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DP16743

**Rooted to the Soil: The impact of social
housing on population in Ireland since
1911**

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Discussion Paper DP16743
Published 21 November 2021
Submitted 19 November 2021

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www.cepr.org

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Abstract

How does housing policy influence the distribution of population? We examine the impact of the world's first large-scale rural public housing scheme on the long-term dynamics of rural population, specifically the case of Ireland's Labourers Acts. We link detailed data on the location of over 45,000 heavily subsidized cottages for agricultural laborers built 1883-1915 in over 200 districts to decennial Censuses between 1841 and 2002. We examine how the density of this social housing, which effectively halved rents for landless laborers, affected subsequent population change and find significant persistence in the effect of this treatment on the population. These findings are from specifications that include other factors plausibly related to future population growth, including initial housing stock, land values and population density, as well as distance to urban centres. A causal interpretation is supported by an assessment of pre-trends, by no effect of cottages authorized but not built and by an IV approach that exploits a 1906 limit on legal costs. Our findings suggest that deep housing policy interventions can have long-lasting effects on population distribution.

JEL Classification: N34, N94, O18, R23, R38

Keywords: Ireland, Labourers Acts, population growth, social housing, migration

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Acknowledgements

We thank Arcangelo Dimico, Alan Fernihough, John Fitzgerald and Cormac Ó Gráda for helpful comments. We also thank Sean Moran and Max Guennewig-Moenert for excellent research assistance, and seminar participants at Queen's University Belfast, London School of Economics, Trinity College Dublin, University College Dublin, University of California (Irvine) and University of Southern California for their thoughts and suggestions. Finally, we thank Niall Cunningham, Ian Gregory, Ian Shuttleworth and Alan Fernihough for kindly sharing data.

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Alan de Bromhead[†] Ronan C. Lyons[‡]

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1 Introduction

The world is becoming increasingly urban. Global population is expected to rise from 7.6 billion people in 2018 to 9.9 billion in 2050, with a 60% rise in urban populations in that period, compared to a fall of 8% in rural populations (UN-DESA 2018). This changing pattern of human and economic activity raises important policy questions surrounding the sustainability of population redistribution and the achievement of the United Nation's Sustainable Development Goals.¹ While research highlights the economic benefits of urbanisation and agglomeration, a long tradition exists among policymakers attempting to stem urbanisation and rural depopulation. According to the United Nations, 75% of surveyed countries have adopted policies to influence the spatial distribution of their populations, with 55% employing policies explicitly aimed at reducing rural to urban migration (UN-DESA 2020).

In this paper, we examine the long-run effects of a significant historical policy intervention aimed at arresting Ireland's rural population decline. The *Labourers Acts* initiated the first large-scale public housing scheme in history (Bureau of Labor Statistics 1915), introduced as part of a broader policy of 'constructive unionism' by the United Kingdom government to mollify nationalist sentiment within Ireland (Lyons 1985). The Acts involved the heavily subsidized construction of cottages for rural laborers, on average halving rents, while also improving housing quality and tenure security. The bulk of construction took place between 1906 and 1915, at which point the scheme was halted due to the First World War. We examine how the intensity of this social housing affected the subsequent path of population growth for more than 200 rural districts on the island of Ireland, between 1911 and 2002. We find a significant and persistent effect: our preferred specification suggests that a one-standard-deviation increase in the number of cottages built per capita by 1911 is associated with +0.27 of a standard deviation in population growth 1911-2002.

Our analysis supports a causal interpretation. We find no effect of cottages authorized but not built by the end of the scheme during World War I and our results are, if anything, strengthened after controlling for pre-trends. They are further supported by instrumental variable (IV) analysis, which exploits a change in the scheme in 1906 limiting legal costs to reduce the threat of local corruption. Lastly, we exploit the partition of Ireland in the early 1920s, and resulting diverging paths on the policy treatment of *Labourers Acts* cottages, in particular significant policy support from the 1930s in (southern) Ireland² for converting tenants into owner-occupiers. We find that the effect is driven by cottages in rural districts in southern Ireland, rather than Northern Ireland.

Our work connects to at least three distinct literatures. The first relates to internal migration, particularly in developing countries. The Harris-Todaro framework is seminal within this and examines the extent to which rural-to-urban migration is driven by higher (expected) income and/or better employment opportunities. The context

¹For example, Sustainable Development Goal 11 targets sustainable cities and human settlements: <https://sdgs.un.org/>.

²The nomenclature of both jurisdictions on the island of Ireland since 1922 is politically contentious. The independent state of Ireland, occupying most of the island apart from 14,000km² in the north-east, was known originally as the Irish Free State and, after 1948, simply as Ireland, which would be ambiguous here. In Northern Ireland, there was a 30-year civil war ending in 1998 between those who wanted Northern Ireland to become part of the Irish State and those who wanted it to remain part of the United Kingdom. Each group had its preferred terms for the jurisdiction, although its official name remains Northern Ireland. For simplicity, we refer to them as Northern Ireland and southern Ireland, the latter with a small 's' to denote that this term is not official and used here simply for clarity of exposition.

for the original Harris and Todaro (1970) model was the phenomenon of high rural-urban migration in developing economies with high measured urban unemployment rates. Their core argument is that, if migrants base their decisions on expected earnings, where wages in the formal urban sector, w_u , are far above the agricultural wage (w_r), migration to urban areas is rational even if it brings the chance of unemployment. Brueckner and Zenou (1999) extend Harris-Todaro to include land markets and find that the cost of housing (rents) and employment probabilities jointly adjust to determine rural-urban migration and thus rural and urban populations.

While the Harris-Todaro literature focuses largely on urban “pull” factors, another strand in development economics examines the “push” factors in rural-urban migration. Following Besley (1995), much of this considers rural residents as (small) landholders. In our setting, however, the treatment of interest is a significantly lower rural rent targeted at residents who explicitly do not hold any land. This can be considered in a Harris-Todaro-style set-up, where the (after-rent) disposable income of a household, w^* , is increased by the halving of rural rents. By halving the burden of rents, and significantly increasing disposable income in rural areas (w_r^*), the *Labourers Acts* created a new equilibrium for those considering rural-urban migration.³ Subsequent measures in southern Ireland, allowing tenants to become owner-occupiers at even more heavily discounted monthly payments, can be seen as a further increase in the value of staying in a rural district, relative to moving to a city.

Secondly, our analysis is related to an economic history literature, examining the period of extensive international migration during the late 19th and early 20th centuries. A substantial literature examines the causes and effects of mass migration during this period. Overall, the consensus is clear that migration responded to wage differentials, as well as to other factors such as existing networks, and that it contributed to convergence in incomes, in particular across the “North Atlantic” economy in this period (Hatton, O’Rourke, and Williamson 1993). Ireland is an interesting case study for migration, given its high relative emigration rates both before and especially after its Great Famine of 1845-1851 (Mokyr 1983; Fitzpatrick 1984). Emigration rates and living standards were hugely intertwined; using county-level data, Hatton and Williamson (1993) find that declining income differentials reduced the incentive to leave Ireland. The reverse relationship also held: emigration pulled up Irish wages (O’Rourke 1995; Hatton and Williamson 1993). In summary, the economic history and development economics literatures are consistent in suggesting that an increase in disposable incomes in rural parts of Ireland would reduce outward migration, whether to other parts of Ireland or further afield.

Thirdly, we connect to a public finance literature on the role played by policy more recently in the decision to migrate. Since Tiebout (1956), a vast literature has explored the link between choice of residence and public services and taxation. One body of research examines the “welfare magnets” hypothesis, such as Razin and Wahba (2015), who find support for the hypothesis that more generous welfare provisions affect the skill composition of immigrants. Another examines the effect of taxes: a recent review paper by Kleven et al. (2020) examined the link between taxation of income and wealth and the decision to migrate. Much of the underlying literature it surveyed focuses on very high earners, who are often subject to more variation, and there is some consensus that there is a form of “home bias”: local-born residents are far less likely

³As we focus only on rural districts, the destination of migrants – whether to a city in Ireland, such as Dublin or Belfast, or elsewhere, in particular Britain or the USA – is immaterial.

to migrate internationally in response to a tax increase than foreign-born, and greater within-country mobility than across-country.

Our paper bridges the research examining historical (mass) migration and the research on present-day migration and the role for policy. Given the nascent welfare state in the late 19th century (Huberman and Meissner 2010), the literature examining historical migration cannot speak to its role in the migration decision. As described below, the *Labourers Acts* represented the largest intervention in social housing anywhere in the pre-war period. Combined with Ireland’s unique circumstances, in particular the deep level of integration of its rural labor market with urban labor markets in Britain and North America at the time, this presents a unique opportunity to examine the decision to migrate in a historical setting, in response to a large policy-driven shock to disposable income. Our paper’s contribution is supported by its focus on the rural point of departure, rather than the urban destination, as is standard in the Harris-Todaro literature, and its unusually detailed spatial data, relative to the existing literature on Irish migration.

