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The Pencil and the Sickle: Labor Collective Action and the Rise of Literacy in Spain

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Abstract

This article analyses the relationship between labor mobilization and human capital formation in Spain. In a context of limited state involvement in education, schooling was largely provided by local councils, churches, and families. Alongside these actors, organized labor endeavored to supply basic instruction to local communities, yet its role has not been systematically examined. I address this gap by empirically assessing whether working-class associations fostered human capital formation between 1860 and 1930, prior to the Second Spanish Republic. Exploiting the staggered creation of over 5,000 associations, I find that cooperatives had the most robust impact on literacy expansion, driven by both demand-side and supply-side channels. The findings highlight the social functions and developmental effects of working-class collective action and shed light on the factors underlying literacy growth before the implementation of mass education systems.

Keywords: human capital, labor movement, state capacity, cooperatives, literacy, collective action

Introduction

The Agricultural Society of Valls, founded in 1888 in a Catalan town of roughly 10,000 inhabitants, was the first legalized agricultural cooperative in the region. Established to protect and organize farmers against the power of landowners, its scope soon expanded beyond economic coordination. Only three years after its founding, it had established a school that welcomed the children of both members and non-members. Daytime lessons for children aged 6 to 14, covering subjects such as arithmetic, geometry, geography, and general history, were complemented by evening classes for adults focusing on writing, reading, and problem-solving. Beyond formal instruction, the association maintained a library and reading room that offered a wide range of printed materials, operating through an efficient lending system, and hosted regular conferences and public lectures. By the early 20th century, the school and the cooperative itself had become a center of social and cultural life (Gavaldà 1989). In a country of scarce and unequal educational provision, this example represents a significant bottom-up contribution to the diffusion of literacy among the popular classes.

This experience was not unique to Valls or Spain, but echoed a broader phenomenon observed across Western Europe during the late-nineteenth and early-twentieth centuries: the labor movement's effort to expand instruction to the working classes through its own schooling network and educational initiatives (Bartolini 2000, pp.81-5). Before modern states assumed responsibility for mass education (Lindert 2004), schooling was organized at the local level, relying primarily on municipal authorities, churches, and families. Under these conditions of limited and uneven state provision, another crucial yet overlooked actor was organized labor. In particular, the labor movement fostered the creation of a wide range of associations and supported the establishment of schools, libraries, and educational activities for the "intellectual improvement" of the popular classes in both urban and rural areas.

Can non-state collective actors shape human capital formation under weak state capacity? And did their organizational forms matter? In this paper, I argue that the emergence of specific forms of working-class organizations, particularly cooperatives, increased literacy rates across Spanish municipalities during the late-nineteenth and early-twentieth centuries. For the labor movement,

education was conceived as a precondition for the emancipation and progress of the working classes. By contrast, associations aligned with the Catholic Church emphasized religious and moral instruction aimed at social order and discipline. A rich body of historical evidence documents how entities linked to the labor movement played a central role in advancing literacy through the creation of schools, libraries, and cultural centers, providing instruction not only to their rank-and-file members but also to the broader community. Nevertheless, systematic quantitative evidence on this topic remains absent. This article addresses this gap by analyzing the contribution of different forms of labor mobilization to literacy growth between 1860 and 1930. As a complementary exercise, I also analyze the influence of organizations within the orbit of Social Catholicism.

Spain between 1860 and 1930 constitutes a particularly suitable case to examine the relationship between literacy and local associational life under conditions of limited state capacity. By 1870, only 30% of Spaniards were literate, compared to around 80% in other countries such as the United Kingdom and Germany (Crafts 1997; Pamuk et al 2010). In a context of gradual industrialization and political liberalization, the 1857 Public Instruction Act (PIA), commonly known as the Moyano Act, first established a national framework that distinguished between primary, secondary, and higher education. Yet state intervention remained confined to higher education, whereas both primary and secondary schooling continued to rely on municipal and private provision. Although the state assumed a more active role in primary education with the establishment of the Ministry of Public Instruction and Fine Arts in 1900, territorial disparities in educational outcomes and access remained substantial in 1930 (Beltrán Tapia et al 2021; Insa-Sánchez 2024). Together with large regional differences in associational life (Arnabat Mata 2019), this variation provides a valuable opportunity to investigate whether, under conditions of limited institutional capacity, municipalities where working-class associations emerged achieved higher literacy levels than those without them.

To test this argument, I construct a novel panel dataset covering all Spanish municipalities with more than 100 and fewer than 10,000 inhabitants as of 1887, observed over the 1860–1930 period. The dataset combines repeated census information with newly collected data on the establishment of over 6,000 local associations, which allows me to track both outcomes and organizational exposure over time. The 1887 Law of Associations marks the starting point for the analysis by providing the first legal framework for the recognition of associations. The treatment period ends in 1920, just before the military dictatorship of Primo de Rivera (1923–1930), as it fundamentally altered the organizational landscape by outlawing most labor organizations (Tusell 2012, p.458). Exploiting the staggered creation of over 5,000 organizations across more than 7,000 municipalities during the 1887–1920 period, I employ a difference-in-differences design to estimate their impact on literacy. Literacy outcomes are observed across census waves from the 1860 to 1930 censuses to capture both pre-treatment and post-treatment dynamics. In doing so, I estimate the impact of organizational exposure prior to both Primo de Rivera's regime (1923–1930) and the Second Republic (1931–1936), which expanded public education and pursued educational renovation (Solá 1993; Tiana 1997).

The results show that the creation of cooperatives led to statistically significant increases in local literacy rates. Municipalities exposed to cooperative formation saw an increase in literacy of approximately 1.8 percentage points relative to not-yet-treated municipalities, equivalent to roughly 5–6% of the baseline literacy rate of 29.6% in 1887. By contrast, other forms of local organization, such as trade unions and employers' organizations, were not consequential for literacy growth. I further examine demand-side and supply-side channels through which organizational formation could have affected literacy expansion and find evidence supporting both. On the one hand, the impact of cooperatives is particularly pronounced in places with weaker schooling infrastructure. At the same time, cooperatives appear to alter household behavior in ways that are consistent with a decline in the opportunity cost of schooling.

This article contributes to three distinct strands of research. First, this work advances the literature on the historical determinants of literacy by identifying a previously underexamined mechanism:

bottom-up investments in human capital by organized labor. Most studies on literacy's determinants have focused on state capacity (Cappelli and Vasta 2020; Lindert 2004; Paglayan 2024), land inequality (Albertus et al 2020; Beltrán Tapia and Martinez-Galarraga 2018; Cinnirella and Hornung 2016), religion (Becker and Woessmann 2009; Chaudhary 2009), and historical institutions (Beltrán Tapia et al 2024). Nevertheless, the role of local collective actors in contexts where state capacity is limited remains unexplored. The findings also challenge a common assumption in Spanish historiography about the weakness and relative unimportance of social agents (e.g., the church, the family, and social movements) on the expansion of literacy in Spain (Viñao 1990, p.581). By quantifying the impact of different association types both within and outside the labor movement, the article studies whether and how local collective actors contributed to literacy growth amid limited state intervention.

Second, it speaks to research on civil society and public-goods provision by examining how non-state actors, such as working-class organizations, can supply educational services at the local level. While existing research argues that civil society can produce and sustain public goods, particularly in contexts where the role of state institutions is marginal (Klein and Lee 2019), most quantitative research has focused on the political and civic implications of associational life (e.g., Amat et al 2020; Putnam 1994; Verba et al 1995). By contrast, less attention has been devoted to how and under what conditions different types of organizations are able to produce public goods. By comparing different organizations in a context of competition over the provision of "popular education" (e.g., the instruction of the working-class outside formal institutions), the analysis indicates that not all forms contribute equally to local development. Organizations centered on the empowerment and collective advancement of workers (i.e., cooperatives) invested more in human capital than those focused on socioeconomic coordination or labor control. Under conditions of weak state provision, the capacity of collective actors to deliver public goods is thus associated with their incentive structures and degree of local embeddedness.

Third, the article also engages with the long-standing literature on the political and social consequences of early labor mobilization in Western Europe. Seminal research by Luebbert (1987) investigates how different patterns of early labor mobilization shaped the advent of distinct interwar political regimes. A related body of research analyzes how working-class sociopolitical mobilization structured political cleavages and party systems (Bartolini and Mair 1990; Lipset and Rokkan 1967), while Esping-Andersen (1990) links variation in the strength of organized labor to the emergence of different welfare state regimes across Europe. Drawing on this tradition, this study focuses instead on a largely neglected dimension of labor mobilization: its contribution to literacy development. To the best of my knowledge, this article provides the first quantitative evidence that labor-oriented organizations contributed to literacy growth amid limited state intervention.

Determinants of Literacy Expansion in Historical Perspective

Seminal research has typically associated literacy expansion with modernization and its related processes of industrialization, economic growth, nation-building, and democratization (Cipolla 1969; Lipset 1959). More recent quantitative work has focused on the role of political institutions and specific socioeconomic structures in facilitating the spread of formal schooling and increasing the demand for basic skills.

A first strand of research studies the supply-side political determinants of educational expansion. Classical accounts argue that governments promoted mass education during processes of nation-building to construct national communities and consolidate state authority (Alesina et al 2021; Darden and Mylonas 2016; Weber 1976). In line with this, a related body of research prioritizes the extension of democratic voting rights as democratization grants political influence to low-income groups, who benefit the most from public schooling (Lindert 2004). However, recent work by Paglayan (2024) revisits this logic. Analyzing the origins of mass education and schooling in Europe and Latin America, the author contends that what motivated central governments to provide

instruction to the lower classes was neither democratization nor industrialization, but social control and discipline. Focusing instead on institutional design, Cappelli and Vasta (2020) show that the 1911 Italian reform that centralized the educational system expanded literacy while also reducing regional disparities, illustrating how centralization can affect local outcomes. While these works underscore the importance of supply-side factors such as strong political institutions, national-level dynamics alone cannot account for the significant regional variation in educational outcomes observed during the early twentieth century, as documented by Cappelli et al (2025).

A complementary body of scholarship argues that the spread of mass education hinged not only upon supply-side constraints, but also on local socioeconomic structures shaping the demand for schooling. Some works have accordingly examined the impact of inequality on human capital formation, assuming that inequality and poverty reduce the demand for instruction by increasing poorer households' costs of schooling. In this regard, higher land inequality has been shown to have a negative effect on a variety of educational outcomes, such as public spending on education (Galor et al 2009; Ramcharan 2010), primary school enrollment rates (Cinnirella and Hornung 2016), or literacy rates (Beltrán Tapia and Martinez-Galarraga 2018). Contrary to these findings, Albertus et al (2020) investigate land reform in 1970s Peru and argue that land redistribution negatively affected educational attainment by reducing families' opportunity cost of remaining in the countryside. Yet these works do not consider how inequality-induced grievances can also trigger class conflict and mobilization, potentially mediating the impact of inequality on education through institutional and organizational innovations (e.g., cultural societies targeting uneducated populations).

Beyond political and economic determinants, cultural and religious norms can also shape educational preferences and incentives. Exploring variation in the distribution of primary and secondary schools across districts in British India, Chaudhary (2009) demonstrates that greater social fragmentation (e.g., diversity in religious and caste terms) inhibits the supply of primary and secondary education by increasing coordination costs. Already in 19th-century Prussia, Protestant-majority localities displayed higher literacy levels, consistent with Weber's famous "Protestant ethic" hypothesis (Becker and Woessmann 2009). Gendered norms likewise influenced human capital formation, as evidenced by Cappelli and Quiroga Valle (2021). They establish that the feminization of the teaching profession in Italy and Spain was associated with higher enrollment rates, particularly for girls, as it encouraged girls to enroll in primary education. The persistent impact of premodern institutional arrangements is analyzed by Beltrán Tapia et al (2024), who study local jurisdictions in ancien régime Spain. Using the Kingdom of Valencia as case study, they conclude that male literacy rates in 1860 were consistently lower in municipalities under lordships than in those under royal jurisdiction due to harsher socioeconomic conditions.

Despite this rich body of research on literacy expansion, the literature has devoted little attention to local collective actors, particularly organized labor, which often occupied a central position in the social and economic life of local communities. Yet systematic quantitative evidence on whether the educational initiatives of the labor movement shaped local literacy outcomes remains absent. This omission is particularly striking in Spain, where the absence of a strong central government and rampant social inequalities made working-class organizations important providers of schooling and other welfare services. This paper fills this gap by investigating how labor mobilization influenced mass literacy across Spanish municipalities between 1860 and 1930.

Historical Background

By 1850, between 45 and 50% of the European population could not read, with male literacy rates typically higher than female ones (Cipolla 1969, pp.71-85). Within Europe, cross-national differences were acute: whereas northern and central countries (e.g., Germany, Switzerland, Sweden, etc.) had already progressed towards mass literacy, southern and eastern countries, including Spain, Italy, and Russia were at the other end of the spectrum. At the same time, disparities were also stark at the

regional level, as urban centers were generally more literate than rural areas (Cipolla 1969). This two-level heterogeneity resulted from both supply-side and demand-side factors, reflecting uneven patterns of socioeconomic development, urbanization, government intervention, and local provision and demand for instruction.

Spain lagged markedly behind in educational terms. Even when regional inequalities narrowed during the 1860–1930 period, a north–south divergence persisted, with Madrid and the northern provinces outperforming the southern and eastern regions of the Peninsula (Beltrán Tapia et al 2021; Cipolla 1969).[1] As in many other countries (Lindert 2004; Paglayan 2024), the education system remained substantially decentralized until the late nineteenth and the first decades of the twentieth centuries, and the supply of basic instruction rested with families, religious congregations, and local councils. In the Spanish case, the move toward centralization and homogenization was further complicated by a slow and turbulent transition to a liberal regime, marked by recurrent internal unrest and major external conflicts throughout the 19th century (Tusell 2012).

The 1812 Liberal Constitution outlined a unified, national education system and formally mandated the establishment of primary schools throughout the territory. Still, political instability and limited fiscal capacity prevented its implementation, resulting in roughly 70% of the population aged ten and over unable to read or write by 1860 (Viñao 1990, p.574). This led to the emergence of a stronger legal framework with the Moyano Act of 1857, which distinguished between elementary, secondary, and higher education. The law made primary schooling compulsory for children aged 6 to 9 and introduced population thresholds for the presence of schools across municipalities. Although the state retained control over higher education, especially universities, primary and secondary education continued to depend on both the willingness of municipalities and their funding capacity (Beltrán Tapia et al 2021; Nuñez 1992).

The resulting public schooling system remained severely deficient: teachers were not adequately qualified, facilities were inadequate, and the scarcity of basic teaching materials was widespread. In practice, however, public provision of secondary education was especially underdeveloped, which promoted the expansion of private initiatives, primarily Catholic schools, in urban and economically dynamic contexts (Insa-Sanchez and Diez-Minguela 2023). [2]By contrast, private schooling had a marginal presence in elementary instruction and was thus unable to compensate for these deficits, as it largely served specific sectors of the population (e.g., adult evening and Sunday students, orphaned preschoolers, or children from wealthy families) (Nuñez 1992, pp.248-9).

The limited effectiveness of the Moyano Act in curtailing illiteracy, combined with the national crisis triggered by the 1898 colonial disaster and sweeping socioeconomic transformations, generated growing demands for comprehensive reforms. As a consequence, the state undertook a process of institutional modernization, fundamentally expanding its role in the education system. A key step in this direction was the centralization of educational spending: first for secondary education in 1888, and then for primary education with the establishment of the Ministry of Public Instruction and Fine Arts in 1902 (Nuñez 1992, p.289).

This shift towards centralization was accompanied by the professionalization of the school system. New schools were built across the territory to address infrastructure shortcomings, compulsory schooling age reached twelve in 1909, and the creation of the Department of Primary Education in 1911 was aimed at enhancing teacher training and supervision (Beltrán Tapia et al 2021). Although these reforms represented a decisive departure from decentralized provision, they proved insufficient to eradicate regional disparities and expand primary instruction. Moreover, access to both primary and secondary schooling remained territorially uneven and especially deficient outside urban centers (Boyd 1976; Insa-Sánchez 2024). The central government did not assume a proactive role in education until the Second Spanish Republic (1931–1936), which implemented a far-reaching program of

[1]Figure 1 illustrates the regional distribution of literacy in 1860.

[2]Only four state secondary schools were created between 1857 and 1901 (Insa-Sanchez and Diez-Minguela 2023, p.241).

educational reform and public school construction (Nuñez 1992, p.224).

Therefore, the scope and quality of primary education were largely insufficient during the 1860-1930 period. It was in this context of inadequate schooling that local collective actors, particularly the labor movement emerged as significant educational providers. The next section explores *whether* labor-oriented organizations contributed to the local provision of instruction and *how* they might have affected literacy trajectories across Spain.

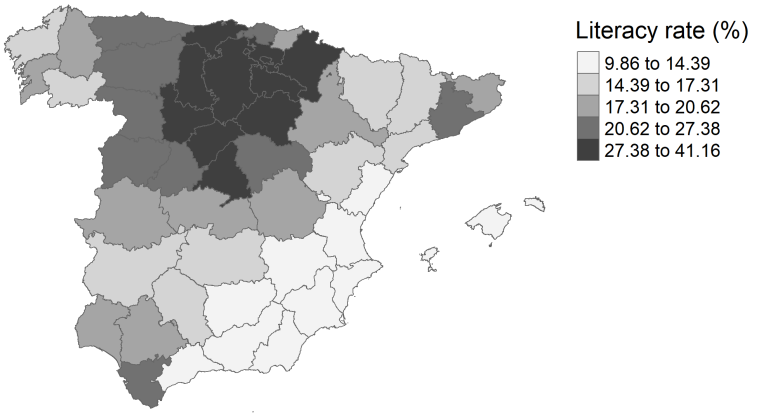


Figure 1. Provincial literacy rate (1860)

Popular Education and Non-state Actors in Spain

The situation and education of the popular classes in Spain were a source of timid concern before the emergence of a modern state-led educational system. As early as the seventeenth and eighteenth centuries, the Catholic Church, following the French example, established a school network managed by different religious orders, although this effort did not develop with the same intensity as in France (Viñao 1990, p.582). Besides religious congregations, associations run by the upper classes, such as the Economic Societies of the Friends of the Country, were founded in several Spanish cities during the second half of the 18th century and into the early decades of the 19th century (Tiana 1997, p.131). Infused with Enlightenment ideas, they pursued a wide range of educational activities and services. Still, they mainly targeted the upper classes and their reach was confined to larger cities and the intellectual centers of Spain.

The late arrival of industrialization in the second half of the 19th century generated sharp social tensions and widening inequalities in Spain. As in most of Europe, the so-called "social question" became central to the Spanish political life and brought new agents and ideological projects into the field of education. Several non-state actors, including the social reformists, the labor movement, and the Social Catholics, thus engaged with the problem of popular education through the articulation of their own pedagogical responses and educational models, based on different diagnoses of social reality and approaches to improving the situation of the popular classes (Tiana 1997, pp.131-3).[3] In

[3]These projects were often financially supported by municipal and provincial governments, implicitly recognizing the systematic failure of official education (Boyd 1976, p.140)

this context of fragmented educational provision, competition was particularly pronounced between organizations associated with Social Catholicism and working-class organizations, as they targeted the same population -the popular classes- while differing in their organizational objectives and models. This paper focuses on the impact of organized labor within this competitive environment, while also considering alternative non-state actors in a complementary exercise.

