

# The Deep Roots of Rebellion: Evidence from the Irish Revolution

Gaia Narciso and Battista Severgnini

**Abstract:** What drives individuals to become insurgents? How do negative shocks explain social unrest in the long-run? This paper studies the triggers of rebellion at the individual level and explores the long-run inter-generational transmission of conflict, using a unique dataset constructed from administrative archives. Drawing on evidence from the Great Irish Famine (1845-1850) and its effect on the Irish Revolution against British rule (1913-1921), we find that rebels were more likely to be male, young, Catholic and literate. Moreover, we provide evidence showing that individuals whose families had been most affected by the Irish famine were more likely to participate in the rebellion. These findings are also confirmed when controlling for the level of economic development and other potential concurring factors, such as past revolutions and soil quality. Robustness checks based on the role of family names for studying socio-cultural persistence across generations support the above findings. The instrumental variable analysis, based on the extraordinary meteorological conditions that determined the spread of the potato blight that caused the famine, provides further evidence in support of the inter-generational legacy of rebellion.

**JEL classification:** Z10, F51, N53, N44.

**Keywords:** conflict, cultural values, inter-generational transmission, persistence, Great Famine, Irish Revolution.

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## 1. Introduction

Over the past decades, a large number of contributions in social science have investigated the origins of civil unrest and conflict. Various factors can be identified as potential drivers, such as economic conditions, inequality, political exclusion, ethnic and religious fractionalization, and natural resources.<sup>1</sup> However, empirical evidence on the individual decision to fight is still very limited for two reasons. First, investigating the characteristics of insurgents is a challenging task: rebels are a hidden population, which, by its very nature, is difficult to identify in a systematic way.<sup>2</sup> Second, social unrest and civil conflicts are usually studied *ex post*, making it hard to disentangle the short and long-run factors that trigger the rebellion decision at the individual level.<sup>3</sup> This paper overcomes these two issues. By using a unique dataset constructed from administrative data, we investigate the *individual* determinants of joining a rebellion and explore the long-run inter-generational transmission of cultural values and conflict.

Drawing on evidence from the Great Irish Famine (1845-1850) and its effect on the Irish Revolution against British rule (1913-1921), we show how negative shocks can explain social unrest in the long-run. We provide evidence showing that individuals whose families had been most affected by the Irish Famine were more likely to participate in rebellion against British rule during the revolutionary period. The instrumental variable analysis, based on the extraordinary meteorological conditions that determined the spread of the potato blight that caused the Famine, confirms the above findings.

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<sup>1</sup> See, among others, Collier and Hoeffler (2004), Miguel et al. (2004), Acemoglu and Robinson (2006), Gleditsch (2009), Blattman and Miguel (2010), Ponticelli and Voth (2012), Chaney (2013), and Caselli et al. (2015).

<sup>2</sup> There are only a few remarkable contributions exploiting micro level data on smaller scales, namely Costa and Kahn (2003), Krueger (2007, 2015) and Humphreys and Weinstein (2008).

<sup>3</sup> See, among others, Kuran (1989, 1991) and Cantoni et al. (2017).

We construct a unique data set at the individual level and investigate the consequences of the famine in a long-run perspective. To do so, we proceed in four steps. First, we consider individuals and households from the totality of the 1911 Irish Census. This data set, which contains about 4 million observations, provides a formidable source of information at the individual and household level shortly before the start of the Irish revolutionary era. Second, we make use of the lists of rebels, largely provided by the Irish Military Archives, and match it with the 1911 Irish Census, using both manual techniques and automated statistical methods. This allows us to investigate the individual characteristics of those who joined the movement of independence. We find that rebels are more likely to be male, young, Catholic and literate. Third, we gather a set of measures of the severity of the famine at local level, together with information on the exogenous drivers of the potato blight that caused the famine, which we then use in the instrumental variable analysis. This allows us to detect whether the long-run inter-generational transmission of individuals' behavior and attitudes (Cavalli-Sforza and Feldman, 1981) had a role in fuelling discontent against British rule. Finally, we collect detailed historical data on the Irish socio-economic and institutional set-up during the 19<sup>th</sup> century, which provide a very informative picture of Ireland before and after the Famine. The structure of our dataset allows us to shed light on the relationship between the inter-generational transmission of cultural values and conflict.

Over the last few years, several economic studies have investigated the roles of cultural values and how shocks can shape cultural behavior and economic trajectories in a long-run perspective.<sup>4</sup> In particular, our paper relates to the theoretical findings of Bisin and Verdier (1998), who provide evidence of the role

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<sup>4</sup> See the seminal work by Weber (1905 [1930]) on the connection between culture and growth and the review of the literature by Nunn (2009). See also Jha (2013) and Verghese (2016) on how historical events kindled the evolution of conflicts in India.

of a paternalistic transmission of culture and inter-generational persistence of sentiments towards institutions,<sup>5</sup> and to Chen and Yang (2015), who show the long-run effect of the Great Chinese Famine in shaping distrust in the local government 50 years later.<sup>6</sup> Famine episodes are indeed ideal candidates for studying the inter-generational transmission of values in a long-run perspective. The Irish Famine, caused by the diffusion of a potato blight, was one of the biggest tragedies of modern history. Over the period 1845-1850, about 1 million people died due to starvation and related diseases, while around 1 million emigrated, mainly to North America (Ó Grada, 1989). Relief was provided by Westminster in the form of public works, workhouses and eventually by Irish-run soup kitchens. However, the consensus among both modern historians and critics at the time was that these efforts were insufficient with “*relief being too little, too slow, too conditional and cut off too soon*” (Ó Grada, 2009). Indeed, Sen (1999) identifies the role of cultural alienation in his analysis of the Great Irish Famine, as “*Ireland was considered by Britain as an alien and even hostile nation*” (Mokyr, 1983).

The casual link between the Irish Famine and revolutionary episodes against the British government has been highlighted by a few studies on the Irish identity in the United States. Whelehan (2012) makes an explicit association between the two Irish events, writing that the “[i]ntergenerational transmission of Famine memories became a means of preserving visceral opposition and hostility toward British rule in Ireland and of efficiently mobilising the political and economic resources of the diaspora to advance the goal of an Irish Republic”. Our empirical results provide

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<sup>5</sup> Grosjean (2014) and Doepke and Zilibotti (2017) explore the persistence of political values over time. A culture of rebellion can also spread in a specific geographical area when people socially interact (Glaeser et al., 1996) and these effects can be persistent over a long period of time (Guiso et al., 2009 and 2016; Jha, 2013, Voigtlaender and Voth, 2012; Fouka and Voth, 2016). An alternative mechanism combines cultural transmissions with other social and economic factors, as in the work by Tabellini (2008).

<sup>6</sup> Meng and Qian (2009) investigates the health, education and labour effects of China’s Great Famine (1959-1961) on survivors’ descendants.

evidence in support of the famine's inter-generational legacy of rebellion: we show a strong relationship between the extent of the famine and the probability of participating in rebellion activities *two generations afterwards*. Inspired by studies on the importance of family names for studying socio-cultural persistence across generations (*e.g.*, Güell, Rodríguez Mora and Telmer, 2014; Clark and Cummins, 2015; and Bleakley and Ferrie, 2016), we exploit surnames in our dataset for tracking how rebellion animosity could have smouldered under the surface for more than one generation. Our results are robust even when controlling for the level of economic development and other potential concurring factors, such as past revolutions and soil quality. Finally, we base our instrumental variable analysis on the evidence related to the smooth and isotropic spread of the potato blight (Zadoks and Kampmeijer, 1977; Cavalli-Sforza and Feldman, 1981). We exploit the exogenous shock of the blight (Mokyr, 1980) and the extraordinary weather conditions that affect its spread to conduct an instrumental variable analysis at the local level. The results of the instrumental variable analysis support the view that cultural and political values are transmitted across generations.

The rest of the paper is structured as follows. Section 2 provides an overview of the Irish Revolution against British rule and the Great Famine. Section 3 describes the data sources and presents the structure of our dataset. Section 4 introduces the empirical strategies adopted and the main estimation results, while Section 5 investigates the inter-generational transmission mechanism. Section 6 presents the robustness checks and the instrumental variable analysis. Finally, Section 7 concludes.

