Author: Dr Michael Marshall

Institutional/organisational affiliation: University of Sheffield

Job title: Research Associate

Email address: michael.marshall@sheffield.ac.uk

Paper title: The spatial distribution of non-decent homes: Introducing the Non-Decent Index

Word count: 6,591

Abstract

Long-term underinvestment in England's housing stock has resulted in systematic issues with housing quality and standards across tenures. Government has responded through several legislative and programmatic agendas, including reforming regulatory standards in the social sector, stating an ambition to extend the Decent Homes Standard (DHS) to the private rented sector, and an assortment of low-lost loans and grants for owner-occupiers. In this paper I argue that there is a lack of knowledge on the spatial distribution of housing quality issues, especially at lower spatial scales. This gap inhibits the development of programmes and initiatives to improve housing standards at the area level. Consequently, I construct and open-source index – the Non-Decent Index (NDI) – which aims to identify lower-super-output-areas with a relatively high concentration of properties that fail the DHS. The NDI can be used as a strategic tool to target resources, information and enforcement activity to support area-based programmes of housing improvement in the private sector. Furthermore, using a logit regression model and English Housing Survey data, I show that private rented and owner-occupier households have a higher probability of non-decency relative to social housing, even after controlling for structural property characteristics, which underlines the need for intervention.

1. Introduction

The then Labour government introduced the Decent Homes Standard (DHS) in the 2000s to establish a minimum standard of condition for social housing. The DHS outlined four criteria that defined decency. Decent homes must:

- meet the statutory minimum standard for housing, as defined by the Housing Health and Safety Rating System (HHSRS);
- be in a reasonable state of repair;
- have reasonably modern facilities and services; and
- provide a reasonable degree of comfort.

Currently the DHS provides a statutory minimum standard for social housing dwellings only. Yet it has become a de facto indicator of housing condition and quality, and is reported as a national statistic across tenures in the English Housing Survey (EHS). The current Labour government is committed to extending some version of the DHS to the PRS via the Renters' Rights Bill, reflecting the higher rates of non-decency within this tenure (Marshall et al., 2022). And the previous Conservative administration initiated a consultation to update the DHS from the 2006 version that currently exists but is widely acknowledged as being out of step with modern expectations (MHCLG, 2020: 54).

However, previous reviews of the effectiveness of the DHS highlight an often-overlooked lesson if ambitions to improve the quality of the nation's housing stock are to be realised – the DHS was ultimately in service to a *Decent Homes programme* that aimed to bring all social housing, and 70% of vulnerable households living in the private rented sector (PRS), "into decent condition" by 2010 (Marshall et al., 2022). The programme did not meet its ultimate target, but it did produce a substantial improvement in the general condition of social housing (CLGC, 2010). Key elements of the programme included long-term investment from central government and stock transfer, area-based programmes of stock renewal and estate regeneration, collaboration across social landlords and local authorities to share best practice and secure procurement efficiencies, and efforts to use the programme as a platform for local employment and economic growth (Marshall et al., 2022).

By contrast, securing compliance with minimum standards of energy efficiency and health and safety in the private sector has proven more difficult. Common explanations for lower levels of decency in the PRS include the disparate nature of the tenure, a relatively low level of awareness of landlord obligations compared to the social sector, and local authority funding constraints (Harris and Marsh, 2022; Cowan et al., 2024). Lower levels of non-decency in the owner-occupation sector are in large part due to housing quality being the responsibility of the owner, compounded by the mixed-record of government initiatives to promote and distribute low-cost financing for home improvement among owner-occupiers (Wilson, 2017). But one of the key lessons from these contrasting experiences across tenures and time periods is the importance of effective implementation of policy. Compliance with the DHS and improving housing standards is largely contingent upon the successful translation of legislative change into action.

The importance of translating legislation into action draws attention to a further general challenge – a lack of data on the location of non-decent homes. In a context where national and local government funding is constrained, efforts to secure compliance can be supported by effective coordination and targeting of actors, resources, and information. Yet there is a surprising lack of data on the spatial distribution of non-decency, especially in private sector housing (Marshall et al., 2022: 34-35). In this paper I seek to address this gap by identifying relatively small areas – lower-super-output-areas (LSOAs) – where the incidence of non-decency is expected to be high. Furthermore, I

construct an open-source tool – the Non-Decent Index – which can be used to target resources when securing DHS compliance and improving housing standards in the private sector.

The paper proceeds as follows. Firstly, I review the literature on home improvement and regulatory practice relating to housing standards in England. In doing so, I argue data on the spatial distribution of non-decency is a potential enabler for delivering effective programmes to improve housing standards in the private sector. Secondly, I outline a multi-stage methodology for constructing and validating the Non-Decent Index. Finally, I conclude by discussing the implications of the research and outlining recommendations.

2. Literature review: Improving and regulating housing standards

The English housing system has historically been categorised as a *dualist* system under Kemeny's (1995) seminal framework. Dualist systems are defined as housing systems with a binary between a profit-seeking PRS and a tightly controlled social renting sector, with the border between these rental sectors strictly policed in terms of funding and regulation (ibid.). Questions have been raised as to the accuracy of this classification – Stephens (2020: 540) argues that the English system was not defined by a social renting vs. market renting dynamic, rather the primary division was between social renting and homeownership. Furthermore, the ability of Kemeny's framework to describe the contemporary housing system is open to debate given it is now quite dated (Marshall et al., 2023). Arguably, the contemporary English housing system features greater fluidity, including reliance upon a mix of private and public funding to deliver housing across tenures, and the reemergence of the PRS as a tenure housing significant amounts of lower-income households (Blessing, 2016; Gibb, 2024).

Yet one area in which there continues to be divergence between rental tenures is on regulating housing standards. The regulatory regimes of both rental tenures have been subject to multiple rounds of reform across the 21st Century, but they remain contrasting in terms of obligations regarding housing condition and landlord service, and in the approach to securing compliance (Marshall et al., 2023; Marsh et al., 2023).

Regulation in the social sector has developed in a non-linear fashion, fluctuating between high and low levels of focus on housing standards. In the 2000s, the Decent Homes programme resulted in an estimated £37billion being invested in social housing throughout by 2011 (NAO, 2010). And the Audit Commission delivered an inspection regime to accompany the programme that was intended to monitor progress and ensure funding was deployed by landlords delivering an effective service to residents (Morrison, 2013). The transformational effect of the Decent Homes programme varied between landlords according to their funding level and strategy for implementation, with some landlords adopting a narrow interpretation of 'decency' that Morrison (ibid.) argues contributed to a long-term burden of underperforming assets and reoccurring disrepair. Nonetheless, the 2000s represented a period in which housing standards were a key priority in social housing policy.

This contrasts with the regulatory period that followed the election of the Coalition government in 2010. With an ideological preference for light-touch regulation, the Coalition determined to proactively regulate the financial viability of social landlords, but to reactively regulate compliance with consumer standards i.e. standards relating to housing condition and quality of service (Marshall, 2023). The Coalition also introduced the serious detriment test, which in effect precluded the regulator from intervening on consumer standards unless there was a risk of *serious detriment* to an occupant, which in practice often referred to a risk of serious injury or fatality (LUHCC, 2022). This regulatory regime came under severe criticism and scrutiny following the Grenfell Tower fire in 2017,

and the emergence of numerous cases of damp, mould and disrepair within social housing in the early 2020s (ibid.). As such, the government passed the Social Housing Regulation Act 2023 to remove the serious detriment test and implement a proactive regime of consumer standards regulation.