The group of intellectuals, university professors, and Republican politicians who formed the reformist or 'institutionist' core viewed the education of the lower classes as an indispensable condition for a functioning democratic system, as well as an effective means of preventing social conflict (Tiana 1997). Inspired by the pedagogical movement known as Krausism, they promoted the creation of modern, secular educational institutions such as the Free Teaching Institution (*Institución Libre de Enseñanza* in Spanish), popular universities, and university extension programs. While the movement initially focused on university studies, it later adopted initiatives aimed at strengthening the network of primary and secondary education (Carr 2009, p.390). Overall, the influence of the reformists remained mostly confined to intellectual and cultural spheres (Carr 2009, p.392). They shaped pedagogical discourse and elite formation, functioning more as a movement for Spain's social and cultural renovation than as a driver of mass education.

The Labor Movement

The labor movement constituted a distinct organizational force committed to the education of the popular classes. Although its educational principles and methods were shaped by a strong ideological bias (Tiana 1992, p.427), organized labor conceived popular instruction as a key precondition for the emancipation, autonomy, and sociopolitical mobilization of the working classes. The International Working Men's Association or First International, founded in 1864, formalized the concern of both socialism and anarchism with workers' education. The concept of "integral education" emerged from these congresses, referring to the provision of instruction to all members of society on egalitarian grounds and guided by principles of scientific rationality (Devreese 1999). However, given its limited capacity to implement this project internationally, responsibility was delegated to national and local branches. This fostered the development of a dense associational fabric of local workers' associations, including mutual aid societies, trade unions, and cultural centers, which operated as hubs of sociability, welfare provision, and political mobilization (Bartolini 2000).

In the Spanish context, some labor organizations began sponsoring educational activities in the first half of the 19th century, particularly in major urban centers such as Madrid or Barcelona (Tiana 1992, 1997). Yet it was not until the late 19th century that integral education was embraced by Spanish anarchism through the creation of autonomous centers whose main mission was to "prepare the masses for the revolution" (Boyd 1976). Socialism followed a different path, as its initial distrust of state and bourgeois education was gradually abandoned in favor of reformist stances, leading to the development of their own educational project during the first decades of the 20th century (Tiana 1997).

Particularly after the 1887 Law of Associations, a whole network of workers' societies, trade unions, and cooperatives unfolded, among whose core objectives were not only the socialization and formation of political activists, but also the diffusion of basic education among the lower classes (Navarro 2005). Illustratively, the founding congress of the National Confederation of Labor (or *CNT* for its acronym in Spanish) in 1910 included on its agenda "the need to establish schools within labor unions", encouraging federations and local societies to undertake this task (Tiana 1997).[4] At a minimum, these initiatives sought to equip workers with basic skills in reading, writing, and arithmetic.

[4]The need to create Normal Schools for teachers and schools within associations is constantly raised at labor congresses and conferences during the first three decades of the 20th century (Díaz del Moral 1967, p.172).

This translated into the establishment of libraries, reading rooms, and schools within labor organizations. These spaces often served as laboratories where pedagogical innovations, such as the New School and Modern School movements, were tested out (Arnabat Mata 2019). Despite their differences, such approaches were grounded in rationalist, secular, and scientific principles while emphasizing hygiene in schools, coeducation of boys and girls, and learning-by-doing (Ferrer Guardia 1911). Schools tended to operate during the day for children and after working hours for adults, and were typically financed through fees and tuition payments made by the students themselves (Gavaldà 1989; Navarro 2005; Tiana 1992). Membership was predominantly working-class, with upper classes occasionally participating as protective or honorary members.[5]

Within this organizational apparatus, the cooperative movement emerged as another crucial working-class initiative oriented towards social and economic emancipation (Bartolini 2000). As a mechanism to shield workers from the risks of the market economy, cooperatives first appeared in Britain and drew on the ideas of Robert Owen and the model established by the Rochdale Pioneers in 1844 (Jackson 2016; Vernon 2016). Emphasizing collective ownership and democratic control over production, they played an increasingly important role in the life of local communities from the late nineteenth century onward. In addition to improving economic conditions, they also sought to foster social, political, and cultural advancement among their members. The principles of the Rochdale Pioneers explicitly included the "intellectual improvement of the members", to be pursued through the creation of a separate fund financed by a fixed share of its profits and devoted to maintaining libraries and promoting educational activities for members and their families (Jackson 2016, p.31).

Such formal obligation to education constituted one of the defining organizational features of cooperatives.[6] The rationale behind this institutional mandate was twofold. First, it reflected a strong normative commitment to working-class emancipation through knowledge and self-instruction. Second, it responded to practical organizational requirements, as cooperatives depended on collective participation and group decision-making. The education and training of members were thus necessary not only to strengthen solidarity and collaboration within the movement, but also to sustain business development and organizational functioning (Vernon 2016; Woodin 2011). By integrating education within their institutional structure, cooperatives were particularly predisposed to foster the diffusion of basic skills among their members and the broader community. These characteristics suggest that cooperatives could contribute to human capital formation by shaping members' incentives to invest in education and by facilitating access to local educational opportunities.

Despite these features, cooperatives were sharply criticized by thinkers such as Marx and Luxemburg, who viewed them as reproducing "the role of capitalist entrepreneur" (Luxemburg 2007, p.81). Under this view, cooperatives were not only instruments of working-class mobilization but could also serve as vehicles for the organization of relatively well-off rural groups. While this interpretation cannot be entirely dismissed, historical evidence suggests that the Spanish case diverged from this pattern, as they remained largely rooted in lower rural strata. In contrast to experiences in countries such as Denmark, Germany, and the Netherlands, Spanish cooperatives were predominantly composed of landless laborers and small-scale farmers (Arnabat 2017; Castillo 1979; Garrido et al 2006; Simpson 2000). [7]

A variety of local and regional historiographical studies have examined the influence and scope of these projects pioneered by the labor movement. Díaz del Moral (1967) explains that the typical statutes of labor societies in the province of Cordoba systematically included the establishment of a

[5]This composition was frequently formalized in the associations' statutes (Castillo 1994).

[6]Not all cooperatives pursued this educational purpose in practice. For instance, Vernon (2016, p.70) notes that educational funds within the UK Co-operative Union were not always strictly devoted to instructional purposes.

[7]According to Garrido (2007, p.194), the social composition of two cooperatives in two different Valencian cities was as follows: "The 'Sagrado Corazón' syndicate in Algemesí had 1,557 members in 1919, forty-nine per cent of whom were landless laborers, twenty-seven per cent were smallholders, twenty-two per cent were middle farmers, and the remaining two per cent were wealthy farmers. The 'Católico-agrario' syndicate in Vila-real had a total of 1,168 members by the end of the same year, and these proportions were forty-seven, thirty-one, twenty and two per cent, respectively."

school among their foundational objectives, and that the majority of such societies effectively installed schools for both children and adults within their registered premises. In a biography of an important Catalan cooperativist, Santesmases (2022) describes how a local farm laborers union founded a school that operated intermittently between 1906 and 1933, enrolling more than 200 pupils by its second year and partially compensating for the poor quality of public schooling. Similarly, Gavaldà (1989) documents the functioning of an adult and children school run by another local farmers' union in Catalonia, which also hosted regular conferences on a wide array of topics ranging from agricultural issues to literature. Reading groups in which a worker read aloud from a text that was subsequently discussed constituted another widespread practice within labor organizations (Luis Martín 2010). More broadly, the creation of libraries was a fundamental component of the educational mission of the labor movement and an indispensable resource for the diffusion of literacy (Arnabat Mata 2019).

Taken together, this historical evidence indicates that organizations within the orbit of organized labor contributed to the provision of instruction prior to the emergence of state-led educational systems, when literacy was highly dependent on the capacity of local actors to complement weak provision. Against this backdrop, the distinctive economic and organizational characteristics of cooperatives suggest that they could shape both the supply and demand for education, particularly in a setting with multiple providers competing to deliver basic instruction to the lower classes. Figure 2 summarizes this argument.

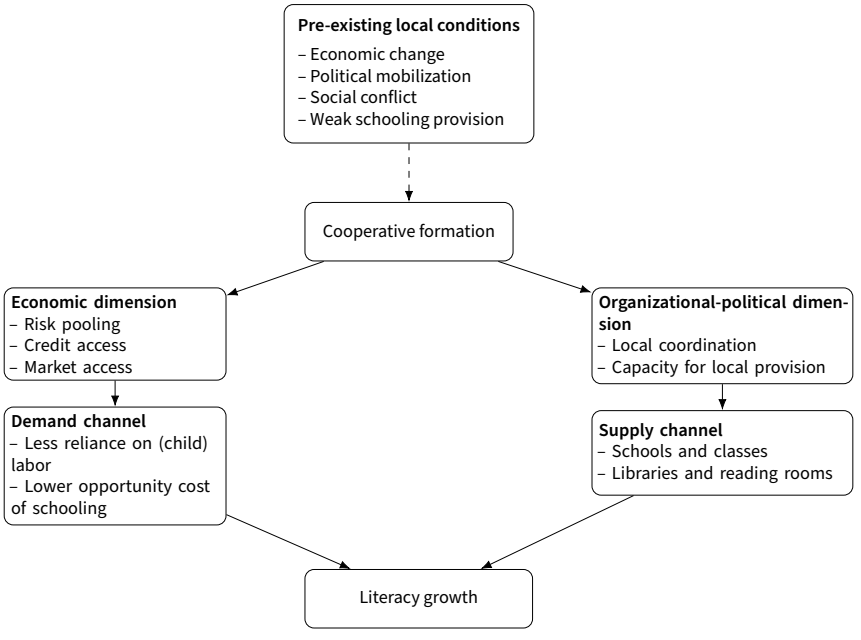


Figure 2. Theoretical framework. Pre-existing local conditions shape cooperative emergence, whose economic and sociopolitical dimensions affect literacy through demand-side and supply-side channels.

Beyond their political role as spaces of sociability and democratic participation, cooperatives emerged as a collective response to the socioeconomic risks faced by smallholders and workers. In the case of producers' and agricultural cooperatives, their main economic functions included the collective purchase of inputs, the commercialization of output under more favorable conditions, and improved access to credit (Medina-Albaladejo et al 2021). By pooling risks and easing access to resources otherwise beyond individual reach, cooperatives could alleviate households' economic volatility. In agrarian settings, where production relies heavily on family labor, greater economic stability may lower the opportunity cost of schooling, and families may thus be more willing to

invest in education.[8] This constitutes the demand-side channel through which cooperatives could drive literacy expansion.

Cooperatives could also influence literacy through a supply-side channel. As locally embedded organizations with substantial coordination capacity, cooperatives could mobilize resources, disseminate information, and respond to local needs. Central to the wider working-class associational ecosystem, cooperatives were frequently connected to movements advocating pedagogical renovation and educational reform across Europe (Barreiro 2010; Devreese 1999; Luis Martín 1991). They also provided direct instruction through their own schools, libraries, and reading spaces. For instance, Gavaldà (1989, pp.301-2) documents the daily curriculum of the cooperative school in the Catalan city of Valls, which organized instruction across three daily sessions (i.e., morning, evening and night) that combined basic literacy training with practical subjects. By adapting to workers' schedules, the cooperative reduced barriers to participation and expanded access to education. Accordingly, the impact of cooperatives should be stronger where formal schooling infrastructure was deficient.

Although supply-side interventions were not exclusive to cooperatives, their combination with demand-side incentives evinces the importance of this organizational form. The main expectation is therefore that municipalities exposed to cooperative formation experienced greater literacy growth between 1860 and 1930. In contrast, other forms of local organization, especially those outside the labor movement, lacking this dual mechanism are not expected to generate a comparable impact.

Data and Variables

To test these claims, I rely on a novel municipal-level panel dataset covering all Spanish municipalities with more than 100 inhabitants and fewer than 10,000 inhabitants as of 1887.[9] By doing so, I restrict the analyses to mostly non-urban areas, where students faced systematic disadvantages in access to secondary education during the late nineteenth century (Insa-Sánchez 2024) and local collective actors often operated as important welfare agents. The period under study spans the consolidation of the educational framework that emerged with the 1857 Moyano Act and ends before the Second Spanish Republic, whose reforms represented the most substantial institutional effort to shape the education system. Over this period, a first phase of limited state involvement runs from 1860 to 1900, followed by a phase of gradual centralization after the creation of the Ministry of Public Instruction and Fine Arts in 1900 (Beltrán Tapia et al 2019, p.50).

Literacy data come from population censuses carried out between 1860 and 1930 and are thus observed at roughly decennial intervals: 1860, 1887, 1900, 1910, 1920, and 1930. [10] The censuses provide information on the population's elementary educational attainment at the municipal level, classifying the population into three self-reported categories: reading ability, reading and writing ability, and illiteracy. The main dependent variable is municipal literacy rate, defined as the share of individuals who can read and write over the total population. Although this indicator deviates from conventional measures because it does not exclude children aged 10 or younger from the calculation, it has been extensively used to study literacy in Spain (Beltrán Tapia et al 2021, 2024). The main analyses are replicated using illiteracy rates and sex-specific rates and results remain substantively similar.

Organizational data are drawn from the Social Reforms Institute (*Instituto de Reformas Sociales*), a collegiate body established in 1903 that played a pivotal role in the development of the modern social policy framework (Tusell 2012). Specifically, I use the 1916 Census of Professional Associations to capture organizational creation between 1840 and 1920. This introduces an important limitation,

[8] The negative impact of harvest season on school attendance is well documented both historically (Ferrer 1987; Sarasúa 2002) and in the present (Baland and Robinson 2000; Guarcello et al 2008).

[9] To avoid conditioning on post-treatment, municipalities remain in the panel in subsequent years even if their population later falls below 100 or exceeds 10,000 inhabitants.

[10] Data come from Beltrán Tapia et al (2019) and Beltrán Tapia et al (2021).

as the data capture only formal, state-recognized institutions with written statutes.[11] Moreover, the source does not permit tracking organizational exit. Taken together, these features imply the presence of measurement error due to underreporting and unobserved organizational persistence.

The source classifies associations in two broad categories: professional and non-professional organizations.[12] Within professional organizations, the census distinguishes between workers' associations, employers' associations, and mixed associations.[13] Non-professional organizations are grouped under saving, cooperative, and mutual aid institutions, which can be broadly interpreted as cooperatives. An initial limitation of the source is that it does not permit a systematic distinction between consumer and producer cooperatives. Nonetheless, consumer cooperatives were typically more prevalent in urban settings, both in Spain and internationally (Hilson et al 2017; Medina-Albaladejo and Pujol-Andreu 2022; Planas 2022), contexts that fall outside the scope of this article.

In rural areas, most entities classified as cooperatives took the form of agrarian cooperatives and agricultural syndicates that operated as umbrella organizations in practice (Garrido 2007; Planas 2022; Reventós 1960; Roda 1948). These unions performed multiple complementary functions through a series of specialized branches, with the rural credit association (*caja rural*) as the cornerstone ensuring their sustainability. Other branches focused on purchasing and marketing, as well as welfare services (e.g., insurance and retirement benefits). At least in the Catalan case, Planas (2022, p.214) argues that the boundaries between consumer and production cooperatives were often blurred. In the predominantly rural contexts examined in this study, the cooperative movement thus formed multi-functional institutional hubs deeply embedded in local socioeconomic life.

I retain these three categories throughout the analysis to construct local indicators of organizational presence: (1) cooperatives, (2) workers' organizations, (3) cooperatives and/or workers' organizations.[14] To the extent that part of the cooperative movement was promoted by Social Catholicism and conservative sectors (Garrido 2007, 2021), some degree of conceptual overlap and classification uncertainty cannot be ruled out. This heterogeneity can be seen in Table B2, where agrarian syndicates and rural credit unions account for more than 54% of employers' organizations. The empirical strategy therefore evaluates whether literacy gains are associated with organizations embedded within the working-class associational ecosystem, as opposed to employer-oriented or Catholic forms of organization.

The analytical distinction between cooperatives and workers' organizations is based on both the original source classification and the considerations discussed in the previous section. Moreover, the very structure of cooperatives required co-participation and co-management by their members, which created strong incentives to invest in basic education. Along with direct educational supply, this incentive structure points to an institutional channel through which cooperative formation could have affected mass literacy. Nonetheless, I also examine their joint effect, as both represent the associational strand of working-class self-organization.[15] Figure 3 illustrates exposure to these labor-oriented organizations over the full exposure window, and Figures B3-B5 trace their temporal diffusion.

I therefore construct measures of organizational creation for the following periods: 1840-1860, 1860-1887, 1887-1900, 1900-1910, 1910-1920, and 1920-1930, defining treatment as the first observed creation of an organization in a given municipality. Anchored by two institutional junctures, the temporal window of substantive interest is, nonetheless, 1887-1900, 1900-1910, and 1910-1920.

[11] These data have nonetheless been employed to study Spanish social fabric in the early twentieth century (e.g., Arnabat Mata 2019; Mayayo 1995).

[12] Tables B1 and B2 report the original institutional classification of associations.

[13] Mixed associations are those composed of both employers and workers.

[14] A total of 225 associations originally classified as cooperatives within workers' associations are reassigned to non-professional organizations to harmonize the classification. Results do not change when preserving the original classification.

[15] Apart from these categories, the presence of any organization and of employers' organizations is examined separately in a complementary exercise.

The 1887 Law of Associations serves as a natural starting point for the analysis by establishing the first legal framework for the recognition of associations. Although associations certainly existed prior to 1887, this legislation created the institutional conditions under which workers and employers could organize legally, enabling systematic tracking of organizational formation. The treatment period concludes in 1920, just before the military dictatorship of Primo de Rivera (1923-1930), which dismantled much of the organizational landscape that had been developing since 1887 (Tusell 2012, p.458). Literacy outcomes are observed through the 1930 census to capture the effects of organizational exposure prior to the Second Republic (1931-1936). This distinction is important because the Republican government implemented significant educational reforms, including the expansion of public schools and the renovation of infrastructure (Solá 1993; Tiana 1997). By measuring literacy up to 1930, the impact of associational activity is isolated from subsequent policy intervention in education.

