Finding the Right Time and Place: Evidence from a Unique Place-Based Policy in Ireland 1891–1909

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Abstract

Can place-based policies reduce rural poverty? I examine this question through a unique early development programme in Ireland's poorest regions: the Congested Districts Board. The Board tailored interventions to local conditions, aiming to boost employment and living standards. Using newly digitised, geo-coded investment data, I find for every £1 spent, the policy lifted three people out of absolute poverty, improving socio-economic conditions for the poorest. Agricultural interventions were the key mechanism, increasing capital and shifting production from low-value subsistence tillage to high-value pasture farming. This demonstrates that place-based policies aligned with a locality's comparative advantage can generate substantial benefits for its community.

Keywords: agriculture, economic development, place-based, poverty, demography, economic history of Ireland

JEL Codes: J18, N33, N53, O13, O22, Q15

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1 Introduction

Place-based policies have increasingly been embraced by policymakers across the globe to redevelop economic underperforming areas in response to deepening regional inequality (Neumark and Simpson, 2015). Instead of targeting individuals, these policies target places for a form of special economic treatment (Kline and Moretti, 2014), ith policymakers advocating an extensive menu of supply- and demand-side reforms to create new jobs through industrial and agricultural policy, the construction of infrastructure, the development of communities and housing, and investment in higher education (Neumark and Simpson, 2015; Kline and Moretti, 2014).

Although place-based policies are widespread, many economists remain sceptical of their motivation and impact. Since the re-emergence of these policies in the twentieth century, concerns have centred on clientelism and inefficiency (Bartik, 1991). Not only may they crowd out private investment, critics argue they may entrench structural inequalities by shifting resources from high- to low-productivity areas and encouraging disadvantaged individuals to remain in economically weak regions rather than move to more productive ones (Glaeser and Gottlieb, 2008; Kain and Persky, 1969). Large-scale programmes may also distort the location of economic activity, wages, and employment, generating a range of negative externalities (Kline and Moretti, 2013).

Theory predicts that when labour is mobile, redirecting economic opportunities from one area to another is futile, as highly productive workers and firms arbitrage the benefits (Busso et al., 2013). Structural inequalities and skill mismatch can cause new firms to become "ivory towers", incentivising highly productive workers to resettle in deprived areas, increasing rents and living costs (Overman and Xu, 2024; von Ehrlich and Seidel, 2018). By ignoring labour mobility and the agglomeration effects of larger regions, the relocation of economic activity into weaker areas may damage total output and welfare (Kline and Moretti, 2013; Glaeser and Gottlieb, 2008). In addition, political incentives foster "silver-bullet" thinking amongst policymakers divorced from regional and local context (Brownlow and Budd, 2024; Barca et al., 2012) and create ample scope for rent-seeking (Neumark and Simpson, 2015).

Although the economic consensus is that place-based approaches regularly fail, rigorous micro-econometric evidence on their causal effects remains limited (Criscuolo et al., 2019). Moreover, advances in the fields of new economic geography and the economics of institutions have deepened understanding of how such policies can succeed. Advocates emphasise the importance of tailoring interventions to local economic contexts, targeting resources towards projects where an area has a comparative advantage (Barca et al., 2012). Rather than redistributing opportunities from one area to another, this approach recognises the pathdependent nature of development, and is better equipped to address the causes of persistent economic underperformance in lagging regions by accounting for local geography, history, culture, and institutions (Brownlow and Budd, 2024).

This paper contributes to this literature by evaluating a unique early economic development programme in Ireland – the Congested Districts Board (CDB). Established by the Government in 1891 and operating until 1923, the CDB sought to raise employment and living standards in Ireland's poorest western regions through a multifaceted development programme. Uniquely, eligibility was determined by a set of criteria while interventions were tailored to each locality's economic context, combining agriculture modernisation, infrastructure investment, industrial policy, community development, and training initiatives. Despite its longevity and wide remit, the programme has never been subject to a comprehensive economic evaluation and has been generally regarded as a failure (Breathnach, 2005).

This paper contributes a newly digitised and geo-coded dataset of the policy's investment activities, drawn from the Annual Reports of the Congested Districts Board. The dataset includes investments from the Board's foundation in 1891 to its reconstitution in 1909, enabling an unprecedented quantitative analysis of the policy during its first eighteen years. I examine the policy's effect on absolute poverty and public health as direct measures of living standards at Poor Law Union Level (n = 158). My identification strategy uses a Two-Way Fixed Effects estimator within a difference-in-differences framework, applied to a matched sample of comparable Unions with parallel pre-intervention trends.

I find strong evidence that the CDB reduced poverty, improved public health, and increased living conditions for the average resident. A one standard deviation increase in programme investment reduced absolute poverty rates by 0.21 standard deviations, equivalent to lifting three persons out of absolute poverty for every £1 spent. In this rural setting, the policy's focus on agricultural development was the main driver of this effect, primarily by accelerating the transition from low-value tillage, to high-value pasture farming. I verify this result by leveraging higher resolution District Electoral Division (DED) data on the number of farmsteads and out-offices as a proxy for livestock and agricultural capital. Using a geographical Regression Discontinuity Design (RDD) I exploit the policy's eligibility criteria and location of projects to confirm that the policy led to a significant increase in the number of farmsteads/out-offices as a proxy for agricultural capital. At the "congested county border", I find that the construction of farmsteads/out-offices increased by 26 per cent in treated districts compared to untreated districts.

This study exploits a unique natural experiment of history. First, it provides the first economic evaluation of the CDB programme, a policy that historians have generally regarded as a failure – despite the absence of quantitive evidence. Second, evaluations of policies that tailor interventions to local conditions are rare; to my knowledge, no prior study has assessed a programme that developed opportunities aligned with a locality's comparative advantage. Moreover, the CDB operated amid high rural depopulation, providing a rare opportunity to assess a place-based policy in the context of its principal criticism – that mobile workers arbitrage the benefits. Third, little research has examined place-based policies in rural settings, leaving the generalisability of existing findings unclear. Finally, rather than focusing on broad economic indicators, this paper considers whether disadvantaged residents actually benefited by examining the effect of the policy on poverty, health, agricultural production, and capital accumulation.

The most comparable studies to this paper are place-based policies that attempt to correct market failure – providing more public goods, reducing labour market frictions, and addressing poverty traps and credit market constraints. However, such studies tend to be focused on manufacturing rather than agriculture. For example, Kline and Moretti (2013) conduct a long-run analysis of the Tennessee Valley Authority, a programme that invested in public infrastructure, transport, and schools. They find that the policy accelerated the transition to manufacturing, increased wages, and generated self-sustaining agglomeration benefits. In a European context, Becker et al. (2012, 2010) explore if European Structural Funds improved GDP growth in lagging regions. Like this paper, the authors employ a fuzzy RDD, instrumenting treatment with the policy's eligibility criteria, and find that it significantly increased GDP growth.

The main limitation of this literature has been its focus on traditional measures of growth such as GDP, productivity, and economic structure – even in developing country contexts. Junxue et al. (2023) finds that a place-based policy accelerated industrialisation in Western China but did not improve GDP growth, while Shenoy (2018) finds that a subsidy programme in India significantly increased output. Using this same programme in India, Chaurey (2017) finds that workers wages rose with no changes to rents or migration. However, the authors – like most of the literature – cannot disentangle whether the primary beneficiaries of the policy were disadvantaged residents.

Finally, this paper builds on the approach of Ferrara et al. (2022, 2017) who advocate for a more holistic approach to measuring development – one that better identifies who benefits from policy interventions. I also contribute to the qualitative reviews of the Congested Districts board by Freeman (1943) and Breathnach (2005), while contributing tangentially to the literature on the impact of decentralisation and development as discussed by Tselios and Rodrígiez-Pose (2024) and McCann (2024).

This paper proceeds as follows. Section 2 provides an overview of the policy and historical context; Section 3 describes the data; Section 4 introduces my identification strategy; Section 5 reports results, Section 6 provides a wider discussion and outlines future areas of research, and Section 7 concludes.

2 Historical Context and Policy

Ireland changed rapidly in the decades that followed An Gorta Mór – the Great Famine of 1845–1852. High levels of permanent out-migration undoubtedly improved living conditions for those who survived as wages grew, poverty rates fell, economic security increased and the threat of destitution of subsided (Ó Gráda and O'Rourke, 1997; Ó Gráda, 1994; Williamson, 1994). Yet, half a century later, the underdeveloped western areas most affected by the Famine were still the poorest regions. Farms were often no more than a series of small disconnected plots of land less than 4 acres in size, draining systems were non-existent, and livestock were poorly bred, prone to disease, and of little monetary value (DATI, 1902). Consequently, farming alone could not sustain households, and many relied on remittances from relatives in America and seasonal agricultural work in Great Britain (Micks, 1925).[1]

The regional imbalance at this time between the east and west of Ireland has been well documented by scholars. At the time, average land values were around £3.15 per capita, ranging from just £0.20 to over £17. The average land value in western counties[2] was around £2.27 per capita, 28 per cent less than the Irish average and nearly half that of the densely populated urban centres of Dublin and Belfast (British Parliamentary Papers, 1887). In this sense, the west was "congested" as too many people lived on too little and on poor quality land (Langan, 1991). In response to this general economic underdevelopment and the persistent threat of economic insecurity in the west, the government established the Congested Districts Board to devise and implemented an unprecedented development programme in Ireland's poorest District Electoral Divisions (DEDs) (Harvey, 1991).

Eligibility was assigned at DED level and was determined by two criteria: firstly a DED must satisfy the Congested County criteria and reside in a county where at least 20 per cent of the county population live in DEDs where average land values were less than £1.50 per capita. Secondly, an eligible DED residing in a Congested County must meet a Land Valuation threshold of less than £1.50 per capita (British Parliamentary Papers, 1893b). This conservative criteria targeted the policy towards western, peripheral DEDs, with the

[1] The Department for Agriculture and Technical Instruction (DATI) acknowledged that good harvest years only offered households in the congested districts temporary relief from hunger DATI (1902).

[2] Figure is an average of District Electoral Division values. Counties are Donegal, Leitrim, Sligo, Roscommon, Mayo, Galway, Clare, Kerry and Cork (West Riding).

final list of eligible DEDs agreed following the 1891 census.[3] They included 428 DEDs in the western Congested Counties of Donegal, Leitrim, Roscommon, Sligo, Mayo, Galway, Kerry and Cork (West Riding). At the time of its establishment, the congested districts accounted for around 18 per cent of Ireland's landmass and contained around 12 per cent of the population. A map of eligible DEDs by land valuation can be found in Appendix A Figure A.1.

The policy was administered by an independent board of ten members who were granted extensive powers to develop agriculture, fisheries, home industries, and any other project that might improve living conditions in the western periphery (Micks, 1925; British Parliamentary Papers, 1893b). Although the Board was quasi-independent, and did not take direction from either Dublin Castle or the UK Government (Micks, 1925), it was chaired by the Chief-Secretary of Ireland, contained a number of senior civil servants, and – at one stage – an incumbent Prime Minister of the United Kingdom.[4] The programme prioritised schemes that promoted agricultural development and reorganisation, with these schemes accounting for 71 per cent of the programme's expenditure between 1891–1909. The aim of these schemes was twofold; firstly, they aimed to modernise agricultural practices by promoting livestock rearing, diversifying crop production and providing instruction on crop rotation, fertilisation, and animal husbandry (Freeman, 1943; Langan, 1991). Secondly, the board aimed to improve the commercial viability of agriculture through land reorganisation, acquiring large estates, redistributing land, increasing the size of small holdings and improving unproductive land (British Parliamentary Papers, 1893b).[5]

Between 1891 and 1909, the Board operated 33 agricultural development schemes that promoted horse and cattle rearing, forestry, beekeeping, and agricultural instruction. They also purchased over 180 estates encompassing $1850km^2$, sold 8,400 refurbished farms to tenants, restructured 3,048 existing farms, and redistributed $200km^2$ of farmland (British Parliamentary Papers, 1909). Complementing this work, the CDB aimed to improve living conditions and public health by providing farmers monetary incentives to undertake home improvements (British Parliamentary Papers, 1899, 1897). This small grant system was rolled out in 165 parishes and targeted at farmers who's holding was valued at less than £7. Priority was given to applicants that intended to construct out-buildings so that livestock could be moved out of the main dwelling, mitigating the risk of transmitting infectious

[3] This type of targetting is not unusual for place-based approaches, for example the state of California located enterprise zones near or within Targeted Employment Areas – where more than half the population earned less than the median income (Neumark and Simpson, 2015)

[4] A full list of Board members, their occupation, and duration of service can be found in the Appendix Table A1.

[5] Improvement works included installing drainage, roads and fencing, preparing and planting fields and building new high-quality farm cottages.

diseases like typhoid (British Parliamentary Papers, 1899). A total of £57,000 was paid across 10,270 small grants that subsidised the improvement of over 13,000 dwellings and the construction of nearly 14,000 out-buildings (British Parliamentary Papers, 1909).

The second priority of the board was to develop fisheries, improve connectivity, diversify industries, and develop manufacturing skills. The programme trained fishermen; built, leased, sold, and insured vessels; constructed landing stations, piers and harbours; and subsidised boat building, net repair, fish curing, and barrel making industries. To facilitate this work, the board subsidised several maritime and rail transport routes and funded the construction of telegraph stations and laying of cables to improve communication between islands and the mainland (British Parliamentary Papers, 1920).

By 1909, the board commanded a fleet of 189 large fishing vessels, 68 of which were manufactured in the congested districts, established fish curing stations in 49 different locations, and operated 7 fisheries (British Parliamentary Papers, 1909). Further in-land, the CDB provided grant aid to establish cotton mills, carpet factories and developed the Donegal tweed and wider textile industry. To supply these industries, the CDB undertook a large skills programme which provided technical instruction in carpentry, weaving, lace-making, machine sewing, knitting/crochet, barrel making, embroidery, pattern making, shirt making and domestic service.[6] The CDB provided 875 separate technical instruction courses, with nearly half of these in lace-making and crocheting (British Parliamentary Papers, 1909). Notably, with the exception of training and instruction, the Board intentionally employed local labourers in their construction projects (British Parliamentary Papers, 1900), increasing the local multiplier effect of the investment.

Despite the programme's broad remit and activities, the scale of poverty in the west exceeded the financial resources at the board's disposal. Furthermore, the very eligibility criteria that targeted the CDBs work towards the most needy constrained the board's ability to reorganise agriculture (British Parliamentary Papers, 1901). In districts where land was exceptionally poor, improving or redistributing the land was economically unviable, and the board was forced to purchase land in nearby ineligible districts to migrate the population to better quality land (British Parliamentary Papers, 1902). That said, the policy overwhelmingly adopted a place-based development strategy rather than encourage labour market mobility, given the legal complexities of resettlement and its general unpopularity.

The UK Government did not raise new taxes to fund the policy, and the programme was instead awarded an interest payment from several dormant Irish funds.[7] This base income,

[6] Domestic service included training for housekeeping, laundry and cookery.

[7] This included the remnants of the Irish Church Surplus Fund that compensated clergy and officials of Church of Ireland when it's status of the "Established Church" was removed, the Irish Reproductive Loan Fund and the Sea Coast Fisheries fund (Breathnach, 2005).

combined with other grants and income from the CDB's activities gave the board an annual income of £199,000, worth around 2 per cent of total Irish public expenditure in 1892, rising to 3.6 per cent by 1911 (Dunraven, 1912). Compared with other policy interventions, the board's income was equal to 12.6 per cent of the total expenditure of the Irish Poor Law in 1892, or 69.1 per cent of Unions in congested counties (British Parliamentary Papers, 1893a) and it was funded similarly to the Irish Land Commission.

By 1908, the financial position of the CDB was untenable, and the board announced a moratorium on all new works, suspending all works until its funding problems could be resolved (British Parliamentary Papers, 1912). The board was formally reconstituted in January 1910 following a Royal Commission and Act of Parliament that more than doubled the board's funding and geographical remit (Breathnach, 2005). The board was slow to reconvene and was practically inactive for several months as it restructured its governance (Micks, 1925). Given the closeness of this reform to the 1911 census and the lag between projects being devised, approved, built, and brought into use, this paper does not consider the impact of this expanded programme.[8] The CDB was abolished in 1923 by the new Saorstat (Irish Free State) Government, and its powers, responsibilities and assets were centralised into a new Land Commission and Ministry of Industry and Commerce and Fisheries (Breathnach, 2005).

[8] For example by the 1st of February 1911, the board had only agreed the purchase of 33 new estates, 8 of which were in Co. Clare, which had previously been excluded from the programme. By March 1912, only 5 of these estates had been purchased and scheduled for improvement works to the sum of £356, around 0.2 per cent of the CDB's annual budget (British Parliamentary Papers, 1912).

