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### **Cohort component population estimates for Ireland, 1911-1920: A new county-level dataset for use in historical demography**

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Subject Areas: Economic History, History

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#### **Abstract**

This paper introduces a new dataset of vital statistics and cohort component population estimates at a spatially-disaggregated level for the island of Ireland for the period 1911-1920. The raw data were digitised by the authors using official UK government statistics. The population estimates were then derived by the cohort component method from demography. These data provide novel intercensal population estimates at the county level that will be beneficial for researchers working in historical demography, as well as in economic and social history. The data provided can be readily reused and extended by other researchers to produce further series and indicators. An example application of the data in this manner is Colvin and McLaughlin (2021), who combine these population estimates with mortality statistics from the Spanish flu pandemic to demonstrate how demographic composition affects the interpretation of data on public health crises.

#### **Keywords**

Demography, historical demography, population studies, population estimates, vital statistics, mortality, migration, Ireland, twentieth century. [J11, N33, N34]

## Specifications Table

<b>Subject</b>	Social sciences
<b>Specific subject area</b>	Historical demography
<b>Type of data</b>	Population tables
<b>Data format</b>	Raw Analysed Descriptive Statistical
<b>Parameters for data collection</b>	Data pertaining to population change in Ireland was acquired for intercensal years covering the period 1911-1920, to include the end of the Spanish flu pandemic.
<b>Description of data collection</b>	Source data were manually digitised by the authors from official government publications available online from the ProQuest database ( <a href="https://parlipapers.proquest.com/parlipapers/search/basic/hcппbasicsearch">https://parlipapers.proquest.com/parlipapers/search/basic/hcппbasicsearch</a> ). Intercensal cohort component estimates were then calculated by the authors. All data were inputted and stored in spreadsheet files.
<b>Data source location</b>	First-level administrative divisions of Ireland (32 counties), a region of the United Kingdom of Great Britain and Ireland (historical sovereign state, defunct in 1922).
<b>Data accessibility</b>	Repository name: UK Data Service Direct URL to data: <a href="https://doi.org/10.5255/UKDA-SN-854673">https://doi.org/10.5255/UKDA-SN-854673</a> Date published: 22 June 2021
<b>Related research article</b>	C. L. Colvin, and E. McLaughlin, 2021. Death, demography and the denominator: Age-adjusted Influenza-18 mortality in Ireland. <i>Economics and Human Biology</i> 41, 100984. Available at: <a href="https://doi.org/10.1016/j.ehb.2021.100984">https://doi.org/10.1016/j.ehb.2021.100984</a> .

## Introduction

This paper presents a novel historical demography dataset for Ireland in the period 1911-1920 inclusive, intended to serve as a comprehensive account of population change up to the point of Irish partition following the Government of Ireland Act 1920. The dataset contains new disaggregated estimates for the mid-year population and population composition for all 32 counties of Ireland, and with Belfast and Dublin reported separately, for each year between 1911 and 1920. Table 1 summarises this series, showing the average population estimates across all counties in each year by age group and sex.

[TABLE 1 ABOUT HERE]

The dataset also contains the various components of population change which are used to construct the main population estimates. These include: the number of births in each country per year (1911-1920); the number of deaths by age in each county per year (1911-1920), given in five- or ten-year age bins; the number of emigrants leaving from each county per year (1911-1919), from all countries; estimates of the number of international immigrants entering each county per year (1911-1919), to all countries; and estimates of troop movements into and out of each county per year (1914-1919), which are treated as migration movements, as per convention, in the population estimates. These series are formatted as individual tables within the dataset, with column headings displaying a shorthand county ID, county name, county province, year, data value, and age range group (where appropriate). Figure 1 reports the trends for total births and total deaths in Ireland over the period. Total deaths fluctuate around an 1911-1917 average of 72,994 before peaking during the years of the Spanish flu pandemic in 1918-1919 and falling sharply thereafter. Total births steadily decline over the period and remain depressed before rebounding following the end of World War I and the Spanish flu pandemic.