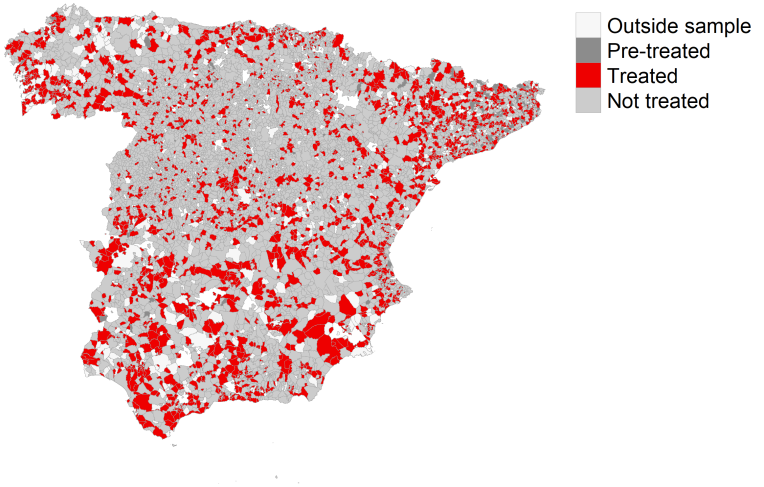


Figure 3. Exposure to workers' organizations and cooperatives across Spanish municipalities (1887-1920)

Other Variables

Because the establishment of organizations was not randomly assigned, municipalities with early organizational formation may differ systematically from those treated later or never treated, raising concerns about endogenous selection into treatment. As a descriptive diagnostic, I examine selection into treatment by comparing pre-treatment characteristics of treated and untreated municipalities across cohorts (Tables C1-C3 in the Appendix). The tables indicate that municipalities with organizations were generally larger, more economically developed (e.g., higher railroad presence), more exposed to early organized labor, and better geographically connected, consistent with the view that organizational diffusion followed broader patterns of industrialization and urbanization. Moreover, Tables C4-C6 examine selection into adoption timing by comparing pre-treatment characteristics of early adopters to later groups. Across organizational types and cohorts, the results imply that treatment timing is correlated with observable characteristics that could also affect municipalities' literacy trajectories. Importantly, Tables C4-C6 provide no systematic evidence that adopters were more educationally advanced prior to treatment, and they even tend to exhibit lower pre-treatment literacy and school enrollment levels.

These differences in both treatment status and timing motivate the inclusion of a rich set of

covariates that augment the baseline specification without controls. First, I incorporate pre-treatment indicators that proxy for the political and socioeconomic conditions that, in line with modernization theory (Lipset 1959), are associated with literacy expansion. To account for pre-existing local political mobilization and social capital, I include a binary municipal-level indicator for the presence of a section affiliated with the International Workingmen's Association in 1873. This measure reflects early exposure to organized labor and sociopolitical networks, which may influence both cooperative formation and subsequent literacy trajectories. I further include several indicators measured at the judicial district level, an administrative unit that operates above the municipality.[16] Pre-existing schooling conditions are proxied by the number of male and female teachers in 1887, and the student-teacher ratio in 1887. To capture the impact of industrialization and land inequality on education (Cipolla 1969), I further include the industrial and agricultural population shares, measured in 1887.

Second, I incorporate time-varying municipal controls. Prior research argues that the railroad network stimulated demand for basic skills by facilitating market integration and economic development Beltrán Tapia et al (2019). I therefore control for the number of stations and railroad density across all census years, which capture changes in local economic integration that may influence both the emergence of cooperatives and literacy outcomes.[17] I also include logged population to account for changes in municipal size, urbanization, and economic activity that could jointly affect both processes.

Finally, in the mechanisms analysis, I introduce two additional demographic variables. The first is the marriage rate, which has been shown to provide insight into local economic conditions and exposure to economic distress (Southall and Gilbert 1996). I also include household size to account for the role of demographic processes related to mortality, fertility, and investments in child quality (for a review on this issue, see Cappelli et al 2025). These controls are available only for the 1900, 1910, 1920, and 1930 census.

Empirical Strategy

I focus on the effect of labor-based organizational formation in municipalities with more than 100 and fewer than 10,000 inhabitants following the institutional turning point represented by the 1887 Law of Associations. Municipalities with registered organizations by 1887 are excluded from the analysis, as are municipalities that registered their first organization after 1920 because of the disruption of the associational landscape following Primo de Rivera's *coup d'état* in 1923.[18] Following standard conventions in staggered adoption settings (Callaway and Sant'Anna 2021; Roth et al 2023), once a municipality records the creation of an organization, it is considered treated in all subsequent census periods.[19] Municipalities that have not yet formed an organization in a given census year serve as the comparison group.[20]

This approach relies on the assumption that exposed and unexposed municipalities would have followed parallel literacy trends in the absence of organizations (i.e., the parallel trends assumption). I assess this assumption in three ways. First, Figures D1 and D2 compare mean pre-treatment literacy trends across cohorts both before and after adjusting for baseline covariates. Second, Figure F1 reports event-study estimates showing limited evidence of anticipatory dynamics. Third, Table D1) reports joint tests of pre-treatment coefficients following (Callaway and Sant'Anna 2021). Yet as emphasized by Roth (2022), these tests should be interpreted with caution, as they may have limited power to detect violations and can reject even economically small deviations in large sample. In line with Roth (2022), I therefore complement these diagnostics by comparing the magnitude of

[16] By 1887, Spain had approximately 470 judicial districts, with an average of 16 municipalities per district.

[17] Railroad data is extracted from Esteban-Oliver and Martí-Henneberg (2024).

[18] I perform the same analyses including this cohort as not-yet-treated and results are unchanged.

[19] Exit is possible, but it cannot be tracked with the available data.

[20] Results remain substantively unchanged when municipalities that never experienced the creation of an organization are employed as the comparison group.

pre-treatment trends (1860–1887) against post-treatment effects. Taken together,the evidence is most consistent with the parallel trends assumption in the case of cooperatives, whereas non-cooperative estimates should be interpreted more cautiously.

For expositional purposes, the baseline model takes the following form:

$$Literacy_{it} = \alpha_i + \lambda_t + \beta D_{it} + \mathbf{X}'_{it}\gamma + \varepsilon_{it},$$

where $Literacy_{it}$ represents the literacy rate of municipality i in period t and D_{it} is an indicator equal to one once municipality i records the presence of labor-based organizations: cooperatives, workers' organizations, and workers' organizations or cooperatives. α_i are municipality fixed effects capturing time-invariant differences across municipalities, λ_t denotes census-year fixed effects absorbing common shocks, and $\mathbf{X}_{it}$ is a vector of municipal characteristics that could influence both the creation of organizations and literacy.

Because municipalities formed associations at different points in time, I estimate the staggered difference-in-differences estimator proposed by Callaway and Sant'Anna (2021), allowing the impact of organizational entry to vary across municipalities and census years. The building block of this analysis is the group-time average treatment effect:

$$ATT(g,t) = \mathbb{E}\left[Y_t(1) - Y_t(0) \mid G_i = g\right],$$

with $G_i = g$ denoting municipalities in which an organization was first formed in census year g, and $Y_t(1)$ and $Y_t(0)$ representing potential literacy outcomes with and without organizations, respectively. I also examine how $ATT(g,t)$ evolves over post-treatment periods and aggregate cohort-specific effects into an overall post-treatment average. Under this framework, treatment effects can vary across cohorts and over time.

Results

Table 1 reports treatment effects of working-class organizational formation on municipal literacy rates using the dynamic aggregation, which averages effects across all census years since exposure. I estimate the impact of each organizational form without controls and with pre-treatment controls to evaluate the sensitivity of the estimates to observable pre-treatment characteristics. Although the establishment of labor organizations is generally associated with higher municipal literacy rates, the magnitude, robustness, and identifying credibility differ substantially across organizational types. This suggests that the educational impact of associational life depends on organizational form more than on organizational presence alone.

Table 1. Labor-oriented organizational formation effects on municipal literacy

	Cooperatives		Workers' organizations		Coops./workers' orgs.	
	(1)	(2)	(3)	(4)	(5)	(6)
Dynamic ATT	1.774***	1.206**	1.779***	0.803	2.212***	1.149***
	(0.450)	(0.478)	(0.658)	(0.671)	(0.384)	(0.406)
Pre-treatment controls		✓		✓		✓
Mean DV	29.84	29.84	29.84	29.84	29.84	29.84
N	44,362	44,350	44,362	44,350	44,362	44,350

Notes: Each column reports estimates from a separate model. The dependent variable is the municipal literacy rate. Dynamic ATT aggregates exposure-length effects across post-treatment periods. Specifications marked with a check include pre-treatment controls. Standard errors are clustered at the province level. *p < 0.10, **p < 0.05, ***p < 0.01.

Cooperatives emerge as the most consequential and robust educational agent. The dynamic aggregation indicates an average increase of 1.8 percentage points in literacy following the creation

of a cooperative without controls and 1.2 percentage points with pre-treatment indicators. Moreover, the impact is robust to alternative aggregations (Table F1 in the Appendix), indicating that the result is not driven by particular cohorts or exposure length.[21] In substantive terms, this corresponds to roughly 4-6% relative to the baseline literacy rate of 29.6 % in 1887. In the context of gradual literacy expansion during the 1860-1930 period (Beltrán Tapia et al 2019), this represents a non-trivial contribution. Conversely, workers' organizations yield smaller and less stable estimates that become statistically insignificant with pre-treatment controls, whereas pooling cooperatives with workers' organizations produces estimates closer to those for cooperatives, indicating that most of the combined effect appears to be driven by cooperatives.

Figure 4 presents the evolution of effects over time. For cooperatives and for cooperatives and workers' organizations jointly, the pre-treatment estimates are not statistically different from zero.[22] Post-treatment estimates are positive and statistically significant for cooperatives alone and for cooperatives and workers' organizations jointly. The temporal pattern is also consistent with the idea that the establishment of schools, libraries, and adult education initiatives generated gradual and sustained improvements rather than short-term effects. By contrast, workers' organizations exhibit comparatively small pre-treatment trends and negligible post-treatment effects.

These findings generally hold when using illiteracy rates and both literacy and illiteracy rates by sex (Figures F2-F4). To evaluate whether the results are driven by historically distinctive regions, Figure F5 implements a leave-one-out strategy in which each of the 50 provinces is sequentially excluded from the estimation sample. The estimates remain highly stable across specifications, confirming that the findings are not driven by any single region.

Because municipalities could eventually host multiple organizational forms, I implement two complementary restrictions to isolate exposure to each organizational type. For treated municipalities, observations are censored once a second organizational form appears, keeping only the clean window of exposure to each organizational type. For control municipalities, I exclude cases that ever hosted two or more distinct organizational types. The prevalence of such bundled exposure is relatively uncommon, as shown in Table B4, whereas Figure F9 in the Appendix shows that results remain substantively unchanged under these restrictions.

The credibility of these findings rests on the parallel trends assumption: absent organizational creation, treated and untreated municipalities would have followed similar literacy trajectories. Because organizational emergence was clearly non-random, assessing pre-treatment dynamics is especially important in this setting. I therefore implement several theoretically motivated restrictions. First, I restrict the sample to municipalities between 100 and 10,000 inhabitants as of 1887, thereby limiting variation in socioeconomic development, urbanization, and schooling infrastructure that could independently affect literacy trajectories. Second, I exclude municipalities with organizations already present by 1887, comparing earlier versus later organizational adopters rather than civic strongholds with distinct trajectories.[23]

[21] In Table F1, the first row displays the average of all group-time average treatment effects weighted by group size, whereas the second row presents the average of cohort-specific treatment effects (group ATT).

[22] These results are robust to alternative event-time normalizations, as shown in Figure F1.

[23] Moreover, all municipalities operated under a common national educational regime.

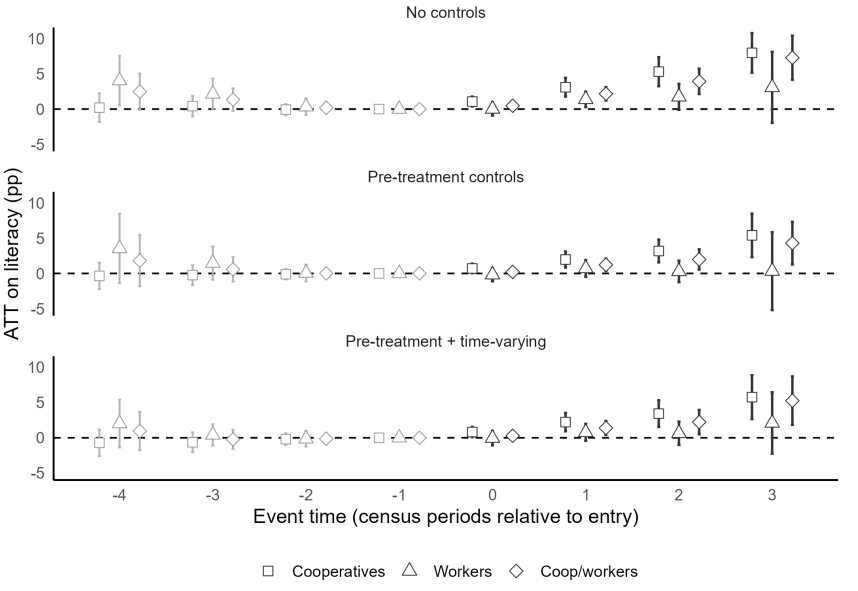


Figure 4. Effects of exposure to organizational formation on local literacy rates. *Note:* Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local literacy rates, expressed in percentage points (pp).

The empirical diagnostics are broadly supportive of the parallel trends assumption in the case of cooperatives. The graphical evidence (Figures D1b and D2b) shows no clear violations of pre-trends, and the joint tests fail to reject the null of parallel trends once baseline controls are included (see Table D1). Event-study estimates likewise display little evidence of anticipatory effects. By contrast, potential violations of this assumption appear for the remaining organizational forms, suggesting greater caution in interpreting these estimates.

Following Roth (2022)'s critique that conventional pre-trend tests may be uninformative, I implement an additional diagnostic that compares placebo pre-treatment trends (1860–1887) with post-treatment magnitudes. This approach assesses whether treated and untreated municipalities were evolving differently already before organizational formation (Table D2 in the Appendix). For cooperatives, the estimated pre-trend is substantively small relative to post-treatment effects. For the remaining organizational forms, the pre-trend is somewhat comparable or exceeds the post-treatment effects, partially reflecting pre-existing divergent trajectories.[24]

In Appendix E, I explicitly examine the stable unit treatment value assumption (SUTVA) for cooperatives. Instead of imposing no-interference, as is standard in most DiD applications (Roth et al 2023, p.2240), I assess whether cooperatives affected literacy outcomes in neighboring municipalities. Such spillovers are theoretically plausible because individuals residing in untreated municipalities could have participated in cooperatives located nearby. At the same time, mobility during this period remained geographically constrained by transportation limitations, seasonal agricultural labor, and the highly radial structure of the Spanish transport network (Herranz-Loncán 2007; López-Ortiz, Melgarejo et al 2016), suggesting that any interference should operate over relatively short distances.

To examine this possibility, I follow the framework proposed by Butts (2021), who extends difference-in-differences designs to incorporate spillover exposure among untreated units. Specifically, I construct indicators for municipalities located within 10 kilometers and 20 kilometers of

[24] I employ this method over the sensitivity procedure proposed by Rambachan and Roth (2023) because the data contain only two widely spaced pre-treatment periods (1860 and 1887), limiting the informativeness of these bounding approaches.

a treated municipality and estimate event-study models separately for treated municipalities and those exposed to spillovers. Spillover coefficients are positive and statistically significant under both province-clustered (Figure E1) and Conley standard errors (Figure E2), although their magnitude is substantively smaller than direct treatment effects.

In response to these findings, I evaluate whether these spillovers bias the estimated treatment effects. In line with recent applications in political science (De Kadt et al 2024), I implement a spatial "donut" design in which municipalities that fall within 20 kilometers of treated municipalities are excluded from the analyses. The results, displayed in Figure E3, show that treatment effects of cooperatives remain stable under this restriction, and results are similar under a 30-kilometer "donut". These analyses indicate that while geographically localized spillovers are present, they do not materially alter the estimated direct effects of cooperative formation on literacy.

Although concerns about endogenous organizational formation cannot be fully ruled out, the evidence consistently identifies cooperatives as the most credible educational actor among the working-class associational forms considered. Other labor organizations, such as trade unions and political societies, do not exhibit effects that are both statistically detectable and consistent with parallel pre-treatment dynamics. Taken as a whole, these findings indicate that not all forms of labor-oriented organization were consequential for literacy growth. Under conditions of limited state involvement in education, organizations that were socioeconomically embedded in the territory and explicitly committed to members' intellectual improvement (i.e., cooperatives) were more likely to generate gains in human capital than organizations primarily focused on labor disputes, political mobilization, or socioeconomic coordination.

Alternative Forms of Mobilization: Educational Provision by the Catholic Church

During the last third of the 19th century, the Catholic Church became actively involved in the social question to counter the expansion of the labor movement and to preserve the Catholic faith. The creation of a network of associations devoted to social assistance figured prominently among its core principles, relying on benevolence and charity to alleviate workers' miserable conditions (Misner 2015, p.9;Tiana 1992, p.303). Sunday and evening schools designed for the instruction of workers outside regular working hours and frequent lectures constituted the most common educational activities advanced by Catholic organizations (Andrés-Gallego 1984; Hernández 2017; Molinero 2010). Within this framework, basic instruction was explicitly subordinated to religious indoctrination, subject to strict discipline, and oriented towards social order and harmony (Andrés-Gallego 1984; Fullana and Montero 2003).

This suggests that, beyond the labor movement's educational initiatives, other actors operating simultaneously within the same local contexts could also have affected literacy expansion. To evaluate this possibility, I replicate the baseline empirical analysis using alternative organizational types to examine whether the observed effects are specific to working-class mobilization or instead reflect broader associational presence. More precisely, I analyze employers' organizations and all associations, both including and excluding cooperatives. Although these associational types differed sharply in ideology, purpose, and scope, their presence and temporal overlap merit systematic empirical examination.

For methodological and historical reasons, I pool Catholic and mixed associations with employers' organizations. Methodologically, the number of mixed associations is limited, which would result in small cohort sizes with reduced statistical power (see Table B1). Substantively, the historical record suggests that the boundaries between Catholic organizations and employers' associations were often blurred, with substantial overlap in leadership, membership, and objectives (Aguilar et al 2025; Andrés-Gallego 1984; Angelis Dimakis 2021). Despite the alliance between employers and Catholicism became politically explicit during the Second Republic (1931-1936), such collaboration had already been developing since the late nineteenth century, as many cooperatives and unions

promoted by the Catholic Church during this period "worked more as employers' associations than as labor unions" (Aguilar et al 2025, p.8). The Spanish case is therefore particularly well suited to analyze whether literacy gains were associated with broader cooperative expansion or instead concentrated among organizations linked to the working-class associational landscape.

Results are presented in Table 2 and Figure 5. In contrast to labor organizations, the impact of associations within the orbit of the Catholic Church and the political right on literacy is small and not robust across specifications. While the inclusion of pre-treatment controls yields statistical significance, this pattern is not supported by alternative aggregations of the treatment effects (Table F2), where estimates are not statistically significant. This lack of statistical significance also extends to alternative literacy outcomes (Figures F6-F8). Importantly, the formal tests reported in Table D1 also point to violations of parallel trends, limiting the credibility of these estimates.

