Do Poor Households Pay Higher Markups in Recessions?

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September 12, 2024

NYU Stern Macro Lunch

"Researcher(s)' own analyses calculated (or derived) based in part on data from Nielsen Consumer LLC and marketing databases provided through the NielsenIQ Datasets at the Kilts Center for Marketing Data Center at The University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ data are those of the researcher(s) and do not reflect the views of NielsenIQ. NielsenIQ is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein."

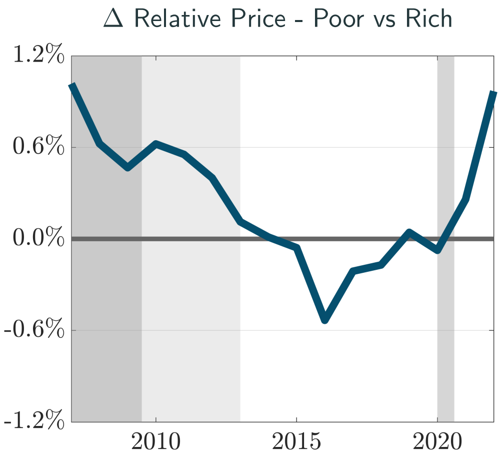
Motivation

- Recessions disproportionately impact low-income households
  - Great recession: nominal income fell by **11%** for poor, **6%** for rich
- Poor and rich households consume different goods and, thus, face different prices
- **This paper:** in recessions, prices for poor increase relative to prices for rich
  - Focus on role of **markups** in relative price movements
- Quantitative model isolates markup channel
  - Great recession: real income fell by **16%** for poor, **5%** for rich

My Argument

- Interpret evidence on consumer spending patterns through model with
  - Nonhomothetic preferences $\rightsquigarrow$ quality margin
  - Oligopolistic competition $\rightsquigarrow$ market power increases in market shares
- **Intuition** for low-quality producers (catering to poor consumers):
  - In **normal times**, compete with high-quality producers for middle class
    - This competition keeps low-quality markups low
  - In **recessions**, middle-class consumers flock to low-quality products
    - This severs the competitive link between quality tiers

Percentage Change in Relative Törnqvist Price Indices Over Time



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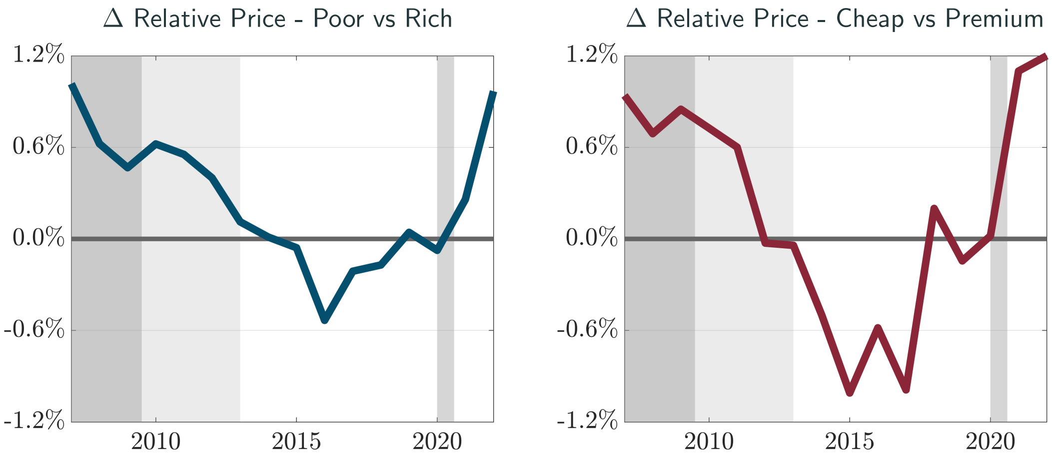

This Paper

- **Data:** Three facts about **consumer behavior** from the NielsenIQ Consumer Panel
  1. Rich households spend relatively more on pricier, high-quality goods
  2. Middle-class households mix cheap and expensive varieties **[new]**
  3. Household-level price elasticities decrease in household-level spending shares **[new]**
- **Model:** Nonhomothetic preference structure which **tractably** reproduces those facts
- **Quantitatively:** Feed observed changes in spending during Great Recession into model
  - Relative price of lower-quality goods increased by **5.42%**
- **Policy:** Redistribution increases prices of lower-quality goods even further

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- Model Environment
  - Nonhomothetic Preferences
  - Micro Evidence
  - Firms & Price-Setting
- Quantification
- Markup Response in Great Recession
- Redistribution in Bewley-Aiyagari-Hugget Model

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Varieties

Household h choose $\{c_{hiqs}\}$ to maximize real consumption c_h

Composite Consumption c_h

Sectors s — milk ········· coffee ········· earphones

Quality q — low | high

Producers (i, q, s) — Folgers, KEURIG (low); La COLOMBE COFFEE, BLUE BOTTLE COFFEE (high)

Preferences

- Household h has nested **nonhomothetic** preferences

- Outer nest over sectors

$$\int_{\mathcal{S}} \left(\frac{c_{hs}}{c_h}\right)^{\frac{\eta-1}{\eta}} ds = 1$$

  with $\eta \geq 1$

- Inner nest makes a **quality distinction**

$$\sum_{q=1}^{Q} \sum_{i=1}^{N_{qs}} \left(\varphi_q \right)^{\frac{1}{\sigma}} \left(\frac{c_{hiqs}}{c_{hs}}\right)^{\frac{\sigma-1}{\sigma}} = 1 \quad \forall \quad s \in \mathcal{S}$$

  where $\sigma > \eta$ and φ_q is a taste shifter

Programs Hicksian Demand

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with $\eta \geq 1$

- Inner nest makes a **quality distinction** [Comin, Lashkari, and Mestieri (2021)]

$$\sum_{q=1}^{Q} \sum_{i=1}^{N_{qs}} \left(\frac{\varphi_q}{\boldsymbol{c_{hs}}^{(\sigma-1)(\boldsymbol{\xi_q}-1)}} \right)^{\frac{1}{\sigma}} \left(\frac{c_{hiqs}}{c_{hs}} \right)^{\frac{\sigma-1}{\sigma}} = 1 \quad \forall \quad s \in \mathcal{S}$$

where $\sigma > \eta$, φ_q is a taste shifter, and $\boldsymbol{\xi_q}$ governs quality appreciation across $\boldsymbol{c_{hs}}$

Sectoral Expenditure Shares Depend on Sectoral Consumption

- Within-sector **expenditure share** on variety (i, q, s) of a household with $\boldsymbol{c_{hs}}$

$$x_{iqs}(\boldsymbol{c_{hs}}, \boldsymbol{p}_s) = \underbrace{\left(\frac{\varphi_q}{\boldsymbol{c_{hs}}^{(\sigma-1)(\boldsymbol{\xi_q}-1)}} \right)}_{\text{Taste Shifter}} \left(\frac{p_{iqs}}{\underbrace{p_s(\boldsymbol{c_{hs}}, \boldsymbol{p}_s)}_{\text{Price Index ►}}} \right)^{1-\sigma}$$

- Spending shares on low-ξ (high-ξ) goods increase (decrease) in sectoral consumption
  - Low-ξ goods are high-quality goods (mostly consumed by rich households)
  - High-ξ goods are low-quality goods (mostly consumed by poor households)

Consumers' Price Elasticities Decrease in Sectoral Expenditure Shares

- **Price elasticity** of variety (i, q, s) for a household with $\boldsymbol{x_{hiqs}} = x_{iqs}(\boldsymbol{c_{hs}}, \boldsymbol{p}_s)$

$$\varepsilon_{iqs}(\boldsymbol{x_{hiqs}}) = \left(1 - \boldsymbol{x_{hiqs}}\right) \underbrace{\sigma}_{\text{Within-Sector}} + \underbrace{\boldsymbol{x_{hiqs}}\, \eta\, \zeta_{qs}\left(\boldsymbol{x_{hiqs}}\right)}_{\text{Across-Sector Substitution}}$$

- Household-level price elasticities decrease in household-level spending shares
- Parsimoniously parameterized with $\{\eta, \sigma, \xi_q\}$
- Expenditure shares x_{hiqs} are **sufficient** to capture cross-sectional heterogeneity in ε_{iqs}

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Empirical Foundation of Modeling Choices

- Preferences are based on consumption patterns along the expenditure distribution

- Specific choice of functional form delivers on three key observations in **micro data**:

    1. Rich consumers spend relatively more on expensive goods
    2. Middle-class consumers mix between cheap and expensive goods **[new]**
    3. Households are least price-elastic vis-à-vis their favored type of variety **[new]**

- Primary dataset is the **NielsenIQ HomeScan Consumer Panel**

▸ Data

Price Premium

- For each region and time, compute an **average** price_{irt} for each barcode i

- For across-module comparability, define a **barcode premium score**

$$\text{premium}_i \equiv \frac{\text{price}_{irt} - \alpha_{\text{module}} - \alpha_{\text{region}} - \alpha_{\text{module} \times \text{region}} - \alpha_{\text{time}}}{\sigma_{\text{module}}}$$

