We use the revealed preference approach from Fryer and Levitt (2004), however instead of being interested in the cultural preferences of the name-holder or namegiver, we want to identify how well soldiers could identify NCO's cultural region on the basis of names.

$$RNI_{jr} = \frac{Pr(name|R = r)}{Pr(name|R = r) + Pr(name|R \neq r)} \tag{6}$$

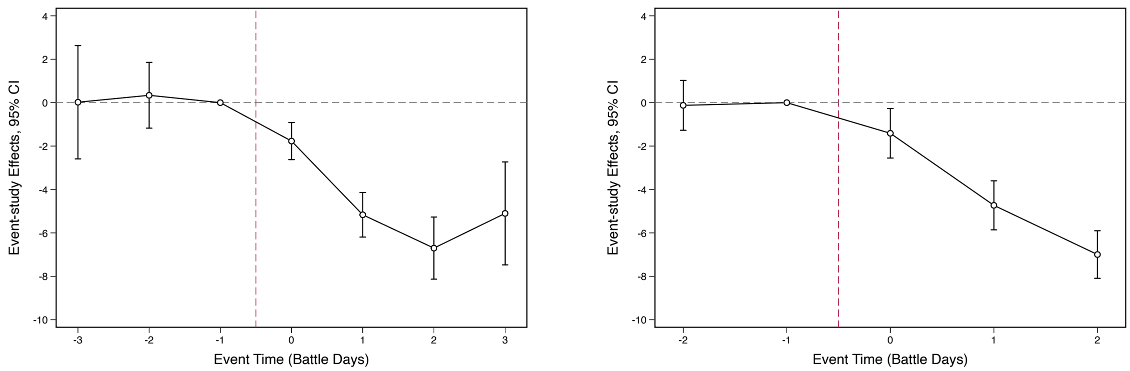
The name index is computed based on everyone in the dataset. The index is calculated separately for first and surnames from a cultural region. Surnames are significantly more “region specific”. To explore differences in the treatment effects, we interact the treatment indicator with these measures in a triple-difference strategy. We expect larger effects for more “regional” NCOs.

Columns (4) through (6) of Table 1 report the results from the exercise. In the first two columns we evaluate heterogeneity by NCO’s migration history. Column (4) interacts the treatment indicator with a indicator variable equal to one if the officer migrated further than 100 km. The effect size for short-distance and non migrants (i.e less than 100 km) is economically meaningful and statistically significant. The coefficient for the interaction term is significant, positive and of a comparable magnitude, implying a null effect if the officer was a migrant to the cultural region. This finding is validated when we use a continuous measure of migration distance (in 100 km). The effect for non-migrants is comparable in magnitude, with greater migration distance attenuating this effect towards zero. Still, migration reflects cultural choice and could hence be correlated with officer’s attitudes to favouritism/discrimination. To this end our preferred measure of cultural “identifiability” uses the regional name index. First names carry information on cultural preferences, particularly those of the name-giver. They are weaker signals for the cultural preferences of the name-receiver, and surnames that were determined many generations ago even less so.

In columns (6) and (7) we interact the treatment with a regional name index for the first and surname respectively. Higher values represents more distinctly regional names. The point estimate at a zero level of regionalism is positive, with the negative effect brought upon by increasing the “identifiability” of the name. This result implies that the death of a NCO only had a negative effect on group-level mortality if the soldiers could easily recognise that the NCO was a coregional. Since we we do not observe the direct command structure in the regiment, information about the death of NCO’s likely travelled through word of mouth. In this instance, it is likely that the distinct nature of names was particularly important. This supports our hypothesis that the effect we identify in columns (1) through (3) is driven by a behavioural response on the part of the soldiers. We find similar patterns for first and surnames, but the magnitude of the effect greater for first names. These results bulwark the interpretation that the fall in relative mortality is driven by a behavioural response.

Non-Battlefield Deaths. Still, the use of relative mortality as a proxy for effort hinges on the assumption that battlefield deaths are the consequence of soldier’s behaviour. In turn, non-battlefield deaths such as those in due to accidents, or in hospitals, should not respond to our treatment if this assumption holds. To test this, in column (8) of Table 1 we replace our outcome variable with crude non-battlefield deaths. We find a null effect using this placebo outcome, supporting our baseline outcome as a proxy for effort.

Event-Study Effects. We are also interested in the dynamics of the effect. To this end we estimate event-study effects across three post and pre periods. Additionally, pre-testing helps verify our identifying assumption that treatment assignment (i.e. the birth region of the deceased officer) is conditionally random. If this were not the case we would expect to see pre-trends in group-level deaths. Panel (a) of Figure 2 plots the event study for the most restrictive sample (i.e., column (3) of



(a) Baseline

(b) Controlling for Compositional Change

Figure 2: Event-study Effects

Notes: The figure plots event-study effects for a leads and lags analogue of the regression model in Equation 5. All estimates are relative to event time -1. Panel (a) plots the effects for the restricted sample (i.e. column (2) of Table 1) while (b) plots results for the subset of instances in the unrestricted sample (i.e. column (1) of Table 1) that are visible for three post-periods. Bars indicate 95% confidence intervals calculated using clustered standard errors at the instance-group level.

Table 1). The absence of pre-trends supports the identifying assumption. Group-level mortality of the treated group – relative to the non-treated groups – start declining immediately upon treatment (t=0), and continues to fall for the first two battle day. Thereafter the effect attenuates slightly, with a significant relative mortality gap between treated and non-treated.

The sub-experiments employed in the stack are unbalanced. Particularly in the more restrictive samples we only observe one pre and post period for many instances. To ensure that our effects are not driven by these compositional changes across the event-study effects we re-estimate the effects for a subsample of instances where we observe all three post periods (i.e., Event-time 0 to +2) in panel (b) of Figure 2. Although the magnitude of the effect is smaller for these instances we still see a significant fall in relative mortality among the treated groups.

Summary. The results presented in Table 1 suggest that soldiers responded to the death of a coregional NCO by taking less risk or exerting lower effort. In the context of WW1 infantry warfare, where high effort translates closely to death, relative group-level mortality is a proxy for the effort different cultural groups in the same regiment exert. This decline in effort suggests that soldiers exerted greater effort when they were commanded by a coregional NCO. In columns (5) through (8) we leverage traits of the NCO's to demonstrate that the effect is concentrated among officers that did not migrate, and that had distinctly regional names. This implies that the ease with which soldiers could identify their NCO as a coregional played an important role in their response. The particulars of our design, specifically the limited allocative capacity of NCOs, make a behavioural response on part of soldiers a more likely mechanism than discrimination/favouritism by the NCOs. Still, we cannot fully disentangle these channels, and how NCOs treated their coregional soldiers likely contributes to the effect we identify. The next section will further disentangle the effect by further exploring this mechanism.

6 Mechanism

The baseline results indicate that risk-taking (as a proxy for effort) fell considerably for soldiers when a coregional NCO died. We show that whether the NCO was identifiable as belonging to the same region is an important component of the mechanism that underlies this result. To further elucidate on the mechanism, we explore heterogeneity across several other dimensions.[23] Across the board, the pattern of the results support the relevance of shared cultural identity to soldier effort. They further suggest that several factors, from underlying motivation and organisational alignment to the exact conditions faced on the battlefield, help to drive our baseline findings.

