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Why are Disability Rates for Older Working-Age Adults in Northern Ireland So High?

Anne Devlin*
Economic and Social Research Institute

Declan French
Queen's University Belfast

Duncan McVicar
Queen's University Belfast and IZA, Bonn

Abstract: Northern Ireland has substantially higher rates of disability and disability benefit receipt than England, despite a common institutional context. This paper exploits newly available data from the NICOLA and ELSA surveys to examine potential health and labour market explanations for this gap, specifically among older working-age people. Observable differences in health and labour markets are sufficient to explain the gap in self-reported activity-limiting disability, but only half of the gap in work-limiting disability and income-replacement disability benefit receipt, and only one-third of the gap in additional costs disability benefit receipt. Possible reasons for these remaining unexplained gaps are discussed.

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* Corresponding author: anne.devlin@esri.ie

I INTRODUCTION

Economic inactivity rates in Northern Ireland (NI) have long been far higher than those in most other United Kingdom (UK) regions. Much of this is accounted for by high rates of inactivity on the grounds of poor long-term health or disability in NI (NISRA, 2017a). In fact, of those economically inactive in NI, 30 per cent are long-term sick/disabled compared to 22 per cent in England. People in NI are also much more likely to be in receipt of disability benefits (Horgan, 2012). A key focus of the NI Executive's last Programme for Government (PfG) was tackling NI's high rate of economic inactivity. To do so, however, requires a detailed understanding of why the level of disability is so much higher in NI. Our current understanding is incomplete, and this paper sets out to fill the gap in the knowledge base by exploiting new and detailed survey data available for both NI and England.

Internationally, many authors have argued that differences in the strength of local labour markets are the key driver of spatial differences in work-limiting disability rates and/or disability benefit claiming rates within countries (Beatty *et al*., 2000; Black *et al*., 2002; Autor and Duggan, 2003; Beatty and Fothergill, 2002; McVicar, 2006; Beatty and Fothergill, 2010). Differences in health are often thought to be of secondary importance (McVicar, 2013). NI suffers from both a comparatively weak labour market (e.g. the employment rate is consistently lower than the other UK regions (ONS, 2017b), as are wages (ONS, 2018)) and comparatively poor health (e.g. life expectancy (and healthy life expectancy) in NI for men and women is substantially lower than is the case in England and Wales (NAO, 2012)). People in NI are also more likely than those in England to report being in poor health, whether physical or mental (Young *et al*., 2010). In NI, the prevalence of mental illness is 25 per cent higher than it is in England (Department of Health, Social Services and Public Safety, 2014). This may, in part, reflect legacy effects from the long-term civil conflict in NI known as the Troubles (O'Connor and O'Neill, 2015; Tomlinson, 2013).

It has been well established that in Great Britain (that is England, Scotland and Wales), slack in the local labour market has led to increased disability rolls (Beatty and Fothergill, 1996; 2002; 2005). The same evidence has yet to be presented for NI, although evidence of hidden unemployment more generally in NI has been presented (Armstrong, 1999). A report by Beatty and Fothergill (2013) on the impact of welfare reform in NI argues that higher disability rates in NI are in part because of poorer health, but as the international literature suggests, are mostly because of the weak local labour market. However, the report does not attempt to quantify either relationship. This paper builds on these existing studies to more fully quantify the determinants of high disability rates, across several measures of disability and disability benefit receipt, in NI.

Specifically, this paper exploits newly available survey data for the 50-64 year-old age cohort to compare NI rates of self-reported disability and disability benefit claiming to those in England. It then analyses the extent to which the raw differences in disability rates reflect differences in a range of underlying health measures, differences in local labour market measures, and other potential explanations. The motivation for focusing on disability rates among 50-64 year-olds is threefold. First, there is a steep age gradient in disability incidence (e.g. Grundy and Sloggett, 2003; Burchardt, 2003), and the difference in disability rates between NI and England is larger for this age group than for younger age groups. Second, this older cohort includes many of those most likely to have legacy health issues relating to exposure to the Troubles. Third, new data have recently become available (the NI Cohort of Longitudinal Ageing (NICOLA)) which, together with its sister survey for England (the England Longitudinal Survey of Ageing (ELSA)), enables a more detailed examination of these issues among this age group than has previously been possible.

This paper finds that the comparatively high rates of activity-limiting disability in NI relative to England can be entirely explained by poorer health and a weaker labour market. A combination of the two explains just over half of the gap in work-limiting disability and out-of-work income-replacement disability benefit recipiency, but only a third of the gap in additional costs disability benefit recipiency. In each case both labour market and observable health factors play a role, but labour market differences are the more important. We go on to discuss possible explanations for the remaining gaps, including differences in willingness to report the receipt of disability benefits, differences in benefit take-up unrelated to health and labour markets, other aspects of relative deprivation, and unmeasured differences in health that may in part relate to a legacy effect of the Troubles.

II EXISTING LITERATURE

There is an extensive international literature on the determinants of disability rates, much of which focuses on the (out of work/income replacement) disability benefit recipiency rate and, in particular, the trend of growing disability benefit rolls.

Within this literature many studies argue that the disability benefit recipiency rate generally has an inverse relationship with the business cycle, i.e. when the economy is growing the disability benefit recipiency rate falls and vice versa, likely reflecting both availability of jobs and the generosity of wages relative to disability benefits (e.g. Rupp and Stapleton, 1995; Duggan and Imberman, 2009; Benítez-Silva *et al*., 2010). There are exceptions to this pattern, however. Burkhauser *et al*. (2001), for example, argue that in the US the employment rate of people with disabilities was procyclical with the business cycle until the 1990s after which the association weakens, with the employment rate of people with disabilities falling

over the duration of the business cycle. Eligibility to receive disability insurance (usually based on work history in the US) has also been found to be an important factor in changes over time in disability rolls, particularly among women given increased female labour force participation (Duggan and Imberman, 2009). Further, on top of cyclical changes, the average replacement rate of disability insurance in the US has been increasing over time because disability insurance payment rates reflect average wage growth which, in a period of rising wage inequality, has tended to exceed wage growth in the bottom half of the US labour market (Duggan and Imberman, 2009; Wiczer, 2015). Autor and Duggan (2003; 2006) argue that less stringent screening of applicants and increased coverage in terms of eligible medical conditions also played a significant role in the increase in disability rolls in the US. More generally, Burkhauser *et al.* (2016) show how disability benefit rolls have been impacted by reforms to disability (and other) benefits, including changes in screening intensity, eligibility and generosity, across several countries. Note that none of these studies suggest that differences in health over time play a major role in driving disability benefit roll growth.