- For instance, in Manhattan in 2024, for 2% milk (web-scraping)

$$\frac{\$2.74}{\text{premium}_i = -0.48}$$

$$\frac{\$4.62}{\text{premium}_i = 0.68}$$

$$\frac{\$6.81}{\text{premium}_i = 1.31}$$

Consumption Patterns

To correlate consumption patterns with expenditures, I define

- A **household premium index** as

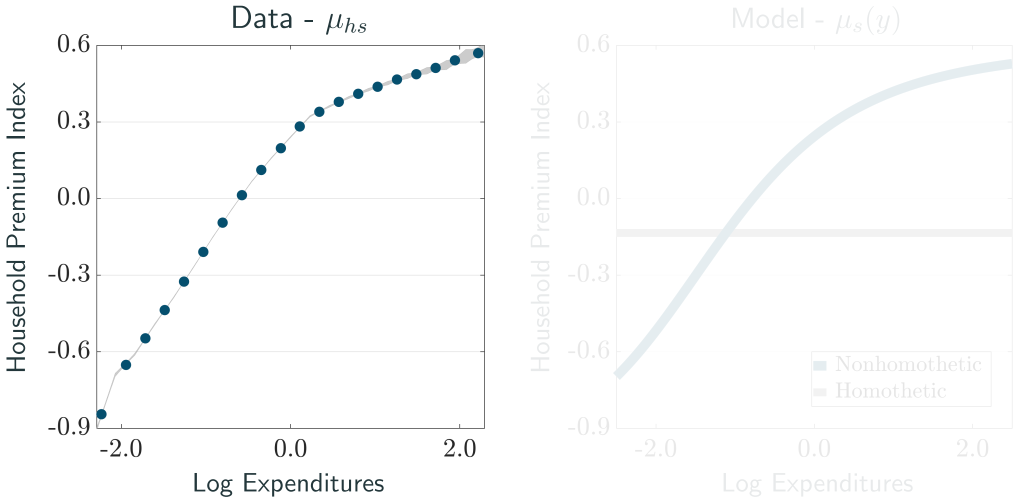
$$\mu_{hst} \equiv \sum_{i \in s} \frac{\text{quantity}_{iht}}{\sum_{i \in s} \text{quantity}_{iht}} \text{premium}_i$$

  - Highly correlated through time at 0.83 and across modules at 0.68

- A measure of **household premium dispersion** as

$$\sigma^2_{hst} \equiv \sum_{i \in s} \frac{\text{quantity}_{iht}}{\sum_{i \in s} \text{quantity}_{iht}} \left(\text{premium}_i - \mu_{hst}\right)^2$$

Fact 1: Rich Consumers Spend Relatively More on Premium Goods



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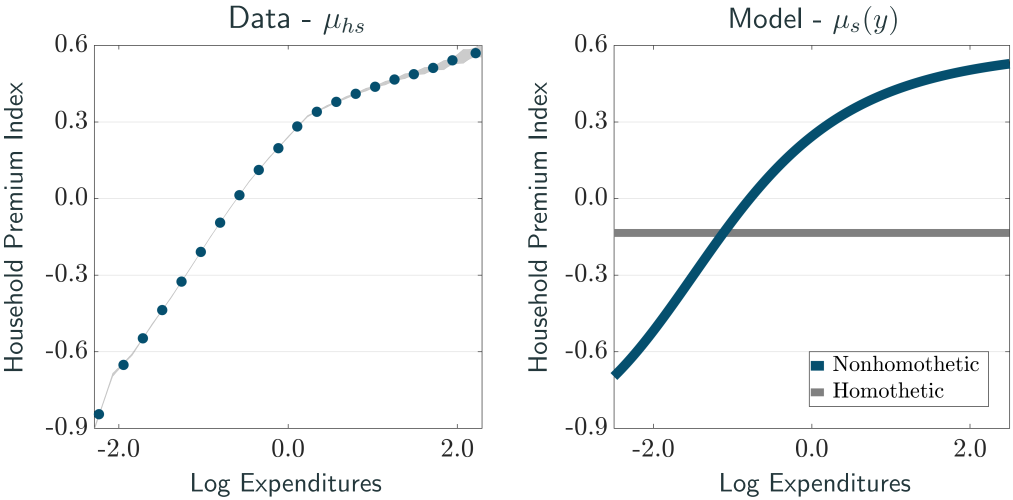
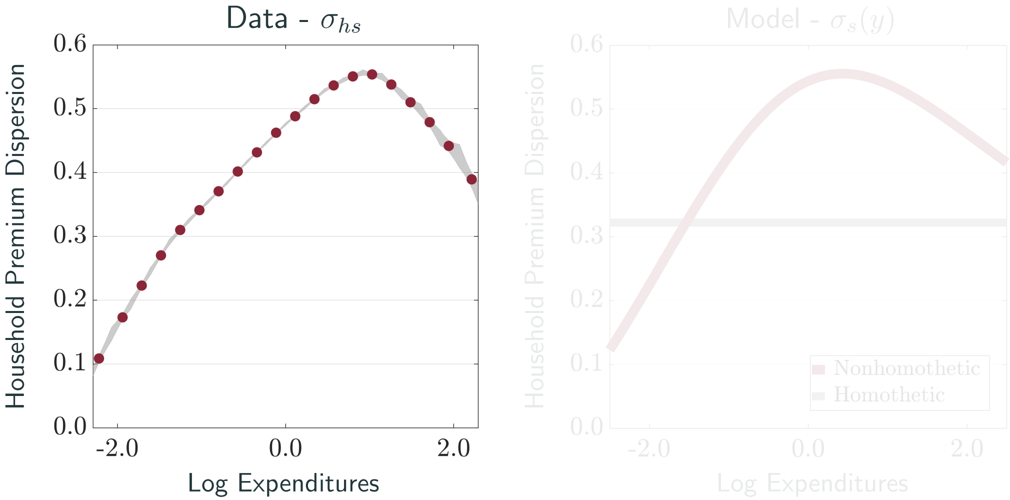


▸ Model Objects

Fact 2: Middle-Class Consumers Mix along the Premium Margin



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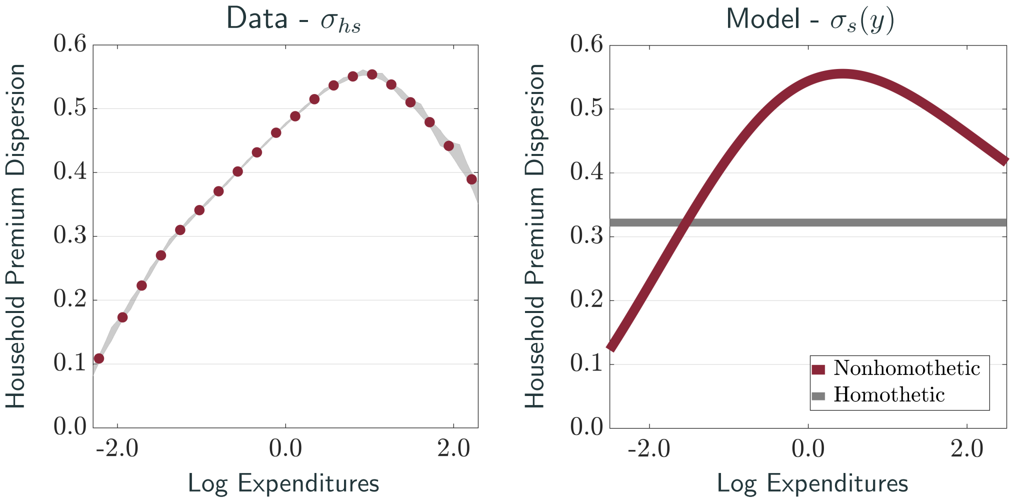

▸ Model Objects

Fact 3: Households are Least Price-Elastic for Most-Consumed Variety

- Stratify population by tertiles $g \in \{\text{poor, mid, rich}\}$ of household premium indexes

- For each (i, g), IV regression to estimate price elasticities $\boldsymbol{\beta_i^g}$

$$\log \text{quantity}_{iht} = \alpha_{ih}^g + \alpha_{ir}^g + \alpha_{it}^g + \boldsymbol{\beta_i^g} \log \text{price}_{iht} + \sum_{j \in \mathcal{K}_{iht}} \beta_{ij}^g \log \text{price}_{jht} + \ldots$$

$$\ldots \gamma_i^g \text{ expenditure}_{ht} + \epsilon_{iht}^g$$

- To address endogeneity, instrument $\log \text{price}_{iht}$ with Hausmann-type shift-share instruments