During the same period, non-price regulation in the PRS has been characterised by being both piecemeal and uneven in terms of its implementation across local authorities (Rugg and Rhodes, 2018). Among the aims of the Housing Act 2004 were to improve housing conditions in the PRS, secure tenancy deposits and introduce selective licensing schemes for landlords of Housing in Multiple Occupation (HMO). But the effect of landlord licensing on standards was to an extent constrained by schemes being non-compulsory (Marsh et al., 2023: 19). The 2018 Homes (Fitness for Habitation) Act provided tenants with the right to seek remediation for unacceptable living standards through the courts. But as with other legislation in the PRS the effectiveness of the legislation has been questioned due to the power imbalance between landlords and tenants – evidence suggests issues and repairs are underreported within the PRS due to fears of retaliatory action such as evictions (ibid.; Harris and Marsh, 2022). As mentioned above, in 2020 Minimum Energy Efficiency Standard (MEES) were established in the PRS, which is estimated to have increased the average Energy Performance Certificate (EPC) score of PRS properties by five points (BEIS, 2021).

The regulatory approach to improving standards in the PRS has also shifted during this period. Case study research suggests that local authorities have taken an increasingly hardline approach to enforcing health and safety legislation and MEES, as opposed to a more collaborative and dialogical compliance focused approach (Cowan et al., 2024). Characteristic of this approach has been increased usage of civil penalties for non-compliance, and the reported drivers of this shift include a prevailing discourse regarding 'rouge landlords' in the PRS and constrained local authority resources (ibid.).

The Renters' Rights Bill recently introduced to Parliament proposes to extend the DHS to the PRS, but implementation faces distinct challenges due to the composition and nature of the sector. One challenge is the disparate composition of the PRS – the majority of PRS landlords remain small-scale landlords which makes coordinating area-based programmes of housing improvement difficult (Marshall et al., 2022). A further challenge relates to the dissemination of information on regulatory change – evidence suggests there remains relatively low awareness of landlord obligations in much of the sector, with many landlords relying upon subjective assessments of housing quality to guide their investment decisions as opposed to government legislation (Harris and Marsh, 2022). Although importantly, the same study identified that many PRS landlords value proactive dissemination of information on regulatory change (ibid.). Finally, as mentioned above the power imbalance between landlords and tenants makes reliance upon tenant reporting of issues as a mechanism for regulatory enforcement inherently limited (ibid.).

Yet a further constraint on the ability to deliver a more programmatic, compliance-based approach to improving standards in the PRS is insufficient data on the location of lower quality housing. An official review of the MEES noted that while there is evidence MEES has improved energy efficiency in the PRS, there are critical gaps in knowledge as to the condition of the stock which limits understanding as to the effectiveness of regulation (BEIS, 2021). More pertinently for the prospective rollout of the DHS to PRS, official data on non-decency provided by the EHS is only available at the regional and local authority scale, preventing the identification of non-decent homes at more granular scales (Marshall et al., 2022). Given the challenges for implementation outlined above, data on non-decency at lower spatial scales could support the implementation of the DHS in the PRS by helping

local authorities target areas-based improvement programmes, focus enforcement activity, and effectively disseminate information to landlords and tenants.

The lack of data on the location of housing quality issues further complicates efforts to improve housing standards in the owner-occupation sector. Improving quality in the owner-occupation sector by its nature relies upon the consent and willingness of owners to invest in the improvement of their homes. Yet this should not obscure that there remains an acute shortage of decent private housing to accommodate an ageing population in England (Robinson et al., 2020). And that the removal of central government funding for private housing renewal has contributed to significant variation between local authorities in terms of the generosity of funding for home improvement and the presence of trusted bodies such as home improvement agencies (Preece et al., 2021). Any future attempts to scale up home improvement programmes within the owner-occupation sector will be necessarily reliant upon knowledge of where non-decent and low-quality homes are located. But the lack of knowledge on the spatial distribution of non-decency at lower spatial scales represents a critical gap. The empirical section of this paper aims to address this issue.

3. Methodology

The paper addresses the following research questions:

1. Which property and household factors are associated with non-compliance with the Decent Homes Standard?
2. How is compliance with the Decent Homes Standard spatially distributed in England, with a focus on variation between small areas?

I adopt a multi-stage approach to the methodology. The first stage addresses question one by estimating a logit regression model with a binary indicator for non-decency as the outcome variable. The second stage answers question two by producing an index of non-decency to identify lower-super-output-areas (LSOAs) where it is expected that there is a relatively high incidence of non-decency. The third stage validates the previous steps by measuring the correlation between the index and the incidence of non-decency at higher spatial scales. In this section I explain each stage of the methodology in further detail.

3.1. Modelling non-decency

To model the probability of non-decency of individual dwellings I estimate a logit regression with non-decency as a binary outcome variable. Data is taken from the 2018-19 EHS, which is the most recent EHS to have included inspections within dwellings and to be deposited with the UK Data Service. The model includes all observations for which there is both a property and household survey (n=11,974).

The EHS features a wide array of variables relating to properties and households, but the potential predictor variables are restricted to those for which is there is accessible data on their prevalence at the LSOA level, which is necessary to link this stage to stage two of the research. As such, variables such as dwelling floorspace are not included as potential predictors. The full list of potential predictor variables is outlined in Table 1. Tenure is included as non-decency is widely reported to be higher in the private rented and owner-occupation sectors (Cromarty, 2022). Variables relating to structural property characteristics include: EPC Band, as lower energy efficiency properties should likely fail the thermal comfort criterion; heating type, as properties without central heating should also fail the thermal comfort criterion; whether the property is a flat, as smaller properties are generally more energy efficient due to often being surrounded by heated space; and property age, as

older properties are often used as a proxy for housing quality and may have an increased probability of failing the state of repair and modern facilities criteria (Storey and Coombs, 2020). Occupancy rates are included – measured by whether households are above, below or at the Bedroom Standard – as the HHSRS reports that overcrowding is associated with health and safety hazards including higher risk of accidents, infectious diseases, condensation and mould (Wilson, 2023). A range of socio-demographic variables are included as they are widely available at the LSOA level and therefore important for stage two of the research.

To select the best model from all potential predictors I adopt a backwards stepwise approach – beginning with a model that includes all potential predictors I subsequently remove the least statistically significant variable until a parsimonious model with only statistically significant predictors remains. In addition, I validate this approach by applying the following inferential rule – if the removal of a variable does not result in a deterioration of the AIC statistic of model fit by at least 5, then the more parsimonious model is preferred (i.e. inclusion of a variable should improve the AIC by at least 5). The final column of Table 1 indicates if variables, or a subset of the categories from a variable, were selected for the final model following this procedure.

I present the model outputs as average marginal effects (AMEs), which can be interpreted as the change in a dwelling's probability of non-decency when a predictor variable increases by one unit. As all of the variables in the model are either nominal or ordinal, the AMEs should be interpreted as the change in probability relative to the baseline category.

