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CAGE working paper no. 737

December 2024

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UKRI Economic and Social Research Council

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Abstract

Agricultural cooperation is seen as a way to solve collective action problems and has been associated with high social capital and other beneficial impacts in the countryside beyond productivity increases. But what if it comes into conflict with existing private concerns? The Irish dairy cooperatives from the 1890s entered a contested market for milk, and soon became associated with various degrees of conflict: legal disputes and physical violence. We hypothesize that this led to poor social capital, manifesting in conflict during the Irish War of Independence. We analyze novel data on cooperative and private creameries, as well as measures of conflict. Our findings indicate a significant positive correlation between the presence of cooperatives and local conflict intensities, persisting even after controlling for various confounders. An instrumental variable approach based on prior specialization in dairying validates this. Cooperation might thus both reflect social capital but also have pernicious impacts on it.

JEL classification: N53, N54, Q13, Z13
Keywords: Ireland, Cooperatives, Social Capital, Market Contestation

*The authors gratefully acknowledge funding from the Independent Research Fund Denmark (grant no. DFF– 6109-00123). We would also like to thank participants at seminars at Heriot-Watt University and the University of Southern Denmark (SDU), the 11th Annual Workshop on "Growth, History and Development" at SDU, and the CEPH Irish Research Initiative (CIRI) workshop on "Irish Agricultural Development 1882–1972" for valuable comments and suggestions.
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1 Introduction

Agricultural cooperation is widely regarded as an effective mechanism for overcoming collective action problems, resulting in economic growth and social improvement. The cooperative model, which encourages shared ownership and collaboration among producers, is frequently associated with high social capital, as well as other positive social effects, such as stronger networks and increased trust within communities, beyond mere productivity gains (Dell, Lane, & Querubin, 2018; Ostrom, 1990, 2010; UN, 2023). However, less attention has been given to the potential for cooperatives to become sources of conflict when they challenge established private interests. This was the case in early twentieth-century Ireland, where the establishment of dairy cooperatives clashed with private creameries, generating disputes that extended beyond economics into the realm of violence. While agricultural cooperatives are typically seen as engines of community development and trust-building, the Irish case presents a paradox: cooperatives, instead of fostering harmony, were associated with local conflict during the Irish War of Independence. Could the introduction of cooperatives, which sought to promote collective action, have actually undermined social cohesion by exacerbating competition with existing private businesses? This puzzle invites a deeper investigation into the potential negative side of cooperatives, particularly in contested markets where cooperation and competition collide.

Our central question is whether the establishment of agricultural cooperatives in Ireland contributed to poor social capital and exacerbated political tensions during the Irish War of Independence. Specifically, we ask: did cooperatives, while designed to promote collective action and economic growth, intensify conflict by undermining existing private enterprises, and did this dynamic fuel broader social unrest?

To address this question, we analyse newly compiled Poor Law Union (PLU)[1] level data on the location of cooperative and private creameries, alongside records of Irish Republican Army (IRA) activity and British reprisals during the Irish War of Independence (1919–1921). Our method involves regressing the spatial pattern of conflict intensity on the concentration of cooperatives while controlling for confounders such as population density and geographic factors. The key challenge is ensuring that our results reflect a causal relationship rather than being driven by omitted variables. To this end, we employ an instrumental variable strategy that leverages the fact that cooperatives were established in areas with pre-existing dairy specialisation, thus putting them in direct competition with private creameries. By isolating the cooperative presence from other factors that might influence conflict, we aim to determine whether cooperatives exacerbated social unrest.

Our results show a significant positive correlation between the presence of cooperatives and

[1]The Poor Law Union (PLU) was a local administrative unit in Ireland, established under the Irish Poor Law Act of 1838. It was designed primarily for the administration of poor relief and was overseen by a Board of Guardians responsible for managing workhouses and distributing aid to the needy. Each PLU comprised several electoral divisions and often spanned both rural and urban areas. PLUs remained an important administrative unit in Ireland until their abolition in 1925.

local conflict intensities, even after controlling for various confounders. In areas where cooperatives were established—particularly in regions where private creameries were already operating—there was a measurable increase in violence. A one standard deviation increase in the presence of cooperatives was associated with a 0.22 standard deviation increase in conflict. Importantly, our instrumental variable approach confirms that the cooperative presence itself, rather than other factors, drove this rise in conflict.

We also find regional differences in the impact of cooperatives. In Ulster, where socio-economic structures were different—stronger industrialisation, a higher proportion of Protestant Unionist communities, and, importantly, a small private dairy sector—the relationship between cooperatives and conflict was weaker. The estimated effect of cooperative presence on conflict fell by half in Ulster relative to the rest of Ireland, suggesting that the dynamics of contestation were less intense in this region. Despite these regional variations, our results remain robust across different model specifications, including ordinary least squares (OLS) and instrumental variable (IV) estimations, and when controlling for potentially endogenous factors.

Our study contributes to both the economic history of Ireland and the broader literature on social capital and cooperation. While existing studies often highlight the success of agricultural cooperatives in promoting economic and social development—particularly in Denmark, where cooperatives were driven by grassroots initiatives from farmers themselves (Henriksen, McLaughlin, & Sharp, 2015; O'Rourke, 2006, 2007)—our work provides a contrasting perspective. In Ireland, cooperatives were largely a top-down initiative introduced by the Irish Agricultural Organisation Society (IAOS), which sought to challenge existing private creameries. This external introduction, especially in markets already dominated by private businesses, set the stage for fierce competition over limited milk supplies (McLaughlin & Sharp, 2021).

Furthermore, our findings speak to the complex nature of social capital. According to Putnam (1995, 2000), social capital consists of networks, norms, and trust that facilitate collective action. However, as our study shows, this dynamic can shift when cooperatives enter contested markets. While cooperation often builds social capital, in Ireland, cooperatives may have weakened it by undermining trust between competing entities. This complements the work of Mannemar Sønderskov (2009) and Berger (2023), who highlight the potential for sanctioning and non-cooperative behaviour within cooperative structures. It also aligns with the broader insight from Putnam (2000) that elites or particular groups can manipulate social capital for pro-social or anti-social goals depending on the political or economic context.

Our study also relates to the literature on the political consequences of social capital. For example, Fabian, Breunig, and Neve (2020) show how strong rural communities in the United States were unexpectedly supportive of political populism, while Satyanath, Voigtländer, and Voth (2017) connects social capital to the rise of Nazism in Germany. In Ireland, we argue that the establishment of cooperatives in areas with pre-existing private creameries acted as a catalyst for social conflict, turning what could have been a cooperative success story into a

narrative of violence and division. Thus, our findings suggest that cooperatives, rather than being universally beneficial, can have unintended, adverse effects when introduced into already contested economic landscapes.

