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Barrington Lecture 2023/24

**Economic Geography and the Irish Border:
A Market Access Approach¹**

Alan Fernihough²

Queen's University Belfast
CEPR

(read before the Society, 25th January 2024)

Abstract This paper examines the economic impact of Ireland's partition, assessing market access losses using detailed geospatial data and multimodal transport network analysis. The study reveals that partition significantly reduced market access on both sides of the border, contributing to population decline. Districts closest to the border were the most affected, with estimated population figures being approximately 10 per cent lower than they would have been without the border. This negative impact has persisted, remaining evident despite the reduction of many physical border barriers. A counterfactual analysis suggests that absent the border, the current populations of the Republic of Ireland and Northern Ireland would have been 3 per cent and 5 per cent higher, respectively. These findings illustrate the persistent role of political borders in shaping regional economic activity.

Keywords: Economic Geography, Irish Border, Market Access, Economic History of Ireland

JEL codes: R12, F15, R11, N94

1. INTRODUCTION

Addressing regional economic imbalances is a key priority for policymakers globally. In recent decades, this issue has gained greater significance in Ireland as economic activity is increasingly concentrated in Dublin and Belfast. Ongoing initiatives like the *National Planning Framework* (Republic of Ireland) and *Shaping Our Future* (Northern Ireland) reflect policymakers' commitment to reducing these spatial disparities on both sides of the border. Consequently, understanding the underlying causes of contemporary regional economic differences is crucial. While the political motivations and repercussions of partition have received extensive scrutiny from historians and political scientists (Ferriter 2019), the economic significance of the border has received relatively less attention. This paper aims to fill this gap by applying established theories on New Economic Geography to the Irish context and analysing how the border influenced economic activity on the island and thus contributed to present regional imbalances.

Moreover, this study adds to the broader economics literature on border effects on market access (Redding and Sturm 2008; Brühlhart, Carrère, and Robert-Nicoud 2018; Yang, Partridge, and Chen 2022). Typically, international borders represent first-order physical geography, such as rivers or mountains. The Irish border is distinct in the sense that this is not the case. Thus, this context represents an ideal empirical testing ground for New Economic Geography theories, which hypothesise the importance of second-order geography—the spatial positioning of economic agents and the ability to transport goods over this space. This investigation into an atypical border context thus provides insights of substantial value not only for Ireland but also for a broader international audience.

The closest Irish partition-related study is that of Ó Gráda and Walsh (2006), which focused on population dynamics across the Republic of Ireland's 26 counties. They observed that counties near the border exhibited slower growth or decline in subsequent decades, suggesting a negative border effect. Additionally, Ó Gráda and Walsh (2006) analysed a sample of border towns (located at least 34 miles from the border) to assess the impact of proximity to the border on population retention and growth. Again, their results here also found a negative border effect as towns further from the border fared better in terms of population retention and growth.

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² (a.fernihough@qub.ac.uk; <https://orcid.org/0000-0003-0911-308X>).

While informative, the study by Ó Gráda and Walsh (2006) presents several opportunities for improvement. Firstly, I adopt a new economic geography framework, better aligned with contemporary market trade theory, to measure partition in terms of market access loss. This approach provides a more precise understanding of the partition's economic impact. For instance, districts on the eastern seaboard, closer to Belfast and Dublin, are hypothesised to be less impacted than their counterparts in more remote areas, such as Co. Donegal (located in the North-West), which lost significant portions of its natural trading hinterland. Secondly, I employ highly detailed geospatial data and methods for a finer analysis. Thirdly, the inclusion of key geographic and demographic control variables is aimed at reducing potential confounding variation. Fourthly, the data employed are current, capturing demographic and economic trends up to the year 2022, thus reflecting the latest developments in regional disparities.

This study investigates the extent to which the border dividing the six northern counties from the 26 southern counties in Ireland influenced population growth on either side. This approach examines the border's impact across short-, medium-, and long-term spans, in both jurisdictions. Methodologically, this study makes a significant contribution by employing a difference-in-differences approach to address the issue of causality. Furthermore, the econometric model controls for confounding factors such as location, initial conditions, and the ethno-religious composition of the areas. Taken together, this approach provides a robust estimate of the border's overall impact, going beyond basic correlations or descriptive statistics.

Employing a rigorous methodological framework, this study combines a difference-in-differences econometric approach with the analysis of highly disaggregated spatial data. The dataset is extensive, encompassing nearly 3,400 observations, which offers an exceptionally detailed view of population movements in Ireland from 1841 to 2022. This temporal span is particularly pertinent to this research question, as it covers a substantial period both before and after the partition, allowing for an analysis of over a century of demographic changes.

The analysis uncovers several compelling insights into the impact of the Irish border on population dynamics. Notably, border counties, particularly Donegal with its remote location, experienced significant market access loss post-Partition. This geographical impact directly translated into demographic shifts. Descriptively, districts most affected by the border experienced more pronounced levels of population loss, regardless of broader national trends. This finding is replicated in the regression modelling framework that controls for confounding factors. Interestingly, no pre-trend of population change was evident in either jurisdiction before Partition. However, post-partition, a marked negative effect on population growth emerged. This effect intensified over time in the Irish Free State/Republic, while in Northern Ireland, the impact was evident by 1926 but grew moderately.

Furthermore, a counterfactual analysis shows population losses attributable to the border. The Republic's current population would be 3 per cent larger today, while Northern Ireland's would be 5 per cent larger, had the border not been established. County-level analysis confirms Donegal as the most adversely affected region. These findings not only quantify the border's demographic impact but also highlight the long-lasting effects of political decisions on regional economic and population trends. The analysis also includes a discussion of mechanisms underpinning these results. The failure of these border effects to attenuate over time despite the removal of many barriers suggests that the border may have acted as a one-time shock to Ireland's economic geography. The persistent effect of the border hints that the initial market access loss caused by the border's imposition metastasised to dispersion/scale effects that compounded over time. If true, this suggests that addressing the border-induced regional imbalances represents a large challenge for policymakers and that simply reversing as many or all border-related barriers would be insufficient.

This paper proceeds as follows: Section 2 explores the literature, examining both the historical context of the Irish border with economic activity, and the broader themes of market access and new economic geography. Section 3 presents the data, with a focus on quantifying the market access loss due to partition and its spatial distribution. Section 4 discusses the findings, encompassing both descriptive analysis and a regression-based difference-in-differences approach, alongside counterfactual scenarios. The paper concludes in Section 5.

