ECONOMIC STATISTICS CENTRE OF EXCELLENCE

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DO ENERGY IMPROVEMENTS PAY FOR THEMSELVES IN THE HOUSING MARKET? A MICRO-LEVEL HEDONIC COMPARISON ACROSS ENGLAND AND WALES.

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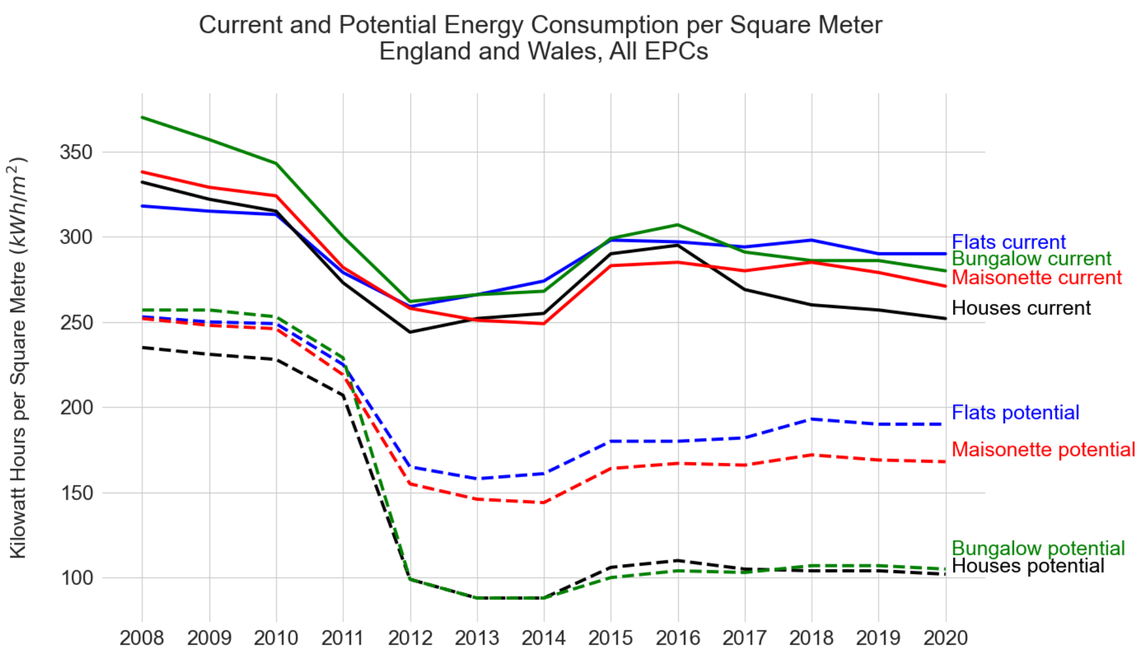
Introduction

- Since 2008, residential property transactions in the United Kingdom must be accompanied by an Energy Performance Certificate (EPC). Around 1.3 million EPCs are issued each year.
- EPCs also include specific recommendations for improving the energy efficiency of the property as well as their estimated cost and potential energy improvements.
- The UK government has set a target to reduce carbon emissions to zero by 2050. As part of this goal, the energy efficiency of all residential buildings should be raised to at least Level C by 2030.



Objectives

We analyze how housing markets value EPC investments.

- **For which regions in UK do the energy improvements recommended in EPCs pay for themselves?**
- **For which regions in the UK do energy improvements up to level C pay for themselves?**

Methodology

1. We estimate regional hedonic models to predict the impact of energy improvements on house prices.
2. Land area is missing for houses. We estimate land areas based on GIS distances between houses.
3. We show the percentage of properties in each ITL region for which the increase in property prices is greater than the cost of implementing EPC recommendations.
4. About six percent of properties do not reach Level C even after implementing all EPC recommendations. For those, we try to find additional improvements to reach Level C.
5. For all other properties below Level C, we estimate the cost of achieving Level C, but not higher.
6. We then show the percentage of properties in each ITL region for which the estimated increase in property prices exceeds the cost of reaching Level C.

Data

We combine 4 datasets:

1. House price transaction data from Land Registry, Price Paid Data (**PPD**)
2. Energy performance certificates (**EPC**)
3. Unique property reference number (**UPRN**)
4. Output area classification (**OAC**)

Hedonic Model

1. Measuring the private incentives to implement energy improvement recommendations in EPCs

A. For each region and property type (i.e., flat, detached house, or semi-terraced house), we estimate the following semi-log regression model:

$$\ln(p_n) = \sum_{c=1}^{C} \beta_c x_{c,n} + \sum_{l=1}^{L} \delta_l d_{l,n} + \theta\, e_n + u_n$$

B. Next, we predict a market price for the current and the potential energy efficiency

$$\hat{p}_n = exp\left(\sum_{c=1}^{C} \hat{\beta}_c x_{c,n} + \sum_{l=1}^{L} \hat{\delta}_l d_{l,n} + \hat{\theta} e_n\right)$$

$$\hat{p}_n^* = exp\left(\sum_{c=1}^{C} \hat{\beta}_c x_{c,n} + \sum_{l=1}^{L} \hat{\delta}_l d_{l,n} + \hat{\theta} e_n^*\right)$$

C. To estimate the private incentive (PI_n) of undertaking the refurbishment for property n, we deduct the cost (k_n) stated in the EPC from the estimated price change of the energy improvement.

$$PI_n = \left(\hat{p}_n^* - \hat{p}_n\right) - k_n$$

2. Measuring private incentives to increase energy efficiency to Level C

A. In addition to the hedonic price model, what is needed is a second hedonic model estimating the energy improvement of each recommendation. This can be used to determine which recommendations are most cost effective for increasing energy efficiency to level C.

$$\Delta e_n = a\ e_n + \sum_{j=1}^{36} \gamma_j\ f_{n,j} + \sum_{k=1}^{9} \delta_k\ d_{n,k} + \epsilon_n, \qquad \text{for } n = 1, \ldots N,$$

B. Again, we then compare the predicted price change $(\hat{p}_n^* - \hat{p}_n)$ with the predicted cost $\hat{k}_n$.

Results

Region	Flats
North East	41.2 %
North West	45.1 %
Yorkshire and The Humber	28.4 %
East Midlands	45.4 %
West Midlands	23.8 %
East	36.3 %
London	47.6 %
South East	38.6 %
South West	33.3 %
Wales	10.8 %

Current Energy Efficiency Class	Flats
A	50.0 %
B	48.4 %
C	36.6 %
D	36.1 %
E	49.6 %
F	55.1 %
G	66.0 %

Percentage of EPC recommended improvements that are cost-effective per ITL region (left) per current energy efficiency rating (right), for Flats, Year 2020