To ensure the robustness of our findings, we perform several additional checks, including using alternative measures of cooperative presence and conflict intensity. Our results hold across these specifications, suggesting that the relationship between cooperatives and conflict is robust. Moreover, we test whether the effect of cooperative presence was driven by the cooperatives themselves being targets of violence, finding that while some creameries were attacked during the War of Independence, this alone does not explain the broader pattern of conflict. The implications of our findings extend beyond the Irish case, highlighting the need for contemporary policymakers and development practitioners to carefully consider the potential unintended consequences of introducing cooperatives into contested markets.

In the following section, we provide a detailed historical overview of Ireland's dairy cooperatives, examining the interplay between economic organisation, social capital, and political unrest. Section 3 presents our data and empirical strategy, while Section 4 details our results. Finally, Section 5 concludes by reflecting on the broader implications of our findings for understanding the role of cooperatives in contested markets.

2 Historical background

Southern Ireland seceded from the United Kingdom in 1922 following a war of independence, itself following decades of attempts to secure "Home Rule", a form of devolution, for all of Ireland. When devolution was legislated it was shelved due to the outbreak of the First World War. The nationalist landscape was radically changed following a civil uprising in 1916 and the landslide victory for *Sinn Féin* in 1918. The 1918 election also coincided with a widening of the electorate, however the change in public opinion is what swayed the vote not the change in the electoral composition (de Bromhead, Fernihough, & Hargaden, 2020). The War of Independence began with an ambush of Royal Irish Constabulary officers by IRA members at Soloheadbeg, Co. Tipperary in January 1919.[2] The War of Independence ended with the agreement of the Anglo-Irish Treaty, which was signed into law in Ireland in December 1922, only to be followed by a Civil War between those for and against the Treaty.[3]

The economic context here is crucial, since Ireland had a mixed experience of the Industrial Revolution. The north of the island industrialised while the south until the early twentieth

[2]Full disclaimer, the great-great-grandfather of one of the present authors died that day.

[3]Economists have viewed the secession of states through the lens of costs and benefits (Alesina, Spolaore, & Wacziarg, 2000). From this perspective, Hynes (2014) argues that Ireland had a difference in preferences for public good provision, principally that it had not benefited from fiscal reforms in the UK and therefore had an incentive to secede to create a state which matched the fiscal preferences of Irish voters. Other reforms in the late-nineteenth century had attempted to placate an agricultural sector exposed to the forces of globalisation.

century was primarily agrarian (Bielenberg, 2009), with a significant emphasis on the dairy industry. Ireland, as a whole, grew faster than Britain in the latter half of the nineteenth century and converged on UK living standards (Geary & Stark, 2002, 2015). However, there was significant regional variation; the south of the island had a lower level of income than the north and much lower than the rest of the United Kingdom by the start of the twentieth century, and was also a laggard in terms of growth (Kenny & McLaughlin, 2022). The poor performance of the south thus spurred demands for greater independence as the slow growth was attributed to the Union, whereas the north attributed their success to the Union. The divergent growth experiences were thus a reflection of urban rural divides within Ireland but also within the south of Ireland. The last decade of the nineteenth century was characterized by a push towards modernizing agriculture, inspired by the Danish model's success, which saw the rise of agricultural cooperatives as a means to improve farmers' economic conditions. The Irish Agricultural Organisation Society (IAOS), under the leadership of visionaries like Sir Horace Plunkett, played a pivotal role in advocating for cooperative principles, aiming to address issues such as market access, pricing stability, and technological advancements within the dairy sector (Henriksen et al., 2015; McLaughlin & Sharp, 2021; O'Rourke, 2006).

The IAOS's approach to establishing cooperatives was not merely about promoting collaboration among farmers; it was also a strategic effort to contest the dominance of private creameries. By deliberately setting up cooperatives in close proximity to these private entities, the IAOS aimed to redistribute market shares and foster a more equitable economic landscape within the dairy industry (McLaughlin & Sharp, 2021). This tactic of contestation was indicative of a broader strategy to challenge existing economic structures and promote a cooperative model that emphasized shared success and community resilience. This practice led to a conflict over milk, the so called "milk war" as cooperatives and proprietary creameries aggressively competed for a scarce input (Fathartaigh, 2014). R. A. Anderson, the secretary of the IAOS, likened the atmosphere surrounding the dairy conflict to a "civil war" (Doyle, 2019, p. 30), and recognizing this, the IAOS looked beyond the traditional homeland of dairying in the south, and began focusing on the north, where there was little tradition of dairying and few private operators (McLaughlin & Sharp, 2021). The War of Independence led to renewed conflict, with Doyle (2019) noting that competition intensified "under the cover of violence".

Thus, the cooperative movement's rise in Ireland coincided with a period of significant socio-political upheaval, as the country grappled with its quest for independence from British rule. Economic self-sufficiency became intertwined with political aspirations, with cooperatives seen as integral to achieving autonomy. The Gaelic Revival and *Sinn Féin*'s rise further popularized economic nationalism, embedding the cooperative movement within the broader narrative of Irish self-determination (Beatty, 2019; Breathnach, 2000). Indeed, cooperatives were associated with different cultural movements of the time, many of whom were central to the nationalist movement. Doyle (2019) argues that there was a direct association between *Sinn Féin* as a political movement and the cooperative movement. This is surprising at first glance, given that the IAOS was led by a prominent Unionist political figure, namely Horace Plunkett (West,

1986). Plunkett's efforts to establish cooperatives were top down and involved the participation of landlords and their agents. This came at a time of a contentious dispute over land reform and during a period when nationalist aspirations for devolved "Home Rule" appeared thwarted. One infamous anecdote from Plunkett's early cooperative proselytising travails came from the town of Rathkeale in Limerick where he was told that "every pound of butter made in this Creamery must be made on nationalist principles, or it shan't be made at all" (O'Rourke, 2007). There was scepticism of, and hostility towards, the cooperative movement from nationalist politicians, those representing the Irish electorate at Westminster, as they associated cooperation with British policies to undermine Irish (legislative) independence (Kennedy, 1978). However, evidence suggests that the rank-and-file membership of cooperatives were nationalist in outlook (Kennedy, 1983); Plunkett himself estimated that 75 per cent of the membership were nationalist (Gailey, 1987).

As noted above, McMahon (2008) shows how there was a close association between the Gaelic League and cooperatives. The Gaelic League supported cooperatives through industry sub-committees involving IAOS leading lights and they published articles in support of cooperation, while cooperatives provided venues for Gaelic League meetings and for social events such as classes and *ceilidhs* (traditional Gaelic social gatherings). This close association between the Gaelic League and cooperatives was highlighted by Paul-Dubois (1908), who saw the combination as a way to increase industry but also to provide leisurely pursuits. For example, when discussing cooperative dairies he noted that cooperatives, together with the Gaelic League, were making "a strenuous effort ... to lessen the melancholy of country life by improving the condition of the cottages, and by establishing libraries, classes, and lectures" (Paul-Dubois, 1908, p.448-449). The meeting spaces that cooperatives provided were important as a social outlet and therefore the contestation within the dairy sector could possibly undermine this.