2. LITERATURE REVIEW

2.1 Historical Context

In the aftermath of a politically turbulent decade, the Government of Ireland Act (1920), which established the principle of partition, alongside the Anglo-Irish Treaty (1921), marked the formation of an international frontier within Ireland. This customs border officially came into effect in April 1923. Initially, partition served as a temporary measure, and a Boundary Commission was subsequently established to redraw the border. This redrawing was intended to align more closely with local political preferences. The commission's mandate included the redistribution

of land, with the stipulation that such adjustments should align with ‘economic and geographical conditions’ (Nash, Dennis, and Graham 2010)—an instruction that demonstrates how policy-makers were keenly aware of the significant implications of changes to the region’s economic geography and market access loss.

Policing the Irish border involved teams of patrol officers and customs officials on both sides. Unlike typical borders, which often align with natural geographical features such as rivers and mountains, the Irish border’s unusual layout presented unique challenges. Road travel across the border was designated along ‘approved roads,’ which were manned by customs officials. In contrast, there were ‘unapproved’ crossing points that lacked official checks. These unapproved roads were generally of poorer quality, and some were deliberately blocked by customs officials, leading to consternation among residents (Nash, Dennis, and Graham 2010). The transportation of bulky goods primarily occurred by rail and was significantly easier to monitor.

The onset of the 1930s marked a significant increase in the importance of customs checks. Heightened political tensions led the British to impose tariffs on agricultural exports from the Irish Free State, a move that was reciprocated by the Free State. This development was part of a larger global trend towards protectionism, characterised by the erection of trade barriers. As a consequence, smuggling activities intensified along the porous Irish border. For example, Johnson (1979) estimated that in 1935–36, cattle smuggling accounted for over 20 per cent of all declared Free State exports to Northern Ireland. This era of protectionism accentuated the economic differences between the two states. A striking example of the border’s impact on market access is evident in the town of Pettigo, which lies on the Donegal-Fermanagh border. In 1933, eggs were priced at 1s 3d per dozen on the Northern side, whereas they were only 11d per dozen on the Free State side (Nash, Dennis, and Graham 2010).

The establishment of the border introduced a significant one-time shock to North-South trade, fundamentally altering market access. By severing districts from their natural trading hinterlands, it created frictions that hindered price arbitrage and the functioning of market forces. However, the impact of partition on the border region extended beyond trade. Variances in fiscal, administrative, and monetary policies between the two sides acted as additional sources of economic disruption. These differences continued to influence the region even as trade barriers were eased in the latter half of the 20th century. Ó Gráda and Walsh (2006) conducted an analysis, employing county-level regressions for the 26 counties in the south, to understand this impact. This study included a dummy variable for five border counties: Donegal, Louth, Monaghan, Cavan, and Leitrim. The initial results indicated a negative effect of the border on population growth, although the model’s effectiveness was hampered by a small sample size. A further examination involving forty border towns (with Coleraine, 34 miles away, being the furthest) showed that distance from the border was a significant factor: town populations increased by 2.2 per cent for every mile of distance from the border.

The European Union integration and the cessation of violence related to the Troubles have significantly improved the conditions for North-South trade in Ireland. This transformation has been the subject of research by Fitzsimons, Hogan, and Neary (1999) and Lawless, Neary, and Studnicka (2019), who examined the issue from a macro-trade perspective. Fitzsimons, Hogan, and Neary (1999)’s study, using data from 1970 to 1992, found that bilateral trade between the two regions exceeded what standard gravity models would predict. On the other hand, a more recent analysis by Lawless, Neary, and Studnicka (2019), using data from the ROI, provided a slightly different perspective. While their aggregated data analysis indicated that Northern Ireland does not significantly alter trade dynamics based on the usual gravity model covariates, their disaggregated data approach revealed that Northern Ireland is a more frequent destination for ROI’s firms and products. These findings suggest that traditional trade barriers have diminished, leading to considerable economic integration over the past fifty years. However, while these studies highlight the absence of a long-term partition effect through contemporary trade channels, they do not address whether the border had differential short- or long-term impacts on the spatial distribution of Irish economic activity, an aspect this paper explores.

2.2 Market Access

New Economic Geography (NEG) offers a comprehensive theoretical framework to explain the phenomenon of economic activity clustering both between and within countries (Krugman 1991). Unlike traditional neoclassical models that emphasise first-order conditions like natural resource endowments, climate, and terrain, NEG focuses on second-order conditions. These conditions refer to economic concentrations driven by agglomeration and dispersion forces, which arise from the spatial distribution of economic agents. The core of NEG models involves an interplay between producers who differentiate products to match consumers’ preference for variety, the costs associated with transportation, and increasing returns to scale in production. Combined with factor mobility, these models accelerate

agglomeration forces, leading to spatially concentrated economic activity. This framework marks a significant shift from traditional approaches, highlighting dynamic interactions in economic geography.

Market (and supplier) access is broadly defined as the transport-cost-adjusted proximity to producers and consumers. Locations with poor transport links, especially if geographically remote, typically face hindered economic development, while those with better links often experience growth. In NEG, these access variables are crucial. Producers aim to be near markets to sell products and buy intermediate inputs at the lowest cost, and workers seek proximity to these firms for potentially higher wages and/or lower prices. Market access acts as the driving force behind the occurrence of NEG-related effects.

Patterns of economic location and spatial concentration typically align with the predictions of NEG. For example, Ireland's post-Famine economic history can be viewed through an NEG lens. The significant initial depopulation shock, resulting in a persistent population decline and the lack of industrialisation, alongside the consolidation of the agricultural sector, closely follows the model proposed by Krugman (1991) (Whelan 1999). According to NEG, regions with greater market access, defined as the ease of reaching markets and suppliers, typically enjoy more economic success. However, establishing a causal link presents challenges. One such challenge is reverse causality, where economic growth might itself improve market access. Additionally, other factors, such as institutional quality, may act as confounding variables.

To address empirical challenges in studying market access, researchers have leveraged exogenous changes, or changes originating outside the economic system, linking these to economic outcomes. A prime example is the introduction of railroads, which significantly lowered transport costs in the 19th century. This development can be viewed as a 'natural experiment', where railroads increased market access while controlling for other confounding variation. This methodology was used in studies like Donaldson and Hornbeck (2016) and Hornbeck and Rotemberg (2019), which found that the enhanced market access provided by railways in the United States led to notable increases in agricultural land values and manufacturing productivity by the end of the 19th century. More recent work by Fernihough and Lyons (2022) offers a different view, particularly in the context of post-Famine Ireland. While the introduction of railways improved domestic market access, leading to increased population growth, the situation was different for foreign market access. Here, easier access to international ports reduced population growth.