Variable Name	**Description**	**Categories**	**Included in final model**
Working status	Working status of household reference person	Full-time work Part-time work Retired Unemployed Full-time education Other inactive	Yes (subset) Retired (Dummy variable: Not retired = 0, Retired = 1)
Household composition	Household composition	Couple no dependent child(ren) (baseline) Couple with dependent child(ren) Lone parent with dependent child(ren) Other multi-person households One person under 60 One person aged 60 or over	No
Benefits status	Household in receipt of means-tested benefits	Yes No (baseline)	No
Higher-managerial	Household reference person or partner is classed as 'higher-managerial or	Higher managerial or professional, Not higher-managerial or professional (baseline)	Yes

	professional' under the National Statistics Socio-economic Classification (NS-SEC)		
Bedroom standard	Household occupancy relative to the Bedroom Standard	Below bedroom standard At bedroom standard Above bedroom standard (baseline)	Yes (subset) Below bedroom standard (Dummy variable: Not below = 0, Below = 1)
Ethnic minority	Ethnic minority status	Not ethnic minority (baseline) Ethnic minority	No
Sex	Sex	Male (baseline) Female	No
Tenure	Tenure	Housing association (baseline) Local authority Owner occupier PRS	Yes (subset) Owner occupier PRS Social housing (baseline)
Long-term sick	Household includes member who is long-term sick	Yes No (baseline)	No
Heating source	Primary heating source	Central heating (baseline) Storage heater Fixed room heating	Yes
Flat	Whether a dwelling is a flat or not	Flat Not flat (baseline)	No
EPC	EPC Band	A/B (baseline) C D E F/G	Yes (subset) A-D (baseline) E F/G
Dwelling age	Property age band	Pre-1919 1919-1944 1945-1991 Post-1991 (baseline)	Yes

Table 1: Variables for logit regression model

3.2. The Non-Decent Index

Analysing the spatial distribution of non-decency is inherently complicated by the characteristics of the EHS data. The EHS sample sizes are insufficient to provide reliable estimates of the prevalence of non-decency within small areas such as LSOAs. Indeed, the only spatial scale included with the EHS dataset is government office region. The lack of granular spatial data within EHS also prohibits the usage of advanced statistical techniques that could be used to approximate small area estimates, such as multilevel regression with poststratification (MRP), which augments survey data with the known prevalence of covariates at the area level using census data. As such, the approach taken in this research has inevitable limitations.

Nonetheless, I analyse the spatial distribution of non-decency by producing an index of non-decency – hereby the non-decent index (NDI). The data underlying the NDI is the prevalence of the predictors from stage one at the LSOA level e.g. the proportion of retired households, the proportion of homes in energy bands F and G etc. Table 2 outlines the data used to construct the NDI and their respective sources. The index is calculated as a weighted sum of the prevalence of each predictor, with weights being the AMEs from the first stage. Thus, predictors associated with an increased probability of non-decency will receive a higher weighting in the index. For ease of interpretation, the index is scaled to range between 0 and 1.

With one exception, data for the prevalence of predictor variables was available for all LSOAs in England, although the Isles of Scilly are removed as their small population makes them an outlier (n=33,754). The exception where data is missing is dwelling ages. The proportion of dwellings in different age bands within LSOAs is publicly available via the Consumer Data Research Centre (CDRC), derived from Land Registry and Valuation Office Agency (VOA) data. However, the CDRC dataset uses the 2011 LSOAs, as opposed to the 2021 LSOAs available for all other variables. And is slightly dated, having been published in 2015. In total there were 1,945 missing values from the property age variables, which were imputed using a random forest machine learning model where the predictors were all other variables in Table 2 plus the local authority. In addition, dwelling ages were banded into relatively large groups for the analysis despite more granular age bands being available in both the EHS and CDRC data (e.g. ten- or twenty-year bands). These larger bands were chosen as the imputation improved significantly compared to the more granular age bands. Consequently, there is inevitably some measurement error relating to the distribution of dwelling ages across LSOAs. And future iterations of the NDI should seek to improve upon this limitation (see Conclusion).

At this stage it is worth being explicit as to what the NDI aims to measure. NDI is concerned with the relative probability that an area has a high incidence of non-decency. In other words, a high score on the NDI suggests there is a relatively high probability of a high incidence of non-decency within an area. Similar to the Indices of Multiple Deprivation (IMD), NDI is a relative measure – it presents LSOAs relative to one another in terms of the probable incidence of non-decency. But as an area-based relative measure, it is subject to some important caveats; NDI cannot be used to determine whether individual homes are non-decent, and nor does it provide an estimate of the proportion of homes within an area that are non-decent.

Variable	**Source**
Percentage of retired households	Census 2021
Percentage of higher managerial or professional occupations	Census 2021

Percentage of households below the bedroom standard	Census 2021
Percentage of owner-occupier households	Census 2021
Percentage of PRS households	Census 2021
Percentage of homes with electric heating only	Census 2021
Percentage of homes with fixed room, wood, or solid fuel heating only	Census 2021
Percentage of homes at EPC band E	Open Data Communities by the Department for Levelling Up, Housing and Communities (DLUHC) – sourced via nomis
Percentage of homes at EPC bands F or G	Open Data Communities by the Department for Levelling Up, Housing and Communities (DLUHC) – sourced via nomis
Percentage of homes constructed pre-1919	Consumer Data Research Centre
Percentage of homes constructed 1919-1944	Consumer Data Research Centre
Percentage of homes constructed 1945-1990	Consumer Data Research Centre
Table 2: Variables used for constructing the non-decent index	

3.3. Validating the NDI

To validate the NDI, I assess whether NDI scores correlate with the estimated prevalence of non-decency at higher spatial scales i.e. local authorities. I do so in two ways.

Firstly, I calculate the Pearson's correlation coefficient between a) the NDI of local authorities and b) the MHCLG estimated percentage of non-decent dwellings in each local authority. The local authority NDI is calculated as the mean NDI of all LSOAs within an authority. It is worth noting that the MHCLG estimates are not taken from the EHS direct due to the sample size limitation noted above, rather they are also produced via the estimates of a regression model.

Secondly, I visualise the NDI of LSOAs located within local authorities expected to have high and low prevalence of non-decency according to the MHCLG estimates. This provides a complement to the correlation coefficient discussed directly above as the mean NDI of a local authority may mask substantial variation within a local authority between LSOAs.

The validation checks are intended to provide some confidence that the NDI is identifying probable spatial variation in non-decency. Nonetheless, in the absence of data measuring non-decency that can be linked to LSOAs there will always be an inevitable degree of uncertainty in this regard. The Conclusion section provides some suggestions as to how future research could reduce this uncertainty.

4. Findings

4.1. Modelling Non-Decency

Figure 1 presents the AMEs from the logit regression. Unsurprisingly, the strongest predictors of non-decency are property characteristics, including energy efficiency, heating source, and dwelling age. The probability of non-decency increases by 73.57 percentage points when a dwelling is in EPC Band F or G, which is to be expected given that by definition PRS properties would be non-decent if falling into this category. Similarly, the probability of non-decency increases by 53.94 percentage points if a dwelling has a fixed room heater as its primary heating source, while it increases by 48.69 percentage points if a dwelling is built pre-1919.