The War of Independence introduced new challenges for the dairy sector, as British forces targeted cooperative creameries in reprisal for IRA activities. These attacks occurred over a short period of time, with 42 attacks recorded during 1920[4], and a further fourteen creameries attacked in early 1921, but these activities ceased by April 1921. In addition, 32 creameries were compulsorily closed in 1921. One of the most famous attacks was on the Ballymacelligot cooperative creamery in November 1920 (McLaughlin & Sharp, 2018). This was noted in a Labour Party (1921) report on state violence in Ireland, with Figure 1 showing the aftermath of attacks on two separate creameries in 1920. They were not only strategic but also symbolic, aiming to disrupt the economic infrastructure supporting the nationalist cause. The immediate and long-term impacts of these attacks on rural economies and social capital were profound, highlighting the strategic importance of cooperatives in the national struggle and underscoring the interconnectedness of economic infrastructure and nationalist movements (Doyle, 2018; Fernihough & Lyons, 2022).

Several studies have attempted to quantify the violence and to determine its causes. As

[4] *Irish Homestead*, 18 December 1920.

Figure 1: Creamery Attacks: Achonry, Co. Sligo & Ballymacelligott, Co. Kerry
Source: Labour Party (1921)

Fitzpatrick (1978) notes, Irish nationalism was a "rural preoccupation" and that rural parishes produced rural organisations that facilitated the interaction of a broad swathe of the population. The recognition of the association between revolutionary activity and local organisation is acknowledged in the wider literature with a chapter on cooperatives in the authoritative volume *Atlas of the Irish Revolution* (O'Connor & Byrne, 2017). In a similar vein Rumpf and Hepburn (1977) document the relationship between dairying, and republican activity. In particular, they visually document the spatial link between cooperative dairies and IRA activity (Rumpf & Hepburn, 1977, map 2 & 8) and argue that "the preconditions for co-operative dairy organisations are developed dairy farming, combined with a fair degree of rural wealth, community spirit, and organisation", the same elements required for establishing IRA units. Garvin (1981) tests the Rumpf and Hepburn (1977) hypothesis, finding a correlation at the county level (N=23) between cooperatives (in 1926) and IRA activity (0.54 correlation coefficient) but that there is also a correlation with the previous nationalist movement (1880s Land War) and this correlation is independent of the cooperatives. Garvin (1981) surmised from this that IRA activity and co-operatives were caused by agrarianism, in that IRA activity represents a pattern that predates the introduction of cooperatives.

The centrality of dairying to the Irish revolution is challenged by Hart (1997) as he highlights a low correlation between his measure of IRA activity and cooperative membership in 1912, although this is based on pairwise correlation coefficients across 44 variables over 6 specifications. In the text, he refers to a "low" correlation between coop membership and IRA violence from 1917-19 (0.03) but the evidence presented is selective as the correlation coefficients reported in the appendix were 0.37 for 1921-2 IRA violence and 0.45 for *Sinn Féin* membership. There is clearly more to unpack here. An obvious issue is his focus solely on cooperative creameries without reference to the proprietary creameries. Proprietary creameries were also attacked during the period, although they only constituted 21 per cent of the total (Breathnach, 2006).

Another recent strand of literature has focused on the "deep roots" of rebellion that looks

at the impact of the Irish famine on participants in the revolution. Narciso and Severgnini (2023) link 3,816 rebels, identified through pension applications after the revolution, to census records and find an association between famine severity in a birth county and participation. This study, however, focused purely on the famine era literature and they paid little attention to existing macro studies of the revolutionary era which emphasis more mundane aspects of violence, namely rural interests. Another recent study looked at the the people who donated money to the revolutionary movement. Hargaden (2022) found 16,944 donations to the Irish National Aid Association; there were clearly more people supporting the revolutionary movement with their pockets than by putting their bodies on the line. Analysis of the donations show a strong influence of farmers denoting more money per head to the revolutionary cause and with a geographic concentration of donations coming from the dairying heartlands of Munster. Adams (2022) also studies the funders of the Irish revolution, subscribers to the National Loan, and finds a similar pattern of farmers subscribing the majority of the funds for the revolutionary effort and making up 74 per cent of loan subscribers and 59 per cent of funds raised (Adams, 2022, figure 4.14). In fact farmers were over represented in these samples, with only 44 per cent of inhabitants farmers in the regions, although it is difficult to ascertain which type of farming was practiced as the census only described farmers generically.[5]

Despite these challenges, the cooperative movement's legacy in Ireland is enduring, reflecting its significant role in economic modernization, social capital formation, and the national struggle for independence. By fostering economic self-sufficiency and community empowerment, cooperatives played a pivotal role in reshaping the socioeconomic landscape of early twentieth century Ireland, challenging traditional structures and paving the way for a new era of autonomy (Hviid, 2020). They are remembered today as "a meeting place where suppliers, irrespective of status, engaged in social conversation, leg-pulling and usually (though not always) friendly argument, and where social divisions were bridged by the camaraderie of the assembly" (Cronin, 2005). Our work seeks however to nuance this with an assessment of the negative impact the market contestation they brought with them had on social capital.

3 Data and Empirical Strategy

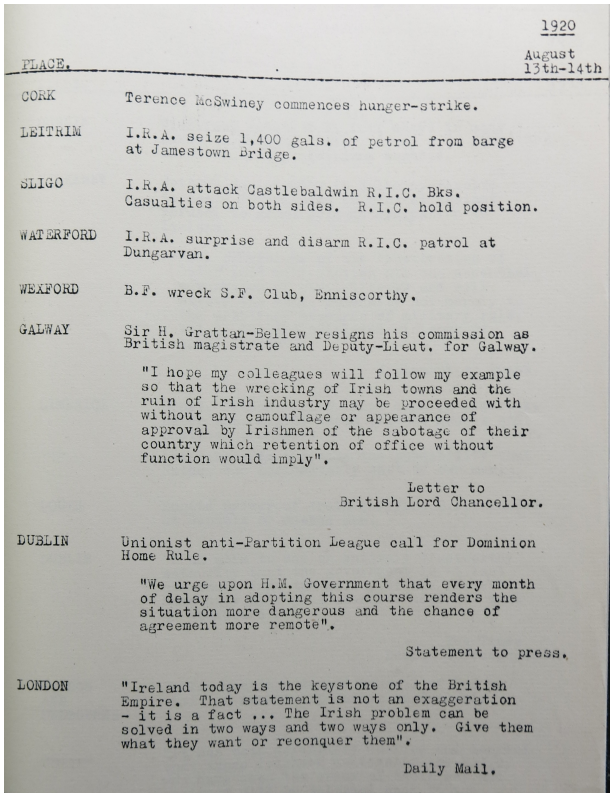
3.1 Data

For our analysis we utilise two new hand collected data sources. For cooperatives, we hand collected from the IAOS' annual reports.[6] These reports provided information on the activities of all types of cooperatives registered with the IAOS - see McLaughlin, Sharp, Tsoukli, and Vedel