The UK literature – most of which focuses on Great Britain, thus excluding NI – similarly emphasises labour market and benefit characteristic explanations for growing disability benefit rolls. Bell and Smith (2004), for example, argue that the increase in disability rolls over the 1980s and 1990s was driven by a combination of fewer labour market opportunities for low-skilled workers at the same time as increasing generosity of benefits pushing these people out of the labour market. Burkhauser *et al*. (2014) comes to a broadly similar conclusion. McVicar (2013) shows that (changes in) incapacity benefit claiming rates at the local level are strongly correlated with (changes in) local labour market factors. A particularly influential strand of this literature examines how industrial decline in particular areas of England (notably those with concentrations of employment in mining or heavy industry) affected disability rolls in England. A key finding is that the unemployment rate changed much less than would have been anticipated, but the disability rolls increased substantially, following widespread job losses in the 1980s and 1990s in these areas (Beatty and Fothergill, 2002; 2013). In other words, disability benefits play, or have played, an important 'hidden unemployment' role in the UK, and one that is concentrated in particular geographical areas. As for the US, it is notable that none of these studies suggest a primary role for changes in health in driving patterns of disability benefit receipt.

There are few studies in this literature that examine NI, which also experienced significant industrial decline over the same period. In partial contrast to the English hidden unemployment narrative of Beatty and Fothergill, however, the dominant labour market issue in NI throughout the 1970s, 1980s and into the 1990s was the very high level of claimant unemployment, especially amongst the Roman Catholic community, which led to a long-running and ultimately unresolved debate about

the extent to which this reflected labour market discrimination against Catholics (for a description of the political and social landscape of NI and the unemployment differential, see Rowland *et al*., 2018). Having said that, Armstrong (1999) presented evidence of substantial hidden unemployment in NI. More recently, as attention has turned to explaining NI's high levels of economic inactivity, Beatty and Fothergill (2013) argue that the higher levels of disability benefit receipt in NI (which they call an "extreme case") can be mostly explained by NI's comparatively weaker labour market, with some of the remaining difference perhaps driven by high levels of mental ill health in NI as a result of the Troubles. They do not seek to quantify either proposed explanation, however.

III MATERIALS AND METHODS

3.1 NICOLA

This paper exploits cross-sectional unit record data on large and representative samples of 50-64 year-olds in NI and England. The NI data are taken from Wave 1 of the NI Cohort of Longitudinal Ageing (NICOLA) study,[1] collected in 2014/15, which contains detailed information on 8,500 respondents in NI over the age of 50 including information on economic activity, disability, health, financial situation, and a rich set of socio-economic characteristics. NICOLA data were collected by face-to-face interview and a nurse visit to gather additional health data including, but not limited to, blood pressure, grip strength and a blood sample to test for various illnesses and biomarkers. NICOLA was designed to be fully compatible with other ageing studies including ELSA in England, TILDA in Ireland, HRS in US and SHARE in the European Union. For further details on the NICOLA study, see Cruise and Kee (2018). These survey data are complemented by aggregate statistics on benefit receipt drawn from administrative data.

3.2 ELSA

The English Longitudinal Study of Ageing (ELSA) (Blake *et al*., 2018) is a similar longitudinal study for England, which collects detailed unit record data on a representative sample of those over the age of 50. Currently there are eight waves of data for ELSA available spanning the years 2002 to 2017. Here we use Wave 7, collected in 2014/15, because that is the closest available wave to NICOLA Wave 1 (in terms of the time of data collection). The data covered by ELSA, and the method of data collection, are essentially the same as for NICOLA. For further details on the ELSA study, see Banks *et al*. (2014). These survey data are again complemented by aggregate statistics on benefit receipt drawn from administrative data.

[1] Only Wave 1 data are currently available, although Wave 2 is in the field at the time of writing.

3.3 Measures and Measurement

Disability is measured here in several ways, First, self-reported disability is either activity-limiting disability or work-limiting disability. Respondents are first asked if they have a long-term illness or disability. Activity-limiting disability is then those people who answer yes to the follow-up question: "does this illness or disability limit your activities in any way?". Work disability is those people who answer yes to: "do you have any health problem or disability that limits the kind or amount of paid work you could do, should you want to?". Activity-limiting disability is commonly used in the literature and is often included in social surveys (e.g. TILDA in Ireland, HRS in America, SHARE in Europe) and it does not suffer from justification bias to the same extent as work-limiting disability (Oguzoglu, 2012; Kapteyn *et al*., 2007).

We also use two measures of disability benefit receipt; receipt of Disability Living Allowance (DLA)/Personal Independent Payment (PIP) and receipt of Employment and Support Allowance (ESA)/Severe Disablement Allowance (SDA)/Incapacity Benefit (IB). The former are benefits for the additional costs incurred from living with a disability and the latter are out-of-work income replacement disability benefits.

In most respects NI and England have common institutions, including common benefit regimes. There is one relevant exception here, however. The Wave 7 fieldwork for ELSA took place in 2014/15 with the large majority of interviews carried out in the second half of 2014. Therefore, some respondents would have interviewed after the PIP rollout in England which began for new claimants on 8 April 2013 (but didn't begin to affect most existing DLA claimants until October 2015). In contrast, the introduction of PIP was delayed by the NI Assembly and as such NICOLA respondents would not yet have been migrated to the new benefit. Because the introduction of PIP was in part intended to cut the benefit caseload by implementing a tougher screening process, we cannot rule out that this difference in the timing of adoption of PIP may impact on NI's recipiency rate relative to England's as of 2014/15 (we return to this point later in the paper). Note, however, that if we look at the DLA claimant rate in ELSA over time amongst the age group of interest, we see no drop between Waves 6 and 7 (in fact the opposite is the case). In contrast, ESA was introduced in 2008 to replace IB and SDA in both NI and England, which at the time of data collection were largely but not entirely phased out.

In the micro-econometric analysis that follows, the disability benefit measures are as reported in the NICOLA and ELSA surveys. There can, however, be some measurement error in survey reporting of benefit receipt. For example, some people may be less inclined to report receiving disability benefits due to the stigma attached to living from unearned income. One recent study (Bruckmeier *et al*., 2014) found that 10.5 per cent of welfare recipients (in Germany) under-reported what they received. This is in line with findings for the US when looking at reporting by food

stamp recipients (Bollinger and David, 1997). It is also possible that some people are unsure what specific benefit they are on, particularly where they have been migrated from one payment type to another. The pooling of ESA with IB and SDA and DLA with PIP is intended in part to mitigate this.