Alternatively, measures of overall organizational presence are associated with positive and statistically significant estimates. Nonetheless, these effects appear to be driven by the presence of cooperatives, as they are substantially attenuated when these are excluded (column 5-6 in Table 2 and Figure 5) and are not robust to alternative aggregations of treatment effects (Table F2). Consistent with this, Figure 5 shows that organizational presence without cooperatives yields attenuated and insignificant effects, a pattern that also holds for literacy and illiteracy rates by gender (Figures F6-F8). Furthermore, the parallel trends assumption is not supported for this organizational measure, as Tables D1 and D2 show.

Table 2. Other organizational formation effects on municipal literacy

	Employers' organizations		Any organization		Any org.(excluding coops.)	
	(1)	(2)	(3)	(4)	(5)	(6)
Dynamic ATT	0.677	1.044**	1.817***	1.021***	0.950**	0.957**
	(0.492)	(0.497)	(0.315)	(0.376)	(0.400)	(0.443)
Pre-treatment controls		✓		✓		✓
Mean DV	29.84	29.84	29.84	29.84	29.84	29.84
N	44,362	44,350	44,362	44,350	44,362	44,350

Notes: Each column reports estimates from a separate model. The dependent variable is the municipal literacy rate. Dynamic ATT aggregates exposure-length effects across post-treatment periods. Standard errors are clustered at the province level. *p < 0.10, **p < 0.05, ***p < 0.01.

Although both Social Catholicism and organized labor competed in the provision of popular education, their differences in objectives, organizational incentives, and geographic reach likely affected their contribution to literacy. Catholic initiatives were often short-lived and geographically concentrated in regions where the labor movement was already well established (Molinero 2010; Rodrigo 1982). Moreover, their educational mission was subject to religious indoctrination and reflected considerable discretion exercised by individual bishoprics (Andrés-Gallego 1984, p.203). By contrast, organized labor created self-contained and durable social environments in which individuals developed a shared class identity and coordinated around common socioeconomic interests (Bartolini 2000; Lipset and Rokkan 1967). Its organizational infrastructure became embedded in the everyday economic and social life of local communities, implying broader membership bases and greater organizational continuity than Social Catholicism. Reassuringly, the concentration of literacy gains among cooperatives, rather than organizational presence more broadly, is difficult to reconcile with explanations based solely on generalized modernization or civic development.

The empirical evidence is consistent with the interpretation that organized labor was better positioned than Social Catholicism to contribute to the rise of literacy. In particular, cooperatives were especially conducive to the diffusion of basic literacy due to their embeddedness in local socioeconomic life and their formal commitment to members' "intellectual improvement" (Jackson

2016, p.31). Ultimately, labor mobilization alone was not sufficient, but its capacity to increase literacy depended on the organizational form and the incentive structures that sustained it.

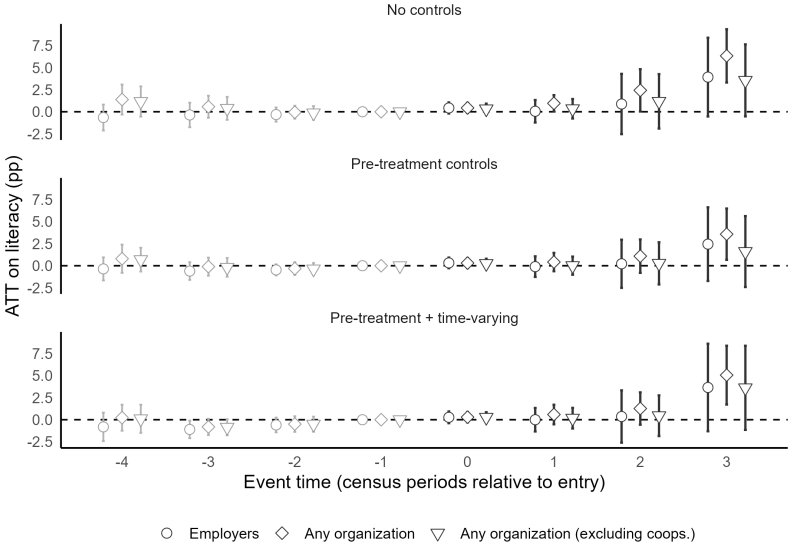


Figure 5. Effects of exposure to organizational formation on local literacy rates. *Note:* Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local literacy rates, expressed in percentage points (pp).

Mechanisms: Educational and Economic channels

In the preceding sections, I show that cooperative formation is consistently associated with literacy expansion, whereas the remaining organizational forms do not exhibit an equivalent impact. In this section, I provide suggestive evidence on the mechanisms through which cooperatives might have generated increases in municipal literacy, focusing on the role of both schooling infrastructure and households' decisions regarding education. While I cannot claim definitive causal mediation, this section explores the conditions and processes through which cooperatives exerted their greatest influence on local literacy.

The supply-side channel concerns the educational mission of cooperatives in contexts of educational underprovision. This instructional goal, explicitly stated in the early Rochdale model that later served as a global example (Woodin 2011), was implemented through the provision of schools, libraries, reading rooms, and adult courses, as discussed in previous sections. If cooperatives operated as providers of basic instruction, their impact should be stronger in municipalities with weaker formal schooling provision. In such contexts, cooperatives may have effectively supplemented or substituted for formal educational supply. In a biography of the Catalan cooperativist Pau Robert, Santesmases (2022) notes that cooperativists explicitly recognized that such educational endeavors would not have been necessary had the prevailing education infrastructure been sufficient.

Figure 6 evaluates this possibility through event-study plots that estimate heterogeneous effects by local schooling conditions, proxied by the presence of private school enrollment (i.e., students aged 6-12 and over 12).[25] This indicator captures both the presence of alternative schooling supply and demand for instruction. Cooperative formation is associated with increases in literacy in both contexts, although the magnitude of the impact is substantially larger in municipalities without private enrollment. Figure G1 replicates this exercise using the presence of publicly owned school

[25]Data come from the 1908 schooling statistics, kindly shared by Alfonso Díez-Minguela and Julio Martínez-Galarraga.

buildings (e.g., by the local council, the province, or the state) in 1908 as an alternative proxy, with results pointing in the same direction. The pattern is thus consistent with the idea that cooperatives partly compensated for insufficient educational infrastructure. In parallel, the presence of positive effects in municipalities with private provision suggests that cooperatives expanded instruction beyond formal educational institutions, potentially through adult education and informal learning spaces.

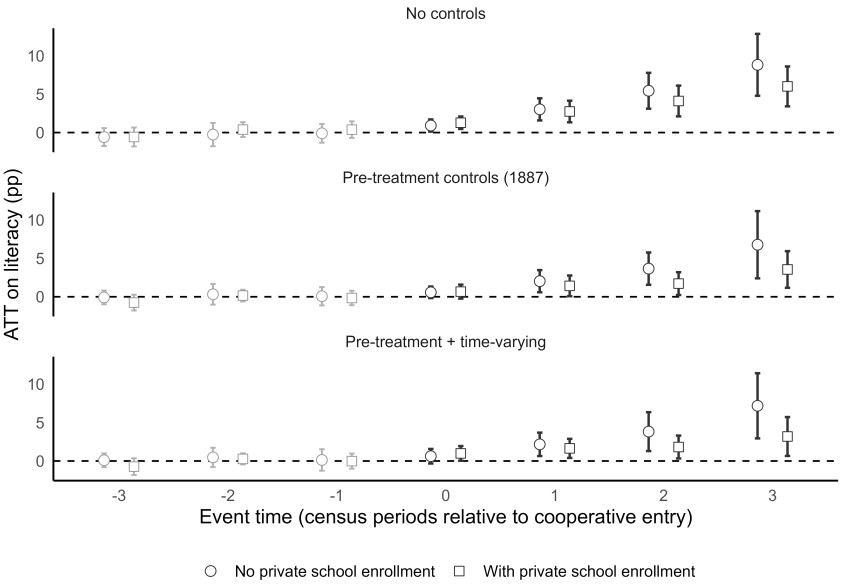


Figure 6. Heterogeneous effects of cooperative formation depending on the presence of student enrollment in private schools.

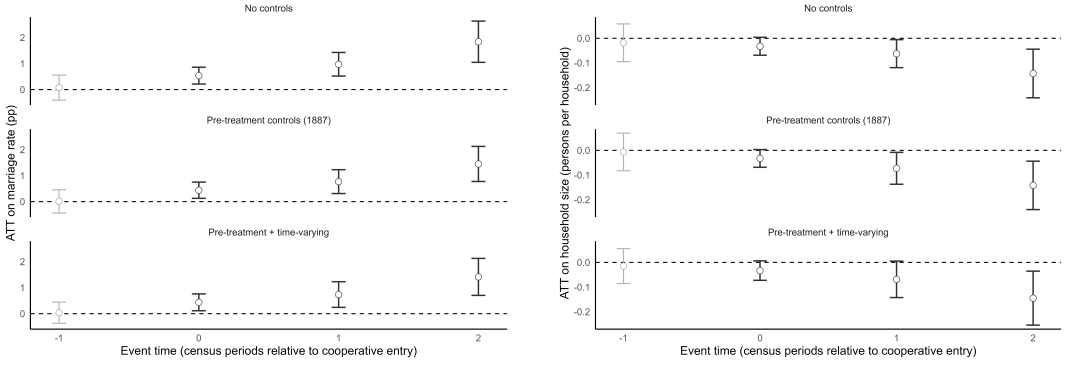
Conversely, the demand-side channel operates through the socioeconomic impact of cooperatives. Existing research suggests that inequality and poverty reduce families' demand for basic instruction by limiting their ability to finance education and by increasing the opportunity cost of schooling (Beltrán Tapia and Martinez-Galarraga 2018; Cinnirella and Hornung 2016; Galor et al 2009). If cooperatives enhanced local living standards and economic stability (see, for instance, Medina-Albaladejo and Pujol-Andreu 2022), they could have relaxed constraints on households' educational investment. This mechanism seems particularly relevant in rural settings, where families often relied on child labor and on large households as a form of insurance, and school attendance fluctuated greatly with harvest cycles (Beltrán Tapia 2013; Sarasúa 2002). Consistent with the child quantity-quality tradeoff (Becker and Lewis 1973), households might have increased investment in human capital in response to improved economic conditions.

I provide suggestive evidence in line with this demand-side mechanism by examining demographic outcomes. Here I build on a large literature that shows that demographic processes such as marriage patterns and household composition respond to current economic conditions and future prospects (Becker and Lewis 1973; Hajnal 1965; Southall and Gilbert 1996). In particular, Southall and Gilbert (1996) show that marriage rates increase with economic stability as uncertainty declines. I consequently test whether cooperative formation is associated with changes in demographic trends, using marriage rates and household size as outcomes in Figure 7. The results show that cooperative formation is associated with higher marriage rates and smaller household size, in line with the interpretation that cooperatives may have shaped households' incentives to invest in human capital through enhanced economic stability.[26] Importantly, comparable demographic effects do

[26]The temporal window here is restricted due to data availability.

not emerge for workers' or employers' organizations, thereby reducing the possibility that such demographic shifts reflect broader modernization processes or secular trends common to treated municipalities (see Figures G2-G4 in the Appendix).

Overall, the results are consistent with the interpretation that cooperatives shaped literacy expansion through a dual mechanism. On the one hand, they expanded the supply of instruction in contexts with limited formal educational institutions. On the other hand, as locally embedded and multi-functional entities, they reshaped local socioeconomic conditions in ways that plausibly lowered the opportunity cost of schooling for both adults and children.



(a) DV = Marriage rates

(b) DV = Household size

Figure 7. Formation of cooperatives on demographic outcomes

Conclusions

Before the consolidation of public educational systems, the instruction of the masses depended heavily on local actors. Existing quantitative research on literacy expansion has emphasized the role of families, municipal authorities, and parish churches, as well as the impact of broader socioeconomic, institutional, and cultural conditions. Yet, the contribution of local collective actors such as organized labor has remained largely overlooked. This article addresses this gap by examining whether different forms of organization within and beyond the labor movement shaped literacy expansion between 1860 and 1930, a period of weak state educational involvement and substantial geographical variation in literacy levels and associational life.

The findings indicate that not all organizational forms were equally important for literacy growth. In particular, the formation of cooperatives, as a key form of labor mobilization, is systematically associated with subsequent literacy gains, whereas other organizational forms do not exhibit a comparable impact. These patterns suggest that, under conditions of limited state capacity and competition in the provision of popular education, certain collective actors can foster local development by contributing to human capital formation.

The evidence is consistent with both supply-side and demand-side mechanisms: cooperatives are associated with larger literacy gains in places with weaker schooling infrastructure, and with changes in local socioeconomic conditions that could have relaxed constraints on families' educational decisions. In contrast to other forms of working-class mobilization, cooperatives institutionalized members' "intellectual improvement" through the creation of dedicated funds for education. The broader implications of these findings may extend beyond the Spanish case, particularly to Southern European contexts characterized by weak state capacity, locally rooted labor movements, and delayed educational expansion.

At the same time, the analysis faces several limitations. First, the source does not allow tracking organizational exit over time, potentially introducing measurement error in organizational exposure.

Second, the classification of organizations was not unambiguous, as disagreements over what defined a worker association and strategic misclassifications, such as employer-influenced workers' organizations, were not uncommon (Luque 2012; Rubio 1988). Although the analysis largely follows the original categorization, with some minor adjustments, this classification ambiguity could attenuate differences across organizational forms and obscure the channels through which they influenced literacy trajectories.

In sum, the spread of literacy in the late 19th and early 20th centuries cannot be understood solely as a byproduct of socioeconomic modernization or state-building. Under conditions of weak formal educational supply, literacy expanded in a context of competition among non-state actors, in which cooperatives emerged as locally embedded institutions that facilitated human capital formation. The consequences of local collective action thus depend not only on its presence or mobilization capacity, but also on the organizational forms and incentives that sustain it.

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Appendix

This appendix provides supplementary historical background, descriptive statistics, identification diagnostics, and robustness checks supporting the results presented in the text, mirroring the article's structure.

The Instituto de Reformas Sociales and Dataset Construction

In this section I describe the historical source employed to construct the panel of organizations.

By the end of the nineteenth and beginning of the twentieth centuries, initial steps were taken towards creating a legal body to draft labor legislation and regulate the capital-labor conflict in Spain. First came the Social Reforms Commission, established in 1883 and operating until 1903, when the Social Reforms Institute was founded by Royal Decree. Its aim was to establish a neutral collegiate body working both as a meeting point and mediator for social conflicts between employers and workers through legislative proposals to various governments. It also undertook the inspection of workplaces and labor relations, where the Social Reform Boards played a crucial role (Marín 2014; Rubio 1988).

These Boards were established in 1900 to ensure compliance with emerging social legislation (i.e., concerning child and women work) and gained significant influence and participation from workers after a 1904 royal order clarified their constitution and norms (Rubio 1988). They were constituted in all municipalities with industry or any exploitation involving both employers and workers, and where they were requested by either party (Marín 2014). The boards comprised employers and worker representatives (usually six each with respective alternates), the local mayor as president, the parish priest, and the municipal doctor. Typically, it was the workers who requested their formation and to a lesser extent, employers and mayors sometimes promoted their creation. Finally, the Institute could also urge their establishment in industrial areas lacking them.

Eligibility for board membership required registration in any worker or employer society within the board's territorial scope. In areas without these organizations, employers and workers were convened by local authorities to elect the representative members. Elections were often manipulated or fraudulent, leading the disadvantaged party (frequently the workers) to appeal to the respective provincial governments. Common complaints included failure to notify parties in advance, exclusion of particular organizations, or inclusion of inappropriate societies, such as an employer-influenced worker organization (Rubio 1988). Disagreements over what defined a worker association were frequent, and the 'workerist' thesis eventually prevailed, hence leaving aside organizations (i.e, catholic circles and mixed societies) whose working-class character was questioned. Through their participation in these boards, both groups sought to consolidate their class and syndical hegemony within its area of operation. Elections engaged thousands of individuals, involving assemblies, candidate proposals, and negotiation between associations to secure representation (Marín 2014). Overall, they were effective to the extent that the most relevant employer and workers organizations were present, signaling their strong grip on the world of labor (Marín 2014).

Another crucial task carried out by the Institute and the local boards was the organization and publication of labor and other social statistics: strikes, cost of living, labor market reports, industrial courts' reports, and censuses of organizations. From 1904 to 1920, the Associations section published four statistics on the local presence of organizations: the 1904 Statistics on Saving, Cooperation, and Prevision Institutions, the 1904 workers' association Statistics, the 1916 Census of Professional Associations, and the 1920 Social Electoral Census. Except the first one, the remaining three have been digitized for the first time.

Comunidades de regantes.

Albacete.

1. Sindicato de riegos del Canal de María Cristina. 22 junio 1876. — Albacete.
2. Comunidad de regantes del Canal de Isabel II. — Albacete.
3. Sindicato de aguas del pantano de Almansa. — Almansa.
4. Comunidad de regantes. — Lezuza.

Alicante.

5. Sindicato de riegos de la Huerta. 24 enero 1865. — Alicante.
6. Riegos de Alcolecha y Beniafe. 18 noviembre 1861. — Alcolecha.
7. Régimen de las aguas del río Polop. Diciembre 1869. — Alcoy.
8. Fuente de Barchell. 5 mayo 1876. — Alcoy.
9. Régimen de riego de Alfafara. 1.° octubre 1865. — Alfafara.
10. Aguas del Azud de Alfeitami. 13 enero 1794. — Almoradi.
11. Riego nuevo de Altea. 13 octubre 1882 — Altea.
12. Huerta mayor y Tanjui. 30 diciembre 1884. — Aspe.
13. Riego mayor. 16 enero 1871. — Bañeras.
14. Riego mayor. 16 diciembre 1859. — Benejama.
15. Comunidad de regantes de Benitrome Illetes. 3 septiembre 1838. — Beniarbeig.
16. Riego mayor de Alfar. 16 septiembre 1817. — Benidorm.
17. Riego mayor. 9 julio 1862. — Biar.
18. Riegos denominados Sorocha, Pueblo, Ferrers y Huerta Abajo. 16 junio 1862. — Bolulla.
19. Comunidad de regantes. 27 mayo 1899. — Catral.
20. Régimen de riego de la Acequia. 29 mayo 1865. — Cox.
21. Riego común. 23 junio 1857. — Crevillente.
22. Riego de Dolores y San Fulgencio. 28 julio 1875. — Dolores.
23. Sociedad de la Sonda Artesiana. 8 febrero 1840. — Elche.
24. Riegos de la Huerta. 1.° abril 1890. — Elda.
25. Juzgado de aguas. 11 julio 1623. — Guardamar.
26. Huertas mayores de Santamaría. 18 junio 1863. — Ibi.
27. Comunidad de regantes. 6 julio 1901. — Jalón.
28. Aguas de los riegos. 20 octubre 1866. — Lorcha.
29. Acequia 16 mayo 1895. — Marchena.
30. Rambla del Vinalopó. — Monforte.
31. Riegos. 4 octubre 1826. — Novelda.
32. Huerta. 31 agosto 1833. — Orihuela.
33. Juzgado de aguas de Orihuela y Callosa de Segura. 4 abril 1902. — Orihuela.

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Figure A1. Example of the 1916 census of professional associations

Descriptive Statistics and Spatial Distribution of Organizations

This section presents descriptive statistics for the main variables used throughout the article and documents the spatial distribution and temporal diffusion of the organizational forms analyzed.