[5]There were however three creamery managers listed as subscribers: John Cawley, a boarder in Granard, Longford (born Sligo) subscribed £10; Patrick O'Gorman in New Inn, Tipperary subscribed £5, and James Mohan of Annayalla subscribed £1. Data provided by Robin Adams from database of subscribers to National Loan, based on surviving records from Longford, South Monaghan, and East Tipperary.

[6]Copies of the annual reports of the IAOS are found at the National Library of Ireland.

(2023) for a description of the data on cooperative creameries. In addition, we hand collected data from the original chronology of the Bureau of Military History.[7] Figure 2 provides an example of this source, it lists the date, describes the event, and specifies the location of the event. The locational information enables us to go beyond the county-level analysis (n=32) that characterises existing ecological studies of the Irish revolution (e.g., Garvin (1981); Hart (1997))



1920

PLACE.	August 13th-14th
CORK	Terence McSwiney commences hunger-strike.
LEITRIM	I.R.A. seize 1,400 gals. of petrol from barge at Jamestown Bridge.
SLIGO	I.R.A. attack Castlebaldwin R.I.C. Bks. Casualties on both sides. R.I.C. hold position.
WATERFORD	I.R.A. surprise and disarm R.I.C. patrol at Dungarvan.
WEXFORD	B.F. wreck S.F. Club, Enniscorthy.
GALWAY	Sir H. Grattan-Bellew resigns his commission as British magistrate and Deputy-Lieut. for Galway. "I hope my colleagues will follow my example so that the wrecking of Irish towns and the ruin of Irish industry may be proceeded with without any camouflage or appearance of approval by Irishmen of the sabotage of their country which retention of office without function would imply". Letter to British Lord Chancellor.
DUBLIN	Unionist anti-Partition League call for Dominion Home Rule. "We urge upon H.M. Government that every month of delay in adopting this course renders the situation more dangerous and the chance of agreement more remote". Statement to press.
LONDON	"Ireland today is the keystone of the British Empire. That statement is not an exaggeration - it is a fact ... The Irish problem can be solved in two ways and two ways only. Give them what they want or reconquer them". Daily Mail.

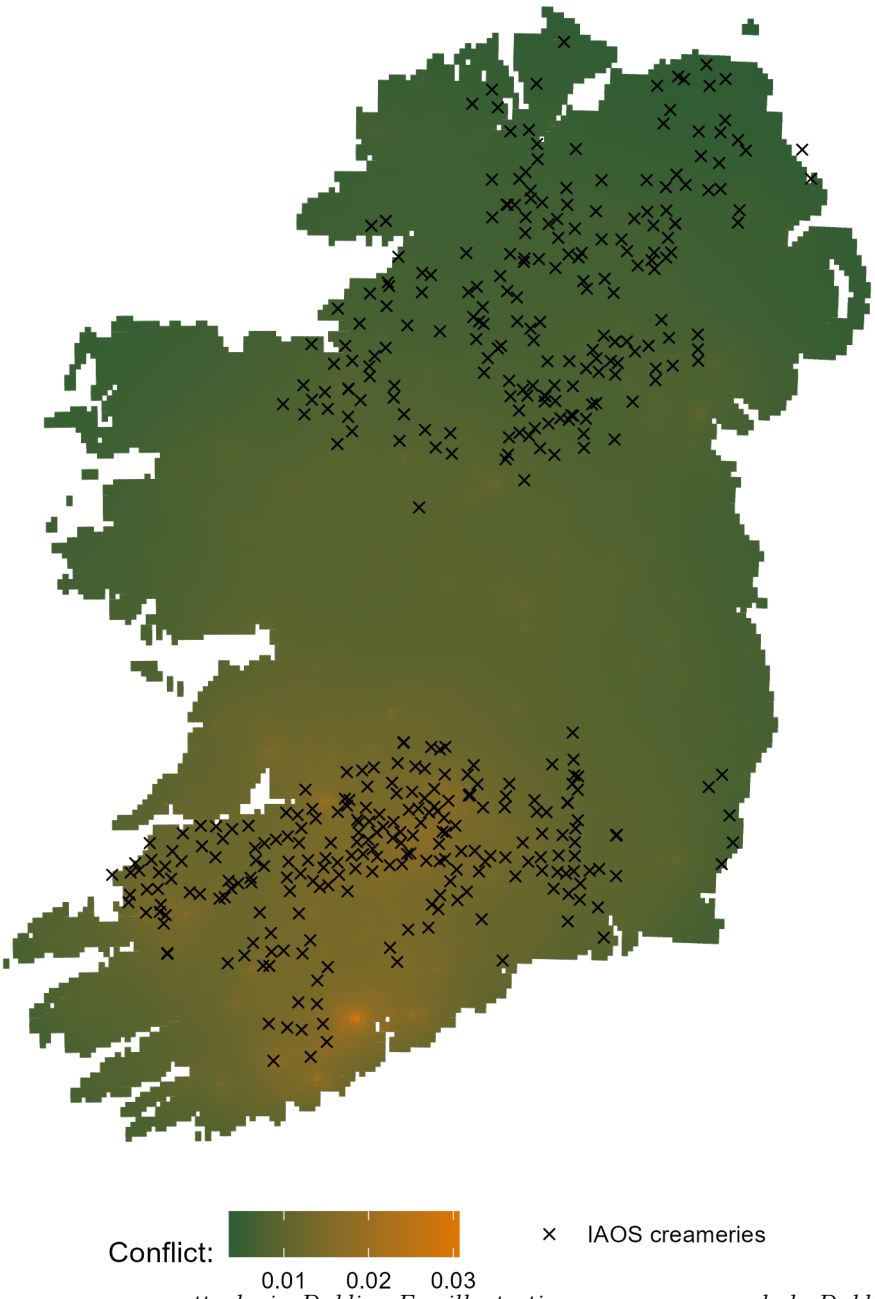
Figure 2: Entry in Chronology of Bureau of Military History, 13 August 1920

Our analysis relies on explaining the PLU-level intensity of conflict, which we denote $Conflict_i$. We construct this following Harris' "market potential" (MP, Harris (1954)), measured as the average (unweighted) distance from the PLU-centroid to geolocated episodes of conflict recorded by Hart (1997), Rumpf and Hepburn (1977) and the Chronology of the Bureau of Military History.[8] We also employ information on creamery attacks, mostly from the IAOS annual reports, but also *Irish Homestead*, a newspaper published by the IAOS, and Bolger (1977).

