Household Heuristics & Price Shocks

Benedict Guttman-Kenney

University of Chicago, Booth School of Business

BE Lab, August 2022

Today!

- NOT my JMP.
- Early work.
- Want feedback whether to reallocate effort to turn into paper OR kill (N other projects so killing is fine)
- BE Lab effective commitment device.

One Slide Summary

Research Question:

- (How) Do heuristics respond to price shocks?

One Slide Summary

Research Question:

- (How) Do heuristics respond to price shocks?
- Externalities of heuristics on other spending?

One Slide Summary

Research Question:

- (How) Do heuristics respond to price shocks?
- Externalities of heuristics on other spending?

Data:

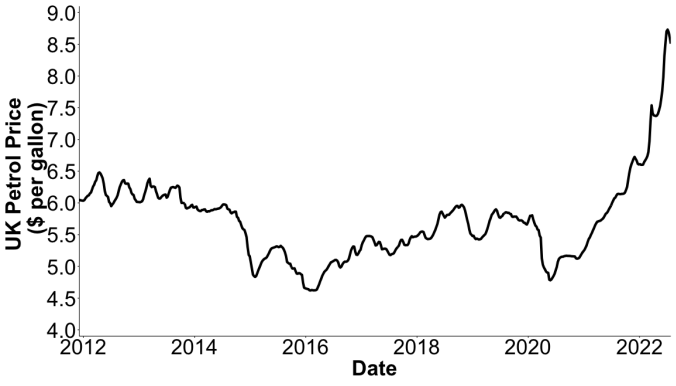
- Real-time UK credit card transactions data (fable data).

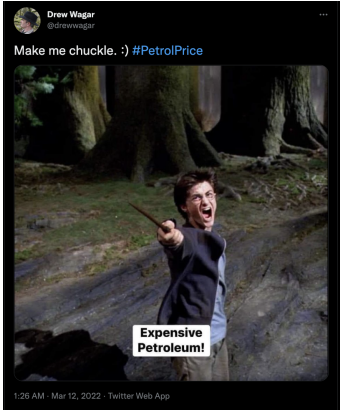
Empirical Methodology:

- Describe heuristics in transaction-level data.
- Causal analysis exploiting differential consumer exposures to exogenous price shocks.

Two Motivating Facts

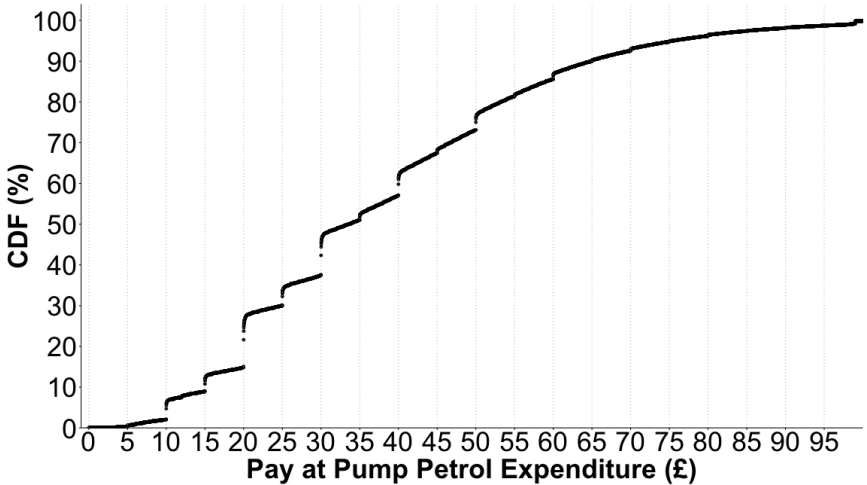
FACT 1: UK Petrol (Gas) Prices ↑ 40% p.a. in 2022 and ↑ 66% since 2020





(in old money... £1.86 per litre in July 2022)

