



Morts pour la France: do demographic factors alone explain the regional disparities of the great war?

Henri Gilles, Jean-Pascal Guironnet, Antoine Parent

► To cite this version:

Henri Gilles, Jean-Pascal Guironnet, Antoine Parent. Morts pour la France: do demographic factors alone explain the regional disparities of the great war?. 2013. halshs-00860571

HAL Id: halshs-00860571

<https://shs.hal.science/halshs-00860571>

Preprint submitted on 12 Sep 2013

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

MORTS POUR LA FRANCE: DO DEMOGRAPHIC FACTORS ALONE EXPLAIN THE REGIONAL DISPARITIES OF THE GREAT WAR?

Henri Gilles, Jean-Pascal Guironnet,** and Antoine Parent****

Abstract: *This article delivers the first comprehensive analysis of the new database, 'Mémoire des hommes', which gathers more than 1 Million French soldiers officially recognized as dead for France during WW1. Crossing this source with the 1911 census, we evaluate the potential numbers of recruits by French regional department. From this, a model identifies the factors affecting the number of dead. While demographic factors are the principal determinants, adding economic, political and locally significant factors reduces the unexplained variance between regions and significantly improves the explanation of the disparity in the number of dead by region.*

JEL codes: N34, N44.

Keywords: War, Demography, Count Models, Cliometrics.

I. Introduction

For the authorities, the foremost problem of the Great War dead lay in responding to the expectations of the bereaved families. In their work *Nos morts: Les sociétés occidentales face aux tués de la guerre*, Luc Capdevila and Danièle Voldman aim to reconstruct how those killed and disappeared during the Great War were dealt with in material and memorial terms.

No action was taken to process the dead until the autumn of 1914. The directives of the military hierarchy were limited to the use of the 'pit' grave for the rank and file. The general rule of the health service while on campaign was to entrust the burial of dead soldiers to the troops, under the control of medical officers. The German offensive rendered these orders obsolete: French fighters were buried by the enemy randomly according to circumstances, in communal pits, in scattered

* Historian, email: h.gilles@wanadoo.fr.

** Université de Caen Basse-Normandie, CREM, 19 rue Claude Bloch, Campus 4, 14000 Caen, email: jean-pascal.guironnet@unicaen.fr.

*** IEP de Lyon, 14 avenue Berthelot, 69365 LYON Cedex 07 et LET UMR CNRS 5593; email: antoine.parent@sciencespo-lyon.fr, corresponding author.

graves, in cemeteries, without the necessary precautions for subsequent identification always having been taken.¹

The authors further report the following:

The burials of fighters brought back from the front were the occasion for the first, big, patriotic funerals at home, in the summer of 1914. It was urgent to legislate. In a circular of 19 November 1914, the chief military commander forbade the exhumation and transportation of bodies of soldiers killed by the enemy ... Faced with clandestine exhumations and transfers from that point onwards, the directive was repeated in 1915 ... Preoccupied by the mass of corpses and the risks of infection, the public authorities envisaged organizing a large-scale incineration of unidentified bodies. A legal proposition to this effect was voted on 18 June 1915. Emotions ran high among the population. The text was rejected by the Senate on 27 January 1916.²

A service called ‘from the battlefield’ (*du champ de bataille*) was initiated by the civil authorities on 19 July 1915. Its orders included to ‘stop the practice of communal pit graves, to group the bodies in such a way as to avoid scattered burial sites, to bury either in individual graves or in groups of ten (the bodies being placed side-by-side and not on top of one another)’.³ The use of the ‘battlefield notebook’ (*carnet du champ de bataille*) was also made obligatory for noting the exact location of burial sites, and it was recommended that a lead plaque with the number recorded in the notebook be fixed to every interred body, to allow for the identification of bodies in the event of subsequent exhumation.⁴ It was not until the adoption of the law of 31 July 1920, and the government decree of 28 September 1920, that repatriation to family graves and vaults could begin.

¹ Capdevila and Voldman, (2002), *Nos morts*, p. 7. All translations are the authors’ own.

² Ibid., pp. 78–9.

³ Ibid., p. 80.

⁴ Source: ‘Summary of the functioning of the inhumation service between 2 August 1914 and 10 January 1919’, Paris, 10 May 1919, National Archives, BB18-2607-1484 A 18, Ministry of War, under the office of State administration, General Pensions Service.

After the war, reclaiming the dead, particularly those who had not been identified, and bestowing suitable honours upon them, came to dominate the administrative channel between the military authorities and the families. Capdevilla and Voldman report that between ‘1921 and 1923, 240 thousand remains were exhumed and moved all around France to be returned to relatives’,⁵ and that ‘from 1926 to 1935, 122 thousand bodies without graves were found on the battlefields; as to the gigantic commemorative monuments, they house the bones of the unidentified dead who fell on the field of honour’.⁶

The question of memory thus was central to the treatment of war trauma. In this article, however, we focus on a different aspect of this memory: namely, the purely statistical dimension of losses by department. Curiously, French historians, and particularly those in the French tradition of the history of ideas,⁷ have put this issue to one side, or have broached the question of the total losses purely from the point of view of a critique of sources, emphasizing their inaccuracy and the difficulty of cross-checking. The treatment of the disappeared and the lack of marked graves in the first months of the war plays a central part in the contestation of official figures for the total number of dead. However, the quantitative history of the dead deserves a different treatment, and we here apply ourselves to an attempt to fill a gap in the literature with respect to the question: Do demographic factors alone explain the regional disparities in the deaths of the Great War?

In section II we present the database used to this end; in section III we set out the explanatory variables; in section IV we present the results of a principal component analysis (PCA) carried out with respect to the variables thus identified, and the econometric steps adopted; sections V and VI are devoted to presenting and discussing the results of the modelling (the demographic model alone, and then the demographic model widened to include geographic, socio-economic, and political variables); section VII seeks to identify

⁵ Capdevilla and Voldman, (2002), *Nos morts*, p. 89.

⁶ Ibid., pp. 87–8.

⁷ François Cochet, (2005), *Survivre au front*, provides a timely reminder that in France the contemporary debate has been particularly polemical between the historians Stéphane Audoin-Rouzeau and Frédéric Rousseau, and has sets the thesis of ‘consent’ in opposition to that of ‘constraint’. The debate concerns the question of whether it was patriotism or constraint that enabled soldiers to cope with conditions in the trenches.

possible variables hidden in the residual part not explained by our model; and the final section concludes.

II. The Database “Mémoire des hommes”: a new database recording more than one million soldiers officially recognized as “Died for France”

This article takes a new approach to the use of the ‘Mémoire des hommes’ (MdH) database, managed by the French Ministry of Defence. This database, which may be consulted on the ministry’s website,⁸ has been available to the public since 5 November 2003. It assembles in electronic form the death certificates⁹ of all the soldiers who merited the tribute ‘Mort pour la France’ (MPF; ‘Died For France’).¹⁰ The database may be searched by surname, first name, date of birth, and the regional administrative department of origin of the deceased.

This database has considerable advantages over previous means of counting the dead (for example, the list of monuments to the dead, the 1978 Perchet report, and census returns), and constitutes a supplement to the first official statistical report of the deaths of the Great War, namely the Marin parliamentary report of 1921.¹¹ It is not only exhaustive, but now comprises the only official, usable database of the losses of the Great War. It is precise in the sense that it records all those who are officially recognized as having died for France. Of course, it has limits: only those declared ‘MPF’ are included, to the exclusion of all those

⁸ <http://www.memoiredeshommes.sga.defense.gouv.fr/>

⁹ See Appendix for an example.

¹⁰ *Official definition*: MPF is an official mark of respect that must appear in death registers in the margins of certificates concerning soldiers killed in combat or who died of their injuries. It was instituted by the law of 2 July 1915 to honour these deaths. It is the military authorities that decide on its attribution and determine when the death is noted in this way. In other cases (deaths in hospital, for example), it is up to the families to request attribution of this note. As A. Prost, (2008, p. 51), recalls, ‘Still today, the descendants of soldiers whom they feel have been forgotten (deaths in captivity or of pulmonary illness caused by gas) take this step, which explains why the MPF file, accessible on the internet, is not definitively complete’.

¹¹ This report, to which historians are not particularly attached, is nonetheless remarkable in that it attempts to establish, coming out of the war, a statistical evaluation of the number of deaths – that is, ‘an individual census of all of the losses’. The author emphasizes the necessity of recovering and consulting all of sources in order to identify with accuracy the exact number of war losses. For example, can all the disappearances be included within the deaths? In their critique of sources, historians have tended to generalize the critique that Marin addressed concerning the difficulties of collecting information before July 1916 to the whole of the war period. Let us remember that the ‘disappeared’ have still not returned a century later, and that they do indeed figure in the statistics of the losses of the Great War.

whom the military authorities did not consider to merit the appellation: notably mutineers, suicides, those executed, those who died from illnesses not recognised during service, and those who died at home after discharge and whose families did not take the necessary steps to gain the designation (the process of updating the records continues today as and when requests for MPF designation are received, primarily from families). Moreover, the database appears to count deceased officers twice.