Our main explanatory variable is $Coop_i$, which indicates the presence of cooperative creameries within the PLU. We construct this in a similar way to $Conflict_i$ and in this case using the average distance to all cooperatives from the PLU-centroid, from McLaughlin et al. (2023). We illustrate these variables in Figure 3. Similarly, we construct $Priv_i$ based on locations of private creameries from McLaughlin and Sharp (2021), which we use as an instrumental variable. Finally, we take PLU-level population in 1871 from the census (Clarkson, Kennedy, Crawford, & Dowling, 1998), as well as other control variables (see Table 1).

[7]Chronologies are found at Military Archives, Cathal Brugha Barracks, Rathmines, Dublin 6.
[8]Bureau of Military History: Chronology, volumes I-III, 1898-1930.

Figure 3: Map of *Conflict* and IAOS creameries



Note: There were many attacks in Dublin. For illustrative purposes we exclude Dublin here to aid visualization.
Source: See Table 1.

Table 1: Summary Statistics

Variable	N	Mean	SD	Min	25th	Median	75th	Max	Source
Conflict (MP)	163	0.0111	0.004	0.0051	0.0084	0.011	0.0132	0.0385	BMH (1958a, 1958b)
Coop (MP)	163	0.0043	0.0012	0.0024	0.0033	0.004	0.0051	0.0079	McLaughlin et al. (2023)
Priv (MP)	163	0.0031	0.0017	0.0012	0.0019	0.0026	0.0039	0.0103	McLaughlin and Sharp (2021)
Baseline controls									
Ruggedness	163	0.2532	0.1841	0.0185	0.1098	0.1965	0.3342	0.9365	Nunn and Puga (2012)
Population density, 1871	163	0.3147	0.5061	0.0804	0.1768	0.2219	0.2818	4.1892	Clarkson et al. (1998)
Other controls									
Soil type	163	*Categorical*							FAO (2003)
Share of milch cows, 1870	163	0.3959	0.1153	0.0624	0.3288	0.4108	0.4777	0.5973	Clarkson et al. (1998)
Share of grassland, 1911	163	0.4963	0.1265	0.0963	0.42	0.5183	0.5812	0.8061	BPP (1912)
Share of farms over 30 acre, 1911	163	0.3018	0.1232	0.0822	0.1972	0.3055	0.3899	0.665	BPP (1912)
Gaelic League 1900/01 (MP)	163	0.0035	9e-04	0.0022	0.0031	0.0034	0.0038	0.0102	Gaelic League (1902)
Alternative measures of cooperation									
Coop-CDS (MP)	163	0.0033	0.001	0.0016	0.0026	0.003	0.004	0.0057	McLaughlin and Sharp (2021)
Raf. Soc. 1908 (MP)	163	0.0025	6e-04	0.0015	0.0021	0.0025	0.0029	0.004	IAOS (1910)

Notes: Conflict (MP) refers to conflict intensity measured using Market Potential (MP) methodology, which calculates the average (unweighted) distance from the PLU-centroid to geolocated episodes of conflict during the Irish War of Independence (BMH, 1958a, 1958b). *Coop (MP)* and *Priv (MP)* refer to the spatial presence of cooperative and private creameries, respectively, also measured using Market Potential methodology. *Ruggedness* measures terrain ruggedness, following the methodology of Nunn and Puga (2012). *Population density, 1871* uses historical census data to measure population per square kilometre in 1871 (Clarkson et al., 1998). *Share of milch cows*, *Share of grassland*, and *Share of farms over 30 acres* are taken from the 1870 and 1911 Agricultural returns, representing agricultural specialisation (BPP, 1872, 1912). *Gaelic League (MP)* measures the spatial presence of Gaelic League branches in 1900/01 (Gaelic League, 1902). *Coop-CDS (MP)* measures the presence of Cooperative Dairy Societies. *Raf. Soc. 1908 (MP)* refers to the spatial presence of Raiffeisen-style cooperative banks in 1908 (IAOS, 1910).

3.2 Empirical Strategy

Our empirical analysis is structured around the following equation, which we estimate using OLS:

$$Conflict_i = \beta_0 + \beta_1 Coop_i + \mathbf{X}_i'\beta_2 + \varepsilon_i \tag{1}$$

where $Conflict_i$ represents our measure of conflict for PLU i. $Coop_i$ is our measure of cooperative presence. $\mathbf{X}_i$ is a vector of control variables, which includes county fixed effects, economic and demographic characteristics of the PLU, population in 1871 and terrain ruggedness, to address confounders. ε_i is the error term.

A clear confounder is the local population density.[9] Greater population density might drive both demand for dairy products, the supply of available farm workers, and many other things which might be associated with both private and cooperative creameries. Since it is not clear whether it is best to control for the population using the PLU population counts or whether to allow population controls to enter as a market potential variable, we do both.

To address potential endogeneity, in particular that some unknown factor we are unable to control for might determine both cooperative location and conflict, we introduce an instrumental variable approach using the presence of private creameries ($Priv_i$) as an instrument for $Coop_i$. The idea is that private creameries reflect earlier specialization in dairying, and cooperatives were likely to be founded in such areas due to the IAOS' strategy. The location of private creameries does indeed correlate with specialization in dairying, as shown in Figure 4, which plots cow shares against the density of private creameries, and as demonstrated in a regression framework in Table A1 in the appendix.