FACT 2: UK Petrol (Gas) Expenditures Commonly at Round Numbers



Motivation in Literature

- **Petrol** macroeconomically important household expenditure (with volatile prices)
  (e.g. Hastings & Shapiro, 13; Lynn, Flynn & Helion, 13; Levin et al., 17; Gelman et al., 22; Gelman & Roussanov, 22)
- Relatively little known about dynamics of **heuristics** / mental accounts
  (e.g. Thaler, 85; Loewenstein & Prelec, 98; Heath, Larrick & Wu, 99; Pope & Simonsohn, 10; Lacetera, Pope & Sydnor, 12; Drexler, Fischer & Schoar, 14; Gathergood, Mahoney, Stewart & Weber, 19; Argyle, Nadauld & Palmer, 20; Köszegi & Matejka, 20; Dube, Manning & Naidu, 20; Akepanidtaworn, Di Mascio, Imas & Schmidt, 22; Strulov-Shlain, 22; Zhang, Sussman, Wang-Ly & Lyu, 22)
- Large macroeconomics literature estimating **consumption** showing heterogeneity matters
  (e.g. Shapiro, 05; Parker, 14, Kaplan & Violante, 14; Kueng, 18; Ganong & Noel, 19; Fagereng, Holm & Natvik, 20, Havranek & Sokolova, 20; Ganong et al. 21; Golosov et al., 21)

Stylized Example

Suppose consumer's heuristic of petrol spending:

$$(PQ) = £30 \text{ each petrol station visit.}$$

What happens when $P \uparrow$?

Stylized Example

Suppose consumer's heuristic of petrol spending:

$$(PQ) = £30 \text{ each petrol station visit.}$$

What happens when $P \uparrow$? Lots of potential margins of adjustment:

1. **Keep heuristic** $\rightarrow$ purchase $\downarrow$ Q per visit & $\uparrow$ # visits.

Stylized Example

Suppose consumer's heuristic of petrol spending:

$$(PQ) = £30 \text{ each petrol station visit.}$$

What happens when $P \uparrow$? Lots of potential margins of adjustment:

1. **Keep heuristic** $\rightarrow$ purchase $\downarrow$ Q per visit & $\uparrow$ # visits.
2. **Change (or stop using) heuristic** $\rightarrow$ purchase $\uparrow$ Q per visit (e.g. fill tank, target Q).

Stylized Example

Suppose consumer's heuristic of petrol spending:

$$(PQ) = £30 \text{ each petrol station visit.}$$

What happens when $P \uparrow$? Lots of potential margins of adjustment:

1. **Keep heuristic** $\rightarrow$ purchase $\downarrow$ Q per visit & $\uparrow$ # visits.
2. **Change (or stop using) heuristic** $\rightarrow$ purchase $\uparrow$ Q per visit (e.g. fill tank, target Q).
3. **Change driving** $\rightarrow \downarrow$ # visits (e.g. fewer miles, increase efficiency)

Stylized Example

Suppose consumer's heuristic of petrol spending:

$$(PQ) = £30 \text{ each petrol station visit.}$$

What happens when $P \uparrow$? Lots of potential margins of adjustment:

1. **Keep heuristic** $\rightarrow$ purchase $\downarrow$ Q per visit & $\uparrow$ # visits.
2. **Change (or stop using) heuristic** $\rightarrow$ purchase $\uparrow$ Q per visit (e.g. fill tank, target Q).
3. **Change driving** $\rightarrow \downarrow$ # visits (e.g. fewer miles, increase efficiency)

Other non-heuristic consumers may *start* using heuristic
(e.g. used to fill tank in full but can no longer afford to so instead fill up £30).

Stylized Example

Suppose consumer's heuristic of petrol spending:

$$(PQ) = \text{£}30 \text{ each petrol station visit.}$$

What happens when $P \uparrow$? Lots of potential margins of adjustment:

1. **Keep heuristic** $\rightarrow$ purchase $\downarrow$ Q per visit & $\uparrow$ # visits.
2. **Change (or stop using) heuristic** $\rightarrow$ purchase $\uparrow$ Q per visit (e.g. fill tank, target Q).
3. **Change driving** $\rightarrow \downarrow$ # visits (e.g. fewer miles, increase efficiency)

Other non-heuristic consumers may *start* using heuristic
(e.g. used to fill tank in full but can no longer afford to so instead fill up £30).

Externalities of petrol purchasing decision on other expenditures?
(e.g. spend less on groceries)

Data

Fable Data

- Credit cards spending for consumers + SMEs 2016 to yesterday for UK (+ European countries).
- Data fully disaggregated at transaction-level (e.g. £30.00 spent at Shell on 5 January 2020.)
- Can follow individual cards over time.
- N.b. Don't observe debit cards or cash spending.