A more accurate estimate of the total number of deaths in the war should therefore correct the overall figure for deaths classed MPF by removing the duplicates – officers counted twice (see table 1) – and by adding those who were refused the designation (cases of refusal are indicated as such by the military authorities; the number is estimated at 62 thousand), those whose MPF status has not yet been decided (estimated at 31 thousand), those discharged from service during the war, and deaths outside the war period (10 thousand and 5 thousand, respectively).¹²

As the ‘exact’ figure for the total number of war dead is not the topic of this article, and indeed continues to be a subject of polemical debate, we deliberately limit ourselves to the MPF designation in order to identify the geographical origins of the war dead.¹³ Thus, geographical origin under the categories ‘refused MPF’, ‘not decided’, and ‘discharged’ is not

¹² These figures are estimates that come from the management of the database.

¹³ The polemic over the figures essentially revolves around the number of deaths *from* the war (and not *in* the war, for which the MdH source today seems to be irrefutable). The main statistical uncertainties over the number of dead come from the treatment and evaluation of the number of wounded and ill. This problem is beyond the scope of our study. By choosing MdH as a source, we save ourselves the difficulty of cross-checking the number of dead with that of the injured or evacuated. A major difficulty arises as soon as we seek to undertake cross-referencing on the basis of different sources (medical or military) on the injured: in any case, the MPF source provides an indisputable official source ‘which notably does not include deaths from illnesses not attributable to service, 75,000’ according to A. Prost, p. 57. But, as this same author goes on to mention (p. 60), ‘included in the list of monuments are those of the temple, the church, the town hall. Each institution is determined to make public the list of its dead. Represented in these lists, and there to be written or re-written, is an issue for many families, as is witnessed by the case of the executed, for example, some of whom were counted immediately by communes among their war dead, whereas others have waited to be exonerated for their names to be added to the monument ... The question of ‘how many’ was posed long after that of ‘who’ ... for the contemporaries, what was important was not the balance sheet of the war, it was that none of the dead be forgotten or excluded ...’ We have chosen to deal with the question of regional disparities on the basis of MPF status, which identifies deaths in the war and allows us to avoid ‘polluting’ the figures for the deaths in the war with another question, that of deaths from the war; a question that is just as legitimate but which introduces biases in the counting of deaths in the war.

dealt with, as their files are not accessible via the MdH database. We limit our study to official cases of MPF, and thus seek to determine whether the geographical disparities before death of the MPFs may be explained solely by demographic factors. Despite these constraints, our ‘survey’ nonetheless includes 1,187,143 MPFs across all of the metropolitan departments, excepting that the eastern departments, such as Alsace and the Moselle, are not distinguished in the MdH database.

Following this approach, the first statistical analysis (table 1) presents the distribution of the number of deaths by region according to the total male population. To our knowledge, this is the first time this statistic has been published. For legibility, and in order to bring out the results for the reader, these data are presented in the body of the text by region (there are nineteen of them, including what we call ‘historic Brittany’, corresponding to the contemporary administrative region of Brittany, plus the contemporary department of Loire-Atlantique, which is thus excluded from ‘Pays de Loire’; and an amalgamated Upper and Lower Normandy, which, for the purposes of this research, constitutes a single region for the same historical reason).

In general terms, surveying the number of deaths by region relative to the total population shows that the Provence-Alpes-Côte d’Azur (PACA) region is least affected, together with Île de France, and in contrast to Limousin. However, this first result remains imprecise given that the proportion of men to women varies between regions. In reporting the number of deaths in the male population, we notice, for example, that the Corsica region (see the evolution of the hierarchy according to different indicators) has a lower proportion of men relative to the other regions.

Table 1. Proportion of Dead Number by Regions

Regions	Number of dead	Rank	% of dead among the population	Rank	% of dead among males	Rank
Pays de la Loire	62631	(9)	3,76	(3)	7,76	(3)
Limousin	37101	(17)	3,86	(1)	8,24	(1)
Bretagne Historique	125073	(1)	3,82	(2)	8,02	(2)
Corse	9836	(19)	3,38	(7)	7,73	(4)
Aquitaine	70271	(7)	3,11	(14)	6,55	(14)
Midi-Pyrénées	72148	(6)	3,37	(8)	7,03	(8)
Nord Pas de Calais	84421	(4)	2,77	(17)	6,18	(17)
Île de France	113615	(2)	2,13	(18)	4,86	(18)
PACA	40939	(15)	2,11	(19)	4,97	(19)
Rhône Alpes	109846	(3)	3,07	(15)	6,44	(15)
Picardie	45944	(12)	3,15	(13)	6,63	(13)
Auvergne	50368	(11)	3,45	(6)	7,25	(6)
Champagne Ardenne	38832	(16)	3,21	(12)	6,75	(12)
Languedoc-Roussillon	45227	(13)	2,96	(16)	6,30	(16)
Normandie	79490	(5)	3,34	(9)	7,02	(9)
Poitou-Charentes	43756	(14)	3,32	(10)	6,75	(11)
Centre	67248	(8)	3,59	(4)	7,33	(5)
Bourgogne	55089	(10)	3,54	(5)	7,24	(7)
Franche Comté	30292	(18)	3,32	(11)	7,01	(10)
Overall	1187143		3,10		6,62	

Source: « MdH » Database and Census 1911.

Table 1 suggests that we should not be too hasty in passing comment on the number of deaths, since discrepancies could, in reality, be accounted for simply by a difference in the characteristics of the regional populations. We have thus chosen to take account of the age pyramid, which might also differ by region, so allowing us to calculate the number of potential recruits per region.

This latter figure has thus been extrapolated from the 1911 census data (age pyramid by department, proportion of men). Furthermore, we note in our study that there is a lower than expected mortality rate (once the mortality figures are seen in relation to the total

population of the department) in the departments of south-east France.¹⁴ One of the explanations we advance for this is that the low mortality is linked, in part, to the significant proportion of foreigners not mobilized for French military service (notably Italians in the departments of the south-east). Using the 1911 census data, we have thus taken foreign nationals living in France out of the number of potential recruits (in the active categories) in all of the French departments (principally, Italians in Provence; Spaniards in Aquitaine; and Belgians, Polish, and Germans in the departments of the north and east). The last column of table 2 takes account of this correction and gives the number of MPF in relation to the number of potential French recruits aged 19–27 years by department; again, a statistic that to our knowledge has never before been published.

According to table 2, Île de France appears to be the least affected region, in contrast to Limousin, confirming the results of table 1. However, Pays de la Loire seems to be just as strongly affected, whereas historic Brittany now shows a rate nearer the average, contrary to the statistics presented in table 1. It thus seems that if we stick to descriptive statistics alone, uncertainty remains regarding which regions have the greatest and which the lowest mortality rates. Moreover, there are significant differences between the different classes of tables 1 and 2, according to the different criteria taken into account. Consequently, in this article we undertake an econometric analysis to remove this ambiguity and determine the factors influencing the number of deaths. Furthermore, the intra-regional heterogeneities may bias the analysis. Nonetheless, the standard errors of rates of dead within French regions reveal a slight intra-regional variance. Thus, regions seem to be very homogenous, except South-east areas (PACA and Languedoc-Roussillon) which have bordering areas or south areas exhibiting higher rates of dead than their interior areas.¹⁵ Therefore, we present for the sake of clarity, our results at a regional level without loss of information, since the intra-regional variance is very low.

¹⁴ We use the term high (or low) mortality when the number of deaths is greater than (or, respectively, below) a proportional figure based on demographic characteristics.

¹⁵ To a lower extent, a similar pattern is observed for Franche-Comté.