▸ Affine Elasticities ▸ Bartik Instrument

Fact 3: Households are Least Price-Elastic for Most-Consumed Variety

Data: Binscatter of price elasticities for rich relative to poor households

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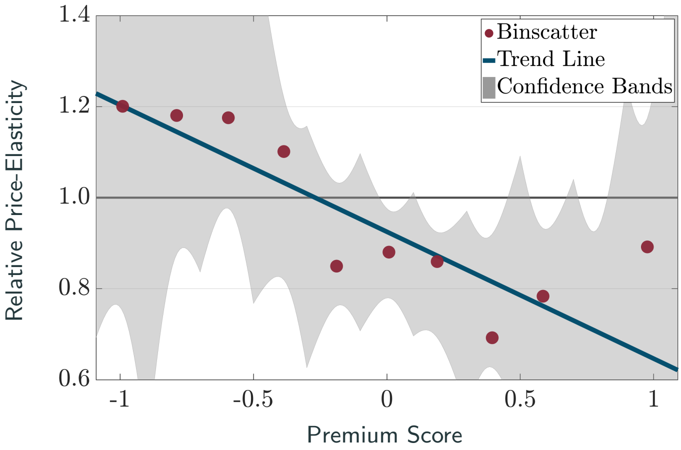
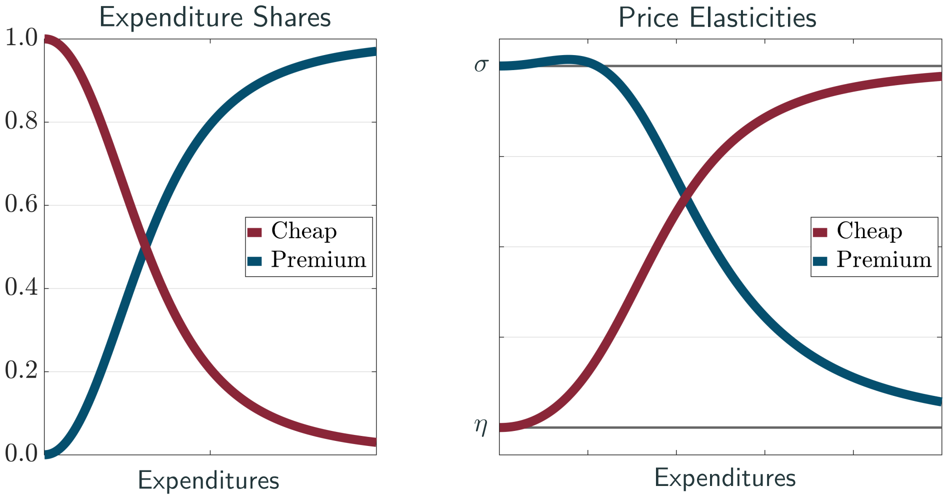
$$\frac{\beta_i(\text{rich})}{\beta_i(\text{poor})} \rightsquigarrow$$



▸ Affine Elasticities

Stylized Example: 1 Cheap and 1 Premium Variety



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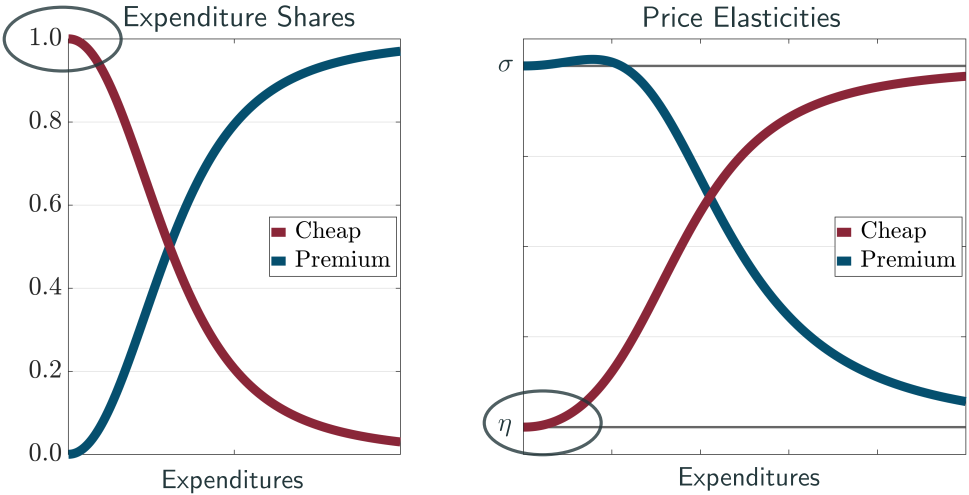

Competition Within Quality Bin | Medium Quality

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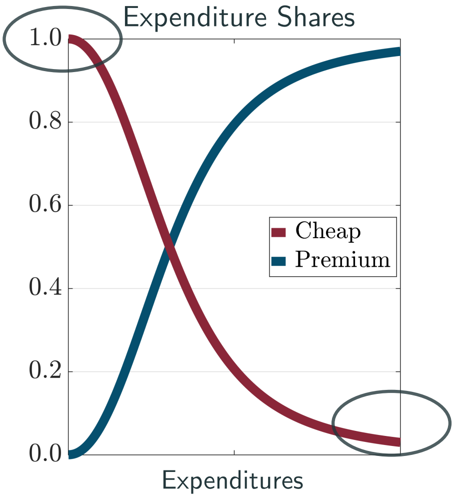

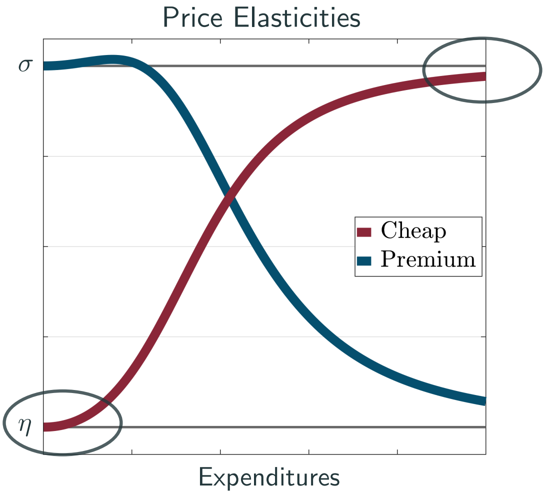

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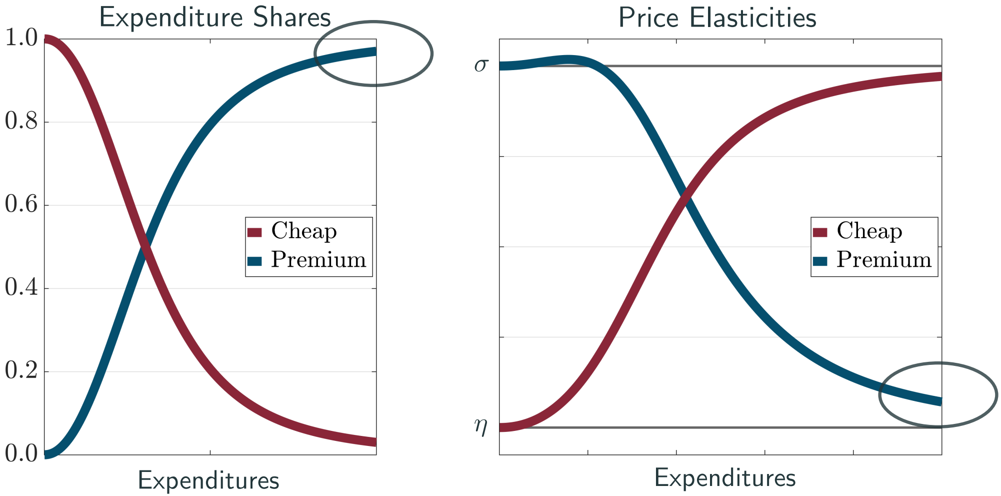

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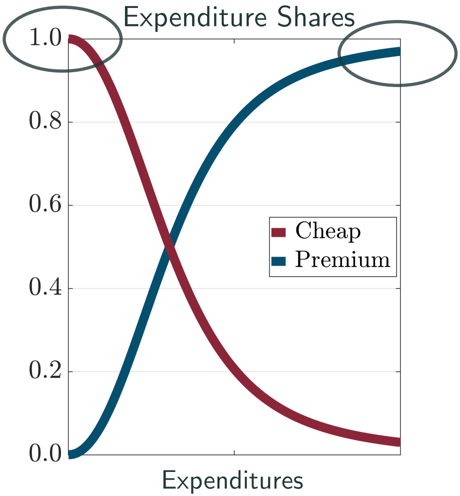

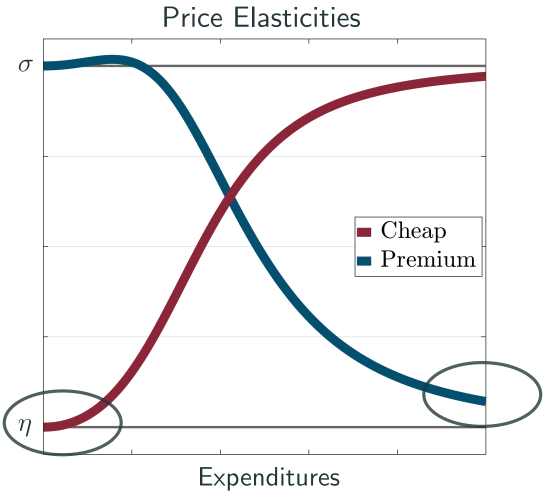

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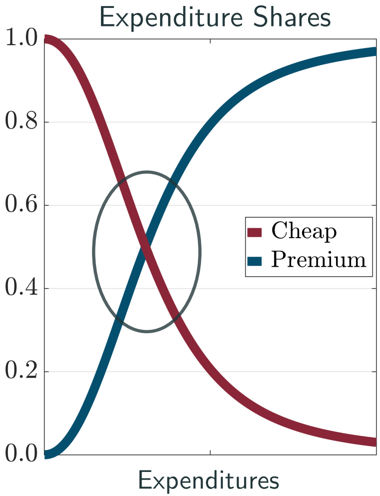