3 Data

3.1 CDB Investment

The primary data source of this paper are the annual reports of the Congested Districts Board 1891–1910. These reports contain an exhaustive list of all CDB investment activities, including the description of the project; the relevant scheme to which it relates; its location; and the amount invested. Although the Board usually provided a qualitative report of the outcome of completed projects, they did not perform an extensive economic evaluation of their own activities. Information on the location of the project is recorded at the townland or town/village level, making it is possible to accurately geo-code all projects. As DEDs are subdivisions of Unions, investments were first linked to the relevant DED, since policy eligibility was determined at this level, and then aggregated to the Union level.[9]

Place-based policies, such as the CDB, target specific geographical regions that meet certain criteria and are, by definition, selective. Consequently, treatment is non-randomly assigned. To enrich the understanding of the policy, I reconstruct the set of eligible DEDs using a 1887 Parliamentary return of land valuations. This return represents the only surviving DED level measure of land valuations compiled on the eve of the policy. Together with project investment data, I can distinguish DEDs by their eligibility, treatment status, and treatment intensity to determine which DEDs had their eligibility and/or treatment misallocated.

Table 1 sets out the cases of eligibility and treatment allocation and misallocation.[10] In total, there were 671 DEDs that were located in a congested county and exceeded the land value criteria. Of these ineligible DEDs, the CDB invested nearly £300,000 in 185 DEDs or around £1,602 on average, with 97 per cent of this investment being made under the estates improvement scheme. Comparatively, the total and average amount invested in eligible areas exceeded that of ineligible areas. The CDB invested a grand total of over £861,000 in 324 DEDs or around £2,659 on average. While the estates improvement scheme represents a significant 66 per cent of investment in these eligible areas, marine and other schemes represent a much larger share than investment in non-eligible DEDs.

[9] Towns and villages often form part or all of a townland, while townlands are the building blocks of all higher levels of administrative geographies in Ireland. Townlands are nested within DEDs, whereas DEDs are neatly nested within Unions.

[10] There were 34 DEDs that were deemed eligible but were not, while 1 DED which should have been eligible was deemed ineligible. See appendix for visualisations of eligibility misallocation.

Table 1: Mean land values and CDB investment by eligibility

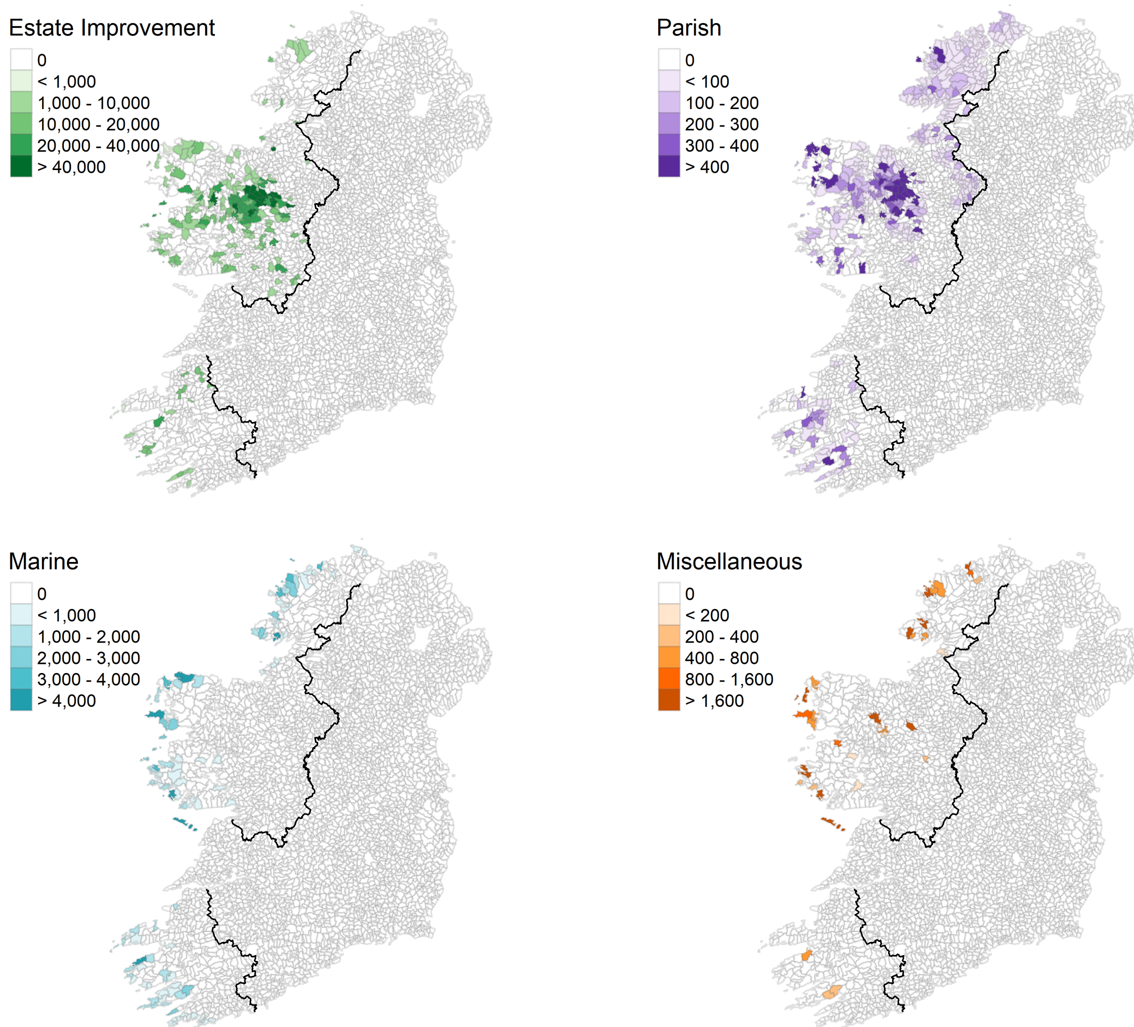
				CDB Scheme		
Group	Count	Land Value	Invest	Estates	Marine	Other
Eligible + Treat	324	1.05	2,659.43	1,761.92	415.75	481.76
		(0.36)	(4,873.44)	(3,888.74)	(1,211.19)	(72.13)
Not eligible + Treat	185	2.70	1,602.31	1,546.30	7.72	48.29
		(1.45)	(4,005.93)	(4,009.92)	(55.21)	(72.13)
Eligible + Not Treat	104	1.11	0.00	0.00	0.00	0.00
		(0.35)	(0.00)	(0.00)	(0.00)	(0.00)
Not Eligible/Treat	2,826	4.08	0.00	0.00	0.00	0.00
		(2.25)	(0.00)	(0.00)	(0.00)	(0.00)
Sample Average		3.63	336.75	249.18	39.58	7.99
		(2.31)	(1944.59)	(1,624.94)	(390.78)	(637.30)

Total number of DEDs = 3,439. Land values (per capita) and CDB investment are averages in GBP. Land value threshold to determine eligibility is < £1.50. Other investment is parish scheme and miscellaneous investment (factories, bespoke grants etc.). Standard deviation in parenthesis.

Figure 1 describes the spatial distribution of CDB investment by scheme, while Figure 2 breaks down total treatment by eligibility within congested counties and shows that treatment misallocation is driven by the estates improvement and parish schemes – the former due to an intentional decision made by the CDB to acquire higher-quality land outside of congested districts, while the latter is driven by inconsistencies between DED boundaries and larger civil parish boundaries. Although the board's investments cover a wide geographical area, they concentrated their investment in the inland districts of Roscommon and Mayo. While the number of eligible DEDs in these counties represent 26 per cent of the total, these counties were allocated 62 per cent of the board's total investment, with the lion share of this investment made under the estates improvement scheme.[11] The CDB justified their prioritisation of these counties due to their extreme levels of poverty, economic backwardness, and poor land quality (British Parliamentary Papers, 1899).

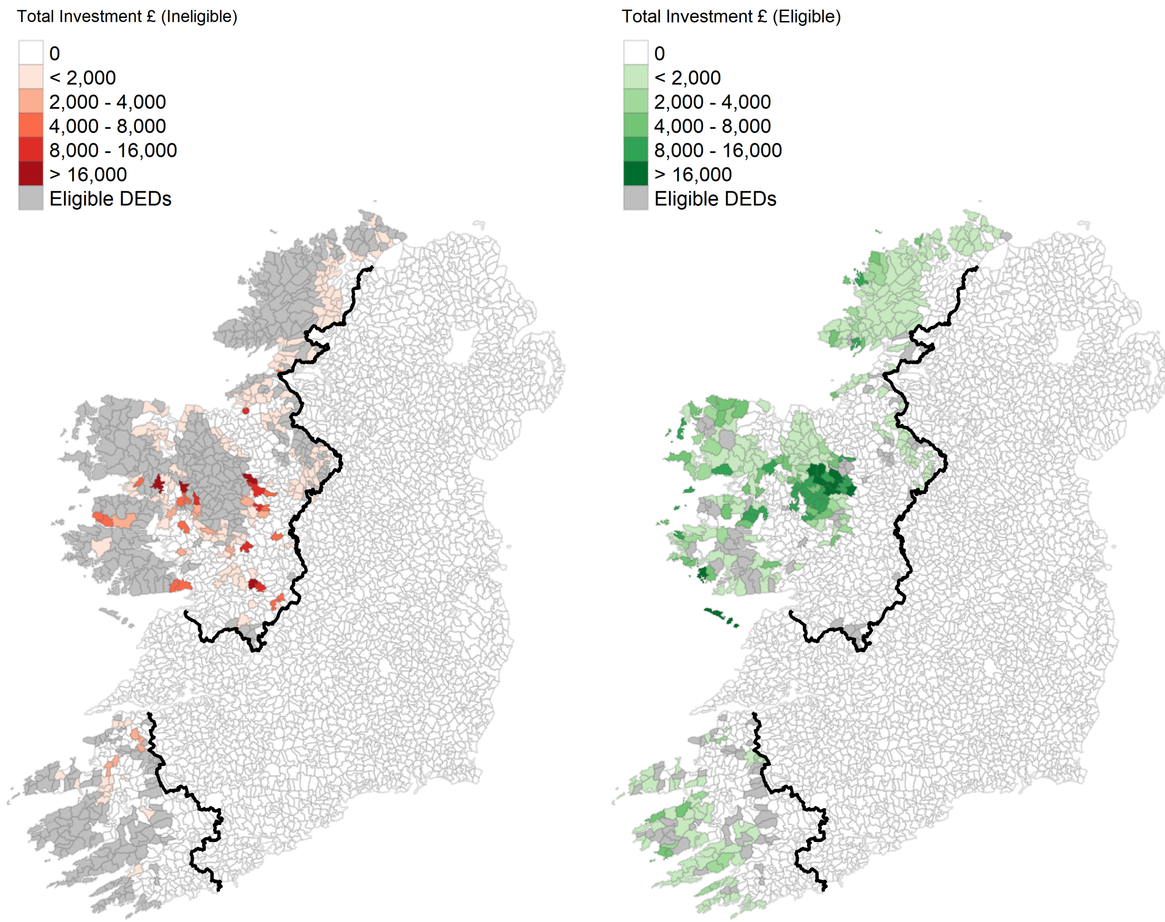
[11] A grand total of £528,915 invested in Mayo (92 eligible DEDs) and £187,026 invested in Roscommon (20 eligible DEDs).

Figure 1: Map showing treatment by scheme 1891–1909



Note: Figures in GBP (£) and congested county border in 1891 shown in black. Map legend is not consistent between maps to improve visualisation. Miscellaneous investments include bespoke grants, factories, steam ship subsidies and forestry.

Figure 2: Map showing treatment misallocation intensity 1891 - 1909



Note: Figures in GBP (£) and congested county border in 1891 shown in black.

The objective of this paper is to isolate the causal impact of CDB treatment on key developmental indicators by analysing the effect of CDB investment on range of socio-economic outcomes related to the board's priorities – modernising agriculture, reducing poverty, improving public health, and increasing employment opportunities. However, in high-labour mobility contexts, measuring these changes over time can be problematic, particularly if the policy systematically influenced migration decisions in congested DEDs. Indeed, the reorganisation of western agriculture required the board to resettle the population on better quality land. Table 2 sets out migratory statistics for all households that had their land vested and moved to holdings with better land quality between 1891 and 1909. Encouragingly, this was only 617 households, half of of which were moved to a holding within the same agricultural estate. 33 per cent were moved to a new estate, while 18 per cent were moved to a different county.

That said, the data reported on these households give an interesting insight into the board's agricultural reorganisation projects. In 74 per cent of cases, migrated households received more land than they previously owned, with average holding sizes nearly doubling from 14.37 acres to 29.83 acres. Excluding the 124 households that did not hold any land, increases the old holding average size modestly to 17.99 acres.[12] In 81 per cent of cases, tenants were granted better quality land than they previously owned, with average rents increasing from £0.38 to £0.54 per acre. For holdings where land quality did not increase, farm size was usually much larger, with more than a sixfold increase in average acreage.[13] While this data suggests that the CDB did play a role in encouraging labour mobility, the actual numbers of households moved was minor. Indeed, the CDB often expressed its frustration at farmers who opposed its efforts, particularly those who refused to sell their holdings or resisted local development initiatives (British Parliamentary Papers, 1909).

[12] These households usually were either landless labourers such as caretakers and herders or evicted tenants/squatters.

[13] There was only one household that was resettled on a holding that was both smaller and less valuable than their old holding.

Table 2: Migrated Farmer Statistics

Congested County	Households	Acreage Old	Acreage New	Rent/Acre Old	Rent/Acre New
Cork	2	11.50	42.01	0.25	0.36
Donegal	38	4.58	14.63	0.43	0.63
Galway	127	8.55	29.82	0.40	0.54
Kerry	14	25.54	55.02	0.28	0.36
Leitrim	1	0.00*	35.34	0.00*	0.65
Mayo	280	23.75	33.26	0.37	0.50
Roscommon	132	14.65	24.56	0.39	0.61
Sligo	23	14.06	26.55	0.45	0.57
Average		17.67	29.83	0.38	0.54

*Old holding data unavailable- holding redistributed to adjoining tenants and not vested by the board. Rent/acre is the estimated "fair rent" calculated by the CDB and is in GBP/acre.

3.2 Poverty, Health, and Agriculture

Poverty data has been collected from the annual reports of the Local Government Board (LGB). Data is collected on all 158 Unions, including the amount of poor rate collected (property tax), spend on poverty relief, poor law valuation, the number of individuals who became inmates in the workhouse, received out-relief,[14] were confined in asylums, average length of workhouse stay, average daily number of inmates in the workhouse, and expenditure on clothes and food. Given that there were no systematic changes as to how individuals qualified for poor relief over the period, this data allows us to construct a consistent and generalised measure of absolute over the period of interest.

Absolute poverty is measured as the weighted aggregation of several poverty indications and includes; Union means adjusted expenditure on Poor Relief, workhouse admissions, out-relief admissions, and average length of workhouse stay. Weights are estimated from the covariance between indicators using a Principal Component Analysis, before the final scores are rescaled to a range from 1 to 100, with 100 representing the Union and year with the highest poverty level in the period. Summary statistics are reported in Appendix A in Table A2 and confirm that poverty rates declined between 1891 and 1911 by around 12 per cent.

Public health data is also collected from the same reports. In addition to feeding and

[14]Out-Relief was a substitute for the workhouse. Rather than enter a workhouse, an individual receiving out-relief was allowed to stay at home and sent a small payment of around 2 shillings a week or payment in-kind in exchange for labour on public works.

clothing those in destitution, Unions also provided a rudimentary system of free healthcare and invested in basic sanitation facilities (Geary, 2011). Individuals who could not afford private healthcare were entitled to acquire a voucher that allowed them to access free medical treatment through a Union employed doctor, midwife, pharmacist, or nurse. For each Union, data is collected on the number of doctors and midwives employed by the Union, total expenditure on medical supplies, number of medical dispensaries, smallpox vaccines administered, and the number of medical vouchers distributed for both home or dispensary visits. Together, this data allows us to calculate the share of the population who relied on free medical care, and explore whether CDB investment had a wider effect on regional well-being.

Between 1891 and 1911, evidence on public health improvements is mixed. While the number of smallpox inoculations fell markedly, from an average of 574 to 447, and average Union expenditures on medical supplies declined by roughly 33 per cent, the average number of Medical Vouchers issued by Union officials rose from 2,499 to over 3,000. However, these vouchers, which entitled recipients to free medical treatment, do not indicate how many were actually redeemed, and some evidence suggests they were subject to corrupt practices (Geary, 2011). The number of drug dispensaries and doctors remained largely unchanged, yet the number of midwives employed increased from fewer than one per Union to nearly five, suggesting some improvement in the provision of pre- and post-natal care. Summary statistics for poverty and public health are presented in Appendix A in Table A2.