Table 2. Potential recruits and number of dead by regions

Regions	Number of dead (1)	Rank	Potential recruits in active categories (generation 1911- 1919)	Potential recruits without foreigners (2)	Dead among French potential recruits (1)/(2)	Std. Error	Rank
Pays de la Loire	62631	(9)	120704	120388	52,02%	0.003	(1)
Limousin	37101	(17)	72329	72201	51,39%	0.001	(3)
Bretagne Historique	125073	(1)	276482	275962	45,32%	0.001	(11)
Corse	9836	(19)	25222	23596	41,69%	0.000	(16)
Aquitaine	70271	(7)	160037	154243	45,56%	0.003	(9)
Midi-Pyrénées	72148	(6)	143113	140097	51,50%	0.002	(2)
Nord Pas de Calais	84421	(4)	257887	226527	37,27%	0.000	(17)
Île de France	113615	(2)	349003	313616	36,23%	0.000	(18)
PACA	40939	(15)	142994	97628	41,93%	0.009	(15)
Rhône Alpes	109846	(3)	265563	254999	43,08%	0.005	(14)
Picardie	45944	(12)	106308	102892	44,65%	0.000	(13)
Auvergne	50368	(11)	107541	107073	47,04%	0.000	(8)
Champagne Ardenne	38832	(16)	85570	80129	48,46%	0.001	(16)
Languedoc- Roussillon	45227	(13)	108633	100939	44,81%	0.010	(12)
Normandie	79490	(5)	176648	175083	45,40%	0.001	(10)
Poitou- Charentes	43756	(14)	102782	102464	47,60%	0.001	(6)
Centre	67248	(8)	135474	134975	49,82%	0.001	(4)
Bourgogne	55089	(10)	116025	115093	47,86%	0.000	(5)
Franche- Comté	30292	(18)	69290	64382	47,05%	0.007	(7)
Overall	1187143		2821605	2662287	44,59%	0.002	

Source: « MdH » database and Census 1911.

III.Explanatory variables

This section presents the variables that are used in our statistical analysis. We can classify these into four categories: demographic, geographic, economic, and political variables. We also discuss other statistical sources used in the construction of these indicators.

The dependent variable in our analysis is the number of deaths per department. This is a variable that allows for numerical analysis. If, instead of the number of deaths, we use a ratio relating this variable to another indicator, this raises the problem of the pertinence of the chosen ratio: Should it relate to the number of deaths in a department in terms of its surface area, its total male population, or only to the number of potential recruits?¹⁶ It seemed essential to address this problem in a manner that would capture the population size effect in all of its (albeit only roughly perceived) dimensions.

The first, commonsense, idea is to attempt to connect the number of deaths by department to its demographic make-up. We have thus sought, on the basis of the model which is most appropriate for this effect (a count model), to test the significance of the hypothesized demographic factors as a primary cause of the death rate per department. To this end, in our first model, two variables are used: the number of potential recruits per department and the population density of the department. These two indicators allow us to capture the influence of the two key demographic factors, before explaining the number of deaths in the department, the age effect of the population of the department, and the size effect of the population of the department.

A more traditional indicator would have been the ratio of recruitable men per km²; however, the step we have taken breaks down this effect in the following way:

$$\frac{\text{potential recruits}}{\text{surface area}} = \frac{\text{potential recruits}}{\text{population}} * \frac{\text{population}}{\text{surface area}} \quad (1)$$

the first ratio ('rate of recruitable men') is an indicator of the age pyramid and of the proportion of men in the department, whereas the second is indicative of an effect of the density of the population.¹⁷ If the first ratio is an indicator that is relative to the demography

¹⁶ An estimate of this ratio was made, but this did not, however, issue in fruitful results. One of the reasons probably comes from the weak variance of this ratio for the majority of regions.

¹⁷ The switch to the logarithm ensures the additive form of the estimated functional form.

of the department, this analysis allows us to take account of the additional effects through the second ratio, since the latter can, therefore, include the effects of measurement errors in the calculation of recruitable men (i.e. those not captured by this variable) as well as potential voluntary recruitment captured by the population density ratio.

There are, in effect, historical reasons for the decision to introduce this second demographic variable; the Marin Report discusses the recruitment drive in these terms:

Besides recruited men, there were adolescents, discharged men and old men: in all the ranks and until the end of the war, the most involving examples were given. Must we, for example, cite all those who signed up through deception... ? Signed-up youth were not only innumerable at the start, but the call-up proceedings up until the end of the war were so considerable that in the calculations of probable manpower, it was necessary to discount the high number of signed-up men from the next calls.¹⁸

After having tested the demographic causes as a primary explanation of the number of deaths by department, our proposal was to consider criteria other than strictly demographic ones and to add them in order to enrich the model.

The ‘geographical’ variables used – ‘distance from the front’ and ‘from the border’ – were supposed to reflect in part the indications of the distance of the departments from the combat zones, it being understood that in the early period of the war, this variable was highly pertinent. As Antoine Prost recalls:

A major distinction was made between the zone of the armies and that of the interior. The zone of the armies was much greater than that of the fighting: in April 1917, for example, Orléans and Provins were part of the zone of the armies

¹⁸ Marin (1921, p. 60).

and not that of the interior. In the zone of the armies, a distinction was made between the zone of the front, that of the staging posts, and that of the rearguard.¹⁹

Our variable ‘proximity’ thus equals 1 when the department is in the ‘zone of the armies’, and 0 when in the ‘zone of the interior’ (see table A1 in the appendix).

In the famous ‘Plan XVII’, conceived prior to 1914, a pre-determined order of battle was fixed by the French military high command, distributing the regional regiments across the zones of the front in the event of hostilities with Germany. The principle guiding this distribution was the criterion of proximity, with the regiments stationed in the regions bordering the conflict zones being the first to be sent to these zones. This criterion must have lost its relevance in due course as the priority of high command came to be to make up for the losses incurred by the regiments at the front. In addition to the variable ‘distance from the front’, it seems to us that particular attention must have been paid to border regions distant from the conflict zones.

The ‘rural’ factor seemed to us to deserve a place of its own. It is widely held that the Great War took the greatest contribution from the most rural zones, and introducing a variable for the rural character of the department allows us to appreciate this impact. Also introduced in this analysis are the economic variables by department, extracted from the 1911 census data. This puts us in a position to ask such questions as: Was there a desire to ‘protect’ certain categories of the population more than others? Was there discrimination according to social position, whether against agricultural labourers, workers, or bosses?

These questions seem to us to be pertinent since, in the Marin Report, which is based on the 1911 census, information appears on losses per social category. To our knowledge, this data has not been reworked on a statistical basis since its original publication.²⁰ Using an

¹⁹ Prost, (2008, pp. 44–5).

²⁰ *Le Dictionnaire de la Grande Guerre* presents the following figures in the article ‘Economie de guerre’: ‘From mid-1916 to the end of the war, around 500 thousand men were mobilized in the factories; between July 1917

analysis by Jean Rey based on the French censuses of 1906 and 1911, the author of the Marin report studied the proportion of adult workers in each social category which supplied servicemen. In fact, this lends itself to a counterfactual exercise: the ‘proportion of recruited men at the start of the war’ is sub-classified into eight professional categories, namely agriculture, industry, business, domestic service, liberal professions, mines and quarries, public services, transportation.²¹ As the Marin report notes,

If each social category had been mobilized on a pro rata basis, the proportion of recruited men would have been indicated in the distribution of the population by social category, but it was not so ... Two categories in particular, public services and transportation, were not completely mobilized. We can estimate the contingent that was provided by these two categories at only 35 per cent, that is 765,000 men, whereas they would have been expected to provide 1,368,000 servicemen. The difference between these two figures must have been made up by the other professions at the start of the war.²²

While the Marin report suggests that the greatest contribution of servicemen came from the agricultural professions, it also notes that industry and business were not spared: these sectors were also called upon to compensate for the deficit of recruits from the categories of ‘transportation’ and ‘public services’.

and November 1918, mobilized agricultural workers rose from 130 thousand to over 300 thousand. In administration and public services (railways), manpower reached 350 thousand from 1917. In the navy and navigation, it was nearly 100 thousand.’ For his part, J. Becker (1988, p. 53), notes, ‘It was on 20 September 1914 that the new War Minister, Millerand, gave industrialists the goal of producing 100 thousand shells a day. The State poured in advances to enable industrialists to equip themselves, to build new factories. This enabled them to meet the targets set in the summer of 1915. To take but one example, the Toulouse gunpowder factory, which employed 100 workers before the war, employed 4 thousand of them from June 1915, 20 thousand in June 1917, and 30 thousand at the time of the armistice. Where did they find this workforce? Naturally, industrialists claimed that they should be given recruited workers at the start. A worker was more important in his post than in the fighting. At the end of 1915, around 500 thousand workers were sent to the armament factories.’

²¹ The Marin Report, (1921, p. 51), compares the actual percentages of servicemen for each of eight separate, professional categories (respectively and in the order given above: 45.3; 29.44; 10.6; 0.3; 2.62; 2.11; 2.78; 6.85) with the actual distribution (in %) of the total male population across these eight categories according to the 1911 census (respectively 41.4; 26.95; 9.71; 0.27; 2.45; 1.95; 5.06; 12.2).

²² Marin (1921, p. 51).