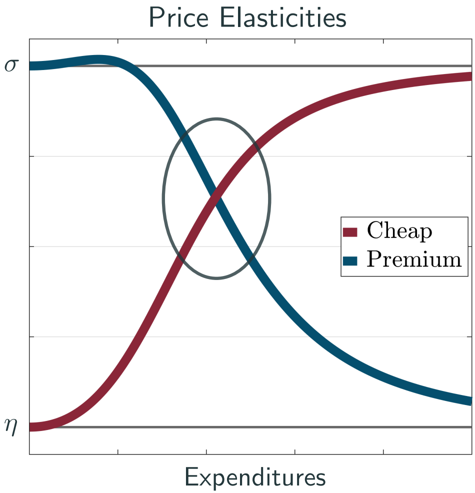

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Firm Behavior & Markups

- Producers operate under constant marginal cost λ_{iqs} and maximize profits

$$\pi_{iqs} = \int c_{iqs}(y, \boldsymbol{p})(p_{iqs} - \lambda_{iqs})\, g(y)\, dy$$

- From profit maximization, markups are

$$\mu_{iqs}(\boldsymbol{p}, g) = \frac{\int \varepsilon_{iqs}(y, \boldsymbol{p})\, \tilde{c}_{iqs}(y, \boldsymbol{p}, g)\, g(y)\, dy}{\int \varepsilon_{iqs}(y, \boldsymbol{p})\, \tilde{c}_{iqs}(y, \boldsymbol{p}, g)\, g(y)\, dy - 1}$$

where $\tilde{c}_{iqs}(y, \boldsymbol{p}, g) \equiv \frac{c_{iqs}(y, \boldsymbol{p})}{\int c_{iqs}(y, \boldsymbol{p})\, g(y)\, dy}$

▸ Nash Equilibrium

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Parameterization

Quantitative model: $q \in \{\text{low, high}\}$, $G(dy)$ from PSID, and $N_q(s)$ from NielsenIQ

Calibrated Parameters

Parameter	Value	Significance
Technology		
λ_{low}	0.80	Marginal cost (low)
λ_{high}	1.13	Marginal cost (high)
Quality		
$\xi_{\text{high}}/\xi_{\text{low}}$	0.74	Nonhomotheticity
φ_{low}	0.86	Taste shifter (low)
φ_{high}	1.33	Taste shifter (high)
ν	20,896	Expenditure scale
Substitution		
σ	18	Within sector
η	1.02	Across sector

Moments Used in Calibration

Target	Source	Data	Model
Price (high/low)	NielsenIQ	1.25	1.24
Premium index (mid/poor)	NielsenIQ	1.06	1.07
Premium index (rich/poor)	NielsenIQ	1.21	1.20
Polarization (mid/poor)	NielsenIQ	5.04	4.48
Polarization (rich/poor)	NielsenIQ	3.18	2.41
Local sales HHI	NielsenIQ	0.23	0.23
Aggregate markup*	BEMX '24	1.31	1.32
Markup dispersion*	BEMX '24	0.23	0.19

*Markup distribution is matched shutting down nonhomotheticites

▸ Validation ▸ Aggregate Markup

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Model-Implied Markup Response – 2006 to 2012

- Feed **observed** changes in the PSID expenditure distribution into calibrated model

		Nonhomothetic		Homothetic
		$\Delta\mu$	Δp	$\Delta\mu$
Overall	Low Quality	6.79 pp	$4.19\,\%$	0 pp
	High Quality	-1.82 pp	$-1.21\,\%$	0 pp

- Markup channel **increases** real consumption inequality
  - Poor households consume low quality $\rightsquigarrow$ increase in price index
  - Rich households consume high quality $\rightsquigarrow$ decrease in price index

▸ Expenditure Distribution

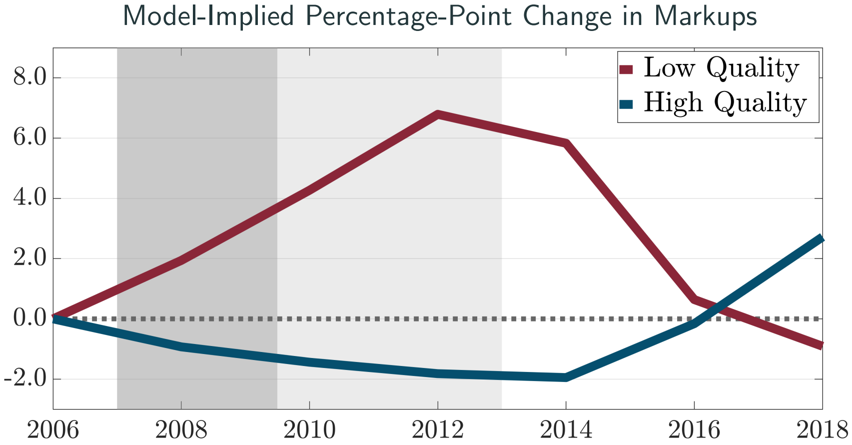
Model-Implied Markup Response - By Competition

- Average markup response driven by comparatively concentrated markets

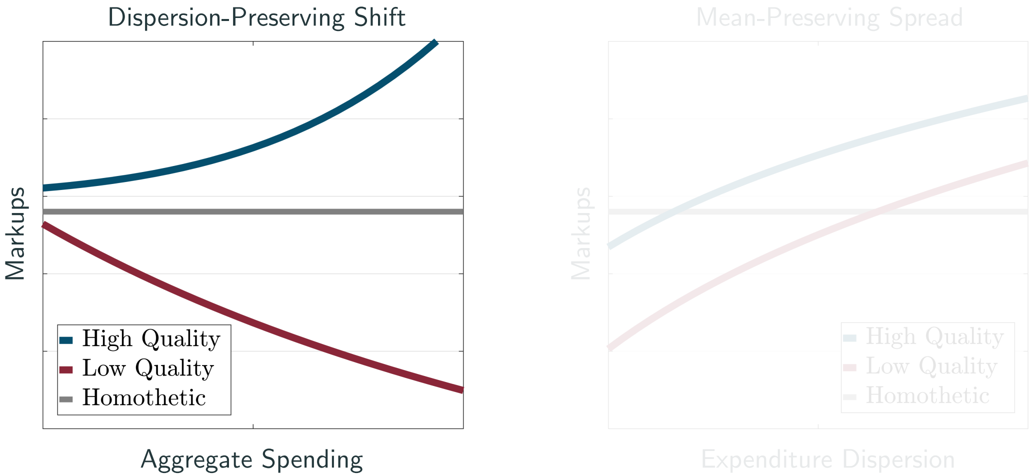
		Nonhomothetic		Homothetic
		$\Delta\mu$	Δp	$\Delta\mu$
Overall	Low Quality	6.79 pp	$4.19\,\%$	0 pp
	High Quality	-1.82 pp	$-1.21\,\%$	0 pp
Low Competition	Low Quality	8.43 pp	$3.97\,\%$	0 pp
HHI ≈ 0.35	High Quality	-2.88 pp	$-1.59\,\%$	0 pp
High Competition	Low Quality	2.57 pp	$1.97\,\%$	0 pp
HHI ≈ 0.10	High Quality	-1.22 pp	$-0.95\,\%$	0 pp

▸ Expenditure Distribution

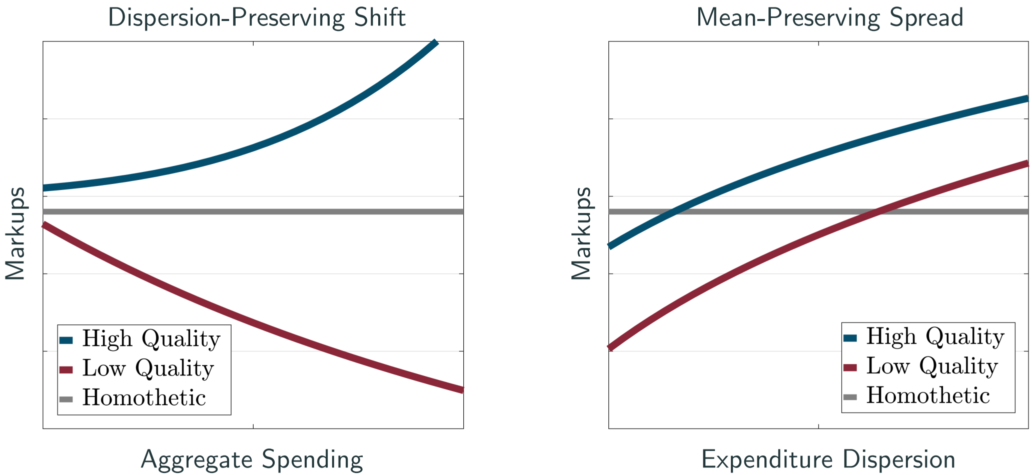
Model-Implied Markup Response – Time Series