Time. We start by looking at heterogeneity across time. Figure 3 plots βs from estimating Equation 5 for subsamples that correspond to quarters since the opening of hostilities on the western front (1st August 1914). We expect that our effect is prevalent in the earlier periods of the war. First, cultural identity was more relevant then. Initially, regiments were more often regionally organised, boosting the visibility of cultural differences. Second, as the war progressed, the experience of fighting alongside one another led to the creation of bonds that could far outweigh abstract ideas of cultural identity. Last, in earlier engagements soldiers had tangible expectations that their effort would translate to success. In the middle years of the war, which were characterised by artillery bombardment and in 1917 mass mutiny, this was no longer the case, and vertical alignment to NCOs was unlikely to move the needle in a meaningful manner.

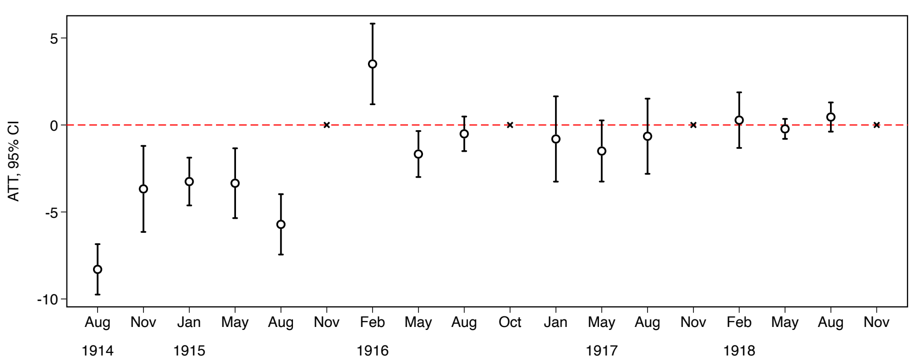


Figure 3: ATT by Quarter after August 1914.

Notes: The figure plots the coefficients from estimating Equation 5 for each quarter of the First World War after August 1914. The coefficients are estimated using the unrestricted sample (i.e. column (1) of Table 1). Bars indicate 95% confidence intervals calculated using clustered standard errors at the instance-group level.

This is exactly what we find. We see significant negative effects for 1914 and the first three quarters of 1915. In the quarter commencing February 1916, the sign of the effect reverses. This period encompasses the first months of the battle of Verdun which were characterised overwhelmingly by artillery bombardment Gay and Grosjean (2023). As such soldier's behaviour had limited bearing on their likelihood of death. One speculative explanation for this brief positive coefficient is that German artillery often hit the same area repeatedly, explaining the pattern we observe if coregionals

[23]We use the least restricted sample throughout (column (1) in Table 1) to ensure that differences are not driven by variation in power across sub-groups.

congregated in the same part of the trenches and fortifications at Verdun. In the next quarter is the last where we observe a significant effect. By May General Pétain had taken over command at Verdun, and the French situation started stabilising. Thereafter all other quarters are statistically indistinguishable from zero. The absence of any notable effect in the later parts of the war, when we would not expect to observe one, is an important validation of our baseline results.

6.1 Cultural Regions

Not all cultural regions are equal. Some have a stronger collective heritage and identity than others. Aside historical differences, variation in the strength of dialects and the degree of assimilation to the central "French" identity leads to significant heterogeneity across regions (Blanc and Kubo 2024). If the effect identified is driven by cultural identity we would expect heterogeneity across regions based on the strength of cultural identity. According to the theoretical framework the magnitude of the effort differential will depend on the perceived distance between soldiers and NCOs. Regions with stronger cultural identities should exhibit shorter perceived distances and larger effect sizes.

Table 2: Cultural Regions: Language

	$MORT_{igrt}$		
	Baseline	Linguistic Connectivity	Distance to French
	(1)	(2)	(3)
$DEATH^{NCO}_{ijr} \times 1 \times POST_t$	-3.923***	-3.448***	-4.168***
	(0.169)	(0.247)	(0.242)
$DiD \times T2^{LingConn}$		-0.844**	
		(0.374)	
$DiD \times T3^{LingConn}$		-1.305***	
		(0.495)	
$DiD \times T2^{LingDist}$			0.996**
			(0.388)
$DiD \times T3^{LingDist}$			-0.690
			(0.473)
Instances	12,059	11,887	11,887
Avg. Control Groups	4.63	4.66	4.66
Observations	339,818	313,542	313,542

Notes. Units of observation are regionregiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 13 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator equal to 1 for the 3 days after treatment at time k. Column 1 gives the baseline result from column 1 of Table 1. Column 2 reports the interaction of this DiD term with a quartile measure of linguistic diversity within a given cultural region (linguistic connectivity). Column 3 reports the interaction with a quartile measure of linguistic similarity to French. Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Linguistic Diversity. One way to operationalising the homogeneity of identity within any given region is to measure linguistic diversity. Areas that have greater internal diversity of language are culturally less homogenous.

To this end, we use data from Goebl et al. (2019) that contains pairwise linguistic distances for 577 municipalities in 1900 France. Linguistic distances are based on the *Atlas Linguistique de la France* which recorded variation in the spoken language across France.[24] We use all pairwise linguistic distances to create a graph network of the municipalities in each cultural region. To measure diversity we compute the algebraic connectivity (Fiedler eigenvalue) for each graph.[25] To obtain an index of connectivity that is comparable across regions, we standardise by mean node strength. Lower connectivity corresponds to more diversity since the linguistic graph across municipalities is more easily partitioned.

In more linguistically connected regions, we expect that soldiers from the treated group identify with their coregional NCO more readily. As such, the interaction of our treatment with a measure of linguistic connectivity serves to validate that we are identifying the effect of cultural ties; the effect should be concentrated in more connected regions. In column (3) of Table 2 we split the connectivity index into terciles and interact it with the treatment indicator. As expected we find that our effect is concentrated among the most linguistically connected regions. The magnitude of the effect is 37.8% for regions of the top tercile than the more diverse regions of the bottom tercile. This provides further validation that regional identity drives our effects.

Proximity to French. The degree of assimilation to the hegemonic national identity describes another important dimension of regional identity. We expect that the cultural identity mattered more to regions that are less assimilated.

To operationalise assimilation, we compute linguistic distance to modern French (Blanc and Kubo 2024). Linguistic distance to French is defined as the distance to the town of Le Plessis-Robinson just outside of Paris (Blanc and Kubo 2024). We compute a population weighted average across all municipalities per region.[26] Cultural regions that already assimilated – and were subsumed – by French national identity should have lower group status. Thus, soldiers belonging to these groups would react less strongly to the death of a coregional NCO.

We interact the treatment indicator with tercils of the distance measure. The results are reported in column (2) of Table 2. Instead of finding that the effect is smallest in the most linguistically distant regions we observe a u-shaped pattern. The effect is smallest in medium distant regions, while it is statistically indistinguishable for the regions linguistically closest and furthest from modern French. One explanation for this unexpected pattern is that regions closest to French, and hence closest to the hegemonic identity group, enjoy greater group status and thus experience a larger treatment effect. Simultaneously the regions linguistically furthest away have strong and more distinctive regional culture. The regions already semi-assimilated into French identity, that no longer have an as distinct identity, but do not enjoy the high status of the hegemonic group, see a smaller treatment effect.