Table B1. Classification of organizations

Type	n
Employers' associations	3896
Workers' associations	2600
Savings, cooperative, and mutual aid institutions	2285
Mixed associations	283
Unclassifiable	95
Total	9159

Notes: The table reflects the original classification in the source. See text for details on the recoding.

Table B2. Classification of organizations by type

	n	%
Panel A: Workers' associations		
Savings banks	6	0.2
Cooperatives	225	8.7
Federations of associations	30	1.2
Trade unions	1616	62.2
Mutual aid societies	405	15.6
Educational and recreational societies	159	6.1
Political societies	159	6.1
	2600	100.0
Panel B: Employers' associations		
Fishermen's guild councils	15	0.4
Agricultural chambers	33	0.8
Chambers of commerce, industry, and navigation (and urban property)	14	0.4
Commercial and industrial circles	42	1.1
Farmers' communities	23	0.6
Irrigation communities	160	4.1
Other agricultural and livestock associations	1178	30.2
Agricultural syndicates and rural credit unions	2111	54.2
Economic societies of friends of the country	5	0.1
Industrial guild associations and related bodies	315	8.1
	3896	100.0
Panel C: Savings, cooperative, and mutual aid institutions		
Savings institutions	246	10.8
Cooperative institutions	376	16.5
Provident institutions	1663	72.8
	2285	100.0
Panel D: Mixed-class associations		
Catholic circles and patronage associations	265	93.6
Associations of employers and workers	18	6.4
	283	100.0
Total	**9064**	

Notes: Original classification of the 1916 Census of Professional Associations. In the empirical analysis, the 225 "Cooperatives" within workers' organizations are reassigned to the category of savings, cooperative, and mutual aid institutions. 95 "Unclassifiable" associations are excluded from the table and from the total count.

Table B3. Summary statistics

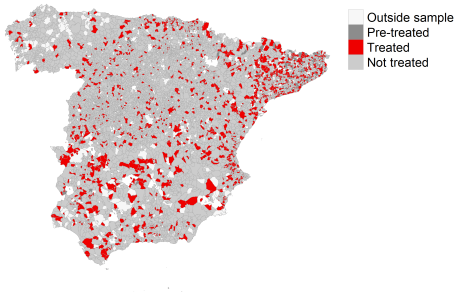
Variable	Mean	SD	Min	Max	N
Panel A: Outcomes (municipality-year, 1860–1930)					
Literacy rate	39.85	19.30	0.76	92.74	44,082
Male literacy rate	49.41	19.30	1.49	97.33	44,082
Female literacy rate	30.36	21.24	0.00	98.41	44,082
Panel B: Associational Presence (municipality-year, 1860–1920)					
Workers' organizations	0.04	0.19	0.00	1.00	36735
Cooperatives	0.04	0.20	0.00	1.00	36735
Coops/workers' organizations	0.07	0.26	0.00	1.00	36,735
Employers' organizations	0.08	0.27	0.00	1.00	36,735
All organizations	0.13	0.33	0.00	1.00	36,735
Panel C: Demographics					
Population (1860–1930)	1,666	1,961	66	31,241	44,082
Household size (1900–1930)	4.01	0.53	1.85	17.45	29,388
Marriage rate (1900–1930)	38.80	4.49	15.53	60.99	29,388
Widowhood rate (1900–1930)	6.64	1.52	0.81	33.18	29,388
Panel D: Infrastructure (municipality-year, 1860–1930)					
Railroad density	0.03	0.10	0.00	1.42	44,082
Train stations	0.20	0.58	0	10	43,578
Panel D: Baseline political mobilization (1873)					
International Workingmen's Association's local section	0.01	0.11	0.00	1.00	44082
Panel E: Baseline District-Level Controls (1887)					
Number of male teachers	47	42	6	971	44,070
Number of female teachers	28	28	1	743	44,070
Student-teacher ratio	137.36	70.55	27.16	749.45	44,070
Industrial population share (%)	6.97	5.13	0.52	40.61	44,070
Agricultural population share (%)	73.29	12.97	8.37	93.03	44,070
Panel F: School Infrastructure (1908)					
Presence of public school buildings	0.83	0.37	0.00	1.00	44,082
Presence of private school enrollment	0.12	0.32	0.00	1.00	44,082

Notes: The estimation sample includes municipalities with population between 100 and 10,000 inhabitants in 1887. Baseline controls are measured at the district level in 1887 and matched to municipalities. Differences in N reflect variation in temporal coverage and data availability.

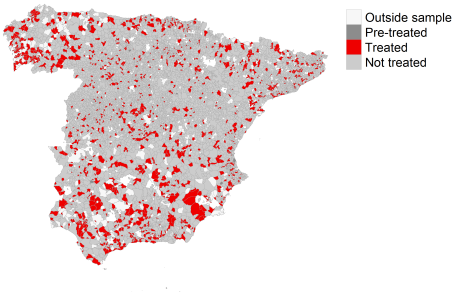
Table B4. Prevalence of simultaneous multi-type organizational formation

Year	Municipality-years	Multi-type municipality-years	Share multi-type
1860	7,358	0	0.0%
1887	7,358	0	0.0%
1900	7,358	41	0.6%
1910	7,358	427	5.8%
1920	7,358	537	7.3%
1930	7,358	0	0.0%
Overall (municipality-level)	7,358	842	11.5%

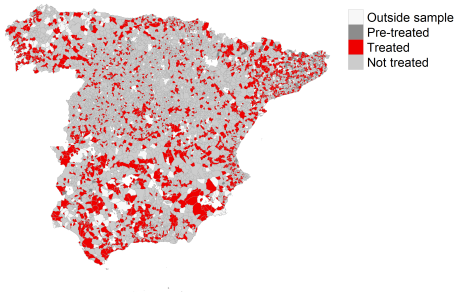
Notes: Bundling is defined as having at least two different organizational forms (e.g. workers' organizations, employers' organizations, and cooperatives) in the same municipality-year. The last row reports municipality-level prevalence: a municipality is classified as ever bundled if bundling occurs in any census year.municipalities.



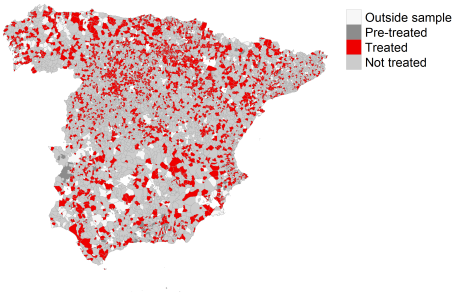
(a) Cooperatives



(b) Workers' organizations

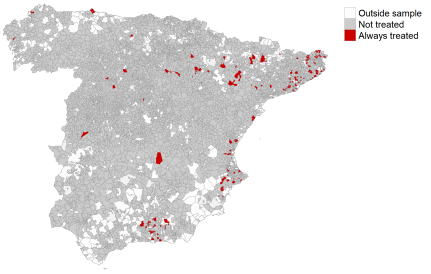


(c) Cooperatives/ workers' organizations

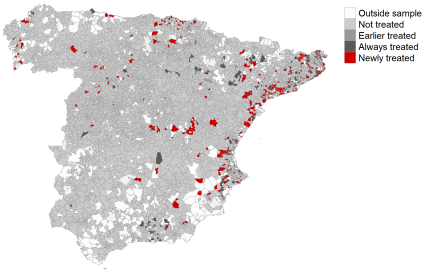


(d) Employers' organizations

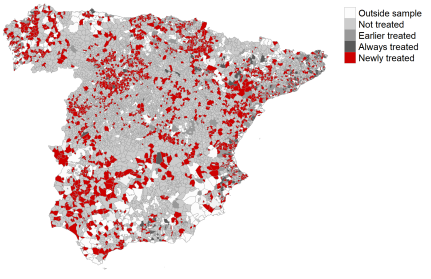
Figure B1. Exposure to different organizational forms across Spanish municipalities (1887-1920)



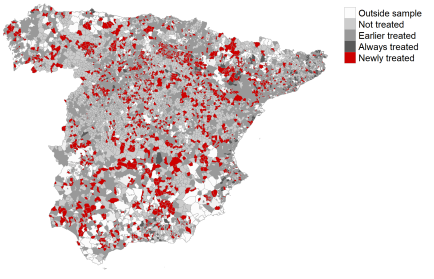
(a) 1887



(b) 1900

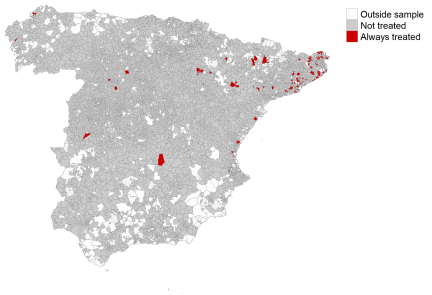


(c) 1910

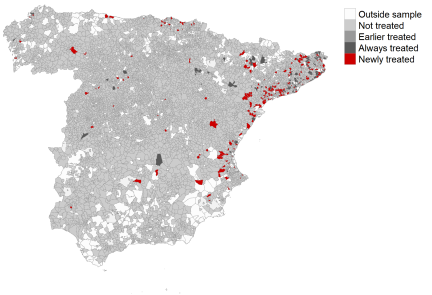


(d) 1920

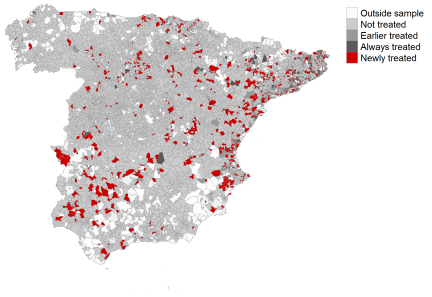
Figure B2. Treatment timing for all organizational types



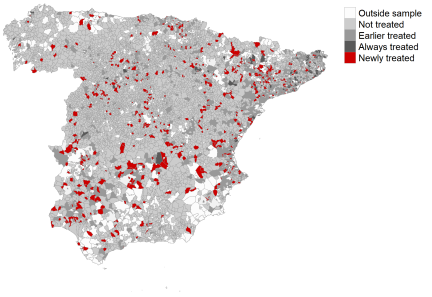
(a) 1887



(b) 1900

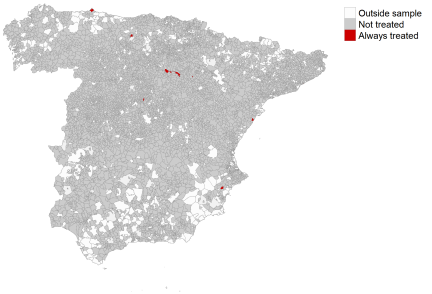


(c) 1910

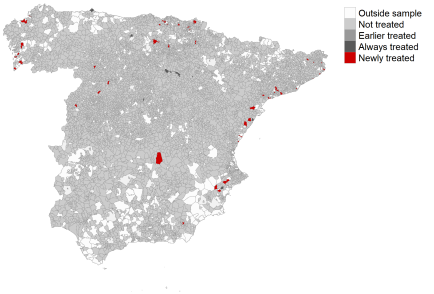


(d) 1920

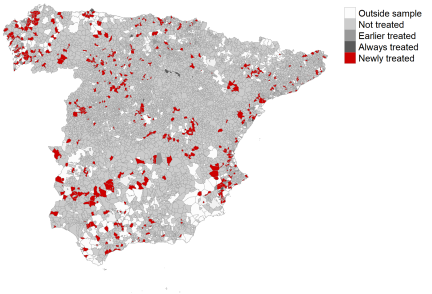
Figure B3. Treatment timing for cooperatives



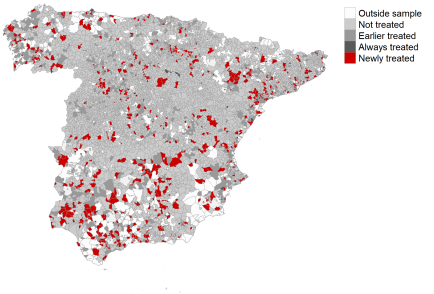
(a) 1887



(b) 1900

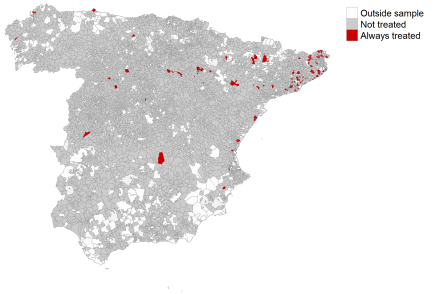


(c) 1910

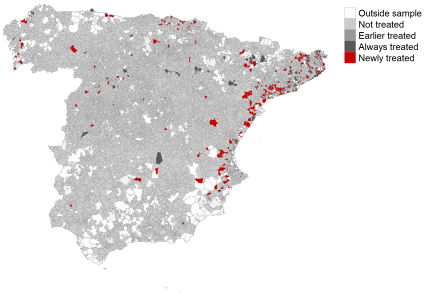


(d) 1920

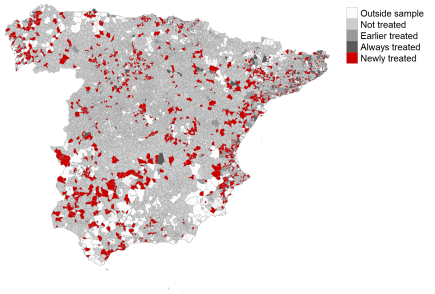
Figure B4. Treatment timing for workers' organizations



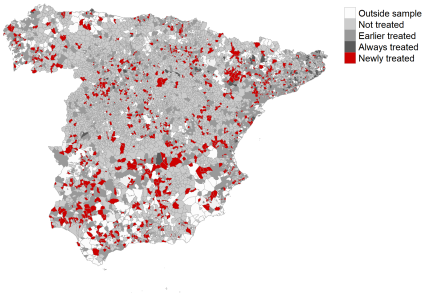
(a) 1887



(b) 1900

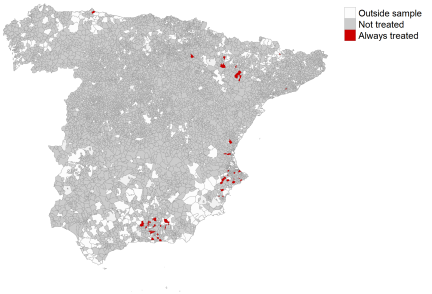


(c) 1910

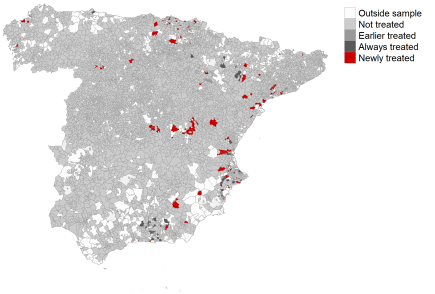


(d) 1920

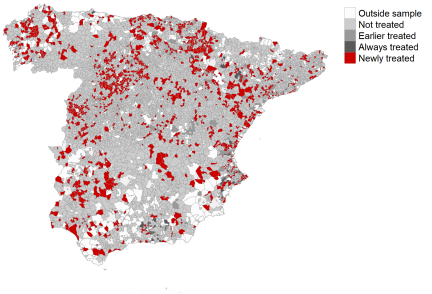
Figure B5. Treatment timing for cooperatives and/or workers' organizations



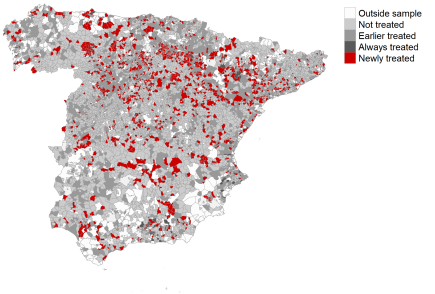
(a) 1887



(b) 1900



(c) 1910



(d) 1920

Figure B6. Treatment timing for employers' organizations

Selection into Treatment and Pre-Treatment Balance

This section examines whether treated and not-yet-treated municipalities differed systematically.

Table C1. Correlates of organizational adoption: 1900 cohort

Covariate	Labor org 1900	Cooperative 1900	Coop/Labor org 1900	Employer org 1900	Any org 1900
Municipalities with data	7401	7401	7401	7401	7401
Treated municipalities (=1)	55	216	258	97	321
Literacy rate 1887	-0.00	-0.00**	-0.00**	-0.00**	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Railroad density 1887	0.04**	0.15**	0.18***	0.07**	0.21***
	(0.01)	(0.06)	(0.06)	(0.03)	(0.07)
Train stations 1887	0.01	0.03**	0.04***	0.02**	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Population 1887	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to coast (km)	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to provincial capital (km)	-0.00**	-0.00**	-0.00***	-0.00*	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mean elevation (hundreds of meters)	-0.00***	-0.01***	-0.01***	-0.00***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ruggedness (hundreds of meters)	0.00	-0.00	-0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Land inequality 1860	0.00*	0.00**	0.00**	0.00*	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Schooling enrolment, boys 1860	-0.00**	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Schooling enrolment, girls 1860	-0.00	-0.00**	-0.00**	-0.00	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
IWA local section 1873	0.03**	0.15***	0.17***	0.10*	0.19***
	(0.01)	(0.05)	(0.05)	(0.06)	(0.05)
Agricultural pop. share 1887	-0.00**	-0.00***	-0.00***	-0.00**	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Industrial pop. share 1887	0.00***	0.01***	0.01***	0.00**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of male teachers 1887	-0.00	0.00	0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of female teachers 1887	0.00**	0.00***	0.00***	0.00	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Student-teacher ratio 1887	0.00	0.00	0.00	0.00*	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: Cells report coefficients from bivariate linear probability models of each treatment indicator (organizational creation during the 1887–1900 period) on pre-treatment correlates. Parentheses report heteroskedasticity-robust standard errors clustered at the province level. Significance stars: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C2. Correlates of organizational adoption: 1910 cohort

Covariate	Labor org 1910	Cooperative 1910	Coop/Labor org 1910	Employer org 1910	Any org 1910
Municipalities with data	7401	7401	7401	7401	7401
Treated municipalities (=1)	564	595	1050	1256	1930
Literacy rate 1900	-0.00*	-0.00**	-0.00***	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Railroad density 1900	0.16***	0.27***	0.33***	0.19***	0.34***
	(0.04)	(0.06)	(0.06)	(0.06)	(0.07)
Train stations 1900	0.07***	0.09***	0.12***	0.10***	0.14***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Population 1900	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to coast (km)	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to provincial capital (km)	-0.00**	-0.00**	-0.00**	-0.00**	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mean elevation (hundreds of meters)	-0.01***	-0.02***	-0.02***	-0.02***	-0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ruggedness (hundreds of meters)	-0.00	-0.00	-0.00	-0.02**	-0.02*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Number of schools circa 1900	0.03***	0.02**	0.04***	0.04***	0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Marriage rate 1900	-0.01**	-0.00	-0.00*	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Widowhood rate 1900	0.00	-0.01	-0.00	0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)
Unmarried rate 1900	0.01***	0.00	0.00*	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Household size 1900	0.03*	0.03	0.04*	0.04**	0.07***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Land inequality 1860	0.00***	0.00***	0.00***	0.00**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Schooling enrolment, boys 1860	-0.00***	-0.00***	-0.00***	-0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Schooling enrolment, girls 1860	-0.00**	-0.00**	-0.00***	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
IWA local section 1873	0.16***	0.23***	0.32***	0.24***	0.35***
	(0.04)	(0.05)	(0.06)	(0.07)	(0.06)
Agricultural pop. share 1887	-0.00*	-0.00***	-0.00***	-0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Industrial pop. share 1887	0.00**	0.01***	0.01***	0.00	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of male teachers 1887	-0.00**	-0.00	-0.00**	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of female teachers 1887	0.00	0.00***	0.00**	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Student-teacher ratio 1887	0.00***	0.00	0.00***	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: Cells report coefficients from bivariate linear probability models of each treatment indicator (organizational creation during the 1900–1910 period) on pre-treatment correlates. Parentheses report heteroskedasticity-robust standard errors clustered at the province level. Significance stars: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C3. Correlates of organizational adoption: 1920 cohort