Thus, considered in general terms, the Marin Report sheds light on the debate over the war effort demanded from different populations. The result is an ensemble of balanced remarks which tends to underscore the fact that the will to preserve or reserve certain categories for the industrial armament effort could undermine morale, in a context of rhetoric of a ‘sacred union’, and strong ‘consent’ to go to the front to fight:

A great effort was made to maintain overall manpower, particularly during 1917, while protecting military needs from the pressure of economic needs. From April 1917 to January 1918, this effort allowed only 300 thousand farmers to return to the land, 32 thousand men to mines, 3 thousand men to marine activities, 5 thousand men to teaching, 8 thousand men to the railways. From January to November 1918, the collapse of the Russian front made considerable numbers of troops available to the enemy, and before the arrival en masse of the Americans, an effort had to be made to enlist 260 thousand men.²³

This development gives a nuanced response to the claim that there were protected professions. However, it also motivates pressing forward with an analysis in order to determine whether the distribution of deaths by department might have been influenced by the socio-professional make-up of those departments.

In a paragraph on ‘The preservation of men for military service despite national needs’, the Marin Report discusses arguments that play down the idea that economic motives alone might have determined the profile of recruitment:

The necessity of dedicating all the possible efforts of the active population to the war was so passionately accepted that errors were made in the preservation from military service of more useful men, even for national defence, in the strict sense, in other fields. It was this noble sentiment that wrongly pushed back the moment when the workers necessary for the manufacture of weapons were returned to the

²³ Marin (1921, p. 61).

war factories ... It was late in the day when many heads of households or men, having already had several brothers or sons killed, benefited from some measure of protection ... It was only when the agricultural problem became critical that some men were returned to the land ... By contrast with other countries, no measure was taken for the liberal professions.²⁴

In addition to this, there was one political variable which seemed particularly relevant to test by department – namely, to find out whether certain departments that we classify as ‘anti-militaristic’ (as measured by a vote for the extreme left²⁵ that is higher than average for French departments) might have been penalized in the fighting. This is a thesis which is aired periodically. In assessing it, we must appreciate the importance of contextualizing these allegations, noting in particular that the political climate at the beginning of the twentieth century in France was far from calm,²⁶ and that the question of the link between mutineers and the pacifist movement has been the subject of intense debate by historians.

At the beginning of the twentieth century, the battle cry of Republicans was the struggle against clericalism: ‘The great reform that is the separation [of the Church from the State] is the greatest that has been attempted in our country since the French Revolution’.²⁷ As Becker has commented, ‘The victory of the anticlericalists, the Dreyfusards (the exoneration of Dreyfus by the Supreme Court of Appeal on 12 July 1906), and the establishment of the radical republic provoked in response a reaction around a new nationalism that Clémenceau denigrates with the label, the *new alliance of the sabre and the aspergillum*’.²⁸ The 1913 proposition to increase the duration of military service to three years provoked an

²⁴ Ibid., p. 62.

²⁵ It is in this manner that the SFIO vote is indicated on the political map of France from 1875 to 1914.

²⁶ As Becker recalls in *La France en guerre* (1988), Jaurès is the object of permanent outrage: Jaurès fought a duel against Déroulède who had described him as ‘the most odious perverter of conscience that had ever, in France, played the game of the foreigner’ (p. 12). Charles Mauras, ‘L’action française’, 18 July 1914: ‘Everyone knows Mr Jaurès is Germany’. Charles Péguy: ‘Right from the declaration of war, the first thing we will do will be to shoot Jaurès. We will not leave these traitors behind us to stab us in the back’ (comment reported by Romain Rolland in his *Journal des années de guerre*, Albin Michel, pp. 31–2.)

²⁷ Jaurès, *La Dépêche*, 30 April 1905.

²⁸ Becker, (1988), *La France en guerre*, p. 16.

impassioned debate that rekindled the opposition between the same two camps as were set against each other in the Dreyfus affair.

This France of two camps (the teacher and the priest) certainly had an unsavoury side: ‘Unionism professed anti-militarism and anti-patriotism and announced its intention to sabotage the call-up if necessary, to the point that a device of repression known by the name of “*Carnet B*” [Notebook B] was enacted. [In the socialist party], a minority assembled around Gustave Hervé courted the same themes’.²⁹ This forgotten or misunderstood point justifies introducing a political variable into our workings.

Nearly two thousand people, anarchists, unionists, as well as some socialists, were classed as likely to attempt to block the call-up and were listed on what was called the ‘*Carnet B*’³⁰ (). Would one apply the *carnet B*? The Minister of the Interior, Louis Malvy, thought that it was not necessary. His decision was not enacted without difficulty: firstly, despite ministerial orders, arrests took place, particularly in Nord-Pas de Calais, and then it was necessary to overcome some opposition, such as that of Clémenceau ... Overall, however, the percentage of these attitudes was more or less negligible.³¹

Even though the declaration of war put an end to overt political cleavage, along with the development of the theme of ‘sacred union’, supposed to symbolize national unity during the war,³² clearly this does not stop us testing the impact of this political variable on the distribution of deaths in France, especially given the emergence during the war of the phenomenon of mutinies, the political nature of which has been a point of serious contestation

²⁹ Ibid., p. 17.

³⁰ Jean-Jacques Becker, *Le Carnet B*, Klincksieck, 1973

³¹ Ibid., p. 28.

³² President Raymond Poincaré made the famous remark: ‘in the war in which it is involved, France still be heroically defended by all its sons; in front of the enemy, nothing will shatter the sacred union’. Becker, *La France en guerre*, p. 29: ‘The most symbolic event of this sacred union was perhaps the funeral of Jaurès on 4 Aug. He who was a target for outrage less than three weeks before, was transformed into a national hero: the public authorities were there but also the representatives of nationalist organisations, Maurice Barrès, the president of the League of Patriots himself! Jouhaux’s speech celebrated Jaurès thus: “We will be soldiers of liberty”.’

by historians. For François Cochet and Rémy Porte, in their *Dictionary of the Great War 1914–18*, it is a theme that is radical but not taboo (which need not stop us shedding some statistical light on the subject). Reference is made to two works, by Guy Pedroncini³³ and by Denis Rolland,³⁴ both of which are based on deep research in the military archives, and both of which seek to analyse the political dimension of these mutinies. These authors draw up a list of the collective movements in the trenches which seemed to emerge from 1916 onwards – that is, well before the Nivelle offensive, considered the catalyst for such movements – and insist on their diversity. Regarding the political interpretation of these events, Cochet and Porte perceive the outlines of a consensus as emerging in the literature:

Even if the *Internationale* was sung and red flags were raised in several places, these external signs of revolt do not in themselves prove the existence of a revolutionary organization. These were symbols, recreational expressions, much more than revealing indicators ... In the end, by way of appeasement, Pétain acknowledged that the soldiers had rights, the right to rest, to material benefits (food and bedding) and right information on the operations in progress (conversations with officers). This contributed to the extinction of the movement.³⁵

What was the extent of the repression? It is pertinent to underline that the number of death sentences was radically reduced by the President of the Republic, exercising his right to bestow grace (412 men had officially been condemned to death). This deserves to be investigated more closely. The number of death sentences carried out (due to the exercise of grace) may be a poor indicator of the depth of the movement, in the sense that it underestimates its intensity. Accordingly, we here make new use of the statistics provided by the Marin Report on the sentences pronounced by the war councils as recorded in the *Tribunal*

³³ Pedronici, (1987), 'Les mutineries de 1917 dans l'armée française'.

³⁴ Rolland, (2005), *La grève des tranchées*.

³⁵ Cochet and Porte, (2008), 'Mutineries'.

de Ressort (regional data),³⁶ allowing us to cross-check this information with our department-based analysis.

In sum, the reasons put forward (political cleavage before the war, mutinies) justify testing the relevance of a politically indicative variable, a proxy for the ‘sanctions against anti-militarist departments’, that would be indicative of a military high command that was still largely anti-Dreyfusard at the outset of the hostilities.³⁷ The data analysis presented below provides a first component of the response regarding the necessity of not limiting the explanatory variables to demographic variables alone.

IV. Principal Component Analysis and count models

By way of a preamble to the econometric model, the first part of this section gives an analysis of the data, in order to unpack the primary determining factors of the number of deaths. The latter part details the econometric model used.