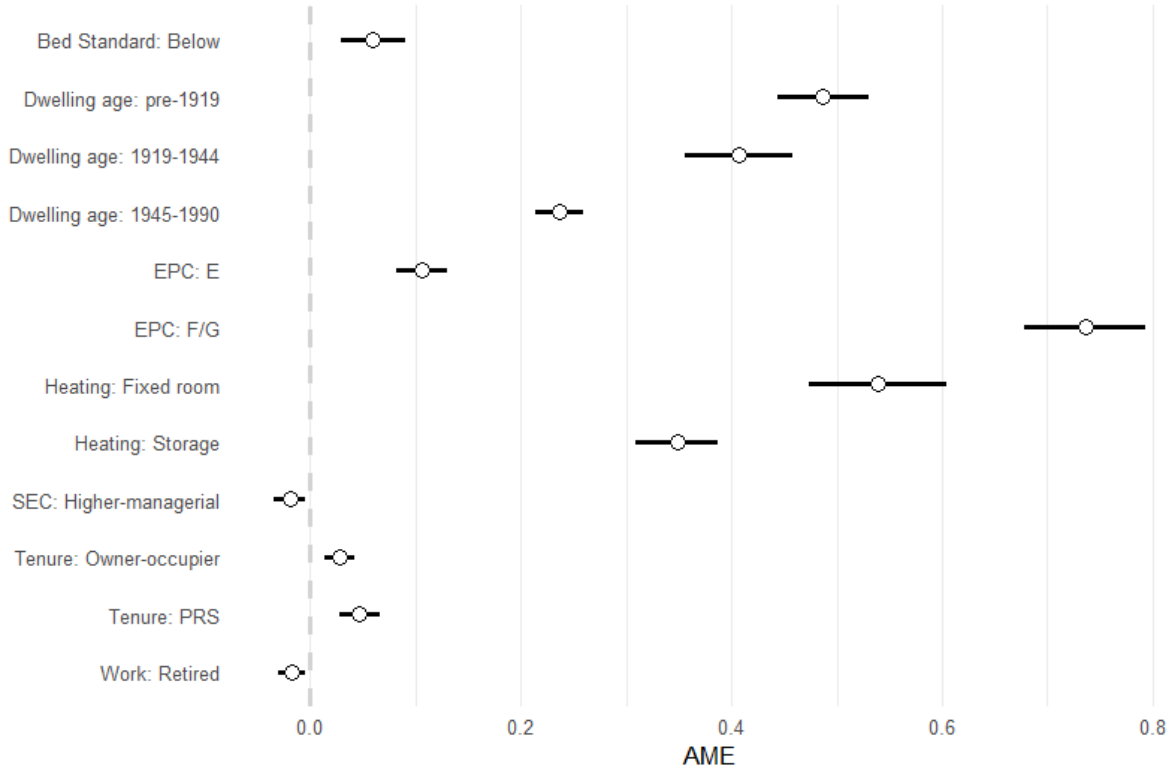

Figure 1: Average Marginal Effects on Non-Decency

Figures 2 and 3 visualise property age and EPC Band by tenure, respectively. They show that the some of the strongest predictors of non-decency – EPC Band E to G, dwelling built pre-1919 – are disproportionately concentrated within the PRS and owner-occupation tenures. However, the modelling also suggests that non-decency is not wholly explained by the structural features of dwellings – relative to social tenancies, the PRS and owner-occupation are both associated with a slight increase in the probability of non-decency after controlling for other factors. A model that disaggregated social tenancies by including a dummy variable for a local authority tenancy was tested but did not improve model fit. In addition, households above the Bedroom Standard (i.e. over-occupiers) are associated with 5.94 percentage point increase in the probability of non-decency, relative to households at or below the Bedroom Standard.

Finally, among the socio-demographic variables included in the model, a household member within a higher-managerial or professional occupation is associated with a slight reduction in the probability of non-decency. And so too is being retired, which is associated with a modest 1.80 percentage point reduction relative to non-retired households.

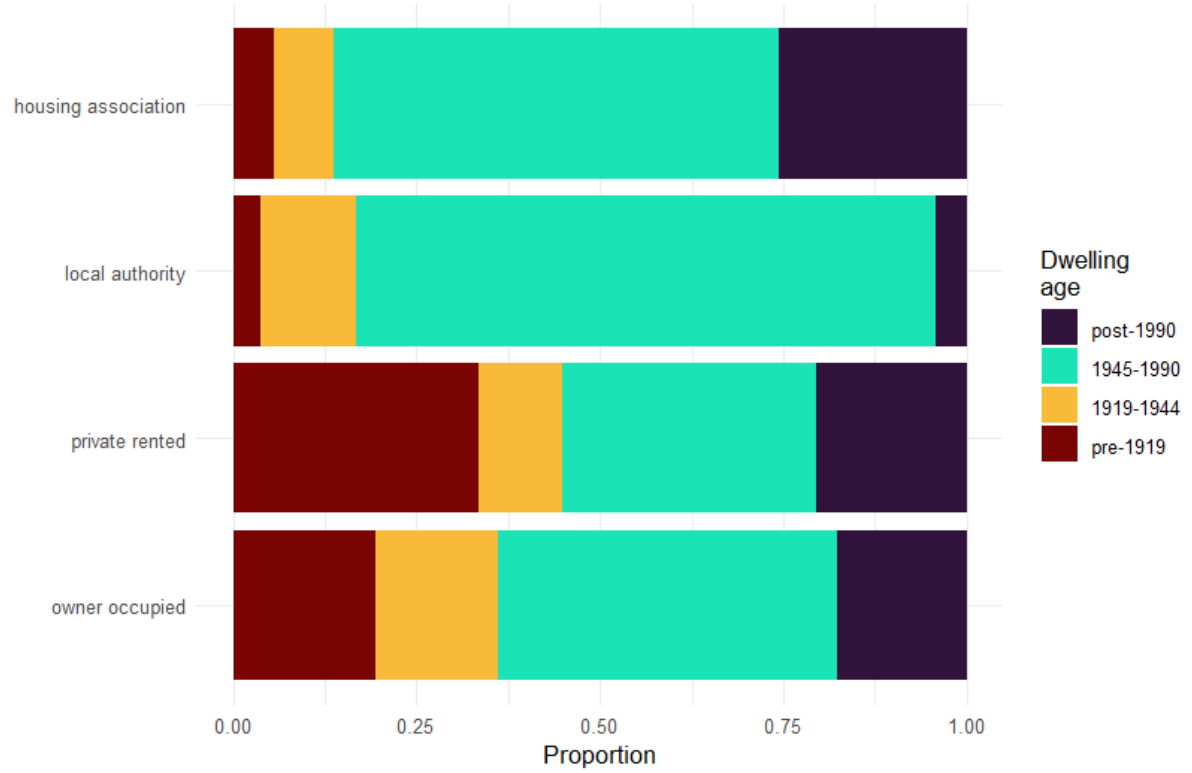

Figure 2: Property age by tenure

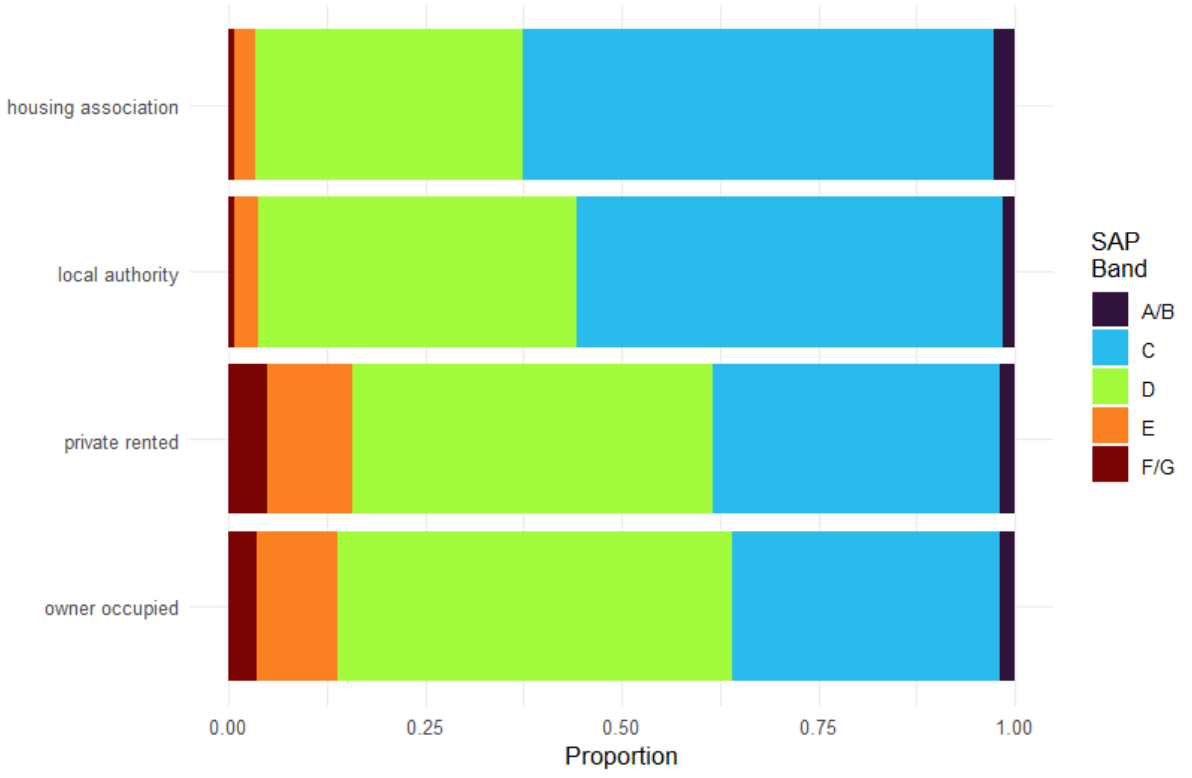

Figure 2: EPC by tenure

4.2. The Non-Decent Index

As described above, the NDI is designed to range between 0 and 1. A score close to 1 implies a high probability of a high incidence of non-decency in an LSOA. A static map of the NDI across England is largely uninterpretable due to the total number of LSOAs. However an interactive, scrollable and zoomable map is available online.[1]