This study uses the creation of an international border as a means to measure the influence of market access on growth, a method similar to the approach in Redding and Sturm (2008). These authors used the post-WWII partition of Germany as a natural experiment, where the proximity of towns and cities to West Germany's border with East Germany served as a basis for designating them as treatment or control units. They argue that this partition created differential market access and their findings show that West German cities closer to the border experienced a decline in population growth between 1950 and 1988, consistent with NEG theory. Similarly, Brühlhart, Carrère, and Robert-Nicoud (2018) examined the economic impact of lifting the Iron Curtain in Austria, observing improved wages in border regions. However, they noted heterogeneity in responses: larger towns experienced a more significant wage increase but a smaller employment response. Further supporting these findings, recent research by Yang, Partridge, and Chen (2022) examines the effects of subnational borders within federal states, focusing on the division of Sichuan province into Chongqing and Sichuan in China. Their study reveals negative effects on counties close to the border, highlighting the impact of market access changes on regional economic dynamics.

3. DATA

To gauge fluctuations in economic activity, this study employs population shifts from state censuses. While metrics such as real income might provide a more precise measure of economic conditions, such data are unavailable for the relevant period. Population counts, however, offer a consistent measure across finely disaggregated spatial units. This approach is predicated on the premise that population movements essentially mirror 'people voting with their feet,' indicating outflows from areas of low economic opportunity and inflows into more prosperous ones.

This study utilises population data spanning from 1841 to 2002, recorded at the District Electoral Division (DED) level. These data were initially collected by the AIRO Research Institute at Maynooth University (Kelly and Fotheringham 2011), resulting in a dataset encompassing 3,400 spatial observations. I integrated recent censuses from both jurisdictions, specifically the (2011) and (2021) censuses in Northern Ireland, and the (2011) and (2022) censuses in the Republic of Ireland. Notably, the electoral divisions, and in the case of Northern Ireland in 2021, 'data zones', are distinct from the DED units. To reconcile these differences, I employed areal spatial interpolation methods, utilising spatial polygons to accurately map and translate data counts to the DED boundaries (Pebesma 2018).

Figure 1: Population Trends and Concentration in Ireland, 1841–2022

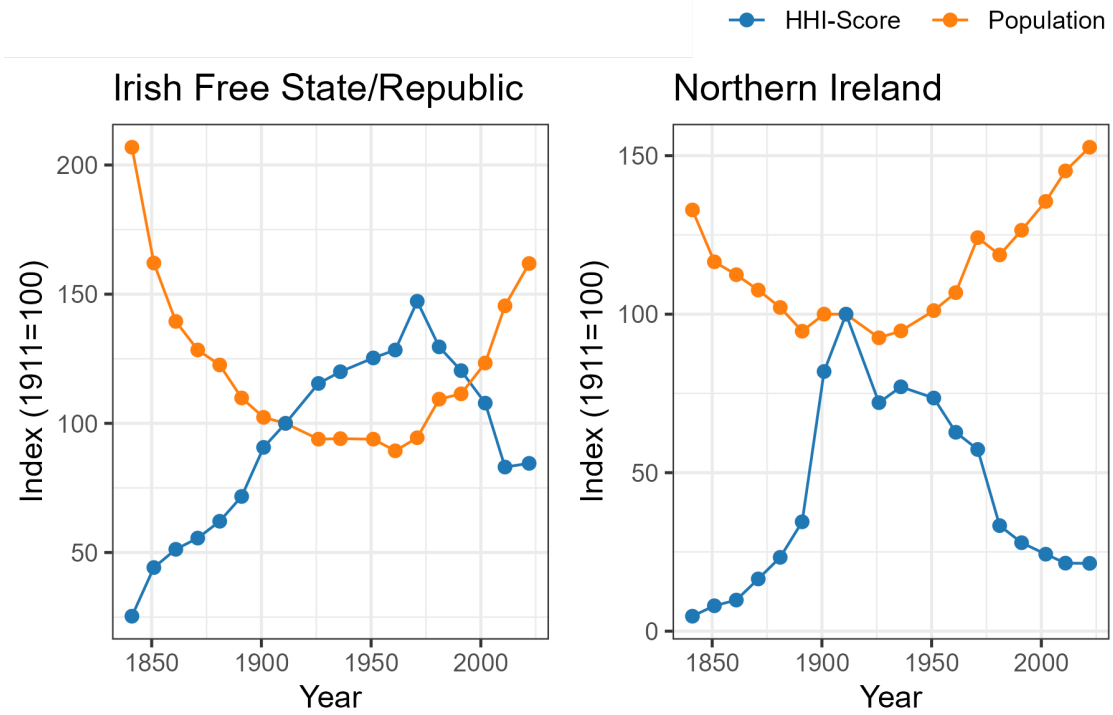


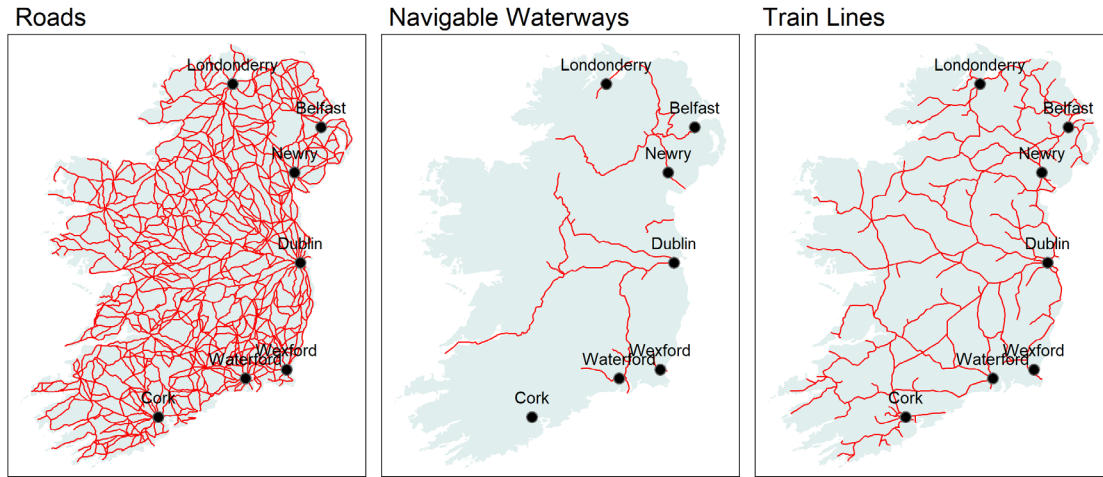
Figure 1 shows the population dynamics and spatial concentration on both sides of the Irish border. Utilising a Herfindahl–Hirschman index (HHI) to measure urban density, the index reflects the population’s consolidation within more urban districts, standardised to a 1911 baseline. The trajectories of both populations are similar. From 1841 to 1911, demographic contractions from the Famine and subsequent waves of emigration, led to population loss, although this was more pronounced in the South’s 26 counties. Subsequently, these losses slowed until post-WWII, when population expansion commenced, initially in Northern Ireland and later in the Republic. Notably, the Troubles’ peak in Northern Ireland (1971–81) only marginally impacted long-term trends. Institutional, political, and cultural divergences have not manifested in substantial demographic disparities. A notable inverse relationship exists between population concentration and growth; more remote rural areas bear the brunt of the decline. Conversely, post-WWII growth coincided with reduced urban density, facilitated by motor transport enabling suburban expansion.