The factor analysis presented below explains on two axes over 80 per cent of the inertia of the regions. The *x*-axis, explaining 45 per cent of the variance, distinguishes an effect of the ‘number of recruitable men’, which thus comes out as a determining factor. This axis is positively correlated with the proportion of the active population in agriculture, with youth, and with the surface area of the department. The position of Corsica is explained by its having a small population, and so, indirectly, a low population of eligible recruits, added to an obviously small surface area. By contrast, the Rhône-Alpes region is characterised by a large surface area, and has a young and predominantly agricultural population. As a consequence, the regions with the highest density of eligible recruits are located in the middle of this axis (Île de France). Historic Brittany has a lower proportion of deaths per km² since the region is

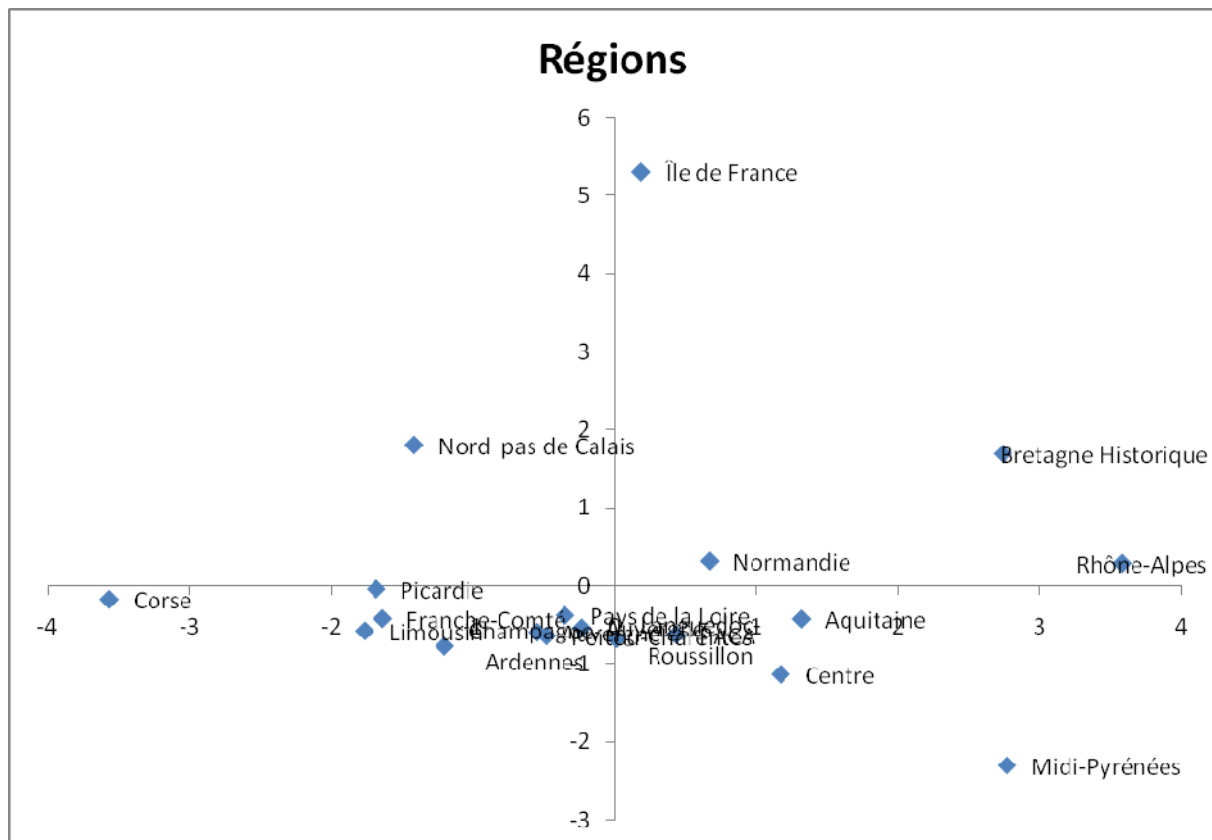
³⁶ Marin, (1921, p. 63).

³⁷ François Mauriac, (1960), *Le nouveau Bloc-notes*, p. 349, underlines the permanence of the ideological fracture after the Dreyfus affair: ‘Today we know that the Affair was not an accident, that the two spiritual families that drew up one against the other did not cease to confront one another’.

evidently far more extensive than Île de France, even though it has a greater total number of deaths.

The regions that recorded the greatest number of war deaths (in absolute terms) are ordered along the y-axis, since this figure is positively correlated with the number of deaths in the land and sea armies, with the number of residents in the regions, as well as with the number of mutinies. In other words, this axis reflects the size effect: the regions with the largest populations are those that have the greatest number of deaths (contrary to the descriptive statistics on related data given in tables 1 and 2). From these figures, it would seem that among the regions with the largest populations, the regions of the north were more affected than those of the south.

Figure 1. PCA



Source: « MdH » database and Census 1911.

The correlation of the number of mutineers with the preceding variables merits attention, although this variable is ambiguous because it captures two dimensions – politics and ‘brutality of fighting’ – which are difficult to dissociate. In addition, there is a difficulty

of a statistical nature: the data on mutinies from the *Tribunal de Ressort* give information on a regional and not strictly departmental basis, which means that this variable cannot be used as a basis for statistical tests. Moreover, this variable may be influenced by individual factors other than political convictions. Having only the number of mutineers at the regional level and taking account of the possible endogeneity of this variable, the latter is only used as a political proxy in the principal components analysis (PCA). The factor analysis seems to corroborate the effect of the brutality of fighting, since the mutinies are positively correlated with the number of deaths. For these reasons, we favor the “extreme left” vote by department as the relevant political variable.

Overall, the factor analysis suggests that a population density effect and a geographical location effect seem to be predominant in the explanation of the number of deaths. Moreover, the criterion of ‘rurality’ allows us to distinguish between regions. The PCA also reveals a certain asymmetry: while the most affected regions, in absolute terms, are clearly distinguished, it is more difficult to distinguish between the more ‘protected’ regions, such as those of the centre and south of France.

Let us assume, then, that the number of events arising at the level of the statistical unit is both discrete and random. The counting of this number of events (hypergeometric law) can be approximated using Poisson’s law. Let Y be a random variable that obeys Poisson’s law with parameter μ , and let y be a positive integer or zero:

$$P(Y=y)=\frac{\exp(-\mu).\mu^y}{y!} \quad (2)$$

with the following relation between the mean and the variance: $var(y) = E(y) = \mu$. In the case of the application of Poisson’s law to n French regions, we hypothesize that the numbers of deaths arising in these regions are n independent realizations $y_1, y_2, \dots, y_n$ of a random variable of Poisson’s law Y , with parameter $\mu = (\mu_1 \dots \mu_n)$, conditioned by the explanatory variables $X_1, X_2, \dots, X_p$:

$$P(Y_i|(X_{i1}, X_{i2}, \dots, X_{ip}))=\frac{\exp(-\mu).\mu^{y_i}}{y_i!} \quad (3)$$

The link between the expectancy μ_i and the linear combination of the explanatory variables and the estimated coefficients usually used is the Napierian logarithm. Poisson's regression equation can thus be written:

$$\ln(E[Y_i]) = \sum_1^p \beta_j x_j \frac{\exp(-\mu) \cdot \mu^{y_i}}{y_i!} \quad (4)$$

However, in the majority of cases, adjusting Poisson's model to a data set does not respect the hypothesis of a variance equal to expectancy.³⁸ If the estimated variances based on the results of the model are greater than the estimated averages, this suggests that there has been over-dispersion. This can be due, for example, to the omission of an explanatory variable or to the non-homogeneity of the environment.

Certain models allow us to take account of over-dispersion, in particular the Negative Binominal (NB) model and the Generalized Poisson (GP) model. To take account of the over-dispersion as well as the influence of explanatory variables on this over-dispersion, the simplest method is to estimate the parameter of over-dispersion θ by comparing the deviance of the model (or the sum of the Pearson residuals) with the number of degrees of freedom.³⁹ We briefly present the hypotheses of NB and GP:

$$(NB) : \begin{cases} E(Y_i) = \mu_i \\ Var(Y_i) = \mu_i + \mu_i^2 / k \end{cases} \quad (5)$$

The law of the negative binominal model can be seen as a mixture of Poisson's law and the law of Gamma. Notably, this mixture corresponds to the hypothesis of Poissonian intra-regional variability combined with an inter-regional variability manifesting a Gamma distribution of a parameter of form k .

$$(GP) : \begin{cases} E(Y_i) = \mu_i \\ Var(Y_i) = \mu_i (1 + k\mu) \end{cases} \quad (6)$$

In both cases, the variance is from then on proportional to the mean (softening the initial hypothesis of Poisson's law). The estimates of the two models often lead to very similar estimates.⁴⁰ A second difficulty in the counting models comes from the value zero for

³⁸ McCullagh and Nelder, (1989).

³⁹ That is, the number of observations minus the number of estimated parameters.

⁴⁰ For comparative purposes, both models will be estimated.

a significant number of statistical units ('zero events'). However, since in our analysis no region has had no deaths, we will not broach this problem.

V.Econometric Results of the Demographic Model

Table 3 presents the results of the model constrained by the Ordinary Least Squares (OLS), NB, and GP. First impressions are that the data follow a normal distribution, since the OLS gives better results than the other models. As the explained variable has a raised average, Poisson's law and the Negative Binominal law both converge in the direction of a normal distribution.

The specification of the models in table 3 tests the hypothesis that the number of deaths by department is explained exclusively by the demographic variables, that is, is proportional to the number of potential recruits⁴¹ and to the population density of the department. This hypothesis is verified since the relationship with these two variables is positive and clearly significant. The proportion of potential recruits greatly increases the number of deaths in the department: it is young males who absorb the impact of the war. The population density translates a size effect of department population, and its impact is logically less than the number of recruits since it takes account of all the effects not taken into account by the ratio of recruitable men. The constant here represents the minimum number of deaths by department.