## **2. Historical background**

### *2.1 The Irish Revolution (1913-1921)*

On Easter Monday April 24<sup>th</sup> 1916, about 150 armed men gathered in front of the General Post Office in Dublin and took it over. Padraig Pearse, one of the leaders of what will then be known as the Easter Rising, stepped out from the General Post Office and read the proclamation of the Irish Republic (Killeen, 2007). More rebels positioned around the city. The fighting between the rebels and the British troops lasted for five days and ended with the insurgents' surrendering. The leaders of the Easter Rising were arrested and executed. The Easter Rising was the first act of what later became the war of independence against British rule.<sup>7</sup> The Irish and British histories have been intertwined over the centuries. In 1916, year of the Easter Rising, Ireland was part of the United Kingdom of Great Britain and Ireland, which had been established with the *Act of Union* in 1801. On three occasions the Irish Members of Parliament had tried to achieve independence via legal ways in Westminster, in order to guarantee Home Rule for Ireland, *i.e.* the set-up of a Parliament in Dublin. The first two Home Rule Bills were defeated in Westminster, while the third Home Rule Bill eventually passed in 1914, just before World War I broke out. World War I played indeed a crucial role in Irish history and in the rebellion that eventually led to the creation of the Republic of Ireland. The implementation of the Third Home Rule Bill was stalled by the war, with the agreement that it would be implemented once the war was over. Following the Battle of the Somme (1916) and the enormous number of lost lives of British soldiers, a proposal to extend conscription to Ireland was put forward by Westminster.<sup>8</sup> An anti-conscription movement emerged in Ireland mainly led by the political party *Sinn Fein*, while the recruitment into the organization of the Irish

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<sup>7</sup> Three main rebel groups had emerged ahead of the Easter Rising. The Irish Citizen Army, which had been set up to defend workers on strike in 1914 against police baton; the Irish Volunteers, which had emerged as a response to the constitution of the Ulster Volunteer Force in 1913; the Irish Republican Brotherhood, a secret conspiracy seeking independence from the British.

<sup>8</sup> About 20,000 British soldiers lost their lives on the first day of the Battle of the Somme (July 1<sup>st</sup> 1916).

Volunteers soared. Irish conscription was eventually abandoned with the entry of the United States into World War I. Nonetheless, the parliamentary election that followed the end of World War I saw the strong victory of the *Sinn Fein* in Ireland. The elected *Sinn Fein* MPs refused to take their seats in Westminster and set up the *Dail Eireann* (Irish Parliament), a shadow Irish government. The rebellion against the British escalated in 1919, with the Irish rebels, now under the Irish Republican Army (IRA) name, conducting ambushes and attacks to British Barracks all over the country (Killeen, 2007). It was a local type of rebellion, based on guerrilla tactics. As of 1920, 675 British barracks across Ireland had been attacked in just over a year. The rebellion continued until 1921, when the Anglo-Irish Treaty, the truce that split the Irish counties between Northern Ireland and the Irish Free State, was signed.

Figure 1 visually presents the geographical distribution of the total number of rebels (over total population) by county of birth. Although the majority of rebels were born in Dublin county, many of them originated from the western (Galway, Kerry) and South-eastern counties (e.g., Wexford).<sup>9</sup>

*[Insert Figure 1 here]*

## 2.2 The Great Irish Famine (1845-1850)

After the Columbian voyages, the introduction of the potato from the Americas had substantial social and economic consequences for the rest of the world. Given the nutritional properties of this tuberous staple and the possibility to obtain a large amount of caloric intake in a relatively small amount of land, the potato easily spread throughout Europe (Langer, 1963; McNeill, 1999). Economic studies have highlighted the causal role of the introduction of potato on growth: Mokyr (1981)

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<sup>9</sup> It is worth underlining that the Irish Rebellion involved not only the main city centers but the entire Irish island, as shown in the *Atlas of Irish Revolution* (Crowley, Ó Drisceoil and Borgonovo, 2017).



finds a positive effect of the introduction of potato cultivations on population growth in Irish counties in 1845; Nunn and Qian (2011) estimate that about one-quarter of the Old World population and urbanization between the 18<sup>th</sup> and the 20<sup>th</sup> century occurred because of the potato. The potato played an important role in setting living standards for Irish population: introduced in the country in the 16<sup>th</sup> century (McNeill, 1949), over the centuries it became the main staple for the Irish population due to its nutritional content and the relative ease of cultivation in the Irish climate (Ó Grada, 1993). It is estimated that by the 1830s, one third of the Irish population depended on the potato<sup>10</sup> for 90% of their food intake (Feehanan, 2012).

The potato blight that led to the Great Irish Famine was caused by a fungus, the *Phytophthora infestans*. Originated in Mexico (Goss, 2014), it was transported to Europe via infected potatoes. It struck much of Europe and was observed in Belgium, France, Germany, and eventually England, Scotland and Ireland (Ó Grada, 1989 and 1994; Kenealy, 2002). The epidemic was most severe in Ireland,<sup>11</sup> particularly due to the widespread planting of potato and favourable unusual weather conditions. Infected potato tubers produce zoospores, which can move through the potato plant transmitting *Phytophthora infestans* to their foliage (Johnson, 2010). Indeed, the blight can be highly contagious, with estimates of 300,000 spores per day being produced by each lesion on a potato leaf (Agrios, 2005) and with these spores being transmitted by water or air. Spores can spread by water either by being washed into the soil of nearby potato plants due to rain, or alternatively by being splashed onto adjacent plants, again due to rain (Agrios, 2005). Infection can also spread from tuber to tuber in the presence of moist soil, both from one tuber to another within the same plant and from one plant's tuber to

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<sup>10</sup> In particular, the lumper variety.

<sup>11</sup> The particular strain of blight that hit Ireland is known as HERB-1, is currently extinct, and is more closely related to old strains of blight than modern ones (Yoshida, 2013).

another plant's tuber (Olanya, 2009). As to travelling by air, changes in humidity and temperature help spores detach from potato plant leaves (Xiang and Judelson, 2014).<sup>12</sup> Realistically for blight to spread significant distances, it needs to do so by air. Once soils have spores present within them they can remain infective to potato tubers for between 15 to 77 days (Andrivon, 1995).

Failures of potato crops were not uncommon in Ireland in the pre-Famine period. However, none of the previous episodes had reached a similar scale and for such a prolonged time span, as we show in Section 7.<sup>13</sup> The blight broke out in Ireland in 1845, when about one third of the potato crop was destroyed by the *Phytophthora* (Ó Grada, 2006). Excess mortality was rather contained in that year, even in the counties that were subsequently more affected by the famine (Ó Grada, 1994).<sup>14</sup> The following year was characterised by an almost complete failure of the potato crop, due to an unusually damp summer. In 1847 the extent of the blight was minimal, but due to the limited availability of seed potatoes from the previous year, the total yields were low, while yields per acre stood high. It was the high yield per acre of 1847 that led the poor and farmers to further plant potatoes in 1848. However, once again, the *Phytophthora* hit badly, and the crop failed almost completely. The blight appeared again, but to a lesser extent, in 1849 and, in some areas, in 1850 as well (Goodspeed, 2016). Excess mortality was particularly high over the winter and spring of 1846-47 (Ó Grada, 2006), once even the livestock holdings, used as buffer stock, had been exhausted. Excess mortality persisted until 1851. The famine claimed one million deaths over the period 1845 and 1851, while one million people emigrated, mainly to North America, out of a population of 8.5 million people (Ó Grada, 1989 and 1994). Given the spread of the potato, as the

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<sup>12</sup> Spores can remain infectious providing they are not exposed to solar radiation (Mizubuti, Aylor, and Fry, 2000).

<sup>13</sup> Feehanan (2012) reports that about thirty famines of diverse intensity had occurred over the century prior to the Great Famine.

<sup>14</sup> The counties of Clare, Cork, Kerry, and Leitrim.

main, if not the only, staple, the famine hit primarily the poor and farmers. It is estimated that the daily intake of potatoes for most of the year was about two kilos per person in the early 1840s. Although it was the main staple for the poor, potato consumption was also high among the higher social classes (Bourke, 1968 and Ó Grada, 1989). Mortality rates were higher for individuals above the age of 40 and for the very young (Ó Grada, 1989).<sup>15</sup> Rather than literal starvation, most of the deaths were due to fever or typhus induced by the hunger, as in other cases of famines, such as in Finland in 1868 (Mokyr and Ó Grada, 2002). Figure 2 presents the extent of the famine across the thirty-two Irish counties, as measured by the excess mortality rate. The west and south-west part of Ireland were more affected than the east, while there is evidence that Northern Ireland was not spared from the Famine.<sup>16</sup>

*[Insert Figure 2 here]*

According to Kenealy (2002), the period between 1845-1850 was characterised by riots and protests, while thefts escalated. Agitations had characterized the pre-famine period too, although the pre-1845 food riots were local in nature and mainly related to food price increases or unfair market practices. During the Famine, food riots and disorders broke out just after harvest in 1845 and 1846, in particular in the south-west of Ireland. Later agitations were more directed, aiming to lower food prices and increase public works wages. The British response to the riots was severe, while the British press covered the episodes as an example of the ingratitude of the Irish poor. As the Famine loomed on, the agitations became less collective movements and more individual actions against property. Towards

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<sup>15</sup> There is some evidence that mortality was higher for men than for women, although the difference was likely to be minimal (Ó Grada, 1994).