Data

TAGGING

- Petrol expenditures tagged via (i) payment processor; (ii) merchant category code (MCC) (iii) transaction string:
  - **Narrow:** Pay at the pump transactions (only petrol).
  - **Broad:** Petrol station transactions (may include some non-petrol spend).
- Round number expenditures tagged if multiples of £5.00.

Data

TAGGING

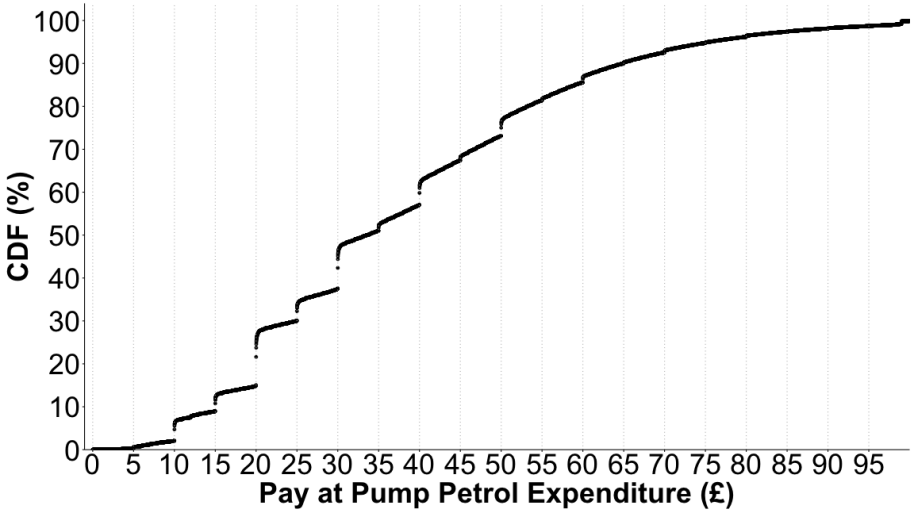
- Petrol expenditures tagged via (i) payment processor; (ii) merchant category code (MCC) (iii) transaction string:
  - **Narrow:** Pay at the pump transactions (only petrol).
  - **Broad:** Petrol station transactions (may include some non-petrol spend).
- Round number expenditures tagged if multiples of £5.00.

SAMPLE

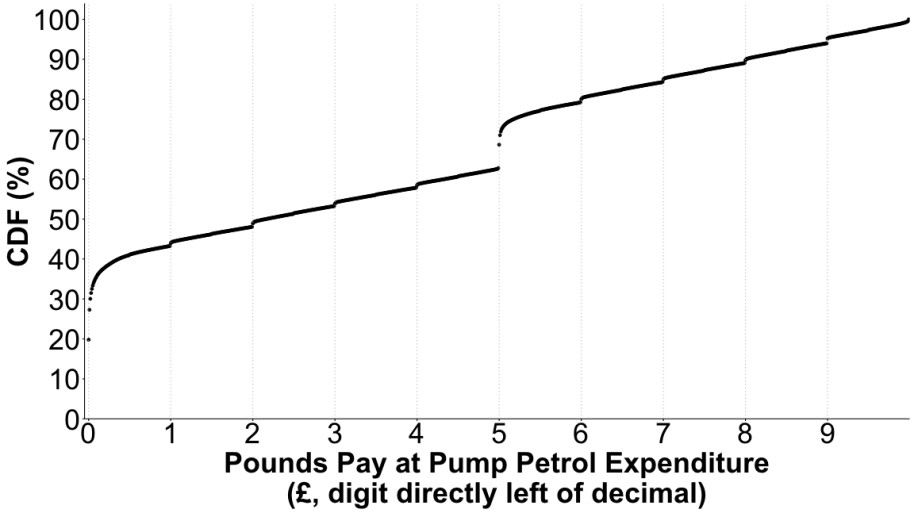
- Descriptive analysis (CDFs and time series) using repeated cross-section.
- Balanced Panel of 20k UK cards spending £250 in June 2020 and June 2022 and with spending every month.