Drop in Spending Leads to Unequal Markup Response



Rise in Inequality Increases Markups



Direct Evidence

- Recession: shift in spending patterns
  - Low-quality producers gain market share in recession Bils & Klenow (2001)
  - Wealthy and middle-class households adjust along quality margin Jørgensen & Shen (2020)
- Great recession: impact on prices
  - Prices faced by the poor increase relative to prices faced by the rich ▸ In Nielsen Data
  - Increase in relative price of cheaper goods Cavallo & Kryvstov (2024) ▸ In Nielsen Data
  - Increase in retail markups for cheaper goods ▸ In Nielsen Data
- Great recession: impact on price elasticities among wealthier households ▸ In Nielsen Data
- Retail markups are lower in regions with larger middle class ▸ In Nielsen Data

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Bewley-Aiyagari Model with Elastic Labor Supply

- Households with heterogeneous labor market ability $e' \sim H(e'|e)$
  - Consume with **nonhomothetic** preferences
  - Elastically supply labor h
  - Save in a single safe asset a
  - Own firms in proportion to asset holdings a
- Firms maximize profits vis-à-vis **now-endogenous** expenditure distribution
  - Spending $y(a, e)$ and distribution $\Gamma(da, de) \quad \rightsquigarrow \quad G \equiv \Gamma \circ y^{-1}$
  - Each firm uses CRS production technology $z_q \exp(\Theta) \, k^{\alpha} \, \ell^{1-\alpha}$
  - Sectors are perfectly symmetric

The Households' Problem

- Consumers with (a, e) choose (c, a', h) to solve

$$V(a, e \,|\, \Gamma, \Theta) = \max \left\{ u(c, h) + \beta \, \mathbb{E}\Big[V(a', e' \,|\, \Gamma', \Theta') \,\Big|\, e \Big] \right\}$$

- Budget constraint

$$\underbrace{p(c, \boldsymbol{p})}_{\text{Nonhomothetic Price Index} \,\blacktriangleright} c + \bar{p}\, a' = (1 + r)\, \bar{p}\, a + (1 - \tau)\, w\, e\, h + \pi(a) + T$$

as well as no-borrowing condition $a' \geq 0$

- Numeraire $p_{\text{high}} = 1$ and relative price of investment good $\bar{p}$

Parameterization & Model Fit

Parameter	Value	Significance	Target	Data	Model
α	0.33	Capital elasticity of output	Assigned	-	-
γ	2	Inverse Frisch elasticity	Assigned	-	-
β	0.9572	Discount rate	Average wealth to income	16.4	16.9
θ	3.46	Constant relative risk aversion	Top 10% wealth share	0.49	0.46
μ	1.36	Mean labor market ability	Gini income	0.39	0.42
s	0.045	Dispersion labor market ability	Top 10% income share	0.31	0.32
ρ	0.968	Persistence labor market ability	Persistence income	0.98	0.97
τ	0.243	Average tax rate	Average tax rate	0.24	0.24
η	1.55	Across-sector substitution	Aggregate markup	1.43	1.40
σ	12	Within-sector substitution	Sales HHI	0.23	0.25
$\varphi_{\text{high}}/\varphi_{\text{low}}$	1.22	Demand shifters	Polarization (mid/poor)	5.04	5.21
$\xi_{\text{high}}/\xi_{\text{low}}$	0.523	Nonhomotheticities	Premium index (rich/poor)	1.20	1.17
$z_{\text{high}}/z_{\text{low}}$	0.84	Relative productivity	Relative price	1.24	1.22

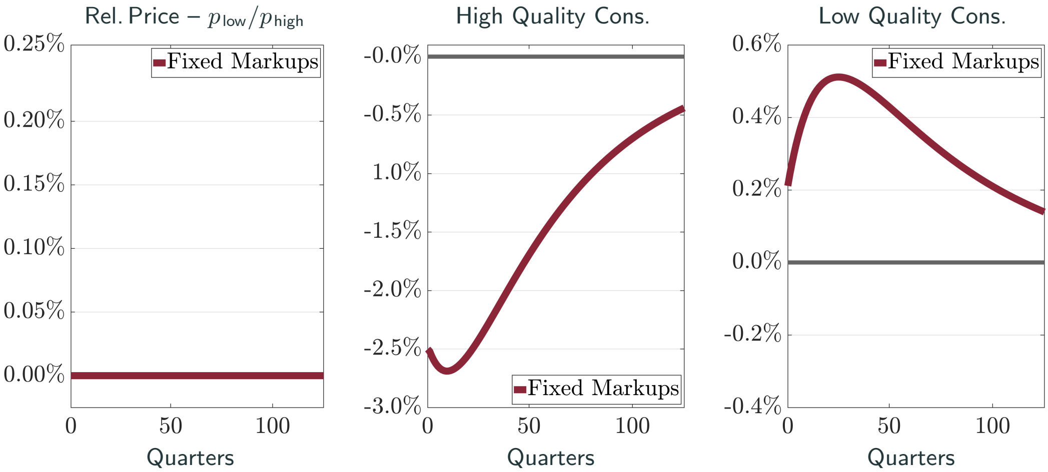
Markup Channel Affects Transmission of Aggregate Shocks

- Consider -5% MIT shock to aggregate TFP with 0.95 persistence

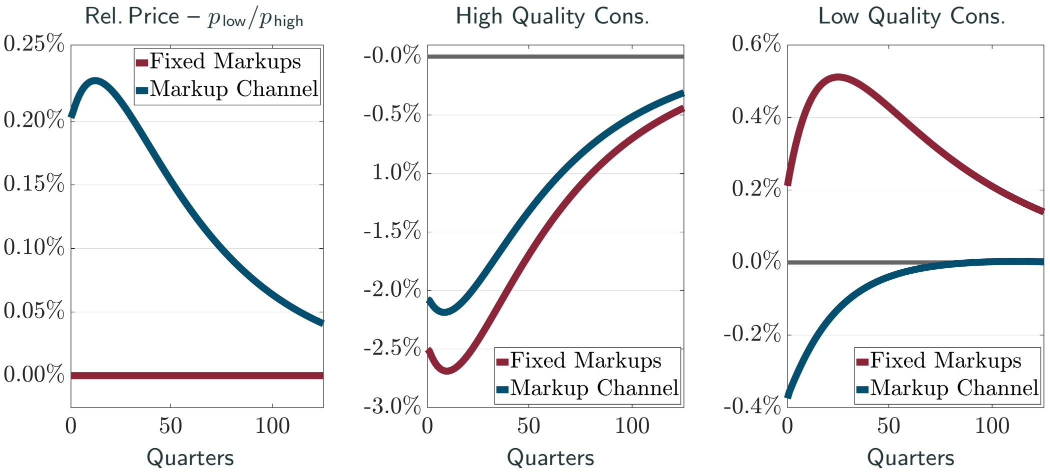
$$z_q \exp(\Theta)\, k^{\alpha}\, \ell^{1-\alpha}$$

- Transition dynamics of relative price $p_{\text{low}}/p_{\text{high}}$ in two scenarios
  - Markups fixed at pre-recession level
  - Firms adjust markups to maximize profits

TFP Shock with Fixed Markups



TFP Shock with Markup Channel



Redistribution through Automatic Stabilization

- Redistribution through automatic stabilizer $\psi\,\Theta$

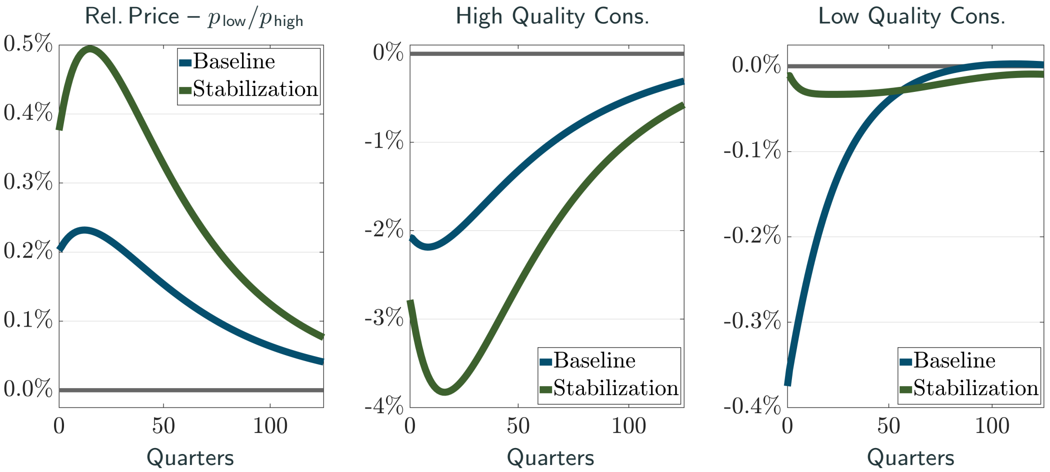
- Households' budget constraint

$$p(c,\boldsymbol{p})\,c + \bar{p}\,a' = (1+r)\,\bar{p}\,a + \left(1 - \tau - \boldsymbol{\psi}\,\Theta\right) w\,e\,h + \pi(a) + T + \boldsymbol{S}$$

- Lump-sum transfer

$$\boldsymbol{S}_t = \boldsymbol{\psi}\ \Theta_t\ w_t \int e\,h_t(a,e)\,\Gamma_t(da,de)$$