Market access is quantified as the sum of potential market opportunities, each weighted by corresponding transportation costs. This effectively reflects the accessibility of various markets, considering both market size and transport options. Donaldson and Hornbeck (2016) demonstrate that this concept is rooted in trade-based economic theories. Theoretically, trade costs influence market access for both consumers and firms, shaping trade flows in a manner akin to a conventional gravity model. The core distinction lies in the objectives: consumers seek to procure goods at lower prices from distant markets, while producers aim to sell at higher prices in more remote markets. In their practical application, Donaldson and Hornbeck (2016) treat the market access measures for consumers and producers as proportionally equivalent, assuming symmetric trade and transport costs. They simplify market access measurement as follows:

$$MA_i = \sum_{j \neq i}^{N-1} \tau_j^{-\theta} Pop_j, \quad (1)$$

where the market access for a location MA_i is calculated as the sum of the populations of all other locations j , adjusted for transport costs τ_j raised to the power of $-\theta$. In this study, transport costs are determined by a least-cost path analysis of the specified multi-modal network Fernihough and Lyons (2022), encompassing road (horse-drawn carriage), waterway (rivers, canals, and coasting), and rail transport. (See Figure 2).

Figure 2: Ireland's Historic Transport Network

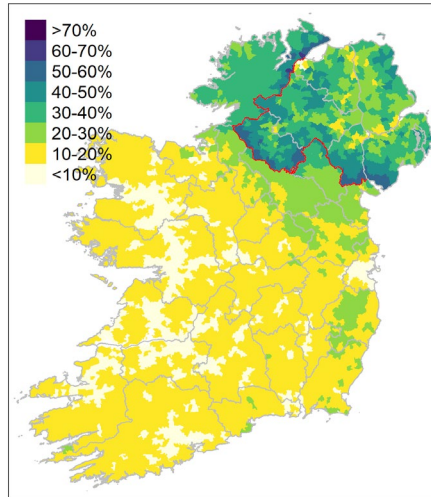


The trade elasticity parameter θ in eq. (1) is crucial in determining market access distribution. It measures the responsiveness of trade flows to trade costs, with higher θ values indicating increased sensitivity, thereby making trade less feasible as transport costs rise. Different values for θ have been suggested in the literature. The concept of market ‘potential’ by Harris (1954) and Crafts (2005) employed $\theta = 1$. However, higher values have been identified, such as 3.6 to 12.86 in Eaton and Kortum (2002), with Donaldson and Hornbeck (2016) favouring 8.22. Contrarily, Simonovska and Waugh (2014) argue these are overestimates, suggesting a lower $\theta = 4.14$. Similarly, Hornbeck and Rotemberg (2019) used $\theta = 2.75$. In this study, a pragmatic approach is adopted, iteratively running linear regressions of land values per acre against market access for varying θ values. This is premised on the idea that 1911 land values should mirror market access, making the best-fitting regression indicative of the most accurate θ value. The selection of the optimal θ was based on minimising the model’s AIC, leading to the conclusion that $\theta = 4$ provides the best fit.

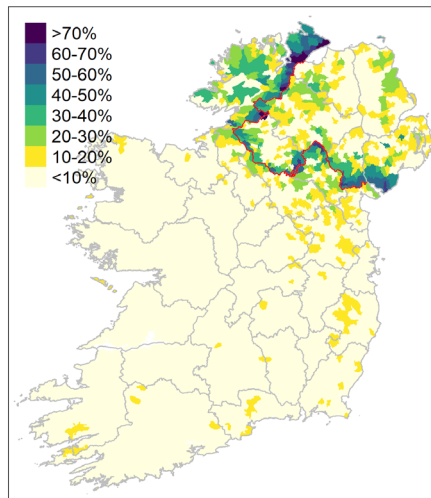
Establishing a market access measure enables the calculation of market access loss attributed to the establishment of the Irish border. To achieve this, I modify the market access formula in eq. (1) to distinguish between the Irish Free State/Republic and Northern Ireland. For District Electoral Divisions (DEDs) in the former, I reduce the market access measure by one-sixth, and similarly for those in Northern Ireland. Effectively, this means each jurisdiction loses five-sixths of the other’s trade-cost-adjusted population in their market access calculations. This approach is based on the findings of De Sousa, Mayer, and Zignago (2012), who report significant conditional border effects, even after controlling for other relevant factors in a gravity model of international bilateral trade.

Figure 3: Marker Access Loss Due to Partition with Different θ Values

(a) $\theta = 2$



(b) $\theta = 4$



(c) $\theta = 8$

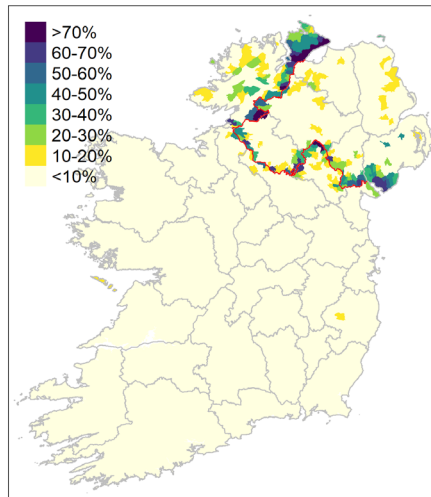


Figure 3 illustrates the predicted market access loss across three θ values. The preferred value, $\theta = 4$, offers what seems to be the most accurate depiction of border impact. This value not only yields the greatest explanatory power in the calibration regressions but also presents a consistent portrayal. With $\theta = 2$, the border effects appear overly pronounced, leading to exaggerated market access losses across the island. Conversely, $\theta = 6$ results in an understated impact, with trade becoming less appealing and partition affecting almost the entire island, except for a few DEDs near the border. $\theta = 4$ strikes a balance between these extremes, suggesting a more realistic estimation of the economic consequences of partition. The impact is most severe in districts along the border, diminishing progressively with distance from the frontier.