[24] In contrast to Blanc and Kubo (2024) who use a shorter list of words to calculate linguistic distances, the Salzburg Team use the full corpus and derive their distance measures from a mixed qualitative–quantitative method. They make available two similarity measures; "RIW" and "GIW". We use the "GIW" since it places greater weight on differences in unique words.

[25] Algebraic connectivity is given by the second-smallest eigenvalue of the Laplacian Matrix.

[26] To population weight we take the 1911 population within 20 km of the municipality in the atlas.

6.2 Regiments

In-Groups. Our theoretical framework predicts that effects vary across different types of regiments and soldiers. Not all groups in a regiment enjoyed the same position. Most regiments were recruited and garrisoned regionally, meaning that one cultural region enjoyed the status of an in-group. Heterogeneity along this dimension is ambiguous. Belonging to the in-group increases group status, potentially increasing the effect a coregional NCO has. Simultaneously, coregional NCOs are more common for the in-group and hence their loss (and presence) was maybe less relevant to effort. To explore this dimension we complement our data with information on the location of recruitment bureaus from Cagé et al. (2023) and garrison locations that we extracted from military history sites.[27] We code a regional group as an in-group if the recruitment bureau or garrison location of that regiment was located in the region. To explore how the effect varies along this dimension we interact the treatment indicator with a indicator variable equal to one if the group is the regimental in-group.

Table 3: In vs Out-group

	$MORT_{igrt}$		$MORT_{igrt}(Z)$	
	(1)	(2)	(3)	(4)
$DEATH^{NCO}_{ijr} \times 1\{g_j = g\} \times POST_t$	-1.333***	-1.843***	-0.148***	-0.193***
	(0.113)	(0.119)	(0.011)	(0.011)
$DiD \times IN^{Garrison}$	-11.239***		-0.546***	
	(0.611)		(0.022)	
$DiD \times IN^{Recruitment}$		-9.513***		-0.369***
		(0.636)		(0.022)
Instances	12,059	12,059	12,059	12,059
Avg. Control Groups	4.63	4.63	4.63	4.63
Observations	339,818	339,818	339,818	339,818

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-4 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. The unrestricted sample, shown in column 1 of Table 1 is used throughout this table. Columns 1-2 use the absolute number of deaths as the outcome, whereas columns 3-4 use the standardised number for region-regiment groups. The odd columns interact our DiD term with a binary variable for the regiment's garrison location being within the region. The even columns do the same, but the binary variable is for the regiment's recruitment bureau being within the region. Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results in columns (1) and (2) of Table 3 suggest that the effect is concentrated among regimental in-groups due to their higher group status. When we introduce the the interaction terms the coefficient for the treatment indicator attenuates for both garrison location and bureau location and both interaction terms are negative. To ensure that this pattern is not driven by different group sizes (i.e., the in-group being significantly larger) we standardise deaths at the group level in columns (3) and (4) to reveal the same pattern. Together, these results suggest that the status of the regional groups soldiers belong to mattered more than their expectation that the replacement officer would come from the same regiment.

[27] We take data on regiment garrisons from a privately maintained French website (`http://www.chtimiste.com/`) that compiles and republishes digitized First World War regimental histories.

Organisational Alignment. So far we assume that soldiers identify with their cultural region, while exploring how variation in the group status, and perceived distance to the group, altered the effect. Endogenous identity choice predicts that soldiers can select into different identities if these yield higher utility. For example, if identifying with the organisation – i.e. the army or their specific regiment – has a greater utility soldiers might stop identifying with their cultural group. If this were the case the loss of a coregional officer should no longer affect relative group-level mortality. We already alluded to this mechanism when discussing time heterogeneity in Figure 3. As the war progressed the perceived distance between comrades shrank and identifying with ones fellow soldiers starts yielding greater utility than holding onto regional identity. Of course identity choice is not binary, with all individuals holding multiple layers of identity. Still, as the relative weights soldiers place on these identities shift the effect of losing a coregional NCO should change.

While heterogeneity by time is solely suggestive, heterogeneity across different types of regiment is a stronger empirical test of this proposition. Infantry regiments varied significantly in their skill and training. There was substantial variation in the professionalism across the broader organisation. More specialised units (1) enjoyed more training, (2) were more highly regarded, and (3) filled with more ambitious and motivated recruits. Together these factors make it more likely that soldiers identified with their regiment/battalion. Longer and more intense training serves to build a shared identity and reduce the perceived distance between soldiers. Higher external regard increases the group status among these units. And selection leads to these units being composed of soldiers who are more aligned with the organisation *a priori*.

Table 4: Organisational Alignment

	$MORT_{igrt}$	
	(1)	(2)
$DEATH^{NCO}_{ijr} \times 1\{g_j = g\} \times POST_t$	-3.923***	-3.994***
	(0.169)	(0.209)
$DiD \times$ Chausseur		2.178***
		(0.368)
$DiD \times$ Regular Reserve		-0.563
		(0.429)
$DiD \times$ Chausseur Reserve		0.631
		(0.974)
Instances	12,059	12,059
Avg. Control Groups	4.63	4.63
Observations	339,818	339,818

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-2 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. The unrestricted sample, shown in column 1 of Table 1 is used throughout this table and our baseline result using the specification is given in column 1 of this table. In column 2 we interact our DiD term with three binary variables for a regiment's professionalism (Chausseur, Regular Reserve and Chausseur Reserve), in order to measure whether organisational alignment affects our results. Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As such, we can exploit the distinctions between regiments across our dataset to consider how initial organisational alignment alters the effect. We expect that soldiers in higher status/training units will be more invested in a collective military identity that can substitute for regionalism. Thus, the effect of loosing a coregional NCO should be smaller, or insignificant, among these units. We interact the treatment indicator with indicator variables for different regimental types. We present the results in Table 4. The effect is significantly smaller (-1.816 vs -3.994) among Chausseurs battalions – more specialised and trained light infantry units – than in the reference category which is the regular line infantry. We fail to find any statistically significant difference between regular and reserve regiments. None the less the magnitude and direction of the marginally insignificant coefficient for the regular infantry reserves is consistent with units that were less recently trained relying more on regional identity. The same pattern is observed between Chausseurs battalions and there reserves. The effect for the less trained reserves is significantly larger (-3.363 vs -1.816) and not statistically different from the reference group (p-value = 0.517).

Summary. In our baseline we find a causal relationship between soldiers relative mortality and the death of an (non-commissioned) officer from the same cultural region. We show that this is driven by the shared regional identity between that officer and soldiers. In this section we probe further how the different regimental structures of the French army, across different regiments and time, alter this baseline. This allows us much greater clarity on where identity was important, and also helps validate the motivation-based interpretation of our results.

7 Robustness

In our final empirical exercise we probe the robustness of our baseline results. In particular we focus on several design choices we make in our empirical strategy. We find that – while we may see minor changes to the magnitude – the direction and interpretation of our main effect persists hold under a host of re-specifications. This confirms the strength of the regional identity effect.

Alternative Linguistic Regions. Our cultural regions (shown in Figure 1), are calculated through surnames and provide a compelling contiguous map of cultural areas across France. However, we must ensure that our results are not an artefact of the specific way we construct culture geographically. At first, we interrogate this by reconstructing our regions based on linguistic similarities rather than naming patterns. We do this using aforementioned data from Blanc and Kubo (2024). Using these alternative regions, which share high overlap (see Figure A4), we replicate our baseline results. This is shown in Table A3. The results are almost identical in all columns. That the results are similar in either approach assuages any concern that our results are an artefact of a specific construction of regional identity, and the similarity between name and linguistic regions supports our conceptualisation of culture.

