

# Identifying areas at highest food insecurity through open data: the “Priority Places for Food Index”

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GISRUK 2023

## Summary

Open data provide the opportunity to be reactive to “shocks to the system”. This paper presents the methodology behind the construction of the “Priority Places for Food Index” and accompanying interactive geo-visualisation, in response to growing food insecurity in the UK associated with the increase in cost-of-living. The Priority Places for Food Index highlights drivers of food insecurity across seven domains around access and affordability of food at a small area geography. We highlight how ongoing engagement with policy makers and key stakeholders has driven the development of the current and planned future iterations of the index.

**KEYWORDS:** Food Insecurity, Open Data, Mapping Inequalities

## 1 Cost-of-living context

Food insecurity is defined as the inability to access a diet of sufficient nutritional quality through socially acceptable means (Dowler et al., 2011). Individuals experiencing food insecurity often eat smaller meals, skip meals, or do not eat, despite being hungry, as food is unaffordable or inaccessible (The Food Foundation, 2022). Pre-covid-19 there was a notable increase in moderate and severe food insecurity in the UK (Pool and Dooris, 2022), with the ongoing cost-of-living crisis further widening food inequality and increasing fuel poverty globally (Romanello et al., 2022). The Food Foundation (2022) estimated that in Autumn 2022 18% of UK households, equivalent to 9.7 million adults and 4 million children, experienced food insecurity.

In response to the current cost-of-living crisis in the UK the Priority Places for Food Index (PPFI) was developed to guide the delivery of support for those experiencing food insecurity through the

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use of open data. The PFFI is a composite index constructed using open data across seven different domains relating to food insecurity for each of the four nations in the UK. The PFFI meets not only the need to identify the neighbourhoods in the UK most at risk of food insecurity but also determines the primary drivers of food insecurity in those localities. The index can support policy-makers, retailers, and third sector organisations in developing targeted interventions in a timely manner.

## **2 Index development**

### **2.1 Stakeholder engagement**

The index was developed in conjunction with “consumer champion” Which?, initially to engage supermarket retailers to provide further targeted cost-of-living support as part of their “Affordable food for all campaign” (Which?, 2022). Since the release of the index, the wider relevance of a tool that identifies high priority areas in terms of food insecurity to aid third sector and government decision-making has been recognised.

### **2.2 Index domains**

Index domains were designed that utilise openly available data at the neighbourhood level<sup>1</sup>. Each domain captured either a measure of access to affordable food or a measure of barriers to being able to afford food. In total, data across seven domains were gathered, outlined in Table 1. The full methodology and supporting technical documentation is published elsewhere (Consumer Data Research Centre, 2022).

The access to affordable food domains build upon the existing E-food Desert Index (Newing et al., 2022), with the addition of a domain to capture access to non-supermarket food provision, including convenience stores and corner shops, which are often a primary but potentially more expensive source of food, as well as markets. The barriers to affording food domains capture income deprivation and additional pressures on household budgets, which have been exacerbated by rising costs of food and fuel. The evidence of demand for further support for struggling families is also captured under these barriers to affording food, indicating where support is already provided, either as free school meals, healthy start vouchers or food banks, but indicative of where further intervention may be required.

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<sup>1</sup>Lower Super Output Areas for England and Wales, Data Zones in Scotland, and Super Output Areas in Northern Ireland, 2011 boundaries in each case

Table 1: Domains and data sources for the PPFI (Consumer Data Research Centre, 2022)

Domain	Weight	Indicator
Access to affordable food	12.5%	Proximity to supermarket retail facilities
		The average distance to the nearest large grocery store (<1,400m <sup>2</sup> )* The average number of supermarket stores (of any size) within 1 km*
	12.5%	Accessibility of supermarket retail facilities
		The average travel time for individuals to carry out a food shop (including effects for store size, brand, and proximity) as modelled via a spatial interaction model.† Accessibility to nearest supermarket via public transport calculated via journey time statistics in England and using physical access/geographic access to service IMD domains for Wales and Scotland‡
	12.5%	Access to online deliveries
		The number of grocery retailers delivering to each LSOA, as described by (?). † The propensity to shop online as determined by the Internet User Classification (Alexiou and Singleton, 2018) †
12.5%	Proximity to non-supermarket food provision	Distance to nearest non-supermarket retail food store (as defined by the used the Food Standards Agency UK Food Hygiene Rating Data (FSA, 2022))*
		Distance to nearest non-supermarket retail food store (as defined by the used the Food Standards Agency UK Food Hygiene Rating Data (FSA, 2022))*
		Count of non- supermarket retail food stores(as defined by the used the Food Standards Agency UK Food Hygiene Rating Data ) within 1km*
		Average distance to nearest market (as defined by the National Market Traders Federation (Consumer Data Research Centre, 2020)) †‡
Barriers to affording food	16.7%	Socio-economic barriers
		Proportion of population experiencing income deprivation (IMD income deprivation domain, (Noble et al., 2006)) Proportion of population with no car access as reported in the 2011 census
	16.7%	Fuel Poverty
		Proportion of households in fuel poverty as model by the devolved nations† Prevalence of prepayment meters (UK dept for BEIS)†
16.7%	Family food support	Free school meal eligibility extrapolated from local authority data Uptake of Healthy start vouchers† ‡
		Distance to nearest foodbank (food bank locations accessed via givefood.org.uk)*

