

# ECB FORUM ON CENTRAL BANKING

26–28 June 2023



## Lukas Nord



### SHOPPING, DEMAND COMPOSITION, AND EQUILIBRIUM PRICES



EUROPEAN CENTRAL BANK  
EUROSYSTEM

# Shopping, Demand Composition, and Equilibrium Prices

**Lukas Nord**  
lukasnord.eu  
lukas.nord@eui.eu



## The Idea

Significant **dispersion** in posted retail prices for **identical** products (20% of avg. price at the barcode level).

In the goods market, heterogeneous households...

- ... do not pay the same price for identical products (**search for prices**). → het. **price elasticities** across households
- ... do not buy the same basket of products (**non-homotheticities**). → het. **demand composition** across goods

- retailer: optimal markup (posted price) changes with demand composition
- **equilibrium: posted price distributions depend on the distribution of households**

### This paper:

1. How does household heterogeneity affect posted retail prices?
2. What are the consequences for inequality?
3. What are the implications for the response of prices to aggregate shocks?

## Theory

**Equilibrium theory** of expenditure inequality and price dispersion:

"Aiyagari meets Burdett-Judd with multiple products"

- idiosyncratic **income risk** and endogenous asset distribution
- non-homothetic preferences → differences in **consumption baskets**
- **search for prices** → search more = pay less for identical product
- **search frictions**: HHs draw at random from posted price distribution
- **retailers** post prices and trade off **higher margin vs. higher sales** → multiple endogenous price distributions

$$\pi_j(p) = \frac{C_j}{M_j} \underbrace{[(1 - \bar{s}_j) + \bar{s}_j 2(1 - F_j(p))]}_{\text{sales per demand (market share)}} \underbrace{(p - \kappa_j)}_{\text{margin per sale}} - K_j$$

demand per seller

**Main mechanism**: retailers target **demand weighted** search effort

$$C_j = \int \lambda(e) c_j(e) de \quad \bar{s}_j = \int \frac{\lambda(e) c_j(e)}{C_j} s(e) de$$

- composition of demand determines **average price elasticities**
- lower **avg. posted prices** if product bought by high-search HHs
- **skewness** of price distributions increases only in search effort
- driven by share of low vs. high prices tracking retailers' tradeoff → **testable condition** for main mechanism

## Data

**Nielsen Consumer Panel:**

- barcode-level quantity & price of HHs' grocery transactions
- information on HHs: income, location, age, size,...
- information on products (barcode): type, brand, size,...

**Test the mechanism:**

- skewness of price distributions by barcode-region-quarter
- proxy for search effort with demand share of high-/low- search HHs
- control for product type and region-quarter FE

$$skew_{j,r,q} = \theta_m + \mu_{r,q} + \sum_{g=2}^G \beta_g expshare_{j,g,y(q)} + \varepsilon_{j,r,q}$$

	all (1)	by expenditures working age (2)	by income working age (3)	by employment all (4)
expenditure quintile 2	-1.638*** (0.242)	-1.467*** (0.206)	income 30k-60k -0.136 (0.133)	1 non-employed household head 0.864*** (0.115)
expenditure quintile 3	-2.309*** (0.256)	-2.076*** (0.221)	income 60k-100k -0.824*** (0.155)	2 non-employed household heads 1.011*** (0.210)
expenditure quintile 4	-3.067*** (0.258)	-2.582*** (0.219)	income >100k -0.820*** (0.139)	
expenditure quintile 5	-3.412*** (0.253)	-3.007*** (0.224)		
FE product module	X	X	X	X
FE quarter-SMA	X	X	X	X
Observations	3,026,551	3,026,404	3,026,404	3,026,551

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

## Retailers' Optimal Price Posting Reduces Inequality

**Decomposition of expenditures:**

- price differences within same product
- price differences across close substitutes

- price differences within product & close substitutes explain ~10% of inequality in grocery spending

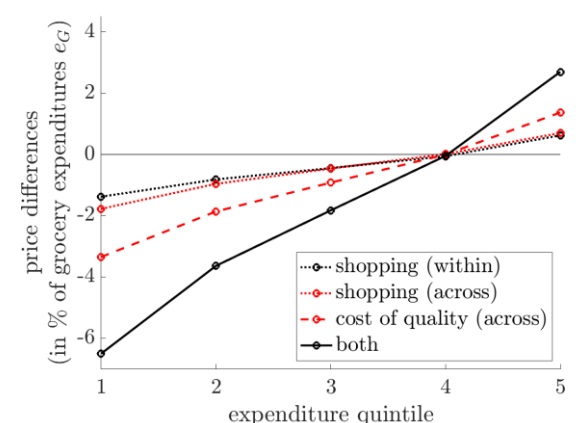
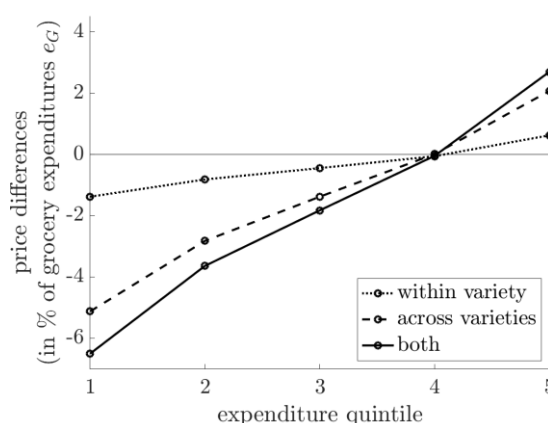
**Contribution of price search to inequality:**

- **direct effect of price search**: pay less for same product → price differences for same variety
- **equilibrium effect**: lower average price if others search → part of difference in avg. price across varieties → disentangle from "cost of quality" (marginal cost)

- search frictions account for 50% of price differences (25% direct / 25% equilibrium effect)

$$e_i^G = \underbrace{\sum_k \sum_{j \in J_k} (p_{ijk} - \hat{p}_{jk}) c_{ijk}}_{\text{within varieties (direct effect of shopping)}} + \underbrace{\sum_k \sum_{j \in J_k} (\hat{p}_{jk} - \bar{p}_k) c_{ijk}}_{\text{across varieties}} + \sum_k \sum_{j \in J_k} \bar{p}_k c_{ijk}$$

$$= \underbrace{\sum_k \sum_{j \in J_k} (p_{ijk} - \hat{p}_{jk}) c_{ijk}}_{\text{margin differences (direct+equilibrium effect of shopping)}} + \underbrace{((\hat{p}_{jk} - \kappa_{jk}) - (\bar{p}_k - \bar{\kappa}_k)) c_{ijk}}_{\text{cost of quality}} + \sum_k \sum_{j \in J_k} \bar{p}_k c_{ijk}$$



## Response of Prices Changes with the Incidence of Aggregate Shocks

**Empirical evidence on cyclicity of retail prices/markups:**

- acyclical to unemployment: Anderson et al. (2020), Coibion et al. (2015)
- procyclical to house prices: Stroebel and Vavra (2019)

**This paper:** incidence of demand shocks matters for cyclicity

- simulate incidence of earnings and wealth losses during Great Recession → wealth losses concentrated among rich households → earnings losses (unemployment) concentrated among poor households

- search frictions generate 0.6pp fall in retail prices on impact
- response accounted for (almost) entirely by wealth losses

- differential response driven by **changing demand composition**:
  - earnings losses reallocate relative demand to high-income (low search) HHs
  - reallocation of demand offsets higher search effort by low income HHs
  - for wealth losses both effects increase demand weighted search effort