[FIGURE 1 ABOUT HERE]

We believe our dataset will be beneficial to researchers working in Irish economic history, social history, and historical demography. Our population estimates can be readily used to complement and enrich new studies, as well as provide opportunities for researchers to combine them with other data, in order to produce useful quantitative indicators. The time period covered by the dataset overlaps with noteworthy historical events such as the Irish revolutionary period, World War I, and the Spanish flu pandemic. These are areas where existing studies have operationalised demographic data—for

example, see Fitzpatrick (1978) and Hart (1997) on the geographic distribution of Irish nationalism and revolutionary behaviour—and, additionally, where researchers must consider the influence of demography in their analysis.

Existing research that seeks to exploit historical Irish demographic data has, for the most part, relied on official government statistics as provided in Ireland's decennial census reports, beginning in 1821. Vaughan and Fitzpatrick's *Irish Historical Statistics* (1978)—an ancillary publication to the multi-volume *New History of Ireland* project—has proved a venerable resource to this end, compiling the statistical tables on populations and vital statistics between the 1821 and the 1971 censuses. While such data are appropriate in many cases, and hitherto have been the only option for researchers, the decennial frequency of census data calls into question their reliability when analysing events occurring in intercensal periods.

Demographic data can be an invaluable tool for quantitatively driven analyses of historical events, however a failure to use the most accurate and relevant data can potentially mislead and give rise to biased results. Colvin and McLaughlin (2021) provide an example of this using the Irish experience of the Spanish flu pandemic of 1918-1919, showing that a reliance on the nearest census for population data can distort the denominator used in mortality statistics. Our dataset is designed to address these concerns and we recommend its usage in future studies into the aforementioned areas of Irish history.

There is also a great deal of scholarly interest in Irish historical demography and geography for their own sake. Tracing the development of, and exploring the causes behind, the substantial and sustained Irish depopulation following the Great Famine into the twentieth century has received interdisciplinary attention; such exercises also extend beyond the academe, with the government of the Irish Republic having established a Commission on Emigration and other Population Problems in 1948. Guinnane (1997), an exhaustive analysis of post-Famine population change focussed primarily on rural Ireland, is a more recent example in this area. Analysis of Irish population change and its relation to the economy has also extended to the pre-Famine period, such as in Graham and Proudfoot (1993), aided by various attempts at pre-censal population estimation. The construction of this dataset is also our effort in improving Irish population history, where we are seeking to address a lack of readily available demographic information for Ireland between the 1911 and 1926 censuses.

### **Experimental Design, Materials and Methods**

Our population estimates are constructed using the cohort component method, described in Smith et al. (2002). This is a commonly used method in demography for future population projection, where the various components of population change—births, deaths, migration, and ageing—are aggregated

to update both the total population amount as well as the population composition (presented by age-sex cohorts here) in each year. But rather than projecting future populations, we use this method to fill in gaps in the historical data and to address the lack of intercensal demographic information for Ireland between the 1911 and 1926 censuses. We stop our analysis in 1920 due to disruptions to statistical reporting during the transition to Irish partition.

The historical data that we have collected and digitised affords a relatively simple approach to the cohort component method that is largely atheoretical, requiring few assumptions or complex methods for projecting the components of population change. We start with the population provided in the 1911 *Census of Ireland* (British Parliamentary Papers, 1913a), the last all-Ireland census undertaken by the British administration, which was digitised by Clarkson et al. (1997) and Crawford et al. (1997). By this time the census reports had become highly accurate in their population counts. The main, relevant concern with the reliability of the 1911 census specifically is its biased age-distribution, resulting from the deliberately inaccurate self-reporting of age among the elderly (Budd and Guinnane, 1991); we discuss how we deal with this below.

From here, we employ the cohort component method to continually update the population within each age-sex cohort with changes that occur in subsequent periods. To do this, we use the following equation:

$$P_{sact} = P_{sac(t-1)} + (B_{sact} - D_{sact} + I_{sact} - E_{sact})$$

where  $P_{sact}$  is the population of sex  $s$ , at age-range  $a$ , in county  $c$ , and at time  $t$ ; and  $B, D, I$  and  $E$  are the various components of population change, namely within-year births, deaths, immigration, and emigration, respectively. Where possible, we have gathered official, contemporary statistics relating to each of these components; all data sources and estimation methods are described below.