<sup>16</sup> The distribution of the Great Irish Famine presented in Figure 2 is consistent with the representation by Goodspeed (2016). We will use the measure proposed by Goodspeed (2016) in the robustness checks in Section 6.

the end of the famine, agitations ceased as prolonged undernutrition, disease and resignation emerged (Kenealy, 2002). Starting from 1847, famine relief was provided by the *Poor Relief (Ireland) Act* of 1838, which had established workhouses for the poor. In 1847 workhouses reached full capacity (Ó Grada, 1999).<sup>17</sup> Numbers of people in workhouses grew dramatically, while the number of individuals working in public works went from 27,000 in September 1846 to 700,000 in March 1847 (Ó Grada 1994, 1999). Apart from the energy consumption of already debilitated individuals, the wage offered for public works was low in real terms, given that the potato, the cheapest staple before the famine, was no longer available. In 1847, the public works were considered a failure and replaced by soup kitchens, according to the *Poor Law Amendment Act* of 1847. In the summer 1847, 3 million people were in receipt of food rations. With the introduction of the soup kitchens, the Irish were left by themselves. In the words of the Irish MP William Smith O'Brien in 1847 "*if there were a rebellion in Ireland tomorrow, they would cheerfully vote 10 or 20 millions to put it down, but what they would do to destroy life, they would not do to save it*" (Grossman, 2013).

Although the demographic impact was immediate, historical evidence suggests that politically motivated rebellion smouldered under the surface for several years. Historians identify two reasons for this delay. First, although the relationship between starvation and property crime is positive and clear, the impact of famines on other types of violence is not as clear-cut. According to Ó Grada (2009), during the years of the Great Famine non-violent offences against property increased substantially, while other violent crimes, such as assassinations, did not vary. Similarly, during the Russian famine, the initial political rebellions (Sorokin, 1975) against political institutions were soon replaced by indifference and resignation, due to the long period of starvation and physical deterioration (Ó Grada, 2009).

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<sup>17</sup> Mortality rates in the workhouses were also particularly high, due to fever and other diseases such as typhus.

Second, as discussed in the previous section, changes of law enforcement and institutional settings introduced by the British government together with the outbreak of the Great War fuelled the spreading of rebellion in Ireland (Kenealy, 2002).

### **3. Data and Matching techniques**

#### *Data from the 1911 census and Military Archives*

The first data source is the 1911 Irish Census, which has been recently digitized by the Irish National Archives. The Census provides extraordinary information, at individual and household level, of the Irish society at the beginning of the 20<sup>th</sup> century. For each household member, the Census records first and last name, gender, age, county of birth, relation to the household head, religion, literacy, knowledge of Gaelic, occupation and type of disability (if any). Furthermore, the Census contains very precise information on the location of dwellings. The 1911 Census dataset consists of over 3.9 million observations, across the thirty-two Irish counties. Table 1 presents the summary statistics at the individual level. Table B1 and B2 in the Online Appendix present the population distribution across counties and provinces.

*[Insert Table 1 here]*

The second source of data is provided by the Irish Military Archives. In 1923, the Irish Parliament (*Oireachtas of Saorstát Eireann*) passed a legislation, which granted a pension to all veterans or widows and children of deceased veterans who had participated in the Easter Rising and the War of Independence. Moreover, veterans involved in military activities during the Easter Rising were awarded a medal (the *1916 Medal*). We identify the rebels based on the list of pension and

medal applicants, which has been recently digitized and made available by the Military Archives. For each veteran, the list provides information about the name, surname, date of birth and place of residence at the time of the pension or medal application.<sup>18</sup> Applications could be made by veterans or their family members (*e.g.* wife or dependants) in case of veteran's death. In total, 4,662 pension or medal applications are available. About 82% of the applications were confirmed and overall 3,816 rebels (or their next to kin) were granted a pension or a medal. In addition, we countercheck and complement veterans' names with secondary sources of information about Irish veterans (Foster, 2015 and Connell, 2015).

### *Matching*

In order to obtain more information about the demographic background of rebels, we match the overall list of veterans with the 1911 Irish Census. This is hardly an easy task, given the frequency of some Irish surnames. Our matching relies on two different strategies. The first one is based on manually matching the list of rebels by exploiting historical sources available from the Irish Military Archives and on the Internet.<sup>19</sup> Integrated by these historical sources, this technique is based on two main principles: complete name (first and last name) and age. Given the evidence on age rounding on census forms, we allow for up to a 2-year discrepancy around the age reported in the Census. In a handful of cases, the manual matching involved the translation of Irish names in the Census into their English version or the matching of shortened names or looking for nee names of female rebels.<sup>20</sup> The manual matching is conducted on individuals who were 16 or older at the time of the 1911 Census. The second matching strategy is based on the

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<sup>18</sup> In a few instances, the veterans report more than one address of residence.

<sup>19</sup> The website consulted are [www.irishmedals.ie](http://www.irishmedals.ie) and [www.irishvolunteers.ie](http://www.irishvolunteers.ie).

<sup>20</sup> For example, the English version of the Irish name Seán is John.

technique proposed by Abramitzky, Mill, and Perez (2018), which links individuals across administrative datasets using an automated statistical method based on Expectation-maximization Method. Section A in the Online Appendix provides a detailed description of the two methodologies implemented.

Each matching technique produces two indicators: overall, two measures are more conservative (*rebel\_con* and *rebel\_8030*) while the other two are less conservative (*rebel\_lib* and *rebel\_6010*). We pool the four indicators and create a dummy variable *rebel* which takes the value 1 if individual *i* in the 1911 Census is labelled as rebel according to at least one of the 4 indicators and 0 otherwise. We identify 1,491 rebels in total, achieving a matching rate of about 24% with the Military Archives list.

Matching the veterans' list with the 1911 Census allows us to investigate the determinants of the decision to participate in the rebellion at the *individual* level. The summary statistics related to the insurgents' indicators are presented at the bottom of Table 1. According to the less conservative measure from the manual matching strategy (*rebel\_lib*), 0.02% of individuals in the Census are categorized as rebels. The more liberal indicator from the manual matching identifies 0.019% of individuals in the Census as rebels, closely followed by the more liberal measure from automated matching (*rebel\_6010*), according to which 0.018% of individuals in the Census were rebels. Finally, the conservative measure from the automated matching (*rebel\_8030*) identifies 0.004% of individuals as rebels.

The two matching techniques identify two different sets of rebels. On average, the manual technique is better able to identify the more historically known rebels or those with less common last names. In the case of women, the manual techniques also allowed searching the nee name of female rebels in the 1911 Census, rather than their married name in the National Military Archives list. Due to frequent recurrence of certain last names (*e.g.*, O'Brien), and first names (*e.g.*, Patrick), the manual matching is less able to match more common names: in case

of ambiguities, an overall conservative approach was adopted, thus leading to a relatively smaller number of veterans with common last names to be matched with the 1911 Census. The automated technique, on the other hand, does better in matching the more common names since it allows matching a greater section of the Irish Census. Given the advantages and disadvantages of each matching techniques, we consider them as complements rather than substitutes in categorizing individuals in the Census. However, as a robustness check, we also present the results for each of the four different indicators of rebellion separately.

Finally, for studying the distribution of Irish family names in Ireland over time, we consider two additional administrative sources. The first one is a survey for determining the status of poverty in Ireland, the *Griffith's Valuation*,<sup>21</sup> which is the only genealogical information available in Ireland before the 20<sup>th</sup> century. Carried out between 1848 and 1867, it provides a representative picture of the Irish society. The second source is the 1901 Irish Census, which is available in its entirety.