The rest of our paper is structured as follows. In Section 2, we provide an overview of the context, including the political background, the Acts themselves, and the subsequent divergence in policy treatment of the resulting cottages across Northern and southern Ireland. In Section 3, we review the data we use for our analysis, in particular relating to density of cottages built by rural district, as well as data across sixteen Censuses from 1841 to 2002. In Section 4, we describe our empirical strategy and present the baseline results, followed by a number of robustness checks, including additional controls, a placebo analysis, IV techniques and an investigation of whether spatial autocorrelation is driving the results. The final section concludes.

2 Historical Context

“For every house you build you are keeping a family in the country and rooting them to the soil. The labourers in this matter owe their salvation to themselves and to their organisation when they won the Labourers Act of 1906. The transformation effected in rural Ireland has been of the most marvellous kind.”

D.D. Sheehan, MP for West Cork (House of Commons Debates 1911)

*“In no other country has such a plan been attempted;
perhaps in no other country would it be even thought of.”*

Nicholas J. Synnott, Statistical and Social Inquiry Society of Ireland (Synnott 1906)

2.1 Political & Economic Background

The *Labourers Acts*, by any measure an expansive, generous and unprecedented social housing scheme, emerged from the unique political and economic context of land and housing in Ireland in the late 19th century. In 1801, Ireland and Great Britain entered a full political and economic union. Prior to the Great Famine in the 1840s, the quality of housing of most of rural Ireland was among the worst in Europe (Fraser 1996). Almost half (44%) of the rural housing stock was classified in the 1841 census as “4th class”: one room cabins made of sod or turf which were little more than hovels. The wretched state of Irish rural housing was well acknowledged by contemporary observers. Frederick Engels, commenting on the living conditions of the Irish rural proletariat in the

1840s lamented that “[t]hese people live in the most wretched clay huts, scarcely good enough for cattlepens” (Engels 1892, p. 272).

The Great Famine, and the decades of emigration that followed, had a dramatic effect on rural Ireland. The rural population fell from just over 7 million in 1841 to just over 3 million by 1901, with landless laborers among those most likely to emigrate, most often to the United States or Britain. At the same time, internal migration increased as rural dwellers left the countryside in search of employment in urban areas, although urbanisation levels remained low (Kelly et al. 2013). Nonetheless, by the early 20th century, some 75% of the population still lived in rural areas (Fraser 1996). The exodus of the poorest landless laborers did however change the share in the lowest quality housing. By 1881, the share of rural housing designated “4th-class” housing had fallen to 7%. Still, the problem of poor quality remained, with some 60,000 rural laborers and their families living in housing of this category. If anything, the problem of poor housing was even more acute in urban areas than in rural areas by the late 19th century. For example, one third of Dublin’s population lived in one-room tenements with associated high mortality rates (Aalen 1987).

However, political conditions meant that policy effort was focused on rural, rather than urban, areas within Ireland. The Irish Parliamentary Party (IPP) emerged in the late 19th century as the dominant force of Irish nationalism and was committed to securing Home Rule for Ireland. The party was extremely successful electorally and was able to claim the majority of Irish seats in Westminster, with the exception of Ulster where Unionists dominated. The party successfully used its position in parliament to extract concessions from the government, most notably on the question of Home Rule, but also in other areas such as land tenure. The most important legislation in this area were the successive *Land Acts* of the late 19th and early 20th Century, which improved tenant rights and financed the transfer of agricultural land in Ireland from large landlords to their tenants. In 1870, only 3% of Irish farmers owned their land while some 800 landlords owned half the county (Fraser 1996). By 1914, over half the agricultural land in Ireland had been transferred to tenant ownership and an entire class of peasant proprietors was created (Guinnane and Miller 1997).

With progress being made on the issue of land reform, the IPP turned to the next largest class employed in agriculture. Landless agricultural laborers, who comprised 25% of the rural workforce in the late 19th century, were unable to benefit from the *Land Acts* and the IPP was keen to secure the support of this important constituency (Fraser 1996). Indeed the problems of housing for laborers may even have been exacerbated by the transfer of land to tenants, as much of the laborer housing that did exist was provided by landlords themselves, a provision that small peasant proprietors may not have been able to match. The various *Labourers Acts* directly followed the *Land Acts* and shared their increasing ambition in terms of scale and scope. For political reasons, whatever reforms were achieved for farmers needed to be matched by a corresponding benefit to agricultural laborers, whose greatest need was improved housing.

The willingness of the UK government to facilitate and encourage these exclusively Irish schemes also reflects the political context of the time (Aalen 1986). Perhaps unsurprisingly, the use of public money to house Irish laborers was not universally supported in UK politics. Rather, the *Labourers Acts* were part of successive policies collectively referred to as ‘constructive unionism’ which aimed to ameliorate the political situation in Ireland through economic development and social improvement (Aalen 1993; Synnott 1906). The need to reduce the high rates of emigration from rural areas was often cited (Fraser 1996). Indeed, calls to emulate the success of the scheme and

extend building to Britain were dismissed, citing Ireland as a unique case. Even the segmentation between rural and urban housing was based on the desire to separate rural subsidies to avoid the precedent being set for urban social housing in the UK (Norris and Fahey 2011). The result was a striking disparity in the provision of rural social housing between the two islands.

2.2 Labourers Acts

The *Labourers Acts* were a series of acts that became progressively more generous and expansive over time. The first was enacted in 1883 and, although in many ways a pioneering piece of legislation, was rather limited in its provisions. Under the act, 12 or more rate payers could apply to the Board of Guardians of a Poor Law Union, the responsible unit of local government at the time, to create a rural housing scheme. The local authorities could then apply for a loan from the central government. Two- or three-room cottages could be built by local authorities, with the added provision of half an acre to supplement an agricultural laborer's income. Maximum rents were set at approximately 1 shilling per week.⁴ Amendments to the Act that followed in 1885 and 1886 improved loan terms and broadened the definition of eligible agricultural laborers (Fraser 1996). These amendments led to an acceleration in building, although progress was uneven geographically, with 60% of cottages built in the south-western province of Munster and relatively little building in the northern provinces of Connacht and Ulster.

An important feature of the early *Labourers Acts* that limited applications was the fact that loan payments on money borrowed by local authorities had to be paid fully out of local taxation. In many Poor Law Unions, this burden proved too great, either for economic or political reasons, especially as landlords still controlled local government in Ireland and were resistant to raising rates to pay for housing for laborers. Progress on this issue was made in 1891 when the *Land Act* of that year set aside funds to subsidise rates. Although small and insufficient to fully address the problem, this represented the first direct subsidy for housing under the Acts and set a precedent for more generous subsidy to follow. Of greater consequence was the change in local government administration that took place with the *Local Government Act* in 1898 (McKay 1992). The Act transformed the administration of local government in Ireland with responsibility for administering the *Labourers Acts* passing from Poor Law Unions to newly-created Rural District Councils, the members of which were elected under a dramatically extended household-franchise, including laborers themselves and women voters for the first time. Following this reform, the power of landlords to oppose housing schemes was curtailed and house-building accelerated. Nonetheless the success of the first two decades of the *Labourers Acts* was "steady but not yet spectacular" with around 1,000 cottages being built per year on average (Fraser 1996, p. 35).

The attractiveness of the scheme was considerably boosted by the 1906 *Labourers Act*, which involved a large direct subsidy from central government, as well as lower interest rates on borrowing. Following the passing of the far-reaching Wyndham *Land Act* in 1903, which provided generous loan terms to tenant farmers as well as financial bonuses to landlords to purchase their plots, the IPP induced the Liberal government to produce an equally generous package for rural laborers. This resulted in the 1906 Act extending the generous loan terms of the 1903 *Land Act* to the provision of laborer housing. The rate of interest charged fell from 4.5% over 50 years in 1904 to 3.25%

⁴Until Independence, Ireland's monetary system was the same as Britain's, with a pound made up of 20 shillings and each shilling having 12 pence, written with the suffix *d*. Decimalisation took place in 1971.

over 68.5 years, significantly reducing the cost to local authorities of financing housing schemes (O'Sullivan 1907). Furthermore, the central government in Westminster met 36% of loan repayments under the act. A report produced by the Bureau of Labor Statistics (1915) provides revealing details of a scheme for 36 cottages in Roscrea, County Tipperary, with cottages on average costing £160 to build. Before the 1906 Act, the cottage would have cost the district £7.20 annually (or 2s 9.3d per week). After the 1906 Act, the grant and lower rate meant the interest costs fell to £3.33 (1s 3.4d per week). With weekly rents set at 1s 7d, the district more than covered its costs. Indeed, the new terms were generous enough that some local authorities were even capable of making a small profit on the scheme.

