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Drivers of income inequality in Ireland and Northern Ireland

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DRIVERS OF INCOME INEQUALITY IN IRELAND AND NORTHERN IRELAND

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Drivers of Income Inequality in Ireland and Northern Ireland

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This report has been accepted for publication by the Institute, which does not itself take institutional policy positions. The report has been peer-reviewed prior to publication. The authors are solely responsible for the content and the views expressed.

EXECUTIVE SUMMARY

The distribution of income differs in Ireland and Northern Ireland. Historically, Northern Ireland has been marked by lower levels of income and lower income inequality. The Gini coefficient, a widely used measure of income inequality that increases as income becomes more dispersed, has averaged 0.29 in Northern Ireland and slightly more than this, at 0.31 in Ireland, between 2003 and 2019. Using harmonised microsimulation models for Ireland (SWITCH) and Northern Ireland (UKMOD), we simulate the Gini coefficient to be 0.26 in Northern Ireland and 0.28 in Ireland in 2019, although these point estimates are not statistically different from each other. Nevertheless, as seemingly similar income distributions can come about for different underlying reasons, we analyse the drivers of income inequality in Ireland and Northern Ireland.

Previous research has identified marked differences in demographics, working patterns, wage levels and the tax-benefit system between Ireland and Northern Ireland. These factors are important determinants of income distribution and are likely to contribute differently to how income is distributed in the two jurisdictions. Using a decomposition technique (following Bargain and Callan (2010); Doorley et al. (2021) and Sologon et al. (2021)), this research identifies the drivers of income inequality in Ireland and Northern Ireland in the year 2019. We isolate the relative contributions of market income differences – attributable to demographics, labour market participation and wage levels – and the tax-benefit system to differences in income distribution in the two jurisdictions.

We find that differences in inequality in market, or pre-tax and transfer income, are driven by two counteracting forces. On the one hand, the younger and more highly educated population of Ireland results in relatively lower income inequality as there are relatively fewer people with no earnings. On the other hand, the higher and more unequal wages paid to workers in Ireland result in relatively higher market income inequality, all else being equal.

We estimate that differences in the tax-benefit system also influence the distribution of income in Ireland and Northern Ireland. The Irish tax system is more progressive and reduces income inequality more than the Northern Irish tax system. However, the level and coverage of means-tested benefits in Ireland is lower than that in Northern Ireland. Therefore the Irish means-tested benefit system is inequality-increasing compared to the Northern Irish means-tested benefit system. The combination of these two opposing effects results in similar overall levels of redistribution by the Irish and Northern Irish tax-benefit systems when taken as a whole.

This research sheds light on possible future developments in income inequality on the island of Ireland. Secular trends in population ageing and upskilling are likely to affect the distribution of pre-tax and transfer income in both Ireland and Northern Ireland. The latter is likely to be particularly important in Northern Ireland, where baseline levels of education are lower.

This research also finds that, if there is any convergence in the future between the tax-benefit systems of Ireland and Northern Ireland, in the context of increased economic co-operation on the island of Ireland, there may be a limited impact on income inequality due to opposing forces in the tax and

benefit system. An understanding of these forces and their impact on income inequality – in isolation and together – can help to guide any such move towards future co-operation.

1 Introduction

There is a large literature on the drivers of cross-country differences in income inequality. Recent advances in this literature have formalised methods to decompose cross-country differences in income inequality into the relative contributions of labour market effects such as: wages and employment; demographic factors such as education and population age structure; and policy effects due to the tax and welfare system.

This paper tackles the question of what drives income inequality differences on the island of Ireland. There is little existing evidence on this issue. Income *levels* are higher on average in Ireland than in Northern Ireland. However, there is little understanding of how differently this income is distributed. Headline measures of poverty rates in the two jurisdictions indicate that Northern Ireland has had a historically higher at-risk-of-poverty (AROP) rate than Ireland.¹ Comparing the available series of headline inequality indices suggests that Ireland has had historically higher income inequality than Northern Ireland.² This difference was relatively small, although persistent in the recovery period from the financial crisis.

Most of the related literature either compares income inequality in Ireland to income inequality in the UK, with results for Northern Ireland aggregated with those of England, Scotland and Wales (Sologon et al., 2021), or compares income inequality in Northern Ireland to that of the other three parts of the UK.³ Furthermore, there has been no systematic analysis of what drives income inequality differences on the island of Ireland although such analyses have been undertaken in many other cross-country settings.⁴

The question of how income inequality differs across the two jurisdictions on the island of Ireland, and why, is extremely relevant at the moment. Since the financial crisis of 2008 and the resulting period of austerity in many countries, the implications of income inequality have risen to prominence in public and

¹ Since the poverty line used for computing this index in Northern Ireland is median income throughout the UK, this doesn't give a particularly nuanced insight into living standards in Northern Ireland itself.

² The before-housing AROP rate has averaged 19% in Northern Ireland and 15% in Ireland between 2011 and 2019. The Gini Index has averaged 0.29 in Northern Ireland and 0.31 in Ireland between 2003 and 2019, according to the Northern Ireland Poverty and Income Inequality Report (<https://www.communities-ni.gov.uk/publications/northern-ireland-poverty-and-income-inequality-report-2021-22>) and the ESRI's Poverty, Income Inequality and Living Standards research (<https://doi.org/10.26504/jr1>)

³ <https://commonslibrary.parliament.uk/income-and-inequality-how-does-northern-ireland-compare-with-the-uk-as-a-whole/>

⁴ For a review of methods for and examples of inequality decomposition across countries, see Sologon et al. (2023).

political debates. There is much evidence that excessive inequality in household incomes is detrimental to economic growth (Carvalho and Rezai, 2015), to social cohesion and to well-being (Case and Deaton (2021), Alesina et al. (2004)). Some commentators point to the effect of income inequality on political stability and the rise of populism (Duca and Saving, 2016). Crucially, there is evidence that the perception of income inequality by the public varies depending on whether it is considered to be 'fair' or not, i.e. based on merit (Satz and White, 2024). For example, inequality in income between two employees, one at the beginning of their career and one with 40 years of experience at the end of their career, is typically perceived to be fairer than inequality in income between a man and a woman at the same stage of the same career. In 2017, 83% of the population of Ireland and 80% of the population of Northern Ireland believed that their government should 'reduce income inequality' (Laurence et al., 2023). Understanding the drivers of income inequality can shed light on the degree of perceived fairness and potential acceptability of that inequality in society.

Considering the proximity of Ireland and Northern Ireland, the level and causes of income inequality in the two jurisdictions are pertinent to social cohesion on the island of Ireland. There is much recent evidence that factors such as productivity and wages (Fitzgerald and Morgenroth (2019); McGuinness and Bergin (2020); Smyth et al. (2022)); demographics (Connolly et al., 2022); the prevalence of public sector employment (Brownlow and Birnie, 2018) and education rates (McGuinness and Bergin, 2020) are substantially different between the two jurisdictions despite their proximity. These differences are likely to drive differences in market income – or pre-tax and transfer income – inequality. In addition, differences also occur in the tax and benefit systems of the two respective jurisdictions. Research has shown that the Irish tax-benefit system is strongly redistributive, substantially reducing income inequality (Roantree, 2020). There is no such evidence for Northern Ireland per se but Sologon et al. (2021) have shown that the tax-benefit system in the UK redistributed less than the tax-benefit system in Ireland in the period leading up to the financial crisis.

In this research, we investigate the drivers of income inequality in Ireland and Northern Ireland. We provide the first comparison of income inequality between the two jurisdictions using harmonised microsimulation models linked to survey data for 2019. There are multiple reasons for working with 2019 data. First, at the time of writing, 2019 is the latest year for which we have harmonised tax-benefit

policies and data for Ireland and Northern Ireland. A second reason to choose 2019 as the year for our analysis is that 2019 is the first year before the COVID-19 pandemic but almost a decade after the Great Recession. The empirical research shows that both the COVID-19 pandemic (e.g. Gentilini (2022) and Roantree and Doorley (2023)) and the Great Recession (e.g. Bargain et al. (2017) and Roantree and Barrett (2024)) profoundly impacted income inequality in Ireland and the UK, as well as the composition of their government public spending. While we capture the impact of the latter in our analysis, we leave the analysis of the aftermath of the pandemic to future research. Most of the previous comparative research focuses on years before the Great Recession, either because these studies were conducted before the economic recession or because the authors explicitly avoided comparing inequality in a period of intense economic turmoil. For instance, Nolan and Smeeding (2005) compare the inequality trends from 1994 to 2000 between Ireland and a subset of rich Organisation for Economic Co-operation and Development (OECD) countries. More recently, Guillaud et al. (2020) compare income inequality between Ireland and OECD countries, using the 2007 data for Ireland as that is the last year before the Great Recession. The same year is used by Sologon et al. (2021) to compare income inequality between Ireland and the UK. Using 2019 data, we further contribute to this literature by illuminating the drivers of income inequality in Ireland and Northern Ireland almost a decade after the Great Recession.

We estimate the difference in income inequality between Ireland and Northern Ireland in 2019 using the Gini coefficient. We estimate that the Gini coefficient of disposable income is slightly higher in Ireland (0.28) than in Northern Ireland (0.26) but that this difference is not statistically significant. Nevertheless, as seemingly similar income distributions can come about for different underlying reasons, we separate this difference into the relative contributions of market income factors and tax-benefit factors.⁵ Specifically, we estimate how much of the difference in market income inequality stems from differences in demographic and labour market factors in the two jurisdictions. We then isolate how differences in elements of the tax-benefit system (tax, social security, means-tested welfare and non-means-tested wel-

⁵ We focus on the Gini coefficient as the most widely used measure of income inequality. The Gini coefficient captures the statistical dispersion in the income distribution across a population. It takes values lying in the interval $[0, 1]$. The coefficient takes a value of 0 when there is perfect equality, meaning that everyone has the same income. The coefficient takes a value of 1 when there is complete inequality, namely when all the income is concentrated in the hands of a single individual or household. Our analysis could be extended to other measures of inequality. It could also be extended to the study of AROP rates. However, as these are very sensitive to the exact level of the poverty line, results may be more spurious and difficult to interpret.

fare) shape income inequality. Due to the complexity of the tax-benefit system in each jurisdiction, this is impossible to do without fully simulating their effect (including the interaction between taxes, benefits and the distribution of market income) on a representative sample of the population, as we do in this research. Finally, we draw policy conclusions.

2 The tax and welfare systems in Ireland and Northern Ireland

The tax and welfare systems in Ireland and Northern Ireland are aligned in many ways and both tend to fall into a liberal (Anglo-Saxon) classification. This classification sees the role of government as working in tandem with, rather than replacing, the market. Benefits are often means-tested and work-conditional policies are common.

The similarity between the two tax and welfare systems has historical origins as, after gaining independence in 1922, the Irish state adopted the UK tax system. As discussed by Carroll (2022), the parameters of this tax system were changed in Ireland in the years that followed but the progressive structure of taxation remained a feature. In a similar manner, the Irish social welfare system was based on the system inherited post-independence and both the Irish and Northern Irish welfare systems currently have a strong focus on targeting.

The tax-benefit system in the UK is mostly a unified system although there are some – typically small – differences across the four parts of the UK. Most of these relate to Scotland although, for example, UK council tax does not apply in Northern Ireland where a system of domestic rates is in place. Northern Ireland has also agreed a series of welfare mitigation measures over the last number of years to temporarily soften the impact of welfare reform on welfare recipients.

Table 2.1 shows the parameters of the main tax and social security instruments in each jurisdiction in 2019, in € terms. As income and price levels differ between the two jurisdictions, we adjust nominal sterling levels in Northern Ireland using a purchasing power parity (PPP) adjusted exchange rate.⁶

In terms of taxation, the first two rates of income tax are identical in each jurisdiction but Northern Ireland also has a third (45%) rate of income tax. The PPP-adjusted threshold for moving from the 20% to the 40% rate is higher in Northern Ireland than in Ireland, indicating less progressivity in the Northern Irish taxation system for low- to middle-earner households.⁷ The third rate of tax in Northern Ireland, however, provides a higher tax burden for very high income families. Ireland operates a system of partly joint taxation – with members of a couple allowed to partially share tax bands and credits – while Northern Ireland has an individualised taxation system. An additional form of income tax exists in

⁶ We use the OECD sterling/euro PPP-adjusted exchange rate for 2019 of 0.843

⁷ This does not account for tax credits/allowances, which are discussed later.

Table 2.1: Comparison of selected instruments in the tax and social security system, Ireland and Northern Ireland, in 2019 €, annual unless stated otherwise

	IE	NI
Taxes		
Rate 1	20%	20%
Rate 2	40%	40%
Rate 3		45%
Threshold (single)	35,300	44,471
Threshold two (single)		177,883
Threshold (one-earner couple)	44,300	
Threshold (two-earner couple)	70,600	
Personal tax credit (single)	1,650	
Employee tax credit (single)	1,650	
Earned income tax credit (single)	1,650	
Home carer tax credit (max)	1,500	
Personal allowance (single)		14,824
Marriage allowance		2,384
Universal Social Charge (USC) rate	0.5-11%	
Social insurance		
Employee, rate 1	4%	12%
Employee, rate 2		2%
Exemption threshold (weekly)	352	197
Threshold (weekly)		1,141
Self-employed, rate	4%	2-9%
Self-employed, exemption (annual)	5,000	7,548

Notes: The sterling-euro exchange rate PPP used is 0.84325. In addition to the self-employed social insurance contribution rate in Northern Ireland, there is a flat rate of €3.42 per week paid on profits below the exemption limit.

Table 2.2: Comparison of selected instruments in the benefit system, Ireland and Northern Ireland, in 2019 €, annual unless stated otherwise

	IE	NI
Means-tested benefits		
Working Tax Credit (single)		2,324
Child Tax Credit (one child)		3,297
Working Families Payment (1 child: max weekly)	521	
Pension Credit (weekly)		193-294
Housing Benefit (weekly)		69-198
Employment and Support Allowance (weekly)		69-87
Universal Credit (monthly)		299-1,314
Benefit cap		15,891-27,275
Jobseekers Allowance (weekly)	112-203	69-87
Supplementary Welfare Allowance/Income Support (weekly)	112-203	69-87
Lone parent unemployment supports (weekly)	150-203	
Disability Allowance (weekly)	203	
Fuel Allowance (weekly)	24.5	
Rent Supplement (weekly)	201	
Carer's Allowance (weekly)	248-429	
Child Benefit (weekly)		25
Non-means-tested benefits		
Child Benefit (monthly)	140	
Attendance Allowance (weekly)		70-104
Disability allowances (weekly)		27-101
Contributory unemployment benefit (weekly)	203	69-87
Incapacity Benefit (weekly)		133
Severe Disablement Allowance (weekly)		46
Contributory employment and support allowance (weekly)		69-87
Carer's Grant/Allowance (weekly)	32.7	78
Fuel Allowance		237
Illness Benefit/Statutory sick pay (weekly)	198	112
Maternity/paternity pay and allowances (weekly)	240	176
Injury benefit (weekly)	198	
Pension		
Contributory state pension (max weekly)	277.30	153
Contributory state pension - partner's insurance (max weekly)	277.30	92
Non-contributory state pension (max weekly)	237	92

Notes: The sterling-euro PPP exchange rate used is 0.84325. Non-contributory state pension is means-tested in Ireland.