### ***Births and Deaths***

We gathered data on the numbers of births and deaths in each county in each year from the *Registrar General's Reports for Ireland*. These report the number of births and deaths within each of the Poor Law Unions of Ireland, which were a second-level administrative unit used for the collection of vital statistics. These annual reports are compatible with the decennial census reports and can therefore be used in conjunction with one another. Walsh (1970) shows that, by 1911, disparities between census data and data reported in the Registrar General's reports had been near eliminated.

The births and deaths within each Poor Law Union were then aggregated to the 32 counties that constitute the country's first-level administrative units. These were then further aggregated to Ireland's four historic provinces (Connacht, Leinster, Munster, and Ulster); while not an official

administrative unit, these are considered socially and culturally important. Finally, these were aggregated to the national total.

Both the birth and death statistics are broken down by sex, and death statistics are additionally reported by age in five-year bins. Together, these allow us to also estimate the change in the population by distinct age-sex cohorts.

We manually digitised the birth and death statistics used in our cohort component estimates from each of the Registrar General's reports between 1911 and 1920 (British Parliamentary Papers, 1912b, 1913c, 1914b, 1915b, 1916c, 1917b, 1918b, 1919b, 1920b, 1921b).

### ***Migration***

Similarly, emigration statistics were also gathered from contemporary British parliamentary records, namely the *Emigration Statistics of Ireland* reports. These contain the number of emigrants from each of the 32 counties of Ireland, which again are broken down by sex and age groups. We digitised the reports corresponding to each year between 1911 and 1919 (British Parliamentary Papers, 1912a, 1913b, 1914a, 1915a, 1916a, 1917a, 1918a, 1919a, 1920a).

Contemporary statistics for immigration into Ireland do not exist. Instead, we base our estimates on information on annual immigration figures reported by Department of Social Welfare (1955, p. 326). We assume that immigration follows a similar spatial pattern to emigration, and allocate immigrants to counties based on county emigration patterns. This is not a heroic assumption given that immigration at the time mostly constituted returning emigrants, who would return to their families in their home counties (Fernihough and Ó Gráda, 2019). Indeed, from over 14,000 Irish returnees that appear in US passport document data for the years 1890-1920, almost three quarters claim family-related reasons as their return motivation (Dunnigan, 2012).

Table 2 reports the numbers of emigrants, in addition to our estimates on the number of immigrants, for each year between 1911 and 1920.

[TABLE 2 ABOUT HERE]

A limitation of our population estimates is the lack of accounting for internal migration within Ireland. We believe, however, that internal migration is of relatively lower concern for Ireland in this period. Historically, Ireland has had much lower levels of internal migration and urbanisation relative to other countries, owing largely to its slower pace of industrialisation (Guinnane, 1997, p. 122). A comparison of the 1901 and 1911 censuses gives a sense of the limited extent of Irish internal

migration; only 13.2 per cent of people were living in a county outside that in which they were born in 1911, compared to 11.4 per cent in 1901 (British Parliamentary Papers, 1901, 1913a). Additionally, World War I further limited the movement of people for most of the intercensal period we deal with.

Internal migration becomes more pronounced following partition of the island, particularly the exodus of minority Protestants and Catholics from the South and North of Ireland respectively (Lynch, 2019, ch. 7). This is another reason—alongside disruption to statistical reporting during partition—why we end the dataset in 1920, as the accuracy of our population estimates would likely be impaired without accounting for this increased internal migration.

### ***Military Personnel***

We account for military enlistment during World War I and treat troop movements as migratory behaviour; Irish soldiers leaving for war is treated as emigration, and subsequent demobilisation is treated as (return) immigration. Military enlistment is treated in the same way in the population estimates provided by the *Registrar General's Reports*; for example, the male population is estimated to have decreased by 49,881 between 1914 and 1915, and then increased by 63,000 between 1918 and 1919 (British Parliamentary Papers, 1921b, p. 40).

