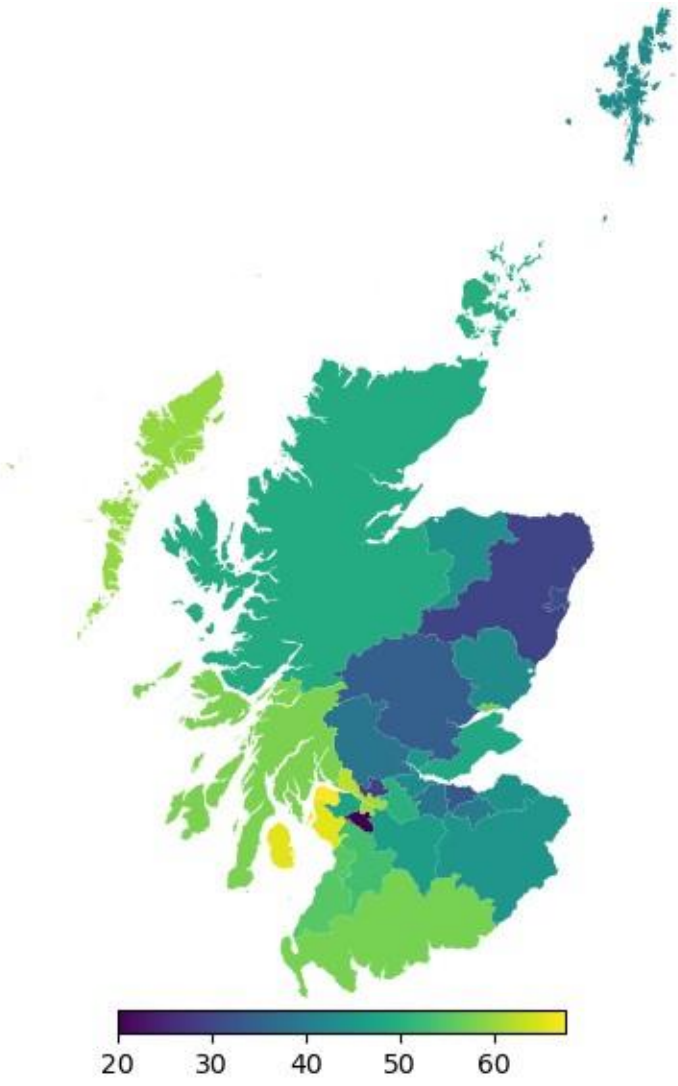
Scottish Fuel Poverty Index - User Guide



Introduction

This document contains a guide on the Scottish Fuel Poverty Index created in the summer of 2023 by EDINA@University of Edinburgh as part of their student internship programme. This guide provides descriptions of each data variable used in creating the index. The basic rationale was to replicate for Scotland work that had been conducted previously but only in respect to England and Wales. The two indices are not strictly directly comparable due to data availability and spatial granularity but provide standalone snapshots of relative fuel poverty across Great Britain. The Scottish Index is fully open source and for purposes of transparency and repeatability this guide provides an open methodology and is accompanied by the underlying data. Data are provided in good faith 'as is' and is the sole product of student effort as part of mentoring activities conducted by EDINA at the University. Each variable that was used in the Index was normalised relative to the individual values for that variable - which means the values presented in the underlying FPI data table do not represent the actual numbers for each local authority - merely the percentage relative to the other local authorities in Scotland. A separate file "Fuel-poverty-index-raw-data-with-calc.csv" is available which contains the raw percentages used for the index along with a table containing the calculations used to obtain the final score and the main FPI data table. An Appendix with example maps are given that were created in the process of making the final index.

Data

The dataset contains 19 different variables. It should be noted that for the purposes of variable weighting to accommodate differential variable importance to the overall index, all the temperature variable and Energy Performance Certificate (EPC)variable values have been multiplied by 2. Similarly, it should be noted that the variables for distance to supermarket, General Practitioner (GP) as well as thermal comfort have been multiplied by 0.5 for weighting purposes. Each variable has been normalised using min max normalisation as follows:

$$x_{scaled} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

This was applied to each variable to scale each local authority on a range of 0 to 100. This scaling is done with respect to each variable separately. This means that there will always be a 0 value and a 100 value in each variable - it does not represent the actual values (percentages) for that local authority, it is merely a way to relatively compare the different areas. Some variables will also have 0 to 200 or 0 to 50 due to the aforementioned weighting being applied.