Ireland, the Universal Social Charge, which applies to all income once it exceeds €13,000 per annum. The rate is progressive, starting at 0.5% and reaching 11% for self-employment incomes over €100,000 per annum.

There is a system of tax credits in Ireland: a personal tax credit of €1,650 for a single person and double this for a couple, with an additional employee or earned income tax credit for employees or the self-employed, respectively. Northern Ireland operates a system of tax allowances. A single person does not pay income tax up to an income of €14,824, which is equivalent to a tax credit of €2,965.

Employee social insurance contributions are paid at a flat rate of 4% in Ireland for those over the weekly exemption threshold of €352 per week. In Northern Ireland, the rate is considerably higher, at 12% for those earning between €197 and €1,141 per week, and drops to 2% for earnings over this amount.

Table 2.2 shows the parameters of the main benefit instruments in each jurisdiction in 2019. Both systems contain in-work benefits: the Working Families Payment in Ireland and the Working Tax Credit in Northern Ireland, which support working households on low incomes. Households with children in Northern Ireland are also entitled to the Child Tax Credit. There is a range of means-tested benefits in both systems designed to provide support to those on low incomes who require extra resources for housing, to support their work in the home as a lone parent or carer, or to smooth their income during a period of unemployment.

Non-means-tested benefits are paid to families with children in Ireland. For those with adequate social security contributions, non-means-tested benefits are also paid to jobseekers or those out of work due to illness or maternity/paternity leave in both jurisdictions. Some benefits, such as disability payments and fuel allowance, are means-tested in Ireland and non-means-tested in Northern Ireland while others, such as Child Benefit, are means-tested in Northern Ireland and not means-tested in Ireland. Pension rates are higher in Ireland than in Northern Ireland, both for contributory and non-contributory payments.

Given the complexity of the benefit system in both jurisdictions, in terms of eligibility, coverage and means-testing, it is difficult to draw conclusions about how the two systems compare based simply on benefit rules. This becomes, therefore, an empirical question, which will require the simulation of the

number of eligible households and the amounts receivable at a population level. This exercise is carried out in the next section.

3 Data and method

In this analysis, we use two microsimulation models, SWITCH and UKMOD. SWITCH is linked to the Survey on Income and Living Conditions (SILC) Research Microdata File (RMF) for 2019, which contains survey information on household demographic characteristics, family composition and labour force participation, as well as linked administrative information from the Revenue Commissioners on earnings and from the Department of Social Protection on welfare receipt.

UKMOD is a microsimulation model for the UK, which contains separate policies for each nation of the UK. It is linked to data from the Family Resources Survey (FRS), which is a cross-sectional household survey that collects information on a representative sample of private households. Income is self-reported by survey respondents, who are encouraged to check documentation when reporting monetary amounts. The survey has been running in Great Britain since October 1992 and was extended to cover Northern Ireland in 2002. Both models are based on the EUROMOD platform and so the format and structure of simulations are harmonised.⁸

In the first stage of the analysis, we identify the drivers of differences in market income inequality in Ireland and Northern Ireland using a reweighting and a propensity score matching technique. Market income is defined as earnings plus investments and private pensions. It is thus a measure of pre-tax and transfer household income. In the second stage, we show how, given existing levels of market income inequality, the tax-benefit system redistributes differently in Ireland and Northern Ireland.

3.1 Estimating the drivers of market income inequality

In the first stage of the analysis, we focus on differences in market income inequality. Following the significant differences established between Ireland and Northern Ireland in the related empirical literature, we focus on three categories that we expect to influence inequality in market income. The first is demographics as there is evidence that the population of Ireland is younger (Connolly et al., 2022) and more educated (Smyth et al., 2022), on average, than the population of Northern Ireland. The second is labour market status as there is evidence that (i) mothers are more likely to work full-time or part-time in Ireland (Curristan et al., 2022) and that (ii) Northern Ireland has particularly high levels of labour market inac-

⁸ See Keane et al. (2023) and Richiardi et al. (2021) for a description and validation of SWITCH and UKMOD.

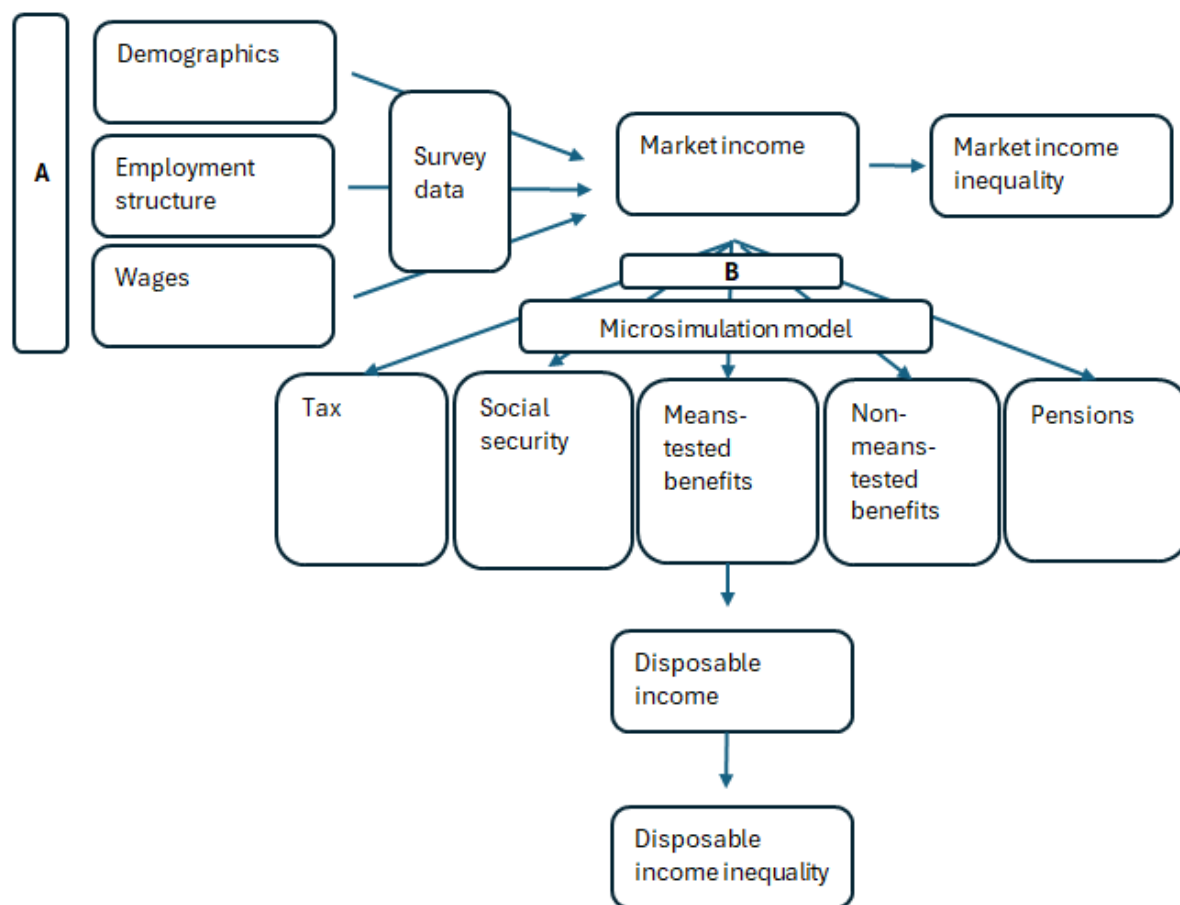
tivity (Niesr, 2023). The last factor we focus on is wages. Northern Ireland is an outlier internationally in that there is no pronounced gender pay gap in favour of men (Jones and Kaya, 2021). Additionally, productivity levels in Ireland have been found to far exceed those in Northern Ireland (Bergin and McGuinness, 2022).

To disentangle the relative contributions of these three factors – demographics, employment and wages – to differences in market income inequality between Ireland and Northern Ireland, we take the following approach. First, aggregate shares of the population in Ireland and Northern Ireland are calculated for (i) age bands and education levels by gender and (ii) the labour market structure. Specifically, for demographics, we calculate population shares by gender, age bracket (0-16, 17-25, 26-35, 36-45, 46-55, 56-65, >65) and educational attainment (primary, secondary, post-secondary and tertiary). On the labour market side, we calculate the population share of workers (employees, self-employed and farmers), those in education, and those not working (unemployed, those with illness or disability, pensioners and others not working). We then reweight the Northern Irish population, following the reweighting procedure outlined in Almeida et al. (2021) and Keane et al. (2023), to achieve Irish demographic and labour market targets separately. We do the same in reverse, reweighting the Irish population to achieve Northern Irish demographic and labour market targets. Appendix Section A outlines this method in more detail.

In the next step, we assign counterfactual hourly wages to employees in each jurisdiction as if they were recompensed for their work according to the wage structure of the other jurisdiction. We match individuals aged over 17 in each jurisdiction. We then reconstruct a counterfactual market income for each person based on the wage they would receive in the other jurisdiction and their actual hours of work. We do this using propensity score matching, a statistical technique that matches individuals from the two jurisdictions with similar 'scores' or probabilities of having the same observable characteristics. In our analysis, we select education, age and gender as characteristics that determine people's wages. In this way, we abstract from the different occupations structures in Ireland and Northern Ireland and simulate a scenario in which the return to basic labour market characteristics is the same in Northern Ireland as in Ireland. We implicitly, therefore, allow for wages to reflect not only the productivity differences but also the wage premia associated with different industry structures.⁹

⁹ We use the Stata `psmatch2` package, using one-to-one nearest neighbour matching without replacement.

Figure 3.1: Microsimulation modelling of income



This gives us three counterfactual income distributions in which the demographics, the labour market structure and the wages of each jurisdiction are 'swapped'. Population level inequality statistics are then recalculated for the new underlying (demographic and labour market status) structure, as well as for the intermediate counterfactual income distributions. This allows us to estimate how each factor (e.g. wage differences) contributes to differences in market income inequality between Ireland and Northern Ireland, holding the other factors constant. Panel A of Figure 3.1 illustrates the work-flow graphically.

3.2 Estimating the contribution of the tax-benefit system to income inequality

SWITCH and UKMOD are both based on the EUROMOD platform and are therefore harmonised in their modelling conventions, and highly suitable for comparable work. However, they are not set up for 'policy swaps'. In other words, it is not possible to directly apply the tax-benefit system of Ireland to the

population of Northern Ireland or vice versa. Following previous economic literature (e.g. Frenette et al. (2007), Biewen and Juhasz (2012) and Bargain et al. (2013)), we therefore adopt a regression approach to this policy swapping.

Taking the tax and welfare simulations from SWITCH for Ireland and from UKMOD for Northern Ireland, we develop regression models for each of the major components of the tax-benefit system (tax, social security, means-tested benefits, non-means-tested benefits). We use a suite of explanatory variables from the survey data underlying each microsimulation model as explanatory variables. We check that the predictions from our regression models match the simulations of the microsimulation models.¹⁰ The coefficients from these regression models for each jurisdiction are saved. By using harmonised explanatory variables from the underlying data for each jurisdiction, it is straightforward to swap the model coefficients in order to create counterfactual net tax distributions as if (i) the population of Ireland was subject to the Northern Irish tax-benefit system; and/or (ii) the population of Northern Ireland was subject to the Irish tax-benefit system. These resulting counterfactual income distributions are used to simulate the level of income inequality that would prevail given the alternative tax-benefit system (or given just a part of the alternative tax-benefit system). We can then estimate how much of the difference in income inequality between the two jurisdictions is due to the tax-benefit system and its components. Panel B of Figure 3.1 illustrates this work-flow graphically.

¹⁰ Further details about the general regression approach and its application to the different predicted components of the tax and benefits system can be found in Appendix Section B.

4 Empirical analysis

4.1 Descriptive statistics

Table 4.1 reports comparative descriptive statistics for Northern Ireland and Ireland using SWITCH and UKMOD for 2019. We confirm previous findings that the population of Northern Ireland is slightly older and less educated than the population of Ireland. Perhaps most strikingly, just 23% of adults in Northern Ireland have tertiary education while the comparative figure for Ireland is 47%. In terms of the labour market, adults in Ireland work slightly more hours per week on average but are paid 50% more per hour in nominal terms.¹¹ The dispersion of hourly wages is also higher in Ireland than in Northern Ireland with an estimated Gini coefficient of 0.35 compared to 0.27.

Panel B of Table 4.1 shows average monthly household income in Ireland and Northern Ireland, and its components. Average market income is around one-half higher in nominal terms in Ireland than in Northern Ireland. The Gini coefficient of market income, which measures how unequal pre-tax and transfer income is, is also higher in Ireland, indicating that, while the level of market income is higher in Ireland than in Northern Ireland, it is also more unequally distributed.

The average tax burden is substantially higher in Ireland than in Northern Ireland, even accounting for the difference in market incomes. Households in Ireland pay, on average, nearly three times as much tax as households in Northern Ireland. The level of social insurance contributions is also higher in Ireland than in Northern Ireland but the magnitude of this difference is more in line with the difference in market incomes. Means-tested benefits are higher, on average, in Northern Ireland than in Ireland, while the opposite is true for non-means-tested benefits. As some benefits may be means-tested in one jurisdiction and not means-tested in the other, some of this difference may be due to how benefits are disaggregated (see Table 2.2 for a list of the main benefits included under each heading). However, we also estimate that one-half of households in Northern Ireland are eligible for a means-tested benefit while just one-quarter of households in Ireland are. Therefore, some of the difference may also be due to a relatively higher coverage of the Northern Irish means-tested benefit system. Since, with some exceptions, the parameters

¹¹ Adjusting for purchasing power, the average hourly wage in Northern Ireland is three-quarters that in Ireland, at €16.

Table 4.1: Descriptive statistics, Ireland and Northern Ireland, 2019

	IE	NI
Demographics (individual level, age ≥ 18)		
Age	47.09	47.73
Primary education	0.12	0.14
Secondary education	0.35	0.61
Post-secondary education	0.07	0.03
Tertiary education	0.47	0.23
Hours worked	22.31	21.75
Hourly wage	22.64	14.84
Income (hh level, average monthly in euro)		
Market income	4542.82	3005.38
Tax	981.20	357.73
Employee SIC	296.97	184.05
Self-employed SIC	23.12	14.83
Means-tested benefits	166.59	202.53
Non-means-tested benefits	129.68	111.82
Disposable income	4077.80	3185.95
Inequality		
Gini (market income)	0.51	0.49
Gini (disposable income)	0.28	0.26
Gini (hourly wage)	0.35	0.27
90/50 ratio (disposable income)	1.78	1.77
50/10 ratio (disposable income)	1.88	1.86

Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Average statistics are calculated as means at the household or individual level. Market income is earnings from employment, self-employment, private pensions and investment income. Average hours worked include individuals with zero hours. A breakdown of the specific instruments included in each of Tax, Employee SIC, Self-Employed SIC, Means-tested benefits and Non-means-tested benefits is provided in Tables 2.1 and 2.2

of the system are the same all over the UK, the relatively lower average income level in Northern Ireland is likely to lead to higher eligibility for means-tested benefits than in the other three parts of the UK.