We estimate total Irish enlistment using contemporary military sources (British Parliamentary Papers, 1921a, p. 9; War Office, 1922, p. 363) and we disaggregate our total enlistment estimate to the county-level using an additional parliamentary source (British Parliamentary Papers, 1916b) that contains data on military age men in Ireland and which covers 97 per cent of the total Irish recruits. War Office statistics are used to estimate military mortality and these imply a mortality rate of 14 per cent for all military personnel.

Figure 2 is a county-level map of military recruitment intensity for the period 1914-1916. This is calculated by taking the estimated total number of recruits in each county as a share of the at-risk county population, defined as the male population aged 20-44 in 1911. Relatively higher levels of military recruitment is observed in urban areas and the province of Ulster.

[FIGURE 2 ABOUT HERE]

Finally, Table 3 reports the weights used to distribute migrants and military enlistment by age cohort, with migrants weights sourced from Akenson (1993) and military enlistment weights sourced from a contemporary government report (British Parliamentary Papers, 1921a). Contemporary estimates of recruitment discuss both the fitness for general service and the age of the population. It

was noted at the time that Ireland's lower share of the male population enlisting in the military was because 'Ireland is chiefly composed of young men up to 18 years of age and of men over 50, as a large proportion of the remainder emigrate to the United States and Colonies' (British Parliamentary Papers, 1921a, p. 9).

The age of military service was between 19 and 41. We have decided to exclude 19-year-olds to avoid introducing complicated assumptions about the proportion of 15-19 year olds eligible for recruitment. For the same reasons, we have included 42-44-year-olds from the 35-44 age group. The exclusion of 19-year-olds and the inclusion of 42-44-year-olds should largely balance one another out in the total recruit estimates. We allocated military recruitment between ages 20 and 44 assuming the age of recruits is proportional to the share of the 20-44 county population.

[TABLE 3 ABOUT HERE]

### ***Adjusting for Ageing***

Once we have accounted for all deaths and migration flows within an age-sex cohort, we then move a share of each age group forward by one year, assuming a survival rate for the last year in the age group. This effectively ages our population and updates the age structure in each year. For example, in the 25-29 age group the 'forwarded' share represents the 29-year-olds that have aged and moved to the 30-34 group; these are then replaced in the 25-29 group by a share of the 20-24 group, representing the 24-year-olds who have aged. We derive assumed survival rates of the last year in any age group using weights calculated from the same age group in the 1926 census, which was then conducted and published separately for the UK-polity of Northern Ireland (Government of Northern Ireland, 1929) and the Irish Free State (Roinn Tionscail agus Tráchtála, 1928, 1929). Table 4 reports the weights that are applied to the upper boundaries of the age groups, these being the relevant ages for the ageing adjustment.

### ***Age-Sex Cohort Categorisation***

We mostly follow the age groups that are reported in the *Registrar General's Reports* and in the Irish censuses, but we instead choose to group all the under-5-years ages together into one single age band of 0-4 years and to collapse all ages over 65 into one single age band of 65+ years. The latter is less impactful in terms of our data's granularity, but the choice was made due to perceived discrepancies with age statements in the 1911 census, our base year for the population estimates.



We elaborate on our choice to collapse the over-65s into a single age band: While Ireland’s census commissioners believed the self-reporting of age was more accurate in the 1911 census than in previous censuses (British Parliamentary Papers 1913a, p. 25), Budd and Guinnane (1991) raise concerns about the deliberate overstatement of one’s age to avail of the 1908 Old-Age Pensions Act, resulting in a biased age-distribution. We choose to collapse all age groups over 65 years-of-age as a way to avoid potential distortions in the 1911 census, that may arise from the overstatement of ages, while not trying to manipulate the underlying census data or introducing additional assumptions.

## **Conclusion**

We believe this dataset has significant reuse potential for research into modern Irish history, while also constituting a novel contribution to Irish demographic history in its own right. The importance of using accurate and relevant demographic data in quantitative historical research is shown in Colvin and McLaughlin (2021)—part of an ongoing research project on the Spanish flu in Ireland—and we recommend the usage of this dataset for historical analyses of Ireland in this time period.