Agriculture data is taken from the annual reports of the Department of Agriculture and Technical Instruction (DATI) for Ireland at Union level. Several measures of agricultural productivity are constructed to explore the association of CDB agricultural development schemes and agricultural output. I develop a measure of crop output per acre in 1891 prices using total acreage and national output statistics for potatoes, oat, wheat, barley/mangle, flax, and hay at Union level. Between 1891 and 1911, crop outputs increased markedly by around 13 percent, with most of this increase driven by an expansion of potato output. Livestock statistics are also collected and calculated on a per holding basis in 1891 prices. This includes the number of farm-use horses, mules and asses, cattle, sheep, swine, and poultry. Finally, data on agricultural topology is collected including the ratio of cropland to grassland and the total number of small agricultural holdings under 15 acres in size. A full description of agricultural summary statistics are reported in Appendix A in Table A3.

4 Identification Strategy

4.1 Estimation Framework

The most appropriate approach to evaluate the effect of CDB investment on poverty is to model the change poverty between 1891 and 1911 as a function of the total amount of CDB investment within a difference-in-difference (DiD) framework with Two-Way Fixed Effects (TWFE). Since DEDs are nested within 158 Unions, and the richest sources of poverty, public health, agricultural, and employment data for the period is available at Union level, I undertake the analysis at this level. This TWFE model can be expressed in the regression equation:

$$Y_{it} = \beta_1 \sum_{x=1}^{n_i} \text{Treat}_{ixt} + Z_{itk} + \delta_i + \gamma_t + \varepsilon_{it} \tag{1}$$

Where Y_{it} is the main outcome variable of interest and is either poverty headcount, measure of public health, agricultural productivity, or economic inactivity of Poor Law/ Urban-Rural District i at time t. $\beta_1 \sum_{x=1}^{n_i} \text{Treat}_{ixt}$ represents the total amount of CDB investment in GBP (£) made to all x DEDs located within the boundary of Poor Law Union i at time t. δ_i are a set of individual Union fixed effects to account for time-invariant unobservable characteristics within Unions, allowing for the effect of CDB treatment to be heterogenous, while γ_t are year fixed effects to absorb shocks that are common between Unions in each time period.

Z_{ik} is a vector of controls which are likely to affect the variable of interest. In this poverty model, to account for differences in poor relief that are linked to Poor Law financial constraints I control for Union land valuations and its square, tax revenues, and the average property tax rate. Since poor relief was administered at a local level, I control for possible confounders that are mechanically related to the number of persons relieved. This includes population density, the average length of stay in the workhouse to account for different turnover rates, the share of relief that is out-relief,[15] and the total expenditure on poor relief during the calendar year including all grant aid and loans. Finally, I control for the share of small agricultural holdings that are 30 acres or smaller to account for changes in agricultural structure and land ownership.

The model to measure the effect of CDB treatment on public health is identical to the poverty model, except that the control of total expenditure is replaced by the amount spent on medical supplies to account for differences in service provision by controlling for the

[15] Workhouse relief was emphasised in Unions controlled by conservative boards, whereas out-relief was emphasised predominantly in nationalist control boards (Crossman, 2006).

number of medical dispensaries, doctors, and midwives employed by the Union. Similarly, for agricultural productivity I remove the poor relief related covariates and control for Poor Law valuations and its square to account for differences in productivity that are driven by land quality, a measure of crop diversity to account for crop specialism, total population, the share of small agricultural holdings and the ratio of grassland to cropland as a broad measure of underutilised agricultural land. Finally, the economic inactivity model controls for land valuations and its square, population density, the share of small holdings, crop-output per acre and a measure of poor relief 'generosity' to account for potential labour supply effects. ϵ_{it} is the remaining error term and standard errors are clustered at the Union level, i.e. the level of individual fixed effects thereby assuming that the error term is likely to be related within individuals rather than between individuals.

4.2 Identification and Balance tests

There are three identification assumptions that the models must meet. Firstly, that there are stable treatment values, where the effects of CDB treatment in one Union do not spillover to another Union. Secondly, there should be no anticipation effect of treatment where, in the anticipation of being treated, Unions will behave differently. And thirdly, that there are parallel trends between treated and control groups prior to the intervention, meaning that socio-economic outcomes in treated Unions would not have changed in the absence of treatment.

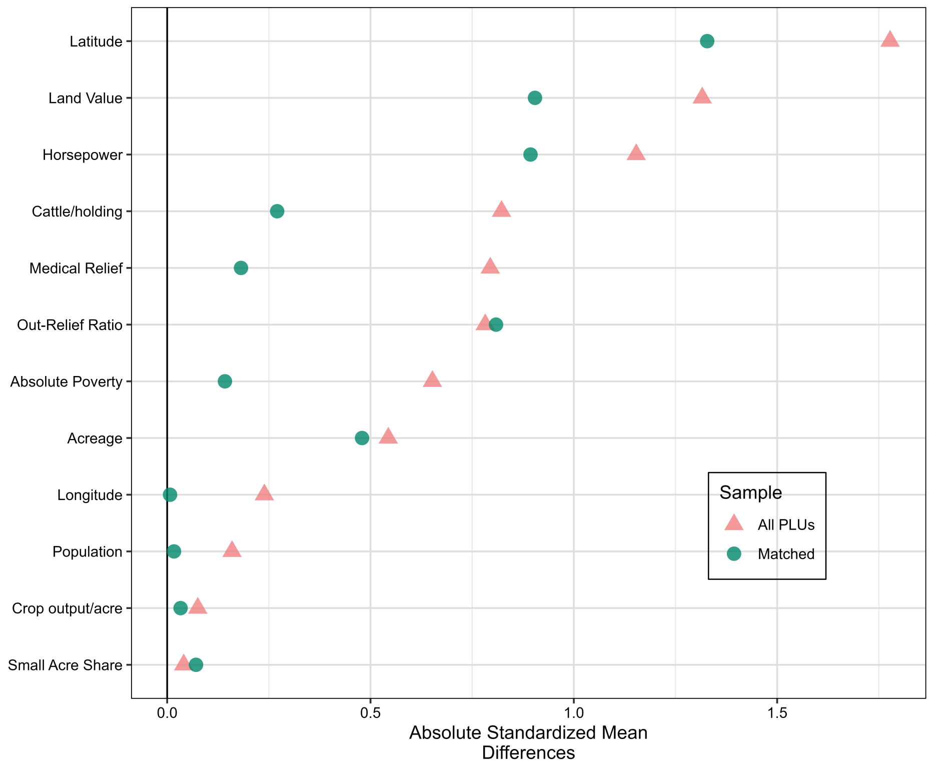
Since Unions are an aggregated geography composed of DEDs and the fact CDB investment was made at the DED level, it is highly likely that I meet the assumption of stable treatment values since Unions are relatively large. That said, the exception to this will be investments that were made in DEDs along a Union boundary, especially infrastructure investments or large factories, which may have an impact on a wider geographical area than the locality that the investment took place. Given the nature of CDB investment and the fact that I observe Unions before and after treatment, it is unlikely that the estimates will be biased by anticipation effects. For example, the measure of absolute poverty exploits poor law statistics which was a highly stigmatised institution of last resort for those who could no longer meet their own subsistence requirements. It is unlikely that such individuals could defer entering or exiting a workhouse in the anticipation of benefitting from CDB investment.

The primary identification assumption of the model is that in absence of treatment, socio-economic outcomes in treated DEDs would not have changed. Although I cannot directly observe this counterfactual, it is possible that systematic changes in Union characteristics that are not common to all Unions over time may be correlated with treatment and bias the estimates. This would be the case if the outcome variables for each treatment group are trending differently. Although baseline differences between treated and untreated DEDs are not problematic for the assumption, it is problematic if the control group of Unions are systematically different than treated Unions. Since treatment is non-random, there is a high likelihood that one of the treatment groups is developing differently across time, biasing the estimates.

4.2.1 Matching

Before testing for parallel trends, I ensure that there is a stable and comparable group of control Unions by matching treated Unions to their nearest comparable untreated Unions across a vector of socio-economic characteristics prior to the intervention in 1891. These characteristics include longitude and latitude, land valuation, number of cattle and farm horses/mules per holding, crop output per acre, absolute poverty and medical relief headcounts, total population, acreage, and the amount of out-relief distributed as a share of total relief. Figure 3 is a covariate balance plot which shows the absolute standardised mean differences between the matched characteristics between all Unions and the matched sample. After matching, the sample becomes much more comparable and I drop 58 incomparable Unions, predominantly those containing large urban centres such as Belfast and Dublin, as well as most of the wealthy pasture province of Leinster and north-east Munster. Figure A.3 in Appendix A maps the matched sample of Unions.

Figure 3: Poor Law Union Covariate Balance Plot



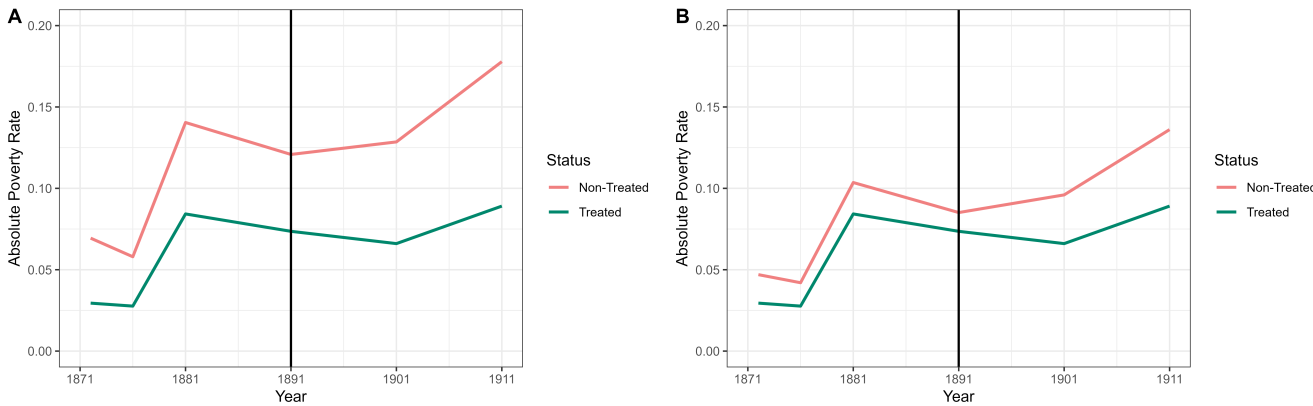
Note: Total number of Unions reduced from 158 to 100 in matched sample.

4.2.2 Parallel Trends

Figure 4 visualises changes in the poverty headcount from 1872 until 1911 first using the full sample of Unions before dropping incomparable Unions. In comparison to eachother, the effect of the matching is obvious and reduces the systematic differences between treated and control in each period. Encouragingly, even without matching, there is strong evidence that the assumption of parallel trends holds. Prior to the intervention in 1891, the change in poverty rates between treated and control is comparable—it is only after the introduction of the policy that the trends diverge, with poverty rates initially falling before increasing slower in treated Unions.

With this matched sample, the argument that the parallel trends assumption holds is more credible. By improving the comparability of Unions across treatment groups, I reduce the risk that unobserved characteristics that evolve over time driving changes in the outcome variable. For example, processes of industrialisation and economic agglomeration in Unions with urban centres, could alter how poverty changes over time in some of the control Unions. Moreover, in the matched sample, trends in poverty prior to treatment are better aligned, which strengthens the argument that in the absence of treatment, poverty would have followed a similar trajectory. As such, this pre-trend similarly, combined with improved covariate balance, supports the validity of the parallel trends assumption.

Figure 4: Change in average poverty rate by treatment group



Note: Panel A includes all Unions while Panel B uses the matched sample. Black vertical line indicates the year 1891 when the CDB was established.

5 Results

5.1 Poverty Levels

To explore whether CDB investment programmes precipitated an improvement in socio-economic conditions, I estimate the TWFE model as specified by Equation 1. The results are reported in Table 3 where columns (1) explores the effect of the policy controlling for Union socio-economic characteristics; (2) adds Union financial controls to account for differences in relief practices driven by funding; (3) adds TWFE; and (4) uses the matched sample of Unions only.

In all specifications, I find that CDB investment significantly reduced poverty levels. In the first column, the coefficient of -0.161 indicates that a one-standard deviation increase in CDB investment led to a reduction in absolute poverty levels by 0.161 points (95% $CI[-0.25, -0.07]$). When Union financial controls are added in column (2), the coefficient nearly doubles, before falling moderately with the inclusion of TWFE in column (3). This reduction suggests that, for the full Union sample, around one-third of the estimated effect of CDB investment on poverty levels can be contributed to time-invariant unobservable characteristics within Unions, as well as macroeconomic shocks affecting all Unions.

Column (4) uses the preferred matched sample, removing incomparable Unions from the sample, and is the most saturated of all poverty models. It indicates that a one-standard deviation increase in CDB investment substantially reduced absolute poverty by 0.223 points (95% $CI[-0.43, -0.02]$). Over the period, the average treated Union received about £23,100 in investment. A one-percent increase in this amount (roughly £230) reduced absolute poverty by around 0.02 percentage points. In 1891, the average absolute poverty rate in treated Unions was an index value of 32.02,[16] implying that an additional £230 of investment lowered the index by approximately 0.07. For comparison, such a sum was not trivial at the local level: the average parish improvement grant amounted to around £350, while the average road development project cost around £220.

Table 3: Main Results – Absolute Poverty Levels

	Absolute Poverty Level			
	(1)	(2)	(3)	(4)
CDB Investment	-0.161***	-0.283***	-0.204***	-0.223**
	(0.044)	(0.042)	(0.071)	(0.106)
Small Holdings Ratio	0.050	0.105**	-0.048	-0.062
	(0.064)	(0.052)	(0.132)	(0.158)
Population Density	-0.091	-0.073	0.258	0.450
	(0.179)	(0.116)	(0.862)	(0.660)
PLV	-0.363***	-2.650***	-3.256**	-0.654
	(0.095)	(0.852)	(1.402)	(2.138)
PLV square	0.143**	0.082*	-0.059	0.141
	(0.068)	(0.046)	(0.450)	(0.431)
Union Financial		✓	✓	✓
R^2	0.150	0.331	0.729	0.722
Observations	316	316	316	200
TWFE			✓	✓

All dependent variables are logged prior to z-score transformation to reduce skew. CDB investment is total amount of investment in GBP. Union Financial controls include tax revenue, Poor Law Valuation and its square, and the local tax rate (property rates). Small holdings share is the share of agricultural holdings under 15 acres. Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

5.2 Public Health

It is unclear whether CDB investment would directly affect public health. Although improvements to agricultural holdings and the construction of modern cottages may have contributed to better health outcomes, only the Parish Improvement Scheme explicitly aimed

[16] Poverty rates are scaled between 1–100, where 100 corresponds to the year and Union with the highest poverty.

to improve public health. This scheme provided small grants for household improvements, prioritising applicants who ensured proper storage and processing of manure and the removal of farm animals from dwellings to improve sanitation and reduce the risk of outbreaks of typhus and typhoid (British Parliamentary Papers, 1899). Since the Board did not systematically intervene in public health provision, any observed effects of CDB investment on health maybe indirect, instead arising as second-order consequences of general economic development rather than as direct outcome of the policy.

As noted in the data section, the Union-run public healthcare system was prone to corruption, as medical vouchers were often issued pre-emptively as a form of patronage (Geary, 2011). This presents a challenge since data is only available on the number of vouchers issued, and not those actually redeemed. Indeed, the correlation between vouchers issued and Union expenditure on medical supplies is only +0.35, indicating that more vouchers were issued than needed. Given that the marginal value free medical relief is higher in poorer western areas, it is plausible that patronage networks are correlated with CDB investment, biasing estimates upwards towards zero.

Table 4 describes the results of Union-level public health regressions. Column (1) explores the effect of CDB investment on medical vouchers controlling for a range of socio-economic characteristics, including average length of workhouse stay to account for differences linked to unsanitary workhouse conditions.[17] Column (2) adds controls for public healthcare supply, including the number of medical dispensaries, doctors, midwives, and total expenditure on medical supplies. While column (3) restricts the analysis to the matched sample, excluding all incomparable Unions. In contrast to the poverty results, there is no evidence that CDB investment affected the number of medical vouchers issued.

Assuming only the sick were treated by Union medical staff, expenditure on medical supplies per head provides an indirect measure of changes in public health. Column (4) tests this by replacing the number of medical tickets issued with annual medical expenditure per head. The results show that a one-standard-deviation increase in CDB investment reduced medical expenditure per head by 0.128 points in treated Unions (95% $CI[-0.25, -0.00]$). This translates into a 0.02 percentage point decline in expenditure for every 1 percent increase in CDB investment (95% $CI[-0.06, 0.00]$), equivalent to a fall of approximately $3\frac{1}{4}$ pence fall (£0.01) for every £1 of CDB investment. While these findings indicate that CDB investment reduced medical expenditures, it remains unclear whether this reflects genuine improvements in public health, local price changes in medical supplies, or differences in how treated Unions

[17] A higher out-relief ratio implies individuals are less likely to be exposed to pathogens in the workhouse, while higher average workhouse stay captures the effect of weakening immune systems and longer pathogen exposure periods.

ordered, purchased, and stored supplies.