Table 1: Median Partition Market Access Loss by County

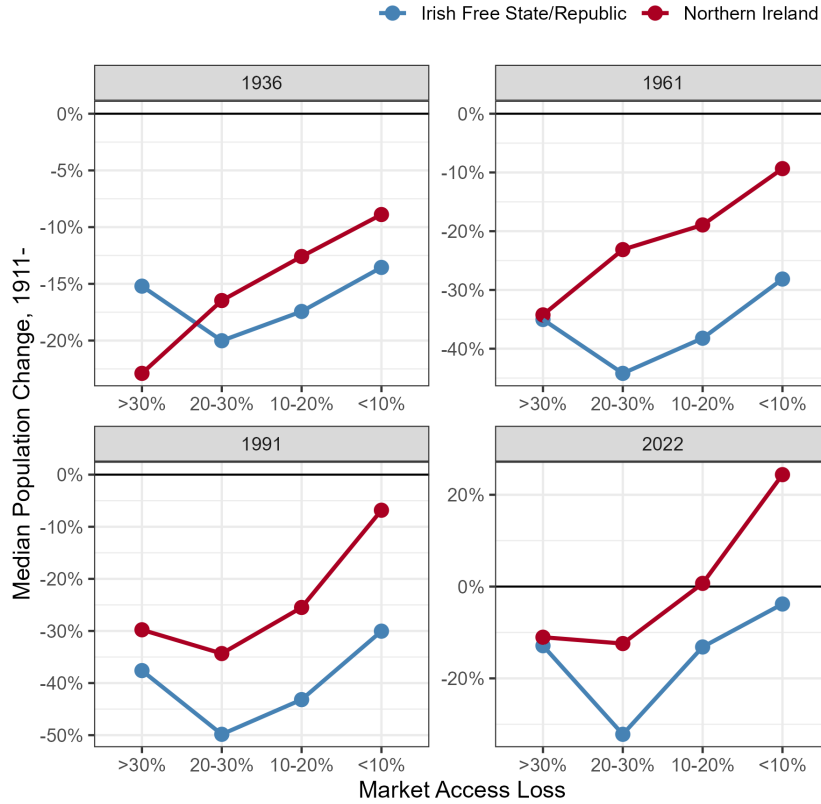
County	Partition Loss (%)	County	Partition Loss (%)
Donegal	-28	Kildare	-2
Monaghan	-20	Carlow	-2
Armagh	-16	Westmeath	-2
Fermanagh	-12	Kilkenny	-2
Down	-11	Laois	-2
Tyrone	-10	Longford	-2
Louth	-8	Offaly	-2
Cavan	-6	Sligo	-1
Antrim	-5	Tipperary	-1
Wicklow	-5	Mayo	-1
Meath	-4	Roscommon	-1
Wexford	-4	Clare	-1
Leitrim	-3	Kerry	-1
Derry	-3	Limerick	-1
Cork	-2	Galway	-1
Waterford	-2	Dublin	0

Table 1 presents the median market access levels for all 32 counties in Ireland. Donegal, located in the far northwest, was most adversely affected, with its DEDs experiencing a loss of approximately one-third of their market access. In contrast, border districts in Monaghan typically lost about one-fifth of their market access. This is in stark contrast to Louth, another Southern border county, which lost less than 10 per cent. Louth's location along the eastern seaboard allowed for compensation through alternative markets. Notably, five of the six counties in Northern Ireland rank among the top ten in terms of market access retention, with Antrim and Derry being relatively insulated from this shock, owing to their proximity to the larger markets of Belfast and Derry city. The subsequent section explores whether these partition effects influenced economic conditions more broadly.

4. RESULTS

Figure 4 presents a descriptive analysis of population changes in border-affected regions compared to less impacted areas, spanning four periods: 1911–1936, 1911–1961, 1911–1991, and 1911–2022. The border is categorised by market access loss: over 30 per cent, 20–30 per cent, 10–20 per cent, and less than 10 per cent. A distinct pattern is evident; districts with minimal market access loss due to the border typically experienced the slowest population decline. In Northern Ireland, this trend is linear. The population fell fastest in districts that were hardest hit by the border. Conversely, in the South, the trend is nonlinear. Districts in the 20–30 per cent loss bracket were the most adversely affected, while those with over 30 per cent loss were less so. This suggests a threshold effect: market access loss exceeding 10 per cent significantly accelerates population decline, but the impact stabilises beyond this point. However, only 85 DEDs, constituting 3 per cent of the Irish Free State/Republic's sample, suffered more than 30 per cent market access loss. The small sample size for this category warrants a cautious interpretation of these results.

Figure 4: Population Change and Partition



4.1 Rolling Regressions

While Figure 4 suggests a negative border effect, it is crucial to consider potential confounding factors. The gradient observed might be attributable to inherent characteristics of the border areas, such as their initial remoteness, lower quality land, lesser urbanisation, or simply their peripheral location. These factors could independently contribute to population declines, unrelated to the border's imposition.

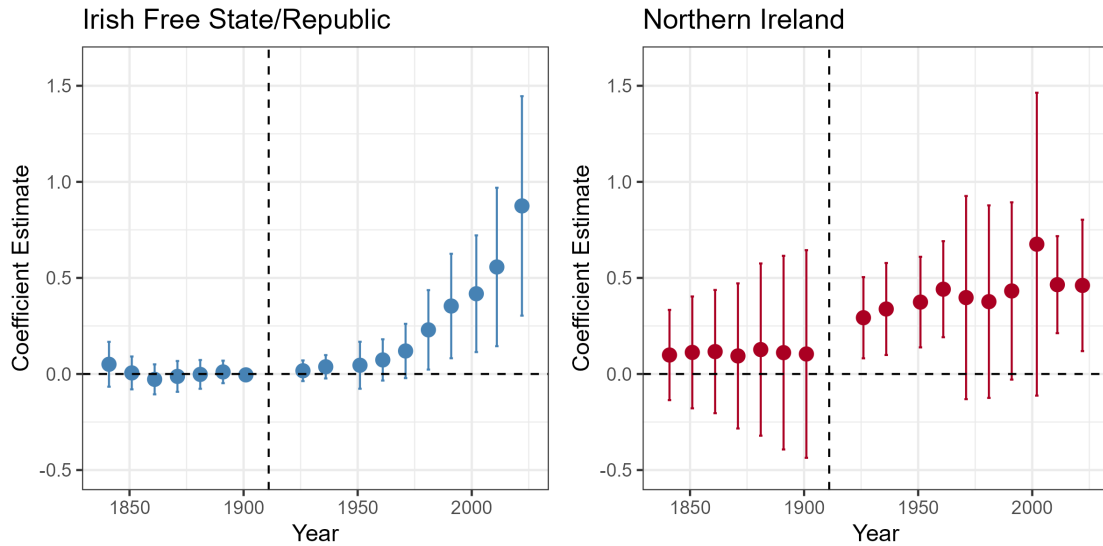
To test this hypothesis, the following regression model is employed:

$$\Delta \ln(\text{Pop}_{t-1911}) = \alpha + \beta \ln(\text{BorderLoss}) + f_1(\text{Lat}, \text{Lon}) + f_2(\ln(\text{LandValue}_{1911}), \ln(\text{PopDens}_{1911})) + f_3(\text{Catholic}_{1911}) + \varepsilon \quad (2)$$

where $\Delta \ln(\text{Pop}_{t-1911})$ represents the change in logged population between the years 1911 and t . This change is modelled as a function of several influencing factors: border loss (measured in log point change), geographic coordinates (latitude and longitude), logged land values and population density from 1911, and the Catholic population share in 1911. These relationships are captured using a Generalized Additive Model (GAM) framework with regression splines for smoothing (Wood 2017). This approach allows the control variables to exert a non-linear influence on the outcome. Since $T = 2$ in all models, eq. (2) represents a difference-in-differences methodology wherein the influence of the border can only influence population changes.