Notably, the data allow for a re-examination of the Irish revolutionary period with new, intercensal demographic information. This can greatly enhance our understanding of the causes and geography of the Irish War of Independence, complementing existing quantitative analyses by Fitzpatrick (1978) and Hart (1997). For example, the authors—alongside Robin Adams—are using the data to investigate the “youth bulge” hypothesis (Weber, 2019), which links the population age structure to episodes of political violence in the 1910s and 1920s.

A key theme in the historiography of this period is Irish military recruitment and the Irish home front in World War I, where research has sought to explain military volunteering patterns and disparities across Ireland, evaluate Ireland’s contribution to the war effort, and investigate events such as the 1918 conscription crisis (Ward, 1974; Fitzpatrick, 1995; Pennell, 2012; Gallagher, 2019; Bowman et al., 2020). This is another example of a research area where the dataset will be beneficial, providing spatially disaggregated estimates of population and military recruitment that can be easily integrated and visualised (Figure 2).

## **Acknowledgments**

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## **Declaration of Competing Interest**

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this paper.

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Table 1: Population mid-year estimates for Ireland, 1911-1920 (national totals by age-sex cohort).

Year	Total										Total
	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65+	
1911	458,472	437,314	426,588	420,936	372,719	633,563	535,425	393,044	281,315	434,699	4,394,075
1912	495,113	444,006	422,928	417,222	366,354	631,429	533,522	391,163	280,406	415,959	4,398,102
1913	482,555	457,147	419,550	415,823	365,459	637,079	535,611	393,556	286,281	407,776	4,400,837
1914	471,099	465,702	419,491	415,174	366,748	643,561	538,289	396,125	292,033	401,162	4,409,384
1915	461,677	470,653	421,260	416,429	354,906	620,853	515,009	398,135	296,863	392,188	4,347,973
1916	448,503	472,843	423,756	418,709	352,790	610,107	501,466	399,014	301,939	384,828	4,313,955
1917	435,530	472,334	426,143	421,370	361,568	616,933	502,276	398,348	306,301	375,998	4,316,801
1918	423,416	469,309	427,976	424,065	371,243	627,915	506,789	398,592	311,780	375,207	4,336,292
1919	412,180	463,704	428,417	426,140	407,152	683,622	548,723	397,064	314,294	366,028	4,447,324
1920	416,051	457,917	428,229	428,281	411,554	697,106	554,856	399,553	318,602	363,921	4,476,070

Year	Males										Total
	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65+	
1911	233,901	221,819	216,925	213,148	188,489	310,205	272,342	197,108	136,278	203,055	2,193,270
1912	249,627	224,855	214,989	211,012	183,433	308,026	270,780	196,370	136,923	192,265	2,188,280
1913	242,796	231,226	213,156	211,367	182,947	310,858	270,772	197,702	140,234	188,259	2,189,317
1914	237,294	235,346	212,980	211,705	183,858	314,218	271,158	198,966	143,473	186,117	2,195,115
1915	233,053	237,731	213,721	212,489	170,078	287,751	245,483	199,603	146,219	181,930	2,128,058
1916	227,115	238,881	214,854	213,635	165,592	272,820	229,290	198,802	148,968	178,509	2,088,466
1917	220,723	238,787	215,992	214,962	172,073	275,423	227,438	196,621	151,182	174,424	2,087,625
1918	214,729	237,445	216,875	216,165	179,350	282,028	228,958	194,921	153,813	174,385	2,098,669
1919	209,140	234,785	217,123	216,892	212,843	334,043	268,741	192,416	154,868	170,381	2,211,232
1920	211,535	231,979	217,086	217,955	215,378	342,883	271,557	192,871	156,608	169,727	2,227,579