Table 4: Results – Effect of CDB Investment on Public Health

	Medical Vouchers			Medical Spend
	(1)	(2)	(3)	(4)
CDB Investment	-0.103	-0.071	-0.070	-0.128**
	(0.063)	(0.062)	(0.106)	(0.063)
Small Holdings	0.033	0.039	-0.082	0.067
	(0.099)	(0.101)	(0.148)	(0.100)
Population Density	-0.779	-0.827	-0.356	-0.070
	(0.814)	(0.758)	(0.595)	(0.433)
Out-Relief Ratio	0.152	0.181*	0.271*	-0.223**
	(0.094)	(0.095)	(0.160)	(0.101)
PLV	1.618**	1.320*	0.724	-0.055
	(0.810)	(0.700)	(1.212)	(0.818)
PLV square	0.116	0.145	0.052	-0.198
	(0.401)	(0.368)	(0.507)	(0.318)
Workhouse Stay	0.092	0.048	0.047	0.127
	(0.073)	(0.069)	(0.108)	(0.080)
Dispensaries		0.006	0.020	0.252
		(0.153)	(0.248)	(0.173)
Doctors		0.043	0.101	0.185
		(0.360)	(0.408)	(0.356)
Midwives		0.071	0.135	0.001
		(0.065)	(0.090)	(0.080)
Medical Spend		0.339***	0.391**	
		(0.104)	(0.156)	
Medical Vouchers				0.185***
				(0.068)
Union Financial	✓	✓	✓	✓
R^2	0.872	0.883	0.809	0.910
Observations	316	316	200	200
TWFE	✓	✓	✓	✓

All dependent variables are logged prior to z-score transformation to reduce skew and are defined as before. Workhouse Stay is average stay in days, while Medical Spend is measured in GBP (£). Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

5.3 Agriculture

5.3.1 Tillage

Given that the policy improved living standards, was this effect driven by the CDB's emphasis on agricultural development in rural areas? To investigate, I test whether the policy accelerated the shift from low-value subsistence tillage to higher-value pasture farming using the matched sample of Unions.[18] I construct approximations of crop output per acre for the major tillage crops – potatoes, hay, wheat, oats, barley, and flax – and adjust all measures to 1891 prices to rule out the influence of price changes.[19] I use a variation of Equation 1 that controls for differences in agricultural productivity linked to the share of small holdings, land valuations, and crop specialisation. [20] I also control for the grass ratio, which measures the ratio of grassland to tillage, as an imperfect measure of pasture and barren land in each Union.[21]

The advantage of the TWFE framework is that time-invariant confounders that affect agricultural output such as soil quality and weather are fully accounted for. As before, all variables are logged prior to z-score transformation to reduce skew, account for non-linear relationships between variables, and improve interpretability. The results are reported in Table 5 and show that CDB investment significantly reduced tillage output per acre. Column (1) describes the effect of CDB investment on total tillage output – a one-standard deviation increase in CDB investment reduced total crop output by 0.208 points (95% $CI[-0.39, -0.02]$). This corresponds to 0.01 per cent fall in output for every 1 per cent increase in CDB investment, meaning a £1 of CDB investment reduced crop output by around half a penny per acre.[22]

Columns (2)–(7) decomposes this total output statistic to analyse which crops were driving this effect. I find that oats, flax, and hay mattered the most for the decline in tillage, with the largest share of the decline driven by oats. This provides some evidence that the CDB successfully reduced farmer's reliance on subsistence tillage since, at the time, oats were a staple crop for most western households (Tuke, 1880). A one-standard deviation increase in CDB investment is associated with a 0.384 point fall in oat output per acre (95% $CI[-0.59, -0.17]$), corresponding to a 0.01 per cent fall in oat output for every 1 per cent increase in CDB investment. In treated Unions, not only did oat output per acre fall, but the total amount of acreage under oats also fell, indicating that farmers were transitioning higher quality land towards other agricultural pursuits.

[18]The matched sample of Unions is used to improve the credibility of the parallel trends assumption, reducing the risk that other unobserved characteristics that evolve over time are driving these results.

[19]See Appendix B for a note on how this is calculated.

[20]I use a Simpson's Diversity Index to measure crop specialisation. This Index measures the relative abundance of each crop where $Simpson = 1 - (\frac{\sum n(n-1)}{N(N-1)})$. n is the acreage of each crop, while N is the total acreage of all crops. Index values closer to 1 indicate high diversity, while lower values indicate less diversity.

[21]Agricultural enumerators recorded mountainous grassland differently across years and Unions – if the enumerator could see sheep it was designated as pasture, if not it was sometimes designated as barren (DATI, 1902). Results are not sensitive to the inclusion of this control.

[22]Total crop output per acre in 1911 in untreated Unions was worth around £50.57 (1891 prices).

Table 5: Agricultural Output – Tillage

	All Crops (1)	Potatoes (2)	Hay (3)	Wheat (4)	Oats (5)	Barley (6)	Flax (7)
CDB Investment	-0.208**	-0.058	-0.183**	-0.045	-0.384***	-0.067	-0.198**
	(0.095)	(0.090)	(0.092)	(0.072)	(0.108)	(0.099)	(0.092)
Small Holdings Share	0.120	-0.121	0.539**	0.072	-0.159	0.004	0.104
	(0.221)	(0.222)	(0.265)	(0.185)	(0.099)	(0.166)	(0.234)
Population Density	-0.692	-0.955	2.150***	0.123	-0.144	-0.050	-0.804*
	(0.614)	(0.599)	(0.591)	(0.446)	(0.628)	(0.629)	(0.449)
Grass Ratio	0.701***	0.534**	-0.607***	0.045	0.193	-0.049	0.533***
	(0.243)	(0.210)	(0.204)	(0.225)	(0.247)	(0.334)	(0.190)
Simpson Index	0.037	0.208	-0.243	-0.101	0.018	-0.060	-0.040
	(0.176)	(0.179)	(0.153)	(0.186)	(0.265)	(0.348)	(0.165)
PLV	-0.427	-0.382	1.611	-0.882	-0.605	0.435	0.171
	(1.745)	(1.700)	(1.275)	(2.529)	(1.488)	(1.878)	(1.187)
PLV square	0.348	0.888	-0.569	0.762	-0.913	-0.811	-0.317
	(0.608)	(0.556)	(0.432)	(1.123)	(0.572)	(0.643)	(0.430)
R^2	0.756	0.781	0.772	0.714	0.757	0.629	0.801
Observations	200	200	200	200	200	200	200
TWFE	✓	✓	✓	✓	✓	✓	✓

Crop output is calculated per acre. All dependent and independent variables are logged before z-score transformation to reduce skew. Wheat, oats, barley and flax are log(x+1) to account for unions that do not raise these crops. Small holdings is the share of agricultural holdings under 15 acres. The simpsons index is a measure of ecological diversity, which in this case measures the relative diversity of crops sown in a Union. PLV is the Poor Law Valuation and measures the total value of land in a union (quality). Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

For flax, a one-standard deviation increase in CDB investment reduced flax output per acre by 0.198 points (95% $CI[-0.38, -0.02]$). Although this decline is significant, I note that by the late 1800's, flax was grown in relatively few Unions as the Irish linen industry increasingly sourced cheaper flax from abroad (Bielenberg, 2009).[23] This limited variation in flax production aside, these results suggests some evidence that the CDB better equipped western farmers to respond to changing market conditions by transitioning away from crops where local demand was in decline.

Hay production also fell in CDB-treated areas. A standard deviation increase in CDB investment reduced hay output output by 0.183 points (95% $CI[-0.36, 0.00]$), equivalent to just over a 0.01 per cent fall for every 1 per cent increase in CDB investment. As shown by Table 5, hay production was higher in areas dominated by small holdings, which in many areas were not more than a series of small, detached plots of land. Per imperial ton, hay was valued at around half the rate of oats, and even carried lower prices than potato.[24] Because hay output data only captures mown grass and excludes pasture, the results suggest that farmers in CDB-treated areas were shifting higher quality land away from low-value fodder production – especially since total acreage under hay also increased in treated Unions.[25]

5.3.2 Pasture

If tillage declined, then pasture farming was the clearest candidate to take its place. To test this, I estimate a variation of Equation 1 that examines how CDB investment affected the number of livestock per farm, again adjusting measures for 1891 prices to rule out the influence of price changes. Pasture acreage data is unreliable, as enumerators classified grassland inconsistently across both time and Unions (DATI, 1902). To address this, I instead use livestock counts per holding – including horses,[26] cattle, sheep, swine, and poultry – and, given the richness of livestock and price data, I allow output figures to vary by animal age.

Although livestock output figures are not directly comparable with my approach to tillage, an increase in the number of livestock held per farm in treated Unions suggests that the CDB succeeded in their objective to modernise agriculture away from low-value subsistence crops and accelerated the transition to pasture farming. As expected, I find evidence that the CDB increased the number of cattle, swine, and poultry per farm, however, I find that CDB investment also reduced the number of horses reared for recreational use, and had no effect on the number of work-horses or sheep – these results are reported in Table 6.

[23] Of the 50 Unions containing CDB eligible DEDs, only 16 of them produced flax.

[24] Imperial ton of hay was worth around £3.29 in 1891 prices. Oats and potatoes were priced at £6.66 and £3.58 per ton respectively.

[25] Acreage under hay increased by 33 per cent between 1891–1911.

[26] Price data for agricultural work horses is not available so simple counts used only.

Table 6: Agricultural Productivity - Livestock

	Horse 1 (1)	Horse 2 (2)	Cattle (3)	Sheep (4)	Swine (5)	Poultry (6)
CDB Investment	0.027	-0.159**	0.051**	0.000	0.096**	0.091*
	(0.025)	(0.065)	(0.023)	(0.031)	(0.047)	(0.047)
Small Holdings Share	-0.231***	0.101	-0.145***	-0.189*	-0.151***	0.034
	(0.078)	(0.110)	(0.034)	(0.100)	(0.056)	(0.106)
Population Density	-0.286*	0.033	-0.278*	0.331*	-0.394	-1.014***
	(0.146)	(0.368)	(0.144)	(0.185)	(0.255)	(0.284)
PLV	-0.097	1.704**	0.531	0.653**	-1.887**	0.540
	(0.368)	(0.835)	(0.350)	(0.324)	(0.918)	(0.912)
PLV square	-0.192	-0.068	-0.479***	0.013	-0.027	0.388
	(0.145)	(0.314)	(0.122)	(0.140)	(0.258)	(0.244)
Grass Ratio	-0.189***	-0.003	-0.217***	-0.013	-0.370*	0.084
	(0.055)	(0.151)	(0.064)	(0.053)	(0.204)	(0.135)
Simpson Index	-0.002	0.142	0.066	0.137**	0.439***	0.192*
	(0.052)	(0.098)	(0.053)	(0.060)	(0.121)	(0.098)
R^2	0.984	0.909	0.985	0.981	0.939	0.940
Observations	200	200	200	200	200	200
TWFE	✓	✓	✓	✓	✓	✓

All livestock figures (except horses) are z-scores of the logged animal headcount per holding in 1891 prices. Price data not available for horses and is a simple count. Horse 1 describes horses used for agricultural purposes, Horse 2 describes horses used for recreation or amusement. All other variables defined as before. Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Column (1) estimates the effect of CDB investment on the number of farm workhorses per household, a direct agricultural horsepower, while column (2) captures the effect on recreational horses. The results show no impact on workhouses but a significant decline in recreational horses: a one-standard deviation increase in CDB investment reduced their number by 0.159 points (95% $CI[-0.29, -0.03]$). The null finding on workhorses is consistent with our tillage results, as these horses were primarily used to drive ploughs. By contrast, the negative effect on recreational horses is less straightforward and may reflect the policy's influence on a broader shift in Irish social structure.

The CDB was also a major purchaser of land, acquiring more than 180 estates covering over $1,800km^2$, many of them owned by gentry and absentee landlords. Since recreational horses were typically associated with wealth, it is plausible that these landowners – many of whom anticipated the trajectory of the Government's Land Acts – took advantage of the CDB's presence by liquidating their assets either prior to or following the sale of their estates. Although speculative, this interpretation suggests that the CDB's negative effect on recreational horse counts may reflect an acceleration in the decline of the Irish landlord class. To complete the analysis, Appendix A Table A6 shows that CDB investment had no effect on the number of horses used for traffic and manufacturing, nor on the number of mules or asses, thereby ruling out broader confounders within the horse-breeding sector.

For other pasture animals, I find that CDB investment led to a significant increase in the number of cattle and swine per holding. A one-standard deviation increase in CDB investment is associated with a 0.051 point increase in cattle (95% $CI[0.01, 0.10)$ and a 0.096 point increase in swine (95% $CI[0.00, 0.19)$. These correspond to an increase in the number of cattle by around 0.004 per cent and and increase in the number of swine by around 0.012 per cent for every 1 per cent increase in CDB investment. Moreover, Table 6 shows that CDB investment increased the number of poultry by around 0.091 points for a one-standard deviation increase in investment. However, this estimate is imprecise and likely underestimates the true treatment effect. Given the magnitude of poultry numbers,[27] counts were probably subject to error. Most were likely reported directly by farmers, who may have provided enumerators with an approximation. This introduces classical measurement error, which attenuates the estimated treatment effect toward zero.

To conclude this section on agriculture production, I provide a rough comparison between tillage and pasture results by converting changes in these outputs into net changes in GBP (£), assuming a hypothetical farm of average size in 1911. A 1 per cent increase in CDB investment of around £230 in a Union reduced the value of crops produced by an average holding by approximately £0.07, while increasing the value of cattle and swine by about

[27] 15.2 million in 1891 and 25.4 million in 1911.

£0.28, leaving a net benefit per holding of £0.21. If all farms in the average Union were identical, a £230 increase in CDB investment would generate a substantial local agricultural multiplier effect of 3.7.[28] Finally, in Appendix A Table A5, I show that CDB investment had no significant effect on the number of small agricultural holdings. This confirms that changes in tillage and pasture were not driven by changing returns to scale but by an accelerated transition from plough to pasture.

5.3.3 Agricultural Capital and Population

To extend and corroborate the finding that the CDB's agricultural focus reduced poverty and improved living standards, I use full-resolution CDB investment data at the DED level ($n = 3,439$) and demographic data from the Province Reports of the 1891 and 1911 Censuses. Since that household returns for the 1891 Census have not survived, these decadal reports provide the richest available demographic data source for nineteenth-century Ireland. At the DED level, they record population by sex, housing (inhabited, uninhabited, and under construction), out-office/farmstead buildings, and land valuations.

Of the 3,446 DEDs in 1891, 274 had their borders modified by the 1898 Local Government Act, raising the total to over 3,600. The quality of census data allows these boundary changes to be detected and fully accounted for in the analysis. Summary statistics for key demographic outcomes, presented in Table A4 in the Appendix A, show that DEDs in Congested Counties were poorer: they depopulated more slowly, consistent with poverty traps limiting migration (Ó Gráda and O'Rourke, 1997), and contained fewer out-offices/farmsteads per household. Although these differences are statistically significant in the full sample, they attenuate toward zero at shorter distances from the Congested County border, confirming that the poorest and least comparable DEDs were those located further west.

This data allows me to test two hypotheses. First, if the policy accelerated the transition to pasture, then the number of out-offices/farmsteads per household should rise, reflecting the need to house livestock and store equipment. Although the province volumes do not distinguish between specific building types, out-offices/farmsteads included stables, animal sheds/barns, workshops, crop stores, and dairy sheds, and therefore serves as a useful proxy for agricultural capital.[29] Moreover, because the CDB directly subsidised the construction of such buildings for the poorest farmers, this measure also captures whether low-income

[28] An average treated Union had 4,056 holdings with an average holding size of 38.8 acres, creating a total agricultural income boost of £851.76.

[29] Out-offices/farmsteads were classified into three groups: (1) stables, coach houses, and harness rooms; (2) animal and dairy sheds; and (3) auxiliary buildings such as workshops, forges, laundries, general sheds, and storage for turf, potatoes, or crops.

households benefited from the policy.

Second, if poorer residents were the primary beneficiaries of the policy, CDB investment should not have triggered an influx of farmers migrating from wealthier areas to exploit its benefits. Although the CDB attempted to resettle poorer farmers on better-quality land, as discussed in the data section, very few agreed to relocate. By contrast, if farmers from wealthier areas had moved into the Congested Districts to access benefits from the policy, improvements in agricultural capital or transition to pasture might be a function of their greater economic resources rather than the policy's effect. To test this, I examine four population-based variables – population change, stock of inhabited/uninhabited housing as a proxy of changes in the purchase and construction of dwellings, sex ratios as a proxy of out-migration, and average household size as a proxy for socio-economic status.

Because eligible DEDs had to be located within a designated Congested County, I employ a fuzzy geographical Regression Discontinuity Design (RDD), exploiting distance to the Congested County Border, to estimate the local causal effect of the policy. Specifically, I examine its effect on (1) the number of out-offices/farmsteads per household as a proxy of agricultural capital and (2) the aforementioned population variables in DEDs near the Congested County border. Provided that the likelihood of treatment is discontinuous at the Congested County border and outcomes remain smooth prior to the intervention, a geographical RDD is an ideal approach to measure the local impact of CDB investment on agricultural capital and population.