Figure 4 visualises the distribution of the NDI within each region of England. Figure 4 shows that the median NDI is highest in London and lowest in the North East. However, the regional picture is relatively limited in understanding the spatial distribution of non-decency – Figure 4 also suggests the distribution of non-decency is long-tailed, and there is more variation within regions than between them, underlining the potential benefits of analysing variation at lower spatial scales.

LSOAs with a higher NDI score tend to be one of three types:

- Rural areas with high proportions of owner-occupied housing that is old and energy inefficient
- Urban areas with a mostly working age population and a higher proportion of overcrowding and PRS housing
- Rural areas in former mining communities with a higher proportion of solid fuel heating

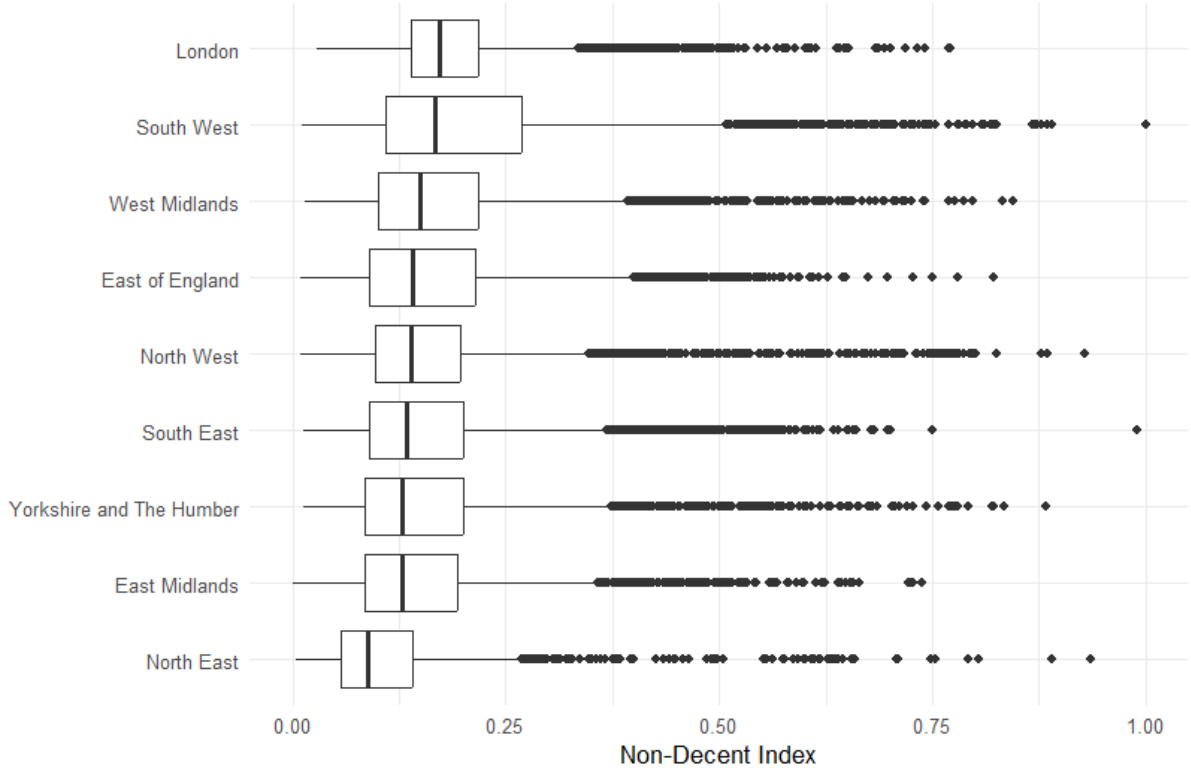

Figure 4: Regional distribution of NDI

[1] https://michael-s-marshall.github.io/non_decent_index.io/

Figures 5, 6 and 7 provide examples of these archetypes using case study local authorities. Figure 5 displays Somerset and West Taunton, which is archetypal of a largely rural authority with older, energy inefficient housing.[2] Figure 6 shows that the higher NDI scores within Sheffield tend to be located in and around the city centre where the age demographic is younger and PRS housing is common. But there is also a notable LSOA with a relatively high NDI in the northwest of Sheffield where the housing stock is older on average and located more rurally. Finally, Figure 7 displays Northumberland, where the urban areas closer to Newcastle Upon Tyne tend to have a low NDI, but rural areas where solid fuel heating remains relatively common have a high NDI. Nevertheless, figures 5, 6 and 7 all attest to the potential for substantial spatial variation within local authorities in non-decency.

This section has shown how the NDI can be used to understand the spatial distribution of non-decency at the LSOA level. Nonetheless, it is worth reiterating that the NDI cannot determine whether individual homes are non-decent, and as such we should expect there to be significant amounts of non-decent housing that does not reside within one of these archetypal locations.

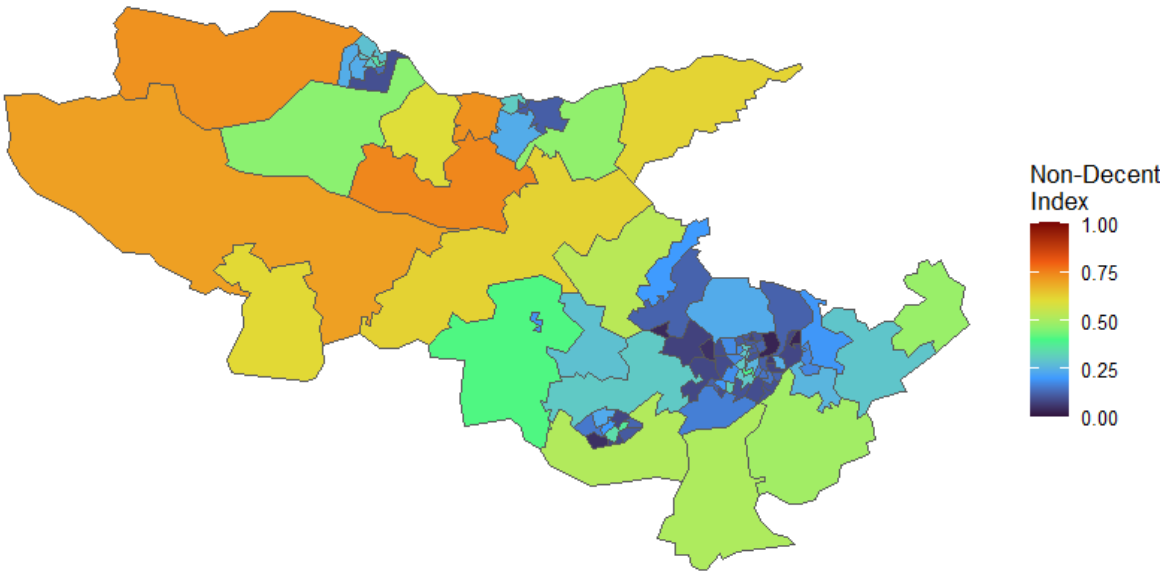

Figure 5: Somerset West and Taunton

[2] Somerset and West Taunton was abolished and replaced by Somerset Council in 2023, but existed at the time of the 2021 Census and is thus included in the analysis.