Year	Females										Total
	0-4	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65+	
1911	224,571	215,495	209,663	207,789	184,230	323,358	263,084	195,937	145,037	231,644	2,200,808
1912	245,486	219,150	207,939	206,211	182,921	323,403	262,742	194,793	143,484	223,695	2,209,824
1913	239,758	225,921	206,394	204,456	182,512	326,221	264,839	195,854	146,048	219,518	2,211,521
1914	233,805	230,356	206,511	203,470	182,889	329,343	267,131	197,159	148,560	215,045	2,214,269
1915	228,624	232,922	207,539	203,940	184,828	333,103	269,527	198,533	150,644	210,258	2,219,918
1916	221,388	233,962	208,902	205,074	187,197	337,287	272,176	200,212	152,971	206,319	2,225,488
1917	214,807	233,547	210,151	206,408	189,495	341,510	274,837	201,727	155,118	201,574	2,229,174
1918	208,687	231,865	211,101	207,900	191,893	345,887	277,831	203,671	157,967	200,821	2,237,623
1919	203,041	228,919	211,294	209,248	194,309	349,579	279,982	204,648	159,426	195,647	2,236,093
1920	204,515	225,937	211,143	210,325	196,176	354,223	283,299	206,682	161,994	194,193	2,248,487

Table 2: Migration estimates for Ireland, 1911-1920.

Year	Emigration (to overseas)			Immigration (from overseas)		Net migration Total
	Males	Females	Total	From US	Total	
1911	16,671	13,902	30,573			
1912	15,325	14,019	29,344			
1913	16,452	14,515	30,967	3,312	5,940	+25,027
1914	10,660	9,654	20,314	4,466	7,779	+12,535
1915	6,567	4,092	10,659	2,687	4,983	+5,676
1916	1,743	5,559	7,302	2,409	4,020	+3,282
1917	838	1,273	2,111	412	711	+1,400
1918	442	538	980	177	448	+532
1919	1,137	1,838	2,975	5,290	7,992	-5,017
1920	6,044	9,487	15,531	3,877	6,018	+9,513

Note: No immigration statistics were published for 1911 and 1912. For our dataset, we assume that immigration for 1911 and 1912 was the same as in 1913.

Source: British Parliamentary Papers (1912a, 1913b, 1914a, 1915a, 1916a, 1917a, 1918a, 1919a, 1920a).

Table 3: Age group weights used for migrants and military personnel.

Migrants								
Age group	0-14	15-19	20-24	25-29	30-34	35-54	55+	Total
Male	0.09	0.13	0.42	0.18	0.1	0.08	0.01	1
Female	0.09	0.27	0.39	0.12	0.07	0.06	0.01	1
Total	0.09	0.2	0.4	0.15	0.08	0.07	0.01	1
Military enlistment								
Age group	0-19	20-24	25-34	35-44	45+	Total		
Male	-	0.24	0.41	0.36	-	1		

Note: Source of migrant weights is Akenson (1993); source of military enlistment weights is a contemporary military report (British Parliamentary Papers, 1921a).