Descriptive Analysis

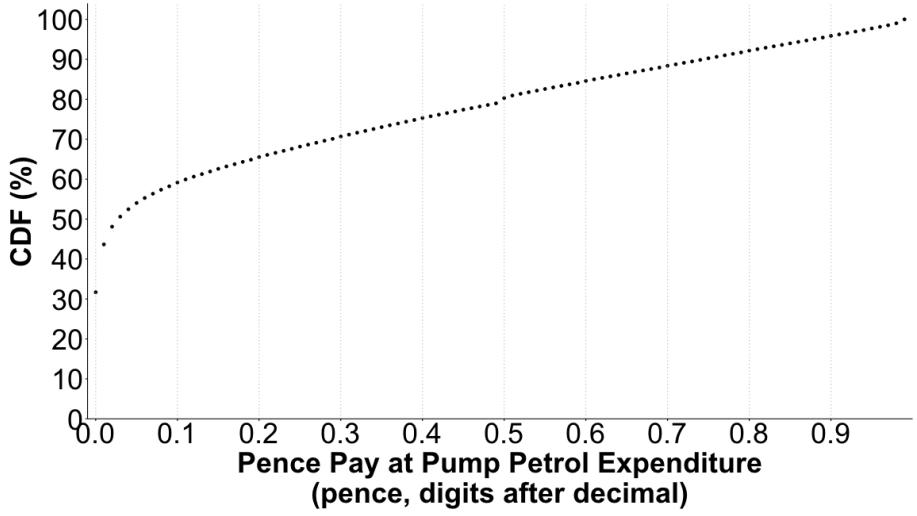
UK Petrol (Gas) Expenditures Commonly at Round Numbers



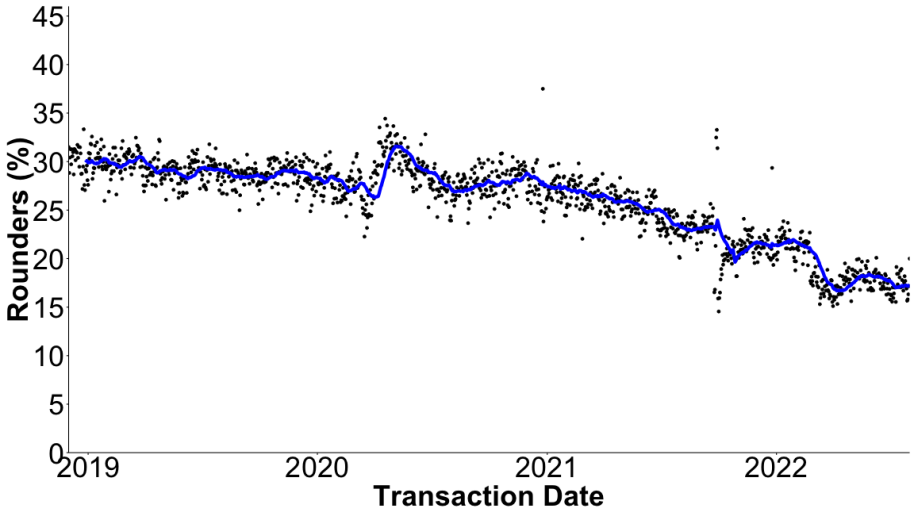
UK Petrol (Gas) Expenditures Commonly at Round Numbers - Pounds



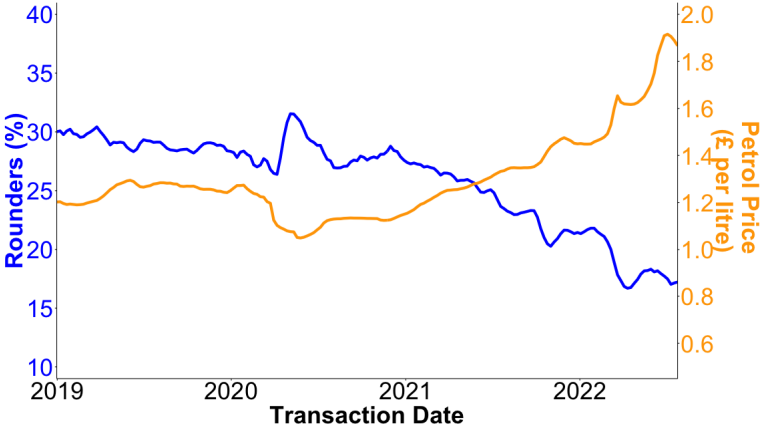
UK Petrol (Gas) Expenditures Commonly at Round Numbers - Pence



Round Number Expenditures (% Pay at Pump Expenditures) Over Time



Weekly Petrol Prices (orange) Vs. Round Number Expenditures (blue)