However, while these results are significant, we observe that the dispersion in the number of deaths according to departments θ is also significant. Despite having taken account of these two demographic variables, there remain important significant differences between the number of deaths observed and those predicted by this model.

In order to distinguish the regions that do not follow this demographic process, we have regressed the residuals of this model by including a fixed effect for each region. Since

⁴¹ Calculated from the 1911 census, which gives the total population of the department by age range. The potential recruits are those 20–27 years old; only 'Class 19' was mobilized in 1918 (taken into account in the calculations).

demographic reasons explain the majority of the variance in the number of deaths, we have chosen wider thresholds of significance (5, 10, and 20 per cent).

Table 3. OLS and Count Model (constrained model)

	OLS	NB	GP
AIC	79.2	1593.18	1593.18
BIC	81.5	1602.81	1602.81
Intercept	7.001***	7.154***	7.154***
Rate of Potential Recruits	0.280***	0.261***	0.261***
Density	0.006***	0.006***	0.006***
θ	-	0.097***	0.097***
Regions	Obs. Dead	Predicted by OLS	Unexplained Dead (%)
Pays de la Loire (+)	62631	49218	21.42
Bretagne Historique (+)	125073	103561	17.20
Aquitaine (++)	70271	52222	25.68
PACA (+)	40939	48709	-18.98
Franche Comté (+++)	30292	49386	-63.03

Note: * significant to 10%, ** significant to 5%, *** significant to 1%. (+)significant to 20%,(++) significant to 10%, (++++)significant to 5%.

Source: « MdH » database and Census 1911.

Among the nineteen regions, the demographic model provides an estimate very close to the number of deaths observed for fourteen of them. Only five regions deviate more strongly from this demographic model: Pays de la Loire, historic Brittany, Aquitaine, Provence-Alpes-Côte d’Azur (PACA), and Franche-Comté (the two last ones seem to have been relatively spared). Franche-Comté, a more densely populated region, should have had a greater number of deaths according to our demographic model: Was voluntary inscription therefore lower?⁴² On the other hand, Pays de la Loire, historic Brittany, and Aquitaine seem to have paid a heavier price than that foreseen by demographic criteria alone. Is the feeling of sacrifice in these regions – something which is still perceptible today – therefore justified? Alternatively, can we trace the higher death rate in these regions back to other explanatory factors? In the next section we develop these thoughts further.

⁴² The number of mutineers observed in this region (see table A3) seems to confirm this hypothesis.

VI. Econometric Results of the model including demographic, geographic, economic and political variables

In order to explain the persistence of these differences, it is necessary to look to factors other than the purely demographic. To this end, we have introduced the following explanatory variables in a second model: Proximity, Border, Sailors,⁴³ Employers (regions with a strong fabric of ‘small employers and self-employed’), Unemployment Rate, and Farmers (see table A1 in the appendix for a description of the variables).

The introduction of these six additional variables allows us to halve the percentage of the number of deaths not explained, without affecting the impact of the demographic variables already highlighted. At the same time, the introduction of these variables allows us to better explain the variability in the number of deaths between departments, since the distribution coefficient reduces significantly. The OLS is better suited here than the NBIN and GPOIS specifications, and has fewer residuals and a better information criterion (AIC and BIC). Following Box and Tidwell,⁴⁴ all the variables show a linear relation with the dependent variable, with the exception of the variable ‘Sailors’ (see discussion below).

In terms of our analysis, it emerges that those from a professional background of ‘small employers and self-employed’ were more protected than those from a working class background. Small employers and craftsmen⁴⁵ were able to benefit from both a better network of social relations, which allowed them to escape recruitment, and from the deliberate decision on the part of the authorities to protect economic activity amid the war effort. The unemployment rate is here used as an indicator of economic activity. Regions with strong economic activity (that is, the regions with low unemployment rates) seem to have been spared compared to the others. Similarly, the most rural regions (those with the greatest share

⁴³ Half of sailor deaths come from the departments of Brittany; nonetheless, this factor (being involved in the navy) ‘protected’, because the death rate in this wing was much lower than in the infantry.

⁴⁴ Box and Tidwell, (1962).

⁴⁵ This variable does not capture an age effect. Small employers and self-employed do not necessarily include older people.

of agricultural professions) show a larger proportion of war deaths than regions where industrial workers dominate. This reveals the authorities' preference for protecting industrial activity during the period of hostilities. Industrial activity was supported in order to feed the war effort.

At the level of deaths per department, our results corroborate the overall data on losses per profession pointed to in the Marin Report with respect to the 'Distribution of losses [by social category] for each period of the war':

First period: 1 August 1914–1 December 1915: The losses were spread between social categories according to the proportion of each profession at the time of the call-up.

Second period: 1 December 1915–31 December 1916: At this time, there were 2,800 thousand fighters at the front, of whom 500 thousand workers and 50 thousand miners were taken. As the number of fighters remained constant, it was necessary for the other professions to compensate this reduction in manpower. During this second period, the losses were distributed in the following proportions: farmers 58.32 per cent; industry 11.59 per cent; liberal professions 3.37 per cent; transportation 8.8 per cent.

Third period: the year 1917: 180 thousand farmers; 40 thousand factory workers, 40 thousand railway workers were temporarily withdrawn from military service and taken out of the army zone to facilitate the acceleration of transportation, notably that which affected the American army. There were 2,900 thousand men at the front. The losses were divided among the following professions: agriculture 52.9 per cent; industry 10.2 per cent; business 19.4 per cent; liberal professions 4.78 per cent; transportation 7.42 per cent.

Fourth period: the year 1918: At the beginning of 1918, 20 thousand more industrial workers were taken out of the army zone, along with 27 thousand transport workers and 13 thousand miners. The contingent of the latter was nearly reduced to zero.⁴⁶

⁴⁶ Marin (1921, page 51).

The report then recapitulates the total losses per social category:

It is noted, in the final analysis, that agriculture lost 673,700 men; industry, 267,400; business, 196,720; liberal professions, 71,070; public services, 55,240; transportation, 99,240. The liberal professions lost 71,070 dead ... whereas [according to] the percentage of their profession within the nation they would only have given 34,000. They lost more than double the number they should have lost and so they sacrificed nothing but having over 33 per cent of their members killed. Agriculture lost 17.5 per cent more than its expected percentage, that is, 673,700 instead of 573,000.⁴⁷

Pursuing a different line of thought, we notice that the regions farthest from the front (by contrast with the more northerly regions – and excepting those situated in the combat zone, such as those of the north or east which were under German control) were more protected in terms of deaths than the others: this phenomenon must undoubtedly have been more marked at the start of the hostilities (as a consequence of the dispersal of troops on the chessboard according to ‘Plan XVII’) rather than later. We also notice that the border regions (notably Franche-Comté on the border of Switzerland, a neutral country) benefitted from a comparative advantage relative to other French regions.

Finally, two additional factors (somewhat less significant than the preceding ones) may also be able to refine the analysis. Firstly, the coastal regions (of historic Brittany in particular) seem to have been less affected than the regions of the interior, since the square root of the ‘sailors’ variable is significant and positive. This function indicates that the more a department mobilizes in the navy, the greater the reduction in the proportion of deaths. This result confirms the historical narrative presented above, namely that the death rate in the navy was 7.4 per cent compared with 17 per cent for the land army.⁴⁸ Secondly, and in keeping with the results of the PCA, proximity to the combat zone is a factor which increases the number of deaths. Because of its lower significance, this factor alone is not sufficient to explain the high death rate observed in the regions of the north.

⁴⁷ Marin, (1921, p. 51).

⁴⁸ File 38 of the researcher’s guide, Association Bretagne 14–18.

Table 4. OLS and Count Model (full model)

	OLS	NB	GP
AIC	58.8	1581.78	1581.78
BIC	61.1	1605.85	1605.85
Intercept	6.856***	7.153***	7.153***
Proximity	0.137*	0.084	0.084
Border Area	-0.269***	-0.227***	-0.227***
Potential Recruits	0.184***	0.193***	0.193***
Sailors	0.016**	0.013*	0.013*
Density	0.005***	0.006***	0.006***
Small employers	-0.313**	-0.327***	-0.327***
Unemployment Rate	0.493***	0.313	0.313
Farmer	0.011**	0.006	0.006
θ	-	0.073***	0.073***
Regions	Obs. Dead	Predicted by OLS	Unexplained Dead² (%)
Aquitaine (++)	70271	53703	23.58
Franche Comté (+++)	30292	39648	-30.89

Note: * significant to 10%, ** significant to 5%, *** significant to 1%. (++) significant to 10%, (+++) significant to 5%.
Source: « MdH » database and Census 1911.