We also consider a set of potential explanatory variables for spatial differences in disability rates. The first set of potential explanatory variables we examine relate to the strength of the local labour market. Specifically, we use the local weekly earnings and the local claimant count unemployment rate. These are measured at government office region level in England (nine regions) but further disaggregated in NI to local government district (LGD) level.[2] Weekly earnings are taken from the Annual Survey of Hours and Earnings (ONS, 2015) to coincide with the respective surveys. We use the local claimant count rather than the unemployment rate from the Labour Force Survey (LFS) because the sample size in the LFS is insufficient to support reliable LGD-level analysis for NI (see NISRA, 2015). The claimant count measures all those who are in receipt of job-related unemployment benefits as a proportion of the working age (16-64 years) population.

The second set of explanatory variables we consider relate to health. The surveys give the possibility of using a range of health measures from the subjective to the objective, but we specifically use the self-reporting of doctor diagnoses of certain conditions. Given concerns over systematic reporting biases for highly subjective self-reported health measures (e.g. rating your general health on a Likert scale: see Anderson and Burkhauser, 1985), we primarily restrict our attention to health measures which are arguably more objective. Respondents in both surveys are asked whether a doctor has ever diagnosed them with a list of illnesses and conditions ranging from cancer to emotional or psychiatric conditions. These measures, while self-reported, are seen to be more reliable given the specificity of the question (Baker *et al*., 2004). There are, however, some potential disadvantages. Firstly, it is possible that there is under-reporting amongst lower SES groups due to these groups being less likely to seek a formal diagnosis. Given both NI and England have access to the NHS and free healthcare at the point-of-use, however, this is unlikely to be an important limitation here. (We also control for education in our models to account for such SES-related differences between individuals). Second, for a given prevalence, some illnesses may be more likely to be reported than others. For example, a 2009 study found that conditions which have a greater impact on daily life (e.g. those which cause pain) are reported more accurately than others which are more easily tolerated (Machlin *et al*., 2009). Bush *et al*. (1989) also found differences in the degree of agreement between self-report and medical report by condition.

[2] Data access restrictions meant it was not possible to disaggregate beyond government office region level using ELSA.

While fully objective measures from a nurse assessment are available – blood pressure, lung function, C-reactive protein (CRP) levels (a marker for inflammation) and BMI – in NICOLA and in an earlier wave of ELSA (the closest being Wave 6) they reduce the sample size by half and the non-response is strongly non-random. In particular, given that these people have to travel to the hospital to see the nurse for the assessment, those who report as disabled or those who are sick are less likely to partake. There are also other issues with some or all of these measures, including potential errors induced by white coat syndrome (see Cobos *et al*., 2015) and the snapshot nature of nurse visits. Further, the objective health measures are limited in number and all are related to physical ailments, thus excluding mental ill-health.

For descriptive purposes only we also report differences in self-reported general health, measured on a five-point scale, which we simplify to three binary dummies; good (excellent, very good, good), fair and poor health.

Finally, we control for socio-demographic characteristics. We construct age dummies for 50-54, 55-59 and 60-64 years and gender. Marital status is grouped into those who are married or in a partnership, with all other categories grouped together as 'single'. We also control for highest level of education completed.

3.4 Approach to Estimation

The first step in the analysis is to examine disability differentials between NI and England in the raw data alongside observable differences in health, labour market factors and socio-demographic characteristics in the NI and English cohorts. We then present a series of probit regression models using pooled data for NI and England for each measure of disability or disability benefit receipt to quantify how much of the differentials in self-reported disability and disability benefit receipt can be explained (or more precisely, predicted) by differences in these health, labour market and other factors. The regression models progress from a simple model with only a NI dummy on the right-hand side (capturing the raw disability differential between NI and England), to models controlling for socio-demographic characteristics of the two samples, to models additionally controlling for labour market factors or health measures, then finally to models controlling for all these factors. Our interest is both in the estimated effects of the various socio-demographic, labour market and health factors, and in the remaining estimated effect of the NI dummy (the conditional disability differential) in each case. Estimates are presented as average marginal effects, interpretable as the percentage point change in the probability of being disabled/reporting disability benefit receipt from a one unit change in the relevant explanatory variable.

For each outcome, the regression model takes the following form:

$$\Pr(y_j = 1|x_j = \Phi(X_j'\beta + \lambda NI_j) \quad (1)$$

where y_i is the outcome in question for individual j, NI_j is the NI dummy (equal to one for those in the NI cohort and 0 for those in the England cohort), X_j contains

the various combinations of socio-demographic, labour market and health controls, and λ and β are parameters to be estimated.[3]

IV RESULTS

4.1 The Disability Gap between NI and England among 50-64s.

Table 1 reports sample means and proportions for the outcome variables, health, labour market and socio-economic and demographic characteristics for the two samples, alongside benefit recipiency rates from administrative data. We have applied the weights provided within the studies to the survey data. The reported work-limiting disability rate among all 50-64s in NI (at 28 per cent) is nearly 50 per cent higher than that in England (19 per cent), with the gap largest among men but also present among women. There is a slightly smaller differential in reported rates of activity-limiting disability (32 per cent versus 25 per cent), which is again larger among men than among women.[4]

Table 1: Descriptive Statistics, NI and England, 50-64 year-olds

	NI			*England*			*Test of difference*
	Male	*Female*	*All*	*Male*	*Female*	*All*	
Disability measures							
Work limiting disability	29	27	28	16	23	19	*
Activity-limiting disability	32	32	32	21	28	25	*
ESA/IB/SDA rate	16	13	14	5	6	5	*
ESA/IB/SDA rate (admin figures)	19	16	17	10	8	9	
DLA/PIP figures	17	17	17	5	7	6	*
DLA/PIP rate (admin figures)	17	20	18	8	9	8	
Health							
Self-reported health							
Good health or better	65	71	68	81	77	79	*
Fair health	21	18	19	13	15	14	*
Poor health	14	12	13	6	8	7	*
Doctor diagnoses of….							
Heart conditions	15	12	13	12	9	11	*
Lung conditions	13	15	14	13	14	13	

[3] We also adopted a decomposition approach following Fairlie (2005) and found our overall results to be robust.

[4] Gender differences are not formally modelled as Northern Ireland is our area of interest and the gaps in disability rates are relatively small. For example, 32 per cent of both genders in our sample report as having an activity-limiting disability (Table 1).

Table 1: Descriptive Statistics, NI and England, 50-64 year-olds (Contd.)