As CDB investment selects into the poorest areas, a two-Stage-Least-Square (2SLS) approach is built into the RDD to resolve endogenous assignment of treated. Within this fuzzy design, results must be interpreted as being doubly local since the findings only relate to DEDs close to the border, and is valid for compliers only. Since there is some probability of any DED within a congested county being treated, CDB treatment is instrumented using a variable that measures the centred distance from the border, as well as a dummy that indicates whether the DED is inside of a congested county or not.The first and second stage of the fuzzy geographical RDD can be summarised as:

$$\begin{aligned}\text{Treat}_i = \gamma_0 + \gamma_1 1\{\text{distance}_i > T\} + \gamma_2(\text{distance}_i - T) \\ + \gamma_3(\text{distance}_i - T) \times 1\{\text{distance}_i > T\} + \nu Z_{ik} + \phi_{seg} + \upsilon_i\end{aligned} \tag{2}$$

$$Y_i = \beta_0 + \beta_1 \widehat{\text{Treat}}_i + \zeta Z_{ik} + \phi_{seg} + \varepsilon_i \tag{3}$$

where $Treat_i$ is an indicator that takes the value of one if a DED was eligible for the policy , $\gamma_1 1\{\text{distance}_i > T\}$ is a dummy variable that indicates if a DED meets the policy threshold T i.e. is inside or outside of a congested county, $\gamma_3(\text{distance}_i - T)$ is the running variable that measures distance from the border (km) centred around 0, and $\gamma_3(\text{distance}_i - T) \times 1\{\text{distance}_i > T\}$ accounts for non linearities around the threshold. Together these variables instrument CDB treatment and are used in the second stage to isolate the exogenous component of eligibility and estimate the effect of the programme $\beta_1 \widehat{\text{Treat}}_i$ on Y_i being either changes in the number of out-offices/farmstead buildings per household, or one of the population variables.

I improve the efficiency of the estimates by including Z_{ik} a vector of DED controls measured at baseline including population density and land valuation per acre and its square,[30] decadal population trends 1851–1891, and the total stock of housing at baseline.[31] I also control for each DED centroid's longitude and latitude allowing us to absorb any smooth trends in outcomes across the Congested County Border. Finally, I follow the example of Dell (2010) and split DEDs along the Congested County Border into 20 arbitrary segments ($seg = 1, 2, ..., 20$) and use these as a set of boundary segments fixed effects ϕ_{seg}, enforcing a conservative specification that will absorb time-invariant confounders common to DEDs at either side of the border.[32] ε_i is an idiosyncratic error term, while standard errors are clustered by DED (level of treatment) and Poor Law Union to address potential spatial correlation.

The coefficient β_1 captures the local average treatment effect of CDB investment for complier DEDs only. Given that RDDs can be sensitive to the the choice of bandwidth and order of polynomial, I follow Gelman and Imbens (2019) and enforce a local linear regression within a given bandwidth of the treatment threshold. I first use a parametric approach specifying a 50km bandwidth around the border before following Calonico et al. (2015) and using an optimal bandwidth with a triangular kernel to place the most weight on DEDs closest to the border.

The identifying RDD assumption is that all factors other than treatment change smoothly at the Congested County border. This border was part of an ongoing evolution of county borders stretching back to the 12th century (Litton Faulkner, 1902), and although it follows small mountains and rivers, these geographical features are too minor to have determined the trajectory of long-run economic development. That said, other geographical features such as poor land quality, forced historical resettlement and regional differences in out-migration may have affected economic development, violating the assumption of smoothness. Figure A.4

[30] Controlling for population density as well as land valuations is identical to controlling for population pressure as described in paper 2. This specification simply presents a different linear combination of the same variables.

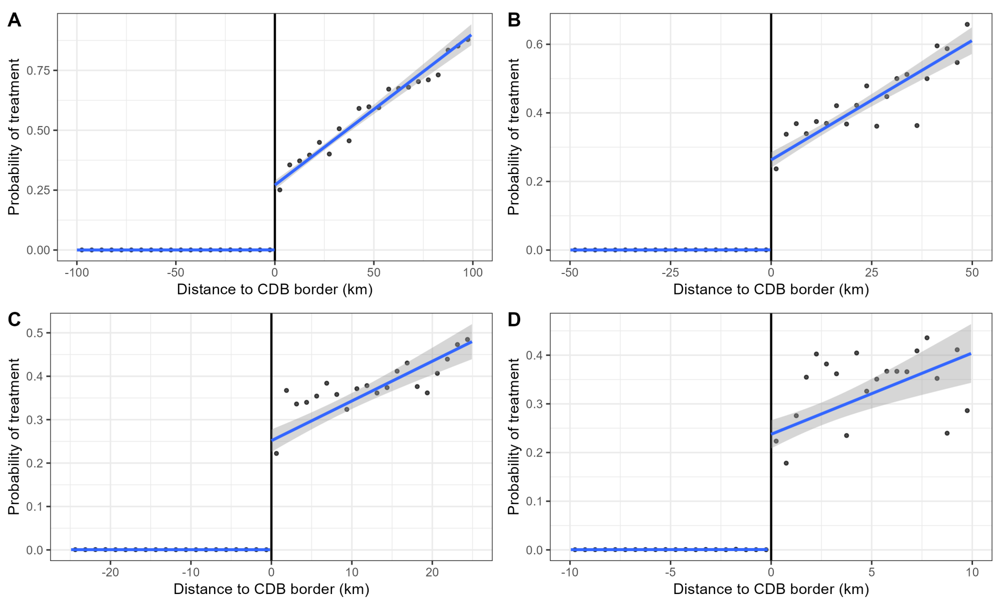
[31] This includes the number of inhabited and uninhabited houses, as well as the existing stock of farmsteads.

[32] A map of these segments can be found in Appendix A Figure A.7

in Appendix A shows that before the establishment of the CDB, outcomes are continuous within a 50km bandwidth of the congested county border, confirming that the smoothness assumption holds.

To the best of my knowledge, no other alternative policy assigns treatment based on the Congested County criteria. Furthermore, since DEDs are nested within the county structure and the eligibility criteria requires a congested county to have 20 per cent of its population living in a DED where land values per capita are less than £1.50, it is impossible for DEDs to sort themselves to either side of the border (see Appendix A Figure A.5 for a McCrary (2008) density test). I confirm that a discontinuity in the probability exists at the border using a fuzzy RDD and parametric methodology and fit a quadratic to either side of the border and reduced the bandwidth stepwise from 100km to 10km, where distance from the border is centred around 0. Positive distances represent DEDs within congested counties and negative distances indicate DEDs outside congested counties. Figure 5 reports the results and confirms that treatment is fuzzy and discontinuous at the border.

Figure 5: Discontinuity in the probability of treatment at the congested county border



Note: Points are binned averages with a quadratic polynomial fitted.

The fuzzy geographical RDD results are reported in Table 7. Columns (1)–(4) use a $+/-50km$ bandwidth, first with a naive OLS for comparability. The OLS results suggestthat there is no significant effect of CDB investment on agricultural capital. This should not be surprising since CDB investment is not randomly assigned and is linked to a multitude of other factors including local economic conditions and whether a DED is eligible for the policy. Since treatment is selected into poor areas where agricultural capital is low – or even declining relative to untreated DEDs – then the true effect of the policy is offset as these unobserved characteristics that are correlated with treatment, with this endogeneity biasing estimates towards zero.

The fuzzy RDD approaches address the endogenous nature of CDB investment by exploiting the plausibly exogenous variation of distance from the congested county border. As noted, this assumes that whether a DED is inside or outside the congested county border is as good as random, with results valid for local compliers only – i.e. DEDs that based on their eligibility status were treated correctly within at least a 50km bandwidth of the border. In the cases of the RDD results in columns (2)–(5), the F-Statistic is large and exceeds the conventional rule of thumb of 10 in both cases, confirming that distance to the border is a strong instrument. The first-stage of these regressions is reported in the Appendix A, Table A7.

The RDD results confirm a consistent positive local effect of CDB investment on agricultural capital, with the estimated effect becoming larger as additional controls are added to the model. The second column reports the results of a fuzzy RDD using a 50km bandwidth around the border with no additional controls and finds that by crossing into a Congested County, the change in the number of farmsteads increased significantly by 0.609 standard deviations. Once boundary segment fixed effects and controls are added in columns (3) and (4), the size of the coefficient increases. The reported coefficient of column (4) is 0.756, with a sizeable portion change due to the boundary segment fixed effects. Given that the congested county border is smooth, these fixed effects absorb time-invariant confounders common to DEDs at either side of the border – including terrain, land quality, or market access. The fact that the coefficient increases with these fixed effects suggests that treated DEDs tend to be located within border segments with the lowest level of agricultural capital, with unobserved time invariant confounders biasing estimates downwards.

The existing stock of agricultural capital in 1891 and longitude – how far east a DED is – also explain much of the change in agricultural capital over the period. DEDs with higher levels of agricultural capital tended to have the least growth over the period, indicating that poorer areas were growing faster, likely because they had a greater extent to grow. That said, it is unclear whether this led to any convergence since agricultural capital increased more rapidly the further east a DED was, indicating that wealthier areas tended to be more able to invest in agricultural capital.

Table 7: RDD Results – Change in Agricultural Capital

	Out-Office/Farmstead Change 1891–1911				
	(1)	(2)	(3)	(4)	(5)
CDB Treat	0.030	0.609***	0.728***	0.756**	0.862**
	(0.090)	(0.224)	(0.187)	(0.356)	(0.430)
House Change 91 - 11				-0.318***	-0.321***
				(0.035)	(0.036)
Inhabited Housing 1891				-0.144***	-0.174***
				(0.041)	(0.050)
Uninhabited Share 1891				-0.056*	-0.096***
				(0.034)	(0.030)
Agricultural Capital 1891				-0.657***	-0.666***
				(0.054)	(0.064)
Longitude				0.582***	0.713***
				(0.176)	(0.258)
Latitude				-0.148	-0.451
				(0.173)	(0.326)
Population Density				-0.135**	-0.165**
				(0.059)	(0.073)
Valuation/Acre				0.107	0.158*
				(0.064)	(0.082)
Specification	OLS	RDD	RDD	RDD	RDD Opt
Distance to Border (km)	50	50	50	50	32
Population Controls				✓	✓
F-test (1st stage), CDB Treat		294.862	303.338	69.112	43.319
R^2	0.000	-0.055	0.071	0.331	0.295
Observations	1,989	1,989	1,989	1,989	1,421
Boundary Segment fixed effects			✓	✓	✓

All variables undergo log transformation before z-scores are computed. Standard errors clustered at DED (level of treatment) and Union level to account for spatial autocorrelation. Inhabited Housing is the count of inhabited dwellings while uninhabited is the share of total dwellings that are empty. Population controls are the decadal log point change in population between 1851 and 1891. Agricultural capital is the stock of Outoffices/Farmsteads in 1891. OLS and RDD specification exploit a parametrically derived 50km distance from the border, while RDD Opt exploit a shorted optimal bandwidth that minimises the mean squared error. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

The final column of Table 7 reports the results of the fuzzy RDD with a shorter, optimal bandwidth, and triangular kernal that places the most weight on DEDs closer to the border. This is the most conservative RDD specification and is intended to measure the true causal effect of CDB investment on the congested county border. I find that the policy increased the agricultural capital by 0.862 standard deviations for complier DEDs just inside the Congested

County border compared to those outside the border (95% $CI[0.02, 1.70]$). The increase in this coefficient suggests that the effect of CDB investment was strongest closer to the border, and corresponds to a substantial acceleration in the construction of out-buildings in treated DEDs by around 26 per cent. The number of out-offices/farmsteads increased at a rate of 0.74 per household in DEDs outside of congested counties, meaning that CDB investment led to a relatively large increase of 0.19 out-offices/farmsteads per household.

In Appendix A Figure A.6, a parametric fuzzy geographical RDD with a $+/-50km$ bandwidth suggests that there is no local effect of the policy on population change, the stock of inhabited or uninhabited housing, sex ratios, or average household size. To confirm this result, I re-estimate the fully specified fuzzy RDD as described by Equation 2 and Equation 3 using each population variable separately. The only difference in these models lies in the population-dependent variables. I also remove the control for changes in housing between 1891–1911, as this is mechanically related to all of the population variables. The results are reported below in Table 8, and confirm that the policy had no significant local effect on any of the population variables in compliant DEDs.

Given that Ireland was depopulating during this period, the evidence suggests that the policy had no meaningful effect on migration trends. While those who intended to emigrate in search of economic opportunities abroad were not deterred by the policy, the benefits it generated for remaining residents were not arbitraged by wealthier farmers from outside the congested districts. There was no significant change in the number of inhabited or vacant dwellings, sex ratios, or average household size. Since wealthier farmers did not take up residence in the congested districts, this indicates that the primary beneficiaries of the policy were the disadvantaged residents who either could not, or chose not to, migrate in pursuit of better economic fortunes elsewhere.

Table 8: Results – Population Change

	Population (1)	Inhabited (2)	Vacant (3)	Sex Ratio (4)	HH Size (5)
CDB Treat	0.296	0.305	-0.118	0.301	0.223
	(0.228)	(0.248)	(0.279)	(0.232)	(0.226)
Inhabited Housing 1891	0.088*	-0.032	0.025	-0.090	0.122**
	(0.046)	(0.039)	(0.038)	(0.094)	(0.048)
Uninhabited Share 1891	0.048*	0.095***	-0.726***	-0.017	-0.030
	(0.028)	(0.036)	(0.039)	(0.031)	(0.024)
Agricultural Capital 1891	-0.095**	0.060	-0.086*	0.060	-0.117**
	(0.037)	(0.056)	(0.044)	(0.056)	(0.046)
Longitude	-0.011	-0.117	-0.140	0.112	0.173
	(0.127)	(0.229)	(0.181)	(0.169)	(0.218)
Latitude	0.546***	-0.084	0.098	0.137	0.290
	(0.163)	(0.223)	(0.194)	(0.173)	(0.204)
Population Density	-0.180***	-0.090	-0.225***	0.002	-0.134**
	(0.061)	(0.063)	(0.050)	(0.100)	(0.057)
Valuation/Acre	0.137**	0.170**	0.358***	0.053	0.021
	(0.055)	(0.066)	(0.055)	(0.047)	(0.052)
Specification	RDD Opt	RDD Opt	RDD Opt	RDD Opt	RDD Opt
Distance to Border (km)	45.19	25.41	38.67	35.90	24.11
Population Controls	✓	✓	✓	✓	✓
F-test (1st stage)	59.336	33.788	51.737	46.913	33.148
R^2	0.097	0.140	0.371	0.029	0.098
Observations	1,849	1,158	1,644	1,545	1,105
Boundary fixed effects	✓	✓	✓	✓	✓

All variables undergo log transformation before z-scores are computed. Standard errors clustered at DED (level of treatment) and PLU level to account for spatial autocorrelation. Dependent variables are changes between 1891–1911, Inhabited and Vacant measures change in inhabited/vacant housing respectively, and HH indicates "household". Agricultural Capital 1891 is the number of out-offices/farmsteads per household, while population controls are the decadal log point change in population between 1851 and 1891. RDDs exploit an optimal bandwidth that minimises the mean squared error meaning that the optimal distance will change depending on the dependent variable. A triangular kernal is used in all specifications. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

5.4 Robustness

I perform a range of robustness tests to show that my results are not sensitive to changes in model specification or empirical strategy. Results for all robustness tests are reported in the Appendix A. For the poverty analysis, the index of absolute poverty is smoothed using relief expenditure to ensure comparability across Unions over time. To rule out the possibility that the policy's effect on poverty is driven by variations in the generosity of poor relief, I replace the index with a simple poverty headcount measuring the share of the population receiving relief. These results, reported in Table A8, show that while the headcount does not capture the relative depth of poverty within each Union, it is consistent with my main findings: the frequency of poor relief declines significantly in treated Unions. Moreover Table A9 also shows that the poverty results are also consistent with mahanlobis distance matching instead of nearest neighbour, and arbitrarily dropping the top quantile of wealthiest Unions.

Spatial autocorrelation could bias my results since neighbouring Unions are likely to respond similarly to treatment. To account for this, Table A10 re-estimates the poverty model first clustering standard errors at the county level. These results suggest no significant relationship between poverty and CDB investment. However, this approach is imperfect: (1) counties are large and populated irregularly by Unions that are not neatly nested within them since county numerical identifiers are assigned by majority overlap; and (2) county clustering does not capture cross-county dependence between bordering Unions. To address these limitations, I implement Conley standard errors with a 30km cut-off from each Union's centroid in the final column. The results remain robust, indicating that spatial autocorrelation is not driving my findings.