Covariate	Labor org 1920	Cooperative 1920	Coop/Labor org 1920	Employer org 1920	Any org 1920
Municipalities with data	7401	7401	7401	7401	7401
Treated municipalities (=1)	844	654	1328	1496	2404
Literacy rate 1910	-0.00***	-0.00	-0.00***	0.00*	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Railroad density 1910	0.18***	0.20***	0.23***	0.16**	0.24***
	(0.05)	(0.05)	(0.05)	(0.06)	(0.07)
Train stations 1910	0.09***	0.08***	0.12***	0.09***	0.13***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Population 1910	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to coast (km)	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Distance to provincial capital (km)	-0.00***	-0.00**	-0.00***	-0.00**	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Mean elevation (hundreds of meters)	-0.02***	-0.01***	-0.03***	-0.01***	-0.03***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ruggedness (hundreds of meters)	0.02	-0.00	0.01	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Number of schools circa 1900	0.04***	0.02***	0.05***	0.04***	0.06***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Marriage rate 1910	-0.00*	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Widowhood rate 1910	0.00	-0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Unmarried rate 1910	0.00*	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Household size 1910	0.00	0.01	0.01	-0.00	-0.01
	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)
Land inequality 1860	0.00***	0.00***	0.01***	0.00	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Schooling enrolment, boys 1860	-0.00***	-0.00***	-0.00***	0.00	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Schooling enrolment, girls 1860	-0.00***	-0.00**	-0.00***	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
IWA local section 1873	0.36***	0.19***	0.37***	0.08	0.29***
	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)
Agricultural pop. share 1887	-0.00***	-0.00***	-0.00***	-0.00	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Industrial pop. share 1887	0.01***	0.01***	0.01***	0.00	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of male teachers 1887	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Number of female teachers 1887	0.00	0.00***	0.00**	0.00	0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Student-teacher ratio 1887	0.00***	0.00	0.00***	-0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: Cells report coefficients from bivariate linear probability models of each treatment indicator (organizational creation during the 1910–1920 period) on pre-treatment correlates. Parentheses report heteroskedasticity-robust standard errors clustered at the province level. Significance stars: $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

Table C4. Pre-treatment covariate balance by adoption cohort: workers' organizations

Covariate	1900 cohort		1910 cohort		1920 cohort	
	Diff	*t*	Diff	*t*	Diff	*t*
Literacy rate 1887	-2.71	-1.40	-4.23	-2.70	-3.36	-2.69
Population 1887	755.72	3.16	967.07	5.78	747.14	5.17
Railroad density 1887	0.05	3.98	0.03	3.75	0.01	3.18
Train stations 1887	0.28	3.69	0.27	6.19	0.15	4.39
Distance to coast (km)	-90.63	-7.27	-58.07	-4.53	-20.78	-1.58
Distance to provincial capital (km)	-8.70	-4.64	-4.19	-2.02	-3.49	-1.94
Mean elevation (in hundreds of meters)	-3.43	-10.56	-2.47	-6.61	-1.74	-4.92
Ruggedness (in hundreds of meters)	-0.01	-0.11	-0.04	-0.52	-0.08	-1.52
Land inequality 1860	7.89	4.01	5.16	4.42	6.10	5.37
Schooling enrolment, boys 1860	-10.42	-4.71	-8.89	-5.76	-6.67	-4.15
Schooling enrolment, girls 1860	-6.78	-2.89	-2.80	-1.70	-2.38	-2.07
IWA local section 1873	0.05	1.82	0.02	2.47	0.04	3.11
Agricultural pop. share 1887	-11.78	-4.08	-5.06	-3.30	-2.87	-2.52
Industrial pop. share 1887	5.59	4.34	2.99	3.46	1.63	3.24
Number of male teachers 1887	0.53	0.11	-3.88	-1.06	-4.53	-1.46
Number of female teachers 1887	14.88	5.78	8.88	3.12	5.45	1.93
Student-teacher ratio 1887	1.17	0.11	14.69	1.87	14.14	2.00

Note: For each cohort year (1900, 1910, 1920), the treated group consists of municipalities that first experienced organizational creation in that period. The control group consists of municipalities with no organizational creation prior to or during that period. *Diff* reports differences in pre-treatment covariates (treated minus control). *t* reports Wald *t*-statistics from regressions of each covariate on the cohort treatment indicator using standard errors clustered at the province level. These comparisons are descriptive diagnostics of selection into treatment timing.

Table C5. Pre-treatment covariate balance by adoption cohort: Cooperatives

Covariate	1900 cohort		1910 cohort		1920 cohort	
	Diff	*t*	Diff	*t*	Diff	*t*
Literacy rate 1887	-2.63	-1.37	-4.15	-2.66	-3.29	-2.49
Population 1887	755.82	3.13	853.33	5.08	745.49	4.97
Railroad density 1887	0.05	4.01	0.03	3.54	0.01	3.08
Train stations 1887	0.28	3.70	0.25	5.89	0.15	3.99
Distance to coast (km)	-90.43	-7.22	-56.80	-4.40	-20.75	-1.51
Distance to provincial capital (km)	-8.62	-4.54	-3.73	-1.77	-3.66	-2.01
Mean elevation (in hundreds of meters)	-3.41	-10.33	-2.39	-6.11	-1.66	-4.55
Ruggedness (in hundreds of meters)	-0.00	-0.07	-0.04	-0.59	-0.07	-1.18
Land inequality 1860	7.97	4.09	5.17	4.50	5.71	5.07
Schooling enrolment, boys 1860	-10.29	-4.67	-8.82	-5.62	-6.66	-3.97
Schooling enrolment, girls 1860	-6.83	-2.92	-2.71	-1.59	-2.21	-1.85
IWA local section 1873	0.06	2.96	0.02	2.39	0.01	1.63
Agricultural pop. share 1887	-11.98	-4.15	-4.75	-3.06	-2.90	-2.44
Industrial pop. share 1887	5.66	4.41	2.84	3.35	1.82	2.86
Number of male teachers 1887	0.89	0.18	-4.21	-1.05	-5.85	-1.81
Number of female teachers 1887	15.15	5.82	9.15	2.98	5.00	1.64
Student-teacher ratio 1887	0.01	0.00	12.84	1.57	14.11	1.92

Notes: For each cohort year (1900, 1910, 1920), the treated group consists of municipalities that first experienced organizational creation in that period. The control group consists of municipalities with no organizational creation prior to or during that period. *Diff* reports differences in pre-treatment covariates (treated minus control). *t* reports Wald *t*-statistics from regressions of each covariate on the cohort treatment indicator using standard errors clustered at the province level. These comparisons are descriptive diagnostics of selection into treatment timing.

Table C6. Pre-treatment covariate balance by adoption cohort: Workers' organizations/Cooperatives

Covariate	1900 cohort		1910 cohort		1920 cohort	
	Diff	*t*	Diff	*t*	Diff	*t*
Literacy rate 1887	-2.50	-1.39	-3.80	-2.88	-4.77	-3.86
Population 1887	960.03	3.56	1429.76	7.91	1139.94	8.39
Railroad density 1887	0.05	4.17	0.02	4.66	0.01	2.43
Train stations 1887	0.27	3.64	0.24	8.14	0.14	4.17
Distance to coast (km)	-91.99	-7.45	-52.76	-4.51	-34.24	-3.22
Distance to provincial capital (km)	-9.70	-5.46	-4.81	-2.60	-4.24	-2.51
Mean elevation (in hundreds of meters)	-3.48	-10.60	-2.40	-7.13	-1.97	-6.37
Ruggedness (in hundreds of meters)	-0.00	-0.03	-0.04	-0.63	0.04	0.65
Land inequality 1860	7.66	4.04	5.19	4.61	6.75	4.75
Schooling enrolment, boys 1860	-10.00	-4.82	-8.16	-5.49	-8.61	-5.63
Schooling enrolment, girls 1860	-6.24	-2.89	-3.87	-2.80	-3.99	-3.64
IWA local section 1873	0.06	2.79	0.02	2.75	0.01	2.64
Agricultural pop. share 1887	-11.74	-4.48	-3.44	-3.54	-1.99	-2.02
Industrial pop. share 1887	5.51	4.54	1.86	3.84	1.14	3.15
Number of male teachers 1887	0.63	0.13	-7.27	-2.10	-4.58	-0.92
Number of female teachers 1887	14.86	6.04	4.15	1.79	3.04	1.13
Student-teacher ratio 1887	1.95	0.20	24.81	3.65	30.23	4.53

Note: For each cohort year (1900, 1910, 1920), the treated group consists of municipalities that first experienced organizational creation in that period. The control group consists of municipalities with no organizational creation prior to or during that period. *Diff* reports differences in pre-treatment covariates (treated minus control). *t* reports Wald *t*-statistics from regressions of each covariate on the cohort treatment indicator using standard errors clustered at the province level. These comparisons are descriptive diagnostics of selection into treatment timing.

Table C7. Pre-treatment covariate balance by adoption cohort: Employers' organizations

Covariate	1900 cohort		1910 cohort		1920 cohort	
	Diff	*t*	Diff	*t*	Diff	*t*
Literacy rate 1887	-4.68	-2.67	0.70	0.46	3.21	2.11
Population 1887	1909.15	6.15	1113.82	6.29	450.04	3.42
Railroad density 1887	0.05	3.36	0.01	2.87	0.00	0.87
Train stations 1887	0.43	4.68	0.16	6.47	0.08	2.59
Distance to coast (km)	-82.20	-5.10	-29.03	-2.54	-18.34	-1.88
Distance to provincial capital (km)	-9.79	-3.06	-3.04	-2.17	-3.41	-2.08
Mean elevation (in hundreds of meters)	-3.29	-6.95	-1.73	-5.74	-0.81	-2.74
Ruggedness (in hundreds of meters)	0.09	1.04	-0.12	-2.45	-0.08	-1.64
Land inequality 1860	4.72	2.21	2.53	2.28	0.41	0.39
Schooling enrolment, boys 1860	-10.14	-4.26	-1.46	-0.76	3.14	1.67
Schooling enrolment, girls 1860	-2.92	-1.34	1.28	0.78	2.92	1.82
IWA local section 1873	0.08	2.58	0.02	2.77	-0.00	-1.06
Agricultural pop. share 1887	-6.76	-3.36	-0.79	-0.74	-0.62	-0.61
Industrial pop. share 1887	3.57	3.07	0.44	1.01	0.17	0.39
Number of male teachers 1887	-7.16	-1.70	-1.88	-0.58	0.33	0.15
Number of female teachers 1887	6.28	1.88	2.96	1.72	1.73	1.15
Student-teacher ratio 1887	24.19	2.15	9.53	1.33	-4.19	-0.71

Note: For each cohort year (1900, 1910, 1920), the treated group consists of municipalities that first experienced organizational creation in that period. The control group consists of municipalities with no organizational creation prior to or during that period. *Diff* reports differences in pre-treatment covariates (treated minus control). *t* reports Wald *t*-statistics from regressions of each covariate on the cohort treatment indicator using standard errors clustered at the province level. These comparisons are descriptive diagnostics of selection into treatment timing.

Table C8. Pre-treatment covariate balance by adoption cohort: All organizations

Covariate	1900 cohort		1910 cohort		1920 cohort	
	Diff	*t*	Diff	*t*	Diff	*t*
Literacy rate 1887	-3.17	-1.87	-1.25	-0.87	-0.04	-0.03
Population 1887	1076.54	4.11	1155.53	7.34	697.02	6.41
Railroad density 1887	0.05	4.34	0.01	4.10	0.00	1.05
Train stations 1887	0.28	4.44	0.16	7.96	0.08	3.55
Distance to coast (km)	-87.77	-7.36	-39.96	-3.59	-24.50	-2.40
Distance to provincial capital (km)	-9.88	-5.54	-3.75	-2.60	-3.50	-2.00
Mean elevation (in hundreds of meters)	-3.42	-10.96	-2.10	-7.05	-1.18	-4.35
Ruggedness (in hundreds of meters)	-0.01	-0.18	-0.10	-2.06	-0.02	-0.28
Land inequality 1860	7.02	3.75	4.05	3.75	3.43	3.33
Schooling enrolment, boys 1860	-10.08	-5.07	-4.37	-2.55	-2.10	-1.33
Schooling enrolment, girls 1860	-5.68	-2.79	-0.69	-0.50	-0.08	-0.06
IWA local section 1873	0.05	2.89	0.02	2.88	0.00	1.22
Agricultural pop. share 1887	-10.24	-4.63	-1.85	-2.32	-0.79	-1.12
Industrial pop. share 1887	4.79	4.60	1.08	3.19	0.39	1.39
Number of male teachers 1887	-1.14	-0.25	-4.48	-1.54	-1.90	-0.58
Number of female teachers 1887	12.61	4.78	3.73	2.40	1.66	0.96
Student-teacher ratio 1887	7.71	0.80	16.96	2.58	13.49	2.30

Note: For each cohort year (1900, 1910, 1920), the treated group consists of municipalities that first experienced organizational creation in that period. The control group consists of municipalities with no organizational creation prior to or during that period. Diff reports differences in pre-treatment covariates (treated minus control). *t* reports Wald *t*-statistics from regressions of each covariate on the cohort treatment indicator using standard errors clustered at the province level. These comparisons are descriptive diagnostics of selection into treatment timing.

Parallel Trends

This section assesses the parallel trends assumption using different strategies.

Table D1. Parallel-trends tests across specifications

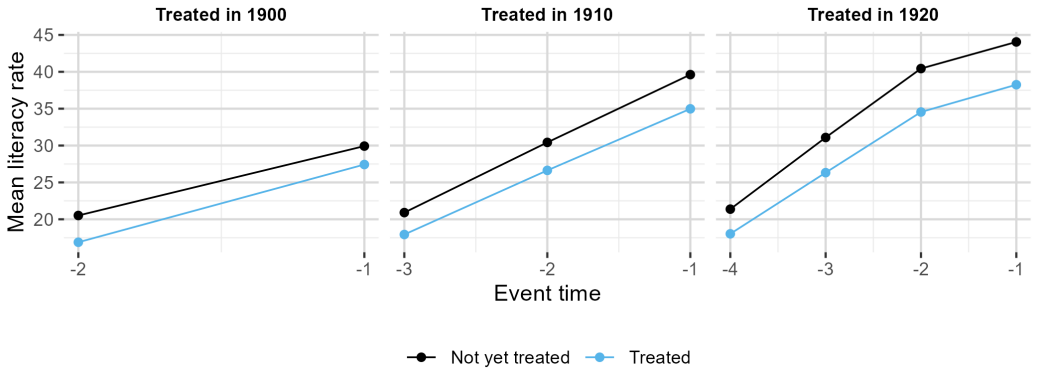
Treatment	(1)	(2)	(3)
Workers	< 0.001	0.001	< 0.001
Cooperatives	0.007	0.283	0.369
Coop/Workers	< 0.001	0.152	0.042
Employers	0.606	0.009	0.002
Any organization	0.012	< 0.001	< 0.001
Pre-treatment controls		✓	✓
Time-varying controls			✓

Note: Cells report p-values from the joint test that all pre-treatment group-time average treatment effects are zero from Callaway and Sant'Anna (2021). Columns mirror the control sets used throughout the main figures: (1) without controls; (2) pretreatment controls (number of male and female teachers, student-teacher ratio, industrial population share, and the agricultural population share in 1887.);(3) pre-treatment plus time-varying controls (log population, railroad density, and number of train stations).

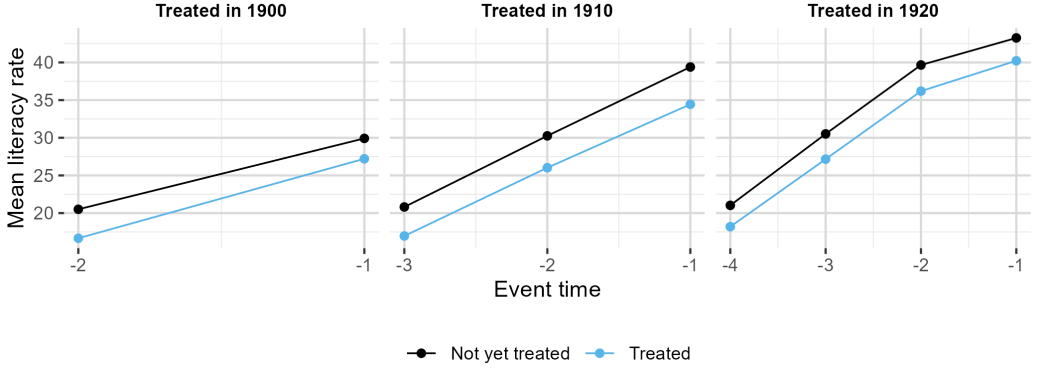
Table D2. Placebo pre-trends and post-treatment magnitudes

Treatment	Pre-trend (1860–1887)	Mean ATT	Peak ATT
Workers	-1.465 (0.513)	0.697	3.075
Cooperatives	-0.239 (0.646)	2.081	7.971
Coop/workers	-0.971 (0.586)	1.323	7.284
Employers	0.263 (0.305)	0.244	3.931
Any organization	-0.360 (0.436)	0.698	6.341

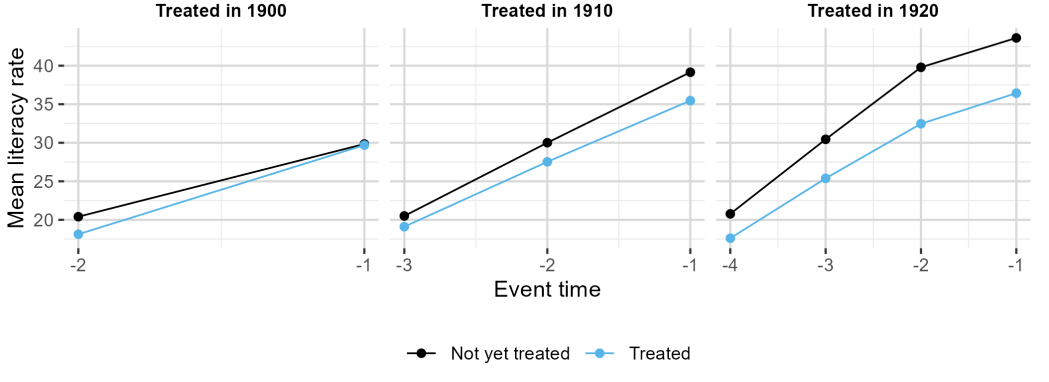
Note: Baseline models without controls. The pre-trend column reports the placebo DiD estimate from 1860–1887 with municipality and year fixed effects. Standard errors (in parentheses) are clustered at the province level. Mean ATT is the average of dynamic ATT estimates at event times 0 and 1, and peak ATT represents the maximum absolute dynamic ATT over event times 0 through 3.