\* Calculated for each postcode in the UK. The mean number for each LSOA/data zone/output area is then used

† No equivalent data were available for Northern Ireland ‡ No equivalent data were available for Scotland

## 2.3 Index construction

Priority Places for Food Index Deciles

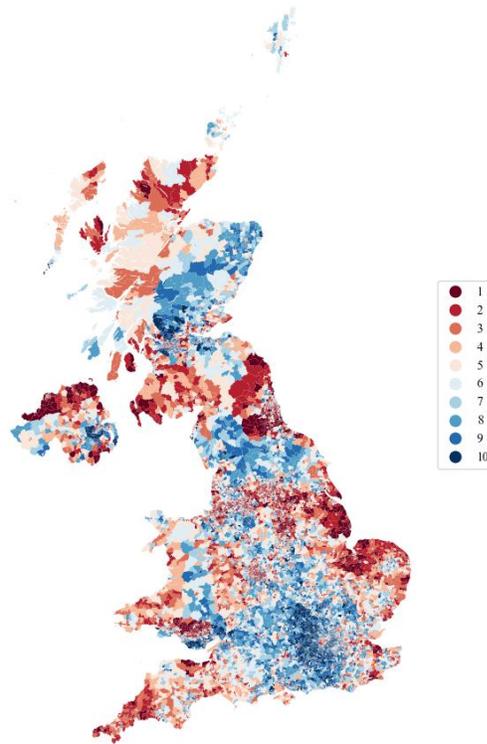


Figure 1: The Priority Places for Food Index (deciles)

The seven domains were combined into a single composite index using similar methods to previous composite index construction such as the UK Government's Index of Multiple Deprivation (Noble et al., 2006) or CDRC's Access to Healthy Assets and Hazards Index (Green et al., 2018). The final index is illustrated in Figure 1, however an interactive version of the tool is also openly available to stakeholders to aid identify the priority places in local areas and explore the domain drivers of insecurity in that area.

We found a large range of areas considered to be high priority. In England, significant concentrations of priority places are found in the North East, Yorkshire and the Humber, the West Midlands and the North West. There are fewer priority places in London, the South East and the South West

(except Cornwall). In Scotland, priority places are found in the Central Belt, with a concentration in and around Dundee. In Wales, the highest concentration of priority places for food is found in the Valleys. Overall, Wales has a larger concentration of priority places for food in rural locations: neighbourhoods in cities such as Cardiff, Swansea and Newport do comparatively well according to the Index. In Northern Ireland, priority places for food are spread across the country with clusters forming in the south-west suburbs of Belfast and in and around Derry/Londonderry.