Meanwhile, laborers benefited from lower rents than those demanded by private landlords. In 1911, market rents for agricultural laborers were on average 2 shillings per week (Department of Agriculture and Technical Instruction 1911), while the typical *Labourers Act* cottage rented for 1 shilling. Further, laborer wages rose in the early 20th century. In 1911, an agricultural laborer in the eastern county of Meath could expect to earn £27.30 per year for work (without lodgings). At market rents of 2 shillings per week, the cost of housing would have comprised almost 20% of income. A rent of 1 shilling per week meant a real cost of rents of approximately 10% of income. In addition, the 1906 Act also broadened the definition of laborer to anyone “working for hire in a rural district, whose average wages... do not exceed two shillings and sixpence a day [£37.50 for a year with 300 working days] and are not in occupation of land exceeding one quarter of an acre” (O'Sullivan 1907, p. 165). It is perhaps no surprise that following the 1906 Act, building accelerated markedly throughout the country, with over 26,000 cottages being built after 1906, compared to a little over 20,000 between 1884 and 1906 (McKay 1992). In Connacht and Ulster, over 80% of all cottages built under the *Labourers Acts* were built after 1906.

2.3 Ireland after Partition

The period following the outbreak of the First World War would prove to be a turning point in relations between Britain and Ireland. Following a War of Independence that began in 1919, Ireland was partitioned into two states. Six northern counties remained part of the United Kingdom under a devolved administration in Belfast, while the remaining 26 counties left the United Kingdom and became the Irish Free State. Despite the newly-won control over housing policy of the Irish government, relatively little new social housing was built in the 1920s, for both financial and ideological reasons, although the government did subsidise the construction and sale of some 5,588 rural houses under the ‘Million Pound Scheme’ by 1927 (Kenna 2011). Reforms to the funding of social housing provision in the 1931 *Housing Act*, combined with the election of a more interventionist Fianna Fáil government in 1932, led to increased funding for local authority social housing in the 1930s.

Alongside the construction of additional laborer cottages, the 1936 *Labourers Act* facilitated tenants of cottages built under previous *Labourers Acts* to purchase their homes at a significant discount. Initially, purchase annuities were set at 75 percent of pre-purchase rent, before being further reduced to 50 percent of pre-purchase rents in 1951 (Norris and Fahey 2011). Minutes of an October 1956 meeting of the Council in the south-eastern county of Wexford outline the impact of these schemes on the rent burden for rural workers. The county was home to 4,250 cottages, of which nearly 2,300 dated from pre-Independence schemes (Wexford County Council 1956). Of cottages

still being rented, 70% had a rent of no more than 2s per week (£5.20 per year), while of those on purchase schemes, the average annual payment was £2. In 1956, the legal minimum wage for an agricultural laborer was £252 (Office 2018). While an industrial worker in 1950s Dublin could expect to earn roughly twice the wage of an agricultural laborer, assuming they could find employment, the annual rent for a house in the city was close to £15 (Keely and Lyons 2020).

The success of this policy is evident in the fact that 80% of cottages built under the *Labourers Acts* were owner occupied by the mid-1960s (Norris 2016). Indeed, the 1936 Act set a precedent that all social housing would come with an expectation of discounted tenant purchase. As the 20th century progressed, the principle of “asset-based welfare” became central to Irish housing policy, predating by a number of decades the large-scale transfer of social housing seen in the United Kingdom during the 1980s (Norris and Fahey 2011; Disney and Luo 2017). The policy had a clear influence on the rate of home-ownership in Ireland: by the early 1990s, 79 percent of housing was owner-occupied, this figure having been as low as 10% in 1922. Significantly, one quarter of all owner-occupied houses in 1991 were former social housing (McManus 2011).

In Northern Ireland, the fate of cottages built under the *Labourers Acts* was very different. Despite some limited provision for tenant purchase of laborers’ cottages in Northern Ireland, only 348 cottages were sold before the decision was made to formally facilitate the process in 1975, nearly forty years after similar provisions were made in Ireland (House of Commons Debates 1975a; House of Commons Debates 1975b). The ‘Right-to-buy’ was then generalized by the Northern Ireland Housing Executive House Sales Scheme in 1979, legislation that closely resembled schemes across the UK (Northern Ireland Housing Executive 2020). This different experience of the privatization of laborers’ cottages in the North and South of Ireland is a feature we will employ in our empirical analysis to understand the mechanism through which historical social housing influenced population change on the island of Ireland.

3 Data

Ireland in the early 20th century was arranged into approximately 3,400 District Electoral Divisions (DEDs) across its 32 traditional counties, each of which had a County Council. Between these administrative layers were around 300 Local Government Districts (LGDs), which were aggregates of DEDs and which nested within counties. Around 200 of Ireland’s LGDs were in rural areas and these form the subject of our analysis.

To undertake our analysis, we collect information on the *Labourers Acts* for the 213 rural LGDs from returns made to the House of Commons. For example, the House of Commons (1911b) return included the number of cottages built by district, to that year, as well as information on legal and other costs. Similar information was collected from returns made in previous and subsequent years. We then compile figures at the LGD level on area, valuation of real estate (for tax purposes), housing stock and other information, from the 1911 Census of Ireland. These series are included in the *Database of Irish Historical Statistics* (Clarkson et al. 1997). Further series from the 1911 census, including religious make-up by district, was also collected from the *Troubled Geographies* database (Gregory et al. 2013). Statistics on agricultural attributes were taken from UK Parliamentary Papers (Department of Agriculture and Technical Instruction 1912). Other information, including the distance from an LGD to Dublin, Belfast or other

nearest urban district, is derived from the location of LGDs. A detailed description of all variables included in the analysis can be found in Appendix A.1 and summary statistics can be seen in Table 1.

This combination of sources from the early 20th century provides the treatment of interest, most control variables and, where relevant, variables used in extensions, such as the number of cottages authorized but not built by the time the scheme ended in 1915. To examine the effect on population over time, our key outcome of interest is the change in population density, by rural LGD, between any two pairs of Census years. To do this, we use population data 1841-2002, at the modified time-consistent DED level, as published on the AIRO Historical Mapping database (Kelly and Fotheringham 2011). These data were then aggregated up to the 213 rural districts level in 1911.

Table 1: Summary Statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Change log pop. 1841-1911	213	-0.910	0.306	-1.485	0.505
Change log pop. 1911-2002	213	-0.0790	0.659	-1.420	2.597
Cottages by 1911 (per capita)	213	10.28	8.849	0	37.28
Cottages by 1911 (% of housing)	213	6.018	5.051	0	20.53
Cottages 1906-1911 (per capita)	213	4.823	4.653	0	26.38
Cottages not built by 1915 (per capita)	213	3.542	7.212	-4.955	81.69
Rated Value in 1911 (thousands)	213	52.64	34.40	8.191	189.3
Population in 1911 (thousands)	213	13.83	8.888	1.815	54.90
Total Houses per km2, 1911	213	8.879	4.410	2.014	31.59
% Catholic	213	82.77	22.67	6.033	99.68
% of holdings owned	213	0.645	0.164	0.0404	0.921
Cattle per acre	213	0.325	0.0611	0.178	0.490
Average Farm size (acres)	213	26.06	8.306	8.112	62.74
Distance to nearest Urban District	213	14.95	10.33	0.214	48.22
Distance to Dublin	213	143.4	64.79	5.774	308.8
Distance to Belfast	213	192.0	98.13	6.960	419.0
Fall in legal costs, 1906-11	213	0.371	0.484	0	1

Source: see text. All per capita variables are per 1,000 population in relevant census year.

Table 1 shows the population decline in rural Ireland over 160 years. The impact of the Great Famine is evident, as is the continued population decline over the 19th and 20th Centuries, with rural population growth only returning in the 1970s. On average across rural districts however, population was approximately 8% lower in 2002 than it was in 1911.

As mentioned above, the spread of cottages was not consistent either over time or across parts of Ireland. Take-up was higher after 1903 and highest between 1910 and 1915, nationally, with an average of 1,150 cottages built per year in the decade to 1896, almost 2,100 per year in the decade to 1906 and over 4,700 per year in the final decade of the scheme. Table 1 also confirms the prevalence of the scheme, with these cottages accounting for 6% of homes in the average district by 1911, and the intensity of the scheme 1906-1911, a five-year period that accounted for two-fifths of all cottages built 1883-1911.