Once taxes and social security have been deducted and benefits added, average household disposable income is around one-third higher in nominal terms in Ireland than in Northern Ireland, which is a smaller gap than that in average market incomes. Income remains more unequally distributed in our simulation for Ireland once tax and welfare have been accounted for, with a simulated Gini coefficient of disposable income of 0.28 in Ireland compared to 0.26 in Northern Ireland.¹²

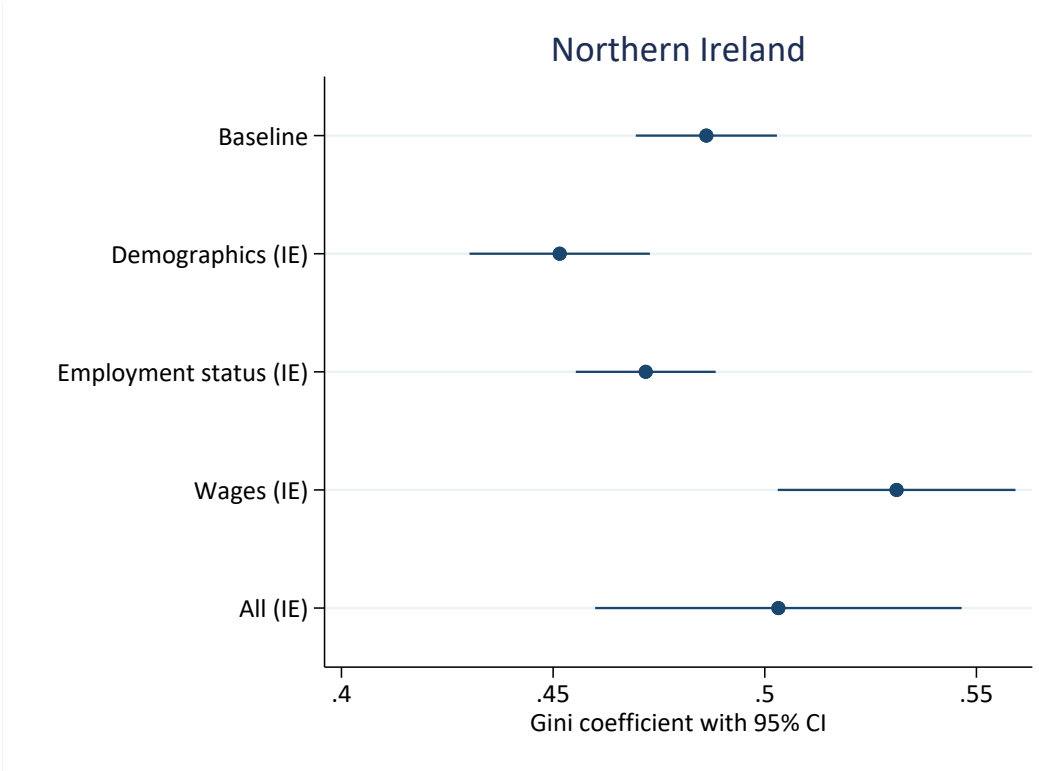
4.2 The drivers of market income inequality

In this section, we investigate the drivers of differences in market income inequality in Ireland and Northern Ireland. To do this, we adjust the survey data for Northern Ireland to reflect a similar structure of population characteristics as Ireland (see Section 3.1 for methodological details). We focus on a number of population characteristics that previous research and our own descriptive analysis suggest are important contributors to market income differences between the two jurisdictions: demographics, employment and wages. In the demographic category, we adjust the Northern Irish population to have the same age and education structure by gender as Ireland. In the employment category, we adjust the Northern Irish population to have the structure of employment, unemployment, in-education and inactive structure as Ireland. Finally, in the wage category, we use propensity score matching to adjust the wage of workers in Northern Ireland to reflect the returns to labour market characteristics observed in Ireland.

Figure 4.1 shows that the Gini coefficient for market income in Northern Ireland is 0.49 in the baseline. If the Northern Irish population had the same demographic structure as the Irish population, market income inequality would be lower than this, by around four percentage points of the Gini coefficient. This indicates that the age and education profile in Ireland is inequality-decreasing compared to the age and education profile in Northern Ireland although, as the confidence intervals slightly overlap, this difference is not statistically significant at the 5% level (but is at the 10% level as shown by Figure C.3). A younger population is typically associated with lower market income inequality as (i) employment income increases with age and (ii) a decrease in the population share of pension-age people results in an decrease

¹² These figures may differ from headline inequality indices as microsimulation models typically assume full take-up of welfare benefits and full tax compliance.

Figure 4.1: Decomposing the difference in market income inequality



Notes: Authors’ calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. The baseline reports the Gini coefficient in Northern Ireland, estimated using the method outlined in Section 3.2. The (IE) counterfactuals report the Gini coefficient for Northern Ireland, where demographics, employment status, wages and all three are adjusted to reflect their structure in Ireland.

in the number of people with zero earnings/market income (Dolls et al., 2019). Given the relatively higher employment rate of those with tertiary education compared to those with primary or secondary education,¹³ adjusting the Northern Irish population to align with Irish education levels also increases the number of people in employment and reduces the number of people with zero market income. Adjusting the age and education profile together substantially decreases the number of people with no earnings, reducing polarisation in the distribution of earnings and reducing inequality in market income.

Figure 4.1 also shows how market income inequality in Northern Ireland would change if the Northern Irish population had the same employment structure as the Irish population, in terms of employment, unemployment rates, in-education and inactivity rates. We find that market income inequality would decrease slightly in this scenario (as the employment rate would increase), indicating that the Irish structure of employment is inequality-decreasing compared to the Northern Irish structure. However, this difference is not statistically significant.

Adjusting wages in Northern Ireland so that workers are paid for their labour market attributes in the same way as they are in Ireland, we find an increase in market income inequality in Northern Ireland compared to the baseline. Hourly wages in Ireland are higher, on average, than those in Northern Ireland, but are also more unequal, with a Gini coefficient of 0.35 compared to 0.27 in Northern Ireland (Table 4.1). Our simulation for Northern Ireland has two effects. On the one hand, it enhances the income of workers, increasing the statistical dispersion. On the other hand, the income of those out of work (on social welfare, pensions, etc.) remains constant. These two effects lead to a polarisation in the simulated income distribution, thereby increasing market income inequality. This result is only statistically different from the baseline Gini coefficient at the 10% level (Figure C.3).

Adjusting all three market income factors together leads to a slight increase in income inequality in Northern Ireland but the change is not statistically significant. Indeed the confidence interval for the Gini coefficient in this final simulation is rather wide, suggesting an imprecise estimate. While we find evidence that the demographic and wage structures are responsible for some differences in income

¹³ Using the FRS data for Northern Ireland, we estimate that 85% of the those aged 18-64 with tertiary education are employed compared to 70% of those with secondary education.

inequality observed between Ireland and Northern Ireland, these differences work in opposite directions so that headline indices of income inequality in the two jurisdictions are closer to each other.¹⁴

We repeat this analysis but adjust the population and wage structure of Ireland to mimic the Northern Irish population and wage structures. Figure C.1 in Appendix C shows that the demographic and employment structure of Northern Ireland is inequality-increasing compared to the Irish structure while the Northern Irish wage structure is inequality-reducing. However, these differences are not statistically significant; neither is their cumulative effect.

4.3 The drivers of disposable income inequality

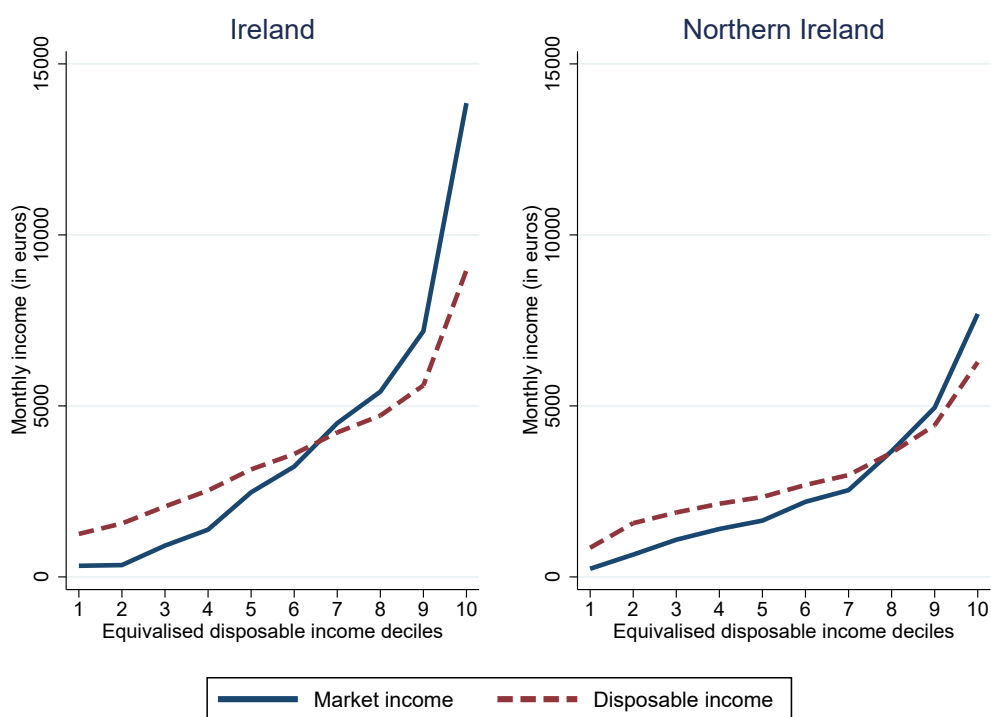
In this section, we switch our focus to the disposable income distribution and how it differs between Ireland and Northern Ireland. We first compare the market and disposable income distributions in Ireland and Northern Ireland, quantifying the intervention of the tax and benefit system. We then move on to a more formal decomposition of how the tax-benefit system affects income distribution differently in each jurisdiction.

4.3.1 The distribution of the components of disposable income

Figure 4.2 shows how market and disposable income are distributed in Ireland and Northern Ireland. In each jurisdiction, the population is divided into equally sized groups, ranging from the lowest income tenth (decile) to the highest. The distribution of market income follows a reasonably similar pattern in each jurisdiction up to the middle of the income distribution, although nominal income levels are higher for this portion of the income distribution in Ireland. Around the median, the average household in Ireland has an average of €2,473 per month, compared to a figure of €1,646 in Northern Ireland. However, average market income by decile increases steeply after this point in Ireland, much more so than in Northern Ireland. This reflects the higher inequality in market income in Ireland compared to Northern Ireland.

¹⁴ The counterfactual Gini Index for Northern Ireland, when demographics, wages and employment are adjusted to be similar to Ireland, is very close to the Gini Index for Ireland reported in Table 4.1. We do not expect it to be identical as there are factors in the Northern Irish data, such as household composition and hours of work, which we have not adjusted to mimic their Irish levels.

Figure 4.2: The distribution of market and disposable income

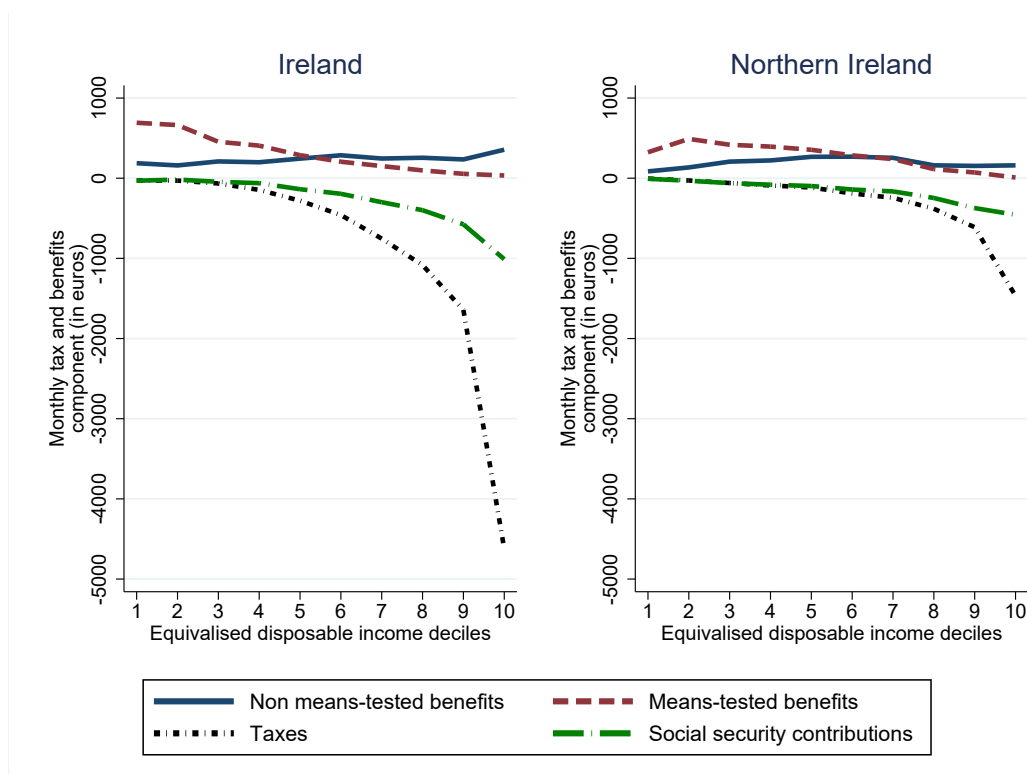


Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Income is equivalised using the modified OECD scale.

Figure 4.2 also shows the distribution of disposable income in each jurisdiction and how it compares to the market income distribution. In Ireland, households are, on average, beneficiaries of the tax-benefit system up to decile six. Average disposable income is higher than average market income in this portion of the income distribution, indicating that households receive more in benefits than they pay in taxes, on average. After that point, households become contributors, on average, with average disposable income falling below average market income.

In Northern Ireland, the switching point from beneficiary to contributor occurs much further up in the distribution. Households in the lowest four-fifths of the income distribution are, on average, beneficiaries of the tax-benefit system while only households in the top two income deciles are, on average, contributors.

Figure 4.3: The distribution of income taxes, mean-tested benefits, non mean-tested benefits and social contributions by income decile



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Income is equivalised using the modified OECD scale.