## 2.4 Index evaluation

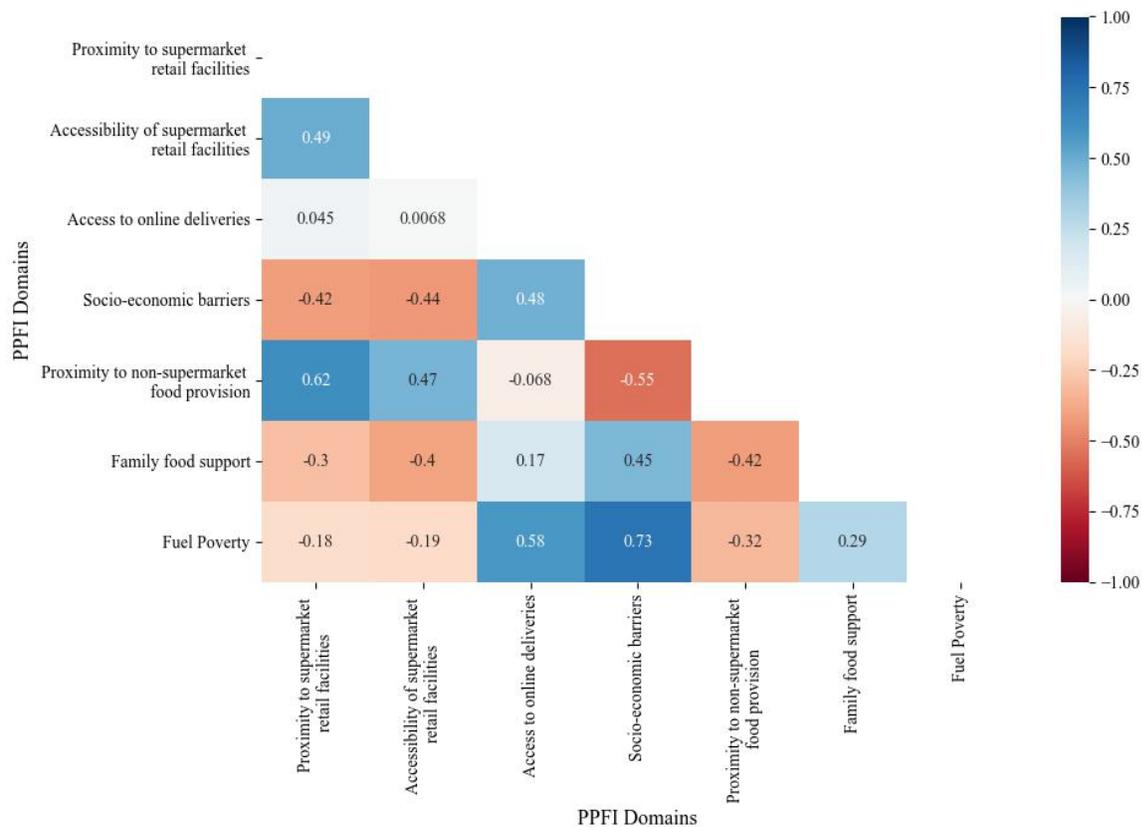


Figure 2: Heat map showing correlation between the domains of the Priority Places Index

Correlation of domains was assessed to ensure the domains did not solely reflect income deprivation, as captured in the ‘socio-economic barriers’ domain (Figure 2). While a degree of correlation is certainly to be expected between domains, each domain brings a unique contribution to the overall index. When comparing the domain level maps in Figure 3 we can see how different factors are driving food insecurity in different areas of the UK.