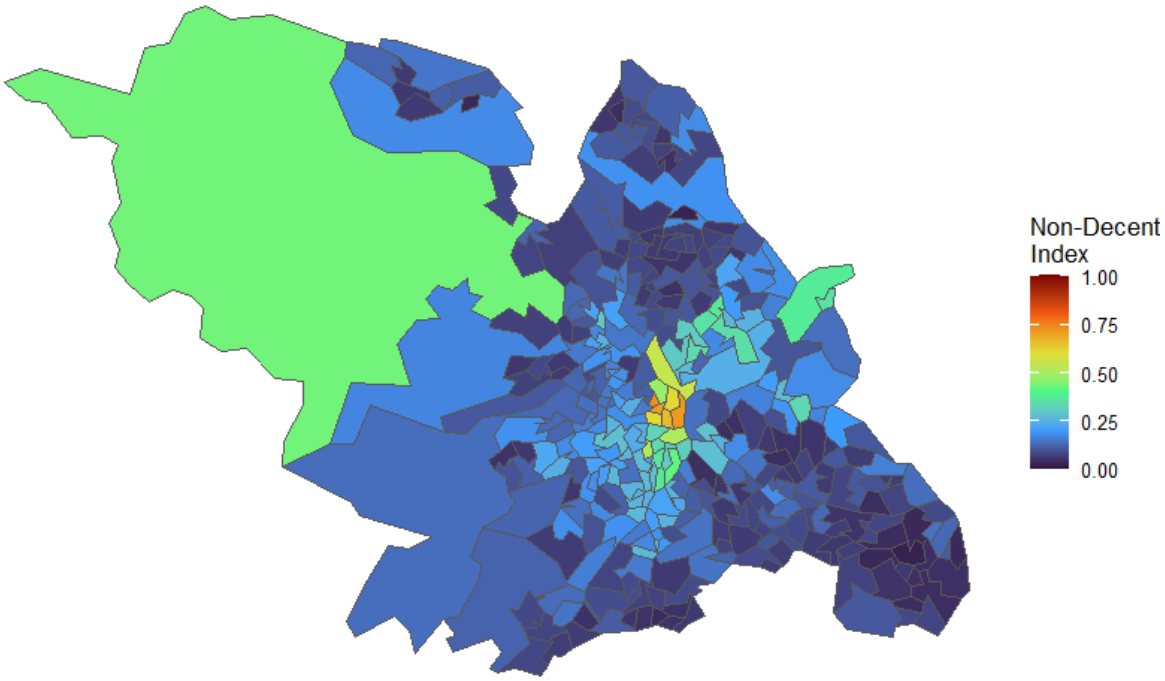

Figure 6: Sheffield

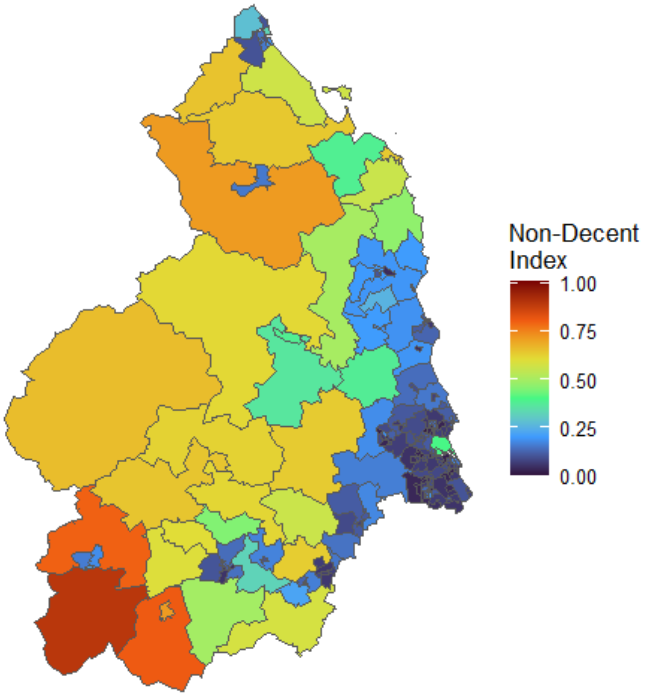

Figure 7: Northumberland

4.3. Validating the NDI

The correlation coefficient between the average local authority NDI and the MHCLG estimates of non-decency within local authorities is 0.548, suggesting a moderate degree of correlation between the measures. Figure 8 displays a scatter plot of the two measures confirming there is a moderate positive and linear correlation between them. Figure 8 also highlights some local authorities where both measures agree there is a likely a high incidence of non-decency – Torridge, West Devon, Cornwall – and two authorities where the measures diverge. The NDI estimates City of London to have a high incidence of non-decency on average, whereas the MHCLG estimates the proportion to be relatively low. The high NDI of City of London is driven by the very high proportion of homes with electric storage heaters in this borough, which the validation check suggests is given greater weighting in the NDI than the MHCLG estimates. By contrast, not including the Isles of Scilly, Derbyshire Dales has the highest estimated prevalence of non-decency according to MHCLG. But its average NDI is around average. This may be because the NDI estimates there to be substantial spatial variation within Derbyshire Dales in the incidence of non-decency, which is masked by the mean across LSOAs. This is revealed by the visual validation check, which is displayed in Figures 9 and 10.