To properly instrument for $Coop_i$, we first define the first stage of the 2SLS procedure:

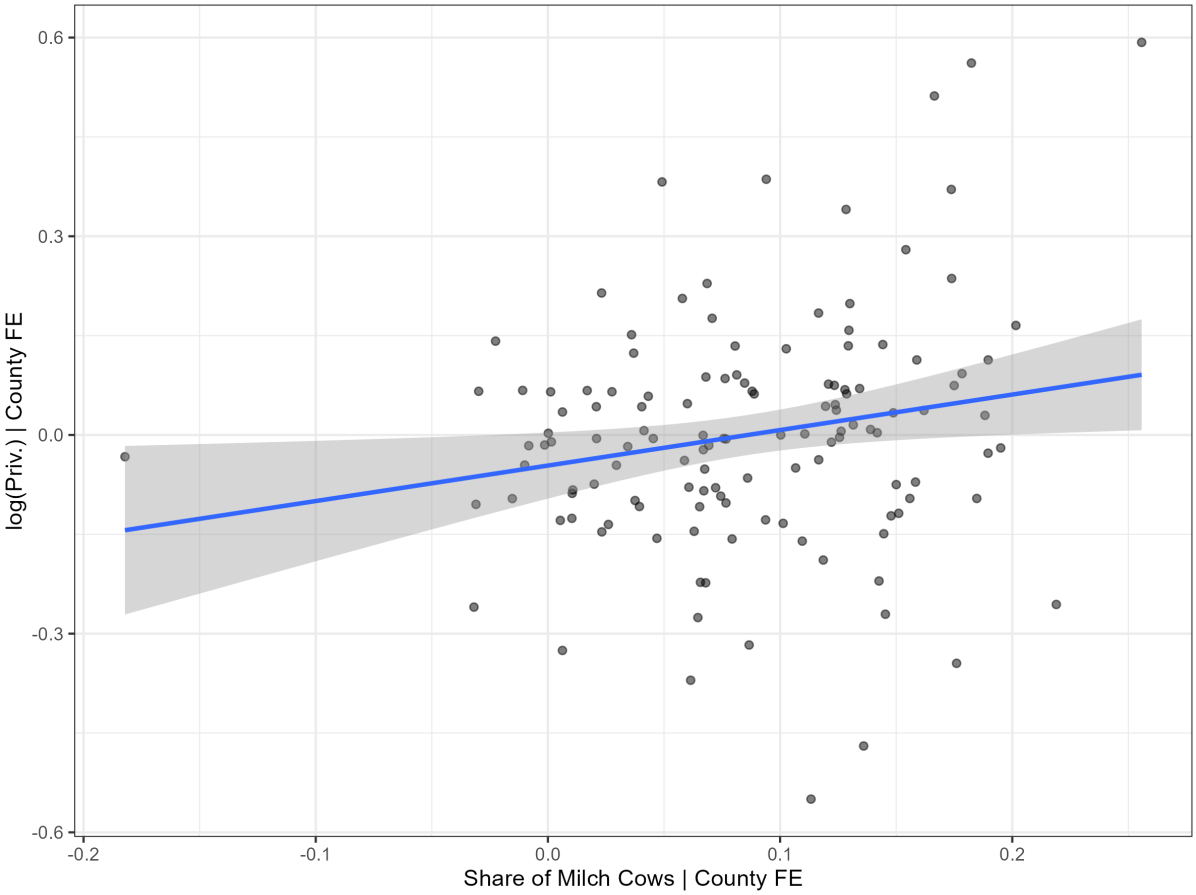
$$Coop_i = \gamma_0 + \gamma_1 Priv_i + \mathbf{X}_i'\gamma_2 + \mu_i \tag{2}$$

Here, $Priv_i$ is the instrumental variable. It is assumed to influence $Coop_i$, but its effect on $Conflict_i$ is hypothesized to occur solely through $Coop_i$. Thus, prior specialization in dairying should not in itself be a cause of conflict. γ_1 measures the strength of the instrumental variable, and μ_i is the error term in this first stage. $\mathbf{X}_i$ includes the same variables as in equation 1.

After obtaining the predicted values $\widehat{Coop_i}$ from the first stage, we use these values in the second stage regression:

[9] We choose 1871 since it is prior to and thus more likely to be exogenous to the emergence of industrialized dairying based on cream separators.

Figure 4: Share of Milch Cows in 1870 and the Density of Private Creameries



Source: See Table 1.

$$Conflict_i = \beta_0 + \beta_1 \widehat{Coop}_i + \mathbf{X}_i' \beta_2 + \varepsilon_i \tag{3}$$

In this stage, β_1 now represents the causal effect of cooperative presence (as purged of its endogeneity through the instrumental variable) on conflict. The rest of the specification ($\mathbf{X}_i$, ε_i) remains unchanged from the original specification, ensuring a robust control over other potential confounders. This instrumental variable approach helps isolate the causal impact of cooperative presence on conflict, under the assumption that $Priv_i$ is a valid instrument, i.e., it is correlated with $Coop_i$ but not with the error terms of the conflict equation, except through $Coop_i$. In order words, the identifying assumption is that pre-cooperative dairying only impacts on unrest through the contestation with IAOS creameries.

4 Results

4.1 Conflict and Cooperative Creameries

Table 2 demonstrates the impact of cooperative creameries on the density of conflict. Columns 1 and 2 based on equation 1 give the OLS results while controlling for PLU population density and population MP respectively. We allow for differential effects in Ulster. Column 3 (equations 2 and 3) gives the IV results, using private creameries as an instrument for cooperative creameries. Note that here we cannot include the interaction with Ulster since this would require two instruments. The first stage results are given in Table 3, column 2. In all cases, we control for a second degree polynomial of longitude and latitude following Kelly (2019). Our results now imply that there is no impact of cooperative presence on conflict in Ulster, or that this is even weakly negative. In Table A2 in the appendix we demonstrate robustness to various "bad" (potentially endogenous) controls. First, we account for soil type, as differences in soil quality could influence agricultural productivity, potentially correlating with both cooperative location and conflict intensity. We also include the share of milch cows to control for the level of dairy specialisation, which might affect both the establishment of creameries and conflict patterns. The share of grassland is another important factor, as grassland areas are more suitable for dairy farming, influencing where creameries were likely to be established. Additionally, we control for the share of farms over 30 acres, which serves as a proxy for land inequality and could affect both social cohesion and conflict dynamics. Finally, we include the presence of Gaelic League branches, recognising the League's influence on nationalist sentiment and its potential correlation with both cooperative activity and conflict. These controls help us ensure that the observed relationship between cooperatives and conflict is not simply driven by other regional or economic factors.

In our preferred specification, column (3), we find that a 10 per cent increase in our measure of cooperative presence implies a 2.7 per cent increase in conflict density - evidence that market contestation led to poor social capital in the Irish countryside.

4.2 Mechanisms

In this section we demonstrate three pieces of evidence in support of our hypothesis that market contestation between cooperative and private concerns led to poor social capital and ultimately violence during the Irish War of Independence. First, we show that it was not attacks on the creameries themselves which is the sole explanation for the overall level of conflict. Second, we show that our results are robust to an alternative measure of cooperative presence, but do not correlate with non-dairy cooperation, so it was not cooperation *per se* which led to violence. Finally, we discuss the differing results for Ulster highlighted above.