Different Officers. Throughout our analysis we focus on NCO deaths. This is central to our identification approach, as these officers (in battle) would not have had allocative capacity. Here, we consider the effects of officer deaths further up the hierarchy. We reconstruct our stack so that treatment events occur when an officer dies from these ranks, and run the specification from column (2) in Table 1 for each rank separately. The results are shown in Table A4. For officers who have substantive allocative capacities (the first four columns) we find different effects (in magnitude and direction) to our baseline finding. In column (5) squad leaders, who are NCO's, report a similar coefficient to our baseline.

Battle Periods. Our analysis so far assigns an arbitrary battle threshold of 30 regimental deaths per day for our preferred specifications in Table 1. We do this based on the importance of isolating intense battle to our identification strategy. However, relaxing this threshold offers us the chance to illustrate two important points: (1) our results are not sensitive immediately on either side of the threshold, (2) when we allow too many non-battle periods into our sample (by lowering the threshold) our identification starts to break down. If either of these prove to be untrue, it undermines our identification strategy. The results are shown in Table A5. To focus on (1) initially, using either 25 or 35 deaths does not change our conclusions. On (2), when using low mortality days we observe substantial positive pre-trends; given the context this likely reflects a form of reverse favouritism whereby in non-battle periods soldiers from the same region were placed in positions that led to higher relative mortality. This makes clear the importance of our restrictions.

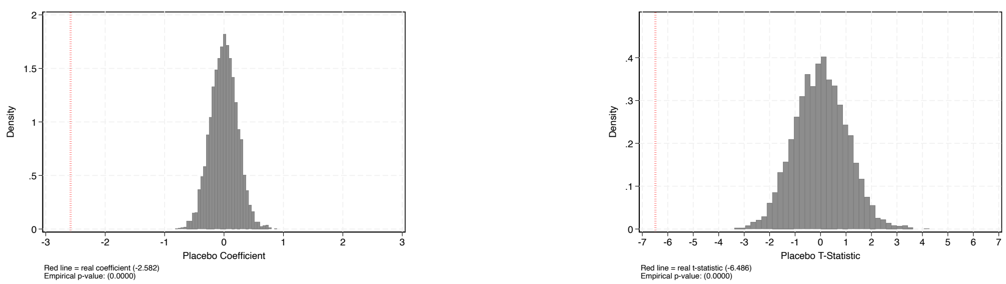
Calendar Window. A further sensitivity check on our design is to change the calendar window we draw our battledays from. For our preferred specifications, we allow battledays (over 30 deaths across the regiment) which occur within 10 actual days of the event. This is important to make sure we pick up on short term changes in mortality, as the further in time we span from our treatment the less certain we become this is a causal response. Yet, small changes to this actual day threshold should have minimal implications, so we allow it to vary between 6 and 14. The results are shown in Table A6. All effects are qualitatively similar, suggesting the results are not sensitive to the specific choice of calendar window.

Clustering. Throughout the paper, we cluster at the instance-group level. This is the unit at which treatment occurs precisely, but we also check that the results hold when clustering at the regiment level or using two-way clustering for region and regiment. These are both incredibly conservative approaches that are not advisable, but consistency under such a strong restriction is nonetheless reassuring. We replicate the baseline results (for all three specifications in Table 1) but with both adjustments to the standard errors. The results are given in Table A7. There are no changes.

Composition. We take several steps to ensure that our results are not driven by compositional change – (1) the fixed effect structure, (2) limited estimation window, (3) group inclusion restriction and (4) a sample adjustment in Figure 2. Although these should be sufficient, we also can adopt a more direct approach and control for composition by including lagged quarterly mortality shares.

We control for either the first or second lag while replicating our baseline results (for all three specifications in Table 1). These quarters are mostly time-invariant, so we interact the lag with the battleday within each cohort. This is restrictive, but it allows us to account for the role of compositional change fully, as well as checking our results are not driven by the size of our treated units. The results are given in Table A8. We find no substantive change.

Randomisation Inference. Last we check that our results could not be the product of chance through a randomisation inference procedure. We run our baseline, and then run a randomisation analysis 5,000 times within each treatment instance. We reassign a placebo treatment at random to one region-regiment group each instance, and then run the same analysis as column (2) in Table 1. This allows us to derive an empirical p-value. This p-value comes from the comparison between the baseline and the simulated counterparts, with the value giving the number of simulated versions that report (in absolute terms) a larger coefficient or test statistic. We compare both the coefficient and test statistic across our simulations, with the later being a more sophisticated measure that factors both size (coefficient) and precision (standard error). The results are given in Figure 4. Our observed (or real) results are denoted with a red line. We do not observe any placebo coefficient or t-statistic that has an absolute value greater than our observed statistic.



(a) Histogram comparing baseline coefficient with ATT from 5,000 placebo treatment sequences.

(b) Histogram comparing baseline t-statistic with t-statistic from 5,000 placebo treatment sequences.

Figure 4: Randomisation Inference histograms.

Notes: The figure above contains two plots that use a randomisation analysis to confirm the strength of the baseline results. 5,000 random treatment placebos are assigned. We run our baseline analysis using each randomised sequences, giving us 5,000 simulated treatment effects that are 'noise'. In panel (a) we compare the simulated coefficients (given in a histogram) to the coefficient from our baseline (given by the red line). In panel (b) we compare the simulated t-statistics (given in a histogram) to the t-statistic we observe in our baseline (once again denoted by the red line).

8 Conclusion

Using a stacked difference-in-difference design with individual-level data from the French Army during World War I, we find that soldiers relative mortality declined when they lost vertical connection to officers from their shared cultural region. This effect persisted for several days of battle after treatment and was most pronounced among the regional group that was identified with the regiment (ingroup). Our empirical strategy, which exploits within-regiment variation in daily mortality between regional groups, combined with placebo tests, supports a causal interpretation of our results. We confirm that the behavioural response we observe is driven by cultural “identifiability” of officers. Heterogeneity analysis further supports a behavioural mechanism.

Identity serves as an associating principal to agents. In theory, it is likely that side-lining questions of identity when designing organisational structure is likely detrimental to organisational performance (Besley and Ghatak 2005). However, our understanding of identity’s effects through hierarchy (rather than horizontally) are limited by identification issues. Namely, managers (principals) allocate. Allocation prevents a pure social connection effect for being identified vertically (Ashraf and Bandiera 2018). Our setting allows us, in extreme battle periods, to overcome this difficulty. We find that vertical connection affected risk-taking, and thus effort, and that the loss drove a sharp behavioural response amongst soldiers. As such, we causally demonstrate the intuitive idea that the identity of officers (principals) affect the behaviour to soldiers (agents), irrespective of their capacity in that role. Who, as well as how, they are matters to the organisation.

References

AGER, P., BURSZTYN, L., LEUCHT, L., and VOTH, H.-J. (2021). "Killer Incentives: Rivalry, Performance and Risk-Taking among German Fighter Pilots, 193945". *The Review of Economic Studies* 89, pp. 2257–2292.