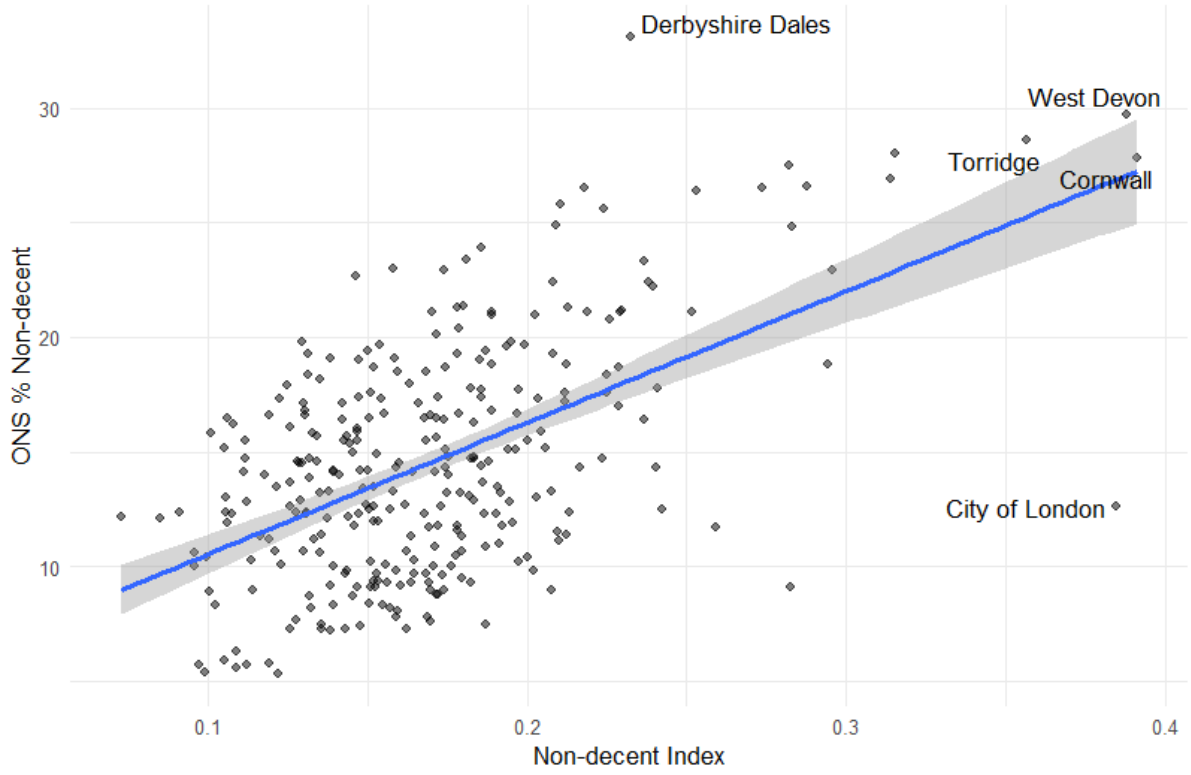

Figure 8: Non-decency and NDI by local authority

Figure 9 displays the NDI within the five local authorities with the highest proportion of non-decent dwellings according to the MHCLG estimates. It confirms that they feature numerous hotspots with a high NDI score, albeit with some spatial variation within each authority. Figure 10 displays the NDI within the five local authorities with the lowest proportions of non-decent dwellings according to

MHCLG. Figure 10 suggests the LSOAs within these authorities have mostly low NDI scores, with the exception of a few LSOAs with moderate scores.

In sum, the validation checks in this section suggest that the NDI is correlated with expected levels of non-decency at higher spatial scales, with some isolated points of divergence. Furthermore, the results suggest the NDI is potentially capturing a significant degree of spatial variation in non-decency within local authorities, even amongst those with a relatively high proportion of non-decent dwellings overall. To confirm this requires further validation checks that are not possible with the currently available data (see Conclusion).

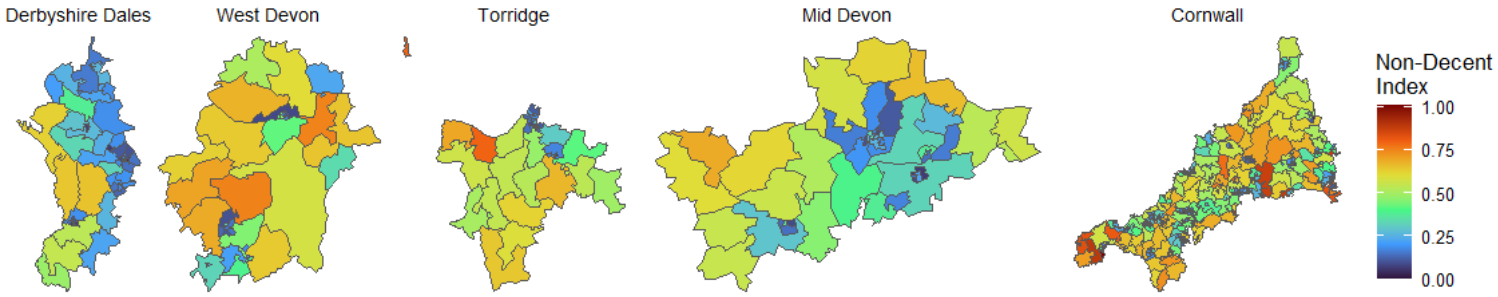

Figure 9: NDI in high non-decency authorities

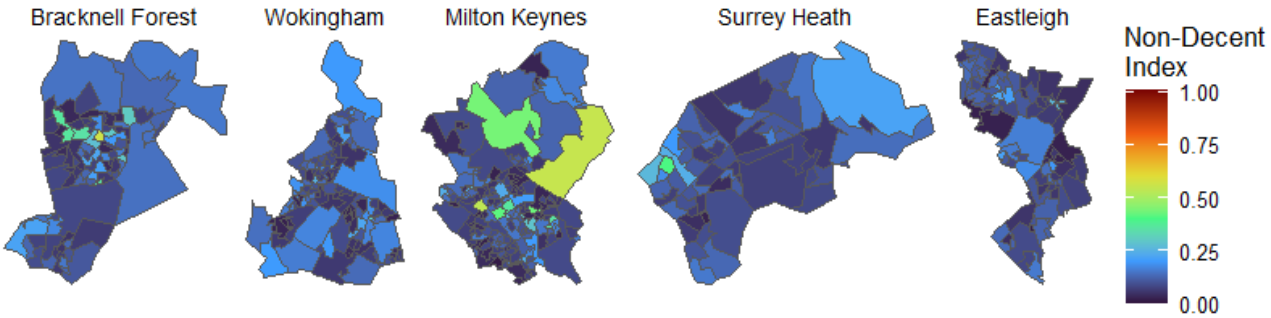

Figure 10: NDI in low non-decency authorities

5. Conclusion

In this paper I have made several contributions with clear implications for policy and practice. Firstly, the results of logit regression at the dwelling level show that non-decency is strongly predicted by structural characteristics of the property, including energy efficiency, heating source and property age. This is to be expected as, by definition, properties with these features will likely fail the thermal comfort criterion of the Decent Homes Standard.

Secondly, the logit modelling has shown that after controlling for structural property characteristics non-decency is predicted by features and outcomes of the housing system, namely private sector housing tenures and household occupancy. Given that dwelling age and energy efficiency varies by tenure, further research could seek to produce a more complicated model that accounts for potential interaction and indirect effects. However, as the logit model in this paper aims to both advance knowledge and provide a practical output (i.e. the relative probabilities that become weightings in the NDI), a relatively simple but interpretable model that is easily translatable into the NDI has been preferred.

Thirdly, I have constructed the Non-Decent Index (NDI) – an open-source tool, constructed using publicly available data, that can be used to identify relatively small areas where there is expected to be a high incidence of non-decency. A high score on the NDI suggests that there is a relatively high probability of high incidence of non-decency within an LSOA. I have validated the NDI by demonstrating that it correlates with existing estimates of the prevalence of non-decency at the local authority level. But in doing so I have illustrated the potential benefits of exploring the variation in non-decency at lower spatial scales by identifying case studies where the NDI suggests there is substantial spatial variation within local authorities.

Based upon this analysis I outline the following recommendations for national government, local governments, and further research.

Recommendations for national government

1. *National government should deliver on its current legislative commitment to extend the Decent Homes Standard to the PRS.* The findings indicate that higher rates of non-decency are not wholly explained by structural property characteristics. But this conclusion also somewhat simplifies what is a more nuanced picture. Indeed, the literature on the historical development of the PRS provides compelling evidence that long-term light-touch regulation and underinvestment in the PRS have facilitated the concentration of risk factors associated with non-decency within this tenure. Moreover, the lower relative risk of non-decency in the social sector suggests that legislation to improve standards within tenures can have an effect, provided it is effectively implemented (Marshall et al., 2022).
2. *Targeted housing investment grants for repairs and renovations should be reinstated and supported nationally.* Central government funding for private sector housing renewal ended in 2011, and the availability of grants and low-cost finance for private homeowners and landlords to improve the condition of their properties varies greatly between local authorities (Preece et al., 2021; Wilson, 2017). This has created a vacuum in which there is insufficient national support to fund investment in the private housing stock. Other research has called for the reinstatement of low-cost loans and means-tested grants for home improvement directed towards private households and landlords, combined with area-based renewal programmes (Gibb, 2024; Preece et al., 2021). The findings of this research are in accordance with these recommendations.