	NI			*England*			*Test of difference*
	Male	*Female*	*All*	*Male*	*Female*	*All*	
Musculoskeletal conditions	20	32	26	19	32	26	*
Other chronic conditions	5	6	6	3	5	4	
Mental ill-health	16	24	20	9	12	11	*
Socio-economic & demographic factors							
Age							
50-54	34	35	34	38	38	38	*
55-59	37	36	37	33	32	32	*
60-64	29	28	29	29	30	30	*
Marital status							
Single/separated/divorced/ widowed	32	34	32	30	34	32	*
Married/partnership	68	66	68	70	66	68	*
Highest level of education completed							
Up to and including primary	14	12	14	19	18	19	*
Secondary	66	66	66	43	49	46	*
Third-level/higher	20	22	20	38	33	35	*
Labour market factors							
Median pay (£ weekly)	376	376	376	431	429	430	*
Claimant Count Unemployed	3.6	3.6	3.6	1.8	1.8	1.8	
N	1,771	2,291	4,062	1,307	1,654	2,961	

Source: Authors' analysis based on NICOLA data for NI and ELSA data for England.
Notes: Proportions displayed (in %) except median pay. Doctor diagnoses are self-reports of various illnesses which have been combined by illness type. Weights have been applied which are provided within the datasets. Test of difference is a two-sample t-test using groups and is undertaken using the full sample. * denotes statistically significant differences at 5 per cent.

There are even larger differentials in disability benefit receipt among 50-64s, with the ESA/IB/SDA and DLA/PIP recipiency rates reported in NICOLA more than twice those reported in ELSA (ratios of close to 3 in each case). Using administrative data,[5] the actual NI/England ratios are smaller at 1.7 (ESA/IB/SDA) and 2.1 (DLA/PIP). Particularly in England, we see that the survey-based estimates

[5] Administrative data on benefit receipt is taken from the Department for Work and Pensions (2013) for England and the Department for Communities (2015) in NI.

of disability benefit receipt are in most cases *smaller* than the administrative data, particularly for income replacement disability benefits; administrative data show that 9 per cent of the 50-64 population are in receipt of ESA/IB/SDA whereas the survey-based estimate is 5 per cent. The number of people in ELSA reporting being in receipt of income-replacement disability benefits is about half what we would expect it to be. This is consistent with evidence presented elsewhere of under-reporting of transfers in household surveys due to stigma (Meyer *et al*., 2009). In NI, however, the administrative recipiency rate of disability benefits aligns much closer with what we find in NICOLA; 14 per cent of respondents report being in receipt of ESA/IB/SDA while administrative figures show that 17 per cent of those 50-64 in NI are in receipt of these benefits.

Now we consider the health of the samples. Again, a higher proportion of those in the relevant cohort in NI report poor/fair health (13 per cent + 19 per cent) compared to their counterparts in England (7 per cent + 14 per cent) with a ratio of 1.5:1. In particular, the ratio of poor health in NI (13 per cent) compared to England (7 per cent) is 1.9:1. Like the disability measures discussed above the gap is slightly larger for men than for women. Over one-quarter (26 per cent) of respondents in both NI and England report suffering from a diagnosed musculoskeletal condition, in line with figures published by Arthritis UK (Arthritis Research UK, 2018). Diagnoses of heart conditions and lung conditions are also similar in the two countries with differentials of only 1.2:1 and 1.1:1. The prevalence of other chronic conditions is 6 per cent in NI compared to 4 per cent in England. The biggest differential in doctor diagnoses, however, is for mental ill-health (20 per cent versus 11 per cent), a differential of 1.8:1. This is larger than the overall (i.e. not age-specific) gap suggested by the Department of Health, Social Services and Public Safety, which suggested that NI had a 25 per cent higher prevalence of mental ill-health than England (DHSSPS, 2014). Overall, in line with published UK health statistics, the picture is of worse health for this cohort in NI than the equivalent cohort in England.

Turning to the labour market variables, the median wage is significantly lower in NI than in England, with median gross weekly earnings of £376 in NI compared to £430 in England. Because benefit payment levels are the same across the UK this implies non-trivial differences in replacement rates between NI and England. Furthermore, the claimant count in NI was also higher than for England. Taken together these measures suggest there may be a less favourable labour market context in NI than in England. However, it must be noted that lower pay in NI occurs simultaneously with a lower cost of living.

There are other differences between the NI and English cohorts. The 55-59 years age group is proportionately larger in the NI population. The English respondents are more likely to report their highest education level as primary or no schooling or as third-level compared to those in NI.

The proportion of non-nationals would also have been a useful control variable to reflect any potential "healthy migrant effect". However, this information is not available in the datasets we accessed from NICOLA and ELSA.

Table 2 shows how disability in NI compares to disability in English regions. Note that NI has the highest levels of disability on all four measures, with the discrepancy between NI disability benefit rates and rates in regions of southern England particularly stark.

Table 2: Sample Proportions Disabled, NI and English Regions, 50-64 year-olds, %

Region	*Work-limiting*	*Activity-limiting*	ESA/SDA/IB	DLA/PIP
Northern Ireland	28	32	14	17
East Midlands	27	31	6	10
North East	26	32	5	10
North West	23	30	8	8
West Midlands	22	28	6	9
East	21	23	4	4
Yorkshire	20	24	5	8
London	19	24	5	8
South West	19	25	2	3
South East	17	21	3	4
England (All)	19	25	5	6

Source: Authors' analysis based on NICOLA data for NI and ELSA data for England.

4.2 Explaining the Gap

4.2.1 Self-reported disability

Table 3 presents the results of a probit regression for activity-limiting disability. The average marginal effect of 0.057 for the dichotomous NI indicator in column 1 is in line with the 7 percentage point gap we see in the raw data presented in Table 1. The local labour market measures and health variables fully explain the higher rates of self-reported activity-limiting disability in NI: by column 5 the NI indicator variable is no longer statistically significant. The signs of the marginal effects on each of the medical conditions, labour market factors and socio-demographic controls are as we would expect (column 5). Men and individuals who are single are more likely to report as activity-limited disabled (0.028 and 0.071 marginal effects respectively). Education reduces the probability of having an activity-limiting disability; those with a higher education are 14 percentage points less likely to have an activity-limiting disability compared to those with a primary level education. In terms of health conditions, mental ill health, for example, is an important predictor of this disability measure.

In terms of the labour market factors, median pay has a positive relationship with our variable of interest while unemployment has a negative but statistically insignificant relationship with reporting as having an activity-limiting disability.