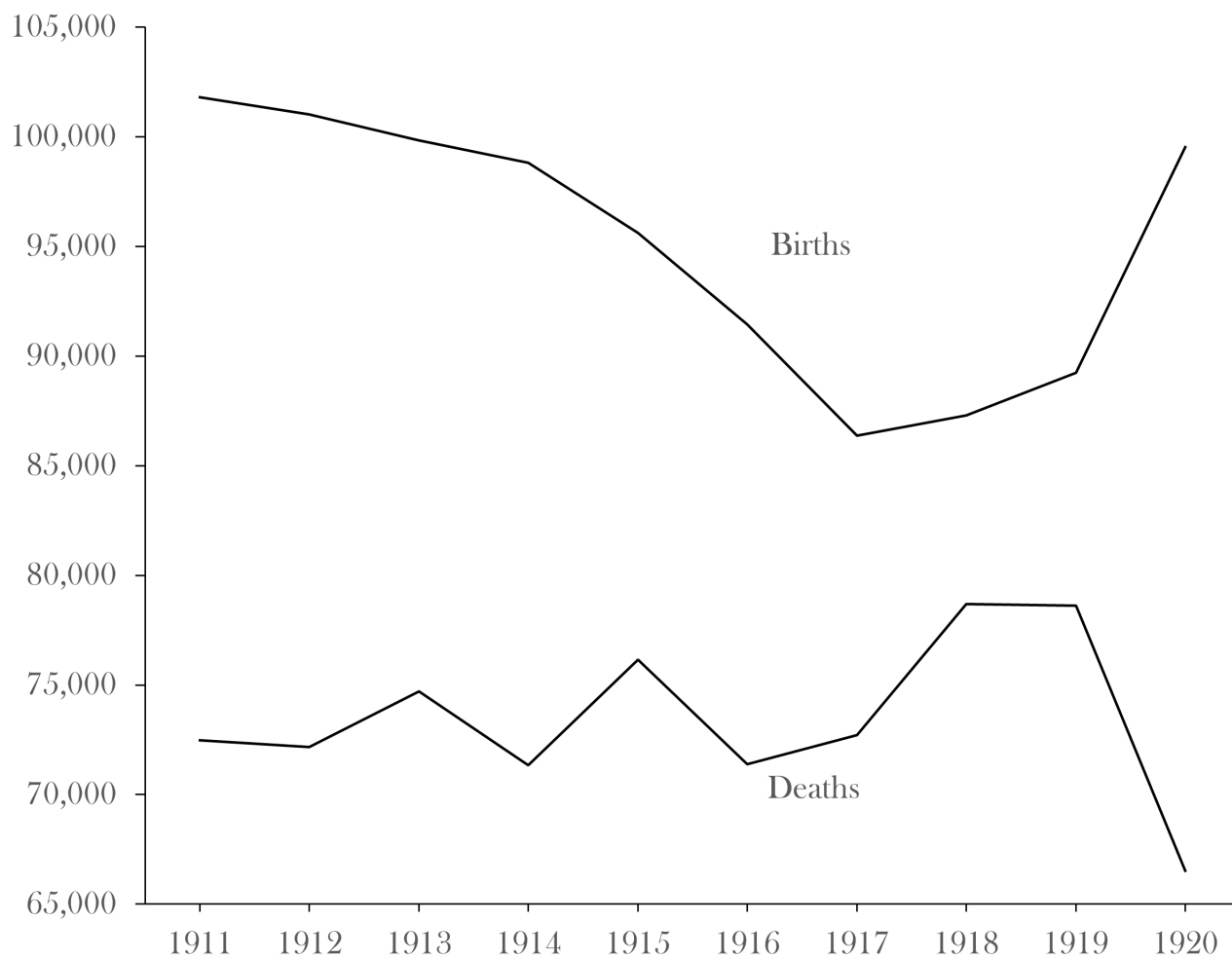


Table 4: Age-bin boundary weights

Age	All-Ireland			Irish Free State (26 counties)			Northern Ireland (6 counties)		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
4	0.205	0.206	0.203	0.203	0.206	0.2	0.208	0.206	0.21
9	0.187	0.19	0.184	0.19	0.193	0.185	0.181	0.181	0.181
14	0.203	0.206	0.199	0.202	0.207	0.196	0.205	0.205	0.205
19	0.19	0.194	0.186	0.188	0.194	0.182	0.196	0.196	0.196
24	0.187	0.18	0.194	0.187	0.181	0.194	0.186	0.179	0.192
34	0.083	0.084	0.083	0.084	0.085	0.082	0.083	0.082	0.083
44	0.084	0.086	0.082	0.083	0.085	0.082	0.086	0.088	0.084
54	0.092	0.098	0.086	0.092	0.1	0.084	0.092	0.092	0.091
64	0.079	0.077	0.081	0.08	0.078	0.081	0.078	0.075	0.08