TFP Shock with Redistributive Policy



Conclusion

- Uncovered novel **markup channel**:
  - Households switch to more affordable goods in recessions
  - Low quality producers gain market share and charge higher markups
  - Change in relative price disproportionately hurts poor consumers
- Markup channel is quantitatively consequential during Great Recession:
  - Relative price of cheaper goods increases by **5.82%**
  - Accounts for close to entire movement in relative price in the data
- Makes case against simple redistribution and calls for **product market intervention**

Appendix

Restrictions on Marshallian Demand with $\eta \to 1$

- Marshallian demand is fully characterized by the budget constraint as well as

$$c_{iq}(y, \boldsymbol{p}) = \varphi_q \, \varphi_b^{-\frac{\xi_q}{\xi_b}} \left(p_{iq} \, p_b^{-\frac{\xi_q}{\xi_b}} \right)^{-\sigma} y^{\sigma \left(1 - \frac{\xi_q}{\xi_b}\right)} \, c_b(y, \boldsymbol{p})^{\frac{\xi_q}{\xi_b}}$$

  for an arbitrary choice of base good/quality b

- Since ξ_q only enters relative to ξ_b, consumption choices are independent of the scale of $\boldsymbol{\xi}$

Nonhomothetic Ideal Price-Index

- Nonhomothetic ideal price index as a function of sectoral **real consumption**

$$p(c_s, \boldsymbol{p}_s) \equiv \left(\sum_{q=1}^{Q} \sum_{i=1}^{N_{qs}} \varphi_q \, p_{iqs}^{1-\sigma} \, c_s^{(1-\sigma)(\xi_q - 1)} \right)^{\frac{1}{1-\sigma}}$$

- Quality-adjusted price for (i, q, s)

$$c_s^{\xi_q - 1} \varphi_q^{(1-\sigma)^{-1}} \, p_{iqs}$$

- Nonhomothetic ideal price index as a function of **nominal spending**

$$p(y, \boldsymbol{p}) \equiv \text{fix} \left\{ p \mapsto \left(\sum_{q=1}^{Q} \sum_{i=1}^{N_{qs}} \left(\frac{y}{p} \right)^{(1-\sigma)(\xi_q - 1)} p_{iqs}^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \right\}$$

◂ back 1 ◂ back 2

Consumer Programs

- Within-sector expenditure minimization

$$\min_{\{c_{iqs}\}} \left\{ \sum_{q=1}^{Q} \sum_{i=1}^{N_{qs}} p_{iqs} c_{iqs} \;\middle|\; \sum_{q=1}^{Q} \sum_{i=1}^{N_{qs}} \left(\frac{\varphi_q}{c_s^{(\sigma-1)(\xi_q-1)}} \right)^{\frac{1}{\sigma}} \left(\frac{c_{iqs}}{c_s} \right)^{\frac{\sigma-1}{\sigma}} = 1 \right\}$$

- Across-sector expenditure minimization

$$\min_{\{c_s\}} \left\{ \int_{\mathcal{S}} p_s(c_s, \boldsymbol{p}_s)\, c_s \, ds \;\middle|\; \int_{\mathcal{S}} \left(\frac{c_s}{c} \right)^{\frac{\eta-1}{\eta}} ds = 1 \right\}$$

- First-order conditions

$$\left(\frac{c_s}{c} \right)^{\frac{\eta-1}{\eta}} = \frac{\sum_q \sum_i p_{iqs}\, c_{iqs}(c_s, \boldsymbol{p}_s)\, \xi_q}{\int_s \sum_q \sum_i p_{iqs}\, c_{iqs}(c_s, \boldsymbol{p}_s)\, \xi_q} \quad \forall \quad s \in \mathcal{S}$$

back

Demand for Varieties

- Hicksian demand for variety (i, q, s)

$$c_{iqs}(c_s, \boldsymbol{p}_s) = \underbrace{\left(\frac{\varphi_q}{\boldsymbol{c_s}^{(\sigma-1)(\xi_q-1)}}\right)}_{\text{Taste-Shifter}} \underbrace{\left(\frac{p_{iqs}}{p_s(\boldsymbol{c_s}, \boldsymbol{p}_s)}\right)}_{\text{Price-Index}}^{-\sigma} c_s$$

- The nonhomothetic ideal price-index $p_s(\boldsymbol{c_s}, \boldsymbol{p}_s)$ depends on c_s Price-Index

back

Marshallian Demand

- Marshallian demand functions for varieties

$$c_{iqs}(y, \boldsymbol{p}) \doteq c_{iqs}\Big(c_s(y, \boldsymbol{p}), \boldsymbol{p}_s\Big)$$

- Marshallian demand for sectoral consumption

$$c_s(y, \boldsymbol{p}) = \arg\sup_{\{c_s\}} \left\{ c \;\middle|\; \int_{\mathcal{S}} p_s(c_s, \boldsymbol{p}_s)\, c_s \, ds = y \quad \text{and} \quad \int_{\mathcal{S}} \left(\frac{c_s}{c}\right)^{\frac{\eta-1}{\eta}} ds = 1 \right\}$$

back

Expenditure Elasticities

- Quasi **expenditure elasticities**

$$\frac{\partial \log x_{iqs}(c_{hs}, \boldsymbol{p}_s)}{\partial \log c_{hs}} = \Big(\sigma - 1\Big)\Big(\bar{\xi}_s(\boldsymbol{c_{hs}}, \boldsymbol{p}_s) - \xi_q\Big)$$

where

$$\bar{\xi}_s(\boldsymbol{c_{hs}}, \boldsymbol{p}_s) \equiv \sum_{q=1}^{Q} \sum_{i=1}^{N_{qs}} x_{iqs}(\boldsymbol{c_{hs}}, \boldsymbol{p}_s)\, \xi_q$$

back

Across-Sector Substitution

- Households internalize the impact their choice of c_s has on sectoral prices

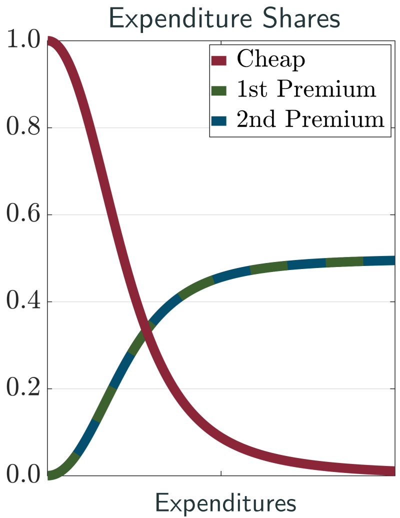
$$\min_{\{c_s\}} \left\{ \int_{\mathcal{S}} p_s(c_s, \boldsymbol{p}_s)\, c_s\, ds \;\middle|\; \int_{\mathcal{S}} \left(\frac{c_s}{c}\right)^{\frac{\eta-1}{\eta}} ds = 1 \right\}$$

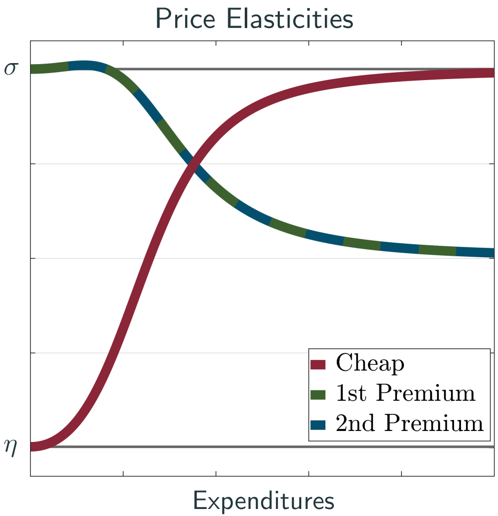
- Fore price elasticities, this modulated across-sector substitutability is reflected by

$$\zeta_{qs}(c_s, \boldsymbol{p}) \equiv \frac{\left(\sigma\, \bar{\xi}_s(c_s, \boldsymbol{p}) + (1-\sigma)\, \xi_q\right)^2}{\sigma\, \eta\, \bar{\xi}_s(c_s, \boldsymbol{p})^2 + (1-\sigma)\, \eta\, \bar{\xi}_s^2(c_s, \boldsymbol{p}) + (1-\eta)\, \bar{\xi}_s(c_s, \boldsymbol{p})}$$

back

Stylized Example: 1 Cheap and 2 Premium Varieties





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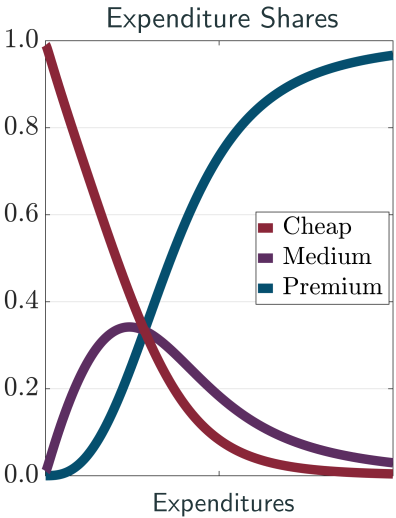
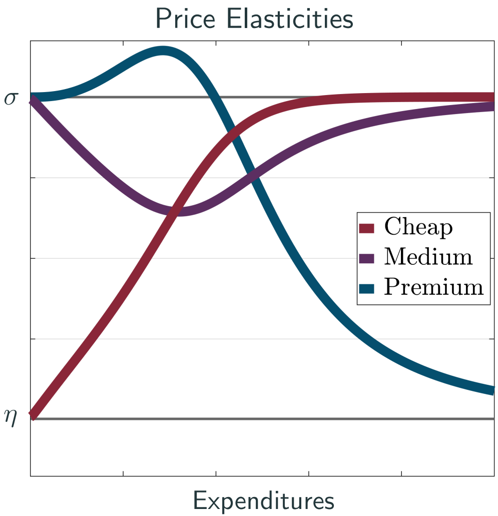
Stylized Example: 1 Cheap, 1 Medium, and 1 Premium Variety