Geographic coordinates, represented by the function $f_1(\text{Lat}, \text{Lon})$, are included to determine if population changes are primarily due to geographical location, especially in terms of distances from growth centres. The land values and population density are modelled through the function $f_2(\ln(\text{LandValue}_{1911}), \ln(\text{PopDens}_{1911}))$, which accounts for population shifts linked to initial conditions. Lastly, the function $f_3(\text{Catholic}_{1911})$ models the influence of the Catholic population share in 1911, reflecting the historical context where the Northern Irish state's support may have been biased, potentially impacting areas with a predominantly Catholic population.

Figure 5: Rolling Regression of Partition Impact on Population Growth



Note: The dots represent the point estimates $\hat{\beta}$ from the regression of population growth relative to the 1911 baseline. The error bars indicate 95 per cent county-cluster-adjusted confidence intervals.

The results of the rolling regression analysis are illustrated in Figure 5, where the model in eq. (2) is iteratively estimated. This analysis is conducted separately for the Irish Free State/Republic and Northern Ireland, providing a comparative perspective. In the Irish Free State/Republic, coefficients are represented as point estimates (depicted as dots) on the left-hand plot of Figure 5. These point estimates are accompanied by error bars, which signify 95 per cent confidence intervals.³ The analysis encompasses the period starting from 1841, extending to 1911, which is established as the baseline and is indicated by a dashed horizontal line. This retrospective examination, particularly of the years preceding 1911, serves as a placebo test within the difference-in-differences framework, evaluating the pre-partition trend in population growth. The close alignment of the point estimates with the null value indicates the absence of pre-trends—DEDs affected by the border were growing at a comparable rate before the border’s introduction—thus confirming that the difference-in-differences methodology is appropriate in this context. As the time frame extends beyond 1911, the coefficients exhibit a non-linear increase, albeit remaining close to zero, thus reflecting the incremental impact of partition on population growth. The most marked effect is discernible in the most recent data from 2022, indicating a near unit elasticity; this implies that for every 1 per cent decrease in market access attributable to partition, there is a corresponding 1 per cent decline in population growth over the period from 1911 to 2022.

Conversely, the right-hand plot of Figure 5 shows the coefficients for Northern Ireland. Before partition, the point estimates approximate zero, with confidence intervals overlapping the null, echoing the findings from the Irish Free State/Republic. Again, the absence of pre-trends validates the credibility of this approach. Post-partition, an immediate and statistically significant positive effect on population growth (0.3) is observable for the period between 1911 and 1926. This trend, indicative of a negative border effect, continues, albeit marginally, from 1926 onwards. The advent of the Troubles post-1961 is marked by an expansion of the confidence intervals, reflecting a wider range of changing scenarios in population change. In subsequent years, these intervals at times overlap the null but consistently hover around the 0.5 mark. The enduring and statistically significant partition effect in the most recent data underscores that the cessation of border checks has not yielded a disproportionately beneficial impact on regions previously affected by the partition.

³ All confidence intervals are adjusted to account for clustering within counties. The implementation of Conley standard errors did not result in any substantial changes to these outcomes. These results can be provided upon request.

4.2 Categorical Regressions

Figure 5 illustrates the border loss elasticity’s evolution over a century. In the Irish Free State/Republic, this elasticity, nearing 1 in recent data, signifies an almost proportional relationship between market access loss and population growth reduction. Conversely, Northern Ireland maintained a consistent elasticity of around 0.5, indicating half a per cent decrease in population growth for each per cent of market access loss. However, this measure has limitations. Its reliance on the border loss variable as a continuous measure, influenced by various potentially noisy parameters, presents challenges. For example, it necessitates θ , transport costs and times, and the border discount (which I take as 6) all be accurately stated.

To counter potential mismeasurement, I developed a simple binary variable. This indicator is set at one when the market access loss due to border imposition exceeds 10 per cent and zero otherwise. Figure 3b demonstrates this measure’s coverage, encompassing border areas and adjacent regions. This dummy variable approach not only addresses the original measure’s specification issues but also has the advantage of yielding an easy-to-digest “border treatment effect”.