Correlation: -0.89

Causal Methodology

Effect of Petrol Shock on Petrol Expenditure:

$$\Delta_k log(P_t Q_{i,t}) = \delta_k \big(\Delta_k log(P_t)\big) + u_{i,t} \qquad (I)$$

Where:

- i is card, t is time (e.g. week or month).
- P_t is average petrol price (from UK government).
- $(P_t Q_{i,t})$ is petrol expenditure on card i at time t.
- Δ_k is k differences

Effect of Petrol Shock on Petrol Expenditure:

$$\Delta_k log(P_t Q_{i,t}) = \delta_k \big(\Delta_k log(P_t)\big) + u_{i,t} \quad \text{(I)}$$

Effect of Petrol Shock on Non-Petrol Expenditure:

$$\Delta_k log(C_{i,t}) = \beta_k \big(s_i \times \Delta_k log(P_t)\big) + \phi_t + \theta_{i,t} \quad \text{(II)}$$

Where:

- $C_{i,t}$ is non-petrol expenditure on card i at time t.
- $s_i = \frac{(\overline{PQ})_{i,pre}}{\bar{C}_{i,pre}}$ is pre-price shock petrol share of card expenditure.

Effect of Petrol Shock on Petrol Expenditure:

$$\Delta_k log(P_t Q_{i,t}) = \delta_k \big(\Delta_k log(P_t)\big) + u_{i,t} \quad \text{(I)}$$

Effect of Petrol Shock on Non-Petrol Expenditure:

$$\Delta_k log(C_{i,t}) = \beta_k \big(s_i \times \Delta_k log(P_t)\big) + \phi_t + \theta_{i,t} \quad \text{(II)}$$

Marginal Propensities for Expenditures (MPX):

$$MPX_k \equiv -\frac{\beta_k}{\delta_k} \quad \text{(III)}$$

(N.b. MPX $\approx 3\times$ MPC see Laibson, Maxted & Moll, 22)

Effect of Petrol Shock on Petrol Expenditure:

$$\Delta_k log(P_t Q_{i,t}) = \delta_k \big(\Delta_k log(P_t)\big) + u_{i,t} \quad \text{(I)}$$

Effect of Petrol Shock on Non-Petrol Expenditure:

$$\Delta_k log(C_{i,t}) = \beta_k \big(s_i \times \Delta_k log(P_t)\big) + \phi_t + \theta_{i,t} \quad \text{(II)}$$

Marginal Propensities for Expenditures (MPX):

$$MPX_k \equiv -\frac{\beta_k}{\delta_k} \quad \text{(III)}$$

(N.b. MPX $\approx 3\times$ MPC see Laibson, Maxted & Moll, 22)

Causal Methodology: Heterogeneity By Rounders

- Re-estimate separately for $R \in \{Rounder, Non - Rounder\}$.
- Rounder defined using pre-price shock
  petrol transactions behavior.
- Check sensitivity to:
  - Rounding on pay at the pump vs. petrol station transactions
  - Definitions (e.g. any, majority, all rounding trips)
  - Pre-period windows (e.g. trips in 3, 6, 12 months)

Also causally examine (i) heuristic use (ii) visit frequency.

N.b. expect rounders to be lower income than non-rounders:
- residualize / control for this.

Causal Methodology: Heterogeneity By Rounders

- Re-estimate separately for $R \in \{Rounder, Non - Rounder\}$.

Effect of Petrol Shock on Petrol Expenditure:

$$\Delta_k log(P_t Q_{i,t}^R) = \delta_k^R \left(\Delta_k log(P_t)\right) + u_{i,t}^R \quad (1)$$

Effect of Petrol Shock on Non-Petrol Expenditure:

$$\Delta_k log(C_{i,t}^R) = \beta_k^R \left(s_i^R \times \Delta_k log(P_t)\right) + \phi_t^R + \theta_{i,t}^R \quad (2)$$

Marginal Propensities for Expenditures (MPX):

$$MPX_k^R \equiv -\frac{\beta_k^R}{\delta_k^R} \quad (3)$$

Can also examine other heuristics in other domains

Asda says some shoppers cashiers to stop at £30

By Emma Simpson
Business correspondent, BBC News

22 June

Thank you!

Any follow-ups:

 benedict@chicagobooth.edu

 @gk_ben

 www.benedictgk.com