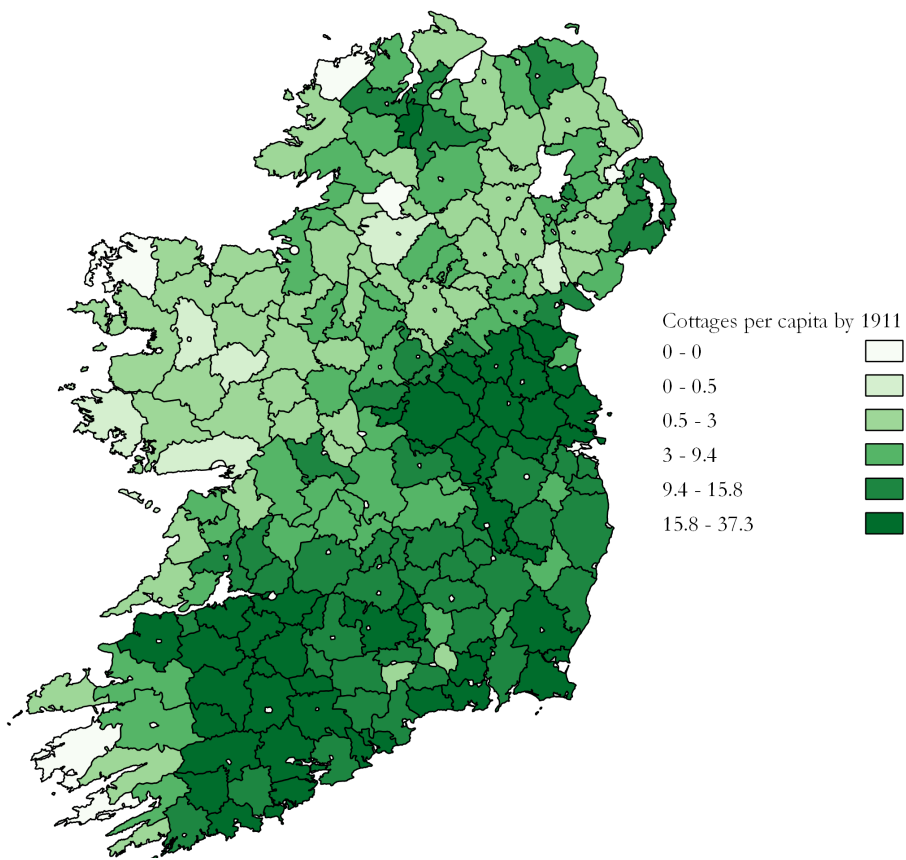


Figure 1: Laborers' Cottages built by 1911

Given the timing of the 1911 Census, we choose that year as our end date for treatment, to avoid contamination between our treatment and any other variables, in particular our outcome of interest. The extent of laborers' cottages built by 1911 can be seen in Figure 1. It shows that building during this period was widespread across the country but that significant variation existed. Almost half of all cottages built before 1906 were in Munster, with most of the rest in Leinster (the south-eastern province). However, after 1906, similar numbers of cottages were built in three of Ireland's four provinces: between 7,200 in Ulster and 8,900 in Leinster. In Connacht, in the north-west, while the uptake of cottages rose substantially after 1906, there were just 2,358 cottages built in the province under the *Labourers Act* schemes.

4 Analysis

We consider the *Labourers Acts* to represent a shock to the migration decision, consistent with the consensus described earlier on the importance of relative earning potential in the source region and potential destination regions in both Harris-Todaro and historical migration literatures. As described in Section 1, Irish migration was sensitive to relative wages in rural areas, w_r , and, thus, to relative income available after rents (and any taxes) are paid, w_r^* . In that context, a halving of rural rents for landless laborers, as a result of the construction of cottages under the *Labourers Acts*, would be expected to diminish migration out of rural areas, by increasing w_r^* . The further halving of housing costs, as part of southern Ireland's tenant-purchase schemes would represent an additional rise in w_r^* from the 1930s, but not in Northern Ireland.

4.1 Dynamic Difference in Differences

We begin our analysis by exploiting the panel nature of our population data to assess the impact of the provision of Labourers Cottages, taking a dynamic difference-in-differences approach. We are particularly interested in exploring any pretrends in our data. It is plausible that more cottages might have been built in areas where trend population growth was higher, confounding the effect of our treatment. Following Lilley, Lilley, and Rinaldi (2020), we estimate the following equation:

$$\log(\text{Population}_{it}) = \alpha_i + \lambda_t + \sum_{j \neq 1911} \beta_j \text{Cottages}_{i,1911} \mathbb{1}_{j=t} + \sum_{j \neq 1911} \gamma_j X_i \mathbb{1}_{j=t} + \varepsilon_{it} \quad (1)$$

where Population_{it} is the population in district i in census year t , $\alpha_i + \lambda_t$ represent district and census year fixed effects respectively, and our key regressor, $\text{Cottages}_{i,1911}$, is the number of cottages built in district i up to 1911, normalized by population.⁵ Additionally, X_i represents our time-invariant baseline control variables: distance to the two major cities, Dublin and Belfast, distance to nearest urban area, population density in 1911, as well as latitude and longitude.

⁵In all cases we normalise by population in the relevant census year. For example, we normalise the stock of cottages built by 1911 by the population in 1881, before the scheme began. In alternative specifications, we normalize per square kilometre and relative to the 1911 housing stock and also use the raw count of cottages, in all cases with and without taking logs. Similarly, where relevant, we vary the start year (focusing only on those built from 1906) and the end year (including all cottages built to the end of the scheme in 1915). As summarized in Appendix Table A.1, our conclusions based on these alternative specifications remain unaltered.

Estimating Equation 1 produces the coefficients estimates and 95% confidence on our treatment variable plotted in Figure 2.⁶ These coefficients suggest a positive and significant relationship between cottages built and population over the 20th Century. Importantly, there is no evidence of a positive pretrend before 1911. Indeed, if anything the pretrend is negative, suggesting that more cottages may have been built in areas experiencing a greater loss of population in the pre-treatment period. To control formally for pretrends we again follow Lilley, Lilley, and Rinaldi (2020) and re-estimate Equation 1 but include a linear time trend interacted with our treatment. These coefficients are also plotted in Figure 2 and show, as expected, that controlling for pretrends has little impact on our results.

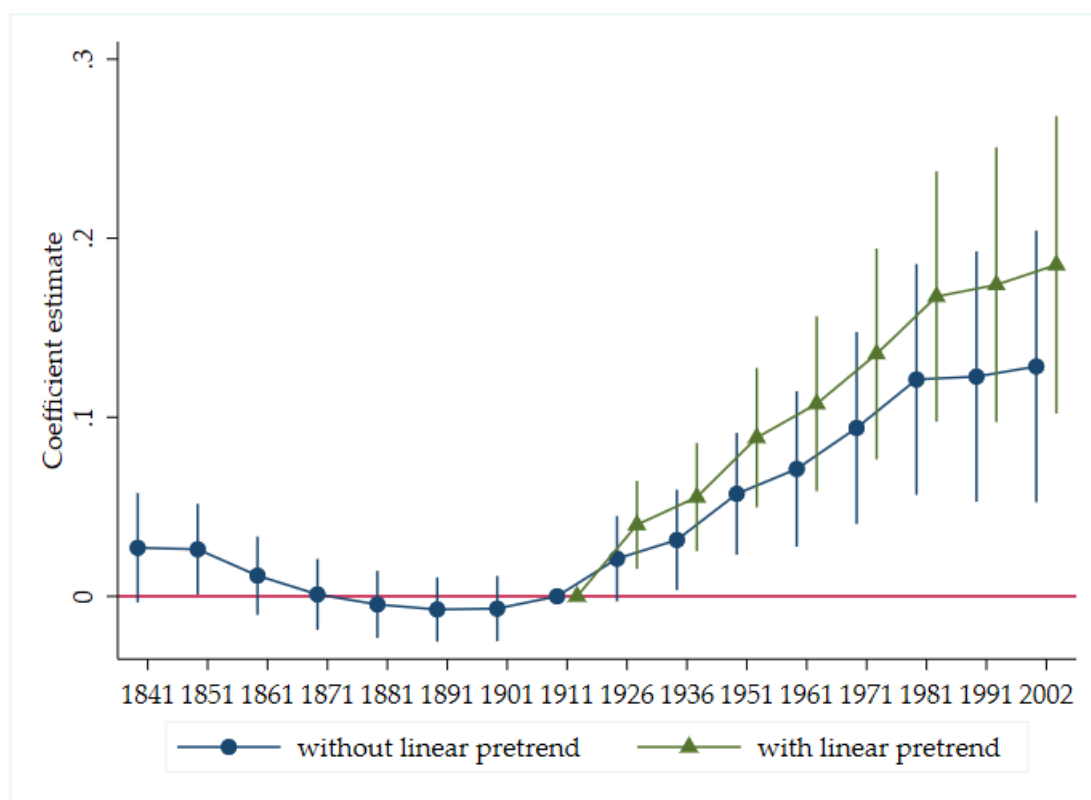


Figure 2: Cumulative effect on population of cottages per capita by 1911

4.2 Cross-sectional analysis

In the previous section, we illustrated a positive relationship between our treatment of interest – the intensity of *Labourers Act* cottages in a rural district – on subsequent population change. In this section we focus our attention on population change over the entire period of analysis, 1911-2002, taking a cross-sectional approach. Our principal outcome of interest is therefore the change in the natural log of population density, by rural district, between 1911 and 2002.