Figure 6: Market Access Loss Greater Than 10 Per Cent

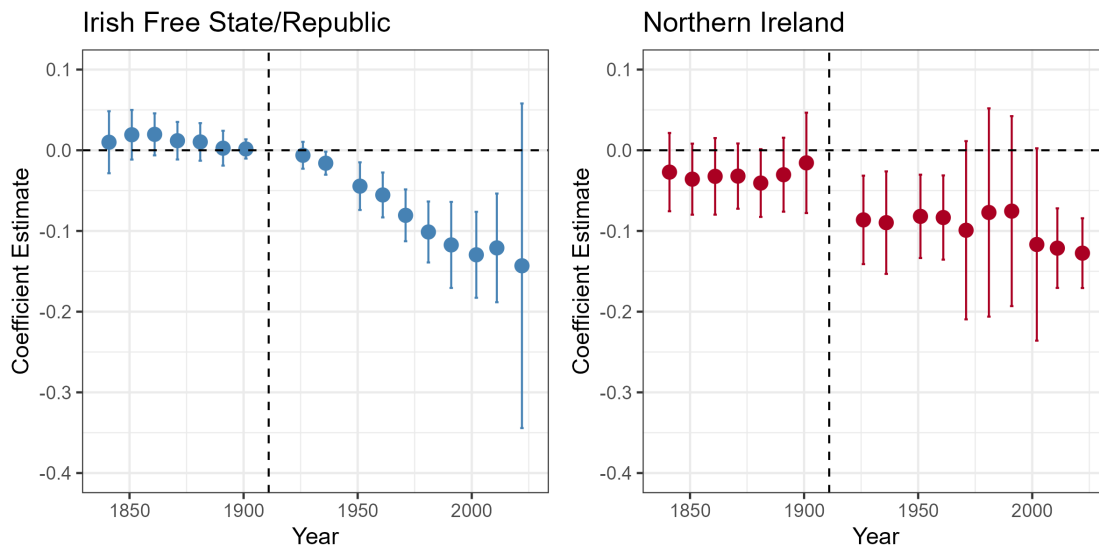


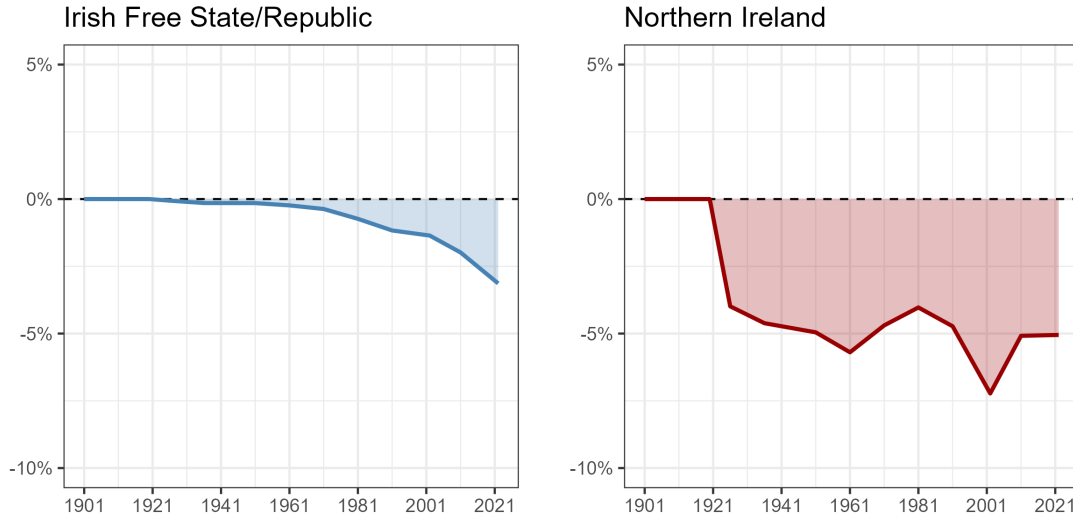
Figure 6 presents the outcomes of applying a rolling regression technique with the border loss variable as a binary measure. In the case of the Irish Free State/Republic, the pattern is similar to that shown in Figure 5. In the pre-partition period, the estimated coefficients are nearly zero, and all confidence intervals overlap the null hypothesis, suggesting no pre-trends before the establishment of the Northern Irish State. Post-1911, the negative coefficient of the border loss dummy variable indicates that districts with over 10 per cent market access loss due to partition experienced slower growth (or greater depopulation) throughout the 20th century. The impact is negligible in 1911–26 and 1911–36, but between 1911 and 1951, the border effect becomes statistically significant as districts impacted by market access loss grew approximately 5 per cent less. This disparity intensifies across the 20th and into the 21st century. By the 20th century’s end, the coefficient reached about -0.12, denoting a 12 per cent population growth loss in border-affected districts compared to unaffected ones. This difference persists in 2011 and is amplified in the most recent 2022 data. Nonetheless, the confidence intervals for this estimate are substantially wider. This increase in sampling variation points to a divergence in outcomes within the border-affected group.

The analysis presented on the right-hand side of Figure 6 charts the progression of the border effect in Northern Ireland. Consistent with previous findings from the continuously measured border rolling regression, the establishment of the border exerted an immediate and significant impact on the most affected districts within Northern Ireland. Again, there is an absence of pre-trends indicating that a difference-in-differences methodology is appropriate.

Between 1911 and 1926, districts impacted by the border exhibited a relative decline of 10 per cent in population growth. Post-1926, the affected districts did not revert to their pre-border conditions. The differential impact of the border remained relatively constant throughout the 20th century. However, during the Troubles, a notable increase in the confidence intervals is observed, suggesting a growing divergence in outcomes across the areas most adversely affected by the border. Entering the 21st century, the border effect has persisted and, arguably, intensified. The latest data, for 2021, reveals a border effect approaching 15 per cent. This significant figure underlines the enduring influence of the border, which, despite being established over a century ago, continues to manifest in substantial population-related outcomes across both jurisdictions.

4.3 Counterfactual Analysis

Figure 7: Counterfactual Populations



Thus far, the evidence strongly points towards a significant and lasting partition effect from a micro perspective. Did the border matter from a macro perspective? To answer this question I perform a series of counterfactual exercises where I project the population on both sides of the Irish border under a “no partition” counterfactual scenario. Taking the model outlined in eq. (2), I define each DED as having a counterfactual population:

$$Y_t^C = \exp\left(\ln(Y_t) - \hat{\beta}\ln(\text{BorderLoss})\right).$$

Before aggregating these totals I need to account for population redistribution. For example, Donegal to Dublin migration should not count in aggregated population totals. Assuming that county totals are just the sums of all population counts ($P_t = \sum Y_t$), I apply a simple county-level correction:

$$P_t^{AC} = P_t + (1 - \kappa)(P_t^C - P_t)$$

where the adjusted count population at year t , P_t^{AC} , is the true population plus the predicted “no border” population difference ($P_t^C - P_t$) discounted by $1 - \kappa$, where $\kappa \in (0,1)$ is the share of Irish-born non-county of birth residents in the county. The κ shares are taken from the respective 1971 census reports.⁴

Figure 7 traces the difference between actual population levels and those projected based on the aforementioned methodology. Between 1911 and 2022, the Southern population would have been 3 per cent larger. The equivalent figure in the North is 5 per cent. Even though the South’s coefficient in the most up-to-date population census is greater (see Figure 5) this does not translate into aggregate effects because much of the South’s population was not affected by the border. Furthermore, the counterfactual pathways differ. In the Irish Free State/Republic, this

⁴ See Central Statistics Office (1971; Northern Ireland Statistics and Research Agency 1971a; b; c; d; e; f; g).

difference has accumulated at an accelerating rate whereas in Northern Ireland, the border's impact was felt immediately and was effectively maximised before the outbreak of the Second World War.

The long-run border effects spatial distribution is shown in Table 2. It details the 2021/22 population counts alongside their projected counterfactuals for each of the 32 counties and Belfast (Belfast straddles both Co. Antrim and Co. Down). It shows that Donegal was the worst-hit county and that the population would be 55 per cent larger today in the absence of partition effects. Monaghan, another border county, is the next worst hit. Belfast is the worst-hit region of Northern Ireland—although such a result is of questionable merit. Belfast is a single DED in these data and an outlier in terms of population. Market access in this application does not account for the internal market. Thus, other counties in Northern Ireland's market access retained full access to Belfast but access to other, less populous, counties was of less benefit to Belfast. Five of the ten worst-affected were in Northern Ireland. Only Antrim, which didn't share a land border, and Derry, which lost access to the sparsely populated and remote Donegal, lay outside this group. Moreover, the majority of counties experienced, at most, minimal partition losses as 19 of the 33 were only 2 per cent or less, worse off.