Table 3: Probit Model of Activity-Limiting Disability, Average Marginal Effects (Clustered Standard Errors)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
NI	0.057***	0.048***	0.027**	0.010	0.001
	(0.020)	(0.016)	(0.012)	(0.017)	(0.013)
Male		–0.013	0.028**	–0.013	0.028**
		(0.012)	(0.011)	(0.013)	(0.011)
55-59 years		0.036***	–0.004	0.036***	–0.004
		(0.014)	(0.012)	(0.014)	(0.012)
60-64 years		0.051***	–0.018*	0.051***	–0.018
		(0.014)	(0.011)	(0.014)	(0.011)
Secondary education		–0.083***	–0.062***	–0.082***	–0.062***
		(0.012)	(0.012)	(0.012)	(0.012)
Higher education		–0.201***	–0.136***	–0.199***	–0.135***
		(0.018)	(0.016)	(0.018)	(0.016)
Single		0.125***	0.073***	0.122***	0.071***
		(0.008)	(0.009)	(0.008)	(0.010)
Angina			0.218***		0.217***
			(0.035)		(0.035)
Heart attack			0.179***		0.178***
			(0.030)		(0.030)
Heart murmur			0.038*		0.038*
			(0.019)		(0.019)
Heart failure			0.348***		0.352***
			(0.096)		(0.096)
Heart rhythm			0.073***		0.073***
			(0.020)		(0.020)
Asthma			–0.060*		–0.058*
			(0.032)		(0.031)
Lung disease			0.196***		0.194***
			(0.028)		(0.029)
Cancer			0.112***		0.113***
			(0.026)		(0.026)
Parkinson's			0.509***		0.506***
			(0.122)		(0.124)
Dementia			0.513**		0.511**
			(0.208)		(0.208)

Table 3: Probit Model of Activity-Limiting Disability, Average Marginal Effects (Clustered Standard Errors) (Contd.)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Arthritis			0.245***		0.245***
			(0.007)		(0.006)
Osteoporosis			0.188***		0.187***
			(0.018)		(0.018)
Mental ill-health			0.166***		0.165***
			(0.015)		(0.015)
Claimant count unemp. rate				0.019**	0.014***
				(0.008)	(0.005)
Median pay (£ weekly)				–0.006	–0.001
				(0.015)	(0.010)
Pseudo R^2	0.003	0.043	0.221	0.045	0.222
N	7,946	7,946	7,946	7,946	7,946

Source: Authors' analysis based on NICOLA data for NI and ELSA data for England.
Notes: Standard errors (clustered by LGD/region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4 repeats this exercise for work-limiting disability. The average marginal effect of 0.086 in column 1 reflects the 9 percentage point gap in work-limiting disability in the raw data. When we control for gender, age, education, and marital status (column 2) the estimated marginal effect for NI slightly decreases (to 0.075) reflecting compositional differences in the relevant populations. Note the marginal effects on these characteristic variables are consistent with our priors e.g. work disability increases with age and decreases with education.

When we then control for health by including the list of individual conditions (column 3) or the labour market (column 4) the estimated marginal effect for the NI variable falls from 0.075 to 0.053 or 0.050 respectively. The finding that adding the health variables increases the explanatory power of the regression by far more than adding the labour market variables, yet affects the conditional disability differential to the same extent, reflects stronger correlation between the NI dummy and the labour market variables than between the NI dummy and the health variables. Including both health and local labour market measures – our preferred specification – leaves an unexplained gap of only 3.8 percentage points between NI and England (column 5). In column 5 we see that a doctor diagnosis of mental illness increases the probability of reporting work-limiting disability by 17 percentage points. The other conditions which have a large effect are not surprising, e.g., Parkinson's disease increases the likelihood of being work disabled by 56 percentage points, and dementia and heart failure also have large effects.

Having a doctor diagnosis of arthritis increases the probability of being work-limiting disabled by 19 percentage points. Labour market factors impact in the way which would have been expected.

Table 4: Probit Model of Work-Limiting Disability, Average Marginal Effects (Clustered Standard Errors)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
NI	0.086***	0.075***	0.053***	0.050***	0.038***
	(0.020)	(0.014)	(0.010)	(0.016)	(0.012)
Male		–0.007	0.026**	–0.006	0.026**
		(0.011)	(0.011)	(0.011)	(0.011)
55-59 years		0.034***	–0.000	0.033***	–0.001
		(0.009)	(0.008)	(0.009)	(0.008)
60-64 years		0.054***	–0.002	0.053***	–0.002
		(0.016)	(0.013)	(0.016)	(0.013)
Secondary education		–0.087***	–0.070***	–0.087***	–0.069***
		(0.014)	(0.012)	(0.014)	(0.012)
Higher education		–0.226***	–0.170***	–0.224***	–0.169***
		(0.018)	(0.016)	(0.019)	(0.016)
Single		0.125***	0.076***	0.123***	0.074***
		(0.011)	(0.010)	(0.010)	(0.010)
Angina			0.191***		0.190***
			(0.023)		(0.022)
Heart attack			0.176***		0.175***
			(0.017)		(0.017)
Heart murmur			0.022		0.022
			(0.020)		(0.020)
Heart failure			0.318***		0.321***
			(0.071)		(0.071)
Heart rhythm			0.075***		0.075***
			(0.018)		(0.018)
Asthma			–0.073***		–0.072***
			(0.026)		(0.025)
Lung disease			0.177***		0.176***
			(0.022)		(0.022)
Cancer			0.112***		0.113***
			(0.023)		(0.024)
Parkinson's			0.563***		0.563***
			(0.110)		(0.109)
Dementia			0.300**		0.299**
			(0.139)		(0.140)
Arthritis			0.190***		0.189***
			(0.006)		(0.006)
Osteoporosis			0.143***		0.142***
			(0.023)		(0.024)

Table 4: Probit Model of Work-Limiting Disability, Average Marginal Effects (Clustered Standard Errors) (Contd.)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Mental ill-health			0.173***		0.173***
			(0.014)		(0.014)
Claimant count unemp. rate				0.012	0.008
				(0.009)	(0.006)
Median pay (£ weekly)				–0.006	–0.002
				(0.018)	(0.012)
Pseudo R2	0.009	0.065	0.233	0.066	0.234
N	7,946	7,946	7,946	7,946	7,946

Source: Authors' analysis based on NICOLA data for NI and ELSA data for England.
Notes: Standard errors (clustered by LGD/region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

4.2.2 Disability Benefit Receipt

Table 5 reports the marginal effects from probit models for ESA/IB/SDA receipt. We see in column 1 that individuals in NI are 9.7 percentage points more likely to report receiving these disability benefits than those in England. When we control for gender, age, education, and marital status this falls slightly (to 8.4 percentage points). Including doctor diagnoses of chronic health conditions (column 3) or labour market factors (column 4) leads to a further fall to 7.1 percentage points and 5.7 percentage points respectively. Again the labour market appears to be a more important driver of the disability gap than health (and the unemployment rate is