We begin our analysis by estimating a series of regression models based on the equation below:

⁶Standard errors are clustered at the district level.

$$\Delta Population_i = \alpha + \beta Cottages_i + \gamma X_i + \varepsilon_i \quad (2)$$

where $\Delta Population_i$ is the difference in (log) population between various census years and our key regressor, $Cottages_i$, is the number of cottages built in district i up to 1911, normalized by population. γ reflects the impact of our baseline controls, X_i , as described in the previous section. Given the results of our analysis of pretrends, we also include population change in the pre-treatment period, 1841-1911 as an additional control.

Next we test the robustness of this relationship to the inclusion of further control variables, focusing on population change in the post-treatment period 1911-2002. Our baseline model that corresponds to the final coefficient in Figure 2 is shown in Column 1 of Table 2. In extensions shown in Table 2, we include as additional controls initial conditions in 1911, including the aggregate value of real estate in the district, the pre-existing housing density, the religious mix, and a variety of agricultural attributes such as average farm size, land use, and tenancy. Column 5 of Table 2 drops the urbanized counties of Dublin and Antrim, to examine whether these are driving the results.

Column 6 adds a squared term while the final column controls for existing cottages built under the scheme prior to the reform of the scheme in 1906. Section 2.2 described the important changes in the scheme that took place in 1906. There is a positive correlation between the intensity of pre-1906 and 1906-1911 cottages and the inclusion of either subset of cottages, individually, yields a positive coefficient that is statistically significant. When both are included, it is the latter more intense part of the scheme – the 1906-1911 cottages – that are associated with greater population growth.⁷

In each of the models in Table 2, the coefficient on the treatment remains positive and significant. Further, in each of the specifications (1)-(5) – where cottages per capita, to 1911, enter linearly – the coefficient is very stable, at between 0.13 and 0.15. This is also the case if alternative scaling metrics for the cottages, including cottages as a fraction of all housing in the 1911 Census or cottages per square kilometre, rather than cottages per capita. The coefficients for six different combinations of treatment and scaling are shown in A.1 and, as in Table 2, the coefficient on the treatment is very stable.

While our regression analysis reveals a positive relationship between cottage building and population change 1911-2002, we can go further and look at other intercensal periods to identify when this population change took place. The coefficients from our baseline model for each intercensal period after 1911 are plotted in Figure 3. This plot reveals that cottages are positively associated with population growth in all periods up to 1971-1981 but not afterwards.

As outlined in Table 1, the rural population fell over the period 1911-2002, with the median rural district experiencing a population decline of 20%. Indeed, population declined in each successive intercensal period up to 1971 before increasing again afterwards. Given this and the pattern of results in Figure 3, we interpret the positive coefficients as indicating a smaller relative decline in population in areas with more intensive cottage building, rather than positive growth. This has important implications for understanding the nature of the relationship between treatment and outcome: as

⁷We end our measurement treatment in 1911, to prevent any contamination between the treatment and the outcome, which is based on the 1911 Census and because many of our other control variables are also from 1911. However, inclusion of the 1911-1915 cottages does not change the size, magnitude or statistical significance of our results, either with 1911-2002 population change or with 1926-2002 population change by district.

Table 2: Regression Analysis

Dependent Variable: $\Delta Population, 1911 - 2002$	(1) Baseline	(2) 1911 Controls	(3) Agri. Controls	(4) Religion/Ni	(5) No Urban Counties	(6) Cottages Squared	(7) 1906 Cottages
Cottages by 1911 (per capita, log)	0.148*** (0.042)	0.136*** (0.042)	0.129** (0.050)	0.151*** (0.047)	0.132** (0.049)	0.093* (0.046)	0.402*** (0.065)
Rated Value in 1911 (logs)		0.174** (0.065)	0.139** (0.057)	0.131** (0.056)	0.157** (0.057)	0.115** (0.051)	0.123*** (0.037)
Houses per km, 1911 (logs)		-0.089 (0.243)	0.122 (0.261)	0.058 (0.254)	-0.289 (0.173)	0.010 (0.252)	0.157 (0.287)
Average Farm size (logs)			0.305 (0.248)	0.180 (0.220)	0.116 (0.284)	0.147 (0.222)	0.262 (0.234)
Cattle per acre (logs)			-0.084 (0.131)	-0.073 (0.151)	0.036 (0.160)	-0.140 (0.176)	0.274* (0.157)
% of holdings owned (logs)			-0.458*** (0.136)	-0.415*** (0.128)	-0.329** (0.146)	-0.396*** (0.123)	-0.476*** (0.144)
% Catholic (logs)				-0.207 (0.157)	-0.315* (0.177)	-0.211 (0.144)	-0.206 (0.175)
Northern Ireland				0.331 (0.210)	0.311 (0.209)	0.315 (0.210)	0.488* (0.252)
Cottages by 1911 (per capita, log, squared)						0.029** (0.013)	
Cottages by 1906 (per capita, log)							-0.209*** (0.051)
Observations	207	207	207	207	178	207	177
R-squared	0.547	0.572	0.609	0.628	0.502	0.635	0.675
RMSE	0.455	0.444	0.428	0.419	0.408	0.416	0.380

All models include baseline controls (see text) and a constant.
 Robust standard errors clustered by County in parentheses.
 *** p<0.01, ** p<0.05, * p<0.1

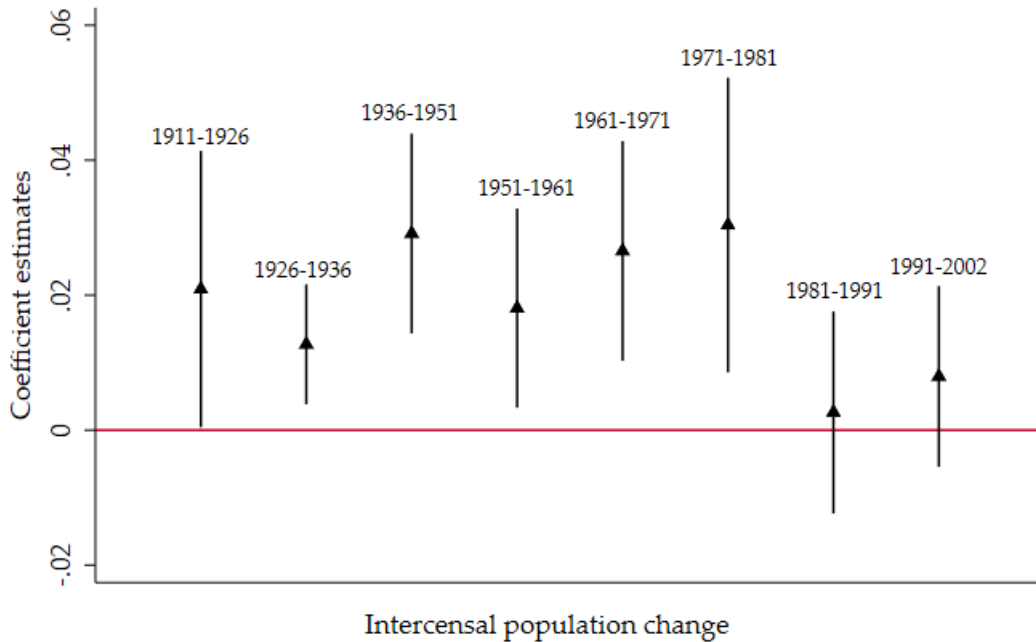


Figure 3: Coefficient Plot - cottages 1911 and pop. change by intercensal period

the effect is not in the context of growth, this is not a story of agglomeration effects. Instead, cottages reduced out-migration and kept some of those that would otherwise have migrated ‘rooted to the soil’.

4.3 Robustness

The interpretation of the results presented above rests on the plausibility of a causal link. In this subsection, we present further evidence of the causal relationship between the construction of *Labourers Act* cottages and subsequent population growth, relative to an alternative hypothesis that districts that built more cottages had unobserved characteristics that were somehow favourable to population growth. These complement the analysis above, including the analysis of pre-trends and extending the list of regressors to include additional controls. Here, we use ‘placebo’ and IV techniques and exploit the differential policy treatment of cottages either side of Ireland’s 1921 border as a natural experiment. We also examine whether spatial autocorrelation may be driving our results.

Placebo Test We begin by exploiting the unexpected ending of the construction of cottages as a result of the outbreak of the First World War. The outbreak of war in 1914 led to an increase in the cost of building materials and a general retrenchment of non-essential government spending which resulted in a large number of cottages, that had been planned and authorized, not being built (House of Commons 1916). The number and location of these planned but unbuilt cottages is calculated as the difference between the total number of cottages authorized and the number actually built by 1915. In the spirit of Donaldson (2018), we exploit this exogenous event as aiding a causal interpretation, using the number of cottages that were authorized but not built as a falsification or ‘placebo’ test. Table 3 presents the results of our placebo test, where cottages that were authorized but not built (per person) is included as an additional regressor. The results show that the number of cottages authorized but not built is not related to population growth 1911-2002 across all specifications. Reassuringly, the coefficient on cottages actually built remains similar to those in Table 2.⁸

IV Analysis As a further test of the causal interpretation of our results, we take an instrumental variables (IV) approach. Specifically, we exploit a change in the 1906 *Labourers Act* that allowed for a limit to be placed on the administrative costs of cottage schemes. The change was motivated by the concern that there was significant variation in the legal costs associated with building cottages across districts, with the legal costs per cottage built varying by more than a factor of twenty in 1906. According to commentary at the time, the high level of fees paid to solicitors was unjustified and suggest that this variation was likely driven by abuses of the scheme by particular district councils (O’Sullivan 1907).

