Distributional and climate implications of policy responses to energy price shocks

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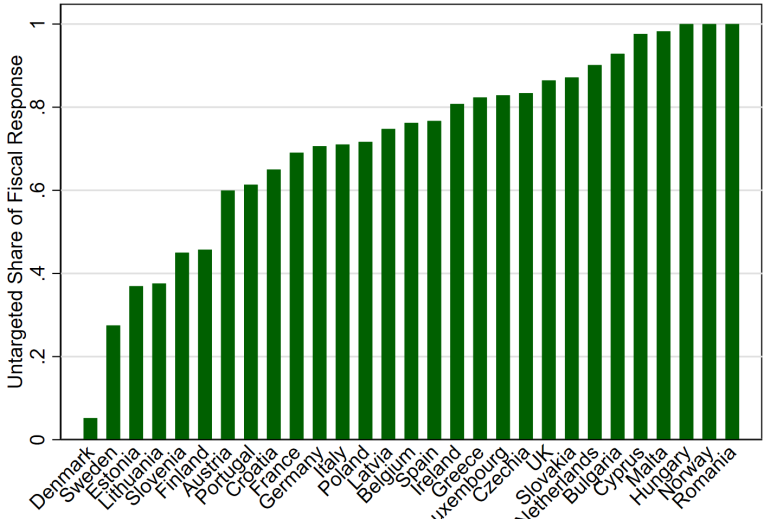
The energy crisis as a trial for carbon taxation in residential sector

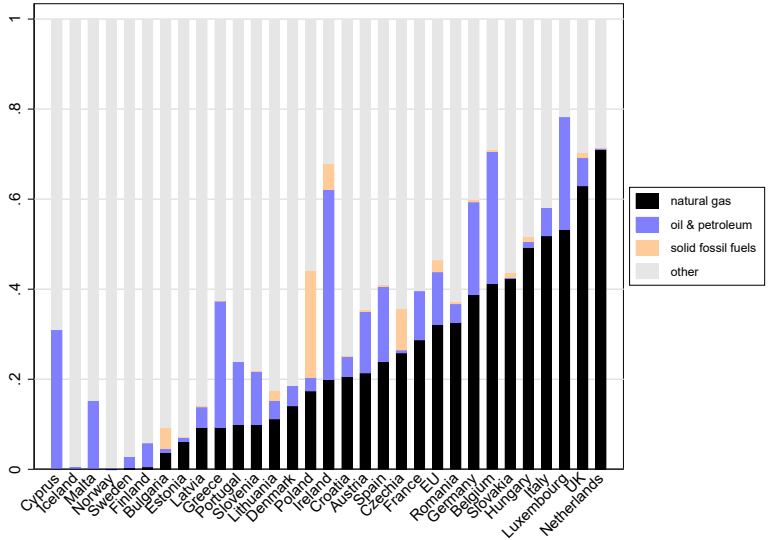
- The residential building sector accounts for 40% of energy consumption and 36% of energy-related GHG emissions in Europe
- The distributional consequences of carbon taxation are unclear
- Absent government interventions, increases in energy prices due to post-pandemic economic recovery & Russian invasion of Ukraine mimic effect of carbon taxes
- Government interventions, instead, might change incentives to invest in energy efficiency
- Growing literature on effects of energy crisis: see e.g. Harari et al., 2022; Bhattacharjee et al., 2022; Bachmann et al., 2022; Fetzer, 2022; Ruhnau et al., 2022

Most EU countries relied on untargeted subsidies to support households during the energy crisis



The UK residential sector lags behind other European countries

- 63% of UK homes rely on gas
- UK homes lose heat faster than in most of Europe
- UK has decent data on energy performance & use



This (and companion) paper

- Build a measure of exposure to energy price shocks using energy performance certificate data "groundtruthed" with area-level energy use data
- Project energy bills under different price policies:
  - Status-quo market prices
  - Energy Price Guarantee (EPG) as implemented (uniform unit-price cap)
  - Counterfactual two-tier tariff, revenue-neutral wrt EPG
- Examine incidence of price shocks at local area level and its determinants under different policy scenarios
- Relevant to understand support for carbon taxation