### *Measuring the Famine and other covariates*

We collect information on the extent of the Irish famine and construct two main measures of the famine. First, we measure the extent of the famine in terms of the excess mortality rate at county level between 1846 and 1850. We consider the data provided by the work of Cousens (1960). Excess mortality rate per thousand inhabitants is calculated as the ratio of excess deaths at county level during the Famine years and the county population in 1841. The excess death measure at a county level is the difference between the postulated deaths and actual recorded deaths. Second, we measure the extent of the famine in terms of potato

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<sup>21</sup> <http://www.askaboutireland.ie/griffith-valuation/>



crop failure rate between 1845 and 1846 at county level. Information on potato production at county level relies on the statistical data provided by Bourke (1959). Moreover, we construct three additional measures of the extent of the Famine at two different level of disaggregation, *i.e.*, townlands and baronies.<sup>22</sup> These three additional measures of the extent of the famine are used in a series of robustness checks. The first measure is constructed taking the percentage change in population between 1851 and 1841 at townland level. Population data are provided by the Historical Mapping Population Change Dataset constructed by the All-Island Research Observatory (AIRO).<sup>23</sup> The second one takes the difference in population growth rate between 1851 and 1841 and the population growth rate in the pre-famine era, between 1841 and 1831 at barony level. In this case, population data are constructed from the Irish Censuses between 1831 and 1851 and published by the UK Data Archive (Clarkson et al., 1997). The third measure arises from the work by Goodspeed (2016) on the extent of the Famine, which is based on textual analysis on the reports of the Parliamentary Relief Commission at the time of the Famine and categorized into three different levels (*i.e.* low, medium, and severe blight). We construct an indicator variable that takes the value of 1 if the famine is reported to be severe and 0 otherwise. This indicator variable is available at barony level.<sup>24</sup>

The geographical coordinates of cities and the borders of Irish counties and related Geographical Information System (GIS) data during the 19<sup>th</sup> and 20<sup>th</sup> centuries are extracted from the EURATLAS files (Nuessli, 2011). We also collect data on soil quality at a county level from the 2002 Food and Agriculture

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<sup>22</sup> There were 326 baronies and 60,679 townlands in 1911 (Source: [www.townlands.ie](http://www.townlands.ie), <http://www.census.nationalarchives.ie/about/>).

<sup>23</sup> <http://airo.maynoothuniversity.ie/mapping-resources/airo-research-themes/historical-mapping>

<sup>24</sup> Figure B3 in the Online Appenidix presents the geographical distribution of the measure introduced by Goodspeed (2016).

Organization (FAO) database on Global Agro-Ecological Zones.<sup>25</sup> This database summarizes the potential of crop cultivation on the basis of information on both climatic and land characteristics at 0.5 x 0.5 degree cells (about 56 km x 56 km). The higher the value of the FAO index the higher crop suitability.<sup>26</sup> We construct two measures taking the average of potential land suitability for cereal production and potato production provided by the FAO database. We also collect emigration rates at the county of origin between 1851 and 1852, as measured by the Irish Emigration Database.

Furthermore, we gather data on social unrest episodes per 1,000 individuals during the 18<sup>th</sup> and 19<sup>th</sup> centuries at a county of birth level: data on the 1798 rebellion (*claimants1798*) are collected from Cantwell (2011), while data on the number of social unrest episodes (*violence1881*) and acts against property (*property1881*) during the Land War (1879-1881) are based on the work of Fitzpatrick (1978).<sup>27</sup> Table 2 presents the summary statistics at county level.

*[Insert Table 2 here]*

Finally, in order to conduct the instrumental variable analysis, we collect data on data on temperatures and precipitations from the datasets constructed by Luterbacher et al. (2004) and Pauling et al. (2005), respectively, and adjusted by the Climate Research Unit of the University of the East Anglia.<sup>28</sup> More precisely, we consider the deviation of the summer temperature (measured according to a Celsius scale) and rain precipitation (measured in millimetres) in 1846 with respect to their average during the period 1744-1844. Given that these data are based on a 0.5° x 0.5° grid resolution, we extend the dataset in the following way: first, we

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<sup>25</sup> <http://www.fao.org/nr/gaez/about-data-portal/en/>

<sup>26</sup> For a more detailed description of the FAO dataset and its potential use in economic studies, see Nunn and Qian (2011).

<sup>27</sup> Missing data for the variable *claimants* have been replaced with 0s for 4 counties.

<sup>28</sup> <https://crudata.uea.ac.uk/cru/projects/soap/data/recon/>

consider the point in the middle of each grid; second, we interpolate the values for each season using the GIS surface inverse distance weighting tools; finally, we compute the average temperature per different geographical areas using GIS statistical zone tools.

#### 4. Estimation strategy

We investigate the determinants of taking part in the rebellion and the role of the famine on the probability of becoming a rebel. We follow the approach by Krueger (2015) and we estimate the following equation:

$$Rebel_{icd} = \alpha + \beta Famine_c + \gamma X_i + \vartheta C_c + \delta Z_d + \varepsilon_{icd} \quad (1)$$

The dependent variable,  $Rebel_{icd}$  is an indicator variable, which takes the value 1 if individual  $i$ , born in county  $c$ , living in district electoral division  $d$ ,<sup>29</sup> takes part to rebellion activities and 0 otherwise. We control for a set of individual characteristics,  $X$ , such as age, gender, literacy, occupational dummies, being Catholic, marital status, whether the individual speaks Gaelic, and household size. The variable  $Famine_c$  measures the extent of the famine in the county of birth  $c$ . The main measure of the extent of the famine is excess mortality rate per thousand individuals at county level. As a robustness check, we also use the potato crop failure rate between 1845 and 1846, measured at county level. In the robustness checks presented in Section 7 we introduce three alternative measures of the extent of the Famine, at barony or townland of birth. We also control for a set of variables at county of origin level,  $C$ , *i.e.* emigration rates between 1851 and 1852, the extent of past rebellions and soil quality as measured by the FAO indices at county level.

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<sup>29</sup> There are 3,329 district electoral divisions in the 1911 Census.

We include a set of characteristics of residence as of 1911 at district electoral district level,  $\mathbf{Z}$ , namely the share of males, the share of Catholics, the share of individuals aged between 25 and 40 years old and adult literacy rate.<sup>30</sup> Standard errors are clustered at the electoral district of residence.

## 5. Main estimation results

Given the large number of observations in our dataset, taking part in rebellion activities can be considered as a statistically rare event. Therefore, we adopt the rare events logistic estimation method, as introduced by King et al. (2003). As a robustness check, we also present the results using a linear probability model. We restrict our analysis to the sample of individuals who were over 10 years old and under 65 at the time of the 2011 Census.

First, we investigate the individuals' determinants of participating in rebellion activities.<sup>31</sup> Column 1 of Table 3 presents the estimation results of a specification that only includes individuals' characteristics. In line with the findings by Humphreys and Weinstein (2008), younger and male individuals are more likely to become insurgents. Given the religious fractionalization, it is not surprising to find that Catholics are more likely to be part of the rebellion. Similarly, we find that speaking Gaelic is positively related with the probability of being a rebel. Individuals belonging to larger households are also more likely to be part of the revolt. We do not find a statistically significant relation between marital status and

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<sup>30</sup> Adult literacy rate is defined as the percentage of individuals over 15 who are literate, i.e. who can read or read and write.

<sup>31</sup> Note that Table 3 presents the results of the rare events logistic estimation method. The estimation results from the linear probability model are reported in Table B3 in the Appendix and are in line with the findings in Table 3. Note that, because of computational limitations, Table 3 does not report the marginal effects. However, following the suggestion proposed by Greene (2011) we can calculate an approximation of the marginal effects in a logit estimates with rare events as  $Prob(1 - Prob)\beta$ , where  $\beta$  is the parameter of interest.

being an insurgent. Column 2 adds information about occupations and location of residence. Professionals are less likely to participate in the rebellion, thus highlighting a potential higher opportunity cost for them to be part of the insurgence. Individuals working in agriculture are less likely to be rebels, although this variable could be capturing location of the respondent rather than the actual occupation. Finally, production workers are more likely to be part of the rebellion.

Column 2 explores the role of peer effects in influencing the decision to participate in the rebellion. We include a set of variables at district electoral division level of residence according to the 1911 Census, *i.e.* the share of men in the district, the share of Catholics, the share of individuals aged 25-40 and adult literacy rate. As expected, individuals living in districts with a higher prevalence of Catholics are more likely to join the rebellion. Similarly, we observe a peer effect of age distribution at district level, as the higher the share of individuals of younger age, the higher the probability of becoming an insurgent. We also control for province indicators of residence. Individuals living in the West of Ireland (Connacht) and in the East (Leinster) have a higher probability of taking part to the rebellion relative to individuals living in the North of Ireland (Ulster). In addition, living in Dublin is positively associated with becoming a rebel. Given that the location choice may be endogenous, we interpret these latter results in terms of correlations. The next column (column 3) introduces our main variable, which measures the extent of the famine, *i.e.* the excess mortality rate at county of birth level.