(a) Cooperative or workers' associations

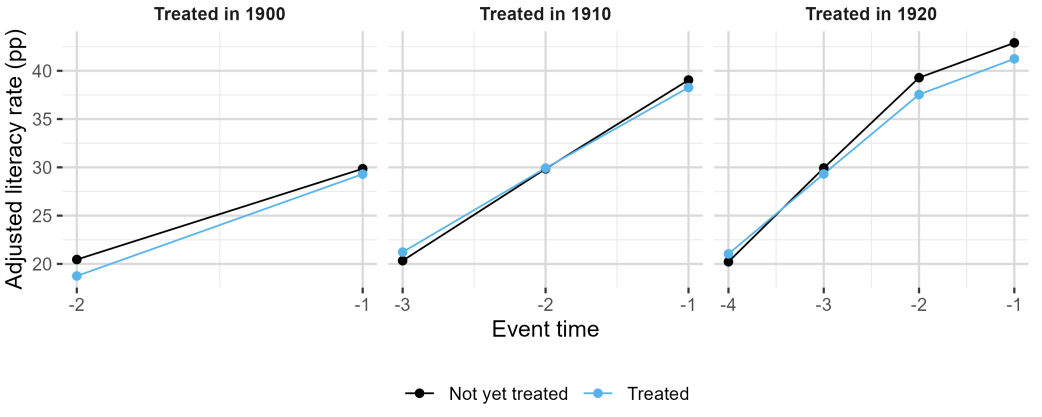


(b) Cooperatives

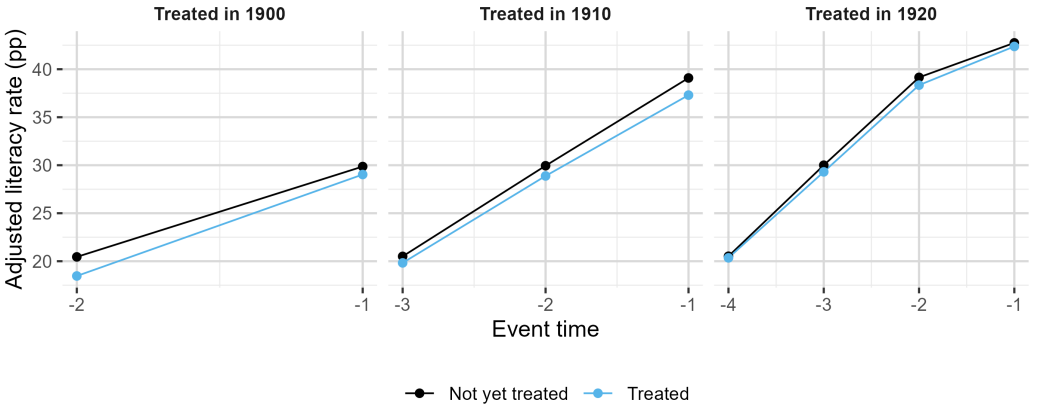


(c) Workers' associations

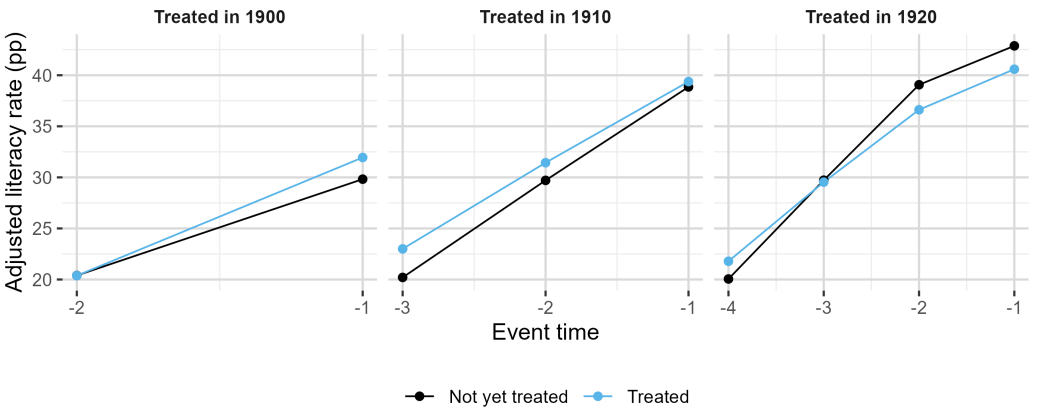
Figure D1. Pre-treatment literacy trends for working-class organizational forms.
Note: Each panel plots mean literacy rates for municipalities treated in each cohort and municipalities not yet treated (unconditional). Only pre-treatment periods are shown.



(a) Cooperative or workers' associations

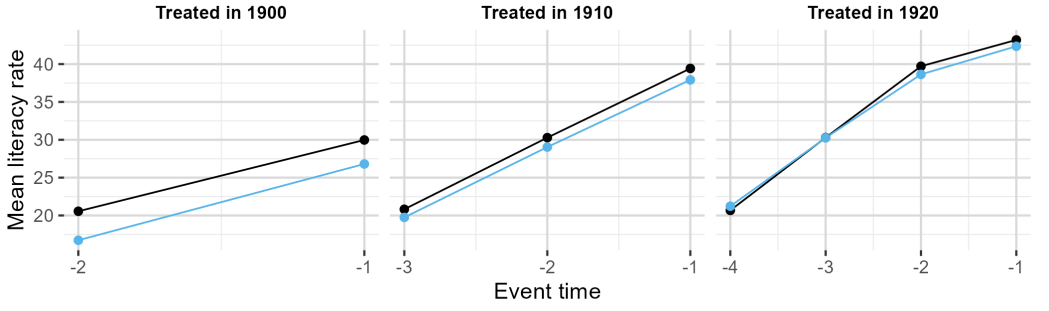


(b) Cooperatives

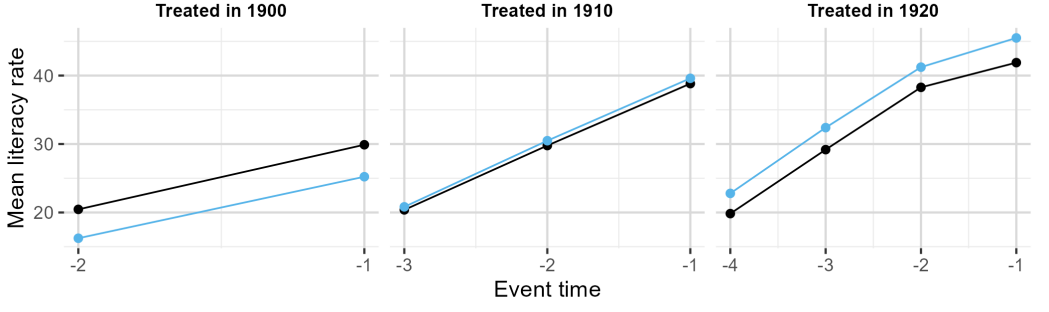


(c) Workers' associations

Figure D2. Pre-treatment literacy trends for working-class organizational forms (adjusted).
Note: Each panel plots adjusted mean literacy rates for municipalities treated in each cohort and municipalities not yet treated. Literacy rates are adjusted for baseline (1887) covariates and predicted at their sample mean. Only pre-treatment periods are shown.

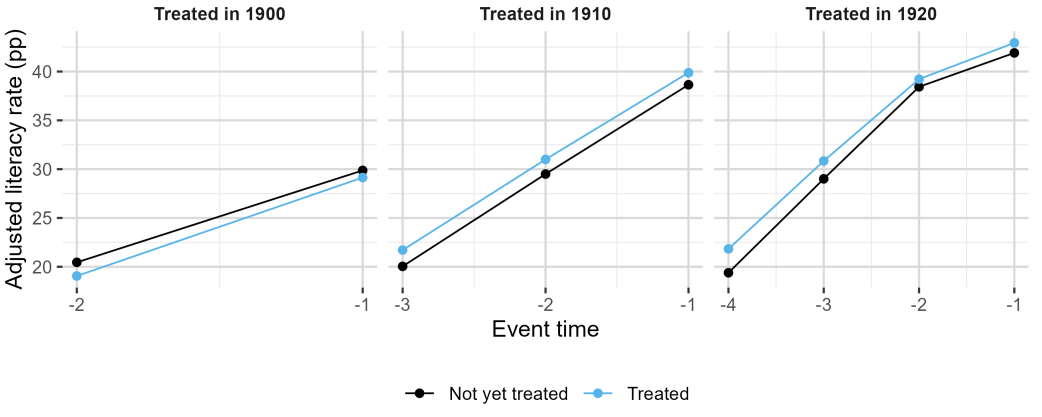


(a) All associations

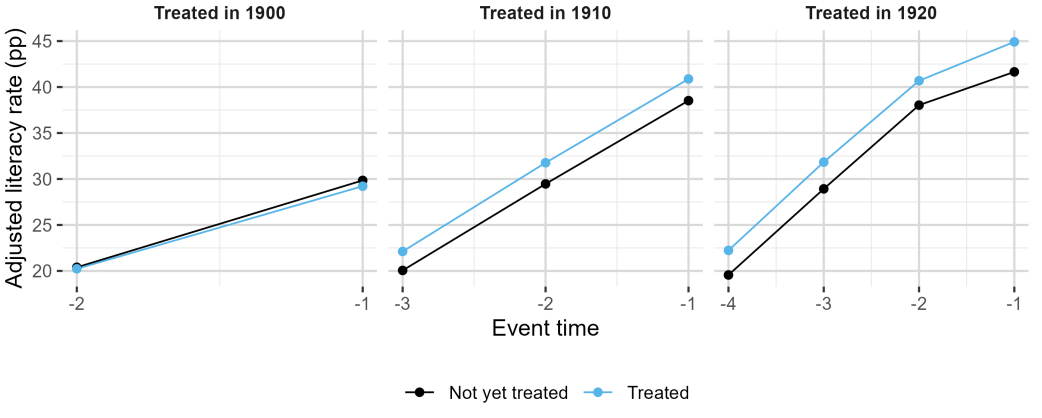


(b) Employers' associations

Figure D3. Pre-treatment literacy trends for other organizational forms.
Note: Each panel plots mean literacy rates for municipalities treated in each cohort and municipalities not yet treated (unconditional). Only pre-treatment periods are shown.



(a) All associations

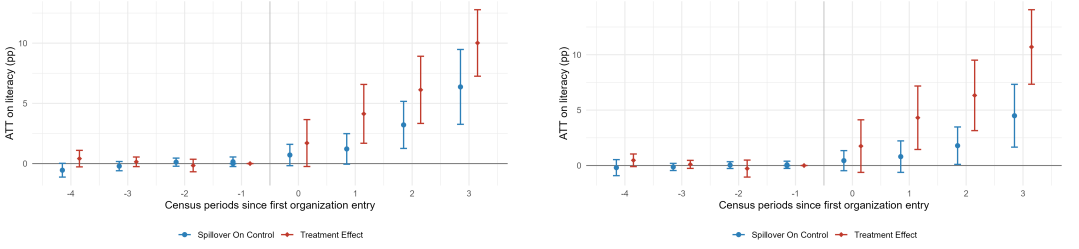


(b) Employers' associations

Figure D4. Pre-treatment literacy trends for other organizational forms (adjusted).
Note: Each panel plots adjusted mean literacy rates for municipalities treated in each cohort and municipalities not yet treated. Literacy rates are adjusted for baseline (1887) covariates and predicted at their sample mean. Only pre-treatment periods are shown.

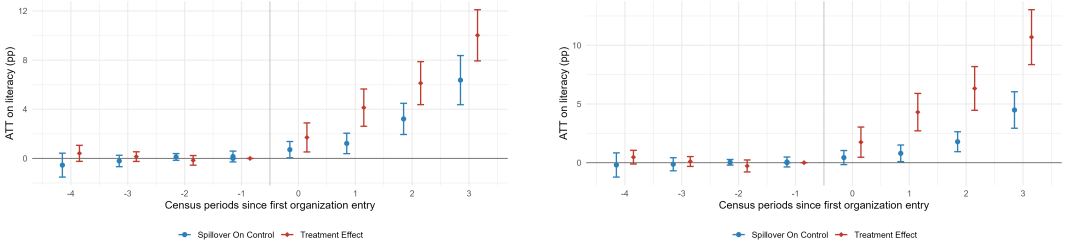
Spillover Effects and Spatial Interference

This section examines the possibility of spatial spillovers or violations of the SUTVA assumption.



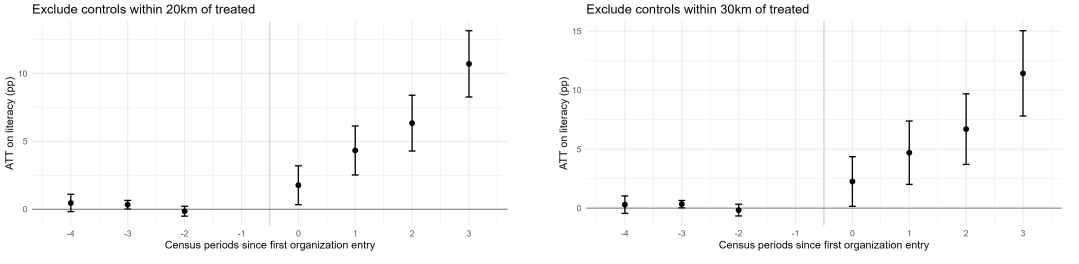
(a) 10 km exposure radius **(b)** 20 km exposure radius

Figure E1. Spillover event-study estimates for cooperatives. Panels report dynamic spillover effects for municipalities within the indicated radius of treated municipalities. 95% confidence intervals shown; standard errors are clustered at the province level.



(a) 10 km exposure radius **(b)** 20 km exposure radius

Figure E2. Spillover event-study estimates for cooperatives with spatially robust inference. Same specification as Figure E1, but confidence intervals are based on Conley (distance-based) standard errors.



(a) Exclude controls within 0–20 km (Conley cutoff: 25 km). **(b)** Exclude controls within 0–30 km (Conley cutoff: 50 km).

Figure E3. Donut robustness to local interference for cooperatives. Event-study estimates for treated municipalities re-estimated after excluding untreated municipalities located within the indicated distance of treated municipalities. 95% CIs using Conley (spatial HAC) standard errors with the cutoff reported in each panel.

Robustness and Sensitivity Analyses

This section presents robustness analyses evaluating the sensitivity of the findings to alternative aggregations, outcome definitions, and estimation strategies.

Table F1. Alternative ATT aggregations for labor-oriented organizational formation

	Cooperatives		Workers' organizations		Cooperatives/workers' orgs.	
	(1)	(2)	(3)	(4)	(5)	(6)
Simple ATT	1.231***	0.823**	0.622	0.279	1.288***	0.690**
	(0.370)	(0.385)	(0.401)	(0.401)	(0.297)	(0.301)
Group ATT	1.210***	0.844**	0.443	0.159	1.126***	0.635**
	(0.377)	(0.390)	(0.395)	(0.396)	(0.298)	(0.299)
Pre-treatment controls		✓		✓		✓
Mean DV	29.84	29.84	29.84	29.84	29.84	29.84
N	44,362	44,350	44,362	44,350	44,362	44,350

Notes: Each column reports estimates from a separate model. The dependent variable is the municipal literacy rate. Simple ATT averages all group-time effects. Group ATT averages cohort-specific effects. Specifications marked with a check include pre-treatment controls. Standard errors are clustered at the province level. *p < 0.10, **p < 0.05, ***p < 0.01.

Table F2. Alternative ATT aggregations across organizational forms

	Employers' organizations		Any organization		Any org.(without coops.)	
	(1)	(2)	(3)	(4)	(5)	(6)
Simple ATT	0.237	0.313	0.909***	0.571**	0.414	0.370
	(0.279)	(0.282)	(0.229)	(0.240)	(0.253)	(0.257)
Group ATT	0.201	0.226	0.798***	0.502**	0.357	0.282
	(0.279)	(0.283)	(0.232)	(0.242)	(0.255)	(0.258)
Pre-treatment controls		✓		✓		✓
Mean DV	29.84	29.84	29.84	29.84	29.84	29.84
N	44,362	44,350	44,362	44,350	44,362	44,350

Notes: Each column reports estimates from a separate model. The dependent variable is the municipal literacy rate. Simple ATT averages all group-time effects. Group ATT averages cohort-specific effects. Specifications marked with a check include pre-treatment controls. Standard errors are clustered at the province level. *p < 0.10, **p < 0.05, ***p < 0.01.

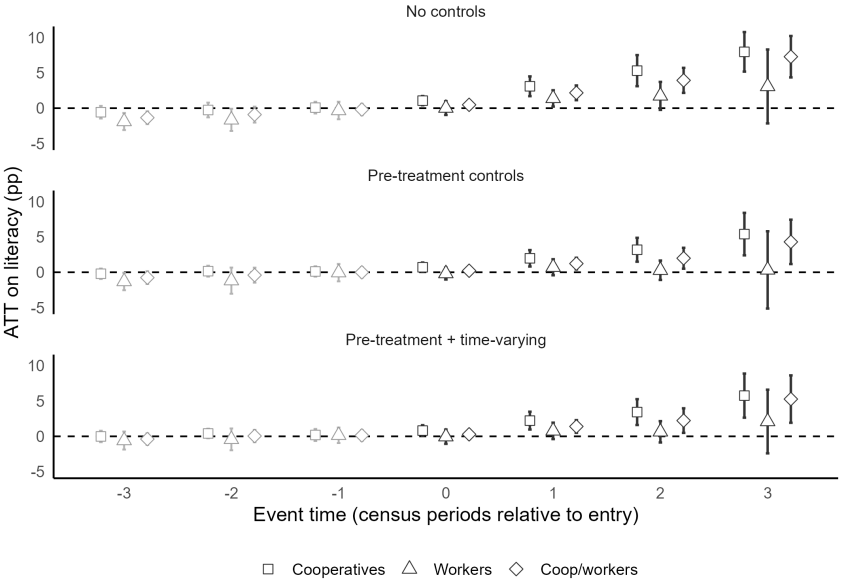
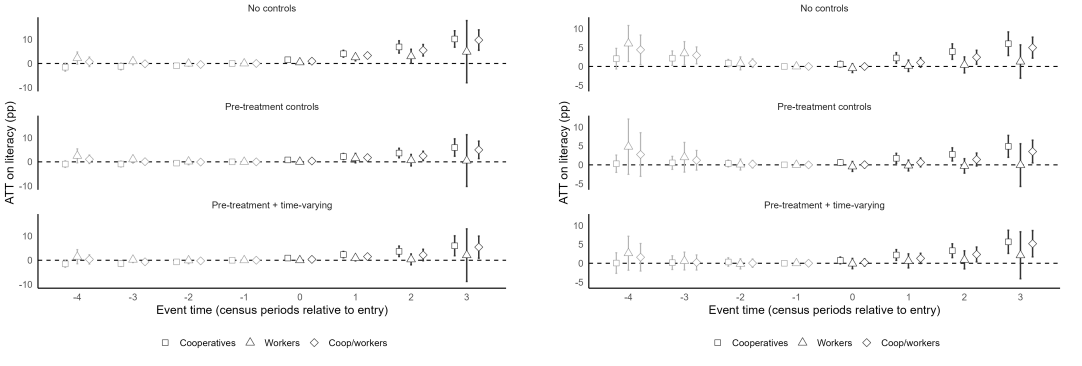


Figure F1. Time-varying organizational formation exposure effects on literacy rates.
Note: Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local literacy rates, expressed in percentage points (pp).