Table 5: Probit Model of Out-of-Work Disability Benefits (ESA/IB/SDA), Average Marginal Effects (Clustered Standard Errors)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
NI	0.097***	0.084***	0.071***	0.057***	0.047***
	(0.017)	(0.012)	(0.011)	(0.011)	(0.011)
Male		0.016***	0.030***	0.017***	0.030***
		(0.004)	(0.004)	(0.004)	(0.005)
55-59 years		0.015**	0.004	0.015*	0.004
		(0.008)	(0.007)	(0.008)	(0.007)
60-64 years		–0.004	–0.021**	–0.004	–0.021**
		(0.011)	(0.010)	(0.010)	(0.009)
Secondary education		–0.026***	–0.019**	–0.026***	–0.019**
		(0.009)	(0.009)	(0.009)	(0.009)

Table 5: Probit Model of Out-of-Work Disability Benefits (ESA/IB/SDA), Average Marginal Effects (Clustered Standard Errors) (Contd.)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Higher education		–0.120***	–0.097***	–0.119***	–0.096***
		(0.013)	(0.012)	(0.012)	(0.012)
Single		0.105***	0.081***	0.102***	0.079***
		(0.009)	(0.009)	(0.008)	(0.008)
Angina			0.064***		0.062***
			(0.013)		(0.012)
Heart attack			0.043**		0.041**
			(0.017)		(0.017)
Heart murmur			0.014		0.014
			(0.014)		(0.015)
Heart failure			0.061**		0.060**
			(0.027)		(0.026)
Heart rhythm			0.001		0.002
			(0.008)		(0.008)
Asthma			–0.015		–0.014
			(0.017)		(0.017)
Lung disease			0.059***		0.058***
			(0.017)		(0.017)
Cancer			0.039**		0.039**
			(0.017)		(0.017)
Parkinson's			0.155**		0.153**
			(0.064)		(0.067)
Dementia			0.105**		0.106**
			(0.050)		(0.050)
Arthritis			0.062***		0.062***
			(0.006)		(0.006)
Osteoporosis			0.041***		0.040***
			(0.014)		(0.014)
Mental ill-health			0.088***		0.087***
			(0.006)		(0.007)
Claimant count unemp. rate				0.015***	0.012***
				(0.003)	(0.002)
Median pay (£ weekly)				0.001	–0.001
				(0.011)	(0.010)
Pseudo R^2	0.041	0.132	0.229	0.137	0.234
N	7,946	7,946	7,946	7,946	7,946

Source: Authors' analysis based on NICOLA data for NI and ELSA data for England.
Notes: Standard errors (clustered by LGD/region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

statistically significant), although both play a role. Including both labour market and health conditions leaves an unexplained differential of 4.7 percentage points, part of which may be due to the under-reporting of receipt of these benefits in England as seen in Table 1. As before, individual health conditions and other variables take the expected signs, with mental ill health similarly an important predictor of disability benefit receipt.

Differences in DLA/PIP receipt are less well-explained by these factors (see Table 6). We start with a raw differential between the two constituent countries of 11.2 percentage points. This decreases slightly (to 10.4) when we include gender, age, education and marital status (column 2). Introducing health (column 3) or labour market (column 4) variables leads to a fall to 9.1 or 8.5 percentage points respectively, again suggesting labour market factors explain slightly more of the gap than observable health factors. Our preferred model, with both labour market and health factors on the right-hand side (column 5), leaves an unexplained gap of 7.7 percentage points. In other words, differences in the strength of the labour market and in health explain only a small part of the variation in DLA/PIP receipt between NI and England. As before, right-hand-side variables generally take the expected signs.

Table 6: Probit Model of DLA/PIP, Average Marginal Effects (Clustered Standard Errors)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
NI	0.112***	0.104***	0.091***	0.085***	0.077***
	(0.022)	(0.019)	(0.017)	(0.018)	(0.016)
Male		–0.002	0.016***	–0.001	0.017***
		(0.005)	(0.005)	(0.005)	(0.005)
55-59 years		0.028***	0.014	0.028***	0.013
		(0.010)	(0.010)	(0.010)	(0.010)
60-64 years		0.033**	0.010	0.033**	0.010
		(0.013)	(0.011)	(0.013)	(0.011)
Secondary education		–0.037***	–0.027***	–0.038***	–0.028***
		(0.010)	(0.010)	(0.010)	(0.010)
Higher education		–0.132***	–0.103***	–0.134***	–0.105***
		(0.015)	(0.015)	(0.014)	(0.014)
Single		0.072***	0.044***	0.068***	0.040***
		(0.009)	(0.008)	(0.008)	(0.007)
Angina			0.071***		0.070***
			(0.019)		(0.018)
Heart attack			0.033		0.032
			(0.025)		(0.025)
Heart murmur			0.001		–0.000
			(0.015)		(0.015)

Table 6: Probit Model of DLA/PIP, Average Marginal Effects (Clustered Standard Errors) (Contd.)

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Heart failure			0.099***		0.099***
			(0.029)		(0.029)
Heart rhythm			0.034***		0.035***
			(0.011)		(0.011)
Asthma			–0.033		–0.032
			(0.024)		(0.023)
Lung disease			0.098***		0.097***
			(0.018)		(0.018)
Cancer			0.057**		0.058**
			(0.023)		(0.023)
Parkinson's			0.232***		0.232***
			(0.058)		(0.062)
Dementia			0.174***		0.173***
			(0.059)		(0.059)
Arthritis			0.079***		0.079***
			(0.007)		(0.007)
Osteoporosis			0.070***		0.069***
			(0.014)		(0.014)
Mental ill-health			0.089***		0.088***
			(0.009)		(0.008)
Claimant count				0.019*	0.016*
				(0.011)	(0.010)
Median weekly pay				0.033*	0.032*
				(0.019)	(0.017)
Pseudo R^2	0.041	0.091	0.196	0.097	0.201
N	7,946	7,946	7,946	7,946	7,946

Source: Authors' analysis based on NICOLA data for NI and ELSA data for England.
Notes: Standard errors (clustered by LGD/region) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

From our econometric analysis, we conclude that demographic, health and labour market factors fully explain the higher rates of NI self-reported activity-limiting disability. For the other three measures, but particularly DLA/PIP, we can explain some of the difference between the countries using these variables but the higher level of disability in Northern Ireland is not completely explained. We discuss why these differences persist for these disability measures in the next section.