Figure 4.3 shows the components of the tax-benefit system that transform household market income into disposable income by income decile. Means-tested benefits are similar, on average, in both Ireland and Northern Ireland for the bottom two income deciles. However, further up the income distribution, the level of means-tested benefits is higher in Northern Ireland than in Ireland. Indeed, households benefit on average from means-tested benefits up to the eighth income decile in Northern Ireland, while in Ireland eligibility for means-tested benefits elapses at lower relative income levels, around decile six. In each jurisdiction, eligibility for non-means-tested (contributory) benefits is low or zero for low income households but increases further up the income distribution.

The distribution of tax and social security is strongly progressive, with low income households in both Ireland and Northern Ireland paying little to none on average. However, the tax burden on households who pay tax is higher, on average, in Ireland than in Northern Ireland, particularly in the top two income deciles.

4.3.2 The contribution of the tax-benefit system to differences in income inequality

Figure 4.5 shows how inequality of disposable income in Northern Ireland, as measured by the Gini coefficient, would change if household incomes were subject to the Irish tax-benefit system. We follow the method described in Chapter 3 and Appendix Section B. This sheds light on the importance of differences in the tax-benefit system in explaining differences in income inequality on the island of Ireland.

The Gini coefficient of disposable income in Northern Ireland of 0.27¹⁵ changes little if, instead of the Northern Irish tax-benefit system (*Baseline*), the Irish system is applied to household income (*All (IE)*).¹⁶ This indicates that the Irish tax-benefit system performs similar redistribution to the Northern Irish system for the population of Northern Ireland.

Breaking this effect down into the relative contribution of the components of the tax-benefit system, Figure 4.5 also shows how income inequality in Northern Ireland would change if specific components of the tax-benefit system were swapped in isolation. The Irish tax system is inequality-reducing in Northern Ireland compared to the Northern Irish tax system. However, this is counteracted by the inequality-

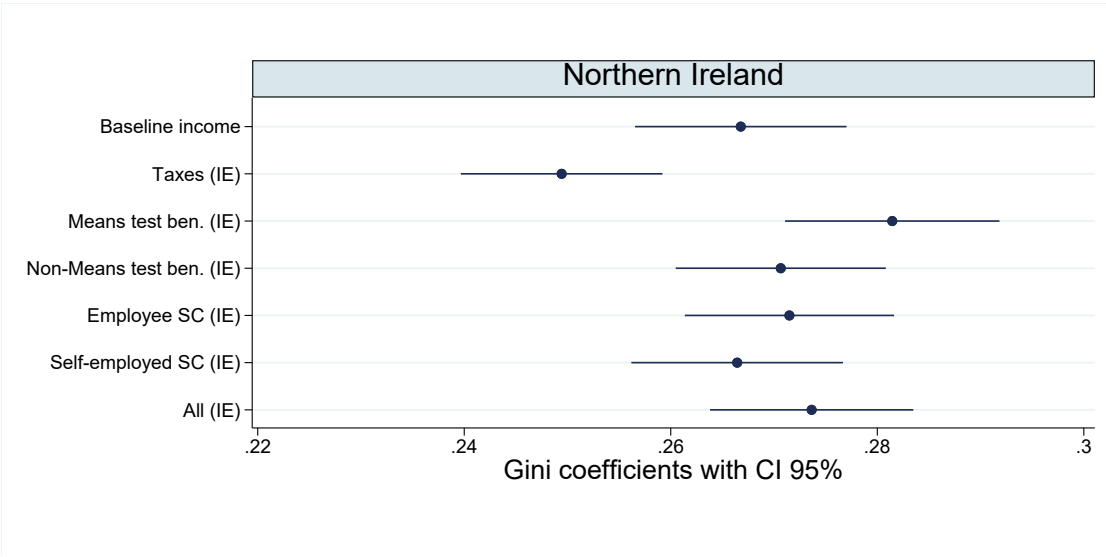
¹⁵ This differs slightly from the simulated point estimate reported in Table 4.1 as it is based on the prediction from the regression model described in Section 3.2. However, the confidence intervals of both estimates overlap.

¹⁶ The simulation, *All (IE)*, does not give the same Gini coefficient as that in Ireland, nor should we expect it to, as there are market income differences between the two jurisdictions which affect income inequality in addition to the tax-benefit system.

increasing effect of the Irish means-tested benefit system. Applying either the non-means-tested benefit system or the social security system of Ireland in Northern Ireland does not substantially affect income inequality.

Therefore, the inequality-increasing effect of the Irish tax-benefit system in Northern Ireland is due to two counteracting forces: an inequality-reducing tax system and an inequality-increasing means-tested benefit system. These effects are not statistically significant at the 5% level, although the tax effect is statistically significant at the 10% level (Figure C.4). Their direction and interpretation, however, align with the relatively higher tax burden and the relatively lower coverage and level of means-tested benefits in Ireland compared to Northern Ireland observed in both Table 4.1 and Figure 4.3.

Figure 4.4: Decomposing the difference in disposable income inequality



Notes: Authors’ calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. The baseline reports the Gini Index in Northern Ireland. The (IE) counterfactuals report the Gini Index for Northern Ireland where if household incomes were subject to the tax, social security and benefit system in Ireland.

In Figures C.6 and C.7, we show results from the same analysis using two different measures of income inequality. The 90/50 ratio measures the difference in income concentration between the top income class (i.e. top 10% of the income distribution) and the middle class (the fifth income decile). The 50/10 ratio, on the other hand, measures the difference in income concentration between the middle class

and the bottom of the income distribution (the lowest income decile). We find that the Irish tax-benefit system reduces the 90/50 ratio in Northern Ireland, primarily through the taxation system. This is in line with the more progressive Irish tax system reducing incomes at the top of the income distribution although the difference is not statistically significant. We find that the Irish tax-benefit system increases the 50/10 ratio, i.e. increases inequality between the middle and bottom of the income distribution. This is driven by application of the Irish means-tested benefit system to the Northern Irish population.

This analysis of the 90/50 and 50/10 ratios further highlights the opposing effects of taxes and benefits and the population that they affect. The Irish tax system is inequality-reducing compared to the Northern Irish tax system as it performs extra redistribution between the top and middle of the income distribution. The Irish means-tested benefit system is inequality-increasing compared to the Northern Irish system due to the associated reduction in redistribution between the middle and bottom of the income distribution.

Figure C.8 in the appendix repeats our main analysis of the Gini coefficient for purchasing power parity (PPP) adjusted incomes in Northern Ireland. This answers the question of how the income distribution in Northern Ireland would change if a PPP-adjusted version of the Irish tax-benefit system were applied instead of the unadjusted Irish tax-benefit system. Results are broadly similar, indicating that differences in purchasing power between the UK and Ireland are not driving our main results.¹⁷

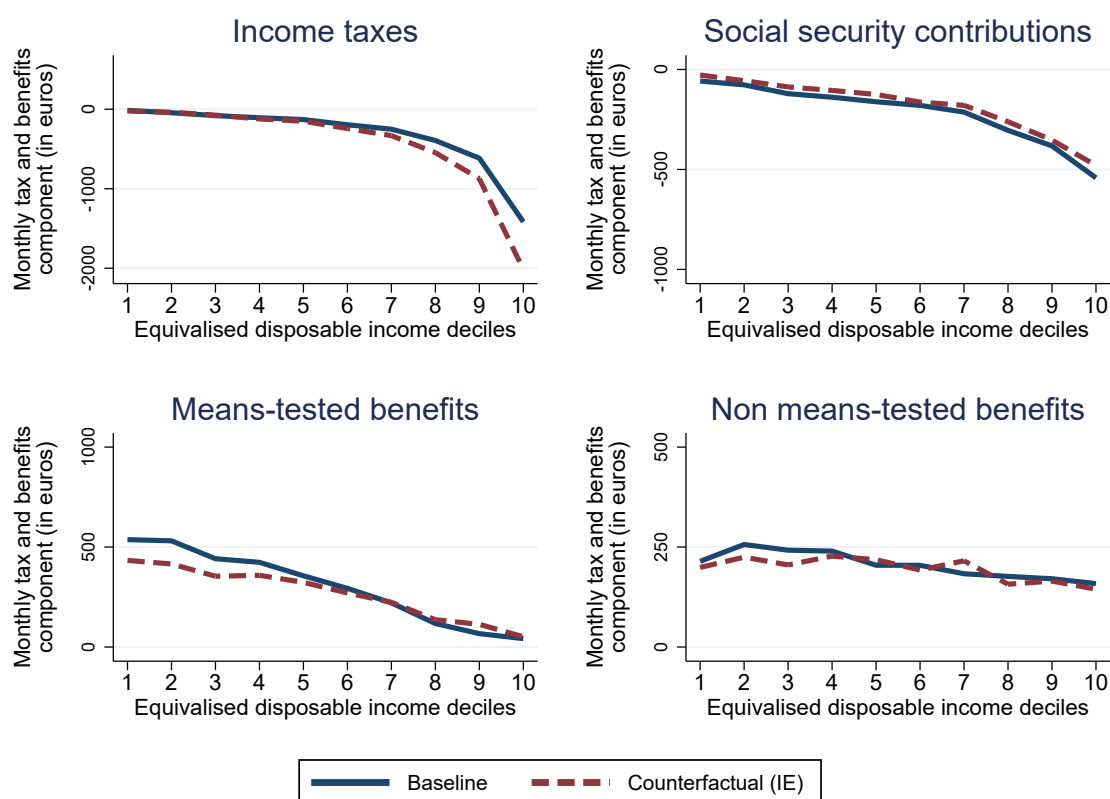
Figure C.5 in Appendix C repeats the analysis for Ireland, implementing the Northern Ireland tax-benefit system for the Irish population and showing how this would change income inequality in Ireland. Compared to the Irish tax-benefit system, the Northern Irish tax-benefit system is inequality-increasing and this differential is largely driven by the taxation (rather than the benefit) system.

Finally, Figure 4.5 shows which part of the income distribution would be affected by swapping the Northern Irish tax-benefit system. Applying the Irish tax system to the Northern Irish population increases the tax burden on households in the top third of the income distribution. By contrast, social security contributions are relatively lower for the Northern Irish population under the Irish social security system. Due to the rather flat-rate nature of social security contributions, this slight difference is evident throughout the income distribution and is, therefore, unlikely to affect income inequality much. The Irish

¹⁷ There is no harmonised PPP figure available for Northern Ireland so we use the UK figure of 0.67£/\$ and the Irish figure of 0.79€/€ provided by the OECD to derive a £/€ PPP for converting Northern Irish incomes.

means-tested benefit system is relatively less generous than the Northern Irish one in the bottom half of the income distribution. The same is true, but to a lesser degree, for the non means-tested benefit system.

Figure 4.5: Northern Ireland: Predicted and counterfactual tax and benefit components by income deciles



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data.

5 Discussion

This research has examined the drivers of income inequality on the island of Ireland. Comparing these drivers in Ireland and Northern Ireland contributes to our understanding of relative living standards north and south of the border. Understanding the sources of income inequality can help policymakers to determine if the level and causes are acceptable or if policy intervention is required.

Using harmonised models and methods, we find that income inequality, as measured by the Gini Index, is higher in Ireland than in Northern Ireland, both before and after taxes and transfers, but that this difference is small and not statistically significant. Nevertheless, as seemingly similar income distributions can come about for different underlying reasons, we analyse the drivers of income inequality in the two jurisdictions. By adjusting the Northern Irish population data to reflect the structure of demographics, employment and wages in Ireland, we investigate a number of potential reasons for differences in the distribution of market income. We find that differences in the demographic profile and wage structure of the two populations lead to differences in how market income is distributed. The demographic profile of Ireland is inequality-reducing compared to Northern Ireland; in Ireland, a younger and more highly educated population has higher labour market participation. This reduces the number of households at the very bottom of the market income distribution who have no earnings, decreasing inequality in market income. This effect is counteracted by the inequality-increasing wage structure existing in Ireland. The wage structure, which is far more unequal than that existing in Northern Ireland, may be a consequence of higher productivity levels in Ireland, which are well documented by Smyth et al. (2022), Fitzgerald and Morgenroth (2019) and McGuinness and Bergin (2020), or the concentration of public sector employment in Northern Ireland (Brownlow and Birnie, 2018), which tends to be associated with a flatter wage profile.

Turning to the influence of the tax-benefit system, we show that the tax system in Ireland is more progressive than that in Northern Ireland, resulting in a relatively higher tax burden for households in the top half of the income distribution. The means-tested benefit system, on the other hand, is relatively more generous in Northern Ireland, with one-half of all households in Northern Ireland in receipt of means-tested benefits, compared to one-quarter in Ireland.

By 'swapping' the tax-benefit system, as a whole and in its constituent parts, between the two jurisdictions, we estimate how differences between the two systems affect income inequality. We find that the Irish tax system is inequality-reducing compared to the Northern Irish system, as it would increase the tax burden on the top-third of the income distribution. We find that the means-tested benefit system in Ireland is inequality-increasing compared to that in Northern Ireland as it is less generous, both in the level of benefits it provides and in the degree of coverage in the lower half of the income distribution. Swapping all elements of the tax-benefit system in Northern Ireland results in a small increase in income inequality, which is not statistically significant, thanks to the counteracting effects of taxes and means-tested benefits.

There are some important caveats to our analysis. First, we consider the tax-benefit system in place in 2019. This is because, at the time of writing, this is the latest year for which we have harmonised tax-benefit policies and data for Ireland and Northern Ireland. Changes to tax-benefit policy, to the population structure, to wages and to employment in the intervening years may affect our conclusions. In particular, the roll-out of the Universal Credit in Northern Ireland, which began at the end of 2018 for new benefit claimants, was in the early stages during our period of analysis. As shown by Ray-Chaudhuri and Waters (2024), the full roll-out of the Universal Credit has important implications for income distribution. Additionally, research for both Ireland (Roantree et al., 2024) and Northern Ireland¹⁸ indicates that real incomes have fallen as a result of the cost-of-living crisis, and there is evidence for Ireland that this fall has been unequally felt, with sharper losses around the median of the income distribution. Future work could replicate this analysis with post-pandemic policies and data when available.

Second, many of the results we discuss in our analysis are statistically significant at only the 10% level. The computational burden associated with microsimulation combined with a decomposition technique may be asking too much of the survey data underlying this analysis, which consists of just over 4,000 households in Ireland and 2,000 households in Northern Ireland. Nevertheless, the direction and pattern of results from our decomposition analysis is consistent with descriptive patterns and greatly aids our understanding of the drivers of income inequality in each jurisdiction.

Third, in terms of the tax-benefit system, we are constrained to investigating those instruments which are modelled by each of the microsimulation models and which have a cash value. Policies such as free

¹⁸ See <https://datavis.nisra.gov.uk/economy-and-labour-market/Employee-earnings-NI-2023.html>

or subsidised healthcare, education or childcare are not considered. Furthermore, we do not model the effect of the pension system in either jurisdiction on income inequality as neither of the microsimulation models underlying our analysis contains sufficient information on contribution histories. As state pension rates are more generous, even after adjusting for purchasing power, in Ireland than in Northern Ireland, this could affect our results.