*[Insert Table 3 here]*

We consider the county of birth of each individual in the census and match it with our measure of the excess mortality rate, as a way of measuring the severity of the Great Famine. The estimated coefficient of the excess mortality rate is positive and statistically significant at the 1% level. Being born in an area where the famine was more severe increases the probability of becoming a rebel by about

0.42%. Of course, many other concurring factors might explain the strong relation between the famine and rebellion activities. We tackle these potential alternative aspects in this table and in the following one. Many authors have investigated the impact of the famine on Irish emigration, in particular to the United States. Therefore, in the next column we control for the extent of out-migration and include the emigration ratio at county of birth, measured as the change in population between 1852 and 1851 over population in 1841. The estimated coefficient is negative and statistically significant, while the estimated coefficient of the severity of the famine is still positive and statistically significant at the 1% level. The negative estimated coefficient of the migration variable seems to suggest that out-migration could act to attenuate the probability of revolting, as also suggested by Hirschman (1970). Finally, column 5 introduces an alternative measure of the famine, namely potato crop failure rate at county of birth level between 1846 and 1845. In line with the previous measure, we find that the higher the severity of the famine, as measured in terms of potato crop failure, the higher the probability of becoming a rebel, with a marginal effect in probability of 0.001% for a 1% loss of potato production. The results offered in Table 3 are based on a rare logistic estimation. Similar findings emerge when we estimate equation (1) using a linear probability model (Table B3 in the Online Appendix).

So far, we have focused on the role played by the famine in determining the probability of joining the movement of independence. Then, the question is: did the famine have a direct effect on the probability of rebellion or can we identify other potential alternative mechanisms? Could previous acts of rebellion, rather than the Great Irish Famine, explain the probability of participating in the movement of independence in the 20<sup>th</sup> century? Were the counties most affected by the famine poorer due to low soil quality, which is potentially linked to the extent of potato cultivation and to the extent of the famine? We tackle these issues in Table 4. Column 1 in Table 4 presents the results of a specification that includes the entire

set of controls (as in column 4 and 5 of Table 3) and investigates the role of soil quality at a county level. We include the two FAO measures, which capture the potential for cultivation of crops on the basis of climatic and land characteristics. We focus on two crops in particular: cereals, which Ireland exported to Great Britain, and the potato. A higher index indicates a higher potential crop production. Including these two measures does not affect the overall statistical significance for the measure of the extent of the famine on the probability of joining the rebellion. The estimated coefficient of the FAO index related to cereals is negative and statistically significant, indicating that individuals born in areas more ideal for cereal cultivation (and potentially wealthier due to cereal exports) are less likely to be insurgents.

The Famine had also a substantial economic impact, as shown by O' Rourke (1991 and 1994). Therefore, counties more affected by the potato blight were more likely to be impoverished as a result of the famine. The relation that we find between the probability of becoming a rebel and the extent of the famine in the county of birth could be driven by economic development rather than the famine itself. In order to take into account of this possibility, column 2 of Table 4 presents a specification in which we control for the adult literacy rate in the county of birth of the respondent. This variable acts as a proxy for the general economic development of the county of birth. The effect of the famine in shaping the rebellion decision is robust to this specification as well, as the estimated coefficient remains positive and statistically significant at the 1% level. On the other side, the literacy rate (*Literacy rate - COB*) is negative and statistically significant, showing that individuals born in counties with a lower literacy rate are more likely to join the rebellion.

*[Insert Table 4 here]*

The next column controls for the role of previous acts of rebellion. We focus on three different variables which capture two main agitations against British rule that characterized Ireland in the 18<sup>th</sup> and 19<sup>th</sup> century. *Violence 1881* and *Property 1881* refer to the Land War, an agitation calling for the redistribution of land from landlords to tenants. We construct two measures: the first one captures the number of acts of violence (per 1,000 inhabitants) in relation to the Land War (*Violence 1881*); the second denotes the number of acts against property registered per 1,000 inhabitants (*Property 1881*). We also include a variable capturing the extent of the revolution of 1798. Although we do observe a relationship between the probability of becoming a rebel and previous insurgence activity in the county of birth, the sign and statistical significance of the famine measure is unchanged. We can conclude that even when controlling for the level of economic development and other potential concurring factors, there is evidence in support of the famine's inter-generational legacy of rebellion.<sup>32</sup>

As discussed in Section 3, the construction of the dataset involves two mechanisms of matching the 1911 Census with the lists of rebels from historical sources. The results presented in Table 3 and 4 use the indicator *Rebel<sub>icd</sub>* as the dependent variable. This indicator takes the value of 1 if individual *i* is identified as rebel by at least one of the 4 indicators arising from the matching. Table 5 presents the estimation results for each of the 4 indicators arising from the manual and automated matching.

*[Insert Table 5 here]*

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<sup>32</sup> Table B4 in the Online Appendix presents the results using the alternative measure of the extent of the famine, *i.e.* the rate of potato crop failure over the period 1846-1845. The estimated coefficient on Famine is less precisely estimated, although the sign is in line with the findings presented in Table 4.



Column 1 and 2 present the specification using the two indicators of rebellion based on the manual matching. The first indicator, *Rebel\_lib*, is the less conservative measure, while *Rebel\_con* is the more stringent one. In both cases, we find that the estimated coefficient of the extent of the famine is positive and statistically significant at the 1% level. Column 3 and 4 present the evidence using the two indicators arising from the automated matching. Again, we distinguish between the less conservative measure (*Rebel\_6010*) and the more conservative one (*Rebel\_8030*). The previous results are also confirmed when considering these two measures taken one by one. Finally, the last column adopts an alternative dependent variable, which captures any pension recipient (rather than pension applicant) that we are able to identify. Indeed, the dependent variable is now the indicator *Rebel\_pen*, which takes the value 1 if individual *i* is identified as a rebel according to at least one of the 4 measures and if the individual is granted a pension. Again, the estimation results presented in column 5 confirm the previous findings.<sup>33</sup>

## **6. Exploring the mechanism: Inter-generational transmission of rebellion**

In this section, we study the relevance of the inter-generational transmission of rebellion during the period between the Famine and the Irish Rebellion. Unfortunately, given the information contained in our historical sources, we are not able to construct a complete and representative map of genealogical trees of Irish families.<sup>34</sup> As an alternative, we exploit the distribution of individuals' surnames across different time periods. If the inter-generational transmission of rebellion

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<sup>33</sup> Table B5 in the Online Appendix presents the estimation results using the alternative measure of the extent of the famine.

<sup>34</sup> Another potential channel of transmission of political discontent could be via visual memories, such as memorials (see, e.g., Assmann, 2009 and Ochsner and Roesel, 2017). However, this does not seem to be the case for Ireland. According to the *Atlas of the Famine*, only 30 memorials were built before the Rebellion. Most of the memorials were built in remote areas around the country.

does play a role, then we would expect that family names that were more exposed to the Famine would be positively related to the probability of rebelling. The use of family names for detecting potential inter-generational transmission of values has already been considered in economics and economic history (e.g., among others, Güell et al., 2014; Clark and Cummins, 2015; and Bleakley and Ferrie, 2016). In our case, we combine the family names reported in the *Griffith Valuation*, the 1901 Census and the 1911 Census, respectively. In order to have homogeneity in family names across different sources, we either translate the Irish surnames in English or uniformize them. In this modified version, we have 1,305, 69,730, and 76,533 surnames from the *Griffith's valuation*, 1901 Census, and 1911 Census, respectively. Finally, we consider the phonetic translation of last names.<sup>35</sup> A correlation using the specificity of the local last names suggests low geographical mobility of surnames over time.<sup>36</sup> In addition, statistical tests suggest that family names in the *Griffith's Valuation* are not related with either measure of the extent of the Famine.<sup>37</sup>

We then consider the estimation framework suggested by Bleakley and Ferrie (2016)'s methodology, which consists of two steps. In a first stage we run an OLS regression of an equation where the dependent variable is our measure of the extent of the Famine (*i.e.*, the excess mortality rate or potato crop failure rate) and the regressors are the family name's fixed effects. The second stage is a modified

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<sup>35</sup> We use the Stata command *soundex*.