To explore the robustness of my fuzzy RDDs, I show in Table A13 that my results are not sensitive to the choice of weight closer to the border by changing the choice of kernel, as well as using double and half optimal bandwidth sizes. The size of the estimated coefficient of agricultural capital increases the closer the bandwidth is to the border, confirming the strongest effects of the policy are present at the border. Finally, while my main analysis is conducted at the Union level and the fuzzy RDD results are at the DED level, it can be argued that the difference in units of analysis means that the results, though consistent, are not directly comparable. In appendix Table A14 and Table A15, I show that the fuzzy RDD results for both agricultural capital and population variables are fully reproducible at Union level, with results for agricultural capital of comparable effect size and significance. Consequently, I conclude that my results are fully robust to a range of alternative model specifications and empirical strategies.

6 Wider Discussion

This paper has examined the impact of a unique, multifaceted place-based policy on disadvantaged communities. Unlike many other place-based approaches, the CDB tailored interventions to the specific endowments of each locality, targeting sectors where comparative advantage could be developed. Its overarching emphasis was on agriculture, driving a transition from low-value tillage to higher-value pasture farming, improving agricultural capital, reducing poverty, and raising living standards. Importantly, the absence of any effect on depopulation suggests that these gains were retained locally, likely generating sizable multiplier effects. A crude calculation of the agricultural multiplier places this at approximately 3.7.

Although the vast majority of disadvantaged residents in Ireland relied on agriculture, an important question remains: how did this place-based policy affect overall employment? With the available data, it is possible to make a preliminary exploration of this issue. Using self-reported occupational data from the general reports of the 1891 and 1911 censuses for males over the age of twenty,[33] and applying a variation of Equation 1, there is some evidence that CDB investment reduced the number of males reporting an occupation. These results, presented in Appendix A Table A16, are statistically significant; however, the large standard errors mean that I cannot rule out the possibility that the true effect is indistinguishable from zero.

Does this imply that the benefits of the policy were offset by losses in alternative employment? Probably not. As shown in Table A16, CDB investment is correlated with sizeable reductions in the number of seasonal agricultural workers travelling predominantly to England and Scotland. It is helpful to interpret these changes through the lens of push and pull factors: poor socio-economic conditions at home tended to push workers into seasonal migration, while high wage differentials abroad pulled them. Although agricultural wages improved across Ireland during this period, the gap remained substantial. In 1911, seasonal labourers in the east and southeast of Scotland could expect weekly earnings of around 21 shillings, while those in England earned between 15 and 24 shillings depending on the season (British Parliamentary Papers, 1911). By contrast, the average weekly wage for an adult male labourer in Connacht was only 11.5 shillings. This meant that a diligent labourer could effectively double his income by working abroad for most of the agricultural season rather than remaining at home.

Although the concentration of seasonal workers in only a handful of Unions means that these regressions are not causal,[34] the correlation between declining seasonal migration and persistent wage differentials is nonetheless informative. The pattern suggests that improvements in socio-economic conditions within treated Unions reduced the need for seasonal migration. While this interpretation is necessarily speculative, the evidence that the CDB significantly reduced poverty, strengthened agriculture, and improved living standards suggests that the policy contributed to the decline in seasonal work.

[33] I focus on males given the limited socio-economic opportunities for females at the time.

[34] Pre-trends are likely not parallel and most Unions report zero seasonal workers limiting the validity of my comparison.

Future work should focus on measuring the effects of CDB investment on employment and economic composition. Rather than relying on total counts of individuals reporting an occupation, such research would benefit from occupation-specific data within the Census, which could uncover important heterogeneity across types of CDB investment and by sex. This analysis would be enhanced by geocoding the 875 training courses provided by the CDB, which predominantly offered basic technical skills to women, particularly in textiles and domestic service. In addition, the anticipated release of the household returns from the 1926 Irish Free State census provide a valuable opportunity to analyse and compare the second, extended CDB programme (1909–1923) to the findings of this paper. Not only will this enable a rich analysis of the policy from conception to dissolution, but it could also form the basis for a longer-run analysis to determine whether the gains for disadvantaged residents were temporary or self-sustaining.

7 Conclusion

Although policymakers have increasingly embraced place-based approaches, economists remain sceptical of their effectiveness, despite limited micro-economic evidence. This paper contributes to the debate by evaluating the effect of an early economic development agency in Ireland – the Congested Districts Board. Established to increase employment and improve living conditions in Ireland's poorest western regions, the Board implemented a wide range of interventions tailored to local economic contexts, including agricultural modernisation, infrastructure investment, industrial policy, community development, and training initiatives.

Using a newly digitised and geo-coded dataset of the policy's investment activities, this paper finds strong evidence that the policy reduced poverty. In this rural setting, its focus on agricultural development was the main driver of this effect, primarily by accelerating the transition from low-value tillage, to high-value pasture farming. To corroborate this, a fuzzy geographical RDD shows the policy significantly increased the number of out-offices/farmsteads, as a proxy for agricultural capital, while having no impact on depopulation trends, indicating that the economic gains of the policy were not arbitraged by mobile labour.

In conclusion, the quantitative evidence suggests that historians have been unduly critical of this policy. The Congested Districts Board was not a failure but instead delivered measurable improvements in living conditions for those facing economic insecurity who were the most vulnerable to agricultural shocks. More broadly, this paper shows that place-based development policies tailored to local economic contexts can succeed, even in rural settings.

In particular, when place-based policies build on pre-existing comparative advantages, they can generate substantial benefits for local communities.

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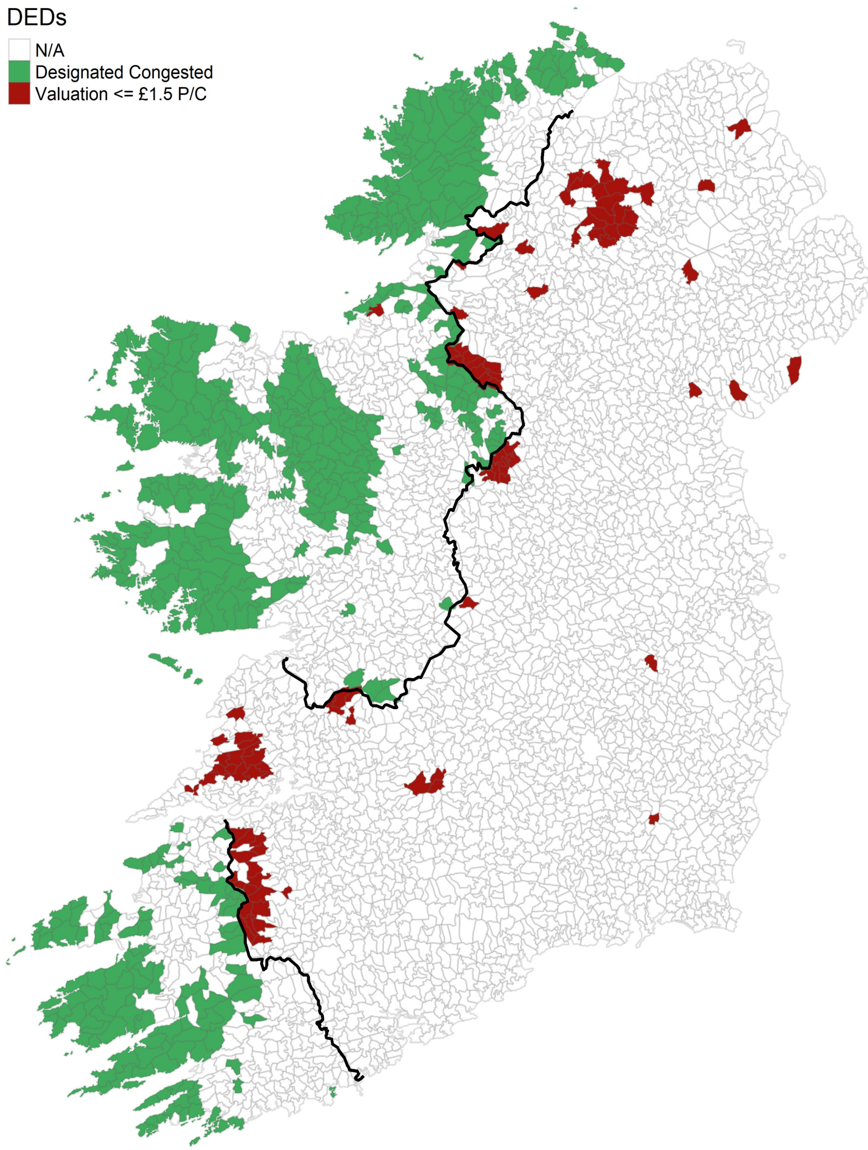
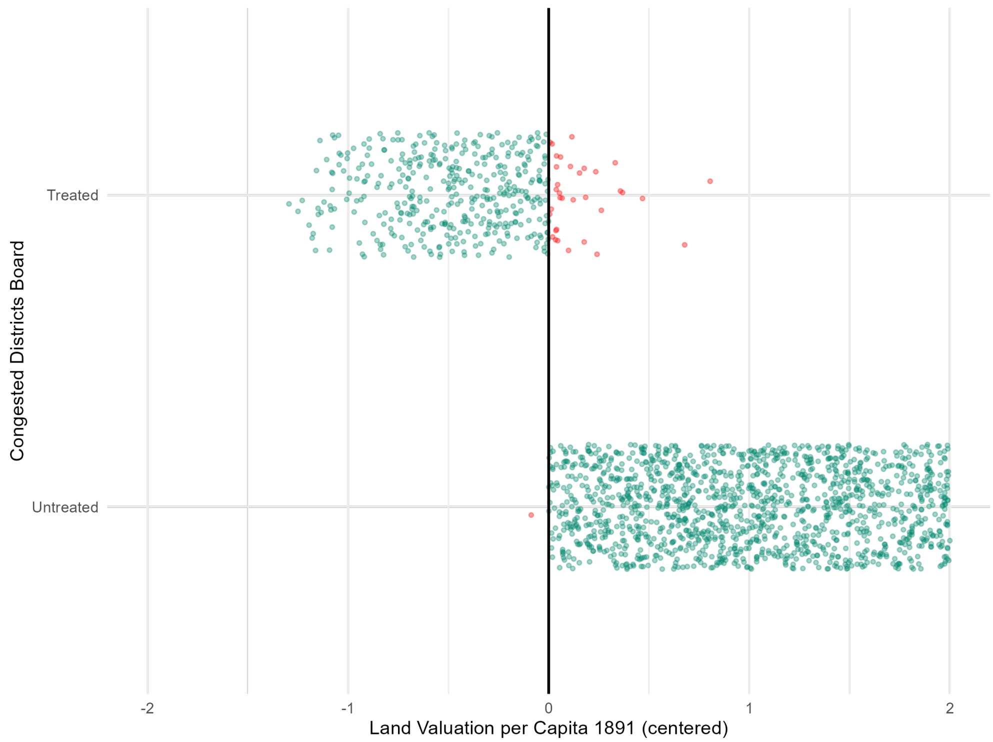
A Appendix

Figure A.1: Map showing DEDs meeting land value criteria



Note: DEDs meeting land value criteria shown in green and red. Congested county border in 1891 in black where all DEDs to the west of this border met the Congested County criteria and deemed eligible for the policy.

Figure A.2: Misallocated Eligibility



Note: 0 indicates the land valuation threshold limited to +/-£2, red points indicate where eligibility has been misallocated. Sample excludes DEDs outside CDB border with land values below £1.50 to visualise actual cases of eligibility misallocation.

Table A1: List of Congested District Board Members 1891–1909

#	Name	Dates of Service	Occupation
1	Arthur James Balfour	1891–1908	Chief Secretary of Ireland, then Prime Minister of United Kingdom
2	Charles Kennedy	1891–1909	
3	David Harrel	1891–1896	Chief Commissioner of Police, then Under-Secretary to the L.L.
4	Frederick Stringer Wrench	1891–1904	Land Commissioner and Privy Councillor
5	Horace Plunkett	1891	M.P. and agricultural reformer
6	James Hack Tuke	1891–1896	Philanthropist and businessman
7	John Morley	1891–1895	Chief Secretary of Ireland
8	Patrick O'Donnell	1891	Bishop of Raphoe, then Archbishop of Armagh
9	Thomas Plunkett Cairnes	1891–1894	Dublin-based businessman
10	William Spotswood Green	1891	Marine Biologist, adventurer, and Anglican Priest
11	William Lawson Micks	1891–1897	Civil Servant – Secretary of the Board
12	William Peacocke	1891–1894	Lieutenant Colonel in British Army
13	Christopher Talbot Redington	1894–1895	Gentry, Commissioner of National Education
14	Denis O'Hara	1895	Catholic Parish Priest in Connacht
15	Frederick W. Pim	1895–1897	Chairman of the Dublin, Wicklow, and Wexford Railway Company
16	Gerald William Balfour	1895–1901	Chief Secretary of Ireland
17	Yvo Richard Vesey	1896–1902	Gentry (5th Viscount de Vesci)
18	F.W.D. Mitchell	1897	Civil Servant (Land Commission)–Secretary of the Board
19	William Purser Geoghegan	1897	Gentleman (son of Thomas Geoghegan MP)
20	George Wyndham	1901–1905	Chief Secretary of Ireland
21	Anthony Ashley-Cooper	1903	Gentry (Earl of Shaftesbury)
22	Anthony Patrick MacDonnell	1904–1907	Civil Servant and Under-Secretary to the L.L.
23	Antony MacDonnell	1904	Under-Secretary for Ireland
24	James Bryce	1905–1907	Chief Secretary of Ireland
25	Augustine Birrell	1907	Chief Secretary of Ireland
26	T.W. Russell	1907	
27	J.B. Dougherty	1908	

List excludes ex-officios who were appointed temporarily in absence of the Chief Secretary of Ireland. M.P. indicates Members of Parliament (UK) while L.L. is Lord Lieutenant (Ireland). Members with no end date of service were present on the board in 1909. Occupational data taken from CDB reports Micks (1925) and Breathnach (2005) where available; others acquired from 1901/1911 Census or Marriage records.

Table A2: Summary statistics – Poor Relief Variables

Variable	Year: Overall N = 316	Year: 1891 N = 158	Year: 1911 N = 158	Δ	p-value
Absolute Poverty	25.68 (9.57)	27.39 (9.59)	23.97 (9.26)	3.4	<0.001***
Tax Revenue (£)	20.35 (8.99)	18.50 (8.17)	22.20 (9.40)	3.7	<0.001***
Poor Expenditure (£)	5,992.24 (8,636.58)	5,515.34 (7,026.35)	6,469.15 (9,991.43)	954	0.3
Land Valuations (£)	94,209.29 (127,465.16)	88,783.91 (95,357.52)	99,634.68 (153,120.60)	10,851	0.5
Workhouse Inmates	2,403.55 (2,635.87)	1,972.18 (2,181.02)	2,834.93 (2,967.91)	863	0.003***
Out-relief Inmates	731.71 (953.63)	793.31 (869.69)	670.11 (1,029.86)	-123	0.3
Asylum Inmates	16.00 (47.26)	5.96 (13.55)	26.04 (63.99)	20	<0.001***
Workhouse stay (Days)	41.83 (24.55)	52.78 (25.40)	30.88 (17.97)	-22	<0.001***
Workhouse costs/Head	5.33 (2.78)	5.86 (2.90)	4.80 (2.56)	-1.1	<0.001***
Medical Dispensaries	7.53 (3.59)	7.31 (3.43)	7.75 (3.74)	0.44	0.3
Doctors	5.13 (2.59)	5.13 (2.53)	5.13 (2.65)	0.00	>0.9
Midwives	2.57 (2.83)	0.50 (1.21)	4.64 (2.44)	4.1	<0.001***
Medical Supplies (£)	148.42 (136.13)	177.37 (143.98)	119.47 (121.49)	-58	<0.001***
Medical Vouchers 1	2,792.30 (5,616.33)	2,499.05 (4,209.17)	3,085.54 (6,737.73)	586	0.4
Medical Vouchers 2	1,033.63 (1,559.69)	1,021.29 (1,399.00)	1,045.96 (1,709.76)	25	0.9
Smallpox Vaccines	510.79 (477.16)	574.11 (538.79)	447.46 (398.05)	-127	0.018**

Means with standard deviations in parenthesis. Workhouse costs are costs per week per capita for food and clothing in shillings. Medical Voucher 1 are for Dispensary visits, while Medical Voucher 2 is for home visits. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A3: Summary statistics – Agriculture Variables