Out of the three regions listed as the most affected in the previous section (see table 3), we can now give an explanation for two of them: historic Brittany and Pays de la Loire. For the latter, it seems it is the criterion of rurality that is principally at work, whereas for historic Brittany, it is the rurality criterion combined with a very high regional unemployment rate. Among the regions identified as the most affected, only Aquitaine's high death rate remains to be explained. With regards to Franche-Comté, the number of deaths expected is the closest to that observed: the "frontier" variable as well as the protection of its industrial fabric, explains the lower death rate here.

In sum, our second model provides a better understanding of the number of deaths and improved our ability to predict this number.

Our last estimate (see table A2 in the appendix) introduces the variable ‘anti-militarist’ into the regression.⁴⁹ By virtue of the endogenous nature of this variable, a probit model has been used to calculate the estimated probability that the department contains a high proportion of anti-militarist adherents.⁵⁰ However, only the proportion of men aged 20–25 years has a significant and positive influence in favour of the anti-militarist movement (the Jaurès vote). Therefore, a problem of identification arises when we put the estimated probability into our regression concerning the number of deaths per department. Within this framework, we think that it is the functional form of the probit that identifies the econometric model. While we are conscious of the instability of this type of model, we think that the results obtained deserve comment.

The first estimate presents the model with the variable ‘anti-militarist departments’ (that is, the regions of the north, centre, and south-east of France). As expected, the coefficient is positive, but is significant only at the 17 per cent threshold. By contrast, the second estimate introduces the estimated probability of a higher proportion of anti-militarism in a department (calculated from the probit model). This variable is highly significant and positive, indicating that the characteristics which positively influence the probability of being anti-militarist ultimately increase the number of deaths. This result is far from surprising since only young men seem to be anti-militarist, capturing the effects of our density and proximity variables, notably in the northern departments bordering on Germany which are marked by a high rate of anti-militarist sentiment. This suggests that the young population could have been anti-militarist because it saw that it would be the first to be condemned in the event of total mobilization. Overall, even if it must be kept in mind that this variable also captures the effects of density and proximity, we cannot exclude the possibility of a sanction against the anti-militarist vote.

⁴⁹ Measured by a vote for the extreme Left greater than the average for French departments.

⁵⁰ Estimate available on demand from the authors.

These results must be set against those existing analyses that seek to capture the real weight of insubordination and its link to anti-militarism. In the paragraph on ‘The search for deserters or insubordinates and the discipline effort’, the Marin Report sets out some very interesting ideas with respect to these matters.⁵¹ The author provides annual statistics for desertions, abandonments of post, revolts, and rebellions, as well as a table summarizing the number and the nature of sentences pronounced by the war council (death – though bearing in mind possible commutation of the death penalty by the President of the Republic; forced labour for life; solitary confinement; imprisonment; fine). It seems that the highest number of judgments stemmed from the tribunals of Paris (Île de France) and Lille (Nord) – precisely those regions with the highest share of unexplained residuals.

In the seventh part, we underline that the excess unexplained residual share of these deaths could to a large extent be due to chance localizations at the front at the onset of hostilities, at a time when the first regiments were made up on a regional basis and when the intensity of losses was the most severe. We thus suggest that the coincidence of localizations could have been necessitated by the structure of the railways as they existed in 1914, and that this in any case was the key to the distribution of troops in Plan XVII as drawn up by Joffre.

VII. The random factor in the location of troops on the most deadly battles

The Marin Report devotes a paragraph to ‘Losses per region’, wherein it notes

the presence of certain bodies at times when the retreats of Morhange and Charleroi were particularly deadly and the use of certain units as attack troops, factors that provoked a quite large difference in losses per region, but that do not suffice to explain the overall difference in losses between such and such a region, but differences between such and such a commune within the same region or between neighbouring regions.⁵²

⁵¹ Marin, (1921, p. 63).

⁵² Marin, (1921, p. 53).

Rather than play down this argument, as the Marin Report seems inclined to do, it seems to us that in the explanation of the residual, this type of argument – the ‘timely’ circumstances of particularly deadly battles – could have a central place in the explanation of those high regional death rates not explained by our model.

It helps to circumscribe this argument and to specify why it has not been possible for us to use it as an explanatory variable in our analysis. First of all, we do not have details of the years of death of the soldiers, and yet the first battles of 1914–15 (border battles, the race to the sea) were the most deadly. It follows that the regiments involved in these battles saw a higher death rate. This helps us to understand why this may translate into a high death rate for certain regions. First of all, it must be borne in mind that from the moment of widespread inscription – that is, 2 August 1914 – the regiments raised were on a regional basis (whereas afterwards this dimension was lessened, the priority becoming to replace the losses of these regiments) which amplified the shock wave of the first battles on the regional level. Being in the wrong place at the wrong time may translate statistically into a strong regional impact.

According to table A3 in the appendix, the largest proportion of mutinies, as a function of the number of potential recruits, is observed in the case of Île de France. As previously discussed, the majority of mutinies coincided with the battles of Verdun and of Chemin des Dames. However, with regards to the mutinies of Verdun, these must be spread out in a proportional way for each region, since according to the orders of Marshall Pétain every regiment was to participate in this battle and then be reassigned to another front, as a measure to avoid the demoralization of the troops. However, this argument does not hold for Picardy and Aquitaine, which must have suffered other bloody battles at the start of the war.

It remains, then, to identify the factors governing the localization of troops at the time war was declared: from an examination of sources from the military high command, it would appear that the mobilization plan as set out in Plan XVII played an essential role in the

provision of army corps (which at the start had a strong regional basis) in response to the German attack. Among the determining factors in the distribution of army corps to the front, the ‘railway network’ dimension played an essential role in the transportation of troops from their places of origin to the front.⁵³ We now turn to trace the importance of these elements, while at the same time recognizing that these factors later lost their significance in part due to the movement of the front line and in part due to the re-composition of regiments on a non-regional basis. Despite these caveats, it remains that these factors may bear on the period of the onset of hostilities, from August to October 1914, when there was a peak in the number of deaths, and so may explain why some regions ended up paying a higher price than others by virtue of the involvement of their regiments in the deadliest combat zones of the war.⁵⁴

What we call the ‘hidden variables’ of the unexplained residual share of our model can be explained partly by reference to Plan XVII and partly by the density of railway networks. As we shall see, these considerations determined the provision of troops at the time of engagement and ultimately influenced which regiments found themselves more ‘to the left’ or ‘to the right’ of the front line (to adopt Joffre’s expression).

The regional character of army corps is confirmed at the beginning of the war. As Pierre Miquel writes:

the high command envisaged with great precision the railway facilities put at the disposal of troops coming from the interior: people from the north would go to the Ardennes, those from the west and from Paris on to Aisne and Verdun. The men of the south-west would disembark in Lorraine and in the Bar le Duc region. Those from the centre would go to the Vosges, those from the south to Mirecourt and Belfort. The bulk of supplies would be delivered after the 17th day of the mobilization, when all the troops would be in place, through the regulating

⁵³ See *Mémoires de maréchal Joffre*.

⁵⁴ P. Miquel, (1995, p. 107), cites accounts of the clamour in the first hours of the war, which describe ‘the panic, the terror of the disconcerted, disabled, unprepared French troops. Under German firepower, some companies registered losses of 80%’.

railway stations (Gray, Is sur Tille, Châlons sur Marne, Troyes, Reims, and Laon).⁵⁵

Colonel Le Hénaff underlines the extent to which the challenge of communications was an essential element of command in the preparation for the war: ‘the enormous task that was the complete preparation of the transportation plan was the work of the 4th office, the organ for the preparation of the orders of the high command’.⁵⁶ The central question was ‘what distance to put between the assembly zone and the border (of combat)’.⁵⁷ ‘All the flows of transport coming from different parts of the territory must terminate between Belfort and Mezières ... it was not an easy thing, the French network having been constructed with Paris at its centre, from where all the major commercial flows stem, but without well-maintained cross-country lines ... It was a matter of putting two-way flows into action with the same performance on all their sections’.⁵⁸

These considerations regarding the maintenance of territory and of transportation served as the basis of the plan for the assembling of troops as dreamed up by Joffre. In chapter ten of his memoirs (‘La mise sur pied du plan XVII’), Joffre writes:⁵⁹

The 4th office had established that the assembly of active corps and reserve divisions on the north-east front would be accomplished along 10 separate lines of transport. The distribution of mobilized formations between different lines would be regulated in such a way as to cope sufficiently with the same load on each transport line. The proposed lines, spread between three beams, would terminate thus: three between Belfort and Toul, three between Toul and Verdun, four between Verdun and Hirson. These beams could be linked up to one another by several operational cross-country lines allowing the execution of alternatives. In particular, the cross-country route Dôle, Dijon, Paris, Creil, Tergnier could carry

⁵⁵ Miquel, (1995, p. 47).