AKERLOF, G. A. and KRANTON, R. E. (2010). *Identity Economics: How Our Identities Shape Our Work, Wages, and Well-Being*. Princeton University Press.

ALSAN, M., GARRICK, O., and GRAZIANI, G. (2019). "Does Diversity Matter for Health? Experimental Evidence from Oakland". *American Economic Review* 109.12, pp. 4071–4111.

ANDERSON, B. (1991). *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Verso.

ASHRAF, N. and BANDIERA, O. (2018). "Social Incentives in Organizations". *Annual Review of Economics* 10.Volume 10, 2018, pp. 439–463.

ASSOUAD, L. (2025). "Leadership and NationBuilding". Working Paper.

BAGUES, M. and ROTH, C. (2023). "Interregional Contact and the Formation of a Shared Identity". *American Economic Journal: Economic Policy* 15.3, pp. 322–50.

BAILEY, R. E., HATTON, T. J., and INWOOD, K. (2023). "Surviving the Deluge: British servicemen in World War I". *Economics & Human Biology* 49, p. 101216.

BANDIERA, O., BARANKAY, I., and RASUL, I. (2005). "Social Preferences and the Response to Incentives: Evidence from Personnel Data". *The Quarterly Journal of Economics* 120.3, pp. 917–962.

BANDIERA, O., BARANKAY, I., and RASUL, I. (2009). "Social Connections and Incentives in the Workplace: Evidence from Personnel Data". *Econometrica* 77.4, pp. 1047–1094.

BANDIERA, O., BARANKAY, I., and RASUL, I. (2010). "Social Incentives in the Workplace". *The Review of Economic Studies* 77.2, pp. 417–458.

BARBER, B. and MILLER, C. (2019). "Propaganda and Combat Motivation: Radio Broadcasts and German Soldiers Performance in World War II". *World Politics* 71.3, pp. 457–502.

BARTHAS, L. (2014). *Poilu: The World War I Notebooks of Corporal Louis Barthas, Barrelmaker, 1914–1918*. Trans. by STRAUSS, E. M. New Haven: Yale University Press.

BEEVOR, A. (1998). *Stalingrad*. 1st American. New York: Viking.

BERTRAND, M. and SCHOAR, A. (2003). "Managing with Style: The Effect of Managers on Firm Policies". *The Quarterly Journal of Economics* 118.4, pp. 1169–1208.

BESLEY, T. and GHATAK, M. (2005). "Competition and Incentives with Motivated Agents". *American Economic Review* 95.3, pp. 616–636.

BEST, M. C., HJORT, J., and SZAKONYI, D. (2023). "Individuals and Organizations as Sources of State Effectiveness". *American Economic Review* 113.8, pp. 2121–67.

BLANC, G. and KUBO, M. (Jan. 2024). *French*. Tech. rep. The University of Manchester.

BLOOM, N., EIFERT, B., MAHAJAN, A., MCKENZIE, D., and ROBERTS, J. (2013). "Does Management Matter? Evidence from India". *The Quarterly Journal of Economics* 128.1, pp. 1–51.

BLOOM, N. and REENEN, J. V. (2007). "Measuring and Explaining Management Practices across Firms and Countries". *The Quarterly Journal of Economics* 122.4, pp. 1351–1408.

BORUSYAK, K. and HULL, P. (2024). “Negative Weights Are No Concern in Design-Based Specifications”. *AEA Papers and Proceedings* 114, pp. 597–600.

BOULANGER, P. (2002). “The 1914 conscripts: contribution of the French youth in forming a mass army”. *Annales de Démographie Historique* 103.1, pp. 11–34.

BRACKEN, J. (2018). *The Verdun Regiment: Into the Furnace: The 151st Infantry Regiment in the Battle of Verdun 1916*. Barnsley, UK: Pen & Sword Military.

BURSZTYN, L., RAWCLIFFE, E., and VOTH, H.-J. (2026). *Never Enough: Dynamic Status Incentives in Organizations*. NBER Working Paper 34707. National Bureau of Economic Research.

CAGÉ, J., DAGORRET, A., GROSJEAN, P., and JHA, S. (2023). “Heroes and Villains: The Effects of Heroism on Autocratic Values and Nazi Collaboration in France”. *American Economic Review* 113.7, pp. 1888–1932.

CHICKERING, R. and FÖRSTER, S. (2006). *Great War, total war: combat and mobilization on the Western Front, 1914-1918*. Vol. Publications of the German Historical Institute. New York: German Historical Institute.

CLARK, C. (2013). *The Sleepwalkers: How Europe Went to War in 1914*. London: Harper.

COSTA, D. L. and KAHN, M. E. (2003). “Cowards and Heroes: Group Loyalty in the American Civil War”. *The Quarterly Journal of Economics* 118.2, pp. 519–548.

DAY, J. (2023). “Mapping the cultural divides of England and Wales: Did the geographies of Belonging act as a brake on British Urbanisation, 18511911?” *PLOS ONE* 18.5.

DEHDARI, S. H. and GEHRING, K. (2022). “The Origins of Common Identity: Evidence from Alsace-Lorraine”. *American Economic Journal: Applied Economics* 14.1, pp. 261–92.

DESERRANNO, E., CARIA, A. S., KASTRAU, P., and LEÓN-CILIOTTA, G. (2025). “The Allocation of Incentives in Multilayered Organizations: Evidence from a Community Health Program in Sierra Leone”. *Journal of Political Economy. Forthcoming*.

DIPPEL, C. and HEBLICH, S. (2021). “Leadership in Social Movements: Evidence from the "Forty-Eighters" in the Civil War”. *American Economic Review* 111.2, pp. 472–505.

DOUGHTY, R. A. (2005). *Pyrrhic Victory: French Strategy and Operations in the Great War*. Harvard University Press.

DU PICQ, A. (1921). *Battle Studies: Ancient and Modern Battle*. Trans. by GREELY, J. N. and COTTON, R. C. Translated from the eighth edition in the French. New York: Macmillan.

FENIZIA, A. (2022). “Managers and Productivity in the Public Sector”. *Econometrica* 90.3, pp. 1063–1084.

FERRARA, A., DIPPEL, C., and HEBLICH, S. (July 2025). *Frontline Leadership: Evidence from American Civil War Captains*. Working Paper 34057. National Bureau of Economic Research.

FETZER, T. (2019). “Did Austerity Cause Brexit?” *American Economic Review* 109.11, pp. 3849–86.

FOUKA, V. and SERLIN, T. (Nov. 2024). *Industry and Identity: The Migration Linkage Between Economic and Cultural Change in 19th Century Britain*. Working Paper No. 33114. National Bureau of Economic Research.

FRYER ROLAND G., J. and LEVITT, S. D. (2004). “The Causes and Consequences of Distinctively Black Names*”. *The Quarterly Journal of Economics* 119.3, pp. 767–805.

FUNKE, M., SCHULARICK, M., and TREBESCH, C. (2023). “Populist Leaders and the Economy”. *American Economic Review* 113.12, pp. 3249–88.

GAY, V. and GROSJEAN, P. (2023). “Morts Pour la France: A database of French fatalities of the Great War”. *Explorations in Economic History* 90.

GHOSH, A. (2025). “Religious Divisions and Production Technology: Experimental Evidence from India”. *Journal of Political Economy*. Forthcoming.