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Data

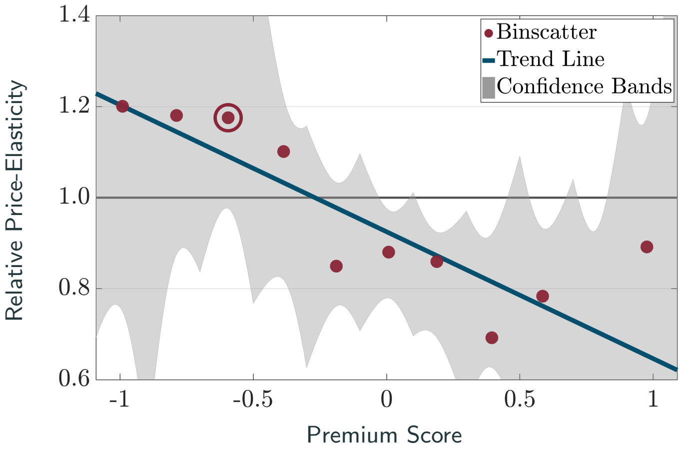
- Primary dataset is the **NielsenIQ HomeScan Consumer Panel**
- Longitudinal choice-data on barcode-level quantities and prices
- Tracks roughly 50,000 US households from 2004 to 2020
- Range of self-reported household demographics
- Covers about 30-40% of spending on goods
- Classifies barcodes into narrow product modules (sectors s)

back

Fact 3: Households are Least Price-Elastic w.r.t. Favored Variety

Data: Binscatter of price elasticities for rich relative to poor households

$$\frac{\beta_i(\text{rich})}{\beta_i(\text{poor})} \rightsquigarrow$$



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Model Counterparts

- Household premium index

$$\mu_{hs} = \frac{\sum_{i\in s} \text{quantity}_{ih}\, \text{premium}_i}{\sum_{i\in s} \text{quantity}_{ih}} \quad \rightsquigarrow \quad \mu_s(y) = \frac{\sum_{q=1}^{Q} \sum_{i=1}^{N} c_{iqs}(y, \boldsymbol{p})\, p_{iqs}}{\sum_{q=1}^{Q} \sum_{i=1}^{N} c_{iqs}(y, \boldsymbol{p})}$$

- Measure of household premium dispersion

$$\sigma^2_{hs} = \frac{\sum_{i\in s} \text{quantity}_{ih} \left(\text{premium}_i - \mu_{hs}\right)^2}{\sum_{i\in s} \text{quantity}_{ih}} \quad \rightsquigarrow \quad \sigma^2_s(y) = \frac{\sum_{q=1}^{Q} \sum_{i=1}^{N} c_{iqs}(y, \boldsymbol{p}) \left(p_{iqs} - \mu_s(y)\right)^2}{\sum_{q=1}^{Q} \sum_{i=1}^{N} c_{iqs}(y, \boldsymbol{p})}$$

◂ back 1 ◂ back 2

Bertrand-Nash Equilibrium

- The Bertrand equilibrium is defined as a price vector $\boldsymbol{p}^* = \left(p^*_{iqs}\right)$ which solves

$$\int \left(\frac{\partial c_{iqs}(y,\boldsymbol{p})}{\partial p_{iqs}}\bigg|_{\boldsymbol{p}^*} (p^*_{iqs} - \lambda_{iqs}) + c_{iqs}(y,\boldsymbol{p}^*) \right) g(y)\, dy = 0 \quad \forall \quad (i,q,s)$$

- The price elasticity of variety (i,q,s) for a consumer of type y is given as

$$\varepsilon_{iqs}(y,\boldsymbol{p}) = \big(1 - x_{iqs}(y,\boldsymbol{p})\big)\,\sigma + x_{iqs}(y,\boldsymbol{p})\,\eta\,\zeta_{iqs}(y,\boldsymbol{p})$$

where

$$\zeta_{iqs}(y,\boldsymbol{p}) \equiv \frac{\left(\sigma\,\bar{\xi}(y,\boldsymbol{p}) + (1-\sigma)\,\xi_q\right)^2}{\sigma\,\eta\;\bar{\xi}(y,\boldsymbol{p})^2 + (1-\sigma)\,\eta\;\bar{\xi^2}(y,\boldsymbol{p}) + (1-\eta)\,\bar{\xi}(y,\boldsymbol{p})}$$

back

Bartik Instrument

- Household specific prices are computed as

$$\text{price}_{i,h,t} = \frac{\sum_s \text{expenditure}_{i,h,s,t}}{\sum_s \text{quantity}_{i,h,s,t}}$$

- The Hausmann instrument is then given as

$$\text{hausmann}_{i,h,t} = \sum_s \frac{\text{quantity}_{i,h,s,t-1}}{\sum_s \text{quantity}_{i,h,s,t-1}} \overline{\text{price}}_{i,g(s),r(s),t}$$

where $\overline{\text{price}}_{i,g,r,t}$ is the average price of barcode i in retail chain g, excluding observations in r.

back

Fact 3: Households are Least Price-Elastic for Most-Consumed Varieties

- For each barcode i, IV regression to estimate price elasticities

- Price elasticities depend on households only through expenditure shares: $\boldsymbol{\beta_i^0} + \boldsymbol{\beta_i^1}\ \text{share}_{iht}$

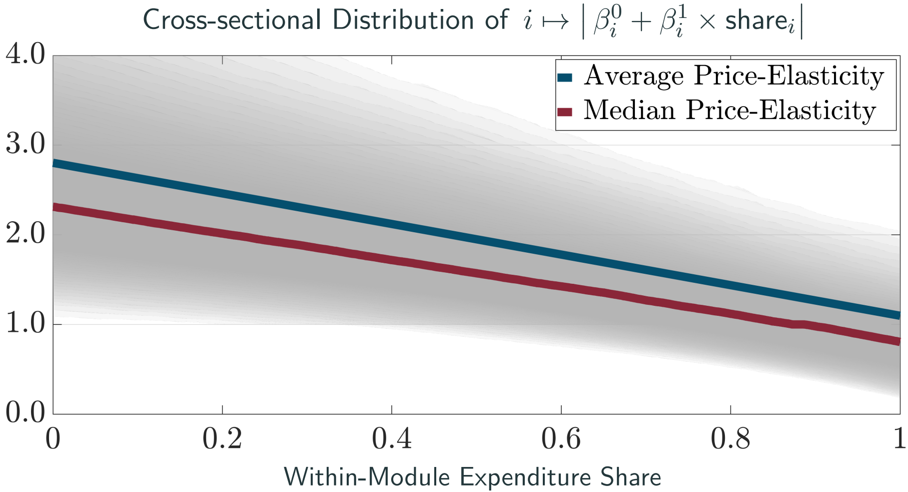
$$\log \text{quantity}_{iht} = \alpha_{ih} + \alpha_{ir} + \alpha_{it} + \left(\boldsymbol{\beta_i^0} + \boldsymbol{\beta_i^1}\ \text{share}_{iht}\right) \times \log \text{price}_{iht} + \dots$$

$$\dots \sum_{j \in \mathcal{K}_{iht}} \beta_{ij} \log \text{price}_{jht} + \gamma_i \text{expenditure}_{ht} + \epsilon_{iht}$$

- To address endogeneity concerns, instrument
  - $\log \text{price}_{iht}$ with Hausmann-type shift-share instrument
  - Within-module spending shares share_{iht} with income_{ht}

back

Fact 3: Households are Least Price-Elastic for Most-Consumed Varieties



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Validation

Moments	Data	Model
Relative price-elasticity - low quality	0.87	0.82
Relative price-elasticity - high quality	1.16	1.23
Relative markup	0.99	0.96

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Quality Distinction Dilutes Competition

- Calibrate homothetic version of environment targeting
  - Local sales HHI from NielsenIQ
  - Moments of model-implied markup distribution from BEMX (2024)
- Within- and across-sector substitutability σ and η as deep preferences parameters
- Fix $\{\sigma, \eta\}$ and calibrate nonhomothetic environment
- Model-implied aggregate markup **increases** from 1.32 to 1.40 at same HHI