Table 2: Explaining conflict

	log(Conflict)		
	(1)	(2)	(3)
log(Coop)	0.1482	0.1740**	0.2674**
	(0.0963)	(0.0830)	(0.1053)
log(Coop) × Ulster	-0.2504	-0.2923	
	(0.1896)	(0.1783)	
Controls			
County FE	Yes	Yes	Yes
Long/lat pol. (2nd deg.)	Yes	Yes	Yes
Ruggedness	Yes	Yes	Yes
Population in PLU	Yes		
Population in MP		Yes	Yes
Estimator	OLS	OLS	2SLS
Observations	163	130	163
1st stage F-stat			164.3

Conley (70km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table presents the regression analysis results estimating the relationship between the presence of cooperative creameries and the density of conflict during the Irish War of Independence. Columns 1 and 2 use ordinary least squares (OLS) methods, while Column 3 implements a two-stage least squares (2SLS) estimator, utilizing the presence of private creameries as an instrument for cooperative presence. We employ PLU level and MP measures of population as controls for population density. Interaction terms with "Ulster" are included to account for regional differences. We use Conley standard errors to account for spatial correlation within a 70 km radius.

With regards to the first, one might imagine that creameries themselves, or something correlating with them, rather than contestation, was the cause of the violence. The British believed they were harbouring Nationalists, and some Nationalists felt that they were outposts of British capitalism. We estimate this on the cooperative creamery level, and test whether creameries closer to private concerns were more likely to be attacked as part of British reprisals. We find no positive effect, and if anything the effect is negative, see Table A3 in the appendix. We see this as evidence that our results are not driven by the attacks on the creameries themselves, but rather reflect poor social capital accumulated over a longer period and wider social unrest, with the British reprisals themselves seemingly unrelated to the contestation itself.

Second, our results are robust to alternative measures of cooperation. Thus, in Table A4 in the appendix we find similar, although somewhat less robust, results using Cooperative Dairy Society (CDS) instead of IAOS cooperatives. These cooperatives did not so aggressively target proprietary concerns, but would nevertheless have been a cause of contestation for milk supplies. On the other hand, in Table A5 in the appendix we find no effect of cooperative (Raiffeisen)

Table 3: Location of IAOS

	log(Coop)	
	(1)	(2)
log(Private)	0.5736***	0.5742***
	(0.0853)	(0.0878)
log(Private) × Ulster	0.3101***	0.3003**
	(0.1152)	(0.1148)
Controls		
County FE	Yes	Yes
Long/lat pol. (2nd deg.)	Yes	Yes
Ruggedness	Yes	Yes
Population in PLU	Yes	
Population in MP		Yes
Observations	163	163

Conley (70km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table examines the relationship between the market potential of private creameries and the presence of IAOS cooperative creameries, with special consideration for regional differences, particularly in Ulster. The coefficients indicate the strength of the correlation between the density of private and cooperative creameries. Columns 1 and 2 show the basic regression results without and with population market potential controls. The interaction term "log(Private) × Ulster" examines whether the relationship differs in the Ulster region. Column 2 in this table is the 1st stage of column 3 in Table 2

banks. We consider this evidence that contestation in the dairy industry and not some other feature of rural cooperation was the cause of the conflict.

Finally, we noted previously that Ulster appears to be different. This might of course be due to its different religious make up, but might also be due to its lack of private concerns, meaning that contestation was not such an issue. As we noted above, we cannot unfortunately control for it easily in the IV specifications, since this would require two instruments. Instead, in Table 3 we presented results where we allow for the Ulster interaction. Column 1 simply shows the estimated relationship between the market potential of private and cooperative creameries. A 10 per cent increase in $Priv_i$ is associated with a 7 per cent increase in $Coop_i$. While Column 1 controls for the population density in the same PLU, Column 2 uses the "market potential" of the population instead - the parameter is unchanged. We see clearly that the strong association between the location of IAOS and private creameries, which is not driven by population density and other unobserved factors captured by the longitude and latitude, is much less strong for Ulster. Since this was the part of Ireland where milk supplies were less contested, we see this as additional support for our hypothesis that contestation led to poor social capital and increased episodes of violence.

5 Conclusion

We have offered new insights into the role of agricultural cooperatives in early twentieth-century Ireland, specifically examining how their contestation with private creameries influenced local conflict during the Irish War of Independence. By utilising newly compiled data on both cooperatives and conflict, and employing an instrumental variable approach to address endogeneity, we have shown that the establishment of cooperatives—while ostensibly aimed at fostering economic cooperation and social capital—had unintended consequences in areas where they competed directly with existing private enterprises. Our results indicate that in these contested markets, cooperatives were associated with an increase in local violence.

Thus, the core of our analysis demonstrated that the presence of cooperatives had a significant positive correlation with conflict intensity, even when controlling for various confounders. This relationship persisted after addressing potential endogeneity through the use of private creameries as an instrument for cooperative presence, reinforcing the causal nature of the relationship between cooperatives and local unrest. Our findings are consistent across different model specifications and hold even when alternative measures of cooperative activity are used. Importantly, our analysis also highlighted the regional variation in the effects of cooperatives. In Ulster, where the socio-economic landscape differed from the rest of Ireland—featuring a smaller private dairy sector—the impact of cooperatives on conflict was notably weaker. This suggests that the dynamics of market contestation, particularly the intense competition for milk supplies in areas with well-established private creameries, were a crucial driver of conflict.

Our work also contributes to the broader literature on social capital and cooperation. While much of the existing literature emphasises the positive externalities of social capital, such as trust, collaboration, and collective action (Ostrom, 1990, 2010; Putnam, 1995), our study underscores the complex and sometimes contradictory role of cooperatives in shaping social outcomes. As Putnam (2000) and others have noted, social capital is not always a force for good; it can be manipulated or weakened in certain contexts. Our findings align with this perspective, showing that in contested markets like the Irish dairy industry, cooperatives may have undermined, rather than strengthened, social cohesion. The historical context of our study is also critical. The rise of agricultural cooperatives in Ireland occurred during a period of significant socio-political upheaval, as the country moved towards independence. Cooperatives were not just economic entities but were also embedded within the broader nationalist movement, which sought to promote self-sufficiency and economic independence from Britain. This dual role of cooperatives—as both economic and political actors—may have exacerbated tensions in areas where they competed with private enterprises, contributing to the broader conflict during the War of Independence.

Lastly, our study provides several important implications for policymakers and development practitioners. First, while cooperatives are often viewed as vehicles for economic development

and social cohesion, our findings suggest that their introduction in contested markets can have negative side effects, particularly when they challenge established private interests. Policymakers need to carefully consider the potential for conflict and social fragmentation when implementing cooperative models in such contexts. Second, our research highlights the importance of local economic and social conditions in determining the success or failure of cooperative initiatives. In regions like Ulster, where market contestation was less intense, cooperatives had a more limited impact on social capital and violence. This suggests that the success of cooperatives may be contingent on the absence of direct competition with private enterprises. Thus, our findings encourage a reevaluation of the traditional narrative of cooperatives as universally positive institutions. While they can play a critical role in fostering economic development and social cohesion in some contexts, they can also have unintended negative consequences, particularly in contested markets.