Table 2: Difference Between Actual and Counterfactual Populations in 2022

County	Population		Difference		County	Population		Difference	
	Counterfactual	Actual	Total	%		Counterfactual	Actual	Total	%
Donegal	250,552	166,144	91,183	55%	Westmeath	83,144	81,945	1,588	2%
Monaghan	82,329	67,402	17,624	26%	Kilkenny	99,238	97,703	1,835	2%
Belfast	255,526	227,441	33,612	15%	Carlow	64,520	63,624	1,140	2%
Down	559,584	527,116	51,832	10%	Derry	257,374	253,734	4,327	2%
Armagh	193,676	180,722	16,494	9%	Kildare	247,955	245,424	3,688	2%
Fermanagh	67,238	62,763	5,330	8%	Laois	91,941	90,876	1,315	1%
Cavan	85,987	81,117	5,686	7%	Cork	587,768	581,383	6,916	1%
Louth	145,892	138,789	8,541	6%	Tipperary	165,490	163,883	1,871	1%
Tyrone	197,758	188,385	11,292	6%	Waterford	120,869	119,827	1,243	1%
Leitrim	36,677	34,947	2,010	6%	Kerry	157,450	156,073	1,485	1%
Meath	236,487	228,301	11,413	5%	Roscommon	85,382	84,718	790	1%
Antrim	470,574	460,443	16,802	4%	Galway	277,495	275,357	2,395	1%
Wicklow	152,685	149,066	5,326	4%	Mayo	136,704	135,653	1,141	1%
Wexford	166,321	161,562	5,326	3%	Dublin	1,455,584	1,446,794	10,957	1%
Sligo	72,028	70,593	1,685	2%	Clare	132,952	132,214	843	1%
Offaly	84,944	83,593	1,666	2%	Limerick	202,688	201,621	1,233	1%
Longford	46,784	46,019	914	2%					

4.4 Potential Mechanisms

Statistically, the border had a negative effect on population growth, but through which channels did this occur? The conventional market access story says that the border damaged economic conditions because it prevented consumers from buying and producers from selling goods at the best possible price. Nevertheless, it is also plausible that the border loss variable used here captures other impediments. Being close to the border means extra inconveniences. Historically, these include non-tariff trade barriers such as physical border checks. A more recent example is the difficulty of receiving satisfactory mobile phone coverage. The border adds difficulty with public goods and service provision.

The North-South difference in the trajectory of these effects is also telling. In Northern Ireland, the population shift was evident by 1926 and widened moderately over the 20th and early part of the 21st centuries. This pattern is consistent with this area abruptly becoming peripheral and a less desirable residence. Including the Catholic share as a control variable in the analysis demonstrates that the observed effect is independent of Northern Ireland's ethno-religious divide and its distinctive political system. This abrupt shift was not mirrored in the South where the immediate difference between DEDs affected by the newly created border was marginal. However, these differences compounded over time and even though much of the border's constraints have been dismantled, the effect of partition has amplified. This result speaks to the importance of dispersion or scale effects. Depopulation by itself reduced the

appeal of residing in the South's border communities. This result aligns well with the research by Bromhead and Lyons (2023), which identified that variations in social housing policies around the turn of the 20th century had enduring impacts on the spatial population distribution in the Republic of Ireland. Furthermore, Bromhead and Lyons (2023) also demonstrated a mechanism through which these agglomeration effects take place—the provision of primary schooling. Thus, it seems plausible that the depopulation resulting from partition in Ireland followed a pathway similar to the one identified by Bromhead and Lyons (2023), where primary schooling provision played a key role in driving spillovers.

The persistence and exacerbation of these effects over the long term align well with established literature in economic geography. For instance, Stuetzer et al. (2016) demonstrate how regions can become 'locked' into certain economic geographies, leading to reversals in fortune. Their study specifically examines the impact of historically significant coalfield locations in Britain, revealing how these once-crucial sites inhibit entrepreneurship in the modern era. This concept of geographical legacy is further supported by Michaels and Rauch (2018) and Flückiger et al. (2022), who provide evidence that locations and road networks established during the Roman era continued to influence economic outcomes long after the empire's collapse.

5. CONCLUSION

This paper has examined the impact of Ireland's partition on population over the past century. In Northern Ireland, demographic shifts were evident by the mid-1920s, whereas in the South, these effects evolved gradually, with the most significant changes observed in border areas, as indicated by recent census data. This trend suggests a key role for market access in shaping demographic patterns in the border regions. However, the innovations and easing of border restrictions throughout the century imply that market access alone cannot fully account for these changes. Partition also introduced a range of challenges beyond economic movement, impacting public goods provision, convenience, and security, particularly during the Troubles. These wide-ranging effects highlight the influence of the border on both jurisdictions.

The study's methodology relied on a multi-modal network of the early 20th-century transport infrastructure alongside 19th-century travel cost data. Updating the analysis to include more recent developments in transport, such as the rise of motor transport and road improvements, may offer additional insights. Furthermore, exploring partition's effects on market access beyond the island of Ireland represents an interesting addition. For Northern Ireland, the advantage of remaining in the UK was access to its affluent markets. Conversely, the Irish Free State/Republic, while maintaining access to British markets, faced intermittent trade disruptions, highlighted by events like the Anglo-Irish trade war. Though extending the scope of market access analysis beyond Ireland falls outside this paper's remit, it offers a promising direction for future research.

Moreover, the study reveals that population data, while valuable for assessing economic vibrancy and appeal, can be a 'noisy' indicator. Economic deprivation in border regions may not always correlate with population shifts, potentially obscuring the real economic impact of the partition. Thus, while informative, population changes alone may not fully capture the partition's nuanced economic outcomes. Future research could benefit from integrating alternative economic indicators, such as household income or housing prices. The advent of big data makes accessing such measurements increasingly feasible. Additionally, examining changes in public goods provision, including the establishment or closure of educational and healthcare facilities, would provide a more holistic perspective.

A notable limitation of this study is its atheoretical nature. While the empirical methodology effectively quantifies the border's causal effects on population, it lacks a comprehensive general equilibrium framework akin to that in Redding and Sturm (2008; Brühlhart, Carrère, and Robert-Nicoud 2018). This shortfall is particularly evident in the approach to counterfactual analysis, which relies on simpler measures rather than a theoretical model. Future research would also benefit from a micro-foundations approach that produces alternative counterfactual estimates and welfare-type analyses.

The long-term policy challenge posed by Ireland's partition is clear from this research. In both the Republic of Ireland and Northern Ireland, the border's intensified effects persist, despite the relaxation of many restrictions. This underlines the difficulty in reversing the trends set in motion by the partition. The research suggests that the entrenchment of these effects, driven by dispersion forces, means that simply removing the border might not be enough to address the resulting issues. There is a possibility that the border has caused a one-time, irreversible shift in economic activity. Addressing these long-run regional imbalances will likely require both a combination of sustained cross-border initiatives—aimed at reducing border-related inefficiencies—and innovative regional economic policies.

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