The thought experiment carried out in this research, of swapping elements of the population structure and tax-benefit system between Ireland and Northern Ireland, is simply a method used to identify the reasons for income distribution differences between the two jurisdictions. It is certainly not intended to be prescriptive for policymaking. It does shed light, however, on possible future developments in income inequality on the island of Ireland. If both jurisdictions follow the trend in European countries over the last number of decades of experiencing population ageing and upskilling, these two effects are likely to have an opposing effect on the distribution of pre-tax and transfer income. It is unclear whether the inequality-increasing effect of population ageing would dominate the inequality-reducing effect of increased education. The latter is likely to be particularly important in Northern Ireland, where baseline levels of education are lower.

This research also indicates that, if there is any convergence in the future between the tax-benefit systems of Ireland and Northern Ireland, in the context of increased economic co-operation on the island of Ireland, there may be a limited impact on income inequality due to opposing forces in the tax and benefit system. An understanding of these forces and their impact on income inequality – in isolation and together – can help to guide any such move towards future co-operation.

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Drivers of income inequality in Ireland and Northern Ireland[†]
(ONLINE APPENDIX)

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A Reweighting the population of each jurisdiction to achieve the structure of the other

Denote G^C the index of interest, e.g. the Gini Index, in country C . Market income inequality is a function of market income, X^C , which is itself a function of demographic characteristics for each individual in the country, z_i^C . Reweighting the population in Northern Ireland, for example, to resemble the demographic structure in Ireland, we construct a counterfactual measure of income inequality:

$$G^{NI} = f(X_i^{NI}(z_i^{IE})) \quad (\text{A.1})$$

In order to estimate which source of demographic variation between the two countries contributes most to market income inequality, we carry out this reweighting in steps, first adjusting z_i^C for demographics (gender, age, education), then for labour market status.

B Using regression-based models to swap the tax-benefit system between Ireland and Northern Ireland

We first predict net taxes calculated by each model as precisely as possible in the following way. SWITCH and UKMOD simulate net taxes $T_i(C)$ for Ireland ($C = I$) and Northern Ireland ($C = NI$) respectively using gross market income, X_i^C , the set of tax-benefit rules for the country in question and any relevant demographic information from the data underlying the microsimulation model (z_i^C). Net taxes are defined as income and payroll taxes minus benefits.

$$T_i(C) = f(X_i^C, z_i^C) \quad (\text{B.1})$$

Taking the same set of characteristics, (X_i^C, z_i^C) as explanatory variables, we model $T_i(C)$ as simulated by each model using a very flexible ordinary least square (OLS) specification, including higher order polynomials to account for non-linear effects and interaction terms of income with all relevant characteristics observed in the data for the assignment of taxes and benefits (for similar approaches, see e.g. Frenette et al. (2007), Biewen and Juhasz (2012) and Bargain et al. (2013)). Subsequently, $\hat{T}_i(C)$ is predicted and validated against the original simulated value, $T_i(C)$. Using predicted net taxes, we then estimate disposable income distributions, $D_i(C)$, for Ireland and Northern Ireland, and the difference in inequality between the two distributions, as measured by indices such as the Gini coefficient, G .

$$D_i(C) = X_i(C) - T_i(C) \quad (\text{B.2})$$

$$\Delta G = G(D_i(NI)) - G(D_i(I)) \quad (\text{B.3})$$

The coefficients from the net tax model are saved. By using harmonised explanatory variables from the underlying data for each country, it is straightforward to swap the model coefficients in order to create counterfactual net tax distributions as if (i) the population of Ireland was subject to the Northern Irish tax-benefit system $\hat{T}_i^{NI}(I)$ and/or (ii) the population of Northern Ireland was subject to the Irish tax-benefit system $\hat{T}_i^I(NI)$. These resulting counterfactual income distributions can be used to simulate the level of

income inequality that would prevail given the alternative tax-benefit system. We can then estimate how much of the difference in income inequality between the two countries is due to the tax-benefit system and how much is due to other factors such as demographics, the labour market, etc.

For example, creating counterfactual income distributions for Northern Ireland as if the Irish tax-benefit system prevailed, we can decompose the difference in income inequality into the relative contributions of the tax-benefit system and other factors:

$$\Delta G = \underbrace{[G(D_i(NI)) - G(D_i^I(NI))]}_{\text{tax-benefit system}} + \underbrace{[G(D_i^I(NI)) - G(D_i(I))]}_{\text{other}} \quad (\text{B.4})$$

For each stage of this analysis, we estimate not only a combined net tax function (which aggregates tax, social security, welfare and pensions at the individual level) but also functions for the major sub components of net tax, i.e. income tax, social security, means-tested benefits and non-means-tested benefits.²

We estimate the following weighted OLS regression for Ireland (IE) and Northern Ireland (NI) separately:³

$$y_{i,c} = \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, \quad (\text{B.5})$$

whereby the dependent variable y_{ic} is the tax or benefit component of the household $i = \{1, \dots, N\}$ in the jurisdiction $c = \{\text{IE}, \text{NI}\}$. In our exercise, we estimate five tax and benefits components: (1) income taxes, (2) means-tested benefits, (3) non-means-tested benefits, and (4) employee and (5) self-employed social contributions. Finally, \mathbf{X}_{ic} is a matrix of household characteristics that are predictors of the tax or benefit component, y_{ic} . Because the prediction of each tax and benefit component needs a different OLS specification, we describe these separately and present each of our estimated tax and benefit components in detail.

² It is much trickier to estimate a regression function for pensions that could be applied to a different country, as pension simulations in microsimulation models are limited by the fact that the underlying data do not contain information on contribution histories. For some pension instruments, simulation is impossible and the models use actual amounts of receipt from the underlying data. For this reason, we do not estimate a pension function. Rather, the differential effect of pensions on income inequality is resigned to a residual category, which also captures any potential interaction between the different functions.

³ For more information about the sampling weights for Ireland see the description of the SWITCH Irish tax-benefit model (Keane et al., 2023, pp. 72-74). For Northern Ireland, see the UKMOD country report (Ven and Popova, 2023, p. 71).

B.1 Income taxes

Households' income taxes are predicted using the following OLS specification:

$$\widehat{TAXES}_{i,c} = \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, \quad (\text{B.6})$$

whereby the set of household characteristics, \mathbf{X}'_{ic} , is the same for Ireland and Northern Ireland, that is: the age of the head of the household, and its squared and cubed values to capture age non-linearities; the household's market income and its value up to the power of three to capture the non-linear effects of market income on household taxes; the number of children, number of adults, number of unemployed members, number of women, number of hours worked, number of civil servants, a categorical variable describing the marital status of the head of the household (i.e. single, married, separated, divorced, widowed), a categorical variable describing the economic status of head of the household (i.e. pre-school, farmer, employer or self-employed, employee, pensioner, unemployed, student, inactive, sick or disabled, other), number of widows, number of retired members, a dummy variable taking value 1 if there is at least a disabled member in the household, a categorical variable describing the housing tenure (i.e. owned on mortgage, owned outright, rented, reduced rented, social rented, free, other), categorical variables capturing the age of the youngest child (i.e. no child, age 0-4, 5-12, 13-18, 19-24, ≥ 25)⁴ and the interaction term between the number of women and the total number of hours worked in the household to capture possible intra-household gender gap in the labour market participation and salary gender income gaps.⁵

Because we use an OLS estimation, our regression (B.6) can predict negative income taxes, which do not exist in Ireland or Northern Ireland. Consequently, following the same strategy used in Frenette et al. (2007, p. 746), we substitute the few negative predicted income taxes with 0, such that:

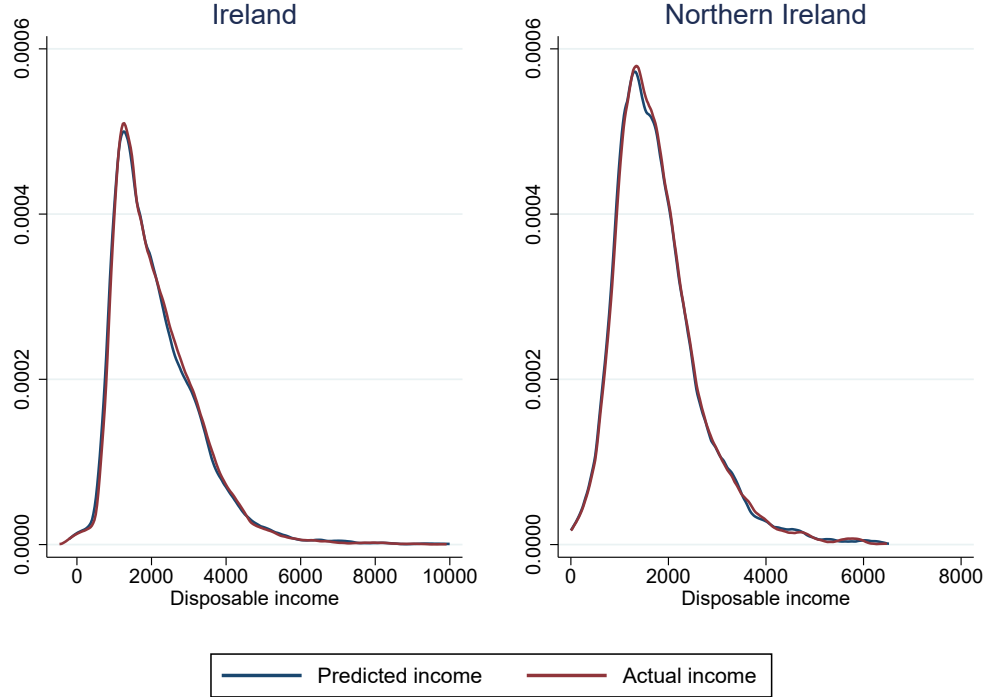
⁴ Age groups created following the CSO's age groups (see: <https://www.cso.ie/en/releasesandpublications/ep/p-cp3oy/cp3/agr/>). The CSO classes include two age classes, namely 25-65 and 65+, which we have aggregated because there is no child older than 65.

⁵ We do not include the number of immigrants as this variable is only available in Ireland. Adding it for Ireland does not change our results.

$$\widehat{TAXES}_{i,c} = \begin{cases} \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, & \text{if } \widehat{TAXES}_{i,c} \geq 0 \\ 0 & \text{if } \widehat{TAXES}_{i,c} < 0 \end{cases} \quad (\text{B.7})$$

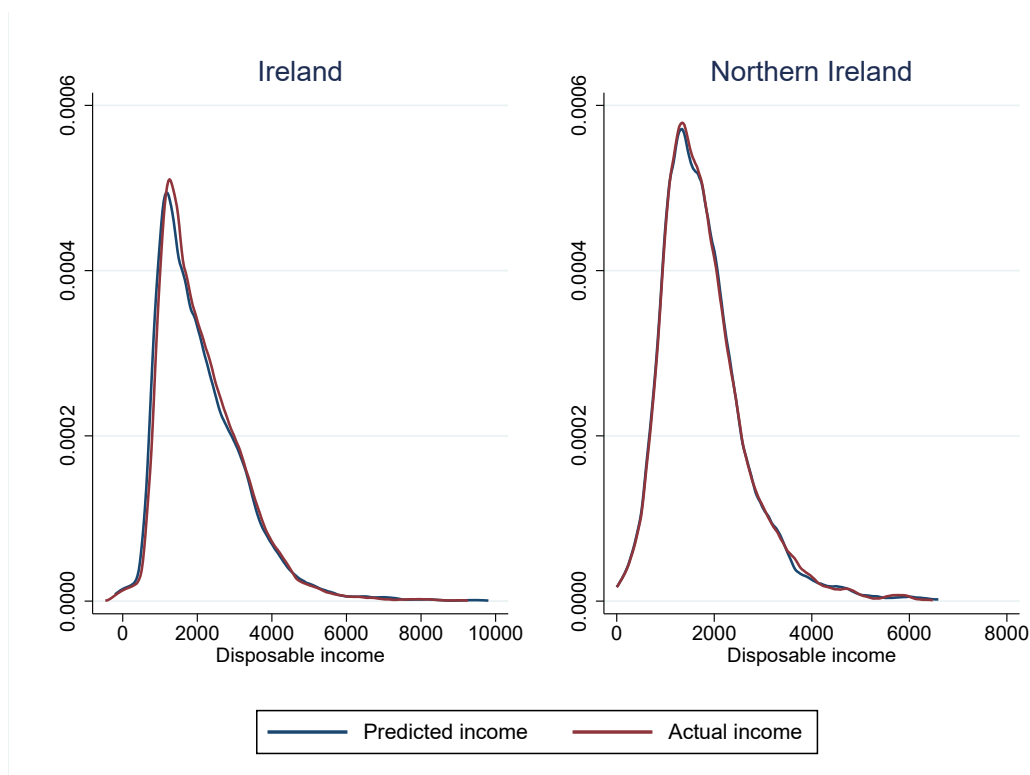
Overall, 951 out of 4,183 observations (about 22% of the sample) for Ireland and 379 out of 2,075 observations (about 18% of the sample) for Northern Ireland are predicted to have negative values and have been converted to 0. This result is driven by the number of households paying 0 taxes (393 for Ireland and 740 for Northern Ireland). A robustness check, suggested by Frenette et al. (2007, p. 746), is used to estimate the taxes using a Tobit model. Thus, we also use a Tobit model with the lower bound censored at 0. The disposable income distributions computed using the OLS-predicted taxes and the Tobit-predicted taxes are similar and predict the disposable income distribution simulated by the microsimulation models well, as shown in Figures B.1 and B.2.

Figure B.1: Taxes: OLS estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data.

Figure B.2: Taxes: Tobit estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated tax shows the distribution of tax simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted tax shows the distribution of tax as predicted by the regression model outlined in Equation B.7.