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Appendix

Table A1: Milk share and private creameries

	log(priv)	
	(1)	(2)
Share of milch cows	1.280***	0.9151**
	(0.4742)	(0.4127)
Controls		
County FE	Yes	Yes
Long/lat pol. (2nd deg.)	Yes	Yes
Population in PLU	Yes	
Population in Market Access		Yes
Observations	157	163

Conley (70km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table examines the relationship between the share of milch cows and the presence of private creameries. The dependent variable is the log of the spatial presence of private creameries, measured using Market Potential (MP). The key independent variable, "Share of milch cows," represents the proportion of cows dedicated to milk production within each Poor Law Union (PLU) in 1870. Column 1 includes controls for PLU population density, while Column 2 instead controls for population Market Potential (MP). County fixed effects and a second-degree polynomial of latitude and longitude are included in both specifications to account for geographic and regional variations. The results show a significant positive association between the share of milch cows and the presence of private creameries, indicating that private creameries were more likely to be located in areas with higher levels of milk production. Conley standard errors (70km bandwidth) are used to account for spatial correlation in both models. This highlights the fact that specialization in dairying is a key determinant of where private creameries were established, supporting its use as an instrument in later regressions.

Table A2: Explaining conflict but with many (potentially endogenous) controls

	log(Conflict)		
	(1)	(2)	(3)
Variables			
log(Coop)	0.2224***	0.2370***	0.4598***
	(0.0763)	(0.0747)	(0.0980)
log(Coop) × Ulster	-0.3521***	-0.3578***	
	(0.0950)	(0.1223)	
Controls County FE	Yes	Yes	Yes
Long/lat pol. (2nd deg.)	Yes	Yes	Yes
Ruggedness	Yes	Yes	Yes
Population in PLU	Yes		
Population in MP		Yes	Yes
Soil type FE	Yes	Yes	Yes
Share of milch cows	Yes	Yes	Yes
Share of grassland	Yes	Yes	Yes
Share of farms over 30 acre	Yes	Yes	Yes
log(Gaelic League, MP)	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS
Observations	156	157	157
1st stage F-stat			68.2

Conley (70km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table explores the robustness of the relationship between cooperative creameries and conflict density, introducing several potentially endogenous controls. The dependent variable is the log of conflict intensity, measured using Market Potential (MP) methodology. The key independent variable, "log(Coop)," represents the spatial presence of IAOS cooperative creameries. Additional controls include variables such as ruggedness, population density (either directly or through MP), soil type fixed effects, agricultural characteristics (share of milch cows, share of grassland, and share of farms over 30 acres), and the presence of Gaelic League branches (log(Gaelic League, MP)). The table shows that even when controlling for these factors, the positive correlation between cooperative presence and conflict remains strong, particularly in southern Ireland. Interaction terms with "Ulster" are included to assess regional differences, where the relationship between cooperatives and conflict appears weaker. Conley standard errors (70km bandwidth) are used to account for spatial correlation in all models. In Column 3, a two-stage least squares (2SLS) approach is used to account for potential endogeneity, with private creameries serving as an instrument for IAOS cooperatives. The robustness of the results across multiple specifications highlights the significance of the cooperative presence in shaping conflict dynamics during the Irish War of Independence.

Table A3: Reprisals and dairying

Dependent Variable:	Reprisal		
	(1)	(2)	(3)
Variables			
log(Priv)	-0.1579	-0.2779*	-0.1149
	(0.1741)	(0.1592)	(0.1965)
Fixed-effects			
County FE	Yes	Yes	Yes
Long/Lat control	No	Yes	Yes
Fit statistics			
Observations	420	420	411

Conley (50km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This regression is at the level of each IAOS creamery. This table examines the relationship between the location of private creameries and the likelihood of British military reprisals against IAOS cooperatives during the Irish War of Independence. The dependent variable "Reprisal" refers to whether an IAOS cooperative was attacked. The key independent variable, "log(Priv)," represents the spatial density (Market Potential) of private creameries. A negative coefficient suggests that IAOS creameries located nearer to private creameries were less likely to be targets of reprisals. The model includes county fixed effects and controls for geographic location using a second-degree polynomial of latitude and longitude. Standard errors are adjusted for spatial correlation using Conley's method with a 50km bandwidth.

Table A4: Location of CDS creameries to explain conflict

	log(Conflict)		
	(1)	(2)	(3)
Variables			
log(Coop-CDS)	0.1327	0.1644*	0.3153***
	(0.1090)	(0.0870)	(0.1124)
log(Coop-CDS) × Ulster	-0.2578	-0.3181*	
	(0.1886)	(0.1742)	
Controls			
County FE	Yes	Yes	Yes
Long/lat pol. (2nd deg.)	Yes	Yes	Yes
Ruggedness	Yes	Yes	Yes
Population in PLU	Yes		
Population in MP	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS
Observations	158	163	163
1st stage F-stat			79.5

Conley (70km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: This table examines the relationship between the location of Cooperative Dairy Societies (CDS) and the intensity of conflict during the Irish War of Independence. The dependent variable is the log of conflict intensity, while the key independent variable, "log(Coop-CDS)," refers to the spatial presence (Market Potential) of CDS creameries. A positive coefficient indicates that areas with a higher density of CDS creameries experienced more conflict. Column 1 uses OLS with PLU population controls, while Column 2 employs population Market Potential (MP) as a control. Column 3 presents results from a two-stage least squares (2SLS) estimation, where the presence of private creameries serves as an instrument for CDS creameries. The interaction terms with "Ulster" test whether the relationship differs in that region, given its unique socio-economic structure. Conley standard errors (70km bandwidth) are used to adjust for spatial correlation in all models.

Table A5: Location of Raiffeisen societies to explain conflict

	log(Conflict)		
	(1)	(2)	(3)
Variables			
log(Raf. Soc.)	-0.0857	-0.0194	-2.076
	(0.2254)	(0.1820)	(1.895)
log(Raf. Soc.) × Ulster	0.0714	-0.0072	
	(0.3131)	(0.2628)	
Controls			
County FE	Yes	Yes	Yes
Long/lat pol. (2nd deg.)	Yes	Yes	Yes
Ruggedness	Yes	Yes	Yes
Population in PLU	Yes		
Population in MP	Yes	Yes	Yes
Estimator	OLS	OLS	2SLS
Observations	163	163	163
1st stage F-stat			1.652

Conley (70km) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Col 1 and 2 show the OLS results controlling for PLU population and MP, respectively. Col 3 provides 2SLS estimates using the presence of Raiffeisen societies.Interaction terms with 'Ulster' examine regional differences.