Variable	**Year**			**Δ**	**p-value**
	Overall N = 316	**1891** N = 158	**1911** N = 158		
Total Farms	3,739.45	3,624.68	3,854.21	230	0.2
	(1,608.55)	(1,615.77)	(1,598.18)		
Small Farm share	0.69	0.69	0.70	0.01	0.4
	(0.13)	(0.14)	(0.12)		
Arable Land	102,610.97	95,775.65	109,446.30	13,671	0.001***
	(37,454.45)	(34,557.53)	(39,068.47)		
Share of cropland	0.25	0.25	0.25	0.00	>0.9
	(0.09)	(0.10)	(0.09)		
Wheat Output	6.47	6.08	6.87	0.78	<0.001***
	(1.61)	(1.77)	(1.32)		
Oat Output	5.38	5.21	5.55	0.34	<0.001***
	(0.82)	(0.91)	(0.67)		
Barley/Mangle Output	5.93	5.76	6.10	0.34	0.12
	(1.96)	(1.81)	(2.10)		
Potato Output	17.72	14.36	21.08	6.7	<0.001***
	(5.27)	(3.07)	(4.87)		
Hay Output	6.28	6.82	5.75	-1.1	<0.001***
	(1.18)	(1.37)	(0.56)		
Flax Output	3.44	4.12	2.75	-1.4	0.004***
	(4.21)	(4.39)	(3.93)		
Total Crop Output	45.22	42.35	48.09	5.7	<0.001***
	(7.24)	(6.07)	(7.20)		
Horsepower/Farm	1.12	1.11	1.13	0.02	0.6
	(0.33)	(0.32)	(0.33)		
Cattle Output	61.65	62.46	60.84	-1.6	0.6
	(27.21)	(27.26)	(27.22)		
Sheep Output	14.17	16.03	12.31	-3.7	0.004***
	(11.39)	1(11.92)	(10.54)		
Pig Output	4.85	4.98	4.72	-0.26	0.3
	(2.25)	(2.34)	(2.15)		
Poultry Output	13.17	10.39	15.94	5.6	<0.001***
	(4.39)	(2.11)	(4.33)		

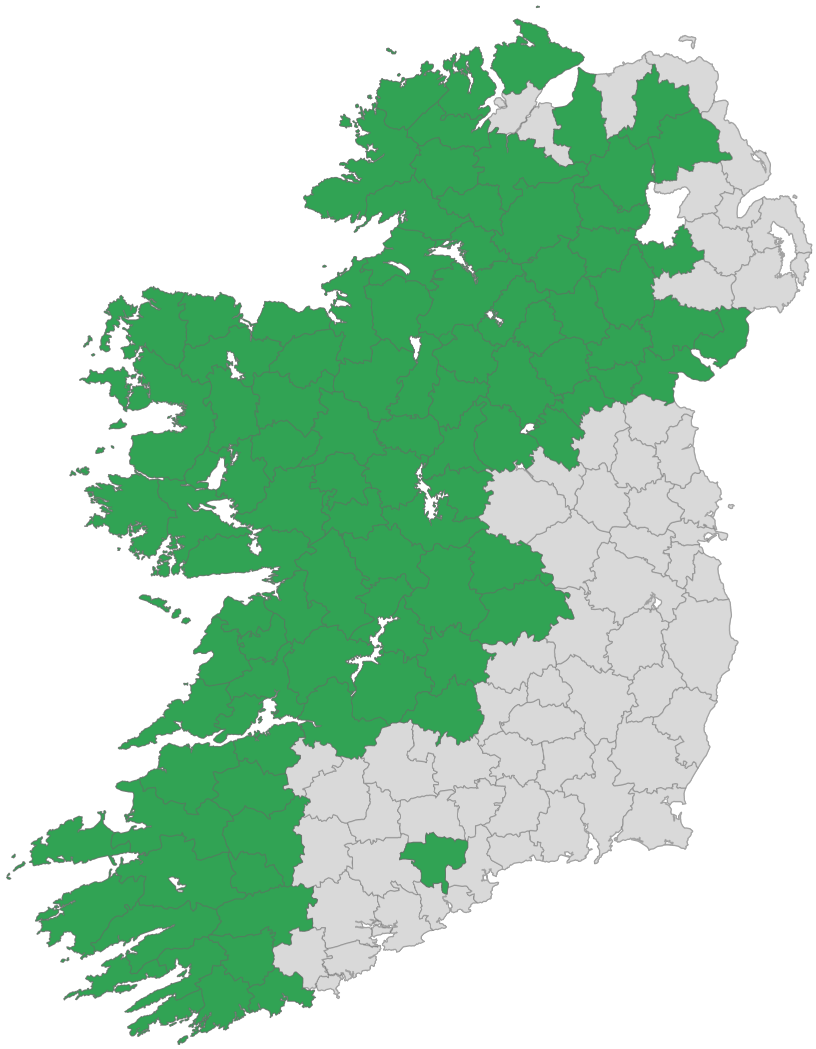
Means with standard deviations in parenthesis. Crop output (wheat, oat, barley & mangle, potato, hay and flax are measured as output per acre in 1891 prices. Livestock output (cattle, sheep, pig and poultry) are measured as output per farm in 1891 prices.

Table A4: Summary statistics – Census variables at DED Level

Variable 1891	Congested County Overall N = 3,264	0 N = 2,933	1 N = 1,038	Difference	p-value
Acreage	5,867.59 (3,026.79)	5,397.93 (2,511.46)	6,874.77 (3,715.53)	1,477	<0.001***
Population	969.97 (634.10)	929.21 (636.25)	1,057.39 (620.80)	128	<0.001***
Inhabited Housing	189.04 (124.49)	187.08 (128.32)	193.25 (115.77)	6.2	0.2
Uninhabited Housing	13.00 (14.88)	14.73 (15.69)	9.30 (12.18)	-5.4	<0.001***
Out-offices/farmstead	616.26 (362.36)	678.43 (384.89)	482.94 (263.11)	-195	<0.001***
Population Density	0.18 (0.23)	0.19 (0.27)	0.17 (0.10)	-0.01	0.034**
Pop Change 51-61	-0.13 (0.15)	-0.16 (0.14)	-0.08 (0.17)	0.08	<0.001***
Pop Change 61-71	-0.10 (0.14)	-0.11 (0.14)	-0.07 (0.13)	-0.05	<0.001***
Pop Change 71-81	-0.08 (0.09)	-0.10 (0.08)	-0.03 (0.09)	0.07	<0.001***
Pop Change 81-91	-0.14 (0.18)	-0.16 (0.20)	-0.12 (0.12)	0.03	<0.001***

DED level data where congested county = 1 are DEDs inside congested counties. Sample means with standard deviations in parenthesis. Population change statistics are logged. DEDs with major border changes dropped.

Figure A.3: Map showing matched Poor Law Unions



Note: Unions retained in the matched sample are coloured green. Notably, matching has removed Unions containing large cities such as Belfast, Dublin, Derry, and Cork, industrialised Unions in the north-east, and Unions dominated by pasture farming in the east and south-east.

Table A5: Share of Small Holdings

	Small Holdings share		
	(1)	(2)	(3)
CDB Investment	-0.046	-0.045	-0.054
	(0.045)	(0.068)	(0.067)
PLV		-0.514	-0.335
		(0.559)	(0.620)
PLV square		-0.162	-0.091
		(0.209)	(0.215)
Simpson Index		-0.012	-0.004
		(0.102)	(0.102)
Grass Ratio		-0.079	-0.130
		(0.147)	(0.160)
Crops Output		0.028	0.035
		(0.070)	(0.069)
Population Density			0.412*
			(0.234)
R^2	0.926	0.927	0.928
Observations	200	200	200
TWFE	✓	✓	✓

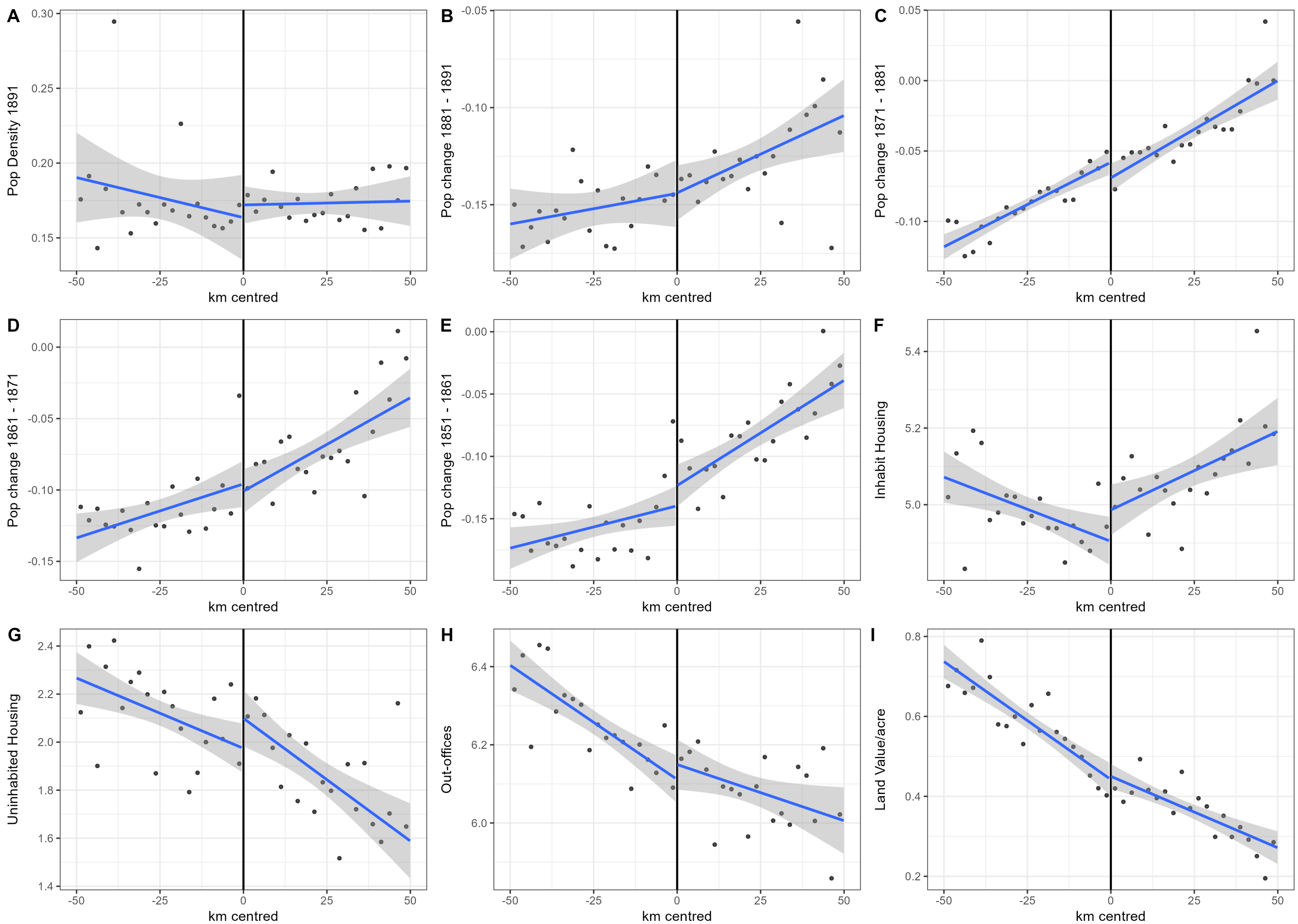
All dependent and independent variables are logged before z-score transformation to reduce skew. Small holdings is the share of agricultural holdings under 15 acres. The simpsons index is a measure of ecological diversity, which in this case measures the relative diversity of crops sown in a Union. PLV is the Poor Law Valuation and measures the total value of land in a union (quality). Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A6: Agricultural Productivity – All Classes of Horse

	Agricultural (1)	Recreational (2)	Asses/Mules (3)	Traffic (4)
CDB Investment	0.027	-0.159**	0.031	-0.041
	(0.025)	(0.065)	(0.029)	(0.065)
Small Holdings Share	-0.231***	0.101	0.117	0.049
	(0.078)	(0.110)	(0.106)	(0.092)
Population Density	-0.286*	0.033	0.130	0.492
	(0.146)	(0.368)	(0.193)	(0.393)
PLV	-0.097	1.704**	0.081	2.672**
	(0.368)	(0.835)	(0.763)	(1.178)
PLV square	-0.192	-0.068	-0.173	0.436
	(0.145)	(0.314)	(0.167)	(0.391)
Grass Ratio	-0.189***	-0.003	0.065	0.017
	(0.055)	(0.151)	(0.091)	(0.191)
Simpson Index	-0.002	0.142	-0.019	0.188
	(0.052)	(0.098)	(0.049)	(0.114)
R^2	0.984	0.909	0.978	0.897
Observations	200	200	200	200
TWFE	✓	✓	✓	✓

All horse figures are z-scores of the logged animal headcount per holding in 1891 prices. Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Figure A.4: Balance of baseline DED characteristics 1891



Note: Distance from the congested county border, where 0 indicates the border and positive values are DEDs within congested counties. Linear models fitted either side of a +/-50km bandwidth and points are binned averages. Pop change, housing and out-offices logged to reduce impact of outliers.