B.2 Means-tested benefits

Households' means-tested benefits (here, $MT_B_{i,c}$) are predicted using the following OLS specification:

$$\widehat{MT_B_{i,c}} = \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, \quad (\text{B.8})$$

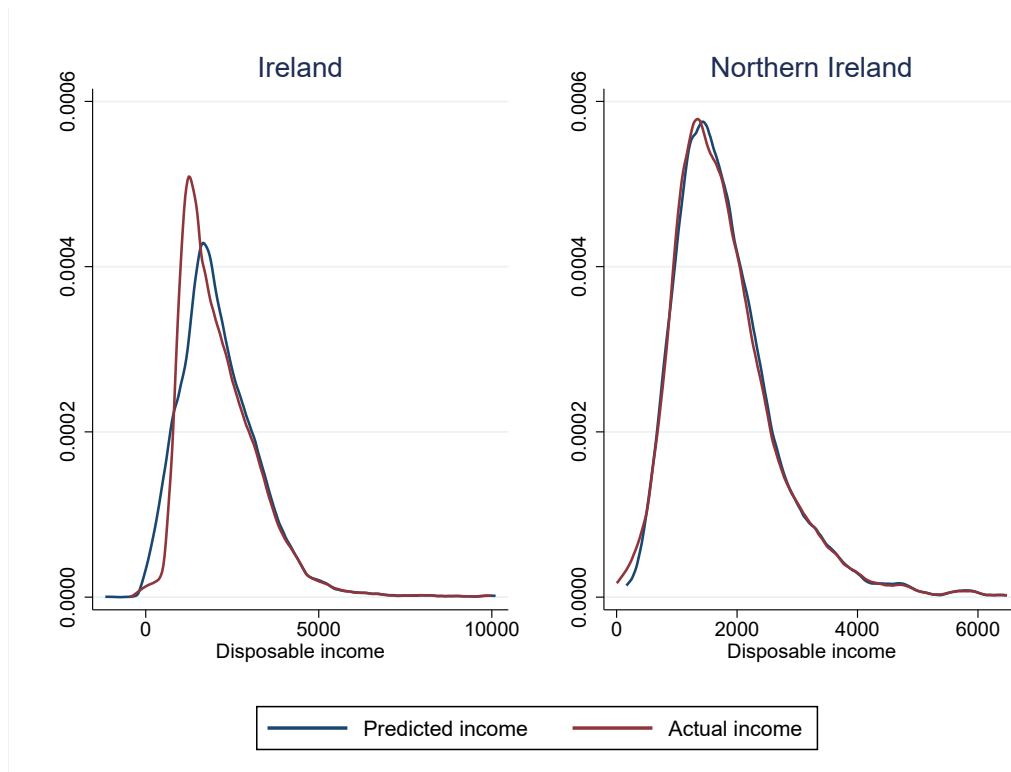
The set of household characteristics, \mathbf{X}'_{ic} , is the same for Ireland and Northern Ireland, that is: the age of the head of the household, and its squared and cube values to capture age non-linearities; the household's market income and its value up to the power of three to capture the non-linear effects of market income on household means-tested benefits; the number of people in the household, the number of children, number of jobseeker members, number of women, number of hours worked, number of civil servants, a categorical variable describing the marital status of the head of the household (i.e. single, married, separated, divorced, widowed), a categorical variable describing the economic status of the head of the household (i.e. pre-school, farmer, employer or self-employed, employee, pensioner, unemployed, student, inactive, sick or disabled, other), number of widows, number of retired members, a dummy variable taking value 1 if there is at least one disabled member in the household, a categorical variable describing the housing tenure (i.e. owned on mortgage, owned outright, rented, reduced rented, social rented, free, other), categorical variables capturing the age of the youngest child (i.e. no child, age 0-4, 5-12, 13-18, 19-24, ≥ 25) and the interaction term between the dummy variable capturing if there are household members with disability and the total number of hours worked in the household.

Similar to the same strategy applied to income taxes in Section B.1, we follow Frenette et al. (2007) and substitute the negative predicted means-tested benefits with 0, such that:

$$\widehat{MT_B_{i,c}} = \begin{cases} \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, & \text{if } \widehat{MT_B_{i,c}} \geq 0 \\ 0 & \text{if } \widehat{MT_B_{i,c}} < 0 \end{cases} \quad (\text{B.9})$$

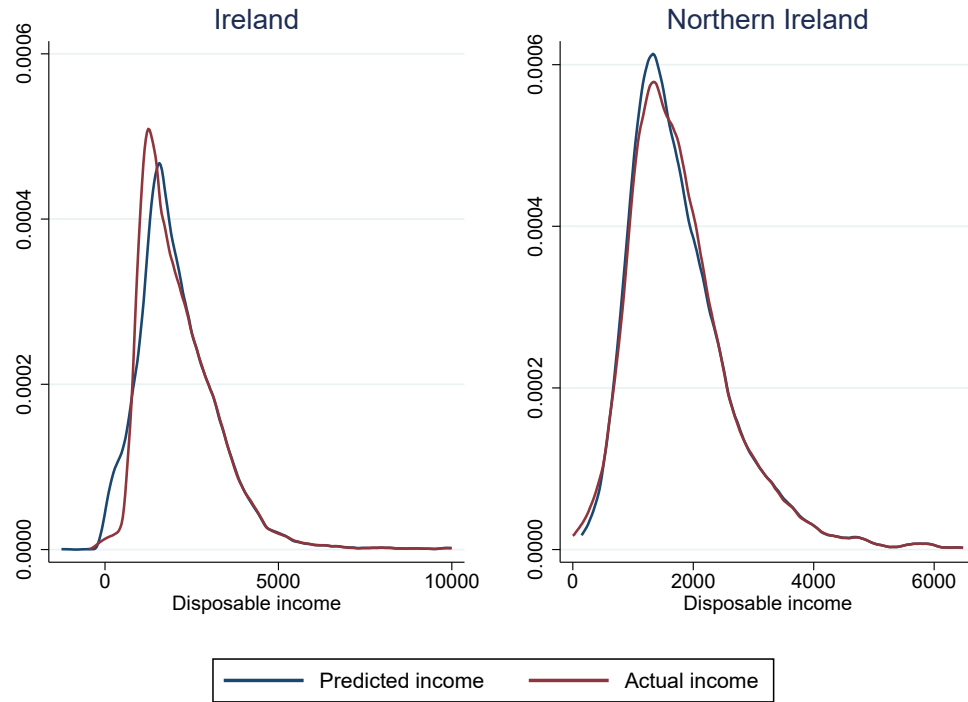
Overall, 693 out of 4,183 observations (about 17% of the sample) for Ireland and 460 out of 2,075 observations (about 22% of the sample) for Northern Ireland are predicted to have negative values and have been converted to 0. As done with the other tax and benefit components, we also estimated a Tobit model truncated at 0, but the results remain similar (See Figure B.3 and Figure B.4 below).

Figure B.3: Means-tested benefits: OLS estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated means-tested benefits shows the distribution of means-tested benefits simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted means-tested benefits shows the distribution of means-tested benefits as predicted by the regression model outlined in Equation B.9.

Figure B.4: Means-tested benefits: Tobit estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated means-tested benefits shows the distribution of means-tested benefits simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted means-tested benefits shows the distribution of means-tested benefits as predicted by the regression model outlined in Equation B.9.

B.3 Non-mean-tested benefits

Households' non-mean-tested benefits (here, $NMT_B_{i,c}$) are predicted using the following OLS specification:

$$\widehat{NMT_B_{i,c}} = \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, \quad (\text{B.10})$$

whereby the set of household characteristics is \mathbf{X}'_{ic} . The set of household characteristics is the same for Ireland and Northern Ireland, that is: number of adults, number of sick people, number of children, number of jobseeker members (categorical, non-linear), number of retired members (categorical, non-linear), a dummy variable taking value 1 if there is at least one disabled member in the household, a categorical variable describing the housing tenure (i.e. owned on mortgage, owned outright, rented, reduced rented, social rented, free, other), categorical variables capturing the age of the youngest child (i.e. no child, age 0-4, 5-12, 13-18, 19-24, ≥ 25), a dummy variable taking value 1 if the mother lives in the household, the interaction between the number of sick individuals and the number of adults, the interaction between mother dummy and the number of children and the interaction between the mother dummy and the categorical variables capturing the age of the youngest child.

Similar to the same strategy applied to income taxes in Sections B.1, we follow Frenette et al. (2007) and substitute the negative predicted non-means-tested benefits with 0, such that:

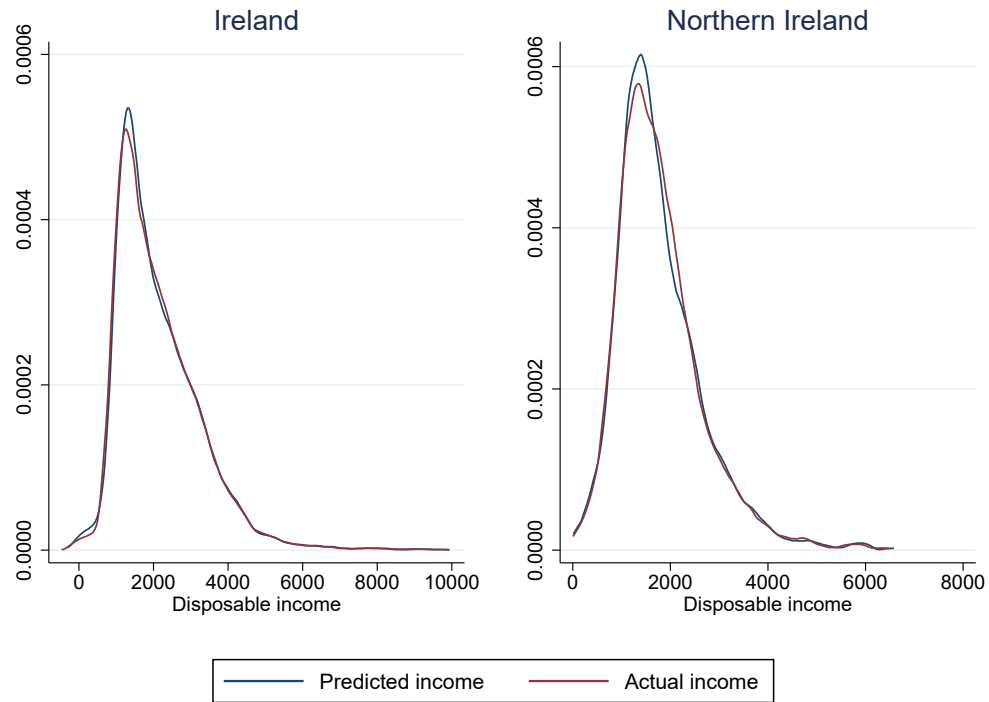
$$\widehat{NMT_B_{i,c}} = \begin{cases} \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, & \text{if } \widehat{NMT_B_{i,c}} \geq 0 \\ 0 & \text{if } \widehat{NMT_B_{i,c}} < 0 \end{cases} \quad (\text{B.11})$$

Overall, 11 out of 4,183 observations (about 0.26% of the sample) for Ireland and 22 out of 2,075 observations (about 1.06% of the sample) for Northern Ireland are predicted to have negative values and have been converted to 0. As done with the other tax and benefit components, we also estimated a Tobit model truncated at 0, but the results remain similar (See Figure B.5 and Figure B.6 below).

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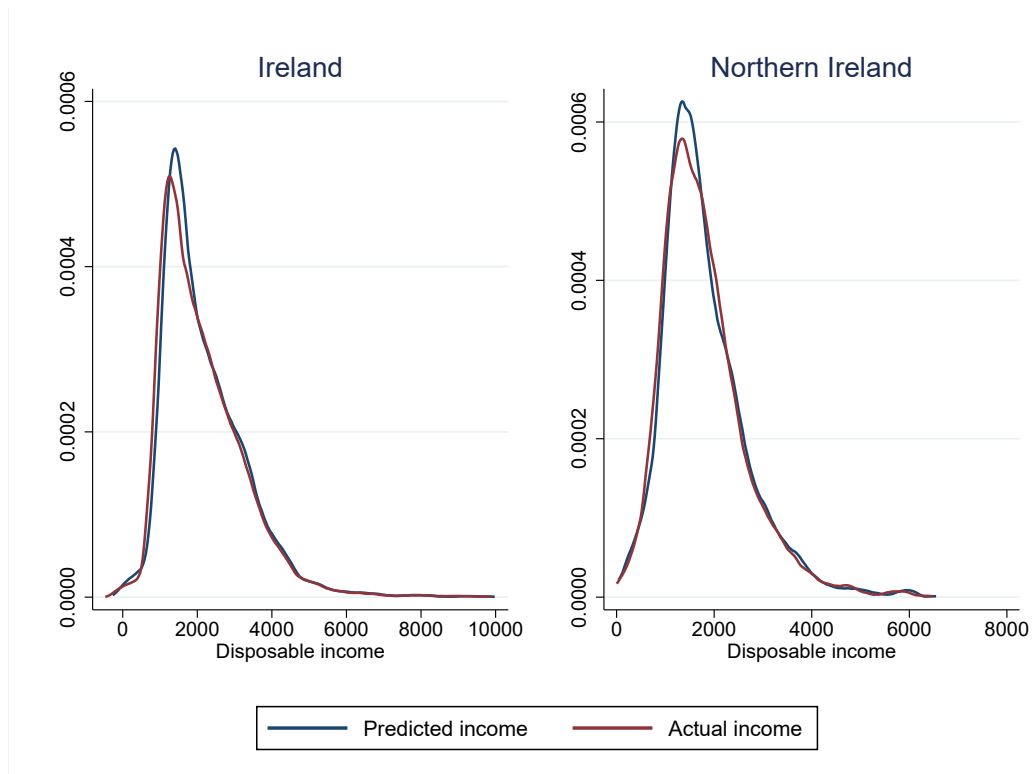
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Figure B.5: Non means-tested benefits: OLS estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated non-means-tested benefits shows the distribution of non-means-tested benefits simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted non-means-tested benefits shows the distribution of non-means-tested benefits as predicted by the regression model outlined in Equation B.11.

Figure B.6: Non means-tested benefits: Tobit estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated non-means-tested benefits shows the distribution of non-means-tested benefits simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted non-means-tested benefits shows the distribution of non-means-tested benefits as predicted by the regression model outlined in Equation B.11

B.4 Employee social contributions

Households' employee social contributions (here, $ESC_{i,c}$) are predicted using the following OLS specification:

$$\widehat{ESC_{i,c}} = \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, \quad (\text{B.12})$$

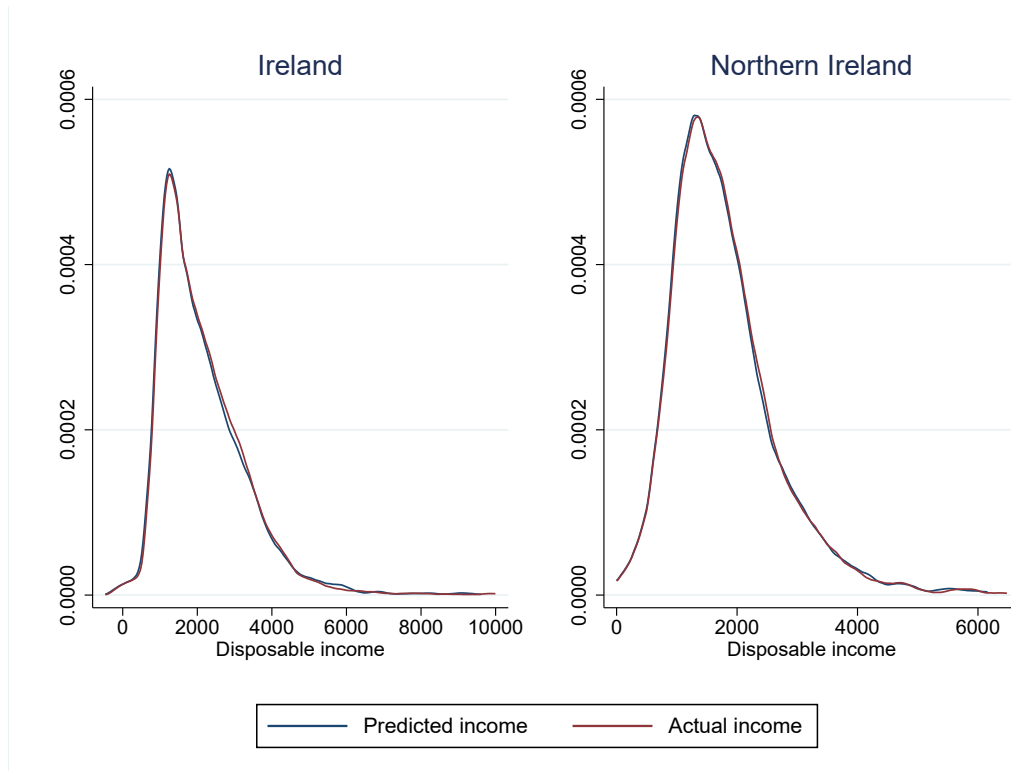
whereby the set of household characteristics \mathbf{X}'_{ic} is the same for Ireland and Northern Ireland, that is: the age of the head of the household, and its squared and cube values to capture age non-linearities; the household's market income and its value up to the power of two to capture the non-linear effects of market income on household taxes; the number of children, number of adults, number of jobseekers, number of women, number of hours worked, number of civil servants, a categorical variable describing the marital status of the head of the household (i.e. single, married, separated, divorced, widowed), a categorical variable describing the economic status of head of the household (i.e. pre-school, farmer, employer or self-employed, employee, pensioner, unemployed, student, inactive, sick or disabled, other), number of widows, number of retired members, a dummy variable taking value 1 if there is at least a disabled member in the household, a categorical variable describing the housing tenure (i.e. owned on mortgage, owned outright, rented, reduced rented, social rented, free, other), categorical variables capturing the age of the youngest child (i.e. no child, age 0-4, 5-12, 13-18, 19-24, ≥ 25) and the interaction term between the number of women and the total number of hours worked in the household to capture possible intra-household gender gap in the labour market participation and salary gender income gaps.