⁸Although our falsification test goes some way in addressing concerns that unobservable characteristics drove both cottage building and subsequent population growth, it is also plausible that our placebo — cottages authorized but not built — was not randomly assigned. A concern would be where districts with a greater number of cottages authorized but not built were also places with poorer prospects for population growth compared to other districts that built cottages earlier. However, there is a positive, rather than negative, correlation between cottages built to 1911 and cottages authorized but never built, suggesting that if the scheme had been continued, it would have intensified the treatment, rather than changed its relative strength across districts.

Table 3: Placebo Treatment

Dependent Variable: Δ Population, 1911 – 2002	(1) Baseline	(2) 1911 Controls	(3) Agri. Controls	(4) Religion/Ni	(5) No Urban Counties	(6) Cottages Squared	(7) 1906 Cottages
Cottages by 1911 (per capita, log)	0.164*** (0.046)	0.149*** (0.047)	0.130** (0.054)	0.151*** (0.050)	0.141*** (0.051)	0.097* (0.049)	0.395*** (0.064)
Cottages not built by 1915, per capita (logs)	-0.017 (0.023)	-0.017 (0.023)	-0.015 (0.019)	-0.016 (0.020)	-0.032 (0.022)	-0.015 (0.020)	0.014 (0.018)
Rated Value in 1911 (logs)		0.170** (0.080)	0.136* (0.073)	0.139* (0.069)	0.163** (0.068)	0.120* (0.064)	0.123** (0.045)
Houses per km, 1911 (logs)		-0.135 (0.239)	0.106 (0.269)	0.036 (0.266)	-0.280* (0.165)	-0.022 (0.260)	0.134 (0.293)
Average Farm size (logs)			0.365 (0.277)	0.215 (0.237)	0.097 (0.278)	0.177 (0.244)	0.286 (0.253)
Cattle per acre (logs)			-0.027 (0.144)	-0.006 (0.159)	0.057 (0.159)	-0.075 (0.187)	0.309* (0.177)
% of holdings owned (logs)			-0.456*** (0.145)	-0.384*** (0.137)	-0.299** (0.146)	-0.364*** (0.130)	-0.464*** (0.155)
% Catholic (logs)				-0.271* (0.155)	-0.334* (0.176)	-0.262* (0.145)	-0.208 (0.204)
Northern Ireland				0.324 (0.234)	0.314 (0.237)	0.311 (0.238)	0.488 (0.303)
Cottages by 1911 (per capita, log, squared)						0.028** (0.013)	
Cottages by 1906 (per capita, log)							-0.208*** (0.055)
Observations	188	188	188	188	165	188	162
R-squared	0.511	0.533	0.572	0.592	0.495	0.599	0.644
RMSE	0.463	0.455	0.439	0.432	0.422	0.429	0.393

All models include baseline controls and a constant.
 Robust standard errors clustered by County in parentheses.
 *** p<0.01, ** p<0.05, * p<0.1

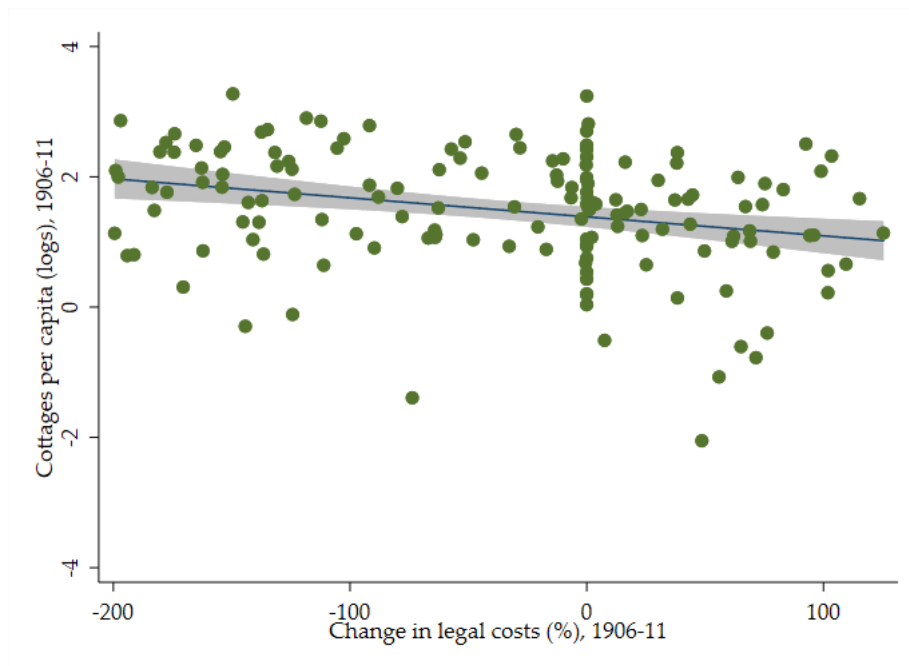


Figure 4: Change in legal costs per cottage and 1906-11 treatment

Table 4: IV Analysis

Dependent Variable:	(1)	(2)	(3)	(4)
Δ Population, 1911-2002	Baseline IV	Baseline Controls	Agri. Controls IV	Agri.
Cottages 1906-1911 (per capita, log)	0.148*** (0.042)	0.247*** (0.071)	0.128*** (0.046)	0.218*** (0.071)
Rated Value in 1911 (logs)			0.133** (0.058)	0.132** (0.055)
Houses per km, 1911 (logs)			0.102 (0.261)	-0.007 (0.244)
Average Farm size (logs)			0.370 (0.243)	0.233 (0.266)
Cattle per acre (logs)			0.083 (0.153)	0.118 (0.151)
% of holdings owned (logs)			-0.484*** (0.156)	-0.481*** (0.149)
Observations	197	197	197	197
R-squared	0.554	0.531	0.615	0.599
RMSE	0.458	0.459	0.431	0.424
K-P Wald F-stat		28.97		27.38

All models include baseline controls and a constant.

Robust standard errors clustered by County in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

To measure the impact of these legislative changes, we calculate the percentage change in legal costs per cottage between 1906 and 1911 for each district. We then define a categorical variable *Fall in Legal costs 1906-11* that takes value of one when legal costs fell in a district over the period and zero otherwise. As can be seen from Table 1, a fall in legal costs occurred in nearly 40% of districts. We then use this variable as an instrument for cottages built over the same period, 1906-1911, in 2SLS regression, whose results are shown in Table 4 for two specifications: firstly, our baseline specification and secondly, the extended specification with additional agricultural controls. In both cases, the coefficient in the 2SLS set-up is positive and statistically significant and similar in magnitude to the overall regression (although the coefficient for the 1906-1911 cottages only is larger, between 0.2 and 0.25).

By focusing on changes in legal costs, rather than levels, we strip out initial variation in legal costs across districts. More specifically, we believe this instrument to be relevant — a link between fall in legal costs and number of cottages built — as districts where legal costs fell experienced a larger shift towards viability (lower burden on rate-payers) than others, in effect shifting out supply. Indeed such a correlation does exist, as can be seen in Figure 4. We also believe this instrument is valid — no link between fall in legal costs and population change 1911-2002, other than through cottages built — as the reform was nationwide and not related to the individual characteristics of a rural district.

Spatial Autocorrelation Given the spatial nature of the dataset, we test for spatial autocorrelation in the residuals from our analysis. Kelly (2019) highlights the potential of inflated t -statistics arising from spatially autocorrelated data. We employ his

procedure and generate spatially adjusted ‘direct’ standard errors to examine the sensitivity of our baseline results, using all cottages to 1911, scaled by the 1881 population (Kelly 2020).⁹ The results of the diagnostic tests are shown in Appendix Table A.2 and Figures A.1-A.3. They reveal that although the data do display a spatial structure, the direct standard error on our treatment variable is similar to the robust standard error reported in Table 2. We also compute Cook’s Distance to identify influential observations. Reassuringly, our results hold when these small number of observations are dropped from the analysis.

4.4 Mechanism

Our description of the decision to migrate earlier, based on the existing literature across development and historical economics, identifies the relative real wage rate as a key variable. The heavy subsidization of cottages by central government allowed Irish county councils to charge lower rents than these tenants had been previously paying to private landlords. As discussed in Section 2.2, a typical rent paid by laborers to private landlords in 1911 was roughly 2 shillings per week, while rents paid to county councils was typically 1 shilling per week (Department of Agriculture and Technical Instruction 1911; Fraser 1996).¹⁰ In some areas, the rent was estimated to have been as little as one-sixth of the private rent (Synnott 1906).