(a) Male literacy

(b) Female literacy

Figure F2. Effects of exposure to organizational formation on literacy rates by gender.
Note: Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local literacy rates, expressed in percentage points (pp).

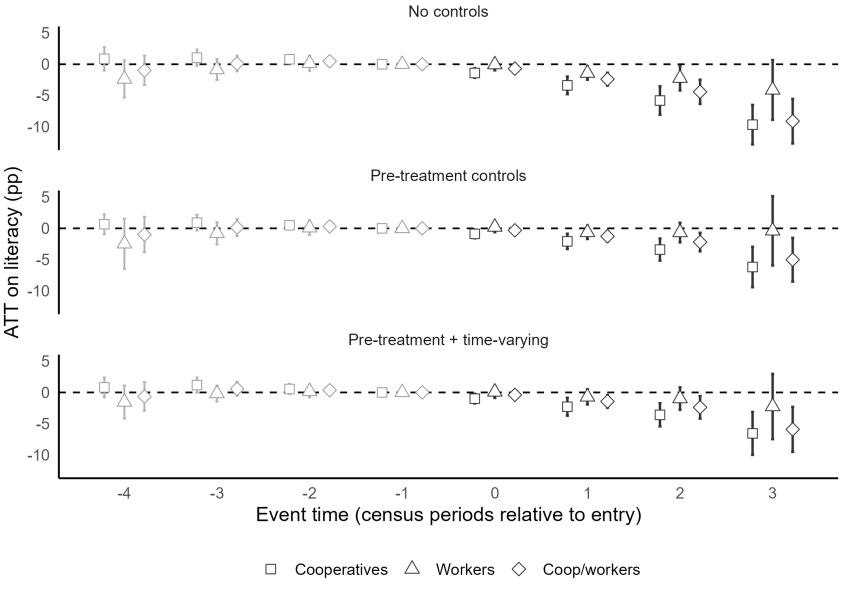
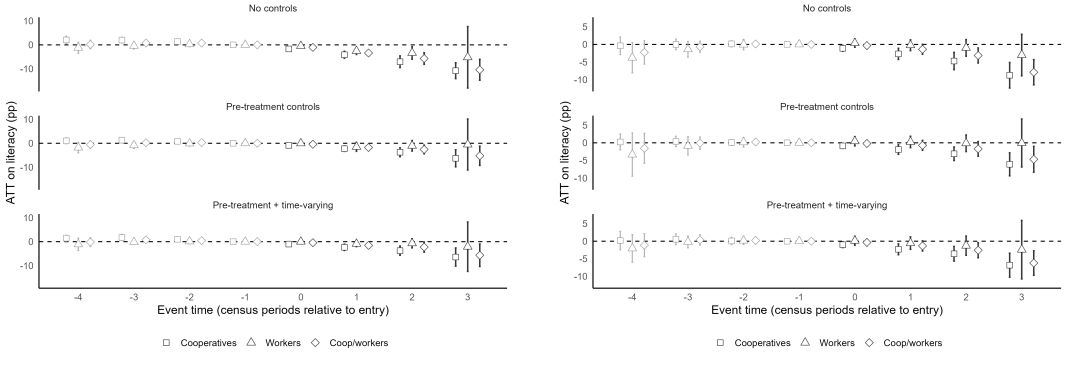


Figure F3. Effects of exposure to organizational formation on local illiteracy rates.
Note: Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local illiteracy rates, expressed in percentage points (pp).



(a) Male illiteracy

(b) Female illiteracy

Figure F4. Effects of exposure to organizational formation on illiteracy rates by gender.
Note: Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local illiteracy rates, expressed in percentage points (pp).

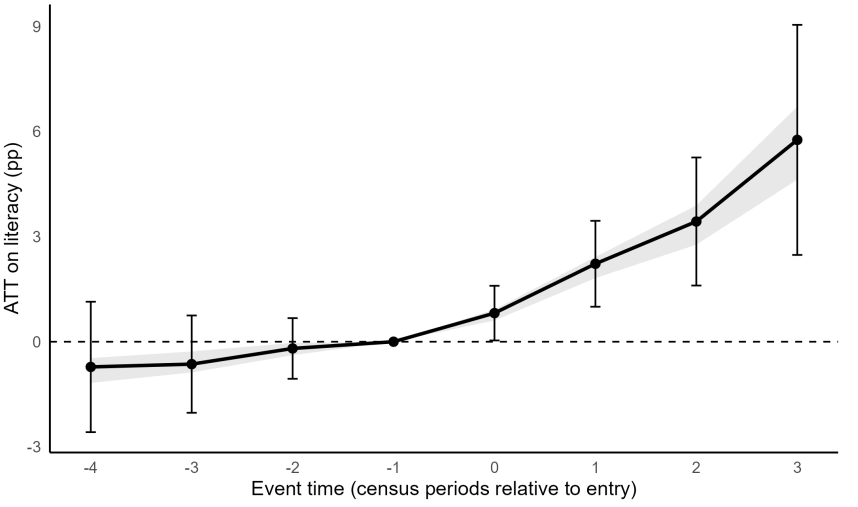
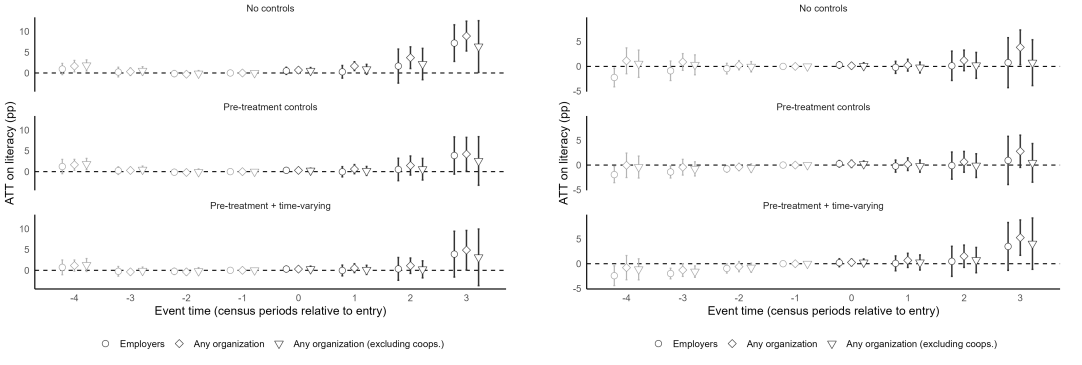


Figure F5. Leave-one-province-out robustness: cooperatives.
Note: Points and solid lines report the baseline dynamic average treatment effects on the treated (ATT) of cooperative formation on local literacy rates, expressed in percentage points (pp), estimated via Callaway and Sant'Anna 2021 with full controls. Error bars indicate 95% CIs. The shaded areas spans the full range of ATT estimates obtained after sequentially excluding each of the 50 Spanish provinces.



(a) Male literacy

(b) Female literacy

Figure F6. Effects of exposure to organizational formation on literacy rates by gender.
Note: Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local literacy rates, expressed in percentage points (pp).

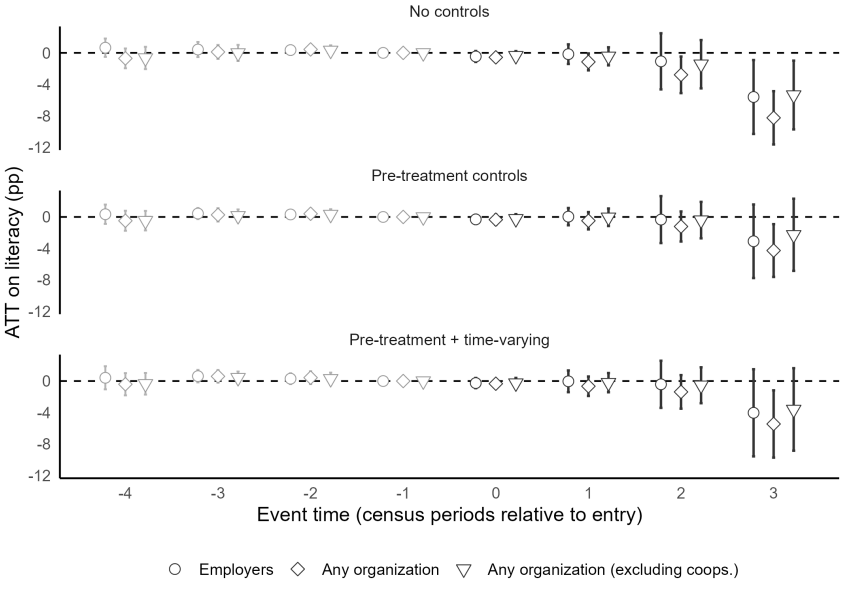
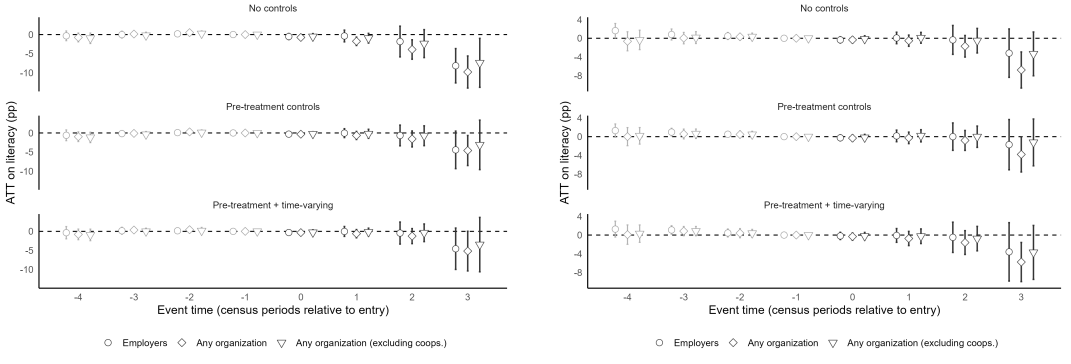


Figure F7. Effects of exposure to organizational formation on local illiteracy rates.
Note: Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local illiteracy rates, expressed in percentage points (pp).



(a) Male illiteracy

(b) Female illiteracy

Figure F8. Effects of exposure to organizational formation on illiteracy rates by gender.
Note: Pre-treatment event times are shown in light gray. Points represent the average treatment effect on the treated (ATT) of different forms of organizational formation on local illiteracy rates, expressed in percentage points (pp).

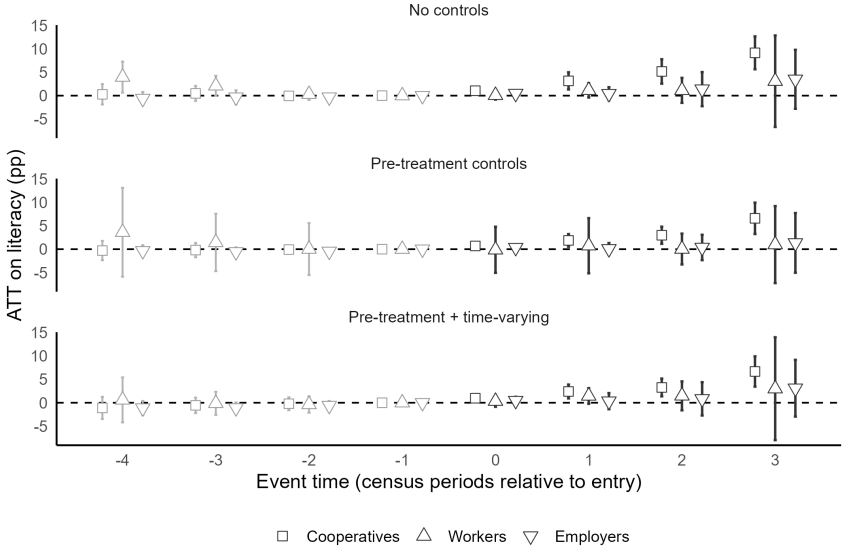


Figure F9. Effects of exposure to organizational formation under organizational overlap restrictions.

Mechanisms

This section incorporates supplementary evidence on the potential mechanisms linking the formation of organizations to literacy expansion.

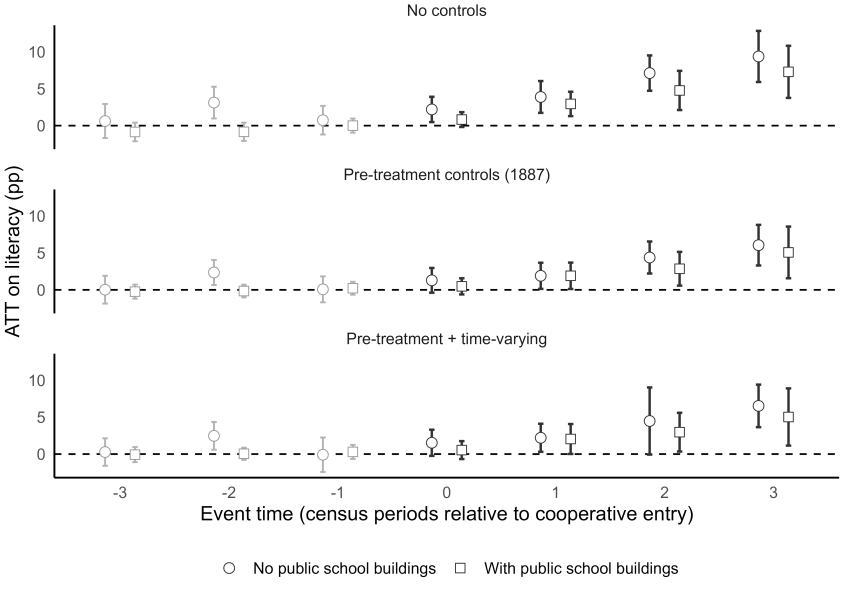
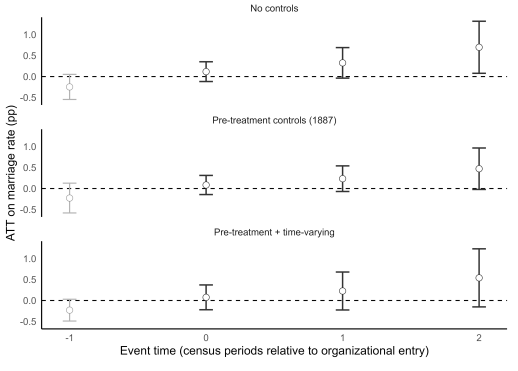
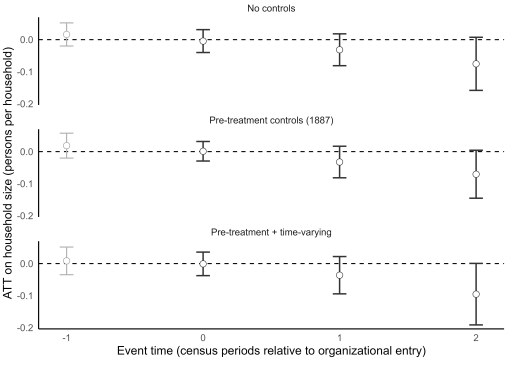


Figure G1. Heterogeneous effects of cooperatives formation depending on the presence of public school buildings

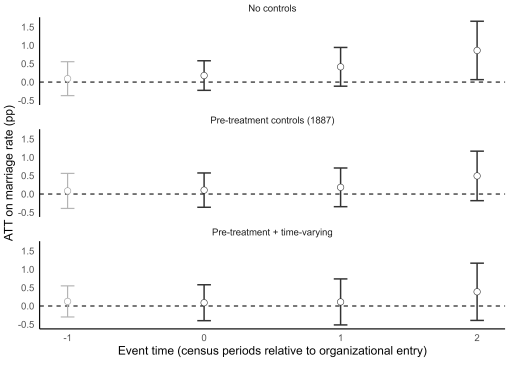


(a) DV = Marriage rates

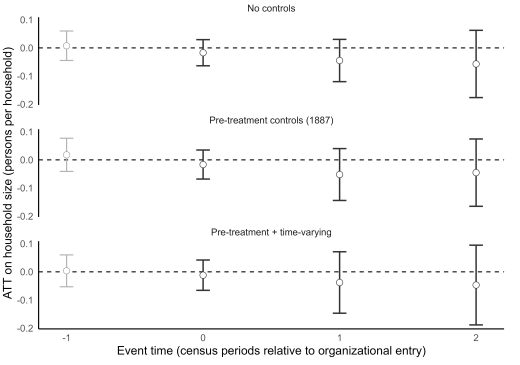


(b) DV = Household size

Figure G2. Organizational formation (all types) on demographic outcomes

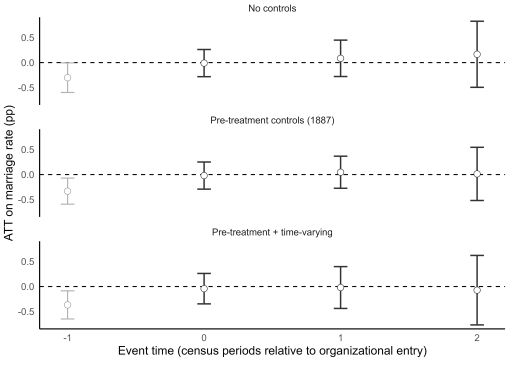


(a) DV = Marriage rates

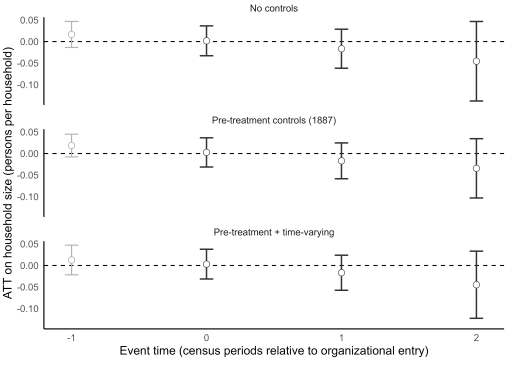


(b) DV = Household size

Figure G3. Workers' organizations formation on demographic outcomes



(a) DV = Marriage rates



(b) DV = Household size

Figure G4. Employers' organizations formation on demographic outcomes