Road map

1. Data and background
2. Empirical analysis
3. Conclusion

Measuring exposure to energy price shock

- 22 million energy performance certificates (EPC)
- 15 million unique properties in England & Wales ($\sim$ 50% coverage)
- Model-based energy consumption estimates for space heating, hot water generation, & electrical light consumption based on:
  - Building physical characteristics
  - A thermodynamic modelling approach
  - Assumptions on occupancy
- These data clearly misses info on **Who** lives in the property and **How**

Rescaling EPC to account for the "Who & How"

- We use 4 million anonomized individual property level consumption data (NEED)
  - "Stratify" on property and region characteristics
  - Rescale EPC consumption estimates by consumption in same percentile in NEED (get EPC-NEED variable)
  - Still misses local area information (e.g., socioeconomic status)
- Use postcode-level median and mean consumption (BEIS) to rescale both EPC and EPC-NEED
- Take *ensemble* average of EPC, EPC-NEED, EPC-BEIS, EPC-NEED-BEIS
- We still underestimate total energy use likely due to EPC coverage
- We focus on median household in each MSOA (6,791 in England)

Demographic characteristics (MSOA-level)

- 2021 Census:

Category	Covariates
Demographics	Highest qualification, ethnicity, occupation, county and country of birth, age, household size
Deprivation	Unemployment, inactivity
Housing	Tenure, second home, council tax band, occupancy
Property	Dwelling type, dwelling age

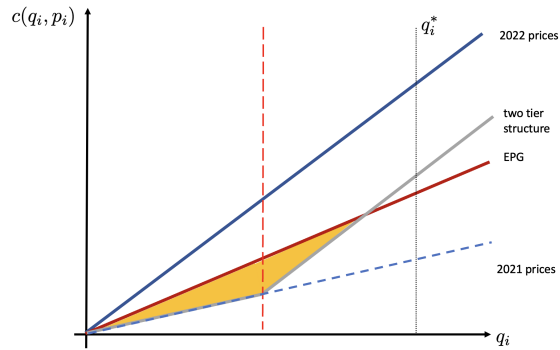
- 2018 model-based income estimates (ONS)
- 2022 fuel poverty rates: energy inefficient property & disposable income $<$ poverty line (BEIS)
- 2021 median property prices per square foot (Land Registry)
- 2019 English Indices of Deprivation (DLUHC)

Energy prices in the UK

- Since 2019, uniform price cap: max that suppliers can charge allowing for modest profits
- Updated every 6 months until October 2022, then quarterly
- Cheapest tariff since summer 2021
- We consider October 2022 prices as **market prices** under energy crisis
- We define difference with October 2021 as **price shock**

Alternative government interventions

- In September 2022, **EPG** reduces per-unit rate to limit average bill to £2,500
- We construct **Two-tier tariff** s.t.:
  - Standing charge fixed per October 2021
  - Tier 1: unit prices for first 9,500 kWh of gas and 2,500 kWh of electricity fixed at October 2021 level (4 pence/kWh for gas; 19-20 for electricity, single-rate vs. multi-register metering)
  - Tier 2: unit price of 20 p/kWh for gas and 60 for electricity
  - Similar cost to government than EPG



(Source: Fetzer 2023 mimeo)