V DISCUSSION

5.1 Comparing Measures of Disability and Under-Reporting

We report unexplained disability differentials of varying sizes between NI and England depending on our choice of disability measure. Typically, existing studies look at only one disability or benefit receipt measure. Clearly, this may not give the full picture for questions about disability differentials more generally. Note that there is surprisingly little correlation between (at least some of) the four disability measures in our samples (see Table 7), and estimated associations between the different measures and the right-hand-side variables in our models vary non-trivially. That correlations between self-reported and benefit receipt disability measures in England are lower than those in NI is consistent with both a greater degree of under-reporting of benefit receipt in ELSA compared to NICOLA, or a lower rate of benefit take-up in the ELSA sample compared to the NICOLA sample for reasons unrelated to our observed health, labour market and socio-demographic variables.[6]

Table 7: Correlation Matrices of Disability Outcomes Within Country

	England			*NI*		
	Work limiting	*Activity-limiting*	*ESA/SDA/IB*	*Work limiting*	*Activity-limiting*	*ESA/SDA/IB*
Work-limiting	–	–	–	–	–	–
Activity-limiting	0.681	–	–	0.734	–	–
ESA/SDA/IB	0.371	0.298	–	0.469	0.408	–
DLA/PIP	0.356	0.307	0.384	0.519	0.477	0.479

Source: Authors' analysis based on NICOLA data for NI and ELSA data for England.

5.2 Disability Living Allowance

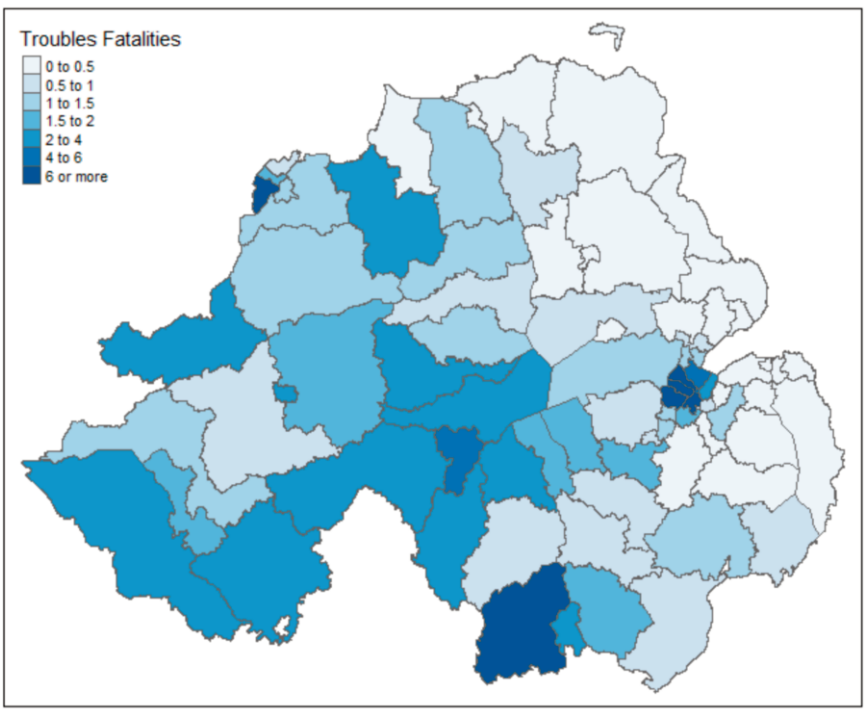
The DLA/PIP measure of disability shows the greatest differential between NI and England even after we control for what the literature suggests are the main drivers. In this subsection, we examine possible explanations for this remaining difference.

Over the 30 years of the NI 'Troubles', nearly 3,700 people were killed (Morrissey *et al*., 1999) and over 50,000 injured. War can have long-run effects on disability with, for example, enduring psychological conditions, lower cognitive ability and higher rates of heart disease (French, 2019). The higher rates of DLA/PIP in NI we observe may therefore be due in part to the legacy effect of this conflict,

[6] Dunn and Zwicker (2018), for example, find that 40 per cent of those eligible for Disability Tax Credit in Canada (a benefit like DLA/PIP) are not claiming the benefit for various reasons. Within NI it has been found previously that disability benefit uptake is higher in urban areas and in areas that were predominantly Catholic (O'Reilly and Stevenson, 2004). These are also the areas in which we find individuals are more likely to be in receipt of DLA/PIP.

as suggested by Beatty and Fothergill (2013). We examine this hypothesis by averaging the residuals from the probit model of DLA/PIP in column 5 of Table 6 for District Electoral Areas (DEAs) within NI (i.e. that part of the DEA-level variation in DLA/PIP in NI receipt that is not explained by our model), and comparing these to the number of Troubles-related fatalities 1969-1998 per 1,000 population in each DEA. These variables are both mapped in Figures 1 and 2. We would anticipate that areas with higher Troubles-related deaths would have higher residuals. However, this ignores the possibility of people moving between areas in the intervening period and it may be that people moved out of those areas which were impacted most by the conflict. Although Northern Ireland experienced large, forced population movements especially during the early years of the Troubles (O'Connor and Sheehy, 1997), it would appear that most population movement was more local as areas became increasingly residentially segregated (Deloitte 2007; Shuttleworth and Lloyd 2009).

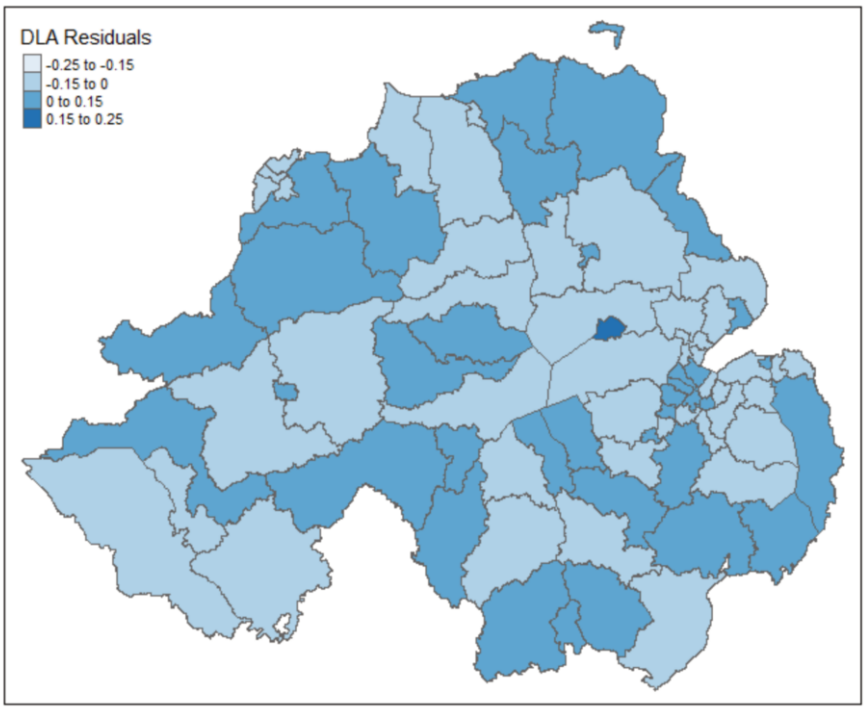
Figure 1: Troubles-related fatalities 1969-1998 by DEA (per 1,000 of population)



Source: Generated by the author using Sutton Index of Deaths.[7]

[7] For more on the Sutton Index of Conflict Related Deaths, see https://cain.ulster.ac.uk/sutton/.