The policy of tenant purchase initiated in 1936 in the newly-independent southern counties of Ireland and described in Section 2 presents a natural experiment. As discussed previously, repayments under the tenant purchase scheme were set as a proportion of the previous rent (75% in 1936 and 50% from the 1950s). To assess the impact of this change, we look at a subset of 57 districts in counties on either side of the border created in 1922, where districts on the Irish side of the border are deemed to be treated from 1936, unlike those on the Northern Irish side (which remained in the United Kingdom). The creation of the Irish border represents a source of quasi-random assignment of districts to treatment and control groups as the border adhered to ancient county boundaries, creating a 310 mile haphazard and arbitrary border which split communities and towns (Hayward 2021).

We focus our analysis on districts in the ‘border region’ defined as the ten counties whose boundaries formed the border.¹¹ We use both temporal and spatial variation. Firstly, the five counties in (southern) Ireland are considered the treatment group, with the five counties in Northern Ireland the control group. Secondly, the 1911-2002 period is split into three, reflecting changes in the availability of tenant purchase schemes. During the period 1911-1936, no tenant-purchase scheme was available and thus no difference between northern and southern districts is expected. During the period 1936-1971, (southern) Ireland is treated but Northern Ireland is not and thus we would expect the impact of cottages on population to be greater in the south. Lastly, for 1971-2002, tenant purchase schemes were available in both jurisdictions, although notably the scheme in Northern Ireland was initially established on far less generous terms

⁹We also apply the HAC correction from Conley (1999) to our baseline specification with various cut-offs, which does not materially affect the results.

¹⁰Weekly private rent is estimated from statistics published by the The Department of Agriculture, market rent being the difference between wages for laborers with and without cottage accommodation provided.

¹¹These counties are Armagh, Cavan, Donegal, Derry, Down, Fermanagh, Leitrim, Louth, Monaghan and Tyrone. Of these, five (Armagh, Derry, Down, Fermanagh and Tyrone) are in Northern Ireland.

(House of Commons Debates [1975b](#)).

Table 5: Northern vs southern Ireland

Dependent variable:	(1)	(2)	(3)
$\Delta Population$	1911-1936	1936-1971	1971-2002
Cottages by 1911 (per capita, log)	0.030 (0.031)	0.095* (0.044)	0.065*** (0.019)
Northern Ireland	-0.030 (0.099)	0.328*** (0.096)	0.129** (0.048)
Cottages by 1911 (per capita, log) x NI	0.023 (0.067)	-0.110* (0.050)	-0.058* (0.029)
Observations	57	57	57
R-squared	0.415	0.808	0.501
RMSE	0.228	0.181	0.156

All models include baseline controls and a constant. Previous period population change is 1841-1911 in (1), 1841-1936 in (2) and 1841-1971 in (3).

Robust standard errors clustered by County in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5 confirms these predictions. In the earliest period (Column 1), the interaction between treatment and a variable indicating Northern Ireland is not statistically significant — the impact of cottages on population growth did not depend on the border. For the period 1936-1971 (Column 2), after the tenant purchase scheme began in Ireland, this interaction term becomes significant, with cottages in Northern Irish districts having a smaller impact on population change. Finally, Column 3 of Table 5 examines the period 1971-2002, when tenant purchase schemes were available on both sides of the border. The effect of the border appears to persist however, suggesting that differences between the generosity of the tenant purchase schemes north and south may have mattered. Taken together, this evidence is highly suggestive of tenant purchase being an important underlying mechanism through which cottage building affected population growth during the period.

5 Conclusion

This paper examined the impact of the various *Labourers Acts* on the path of population growth in Ireland’s rural districts over the course of the 20th century. Using a variety of methods, including a dynamic difference-in-differences research design, placebo analysis and IV analysis, we present evidence that the provision of these cottages moderated population decline over subsequent decades.

The effect was also greater in southern Ireland than in Northern Ireland, and this difference speaks to a key element behind the success of the scheme in keeping rural wage-earners ‘rooted to the soil’ and reducing out-migration. The *Labourers Acts*, especially the 1906 Act, were extremely generous in their provisions. The large direct subsidy from central government meant tenant rents were reduced by roughly half, increasing the opportunity cost of migration, all else equal. Secondly, the scheme was broad in that it was applied to all rural districts in the country. Third, it was highly-targeted, not only in terms of geography but also in that it was specifically aimed at a part of the labor force that was highly likely to migrate: agricultural laborers. De-

spite representing only around 30% of the adult male workforce in 1911, laborers made up 64% of adult male emigrants in the same year (Registrar General 1912).¹² Finally, the introduction of legislation, which allowed tenants of Laborers' cottages to purchase their homes at a significant discount on previous rents, provided a further disincentive to migrate.¹³

This combination of features hints at the broader relevance of this context. With urbanization a prevalent feature of modern life, policymakers, politicians and voters in many settings – across both high- and low-income countries – seek to shape the spread of population and economic activity, in particular by limiting population declines in rural areas. Given that, our results speak to the “people *versus* place” policy debate and show that policies that are place-based in nature can work. However, the intervention we study was arguably both people- and place-based, given it was aimed certain types of occupations and income ranges. The intervention in rural Ireland was expensive and relied on the ability of a large state (the UK) to borrow at low cost over long periods, as well as its willingness to subsidize more than a third of the capital costs involved. The lack of any schemes similar in depth in rural Britain or in urban Ireland or Britain during this time speaks to the limited ability even of the largest economy in the world at the time to undertake a scheme aimed at a wider group.

Given these features of our context, our results raise important questions for future research. Ireland remains one of the least urbanized high-income countries in the world, with consequences in agglomeration economies foregone. The scheme described in this paper may have contributed, along with other factors, to this hidden cost in Ireland's economic development. The scheme described may also have affected other outcomes, including public health and political voting preferences, raising questions about the broader effects of interventions that affect the quality and cost of housing. Our results present research questions beyond the Irish context. For example, the setting is rural. Do urban schemes, more common in housing policy interventions especially in the 21st century, have similar effects? Our setting also involved very generous terms for agricultural laborers. What thresholds or non-linearities might apply, when households consider a decision as discrete as moving to a new location? With urbanization continuing and global population growth slowing, research that answers these and questions will be needed as the “people *versus* place” debate continues and a path towards sustainable urbanization is forged.

¹²The figures here are based on the classification given in the Emigration Statistics and refer to all laborers and not agricultural laborers exclusively. The figure for laborers in the 1911 workforce is based a tabulation of individual level 1911 census data.

¹³This is the case even before we include any wealth effect of asset acquisition.

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A Appendix

A.1 Variable Description and Sources

Change in (log) population to/from 1911 (1841-2002)

Change in population between 1911 and various census years. Data from AIRO Historical Mapping database (Kelly et al. 2013). Equivalent to change in population density as spatial units are consistent over time.

Cottages per capita by 1911

Cottages built under the *Labourers Acts* up to April 1911 scaled by population in 1881 (pre-introduction of the scheme). Cottages data from Parliamentary Papers (House of Commons 1911b). Population data from AIRO Historical Mapping database (Kelly et al. 2013).

Cottages as a share of housing stock, 1911

Cottages built under the *Labourers Acts* up to April 1911 scaled by total housing stock as given in 1911 census. Cottages data from Parliamentary Papers (House of Commons 1911b). Housing stock from (Clarkson et al. 1997).

Cottages per capita, 1906-1911

Cottages built under the *Labourers Acts* between Nov 1906 and April 1911 scaled by population in 1901 (closest pre-1906 census). Cottages data from Parliamentary (House of Commons 1911b; House of Commons 1911a). Population data from AIRO Historical Mapping database (Kelly et al. 2013).

Distance to Dublin, Belfast and nearest urban area

Distance in km from Rural District centroid to Dublin, Belfast and nearest Urban District.

Location (latitude, longitude)

Coordinates of Rural District centroid.

Valuation of district

Valuation of land and buildings for the purposes of local taxation in 1911 (House of Commons 1911b).

Population density

Population per sq. km in 1911. (Kelly et al. 2013; Clarkson et al. 1997)

Housing density

Houses per sq. km, 1911 Census (Clarkson et al. 1997)

Share Catholic

Catholics as a share of population (Gregory et al. 2013).

Share of holdings owned

Share of total agricultural land holdings that are owned (not tenanted) by Poor Law Union in 1911 (Department of Agriculture and Technical Instruction 1912).

Cattle per acre

Number of Cattle per acre of non-mountainous agricultural land by Poor Law Union in 1911 (Department of Agriculture and Technical Instruction 1912).

Farm Size

Non-mountainous agricultural land (acres) by Poor Law Union in 1911 divided by total number of agricultural holdings (*ibid.*).