Outline

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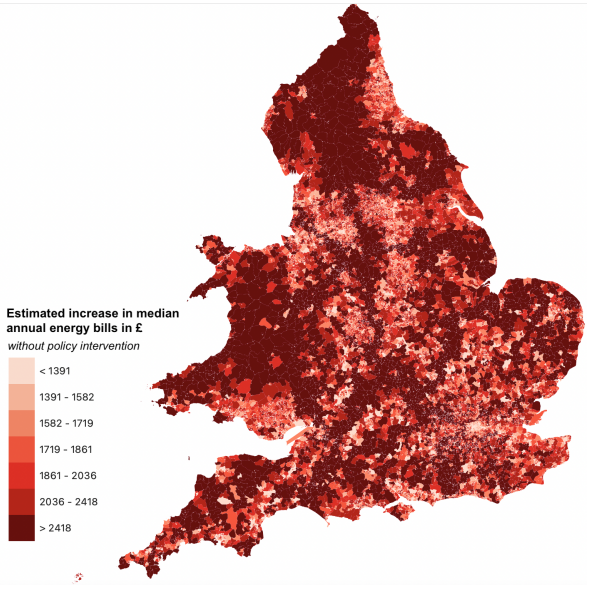
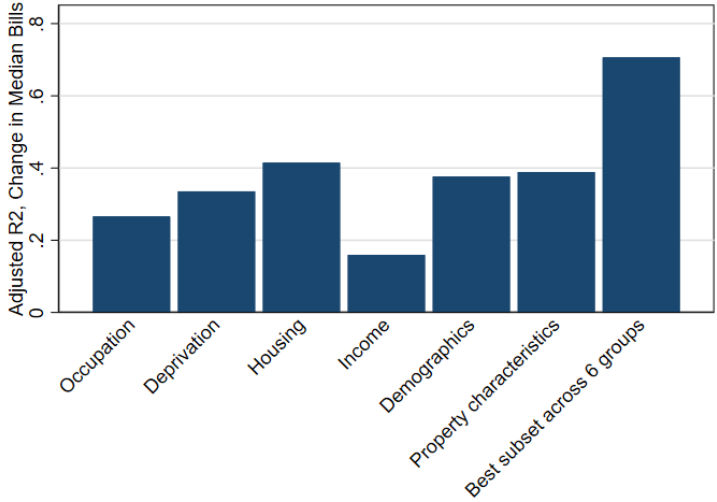
The energy price shock is distributed unequally across space

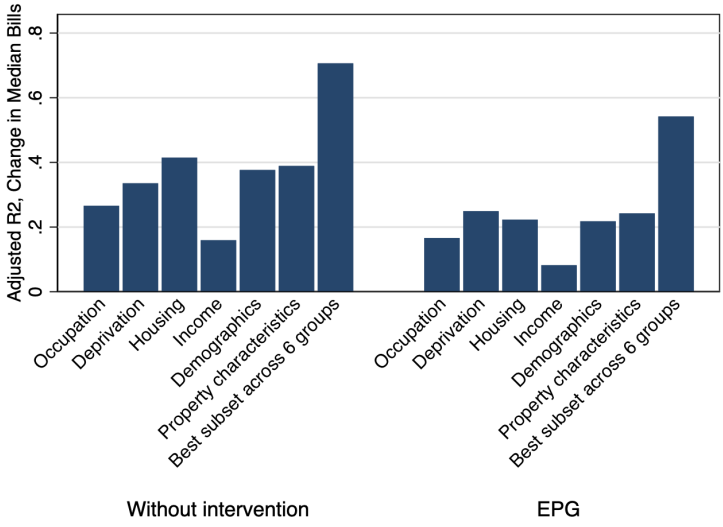


What explains this spatial variation? Correlational analysis

- We perform a best subset selection procedure
- It estimates all regressions including any combination of regressors and returns the model that minimizes an information criterion (AIC)
- We group variables and investigate explanatory power of each group, as well as combined