Similar to the same strategy applied to income taxes in Sections B.1, we follow Frenette et al. (2007) and substitute the negative predicted employee social contributions with 0, such that:

$$\widehat{ESC_{i,c}} = \begin{cases} \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, & \text{if } \widehat{ESC_{i,c}} \geq 0 \\ 0 & \text{if } \widehat{ESC_{i,c}} < 0 \end{cases} \quad (\text{B.13})$$

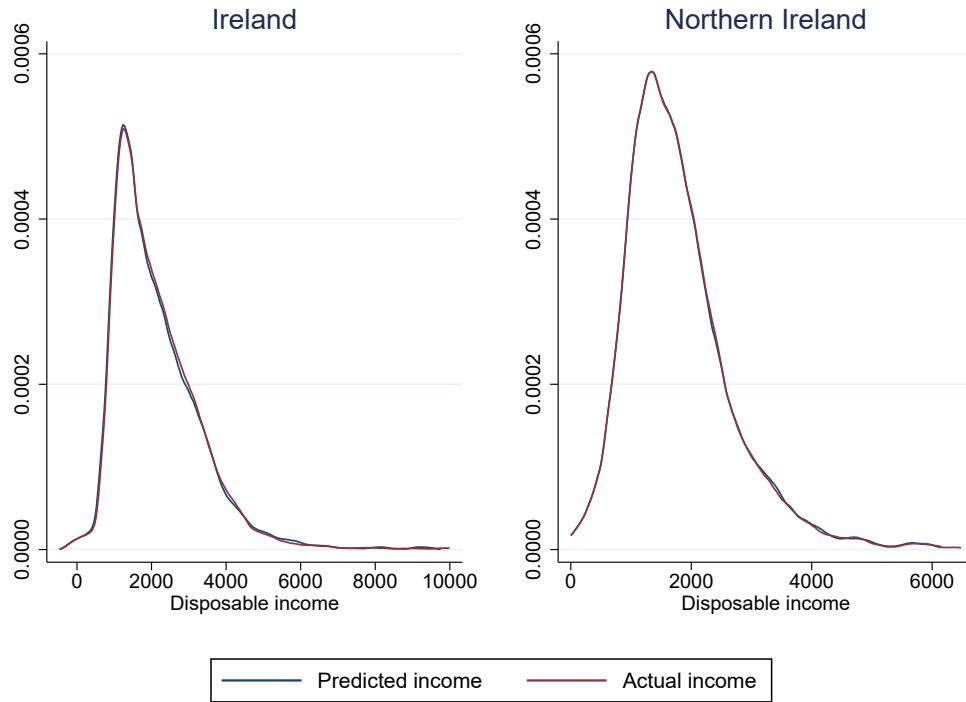
Overall, 1,283 out of 4,183 observations (about 31% of the sample) for Ireland and 657 out of 2,075 observations (about 32% of the sample) for Northern Ireland are predicted to have negative values and have been converted to 0. As done with the other tax and benefit components, we also estimated a Tobit model truncated at 0, but the results remain similar (See Figure B.7 and Figure B.8 below).

Figure B.7: Employee social contributions: OLS estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated employee social security contributions shows the distribution of employee social security contributions simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted employee social security contributions shows the distribution of employee social security contributions as predicted by the regression model outlined in Equation B.13

Figure B.8: Employee social contributions: Tobit estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated employee social security contributions shows the distribution of employee social security contributions simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted employee social security contributions shows the distribution of employee social security contributions as predicted by the regression model outlined in Equation B.13.

B.5 Self-employed social contributions

Households' self-employed social security contributions (here, $SESC_{i,c}$) are predicted using the following OLS specification:

$$\widehat{SESC}_{i,c} = \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, \quad (\text{B.14})$$

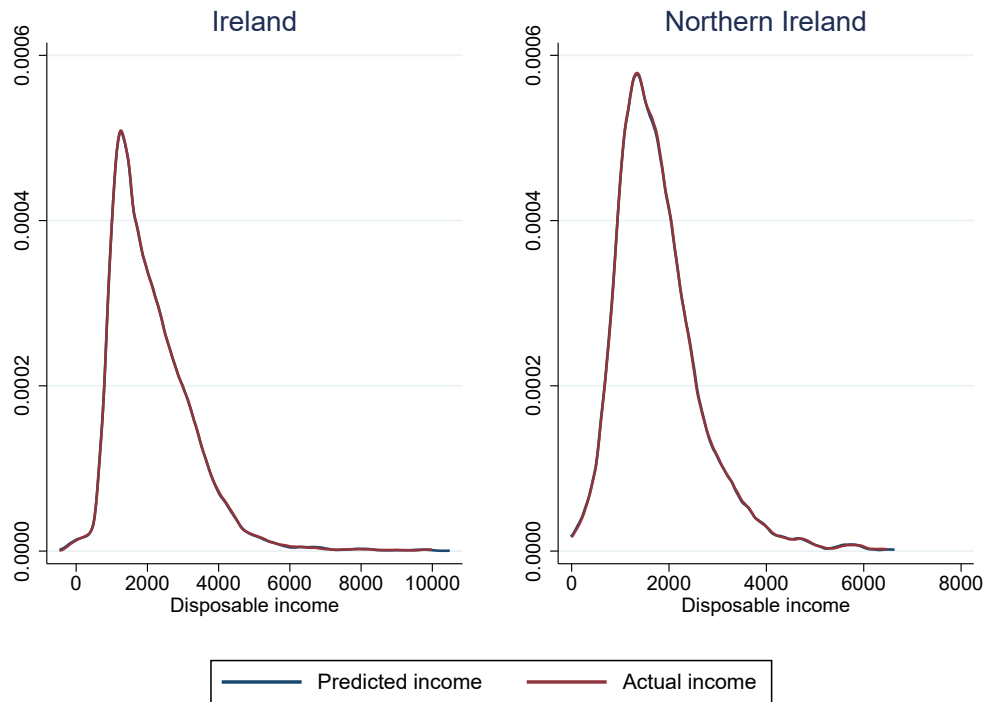
whereby the set of household characteristics, \mathbf{X}'_{ic} , is the same for Ireland and Northern Ireland, that is: the age of the head of the household; the household's market income and its value up to the power of two to capture the non-linear effects of market income on household taxes; the number of children, number of adults, number of jobseekers, number of women, number of hours worked, number of civil servants, a categorical variable describing the marital status of the head of the household (i.e. single, married, separated, divorced, widowed), a categorical variable describing the economic status of head of the household (i.e. pre-school, farmer, employer or self-employed, employee, pensioner, unemployed, student, inactive, sick or disabled, other), number of widows, number of retired members, a dummy variable taking value 1 if there is at least a disabled member in the household, a categorical variable describing the housing tenure (i.e. owned on mortgage, owned outright, rented, reduced rented, social rented, free, other), categorical variables capturing the age of the youngest child (i.e. no child, age 0-4, 5-12, 13-18, 19-24, ≥ 25) and the interaction term between the number of women and the total number of hours worked in the household to capture possible intra-household gender gap in the labour market participation and salary gender income gaps.

Similar to the same strategy applied to income taxes in Sections B.1, we follow Frenette et al. (2007) and substitute the negative predicted employee social contributions with 0, such that:

$$\widehat{SESC}_{i,c} = \begin{cases} \beta_0 + \mathbf{X}'_{ic}\Phi + \varepsilon_{ic}, & \text{if } \widehat{SESC}_{i,c} \geq 0 \\ 0 & \text{if } \widehat{SESC}_{i,c} < 0 \end{cases} \quad (\text{B.15})$$

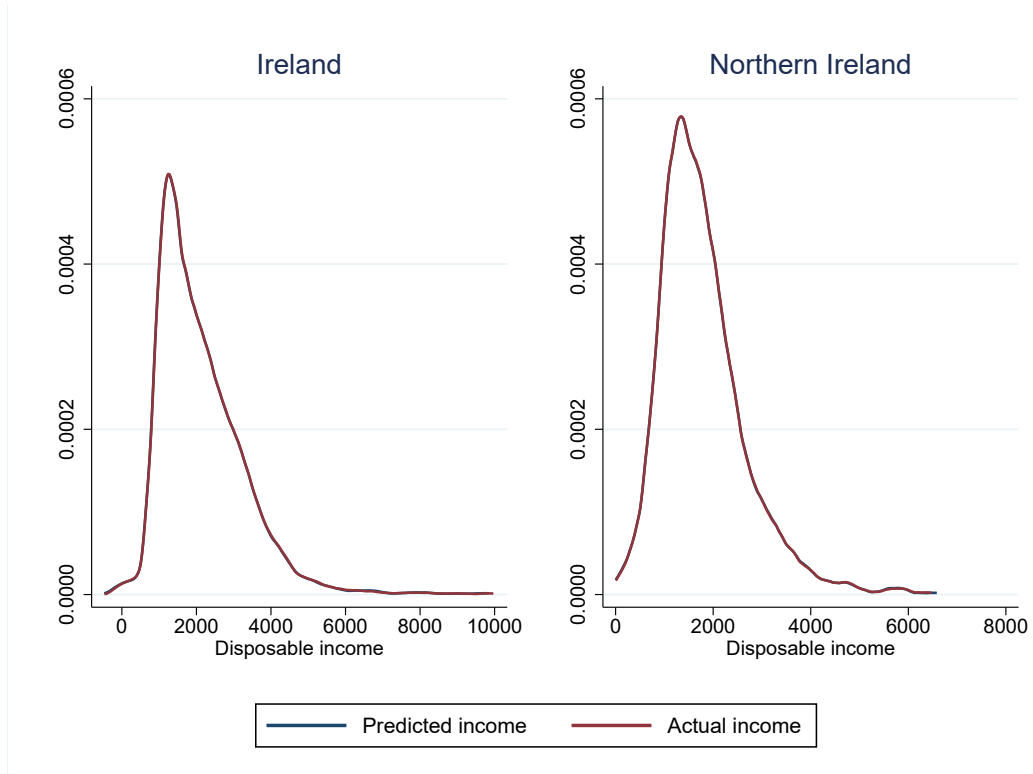
Overall, 1,871 out of 4,183 observations (about 45% of the sample) for Ireland and 1,029 out of 2,075 observations (about 63% of the sample) for Northern Ireland are predicted to have negative values and have been converted to 0. As done with the other tax and benefit components, we also estimated a Tobit model truncated at 0, but the results remain similar (See Figure B.9 and Figure B.10 below).

Figure B.9: Self-employed social contributions: OLS estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated self-employed social security contributions shows the distribution of self-employed social security contributions simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted self-employed social security contributions shows the distribution of self-employed social security contributions as predicted by the regression model outlined in Equation B.15

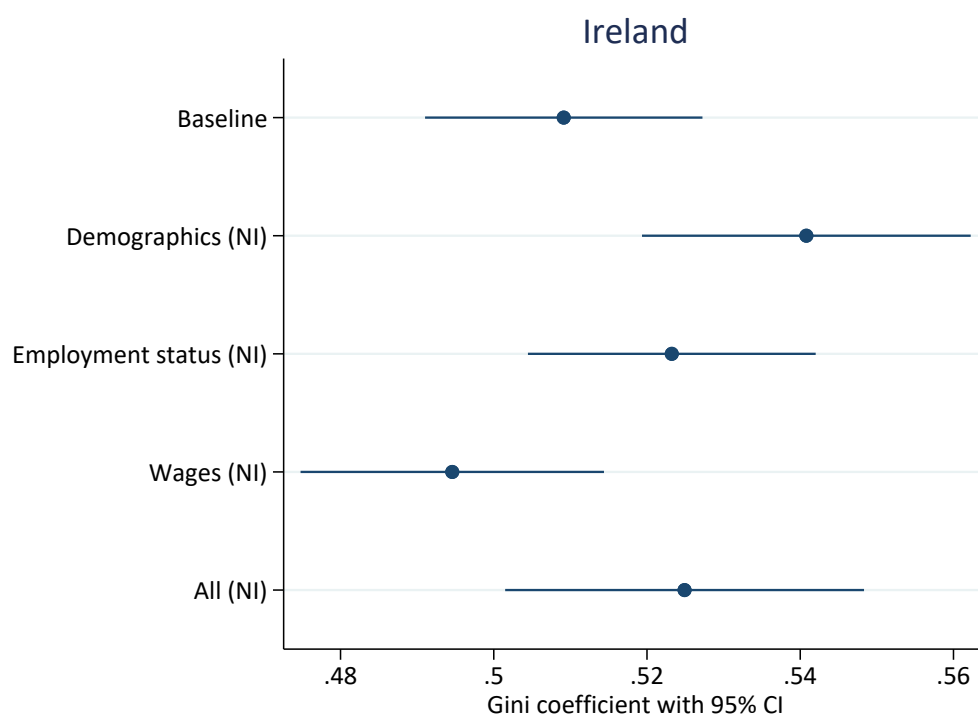
Figure B.10: Self-employed social contributions: Tobit estimation



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Simulated self-employed social security contributions shows the distribution of self-employed social security contributions simulated by SWITCH and UKMOD for Ireland and Northern Ireland, respectively. Predicted self-employed social security contributions shows the distribution of self-employed social security contributions as predicted by the regression model outlined in Equation B.15.