⁵⁶ Le Hénaff, (1922, p. 62).

⁵⁷ Ibid., p. 64.

⁵⁸ Ibid., p. 64.

⁵⁹ Joffre, (1932 p. 51).

out transfers from one transport line to another behind regulatory stations. Part of the available cargo could be brought to any point on this cross-country route – be it the Paris–Lyon line or the Bourbon line or even the Toulouse–Paris line ... The assembly zones could thus be drawn backwards or moved forwards at will between the general line Laon–Soissons, Reims, Troyes, Dijon, Besançon and a front marked out by the course of the Meuse downstream from Pagny and that of the Moselle upstream from Toul.

In the passage above, which in some respects points to the lack of preparation and the urgency of decisions, we also perhaps find an element which may help explain the as-yet unexplained high death rate. What explains the positioning of these regional regiments on the most deadly fronts in the first months of the war? It would seem that the main determinant arises from the problem of the economy of transportation, the use of the most direct rail routes to get to the frontlines. Therefore, part of the unexplained differences in the death rate observed between regions could be due to an unfortunate combination of chance and choice (contestable?) on the part of the military high command, in so far as the locations of the first German offensives were not those envisaged by the French high command. The railways certainly played a key role in the dispersal of regiments before the shock of the war set in. In this sense, the regional losses are in part results of the decisions of high command.⁶⁰ While this variable allows us partly to reduce the uncertainty concerning the assignment zones of regional regiments at the start of the war, the location of the outbreak of the offensive was an unknown (at least, it was not known with any certainty), which means that the losses registered by the regions could to some extent be due to random factors.

VIII. Conclusion

This study was carried out in order to explain regional disparities in the number of deaths during the Great War, by using new data from the MdH database. By cross-checking this data with that of the census, we find that demographic factors largely explain the distribution of the numbers of deaths during the Great War. However, some regions appear to have been

⁶⁰ The question of whether the maintenance of the rail network was optimal in view of the preparations for the Great War and whether the decisions of the military high command were optimal in light of the distribution of the existing rail network (the adequacy of the assignment of transport to the troops and the existing network) is a matter for future research.

more affected (Pays de la Loire, historic Brittany, and Aquitaine) whereas other regions seem to have been more protected (Provence-Alpes-Côte d’Azur and Franche-Comté).

By introducing the variables of economic activity and localization, we have been able to explain a large part of these differences. Pays de la Loire and historic Brittany would have given an additional contribution due to their rural nature, with the addition, for Brittany, of a less dynamic labour market. Taking account of these variables allows an overall reduction in the differences between regions, except for Aquitaine. We thus suggest that this unexplained difference is very probably rooted in the random nature of the assignment of regiments (constituted on a regional basis in the early years of the war, which were also the most bloody), combined with the location of German attacks, and thus of their greater or lesser participation in very deadly early battles.

Finally, in light of our statistical results, the political hypothesis of a sanction against antimilitarist department cannot be rejected and deserves a nuanced conclusion: our last econometric model suggests that while the regions that were most marked by anti-militarist sentiment effectively had more deaths than the others, these regions were also the most densely populated, with the most youthful populations, and were, in some cases, the closest to the combat zones. Anti-militarist sentiment may thus reflect fears that it would be the young who would be mobilized first – a fear which, when fulfilled, meant that it was the regions with youthful populations who suffered the most massive losses. Overall, even if the political proxy captures these effects of youth, density and proximity, the possibility of a sanction against the anti-militarist vote cannot be entirely excluded.

APPENDIX

Table A1. Descriptive Statistics

Variables	Description	Mean	σ	Min	Max
-----------	-------------	------	----------	-----	-----

Dead	Number of dead by area, dependent variable	14477	13227	1849	113615
Proximity	Coded 1 if the area is in the combat zone	0.415	0.496	0	1
Border Area	Coded 1 if the area is bordering	0.195	0.399	0	1
Potential Recruits	Potential Recruits in %	7.00	0.900	3.300	9.200
Sailers	Proxy of potential recruits in the navy	74.244	145.397	3	1034
Density	Population per km ²	73.592	64.331	15.485	444.226
Small Employers	Coded 1 if the proportion of industrial executives is higher than workers	0.085	0.281	0	1
Unemployment Rate	% of unemployment in the workforce	0.4	0.300	0.100	2.00
Farmers	Rate of farmers in the area	51.100	15.300	5.700	74.400
Mutineers	Number of mutineers in the region	107	124	8	543

Source: « MdH » database, Census 1911 and Marin report.

Table A2. Anti-militarist Model

	OLS	
AIC	58.8	10.8
BIC	61.1	13.1
Intercept	6.772***	7.666***
Proximity	0.149*	0.077
Border Area	-0.256***	-0.238***
Potential Recruits	17.824***	11.753***
Sailers	0.017**	0.010*
Density	0.005***	-0.003**
Small Employers	-0.308**	-0.319***
Unemployment Rate	51.111**	38.035**
Farmers	1.251***	0.726**
Anti-militarist Proba.	-	3.785***
Anti-militarist	0.154	-

Source: « MdH » database, Census 1911 and Marin report.

Table A3. Regional Mutineers

Regions	Number of mutineers for 10 000 soldiers
Pays de la Loire	3,0
Limousin	2,2
Bretagne Historique	3,7
Corse	9,7
Aquitaine	9,3
Midi-Pyrénées	2,6
Nord Pas de Calais	0,7

Île de France	17,3
PACA	15,7
Rhône Alpes	11,9
Picardie	1,6
Auvergne	5,9
Champagne Ardenne	1,0
Languedoc-Roussillon	13,2
Normandie	7,8
Poitou-Charentes	4,5
Centre	5,6
Bourgogne	6,6
Franche Comté	16,3

Source: Marin report.

PARTIE À REMPLIR PAR LE CORPS.

Nom LAFARGE

Prénoms Noël

Grade Soldat

Corps 2^e Régiment d'infanterie ^{10^e 1^{re}}

N° 3019092 au Corps. — Cl. 1905

Matricule. 9330 au Recrutement Limoges

Mort pour la France le 18 juillet 1918
dans le combat de nuit de l'Ourcq

Genre de mort Tue à l'ennemi

Né le 2 juin 1885
à Chatain-Val Département Haute-Vienne

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

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

Jugement rendu le 1 décembre 1921
par le Tribunal de Limoges (Haute-Vienne)
note ou jugement transcrit le 29 décembre 1921
à Moitannes (Haute-Vienne)

N° du registre d'état civil

534-708-1021. [20434.]

REFERENCES

Audoin – Rouzeau Stéphane, Christophe Prochasson (2008), *Sortir de la Grande Guerre, Le Monde et l'après 1918*, Ed. Tallandier. Paris.

Becker, Jean-Jacques (1988), *La France en guerre, 1914 – 1918, La grande mutation*, Editions Complexe.

Becker, Jean-Jacques (1973), *Le Carnet B*, Klincksieck.

Box, G. and Tidwell, P. (1962), "Transformations of the Independent Variables", *Technometrics*, 4, 531-50.

Capdevilla Luc, Danièle Voldman (2002), *Nos morts, Les sociétés occidentales face aux tués de la guerre*, Ed. Payot.

Cochet François, Rémy Porte (sous la direction de), (2008), *Dictionnaire de la Grande Guerre 1914 – 1918*, Ed. Robert Laffont, Paris.

Gilles Henri, (2010). « La guerre 1914-1918 : les morts par départements et par régions », p. 275-323, dans *Mémoire et trauma de la grande guerre*, Université Européenne de Bretagne, TIR (éd).

Le Hénaff (Colonel), (1922), « La préparation et l'exécution d'un plan de transport de concentration (août-octobre 1914) », *Revue militaire française*, n° 10 , Avril, pp.62-84.

Perchet Michel (Colonel), (1978), *L'armée de terre dans l'ouest : 1873-1978*, Région Militaire (3^e éd), CIRCA.

Maréchal Joffre (1932), *Mémoires*, Paris.

McCullagh, P. et Nelder, J.A. (1989), *Generalized Linear Models*, 2nd éd., Londres: Chapman & Hall.

Rapport Marin, (1921).

Mauriac François (1960), *Le nouveau Bloc-notes*, 1958-1960, Flammarion.

Miquel Pierre (1995), *La Grande Guerre*, Fayard.

Prost Antoine (2008), « Compter les vivants et les morts : l'évaluation des pertes françaises de 1914 – 1918 », *Le mouvement social*, janvier – mars.

Pedroncini Guy (1987), « Les mutineries de 1917 dans l'armée française », in *Historiens et Géographes*, juillet-août.

Rolland Denis (2005), *La grève des tranchées, Les mutineries de 1917*, Imago.

Rolland Romain (1952), *Journal des années de guerre (1914 – 1919)*, Albin Michel.