

Environmental Impact of Housing in England

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Outline

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English Housing Survey (EHS)

Model A

Multiple Linear Regression

Model B

Multilevel Model

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Problem Setting

Main objective:

- ▶ create an environmental indicator for **housing**.

We aim to:

- ▶ focus on housing efficiency within England;
- ▶ assess accuracy of EPC ratings as an existing metric;
- ▶ describe trends in efficiency at a regional level.

EPC? SAP?

Home energy efficiency and CO2 emissions assessed by

Standard **A**ssessment **P**rocedure

which is used when awarding

Energy **P**erformance **C**ertificate(s)

to homes in the UK.

EPC? SAP?

EPC certificates primarily focus on energy efficiency.

A SAP rating of 1 - 100 informs the band A - G as shown.

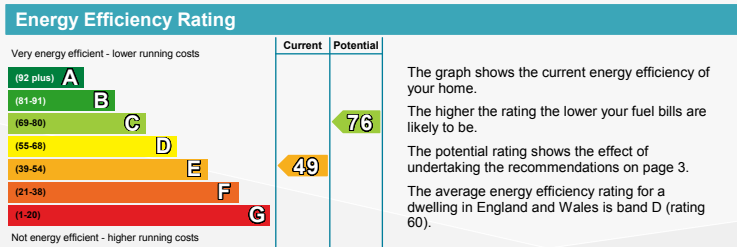


Figure: Sample EPC certificate (Energy Efficiency Rating).

EPC? SAP?

In addition, CO₂ emissions highlighted via an environmental impact rating.

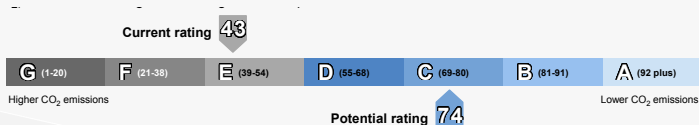


Figure: Sample EPC certificate (Energy Impact Rating).

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Annual national survey of two parts commissioned by DLUHC.

1. **household** interview of occupiers:

- ▶ number of occupants;
- ▶ energy price.

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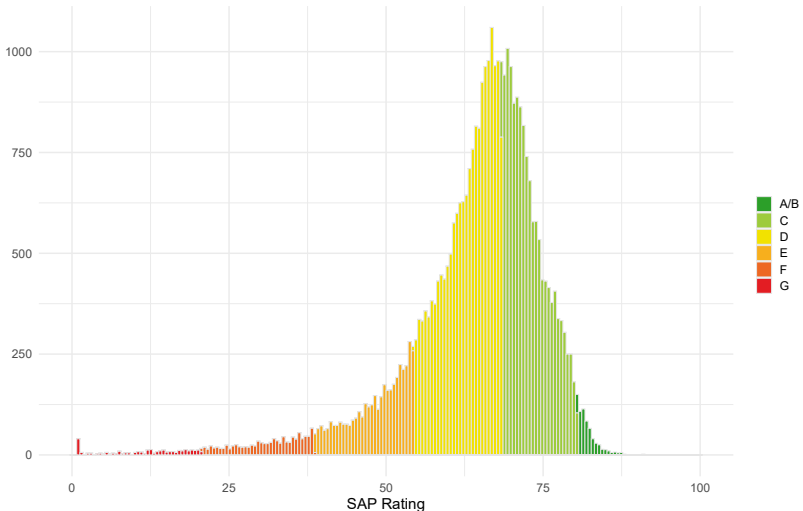
2. physical inspection of the **dwelling**:

- ▶ SAP rating;
- ▶ boiler type;
- ▶ double glazing.

English Housing Survey (EHS)

SAP ratings from 2014 to 2019 (n \approx 37,000)

Mean rating of 64.0 (EPC D)



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Multiple Linear Regression

Following data exploration, we ask:

- ▶ Do SAP ratings describe efficiency accurately?
- ▶ What is (and **is not**) significant to EPC?

Hence, fit a MLR using all relevant features from EHS.

Multiple Linear Regression

All features in EHS are **significant**:

- ▶ boiler type;
- ▶ double glazing;
- ▶ space heating fuel source;
- ▶ water heating system;
- ▶ loft and wall insulation.

EHS gives no data on **renewable technologies**.

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We fit an **intercept only** model as:

$$\text{SAP} = \beta_{\text{Year}} + \gamma_{\text{Year, Region}} + \epsilon$$

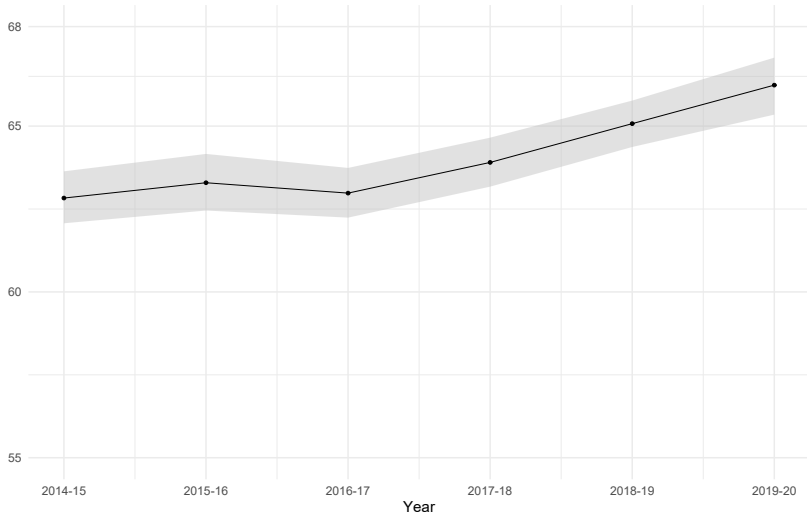
where

- ▶ β represents a population effect, by year;
- ▶ γ represents a region-specific effect, by year;
- ▶ ϵ is a noise term.

Population Effect

Population estimates imply increasing efficiency

Axis scaled to EPC D: (55 - 68)



Regional Effects

Regional-effect estimate(s) close to zero