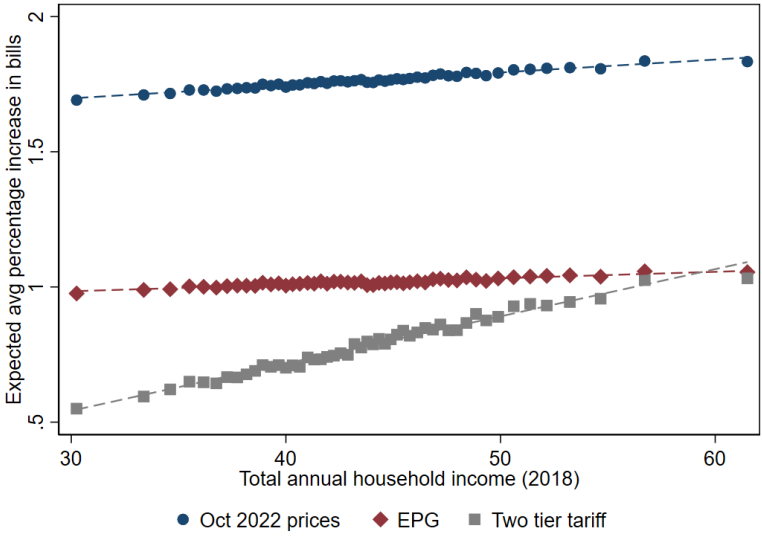


The EPG lowers the explanatory power of area characteristics



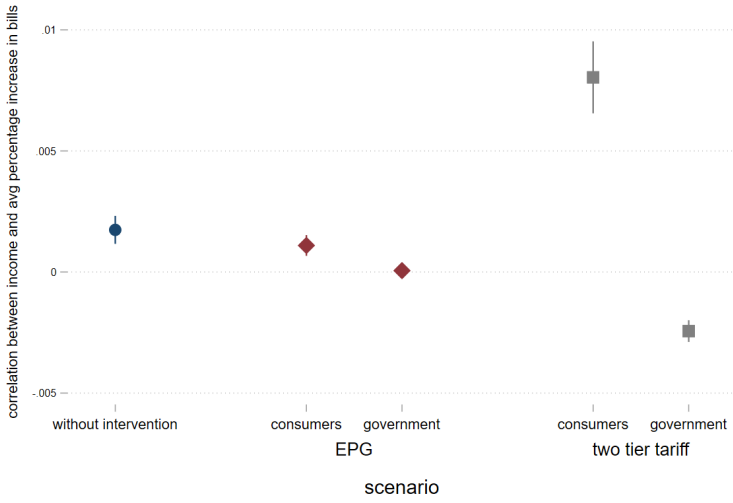
Changes in correlations for individual variables go

A two-tier tariff would increase the income-gradient of the price shock



Under EPG, the government subsidy is uncorrelated with area income

We define the government subsidy for each MSOA as the difference between the consumer-facing shock under market prices and under each policy



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Conclusion

- We develop a measurement framework to model the impact of the energy price shock in the UK and analyze the incidence of actual and counterfactual policy interventions
- Absent intervention, the shock has a larger effect on relatively more affluent areas
- Untargeted subsidies like the EPG disproportionately benefits well-off households who use more energy (and who could invest in energy efficiency)
- Alternative, more targeted policies are cheaper, easily implementable, and could better align incentives
- Our measurement framework provides a set of "pre-registered" hypotheses that can be tested with *ex-post realized* administrative data (energy use, socioeconomic outcomes) (stay tuned!)

Thank You!

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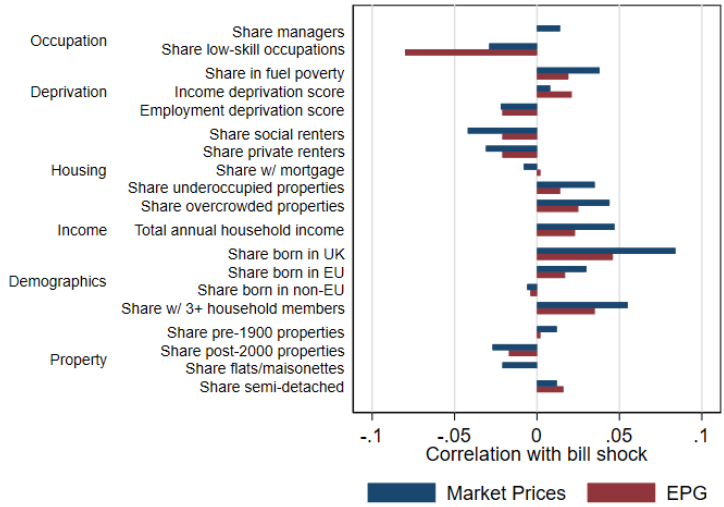
Changes in correlation



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