GOEBL, H., HAIMERL, E., SMEKA, P., CASTELLAZZI, B., and SCHERRER, Y. (2019). *Dialectometry ALF*. https://www.dialektkarten.ch/dmviewer/alf/index.en.html. Retrieved December 13, 2021.

GOODMAN-BACON, A. (2021). “Difference-in-differences with variation in treatment timing”. *Journal of Econometrics* 225.2, pp. 254–277.

GOYA, M., UFFINDELL, A., and STRACHAN, H. (2018). *Flesh and Steel During the Great War: The Transformation of the French Army and the Invention of Modern Warfare*. Pen & Sword Books.

GREENHALGH, E. (2014). *The French Army and the First World War*. Armies of the Great War. Cambridge University Press.

GUILLOT, O. and PARENT, A. (2024). “On Vient de Fusiller un des Nôtres: A Quantitative Study of Military Executions in the French Army during WW1”. *Defence and Peace Economics* 35.1, pp. 128–144.

HART, P. (2013). *The Great War: A Combat History of the First World War*. New York: Oxford University Press, p. 522.

HJORT, J. (2014). “Ethnic Divisions and Production in Firms”. *The Quarterly Journal of Economics* 129.4, pp. 1899–1946.

HOLMSTRÖM, B. (1982). “Moral Hazard in Teams”. *The Bell Journal of Economics* 13.2, pp. 324–340.

HUGHES, M. J. (2012). *Forging Napoleon’s Grande Arme: Motivation, Military Culture, and Masculinity in the French Army, 1800-1808*. NYU Press.

HUNING, T. R. and WAHL, F. (2023). *Does Regional Identity Guide Investments? Evidence from German License Plates*. CEPR Discussion Paper 18074. Centre for Economic Policy Research (CEPR).

JOHN, C. R., WATSON, D., BARNES, M. R., PITZALIS, C., and LEWIS, M. J. (2020). “Spectrum: fast density-aware spectral clustering for single and multi-omic data”. *Bioinformatics* 36.4, pp. 1159–1166.

JONES, B. F. and OLKEN, B. A. (2005). “Do Leaders Matter? National Leadership and Growth Since World War II*”. *The Quarterly Journal of Economics* 120.3, pp. 835–864.

KANDT, J., CHESHIRE, J. A., and LONGLEY, P. A. (2016). “Regional Surnames and Genetic Structure in Great Britain”. *Transactions of the Institute of British Geographers* 41.4, pp. 554–569.

LAFFARGUE, A. (1916). *The Attack in Trench Warfare: Impressions and Reflections of a Company Commander*. Washington: United States Infantry Association.

LAFON, A. (2015). “Comradeship (France)”. *1914-1918-online. International Encyclopedia of the First World War*. Ed. by DANIEL, U., GATRELL, P., JANZ, O., JONES, H., KEENE, J., KRAMER, A., and NASSON, B.

LAZEAR, E. P. (2018). "Compensation and Incentives in the Workplace". *Journal of Economic Perspectives* 32.3, pp. 195–214.

MARX, B., PONS, V., and SURI, T. (2021). "Diversity and team performance in a Kenyan organization". *Journal of Public Economics* 197.

MAS, A. and MORETTI, E. (2009). "Peers at Work". *American Economic Review* 99.1, pp. 112–45.

MCMAHON, C. J. and BERNARD, C. J. (2019). "Storm Cloud on the Horizon: Challenges and Recommendations for Military Recruiting and Retention". *Naval War College Review* 72.3, pp. 84–100.

OTTINGER, S. and VOIGTLÄNDER, N. (2025). "History's Masters The Effect of European Monarchs on State Performance". *Econometrica* 93.1, pp. 95–128.

PLATO (2008). *Symposium*. Trans. by JOWETT, B. Oxford University Press.

RODRÍGUEZ-POSE, A., TERRERO-DÁVILA, J., and LEE, N. (2023). "Left-behind versus unequal places: Interpersonal inequality, economic decline and the rise of populism in the USA and Europe". *Journal of Economic Geography* 23.5, pp. 951–977.

RONCONI, J. P. and RAMOS-TORO, D. (Oct. 14, 2025). "Nation-Building Through Military Service". Working paper.

ROZENAS, A., TALIBOVA, R., and ZHUKOV, Y. M. (2024). "Fighting for Tyranny: State Repression and Combat Motivation". *American Economic Journal: Applied Economics* 16.3, pp. 44–75.

SHAYO, M. (2009). "A Model of Social Identity with an Application to Political Economy: Nation, Class, and Redistribution". *American Political Science Review* 103.2, pp. 147–174.

SHAYO, M. (2020). "Social Identity and Economic Policy". *Annual Review of Economics* 12, pp. 355–389.

SMITH, L. V. (2007). *The Embattled Self: French Soldiers' Testimony of the Great War*. Cornell University Press.

TAJFEL, H. and TURNER, J. C. (1986). "The Social Identity Theory of Intergroup Behavior". *Political Psychology: Key Readings*. Ed. by JOST, J. T. and SIDANIUS, J. 1st. Key Readings in Social Psychology. New York: Psychology Press, pp. 276–293.

TILLY, C. (1992). *Coercion, capital, and European states, AD 990-1992*. Cambridge, MA.

VON CLAUSEWITZ, C. (1976). *On War*. Ed. by HOWARD, M. and PARET, P. Princeton: Princeton University Press.

VOTH, J. and XU, G. (2021). "Discretion and Destruction: Promotions, Performance, and Patronage in the Royal Navy". Mimeo.

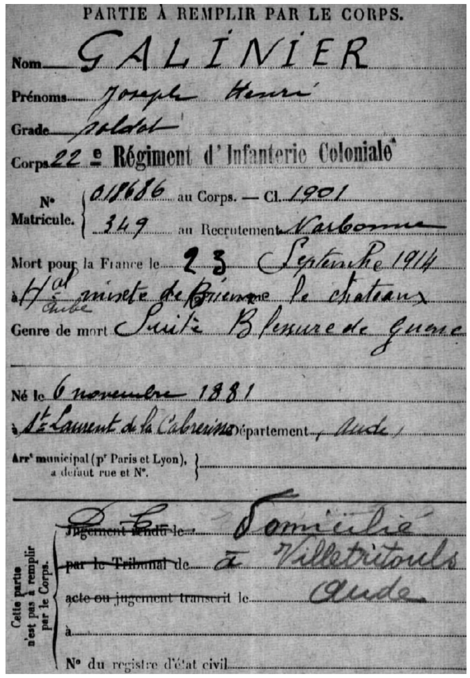
WEBER, E. (1976). *Peasants into Frenchmen: The Modernization of Rural France, 1870–1914*. Stanford, Calif.: Stanford University Press.

WRZESNIEWSKI, A., SCHWARTZ, B., CONG, X., KANE, M., OMAR, A., and KOLDITZ, T. (2014). "Multiple types of motives don't multiply the motivation of West Point cadets". *Proceedings of the National Academy of Sciences of the United States of America* 111.30, pp. 10990–10995.

XU, G. (2018). "The Costs of Patronage: Evidence from the British Empire". *American Economic Review* 108, pp. 3170–3198.

XU, G. (2023). "Bureaucratic Representation and State Responsiveness during Times of Crisis: The 1918 Pandemic in India". *The Review of Economics and Statistics* 105, pp. 482–491.