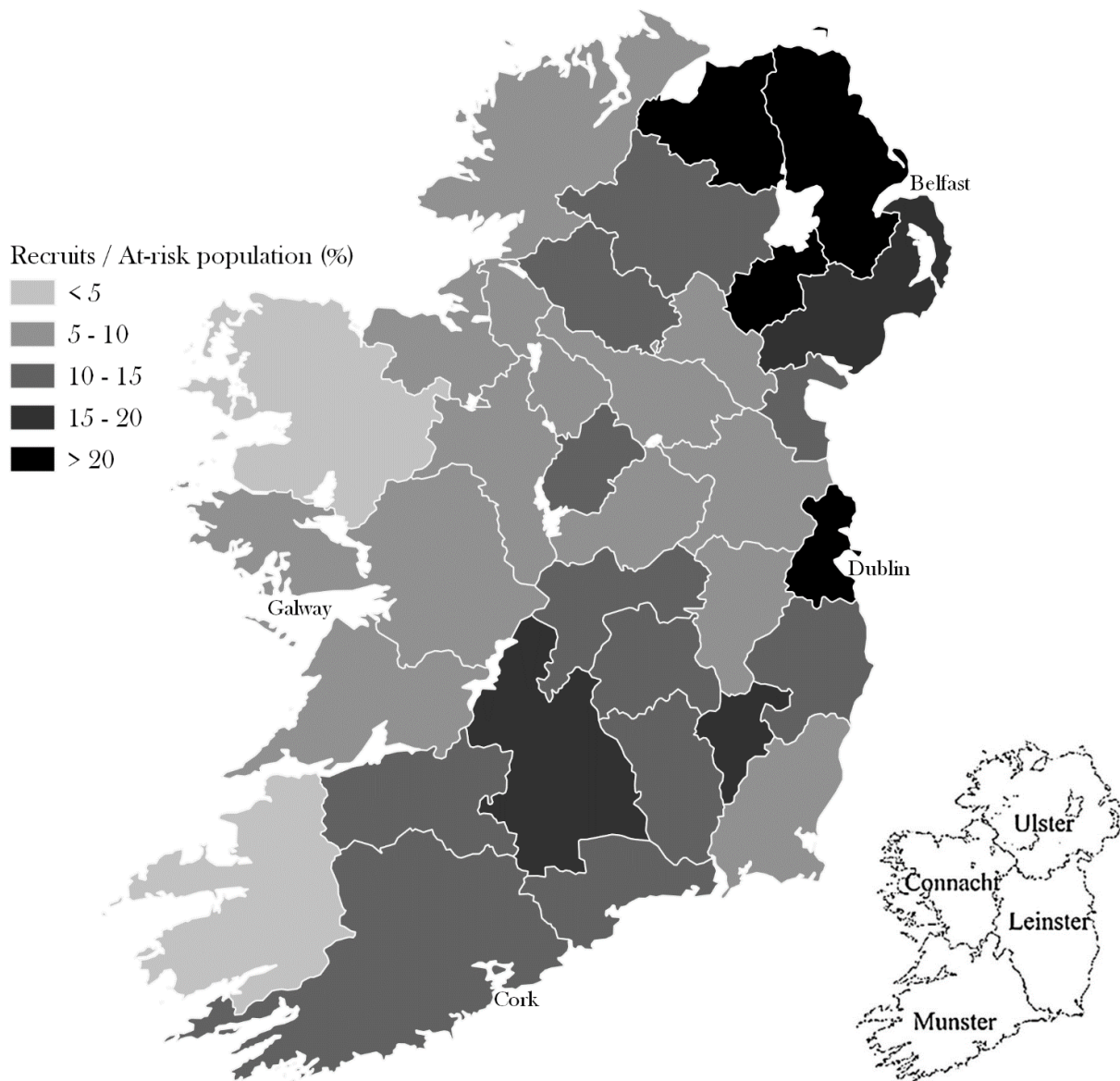
Source: Government of Northern Ireland (1929); Roinn Tionscail agus Tráchtála (1928, 1929).

Figure 1: Total births and deaths in Ireland, 1911-1920.



Source: Registrar General's Reports for Ireland (British Parliamentary Papers, 1912b, 1913c, 1914b, 1915b, 1916c, 1917b, 1918b, 1919b, 1920b, 1921b).

Figure 2: Estimated relative military recruitment, 1914-1916.



Source: Colvin et al. (2021); 1911 Census of Ireland (British Parliamentary Papers, 1913a).

Note: See text for calculation of values. Dublin City is included in Dublin County; Belfast in Antrim.