<sup>36</sup> More precisely, we construct an index for how these surnames are specific in county  $c$  across the three historical sources. The surname index is similar to the ones suggested by Fryer and Levitt (2004), *i.e.*  $Surname Index_{c,t} = \frac{\Pr(Surname|county,t)}{\Pr(Surname|county,t) + \Pr(Surname|Ireland - county,t)}$

We find that surnames in the *Griffith's Valuation* are correlated with the 1901 and 1911 Census with a coefficient of 0.31 and 0.30, respectively, while surnames across the two Censuses have a correlation coefficient of 0.96.

<sup>37</sup> A  $\chi^2$  test on cross tabulation of the first letter of the surname and either the excess mortality rate or the potato crop failure does not reject the hypothesis of statistical independence of the variables.

version of (1), estimated via logit, where we include the predictive power of the surnames ( $\widehat{Famine}_c^{surname}$ ) and the estimated errors ( $\widehat{Famine}_c^{errors}$ ).<sup>38</sup>

$$Rebel_{icd} = \alpha + \beta_1 \widehat{Famine}_c^{surname} + \beta_2 \widehat{Famine}_c^{errors} + \gamma \mathbf{X}_i + \vartheta \mathbf{C}_c + \delta \mathbf{Z}_d + \varepsilon_{icd} \quad (2)$$

Table 6 displays the coefficients of the estimates of (2): the positive and significant sign of  $\widehat{Famine}_c^{surname}$  confirms that the inter-generational transmission of the famine is an important driver for becoming a rebel.

*[Insert Table 6 here]*

## 7. Robustness checks and Instrumental Variable analysis

The analysis we have presented so far relies on measures of the Famine at county level. In this section, we present two alternative measures of the Famine at townland and barony level and perform an instrumental variable analysis using the exogenous drivers of the potato blight that caused the Famine. The analysis at townland and barony of origin allows for a greater geographical variation in the analysis of the effect of the Famine on the probability of rebelling. Two issues arise in relation to the use of more geographically disaggregated measures of the Famine. First, the townland of origin is available in the 1911 Census for 40% of the census respondents in our sample.<sup>39</sup> Second, in some instances it is difficult to distinguish between the county name and the name of the main city of that specific county (*e.g.* Galway city and county Galway). Keeping in mind these potential shortcomings, we construct three additional measures of the severity of the Famine at a more disaggregate level. The three measures, described in detail in Section 3, are: 1) the

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<sup>38</sup> The estimated errors are included to control for the residual effects.

<sup>39</sup> The 1911 Census questionnaire explicitly asks about the *county* of birth, rather than the town of birth.

change in population between 1851 and 1841 at townland level ( $\Delta pop_{5141}$ ); 2) the difference between the population growth rate between 1851 and 1841 and the population growth rate in the pre-famine era (1841 - 1831) at barony level ( $\Delta pop\_rate$ ); the *blight indicator* introduced by Goodspeed (2016) on the severity of the famine at barony level.<sup>40</sup> The results of the estimation using these alternative measures, although less precisely estimated due to the smaller sample size, confirm the results of the analysis conducted at county level (columns 1-3 of Table 7)

*[Insert Table 7 here]*

The estimated coefficients could potentially be biased for two reasons.<sup>41</sup> First, the explanatory variables based on historical data, such as the measure constructed by Cousens (1960) on excess mortality, might contain measurement errors. Moreover, according to Mokyr (1980), the use of population change as proxy of the famine does not take into consideration neither migration effects nor potential pre-famine (Malthusian) dynamics. Second, although we introduce a set of control variables at the individual and county level, a bias of the results could be induced by potential confounding factors positively related both to the extent of the famine and the probability of joining the Irish rebellion movement.

In order to deal with these issues, we propose an instrumental variable approach, where the instruments are based on the extraordinary weather conditions that determined the spread of the potato blight. We refer to the scientific literature based on the dispersion of the potato blight and exploit the natural and *exogenous* drivers of the intensity of the effect of the famine. In particular, we exploit the fact that the *Phytophthora infestans* was transmitted by agents independent from human

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<sup>40</sup> For comparison reasons, we consider the sample for which the blight indicator is available.

<sup>41</sup> An additional concern could be related spatial autocorrelation. Studying our variables at barony-level, a standard Moran I's test provide a p-value of 0.11 and 0.42 of the variable  $\Delta pop\_rate$  and *blight indicator*, respectively. This reinforces even more the isotropy of the diffusion process.

action.<sup>42</sup> The scientific findings by Zadoks and Kampmeijer (1977) and Cavalli-Sforza and Feldman (1981) confirm that the spread of the potato blight between 1845 and 1846 in Europe is a classical example of smooth and isotropic dispersion, ruling out other type of social and human interventions.<sup>43</sup> In our first stage, we instrument our measure of famine with two variables, *i.e.* the deviation of the summer temperature and rain precipitation in 1846 from the average summer temperatures and rain precipitation of the preceding century (1744-1844), at barony level.<sup>44</sup> The choice of these variables is based on the scientific findings of Bourke (1964) and Bourke and Hubert (1993), who remark that humidity and summer temperature are positively correlated with the intensity of the famine in Ireland. Figure 3 displays the entire evolution of the deviation of the temperature with respect to an interval covering the previous 100 years and the periods in which precipitation were higher than the average, showing the exceptionality of weather characteristics.<sup>45</sup>

*[Figure 3 here]*

The results of the Two Stages Least Squares analysis are presented in columns 4-6 of Table 7. The first stage is reported in Table B7 in the Online Appendix. The F-test of the significance of the excluded instruments is above 20 for the three specifications, thus suggesting the instruments are strongly correlated with the two measures of the Famine. Also in this case, our findings are in line with the ones presented in the previous tables. Both measures of population change negatively affect the probability of becoming a rebel in a negative at a 5% statistical

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<sup>42</sup> Mokyr (1980) compares the potato blight to Mrs O’Leary’s cow for the propagation of Chicago fire.

<sup>43</sup> The absence of mountains on the Irish territory favoured this type of dispersion.

<sup>44</sup> Table B6 presents the summary statistics for the three alternative measures of the extent of the famine and the two instrumental variables.

<sup>45</sup> More precisely, we consider the climatic data at the coordinates (-6,25; 53,25) for county Dublin. Figures made on other coordinates within the island display very similar results.

significance level. Individuals born in townlands (column 4) and baronies (column 5) that experienced a sharper population decline due to the Famine are more likely to take part to the Rebellion. Similarly, individuals born in baronies with a high blight indicator (Goodspeed, 2016) are more likely to become rebels.

*[Insert Table 7 here]*

## **7. Conclusions**

This paper studies the triggers of insurgency at the individual level and explores the long-run inter-generational transmission of cultural values and rebellion. Contributions in social sciences have remarked on the impact of conflict on the long-run growth of countries and on the need to understand its causes. Inspired by recent studies in economics on the importance of inter-generational cultural transmission, we investigate whether values modified by negative historical shocks can be drivers of conflicts in the long-run. Our original contribution exploits the information contained in a unique dataset based on Irish historical data during the first two decades of the 20<sup>th</sup> century. By combining different historical data sources, we are able to identify the individual features and determinants of those who voiced their discontent and actively participated in the movement for the independence of Ireland from the United Kingdom. In addition, we test whether radical historical events matter in the decision to participate in rebellions. We analyze the inter-generational transmission of rebellion generated by a large negative radical shock, the Great Irish Famine, on the probability of joining the movement of independence in Ireland during the Irish Revolution over the period 1913-1921. Taking into account other potential concurrent factors, we explore the persistence of cultural transmission in affecting participation in the Irish Revolution and study the peculiar features of politically-motivated rebels. Supported by historical insights, we provide evidence of the famine's inter-generational legacy of rebellion. Robustness

checks related to the distribution of family names and instrumental variable regressions, based on specific and exceptional weather conditions that favoured the dispersion of the blight, confirm our results. Our analysis provides evidence in support of the inter-generational legacy of rebellion and shows how negative shocks can affect the probability of joining an insurgency in the long-run.