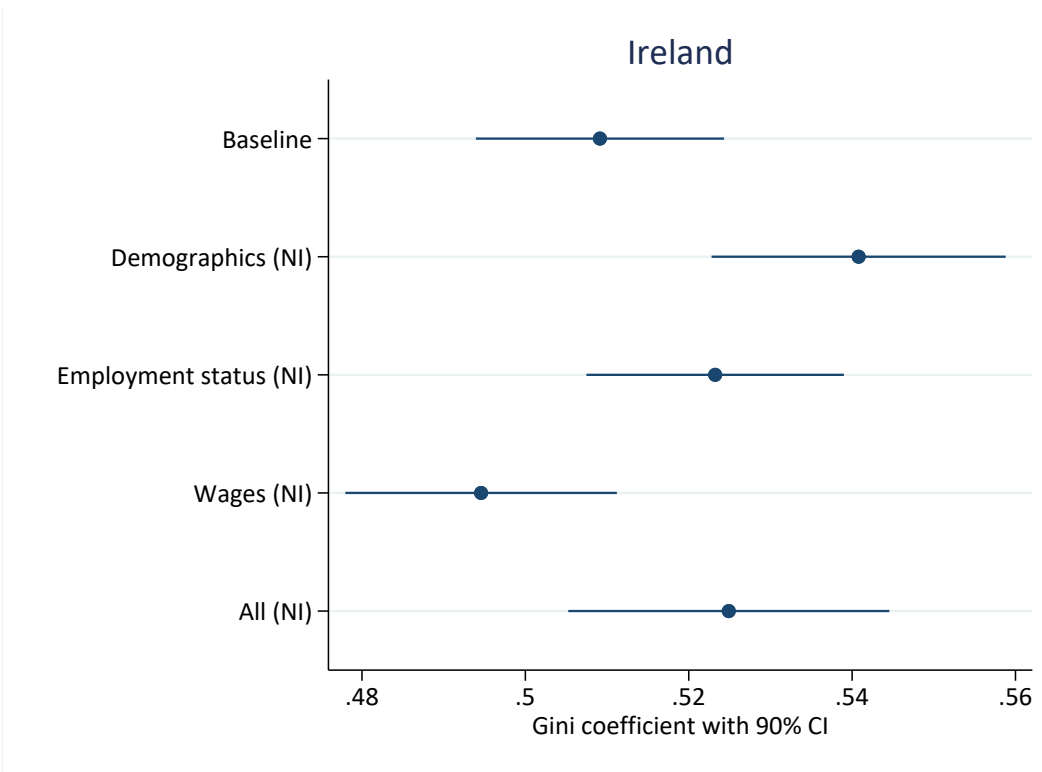
C Robustness checks

Figure C.1: Decomposing the difference in market income inequality in Ireland



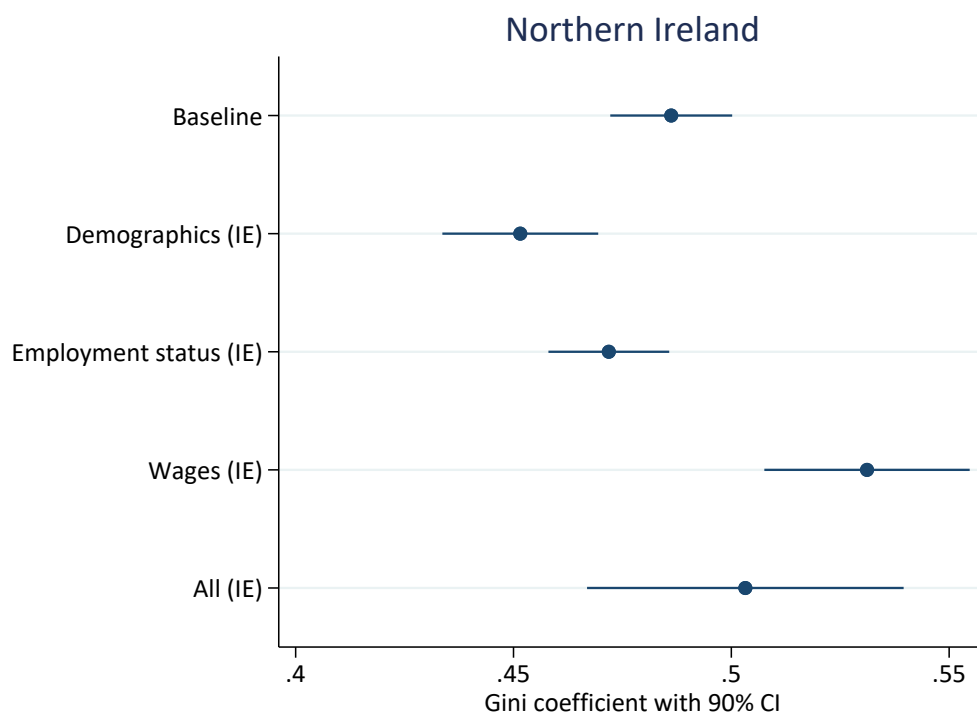
Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. The baseline reports the Gini coefficient in Northern Ireland. The (IE) counterfactuals report the Gini coefficient for Northern Ireland, where demographics, employment status, wages and all three are adjusted to reflect their structure in Ireland.

Figure C.2: Decomposing the difference in market income inequality in Ireland (90% confidence intervals)



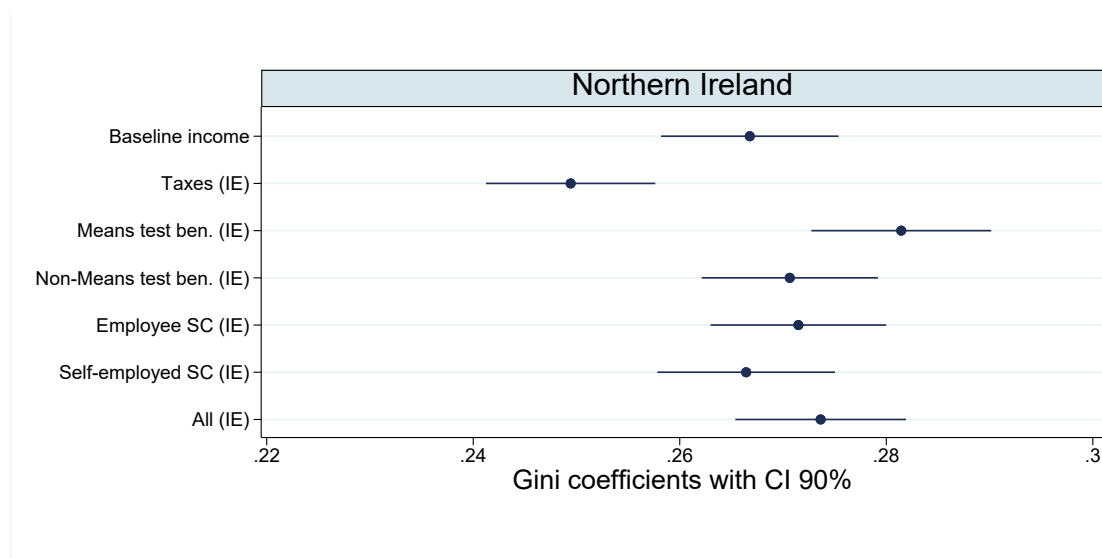
Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 Family Resources Survey (FRS) data. The baseline reports the Gini coefficient in Northern Ireland. The (IE) counterfactuals report the Gini coefficient for Northern Ireland, where demographics, employment status, wages and all three are adjusted to reflect their structure in Ireland. Confidence intervals of 90% applied.

Figure C.3: Decomposing the difference in market income inequality (90% confidence intervals)



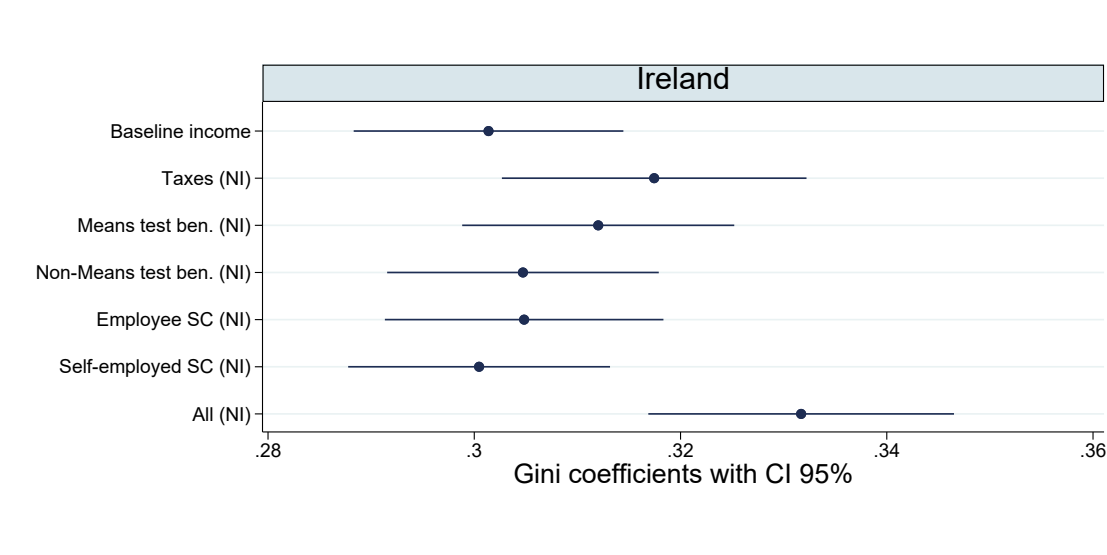
Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. The baseline reports the Gini coefficient in Northern Ireland, estimated using the method outlined in Section 3.2. The (IE) counterfactuals report the Gini coefficient for Northern Ireland, where demographics, employment status, wages and all three are adjusted to reflect their structure in Ireland. 90% confidence intervals applied.

Figure C.4: Decomposing the difference in disposable income inequality (90% confidence intervals)



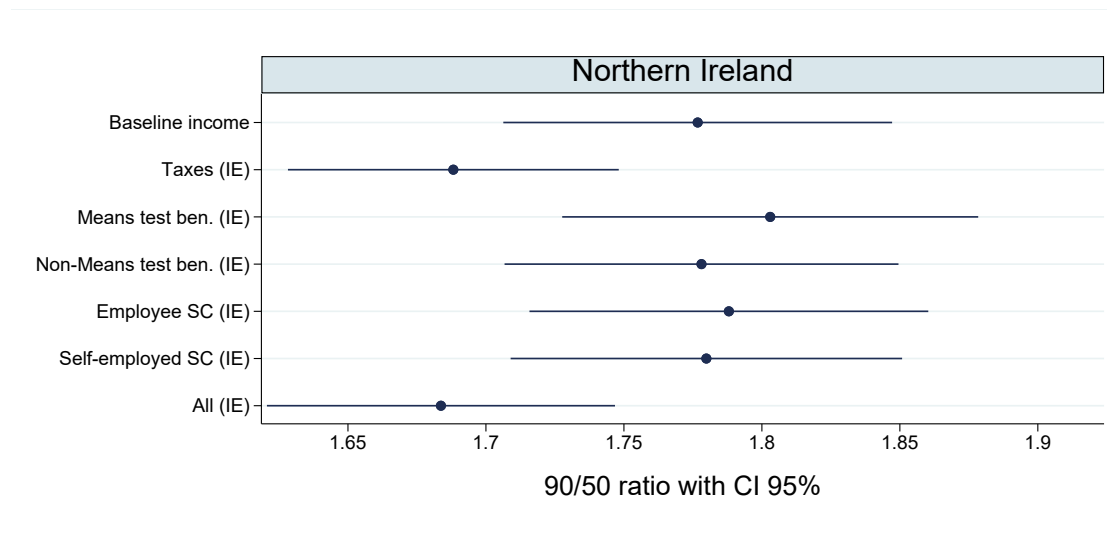
Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. The baseline reports the Gini Index in Northern Ireland. The (IE) counterfactuals report the Gini Index for Northern Ireland where household incomes were subject to the tax, social security and benefit system in Ireland. Confidence intervals of 90% applied.

Figure C.5: Decomposing the difference in disposable income inequality in Ireland



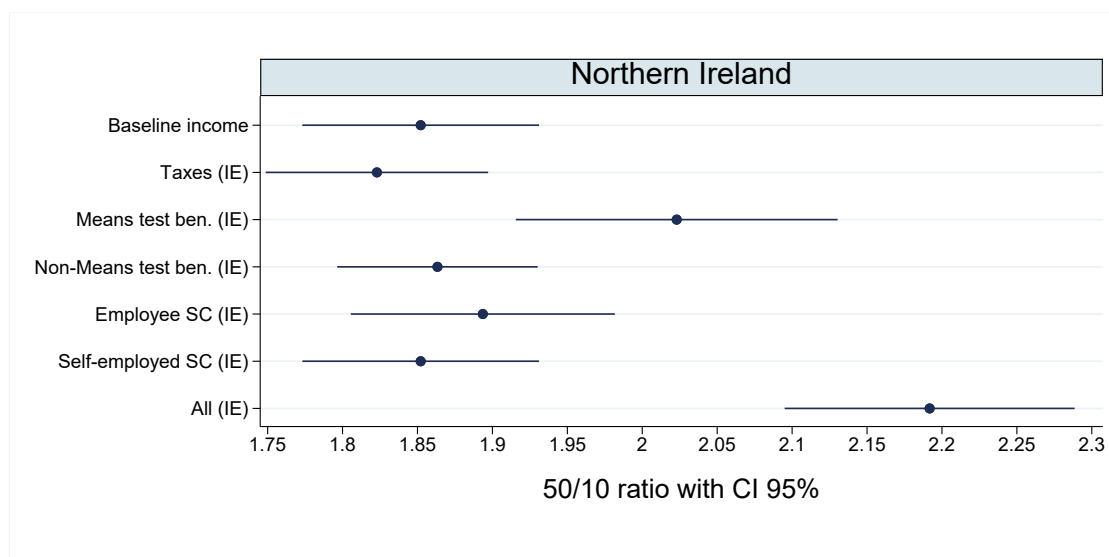
Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data.

Figure C.6: Decomposing the difference in disposable income inequality: 90/50 ratio



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. The baseline reports the 90/50 ratio in Northern Ireland. The (IE) counterfactuals report the 90/50 ratio for Northern Ireland, where household incomes were subject to the tax, social security and benefits system in Ireland.

Figure C.7: Decomposing the difference in disposable income inequality: 50/10 ratio



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. The baseline reports the 50/10 ratio in Northern Ireland. The (IE) counterfactuals report the 50/10 ratio for Northern Ireland, where household incomes were subject to the tax, social security and benefits system in Ireland.

Figure C.8: Decomposing the difference in disposable income inequality: PPP adjusted



Notes: Authors' calculations using SWITCH linked to 2019 SILC data and UKMOD linked to 2019 FRS data. Monetary variables in the Northern Irish data are converted using PPP before the Irish tax-benefit system is applied.

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