A Additional Figures and Tables


PARTIE À REMPLIR PAR LE CORPS.

Nom GALINIER

Prénoms Joseph Henri

Grade soldat

Corps 22e Régiment d'Infanterie Coloniale

N° Matricule. 018686 au Corps. — Cl. 1901

349 au Recrutement Narbonne

Mort pour la France le 23 Septembre 1914

à Hôpital mixte de Brienne le chateau Aube

Genre de mort Suite Blessure de guerre

Né le 6 novembre 1881

à St Laurent de la Cabrerisse Département Aude

Arr' municipal (p' Paris et Lyon), à défaut rue et N°.

Cette partie n'est pas à remplir par le Corps.

~~Jugement rendu~~ le Domicilié

~~par le Tribunal~~ de à Villetritouls

~~acte ou jugement transcrit~~ le Aude

à

N° du registre d'état civil

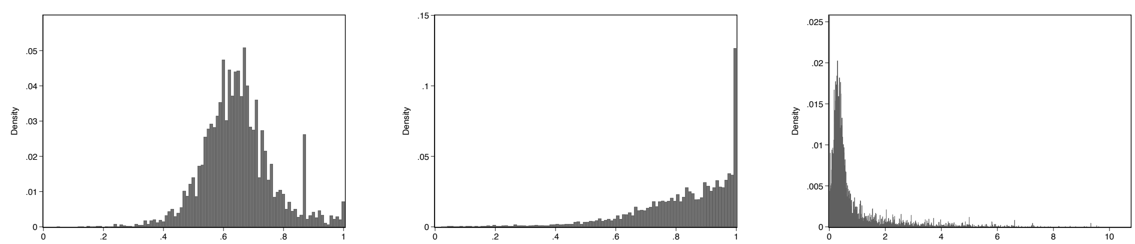
Figure A1: Example of *Mort pour la France* record, (Gay & Grosjean 2023)

(a) Cavalry – 1914

(b) Tank – 1918

Figure A2: Changing Nature of War

Notes: The left panel depicts the British cavalry at Nery, 1 September 1914. (Source: National Army Museum, https://collection.nam.ac.uk/detail.php?acc=2006-09-31-2). The right panel depicts a Whippet tank, 1918. (Source: National Army Museum, https://collection.nam.ac.uk/detail.php?acc=1995-03-84-10)



(a) Distribution of RNI (first names)

(b) Distribution of RNI (last names)

(c) Distribution of migratory distance

Figure A3: Officer Characteristics

Notes: All three panels are histograms that plot the distributions of deceased officer characteristics used in Table 1. The left panel gives the distribution of our regional naming index for first names. The middle gives the distribution of this naming index but for last names. The right panel gives the distribution of migratory distance, given in hundreds of kilometers.

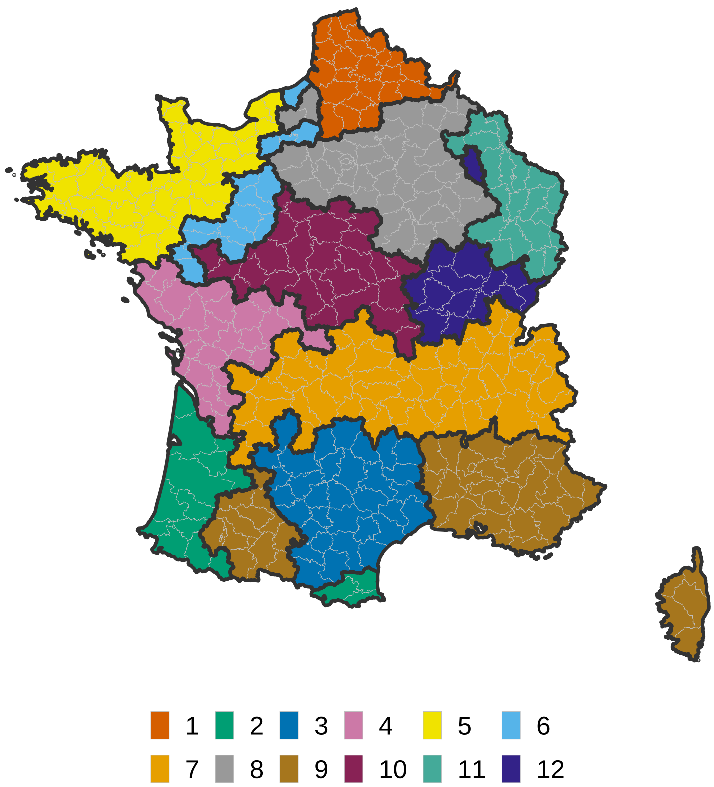


Figure A4: Cultural Regions Linguistic

Table A1: Cultural Regions Validation

	Absolute Standardised Difference				
	Huguenots per capita (1)	Refractory Clergy (2)	Literacy Rate (1786–90) (3)	School Enrolment (1937) (4)	Summer School Attendance (5)
$1\{SameRegion\}$	-0.161***	-0.296***	-0.489***	-0.449***	-0.059***
	(0.017)	(0.011)	(0.013)	(0.012)	(0.012)
$1\{SameDepartment\}$	-0.454***	-0.942***	-0.803***	-0.807***	-0.937***
	(0.050)	(0.035)	(0.038)	(0.036)	(0.038)
Constant	0.588***	1.190***	1.209***	1.183***	0.986***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Arrondissement	361	361	361	361	361
Dyads	59,685	60,726	54,285	59,685	60,726

	Absolute Standardised Difference				
	Temperature (6)	Wheat Suitability (7)	Fertility (Princeton Index) (8)	Distance (km) (9)	Language Similarity (10)
$1\{SameRegion\}$	-0.292***	-0.268***	-0.309***	-271.677***	18.725***
	(0.011)	(0.013)	(0.011)	(2.515)	(0.202)
$1\{SameDepartment\}$	-0.795***	-0.874***	-0.847***	-199.492***	16.596***
	(0.034)	(0.038)	(0.035)	(7.597)	(0.619)
Constant	1.040***	1.098***	1.107***	427.395***	27.830***
	(0.003)	(0.004)	(0.004)	(0.769)	(0.061)
Arrondissement	361	361	361	361	361
Dyads	59,685	55,945	60,726	60,726	65,341

Notes. Absolute standardised differences from dyadic regressions. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Predicting treatment using lagged mortality

	$NCODeath_{igrt}$			
	(1)	(2)	(3)	(4)
	L.1	L.2	L.3	L.1-3
$L1$.Mortality$_g$	0.021			0.021
	(0.014)			(0.014)
$L2$.Mortality$_g$		0.003		0.004
		(0.012)		(0.012)
$L3$.Mortality$_g$			-0.010	-0.009
			(0.012)	(0.012)
Instance $\times$ Group FEs	✓	✓	✓	✓
Instance $\times$ Battle Day FEs	✓	✓	✓	✓
Instances	5,509	5,509	5,509	5,509
Observations	75,134	75,134	75,134	75,134

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-4 contain the results of a stacked DiD regression estimated using OLS. We use lagged daily mortality to try and 'predict' our treatment instances (NCO death). The lags used are given in the title of the column as well as the row titles.

Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Baseline using linguistic regions

	$MORT_{igrt}$						
	Baseline			Migration		Name	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$DEATH^{NCO}_{ijr} \times 1\{g_j = g\} \times POST_t$	-3.960***	-2.567***	-2.307***	-3.045***	-3.095***	2.759	0.907
	(0.158)	(0.385)	(0.394)	(0.461)	(0.481)	(1.840)	(1.222)
$DiD \times 1\{\text{Migrant}\}$				2.299***			
				(0.746)			
$DiD \times$ Migration Distance					0.619***		
					(0.161)		
$DiD \times RNI^{FIRST}_j$						-8.026***	
						(2.917)	
$DiD \times RNI^{LAST}_j$							-4.109***
							(1.481)
Sample Construction							
Control	✓	✓	✓	✓	✓	✓	✓
Window		✓	✓	✓	✓	✓	✓
Treatment			✓				
Fixed Effects							
Instance × Group	✓	✓	✓	✓	✓	✓	✓
Instance × Battle-day	✓	✓	✓	✓	✓	✓	✓
Statistics							
Instances	12,100	5,633	5,316	5,620	5,620	5,633	5,633
Avg. Control Groups	4.85	5.40	5.37	5.40	5.40	5.40	5.40
Observations	353,642	80,099	74,843	79,923	79,923	80,099	80,099

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-7 contain the results of several stacked DiD regressions estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. This table replicates the baseline regressions from Table 1, but constructing cultural regions using linguistic similarity rather than naming patterns. Each of the first three columns uses a different underlying sample, with the checkmarks in the table denoting the sample restrictions used. In columns 4-7 we exploit heterogeneity in the treatment effect using the sample from column 2. We interact our treatment with the characteristics of the deceased officer. Columns 4-5 look at whether the deceased officer was a migrant, and how far they had migrated. Columns 6-7 look at the district 'regionality' of their first or last name.
Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: Baseline with different ranked officers

	$MORT_{igrt}$				
	(1)	(2)	(3)	(4)	(5)
Commander of:	Regiment	Battalion	Company	Section	Squad
$DEATH_{ijr}^{Officer} \times 1\{g_j = g\} \times POST_t$	17.907	20.567	3.175**	0.211	-2.617***
	(15.548)	(18.782)	(1.568)	(0.605)	(0.428)
Instance × Group FEs	✓	✓	✓	✓	✓
Instance × Battle Day FEs	✓	✓	✓	✓	✓
Instances	13	33	752	2,971	5,190
Observations	228	752	14,547	49,398	73,015

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-5 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. We use the specification from column 2 of Table 1, which imposes a battle and calendar restriction on our dataset. We restructure our stack so that treatment events are the death of an officer from other ranks than the NCO's we focus upon in our baseline. The rank for officers used as a treatment event is given in the column heading.
Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Baseline across different thresholds

	$MORT_{igrt}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Death threshold:	10	15	25	30	35	45	50
$DEATH_{ijr}^{NCO} \times 1\{g_j = g\} \times POST_t$	-1.745***	-1.999***	-2.412***	-2.582***	-2.812***	-2.720***	-2.834***
	(0.145)	(0.197)	(0.318)	(0.398)	(0.492)	(0.728)	(0.811)
Instance × Group FEs	✓	✓	✓	✓	✓	✓	✓
Instance × Battle Day FEs	✓	✓	✓	✓	✓	✓	✓
Joint p-val (pre)	0.000	0.004	0.800	0.905	0.858	0.144	0.085
Instance	19,297	13,574	7,287	5,509	4,196	2,512	2,006
Observations	395,985	238,230	106,317	75,134	54,651	31,056	23,457

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (in the baseline 30 deaths). Columns 1-7 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. We use the specification from column 2 of Table 1, which imposes a battle and calendar restriction on our dataset. For each column we do change the sample to a new threshold for a battleday (defined by number of deaths across the unit in that day), to probe the integrity of our results. The threshold is given in the title of the column.
Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: Baseline with varied calendar window thresholds

	$MORT_{igrt}$				
	(1)	(2)	(3)	(4)	(5)
Day threshold:	6	8	10	12	14
$DEATH^{NCO}_{ijr} \times 1\{g_j = g\} \times POST_t$	-2.114***	-2.400***	-2.582***	-2.937***	-2.921***
	(0.419)	(0.407)	(0.398)	(0.412)	(0.395)
Instance × Group FEs	✓	✓	✓	✓	✓
Instance × Battle Day FEs	✓	✓	✓	✓	✓
Joint p-val (pre)	0.760	0.352	0.905	0.912	0.947
Instances	4,925	5,292	5,509	5,770	5,998
Observations	64,570	70,662	75,134	80,083	84,818

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-5 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. We use the specification from column 2 of Table 1, which imposes a battle and calendar restriction on our dataset. For each column we do change the sample to a new threshold for the calendar window (defined by number of days after treatment a battleday can enter our sample), to probe the integrity of our results. The threshold is given in the title of the column.
Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: Baseline with alternative clustering

	$MORT_{igrt}$					
	Sample A		Sample B		Sample C	
	Regiment	Pairwise	Regiment	Pairwise	Regiment	Pairwise
	(1)	(2)	(3)	(4)	(5)	(6)
$DEATH^{NCO}_{ijr} \times 1\{g_j = g\} \times POST_t$	-3.923***	-3.923***	-2.582***	-2.582***	-2.688***	-2.688***
	(0.256)	(0.357)	(0.566)	(0.677)	(0.571)	(0.676)
Instance × Group FEs	✓	✓	✓	✓	✓	✓
Instance × Battle Day FEs	✓	✓	✓	✓	✓	✓
Instances	12,059	12,059	5,509	5,509	5,274	5,274
Observations	339,818	339,818	75,134	75,134	71,893	71,893

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-5 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. We use all three baseline specifications from Table 1, which are given Sample A (column 1), Sample B (column 2) and Sample C (column 3). In odd columns we cluster at the regiment, in even we use two way clustering at the regiment and region level. The level is given in the title of the column.
Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: Baseline controlling for lagged mortality shares

	$MORT_{igrt}$					
	Sample A		Sample B		Sample C	
	L.1	L.2	L.1	L.2	L.1	L.2
	(1)	(2)	(3)	(4)	(5)	(6)
$DEATH_{ijr}^{NCO} \times 1\{g_j = g\} \times POST_t$	-3.633***	-3.755***	-1.269***	-1.479***	-1.362***	-1.583***
	(0.159)	(0.161)	(0.402)	(0.397)	(0.405)	(0.400)
Instance × Group FEs	✓	✓	✓	✓	✓	✓
Instance × Battle Day FEs	✓	✓	✓	✓	✓	✓
Instances	12,059	12,059	5,509	5,509	5,274	5,274
Observations	339,818	339,818	75,134	75,134	71,893	71,893

Notes. Units of observation are region-regiment groups. Periods are defined as days of battle with a regimental death count above a cutoff (here 30 deaths). Columns 1-5 contain the results of a stacked DiD regression estimated using OLS. POST is defined as an indicator variable equal to 1 for the 3 days after treatment at time k. We use all three baseline specifications from Table 1, which are given Sample A (column 1), Sample B (column 2) and Sample C (column 3). In odd columns we control for the first lag of the quarterly mortality share of a region-regiment group (within the whole regiment), in even we control for the second lag. The lag is given in the title of the column. As these lags are almost always time invariant, we interact them with each individual battleday. Clustered standard errors in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.