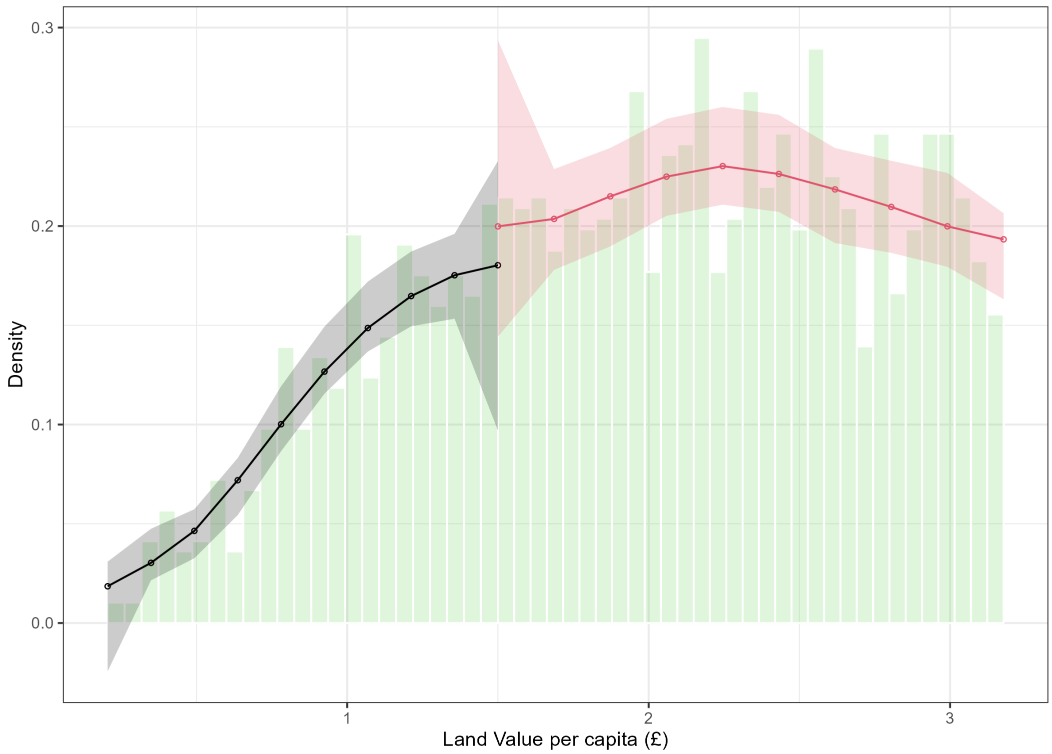


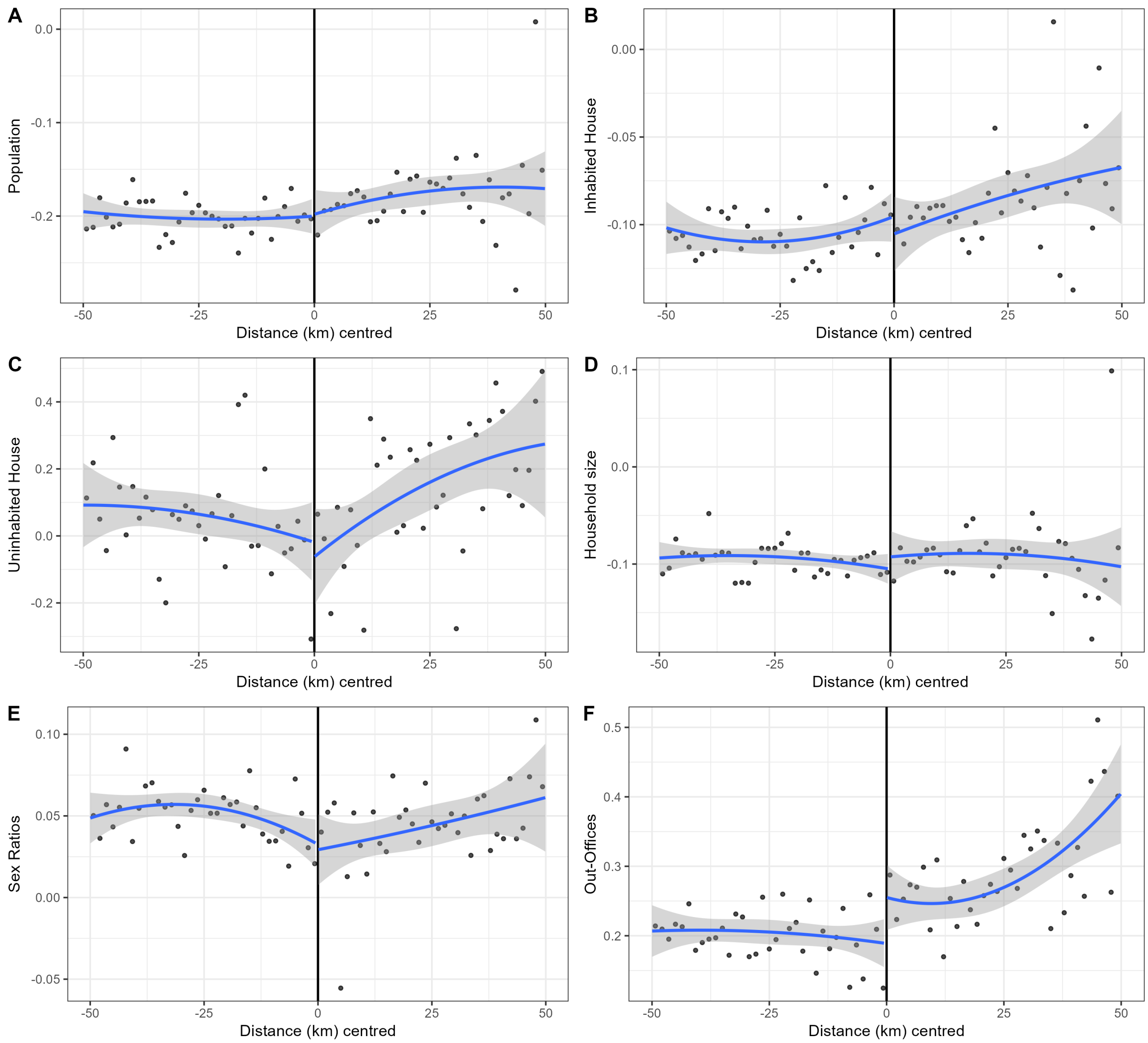
Figure A.5: McCrary density test

Table A7: RDD First Stage Results

	CDB Treat	
	(1)	(2)
Distance to Border	-0.002**	-0.003*
	(0.001)	(0.002)
Congested County	0.224***	0.243***
	(0.062)	(0.068)
Distance to Border × Congested County	0.007***	0.006
	(0.002)	(0.004)
Specification	RDD	RDD Opt
Distance to Border (km)	50	32
Population Controls	✓	✓
F-test (1st stage)	69.112	43.319
R^2	0.444	0.421
Observations	1,989	1,421
Boundary Segment fixed effects	✓	✓

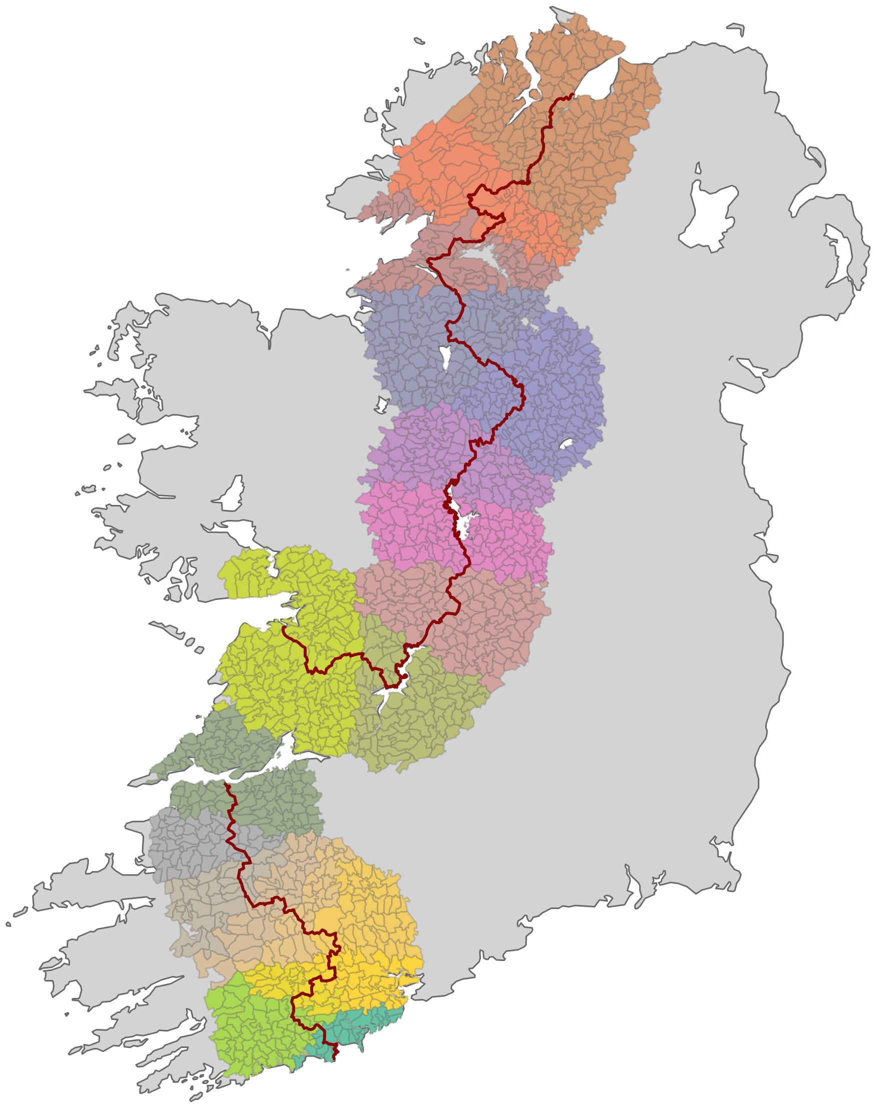
All other variables in second stage also included in these models. Distance to Border measures the distance to the Congested County Boarder in kilometers, while Congested County is a simple dummy that indicates whether a DED resides within a Congested County or not.

Figure A.6: Effect of CDB treatment on demography and housing



Note: Parametric specification with 50km bandwidth and quadratic polynomial fitted. All dependent variables are log-point changes. Points are binned averages.

Figure A.7: Visualisation of 20 artificial boundary segments as per Dell (2010).



Note: DEDs within an optimal bandwidth of $32km^2$ around the border only. These arbitrary fixed effects will absorb time invariant confounders common to DEDs on either side of the border. As CDB investment is discontinuous at the border, these fixed effects leave only the CDB treatment effect unaccounted for. Congested county border shown in red.

Table A8: Robustness – Effect of CDB Investment on Poverty Headcount

	Poverty Headcount Ratios			
	(1)	(2)	(3)	(4)
CDB Investment	-0.085*	-0.236***	-0.162***	-0.283***
	(0.045)	(0.046)	(0.044)	(0.065)
Small Holdings Ratio	0.008	0.071	-0.126	-0.114
	(0.066)	(0.057)	(0.077)	(0.107)
Population Density	-0.031	-0.002	-1.151*	-0.233
	(0.129)	(0.121)	(0.665)	(0.414)
PLV	0.165*	0.575	-0.064	0.382
	(0.099)	(0.856)	(0.902)	(1.256)
PLV square	-0.089	-0.168***	0.269	0.311
	(0.067)	(0.058)	(0.346)	(0.436)
Union Financial		✓	✓	✓
R^2	0.068	0.319	0.895	0.876
Observations	316	316	316	200
TWFE			✓	✓

All dependent variables are logged prior to z-score transformation to reduce skew and are defined as before. The Poverty Headcount measures changes in share of the Union population in receipt of relief to address the concern that the absolute poverty index is biased by Union spending. Column (4) uses the matched sample of Unions. Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A9: Robustness – Matching and Alternative Sample

	Absolute Poverty Rate		
	(1)	(2)	(3)
CDB Investment	-0.212**	-0.181*	-0.193**
	(0.103)	(0.096)	(0.078)
Matching	NN	Mahanlobis	None
Full Spec	✓	✓	✓
R^2	0.721	0.758	0.742
Observations	200	200	236
TWFE	✓	✓	✓

All variables described as before. The last column arbitrarily drops the top quantile of wealthiest Unions from the sample. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A10: Robustness – Poverty Spatial Autocorrelation

	Absolute Poverty Rate		
	(1)	(2)	(3)
CDB Investment	-0.212**	-0.212	-0.212***
	(0.106)	(0.126)	(0.073)
Observations	200	200	200
R^2	0.721	0.721	0.721
Adjusted R^2	0.403	0.403	0.403

All variables are logged before z-score transformation. Model (1) is baseline, (2) clusters standard errors by county, and (3) uses Conely standard errors (30km). Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A11: Robustness – Tillage Spatial Autocorrelation

	Total Crops	Potato	Hay	Wheat	Oats	Barley	Flax
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CDB Investment	-0.208^{***}	-0.058	-0.183^{***}	-0.045	-0.384^{***}	-0.067	-0.198^{***}
	(0.069)	(0.066)	(0.067)	(0.047)	(0.074)	(0.068)	(0.062)

Models specified as before now with Conely Standard errors (30km). All variables are logged before z-score transformation. Model diagnostic statistics are identical. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A12: Robustness – Pasture Spatial Autocorrelation

	Horse 1	Horse 2	Cattle	Sheep	Swine	Poultry
	(1)	(2)	(3)	(4)	(5)	(6)
CDB Investment	0.027	-0.159^{***}	0.051^{***}	0.0003	0.096^{***}	0.091^{**}
	(0.018)	(0.041)	(0.016)	(0.022)	(0.034)	(0.035)

Models specified as before now with Conely Standard errors (30km). All variables are logged before z-score transformation. Model diagnostic statistics are identical. Horse 1 are horses for agricultural use and Horse 2 are horses for recreational use. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A13: Robustness- RDD Change in Out-Offices/Farmsteads

	Outhouse/Farmstead Change 1891–1911				
	(1)	(2)	(3)	(4)	(5)
CDB Treat	0.862**	0.649**	0.998**	0.881**	0.885**
	(0.430)	(0.284)	(0.441)	(0.439)	(0.441)
Distance	Opt	Double	Half	Opt	Opt
Kernal	Triangular	Triangular	Triangular	Epanechnikov	Rectangular
Full Specification	✓	✓	✓	✓	✓
F-test (1st stage), CDB Treat	43.319	108.416	20.999	42.578	42.505
R^2	0.295	0.373	0.312	0.291	0.290
Observations	1,421	2,333	733	1,421	1,421
Boundary Segment fixed effects	✓	✓	✓	✓	✓

All variables specified as before. Optimal distance is around 32km about the congested county border. Standard errors clustered at DED (level of treatment) and Union level to account for spatial autocorrelation. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A14: Robustness of Agricultural Capital at Union-Level

	Farmstead/Out-Office		
	(1)	(2)	(3)
CDB Investment	0.133***	0.106***	0.106***
	(0.019)	(0.017)	(0.018)
Inhabited Houses	-0.419***	-0.176	-0.163
	(0.128)	(0.117)	(0.138)
Uninhabited Houses	-0.067	-0.047	-0.049
	(0.056)	(0.043)	(0.043)
PLV	0.684***	0.475	0.514
	(0.250)	(0.313)	(0.336)
PLV square	-0.118	-0.092	-0.086
	(0.088)	(0.108)	(0.111)
Horse Power		-0.046	-0.107
		(0.072)	(0.083)
Cattle		0.166**	0.154**
		(0.067)	(0.069)
Sheep		-0.256***	-0.244***
		(0.053)	(0.059)
Simpson Index			-0.020
			(0.042)
Grass Ratio			-0.068
			(0.073)
R^2	0.989	0.991	0.991
Observations	200	200	200
TWFE	✓	✓	✓

All variables defined as before. One standard deviation in CDB investment led to an increase in agricultural capital by 0.106. Results are robust to the inclusion of barn animals. Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A15: Robustness of Population Variables at Union-Level

	Population (1)	Inhabited (2)	Vacant (3)	HH Size (4)
CDB Treat	0.020	0.016	0.061	0.048
	(0.013)	(0.012)	(0.048)	(0.036)
Inhabited	0.331**		0.048	-2.699**
	(0.143)		(0.346)	(1.163)
Vacant	-0.101***	0.003		-0.435***
	(0.029)	(0.021)		(0.087)
Land Valuation	-0.011	0.300**	1.113*	1.353**
	(0.221)	(0.119)	(0.580)	(0.620)
Agricultural Capital	0.001	0.042	-0.345	0.372*
	(0.076)	(0.055)	(0.226)	(0.206)
Population		0.177***	-0.928***	0.777***
		(0.059)	(0.297)	(0.263)
R^2	0.995	0.997	0.952	0.964
Observations	200	200	200	200
TWFE	✓	✓	✓	✓

Variables defined as before – now at Union level. Standard errors clustered at DED level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Table A16: Occupations and Seasonal Work

	No Occupation			Seasonal Workers		
	(1)	(2)	(3)	(4)	(5)	(6)
CDB Investment	0.091*	0.121*	0.125*	-0.219***	-0.179***	-0.176***
	(0.051)	(0.062)	(0.068)	(0.061)	(0.031)	(0.031)
Population Density	-0.704*	-0.516	-0.512	0.603*	-0.072	-0.069
	(0.393)	(0.385)	(0.386)	(0.339)	(0.248)	(0.250)
PLV	0.488	0.916**	0.738	1.267**	0.206	0.065
	(0.487)	(0.434)	(0.549)	(0.524)	(0.443)	(0.479)
PLV square	-0.529	-0.780**	-0.721*	-0.500**	-0.159	-0.112
	(0.359)	(0.320)	(0.394)	(0.226)	(0.154)	(0.181)
Small Holdings Share		0.076	0.071		0.117	0.113
		(0.089)	(0.084)		(0.077)	(0.077)
Crop Output		0.099	0.104		-0.020	-0.016
		(0.069)	(0.074)		(0.032)	(0.032)
Simpson Index		0.173	0.174		-0.135**	-0.134**
		(0.138)	(0.142)		(0.054)	(0.051)
Horse Power		0.255	0.254		-0.494***	-0.495***
		(0.167)	(0.172)		(0.152)	(0.148)
Out-Relief Ratio		0.036	0.041		0.138	0.142
		(0.059)	(0.061)		(0.099)	(0.102)
Females Employed			-0.062			-0.049
			(0.139)			(0.056)
R^2	0.896	0.902	0.902	0.941	0.954	0.954
Observations	200	200	200	200	200	200
TWFE	✓	✓	✓	✓	✓	✓

All variables are logged prior to z-score transformation to reduce skew. Employment data is taken from the general reports of the 1891 and 1911 census and describes the share of individuals that reported their occupation to the Census enumerator. Given the socio-economic context of the time, figures are taken only for males over the age of twenty. Seasonal worker data is taken from the Department of Agriculture and Technical Instruction reports on agricultural labourers 1891–1911, and describes the number of seasonal workers that departed primarily to Scotland and England during any part of the year. In both case, these employment variables calculated as the share of the male population over the age of twenty. All other variables specified as before. Standard errors clustered at Union level. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

B Appendix

B.1 Crop Output Figures

Crop output, acreage, and prices are drawn from the 1891 and 1911 Annual Reports of the Department of Agriculture and Technical Instruction. Crops include wheat, oats, barley, hay, potato, and flax, each measured in specific imperial units. Table B1 provides an overview of the measurement units and corresponding prices.

Table B1: Crop units and prices, 1891 and 1911

Crops Harvested		**Prices by Weight in GBP (£)**		
Crop	Unit (imperial)	1891	1911	Change (%)
Wheat	112 lbs	0.371	0.372	0.3
Oats	112 lbs	0.333	0.311	−6.9
Barley	112 lbs	0.367	0.357	−3.2
Flax	14 lbs	0.296	0.428	44.7
Hay	1 ton	3.292	3.167	−3.1
Potato	1 ton	3.583	3.500	−2.0

Let i index the crop type. Output per acre for crop i in year t can be defined as:

$$\Psi_i = \frac{x_{i,t}}{X_{i,t}} \tag{1}$$

where $x_{i,t}$ is the relevant quantity harvested of crop i and $X_{i,t}$ is the acreage sown. To convert output per acre to a monetary value, i.e. crop output per acre in GBP (£), I multiply by the appropriate price of crop i in year t, $p_{i,t}$:

$$Output_{i,t} = \Psi_i \times p_{i,t} \tag{2}$$

To express 1911 values in 1891 prices, I divide the value of crop i by the factor that captures the proportional change in price in crop i between 1891 and 1911 Δp_i. Crop output for 1911 is then defined as:

$$Output_{i1911} = \frac{\Psi_i \times p_{i,1911}}{1 + \Delta p_i} \tag{3}$$

Intuitively, in Equation 3 if the price of a crop rises between 1891 and 1911, the denominator is greater than one, so that the adjusted 1911 output figure is smaller – deflating the output figure and adjusting for price changes. An identical adjustment is carried out for livestock figures.