Figure 2: Residuals from the Probit Model of DLA/PIP (Column 5 of Table 6)



Source: Generated using results from probit regressions in Tables 6, Column 5.

Table 8: Correlation coefficients of NI residuals from probit model of DLA/PIP with NI deprivation ranks and Troubles fatalities by DEA

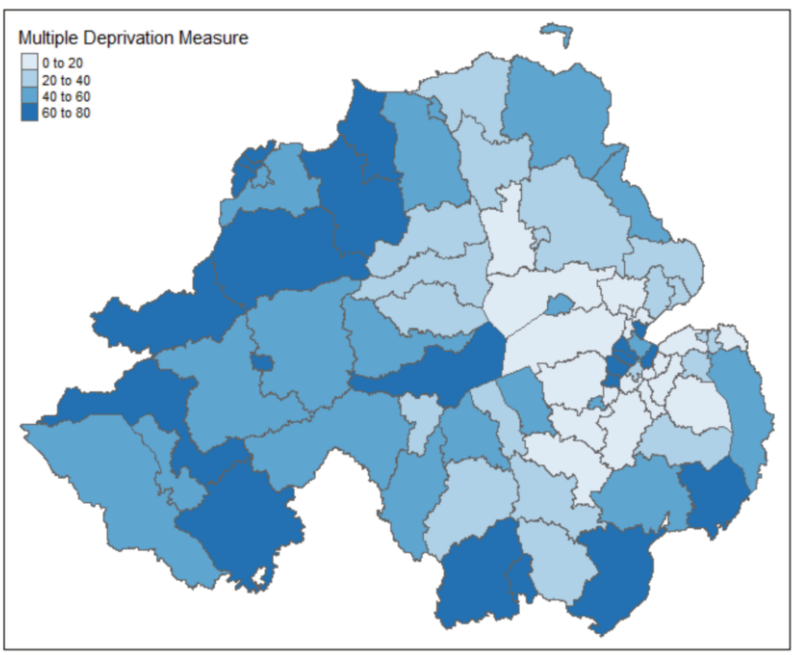
	Residuals
Troubles Fatalities	0.330***
Multiple Deprivation	–0.459***
– Health	–0.437***
– Income	–0.321***
– Employment	–0.422***
– Education	–0.439***
– Living	–0.341***
– Crime	–0.315***
– Services	–0.021

Source: Authors' analysis using NICOLA data and NIMDM 2017.
Notes: Residuals from probit model of DLA/PIP (column 5 Table 6). Deprivation calculated from ranks at Super Output Area averaged by population weights up to DEA-level. Troubles fatalities is the number of Troubles-related fatalities 1969-1998 per 1,000 population in each DEA. *** p<0.01, **<0.05, * p<0.1.

These maps show evidence of higher Troubles fatalities and higher residuals from the probit model of DLA/PIP around Belfast city, along the border with the Republic of Ireland, and to the East of the region. This relationship can also be seen in Table 8 where the correlation coefficient between the DLA/PIP residuals and Troubles fatalities at DEA-level, a statistically significant 0.33, is presented. Residents of NI areas historically exposed to conflict have higher rates of DLA/PIP receipt after controlling for differences in demographics, health, and labour market conditions.

There are also aspects of deprivation we have not controlled for in the probit models of disability, given unavailability of comparable data across both countries. If we accept that NI is more deprived than England (see Abel *et al*., 2016), then the unexplained difference in DLA/PIP receipt may also be in part due to higher levels of deprivation. We repeat the exercise above where we measure deprivation using the NI multiple deprivation ranks at a more disaggregated geographical level (Super Output Areas) averaged by population weights up to DEA-level.[8] The map in Figure 3 shows deprivation across NI by DEA.

Figure 3: NI Multiple Deprivation Measure Ranking by DEA



Source: Generated using the Northern Ireland Multiple Deprivation Measure 2017.

[8] The Northern Ireland Multiple Deprivation Measure is a spatial measure of the distribution of deprivation within NI and provides the relative ranks of areas in terms of seven different types of deprivation alongside a composite deprivation measure. The deprivation measure ranks the most deprived area as 1 and those with higher rankings are less deprived.

Again, there is suggestive evidence from the maps of a correlation between the DLA/PIP residuals and deprivation. Areas around Belfast city and then in the West of the region have both higher rates of benefit receipt and are more deprived. In Table 8, we find there is a high and statistically significant correlation coefficient of -0.459 between multiple deprivation and the DLA/PIP residual. We can also look at individual deprivation domains at the DEA-level rather than the composite multiple deprivation measure; in all but one case (services) there is an economically and statistically significant correlation between the deprivation domain and the DLA/PIP residual.

VI CONCLUSION

This paper set out to understand the high rates of disability in NI compared to England. Our findings suggest that the drivers of disability rates depend on which measure is used. Activity-limiting disability is the sole measure for which we can fully explain the difference between countries, and we find that the local labour market, in particular the higher claimant count rate, is the main driver behind the higher rates in NI. This is broadly in line with the existing literature, albeit for a disability measure less commonly examined. Work-limiting disability is associated roughly equally with poorer health and a weaker labour market, although the higher NI rates cannot be completely explained by observable measures of health and labour market differences. For income-replacement disability benefits (ESA/SDA/IB), the strength of the labour market is also an important determinant, with health differences playing a secondary role, again in line with the wider international literature. There is also evidence of under-reporting being more predominant in England than in NI. But, as for work-limiting disability, the gap between NI and England cannot be entirely explained by these factors. The gap in DLA/PIP receipt, although significantly associated with observable health and labour market factors, is largely unexplained by these factors. We offer a number of explanations such as higher levels of deprivation in NI, the legacy of conflict, and differences in benefit uptake, although we are not able to quantify the roles of these factors.

Reducing the high levels of economic inactivity in NI is a priority for the NI government and our findings suggest that high levels of work-limiting disability are clearly connected to both the comparative weakness of the local labour market in NI and poorer health among the 50-64 year-old cohort. The particularly high DLA/PIP recipiency rate in NI is also associated with poorer health and the weaker labour market, but in this case much of the gap remains unexplained. In further work we will explore in more detail the degree to which historical conflict is leading to currently high rates of DLA receipt in parts of NI.

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