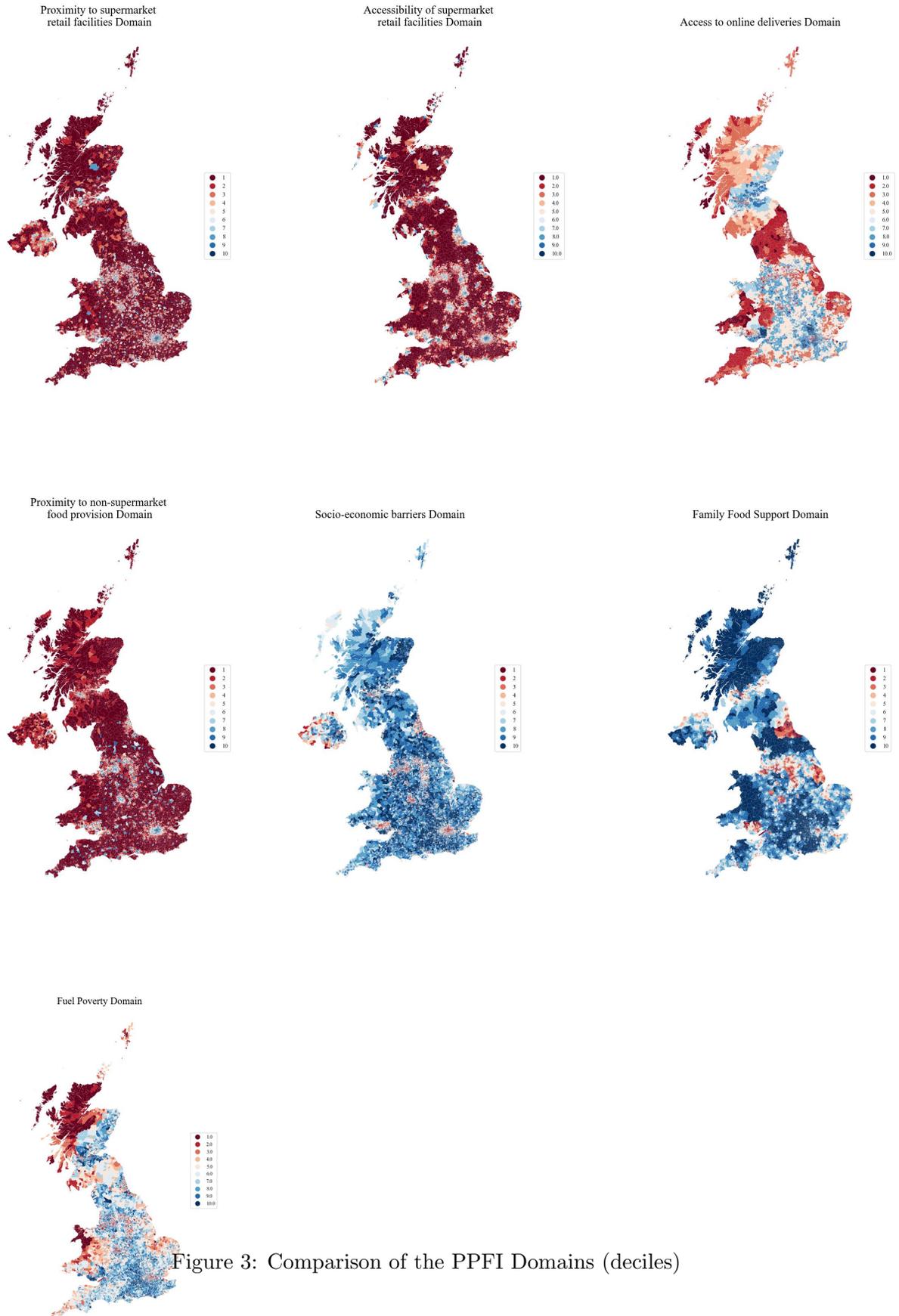


Figure 3: Comparison of the PPF Domains (deciles)

### **3 Future index iterations**

Future versions of the PFFI will be produced annually to ensure the indicators feeding into the index are up-to-date and representative of the national state of food insecurity as new open data become available. This process will work in close collaboration with stakeholders making use of the index, and will encourage new relevant data sources that can both improve and validate the index to be made open where possible.

The construction of an updated index annually will also support the analysis of change, allowing the assessment of measures that have been put in place at the local level to address food insecurity. This may involve the analysis of relative change—for example, if measures are implemented at the local level then the relative decile or ranking performance of that area in comparison to their previous position can point to the success of such measures—or the analysis of absolute change, for example if national action improves the accessibility of food more broadly.

In future years, there may also be additional indicators required, particularly if further spatially varying pressures continue to impact on food availability or household budgets. The use of version control systems and an open sourced code base for index development can play an important role in tracking the evolution of the index and the implications of updating data sources.

### **4 Future Work**

Looking to the repercussions of food insecurity we aim to explore the association with reported health outcomes and health promoting environments to better understand the consequences and drivers of food insecurity.

Through our engagement work stakeholders such as local national government, food redistribution charities, and supermarkets, we have identified several key validation steps. We will work with these partners to ensure the index reflects lived experiences, for example via survey data and by conducting interviews with local food aid workers tackling food insecurity. We will also look to evaluate our tool against other national models of food insecurity (Blake and Cromwell, 2022; Smith et al., 2022).

### **5 Acknowledgements**

The data for this research have been provided by the Consumer Data Research Centre (CDRC), an ESRC Data Investment. Funding references ES/L011840/1; ES/L011891/1. The Priority Places for Food Index was developed by the CDRC at the University of Leeds in collaboration with Which?.

### **6 Biography**

Francesca Pontin is a Research Data Scientist at the Consumer Data Research Centre. Her PhD explored the relationship between the built environment and levels of physical activity utilising

smartphone data. As part of the Nutrition and Lifestyle Analytics team within CDRC, she also leads projects with supermarket retailers.

Peter Baudains leads the Research Data Science team at the Consumer Data Research Centre. He received his PhD from UCL in 2015 and brings to CDRC over 5 years of experience in industry. He has research interests in building data-driven models of human behaviour and in developing derived data products.

Emily Ennis is the Research and Impact Manager for the Consumer Data Research Centre. She oversees all research and impact in the centre, helping researchers and their projects tackle real-world problems and have real-world impacts.

Michelle Morris is an Associate Professor and Turing Fellow based in the Leeds Institute for Data Analytics and School of Medicine at University of Leeds. She leads the Nutrition and Lifestyle Analytics team. Her interdisciplinary research uses novel data, including supermarket transaction records, for research into lifestyle behaviours and health.

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