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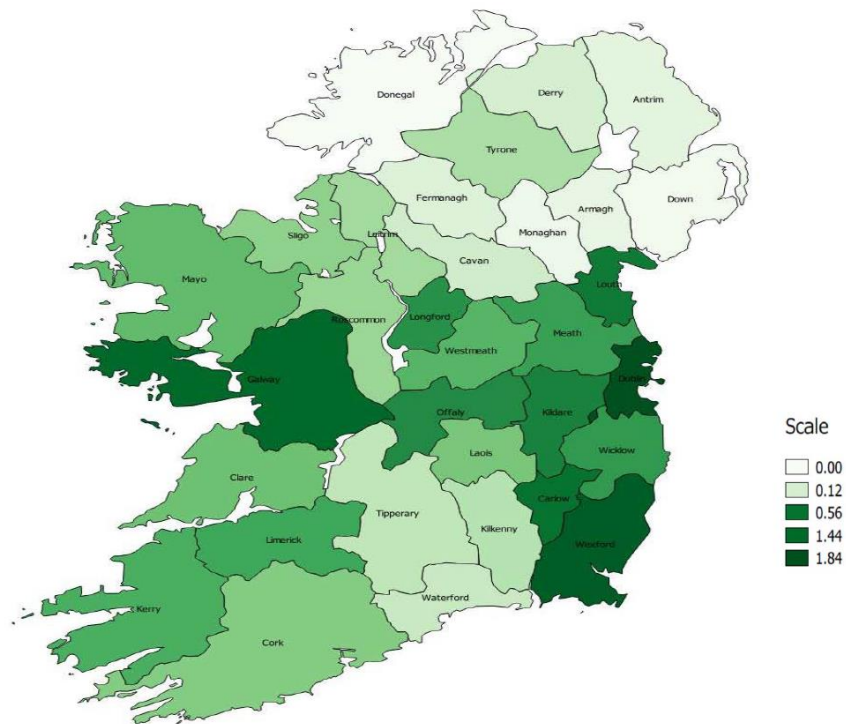
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## Figures and Tables

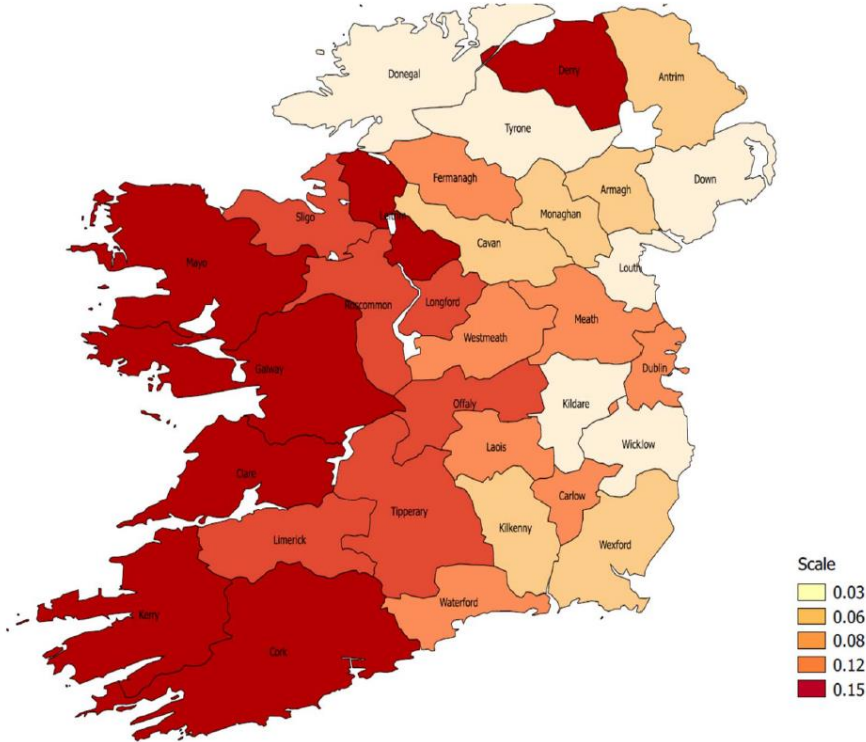
**Figure 1: Geographical distribution of rebels, by county of birth**



*Note:* Geographical distribution of the ratio of the total number of rebels over total population (per 10,000s) by county of birth reported by the 1911 Irish Census, according to a scale ramp. Darker shades represent a higher share of rebels.  
*Source:* Authors' calculations using data described in Section 3.

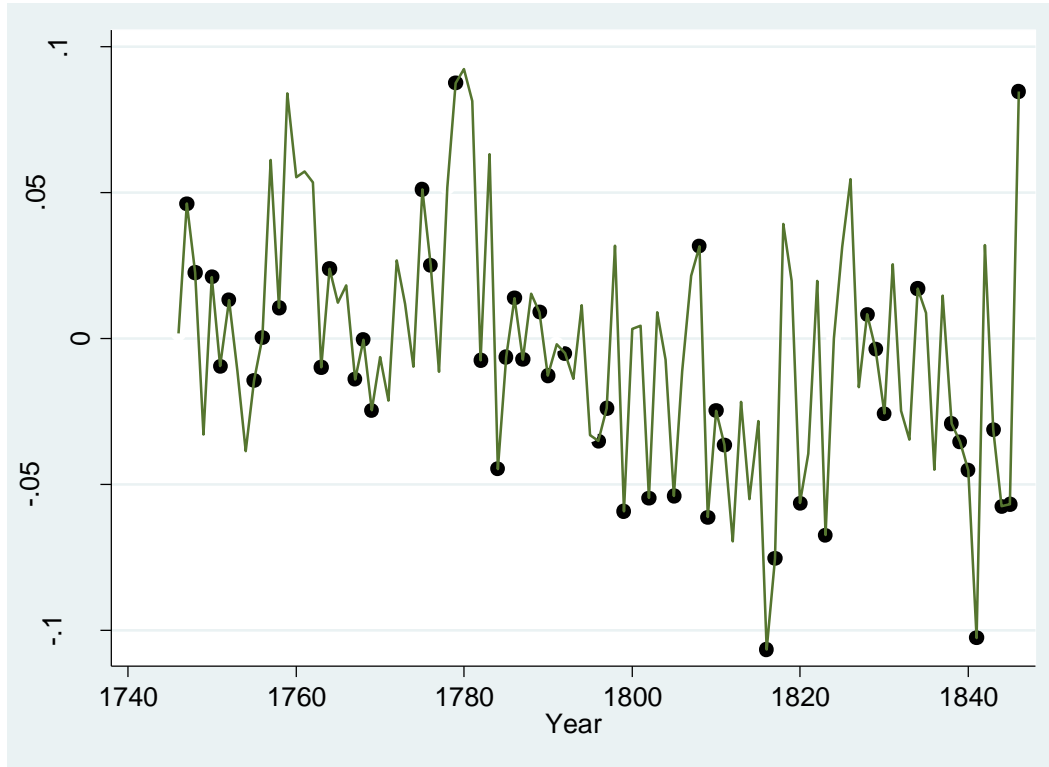


**Figure 2: The Great Irish Famine by county.**



*Note:* Excess Mortality Rate (in %) per thousand individuals by county. Extent of the Great Irish Famine represented according to a scale ramp. Dark shades represent higher incidence.  
*Source:* Authors' calculations using data described in Section 3.

**Figure 3: Weather conditions in county Dublin**



*Note:* Weather condition related to the climatic conditions at the geographical coordinate. The green line shows the evolution of the temperature anomaly (measured as ratio between temperature during the year and the average of the temperature in the interval [year-102, year-2]). The black dots show whether precipitations were higher than the average over the interval [year-102, year-2],

*Source:* Authors' calculations using data described in Section 3.

**Table 1: Individuals characteristics**

	Mean	Min	Max	SD
<i>Individual characteristics</i>				
<i>Age</i>	30.98	0	104	21.64
<i>Female</i>	50%	0	1	
<i>Literate</i>	80%	0	1	
<i>Catholic</i>	73%	0	1	
<i>Married</i>	29%	0	1	
<i>Irish</i>	14%	0	1	
<i>Household size</i>	6.03	0	20	2.73
<i>Occupations</i>				
<i>Professional</i>	20%	0	1	
<i>Clerical</i>	1%	0	1	
<i>Sales</i>	2%	0	1	
<i>Service</i>	4%	0	1	
<i>Agriculture</i>	20%	0	1	
<i>Production</i>	12%	0	1	
<i>Rebel</i>	0.035%	0	1	
<i>Rebel_lib</i>	0.020%	0	1	
<i>Rebel_con</i>	0.019%	0	1	
<i>Rebel_8030</i>	0.004%	0	1	
<i>Rebel_6010</i>	0.018%	0	1	

Total number of observations: 3,990,415

*Source:* Authors' calculations using the administrative historical data, as described in Section 3.