Since a higher score in this index indicates a higher risk of fuel poverty, the minimum temperature and the annual median pay variables needed to have a slightly different normalisation method applied. This was because a higher temperature means lower home heating required and thus this should be reflected by a lower demand score. The same is true for the annual median pay variable, were by the higher the annual median pay the more likely an individual can afford to heat the dwelling. The minor change to the equation used was:

$$x_{scaled} = 1 - \frac{x - x_{min}}{x_{max} - x_{min}}$$

List of variables composing the FPI

Area Code

The Area Code column contains the area code for each Scottish Local Authority, of which there are 32 in Scotland of various sizes. The S12 part of the values shows that its referring to the local authorities in Scotland and the end two digits is unique to each local authority.

Area

The Area column contains the names of each local authority in Scotland and enables someone to associate the Area Code number with a name. For example S12000026 is shorthand for the Scottish Borders.

tmin average

This variable contains the average minimum monthly temperature of Scottish local authorities from 2013 to 2023. The values were obtained from finding the closest weather station to each local authority centroid and basing the temperature off of the value recorded at that weather station.

tmin average grid

This variable contains the average minimum monthly temperature of Scottish local authorities from 1991 to 2020. These temperatures were taken from the Met Office site that has gridded temperature estimates for the whole of Scotland. This was deemed more accurate than just the nearest weather station that was used in the English version of the FPI. Generally, this is the preferred temperature variable to use as Scotland has very few weather stations relative to its area.

tmin average grid excluding rural areas

This variable contains the average minimum monthly temperatures of Scottish local authorities from 1991 to 2020. These temperatures were taken from the Met Office site that has gridded temperature estimates for the entirety of Scotland, but then were further processed to contain only the urban areas and thus excludes rural areas. This meant that mountains and generally colder uninhabited areas were not included which better reflects the actual temperature profiles that people live in.

epc below C

This variable contains the percentage of dwellings that have an Energy Performance Certificate (EPC) rating lower than C. EPC measures how energy efficient a dwelling is rated. The rating ranges from A to G where C or higher is considered to be 'good' and anything lower than a C requires improvement.

Thermal comfort

This variable contains the percentage of dwellings that are considered not to have a reasonable degree of thermal comfort. Thermal comfort as used in the English FPI does not have any Scottish equivalent - so the variable was changed to the percentage of households that do not have central heating in the main room. This was taken from the Scottish Housing Survey.

Percent of 65

This variable contains the percentage of population that are 65 years or over for Scottish local authorities. This was taken from the Scottish statistics website current population estimates.

Household of 4 or more

This variable contains the percentage of households that have four or more permanent residents. This was taken from the 2011 Scottish census.

PIP percent

This variable contains the percentage of the population that claim Personal Independence Payment (PIP). A PIP is a payment given out by the government for people that have a long term physical or mental health condition or disability and struggle with day-to-day tasks.

Average distance supermarket

This variable contains the average distance to the nearest supermarket by Data Zones contained within the local authorities. The distance was calculated using K-nearest-neighbour in kilometres and takes a straight line between the Data Zone point and the supermarket locations not taking into account roads or paths i.e. it is Euclidean distance.

Average distance GP

This variable contains the average distance to the nearest General Practice (GP). The distance was calculated using K-nearest-neighbour in kilometres and takes a straight line from the data zone point to the GP.

Annual median pay

This variable contains the annual median pay by Scottish local authority using residential address.

percent pension credit

This variable contains the percentage of population that get guaranteed Pension Credit. Pension Credit is an extra payment that can be obtained if someone is over the state pension age and is on low income. In the English FPI this was measured using income deprivation affecting older people but has no Scottish equivalent and so was substituted for by Pension Credit. The guaranteed Pension Credit is a fair equivalent as it shows the areas that have concentrations of older people on a low income.

universal credit percent

This variable contains the percentage of the population that are Universal Credit claimants. Universal Credit is a payment that helps people that are on low incomes, out of work or cannot work and so gives a fair picture of who is struggling to pay for basic amenities.

percent of lone parents

This variable contains the percentage of the population that are lone parents.