Cottages Not Built per capita, 1915

Cottages authorized by 1915 minus Cottages built by 1915, scaled by 1911 population (closest census year) (House of Commons 1915).

Change Legal Costs 1906-11

Change in legal costs per cottage built between 1906 and 1911 (House of Commons 1911b; House of Commons 1911a).

A.2 Supplementary Figures and Tables

Table A.1: Alternative scaling of the dependent variable

Cottages	All cottages to 1911	1906-1911 cottages
Per capita (log)	0.148** (0.04)	0.148** (0.04)
Per km2 (log)	0.154** (0.04)	0.152** (0.04)
Percent (log)	0.152** (0.04)	0.152** (0.04)

Numbers shown are the coefficients on the treatment, scaled by the factors shown in the matrix shown.

All models include baseline controls (see text) and a constant.

Robust standard errors, clustered by County, in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

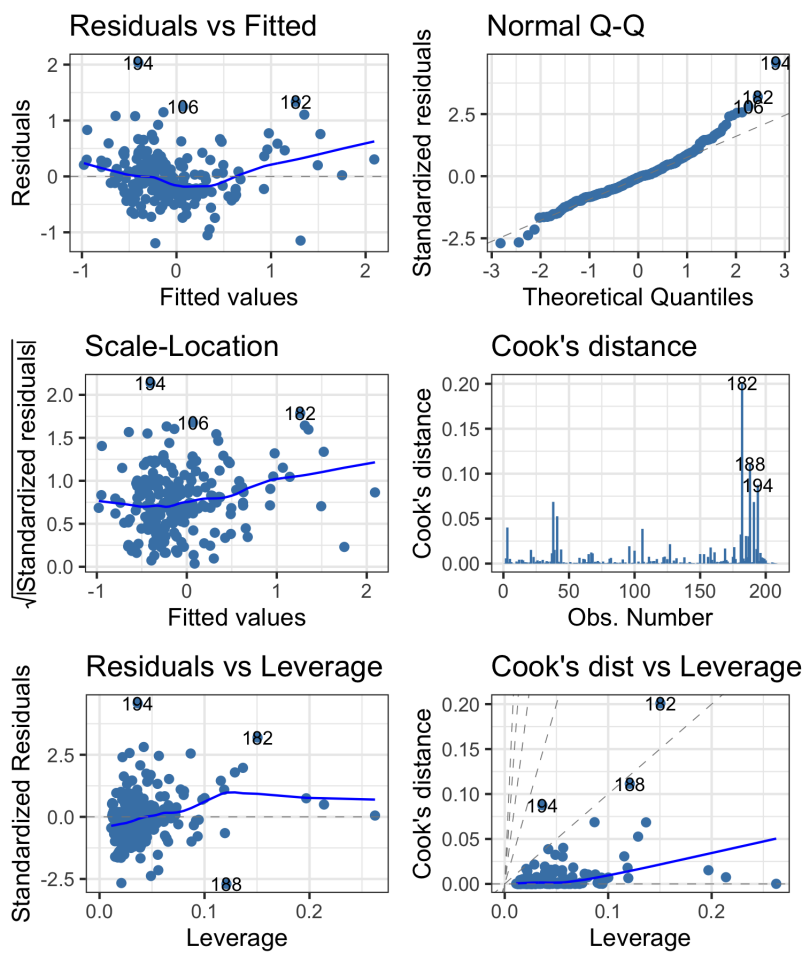


Figure A.1: Spatial Regression Diagnostics (baseline model)

Table A.2: Spatial Analysis

Variable	Coefficient	Robust SE	Direct SE
Intercept	19.309	(4.742)	(6.365)
Cottages by 1911 (per capita, log)	0.149	(0.039)	(0.042)
Distance to Dublin (log)	-0.471	(0.091)	(0.150)
Distance to Belfast (log)	-0.600	(0.151)	(0.180)
Distance to nearest Urban District (log)	-0.065	(0.034)	(0.037)
Latitude	-0.264	(0.077)	(0.107)
Longitude	-0.146	(0.072)	(0.125)
1841-1911 population change	0.744	(0.147)	(0.200)
Population density, 1911	-0.158	(0.085)	(0.127)
R ²	0.547		
Moran's I (<i>p</i> value)	0.000		
Max. Cook's Distance	0.201		
Residual Fit	0.784		
Spatial Structure	0.507		
Effective Range	43.880		
Aniso Ratio	1.046		
Aniso Angle	-17.411		
N	208		

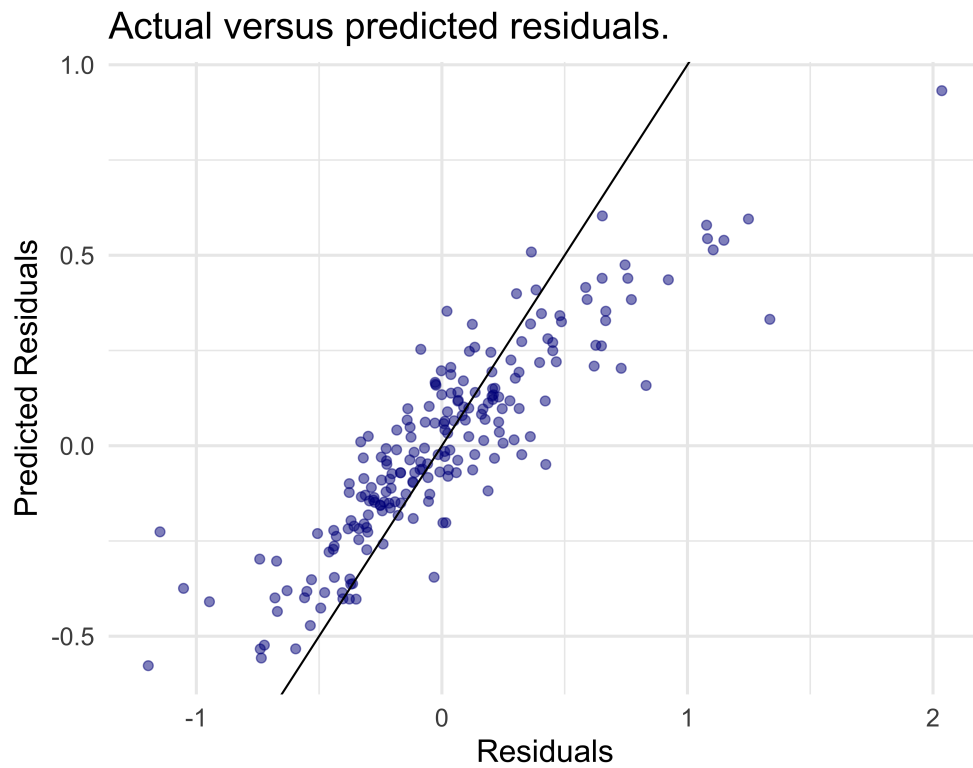


Figure A.2: Actual v. Predicted Residuals (baseline model)

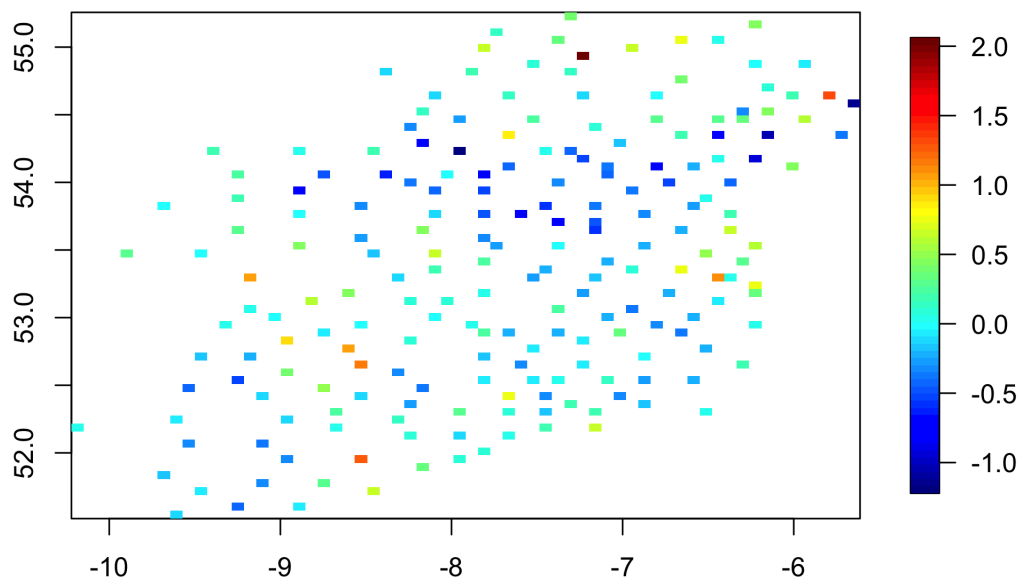


Figure A.3: Spatial Distribution of Residuals (baseline model)