**Table 2: County of birth characteristics**

	Mean	Min	Max	SD
<i>Excess Mortality Rate (per '000s)</i>	0.09	0.04	0.17	0.03
<i>Crop Failure rate</i>	0.24	-0.40	0.68	0.20
<i>FAO - cereal</i>	3.50	-0.56	6.49	2.03
<i>FAO - potato</i>	4.16	2.54	5.65	0.85
<i>Literacy share</i>	0.79	0.48	0.90	0.07
<i>Violence 1881</i>	0.14	0.03	0.48	0.09
<i>Property 1881</i>	0.215	0.04	0.71	0.15
<i>Claimants 1798</i>				
<i>Out-migration rate</i>	0.04	0.02	0.09	0.02
<i>Literacy rate</i>	0.79	0.47	0.90	0.067

*Total number of observations: 32*

*Source: Authors' calculations using data from different geographical and historical sources, as described in Section 3.*

**Table 3: Main specification: Relogit Regressions**

	(1)	(2)	(3)	(4)	(5)
<i>Dependent Variable: Rebel</i>					
<i>Excess Mortality</i>			11.359***	12.253***	
			[2.375]	[2.420]	
<i>Crop failure rate</i>					0.350**
					[0.168]
<i>Individual characteristics</i>					
<i>Age</i>	-0.041***	-0.053***	-0.055***	-0.054***	-0.053***
	[0.002]	[0.003]	[0.003]	[0.003]	[0.003]
<i>Female</i>	-2.074***	-2.095***	-2.094***	-2.094***	-2.103***
	[0.088]	[0.098]	[0.098]	[0.098]	[0.099]
<i>Literate</i>	0.359**	0.278*	0.314**	0.334**	0.338**
	[0.149]	[0.142]	[0.149]	[0.150]	[0.150]
<i>Catholic</i>	1.839***	1.254***	1.202***	1.213***	1.210***
	[0.145]	[0.145]	[0.154]	[0.155]	[0.154]
<i>Married</i>	0.063	-0.087	-0.056	-0.059	-0.065
	[0.112]	[0.094]	[0.092]	[0.092]	[0.092]
<i>Household size</i>	0.021**	0.037***	0.037***	0.039***	0.041***
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
<i>Occupation and other characteristics</i>					
<i>Professional</i>		-0.818***	-0.797***	-0.798***	-0.809***
		[0.099]	[0.101]	[0.101]	[0.101]
<i>Clerical</i>		0.003	-0.014	-0.020	-0.017
		[0.166]	[0.170]	[0.170]	[0.170]
<i>Sales</i>		-0.364*	-0.394*	-0.347	-0.310
		[0.208]	[0.219]	[0.219]	[0.219]
<i>Service</i>		-0.151	-0.105	-0.087	-0.088
		[0.181]	[0.173]	[0.172]	[0.172]
<i>Agriculture</i>		-0.293**	-0.274**	-0.272**	-0.285**
		[0.128]	[0.133]	[0.132]	[0.131]
<i>Production</i>		0.278***	0.320***	0.303***	0.276***
		[0.104]	[0.105]	[0.106]	[0.106]
<i>Share of Catholics - DED</i>		0.759**	0.862***	0.959***	0.828**
		[0.319]	[0.321]	[0.323]	[0.327]
<i>Share of Male - DED</i>		1.724	1.561	1.246	1.450
		[2.041]	[2.083]	[2.072]	[2.089]
<i>Share of aged 2540 - DED</i>		9.083***	9.530***	9.328***	9.591***
		[2.428]	[2.377]	[2.370]	[2.443]
<i>Literacy rate - DED</i>		-0.736	-0.258	-0.406	-0.867
		[0.912]	[0.985]	[0.971]	[0.925]
<i>Emigration rate – COB</i>				-9.111***	-6.141**
				[2.774]	[2.394]

	<i>Location dummies</i>				
<i>Connacht</i>	1.162***	0.379**	0.446**	1.256***	
	[0.202]	[0.181]	[0.184]	[0.213]	
<i>Leinster</i>	0.824***	0.652*	0.780**	0.899***	
	[0.315]	[0.335]	[0.325]	[0.314]	
<i>Munster</i>	0.064	-0.669***	-0.549**	0.180	
	[0.166]	[0.237]	[0.223]	[0.169]	
<i>Dublin</i>	1.022***	0.952**	0.752**	0.748**	
	1.162***	0.379**	0.446**	1.256***	
Observations	2,886,572	2,886,572	2,751,250	2,751,250	2,751,250

Heteroskedasticity-robust standard errors clustered at the district electoral division level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4: Concurring factors - past rebellions and soil quality.**

	(1)	(2)	(3)
	<i>Dependent variable: Rebel</i>		
<i>Excess mortality rate</i>	14.161*** [2.380]	10.548*** [1.889]	17.575*** [2.783]
<i>FAO index – cereal</i>	-0.112** [0.051]	-0.083* [0.049]	
<i>FAO index – potato</i>	-0.128* [0.076]	-0.130* [0.074]	
<i>Literacy rate – COB</i>		-4.263*** [1.186]	
<i>Violence 1881</i>			-2.852*** [0.972]
<i>Property 1881</i>			1.026** [0.508]
<i>Claimants 1798</i>			0.137*** [0.040]
<i>Individual characteristics</i>	Yes	Yes	Yes
<i>Occupations</i>	Yes	Yes	Yes
<i>Location characteristics</i>	Yes	Yes	Yes
<i>Province indicators</i>	Yes	Yes	Yes
<i>Dublin indicator</i>	Yes	Yes	Yes
<i>Observations:</i>	2,751,250	2,751,250.	2,751,250.

Heteroskedasticity-robust standard errors are clustered at the district electoral division level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 5: Disaggregated indicators.**

	(1)	(2)	(3)	(4)	(5)
	<i>Manual matching</i>		<i>Automated Matching</i>		<i>Pension recipients</i>
	<i>Rebel_lib</i>	<i>Rebel_con</i>	<i>Rebel_6010</i>	<i>Rebel_8030</i>	<i>Rebel_pen</i>
<i>Excess Mortality Rate</i>	13.915*** [3.120]	15.231*** [3.464]	10.363*** [2.095]	9.142** [4.566]	14.939*** [3.339]
<i>Individual characteristics</i>	Yes	Yes	Yes	Yes	Yes
<i>Occupations</i>	Yes	Yes	Yes	Yes	Yes
<i>Location characteristics</i>	Yes	Yes	Yes	Yes	Yes
<i>Province indicators</i>	Yes	Yes	Yes	Yes	Yes
<i>Dublin indicator</i>	Yes	Yes	Yes	Yes	Yes
Observations	2,751,250	2,751,250	2,751,250	2,751,250	2,751,250

Heteroskedasticity-robust standard errors clustered at the district electoral division level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6: Intergenerational transmission**

VARIABLES	(1)	(2)
	<i>Rebel</i>	
<i>Excess Mortality<sub>c</sub><sup>surname</sup></i>	22.092*** [4.069]	
<i>Excess Mortality<sub>c</sub><sup>residual</sup></i>	16.672*** [3.299]	
<i>Crop Failure Rate<sub>c</sub><sup>surname</sup></i>		1.444*** [0.532]
<i>Crop Failure Rate<sub>c</sub><sup>residual</sup></i>		1.054** [0.421]
<i>Individual characteristics</i>	Yes	Yes
<i>Occupations</i>	Yes	Yes
<i>Location characteristics</i>	Yes	Yes
<i>Province indicators</i>		
<i>Dublin indicator</i>	Yes	Yes
<i>Past Rebellions</i>	Yes	Yes
<i>FAO indices</i>	Yes	Yes
Observations	889,748	889,748

Logit regressions. Heteroskedasticity-robust standard errors clustered at the district electoral division level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



**Table 7: Alternative measures and Instrumental variable analysis.**

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
			<i>Rebel</i>			
<i>Δpop5141</i>	-0.734 [0.626]			-0.002** [0.001]		
<i>Δpop_rate</i>		-2.853*** [0.937]			-0.001** [0.000]	
<i>Blight indicator</i>			0.279 [0.305]			0.001** [0.000]
<i>Individual characteristics</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Occupations</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Location characteristics</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>Province indicators</i>	Yes	Yes	Yes	Yes	Yes	Yes
Estimation method	Rare logistic	Rare logistic	Rare logistic	2SLS	2SLS	2SLS
F-test (p-value)				27.88	281.81	51.84
Observations	759,650	758,786	759,650	711,011	710,147	711,011

Heteroskedasticity-robust standard errors clustered at the district electoral division level. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1