Demand

This is a composite variable that contains the averages of all the 'demand' variables from the above list of variables. The FPI defines demand using:

- One temperature variable (grid excluding rural areas)
- epc below C
- Thermal comfort

- Percent of 65
- Household of 4 or more
- pip percent
- Average distance supermarket
- Average distance GP

Ability to pay

This variable is also a composite and contains the averages of all the 'ability to pay' variables from the list of variables above which include:

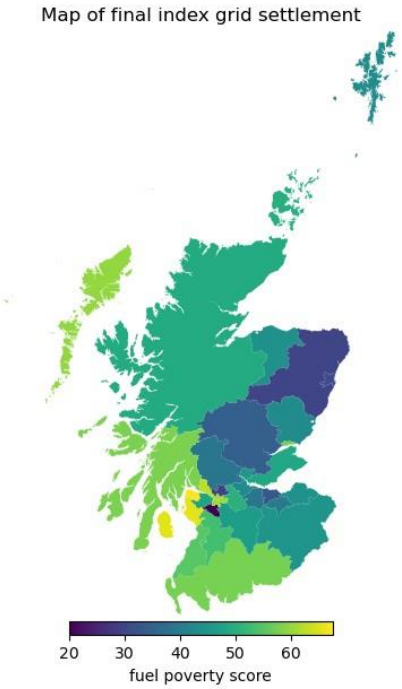
- Annual median pay
- percent Pension Credit
- Universal Credit percent
- percent of lone parents

Fuel Poverty score

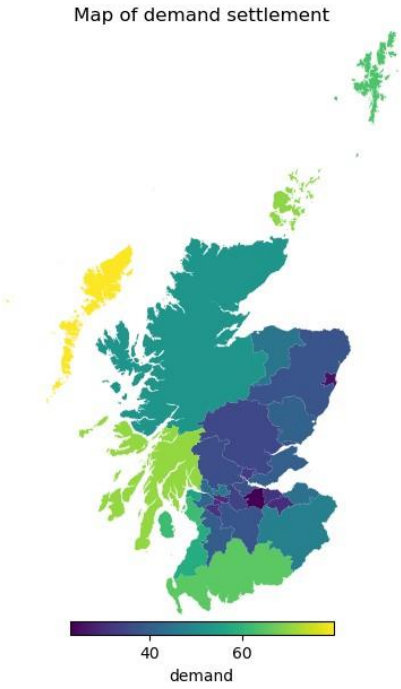
This variable is the computed Fuel Poverty score that takes the average of the demand and ability to pay composite to get the final overall score for each local authority. A low score means the area is at low risk of fuel poverty and a high score means the area is at a high risk of fuel poverty.

Visualisations

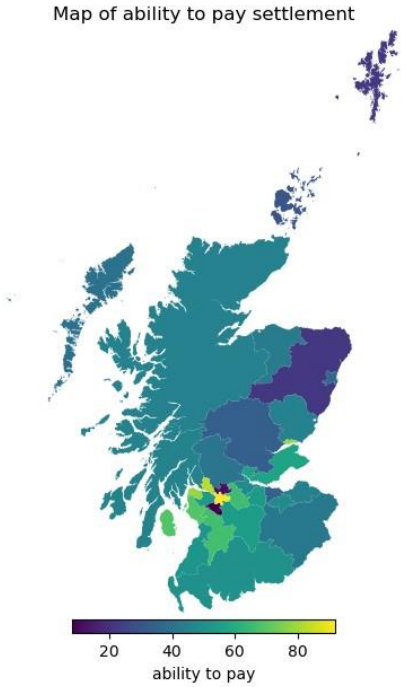
Maps were created to better visualise the FPI and the following maps are some examples created:



(a) Final Fuel Poverty Index

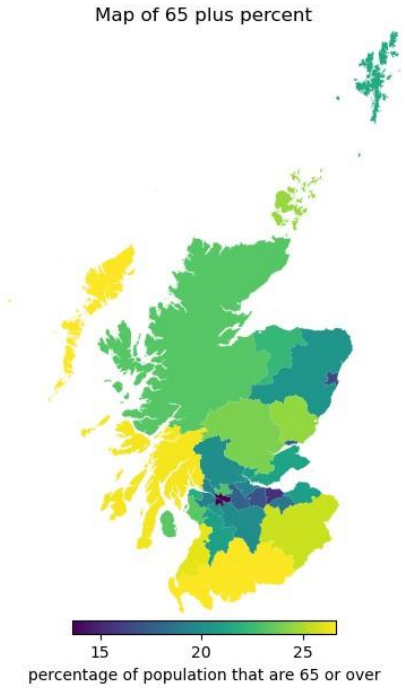


(b) Demand variables

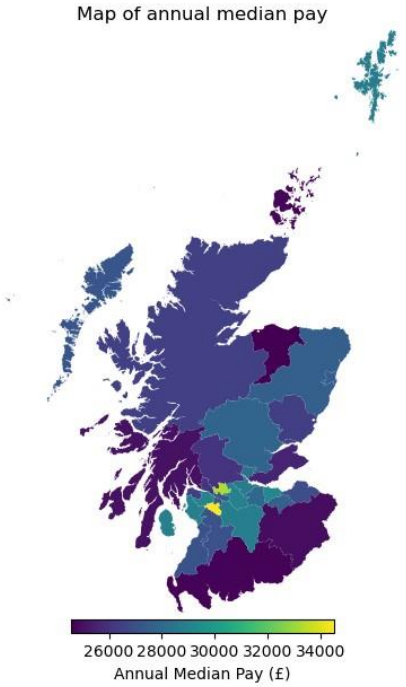


(c) Ability to pay variables

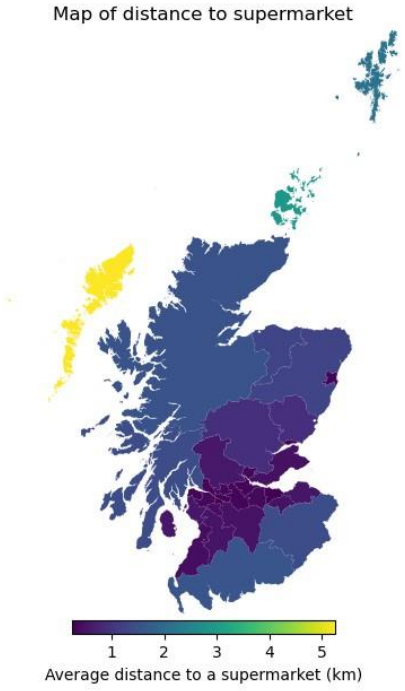
Figure 1: This shows the final Fuel Poverty Index along with its two composite variables - 'demand' and 'ability to pay'. A higher score means areas at a higher risk of fuel poverty, and these are visualised as lighter colours.



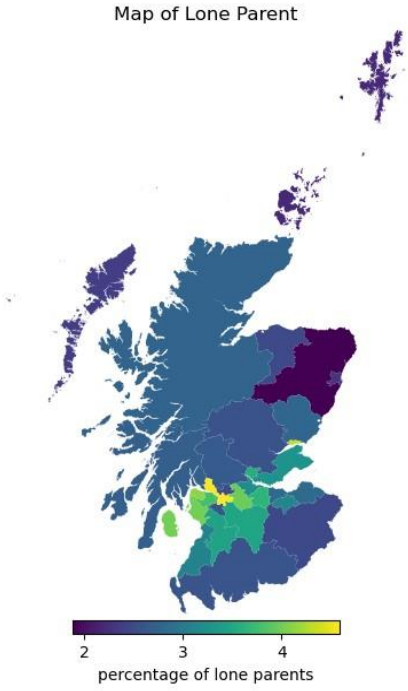
(a) Percentage of the population that are 65 years and over.



(b) The annual median pay for each area.



(b) Average distance to nearest supermarket in kilometres.



(c) Percentage of households that are lone parents.

Figure 2: These figures are a selection of different variables from the final dataset showing aspects that are a byproduct of creating the FPI itself.