3. *In rural areas, area-based programmes of home improvement should be combined with programmes to decarbonise the housing stock to avoid duplication and derive efficiencies.* The research has shown that there is significant overlap between areas with an expectation of high levels of non-decency and energy efficiency, and that many of these areas are located rurally. Rural properties face additional barriers to effective implementation of home improvement and energy efficiency programmes – rural properties are more likely to be off-grid, hard-to-retrofit due to their design and materials, and sparsely located which makes it harder to derive economies of scale from area-based programmes (Qureshi, 2022). As such, any efficiencies that can be gained from avoiding duplication of efforts and resource in rural areas should be considered. The national government responsibility for housing standards and decarbonisation is currently split between MHCLG and the Department for Energy Security and Net Zero (DEZNZ). Pooling a proportion of the relevant budgets from these departments into a single programme of home improvement and decarbonisation, aimed at private sector housing in rural areas, could provide an initial efficiency gain by avoiding duplication. There is also suggestive evidence that homeowners would be more willing to consider energy efficiency improvements and low-carbon heating if this was combined with general home renovation, although the evidence base on this issue is relatively thin and further research is needed (Hall and Caldecott, 2016).

Recommendations for local government

4. *When implementing the Decent Homes Standard within the PRS, tools such as the NDI should be used to proactively disseminate information and target resources on hotspots of poor housing.* At its core, the NDI is a tool to support policy implementation by guiding strategy and resources. Furthermore, as it provides greater weight to private sector housing, an effective usage of the NDI would be to identify hotspots where there is an expectation of a higher relative incidence of non-decent PRS homes. Local authorities could subsequently target resources and communications as part of a programme to improve housing conditions at an area-level. Previous research has indicated that private landlords value proactive communication of housing regulation and landlord responsibilities (Harris and Marsh, 2022). And the finite budgets of local authorities for home improvement and legislative enforcement could be used more efficiently by effectively targeting resource. It is worth reiterating, though, the limitations of the NDI. As a measure predicated upon relative probabilities, the NDI cannot be used to measure change in the decency of dwellings in a particular location or evaluate the impact of interventions. And targeting resources and communications should not preclude households in other areas from benefitting from prospective interventions. The recent history of damp, mould and disrepair in the social sector confirms that non-decency is not an issue exclusive to the private sector. Yet, in theory mechanisms now exist to enforce decency in the social sector through the Social Housing Regulation Act 2023 (albeit this will take time to have an effect, and social landlord resources are currently stretched). Consequently, the NDI is arguably most appropriately used to direct attention towards spatially concentrated non-decent dwellings in the private sector.

Recommendations for further research

5. *Property age band data at the LSOA level should be updated and made publicly available*. There is undeniably some measurement error in the NDI due to the imputation of missing values on property age bands within LSOAs. Indeed, the correlation between the mean local authority NDI and the percentage of non-decency is 0.6 when excluding imputed observations. Consequently, one way to improve the NDI is to update available statistics on

the distribution of dwelling ages at the LSOA level, using the 2021 Census LSOAs. This should be a relatively simple task, achievable in the immediate term, due to existing estimates utilising data accessible from the Land Registry and VOA.

6. *A one-off national survey should be conducted which measures non-decency and includes the location of respondents at a spatial scale smaller than the local authority*. Ultimately the NDI should be seen as a starting point in understanding spatial variation in non-decency, not the destination. And future research should seek to validate and improve upon this approach. The NDI suggests there potentially significant benefit from understanding where non-decency is concentrated at small spatial scales such as LSOAs or middle-super-output-areas (MSOAs). However, as mentioned above, there remains unavoidable uncertainty as to whether the NDI is truly capturing this spatial variation due to data limitations. A one-off national survey of non-decency that includes the location of respondents at smaller spatial scales could help reduce this gap in our understanding. The sample size would have to be larger than currently provided by the EHS. And even with a larger sample it may still be more feasible to include MSOA than LSOA. Yet the provision of this data could allow for more complicated methods such as MRP to estimate the proportion of dwellings that are non-decent at lower spatial scales. An initial trial could be conducted at the level of a single local authority to test this approach and build the case for further research.

References

Blessing, A. (2016). Repackaging the poor? Conceptualising Neoliberal Reforms of Social Rental Housing. *Housing Studies*, 31(2), 149–172. https://doi.org/10.1080/02673037.2015.1070799

Business Energy & Industrial Strategy (BEIS) (2021) Evaluation of the Domestic Private Rented Sector Minimum Energy Efficiency Standard regulations 2020 Interim Process and Impact Evaluation Report. *BEIS.*

Communities and Local Government Committee (CLGC) (2010). Beyond Decent Homes: Fourth Report of the Session 2009-10. *House of Commons Communities and Local Government Committee*

Cowan, D., Marsh, A., Harris, J. (2024). Local authority intervention in private renting: from compliance to hardline enforcement. *Journal of Law and Society*. 51, 390)–412. https://doi.org/10.1111/jols.12489

Cromarty, H. (2022). Housing conditions in the private rented sector (England). *House of Commons Library*

Gibb, K. (2024). Housing subsidy's long-term shift from supply to demand and what might be done about it. *UK Collaborative Centre for Housing Evidence*

Hall, S., Caldecott, B. (2016). Better Homes: Incentivising Home Energy Improvements. *Bright Blue*

Harris, J., Marsh, A. (2022). Understanding landlord behaviour in the Private Rented Sector in the UK. *UK Collaborative Centre for Housing Evidence*

Kemeny, J. (1995). *From Public Housing to the Social Market: Rental Policy Strategies in Comparative Perspective.* Routledge

Levelling Up, Housing and Communities Committee (LUHCC) (2022). The Regulation of Social Housing. *House of Commons*

Marsh, A., Gibb, K., Harrington, N., Smith, B. (2023). The impact of regulatory reform on the private rented sector*. UK Collaborative Centre for Housing Evidence*

Marshall, M. (2023). Institutional Formation in Tumultuous Times: Reforming English Social Housing Regulation Post-Grenfell. *Critical Housing Analysis* 10 (2): 58-69. https://doi.org/10.13060/2336

Marshall, M., Hincks, S., Ferrari, E. (2022). Lessons from last time: A review of the evidence on the first decent homes programme in the social and private rented sectors. *Northern Housing Consortium*

Marshall, M., Hincks, S., Powell, R. (2023). Housing and Welfare in England. In: Grander M, Stephens M (eds.). *Routledge Handbook of Housing and Welfare*. Routledge

Ministry of Housing, Communities & Local Government (MHCLG) (2020). The Charter for Social Housing Residents Social Housing White Paper*. MHCLG*

Morrison, N. (2013). Meeting the Decent Homes Standard: London Housing Associations' Asset Management Strategies. *Urban Studies*. 50(12), 2569-2587. https://doi.org/10.1177/0042098012474512

Preece, J., Robinson, D., Gibb, K., Young, G. (2021). Housing policy and poor-quality homes. *Centre for Ageing Better*

Qureshi, Z. (2022). Reaching Rural Properties: Off-grid heating in the transition to net zero. *Localis*

Robinson, D., Green, S., Wilson, I. (2020). Housing options for older people in a reimagined housing system: a case study from England. *International Journal of Housing Policy*. 20(3), 344–366. https://doi.org/10.1080/19491247.2019.1644020

Rugg, J., Rhodes, D., (2018). The Evolving Private Rented Sector: Its Contribution and Potential. *University of York*

Stephens, M. (2020). How Housing Systems are Changing and Why: A Critique of Kemeny's Theory of Housing Regimes. *Housing, Theory and Society*. 37(5), 521–547. https://doi.org/10.1080/14036096.202 0.1814404

Storey, A., Coombs, N. (2020). Living longer: implications of housing tenure in later life. *Office for National Statistics*

Wilson, W. (2017). Briefing paper: Assistance with home repairs/improvements. *House of Commons Library*

Wilson, W. (2023). Overcrowded housing (England). *House of Commons Library*