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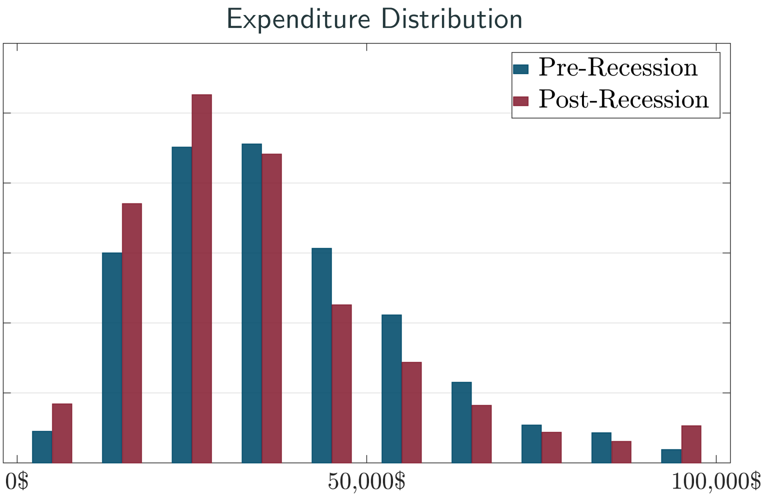
Changes in the Expenditure Distribution - Financial Crisis



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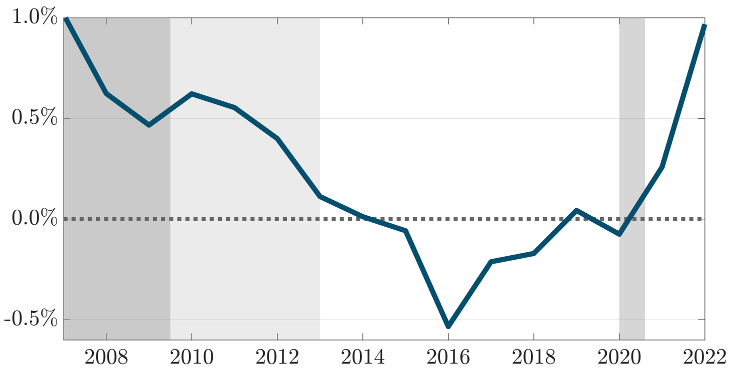
Inflation Gap for Poor versus Rich Consumers

$$\Delta\pi_t \equiv \prod_i \left(\frac{p_{i,t}}{p_{i,t-1}}\right)^{x_{i,t}^{\text{poor}}} - \prod_i \left(\frac{p_{i,t}}{p_{i,t-1}}\right)^{x_{i,t}^{\text{rich}}} \quad \text{where} \quad x_{i,t} \equiv \frac{x_{i,t} + x_{i,t-1}}{2}$$



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Inflation Gap for Poor versus Rich Consumers

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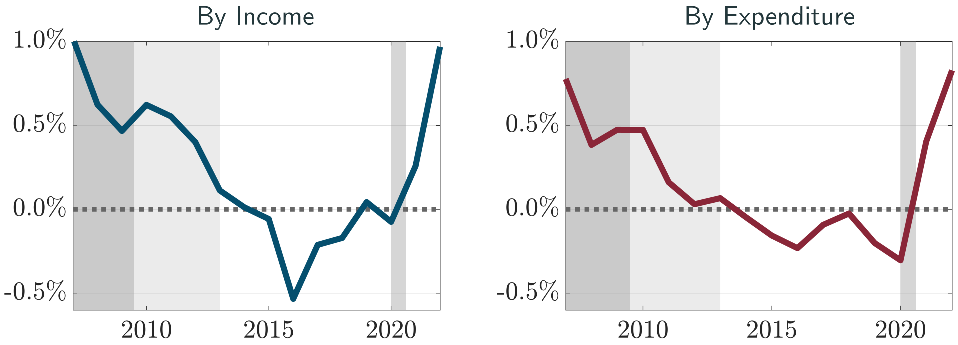

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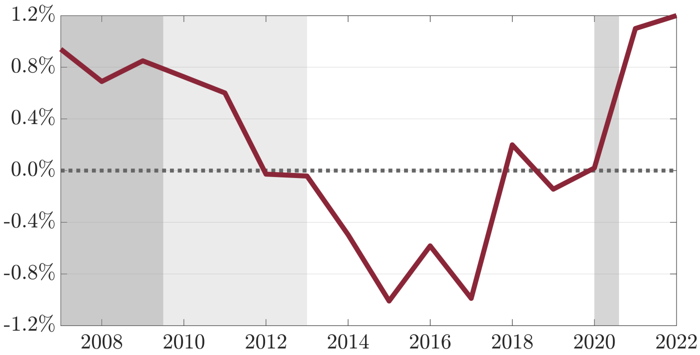
Inflation Gap for Cheap versus Premium Goods

$$\Delta\pi_t \equiv \prod_{\text{cheap}} \left(\frac{p_{i,t}}{p_{i,t-1}}\right)^{x_{i,t}} - \prod_{\text{premium}} \left(\frac{p_{i,t}}{p_{i,t-1}}\right)^{x_{i,t}} \quad \text{where} \quad x_{i,t} \equiv \frac{x_{i,t} + x_{i,t-1}}{2}$$



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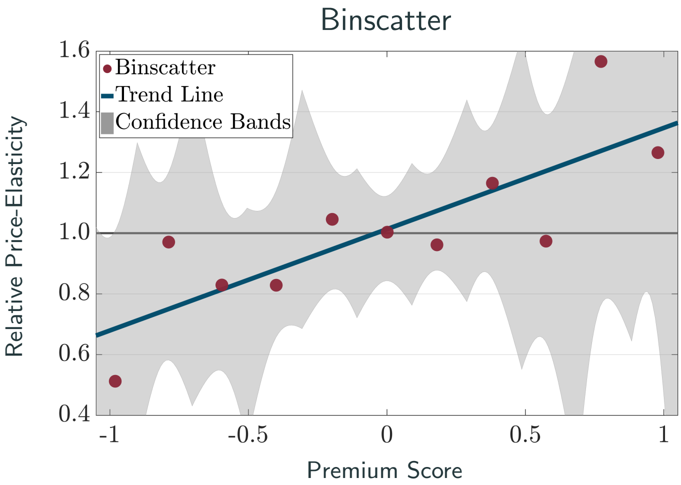
Price-Elasticities among Wealthy Households: Normal Times vs Recessions

$$\frac{\beta_i(\text{recession})}{\beta_i(\text{normal})} \rightsquigarrow$$



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Price-Elasticities among Wealthy Households: Normal Times vs Recessions

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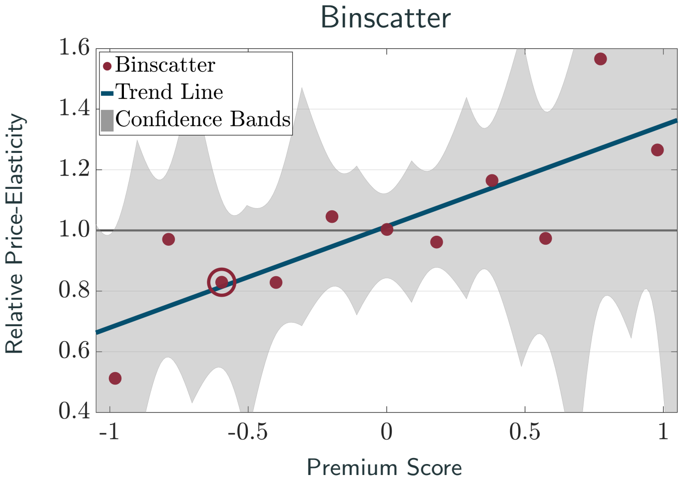

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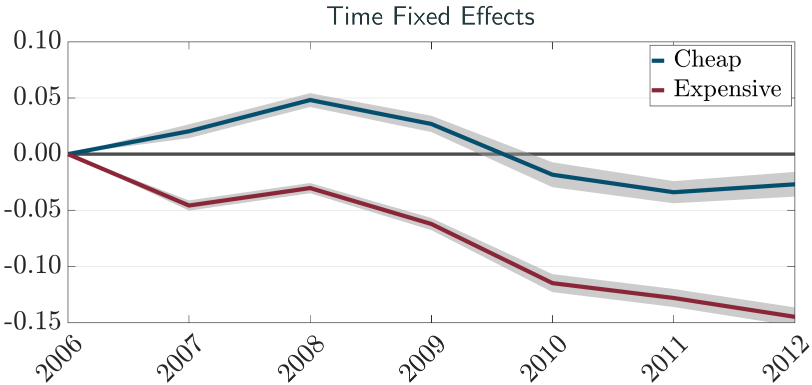
Retail Markups for Cheap vs Expensive Goods

- Partition barcodes into $g \in \{\text{cheap, expensive}\}$
- For each g, run regression $\mu^g_{irt} = \alpha^g_i + \alpha^g_r + \sum_{\tau=2007}^{2012} \boldsymbol{\beta^g_\tau} \times \mathbb{1}\{t = \tau\} + \epsilon^g_{irt}$



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The Moderating Influence of a Large Middle Class

- Regress regional retail markups on different measures of regional inequality

$$\text{markup}_{irt} = \alpha_i + \alpha_t + \beta\,\text{inequality}_{rt} + \gamma\,\text{income}_{rt} + \epsilon_{irt}$$

	Measure of inequality					
	σ^2/μ income	σ^2/μ spending	Q_{20}^{80} income	σ^2/μ income	σ^2/μ income	σ^2/μ income
inequality_{rt}	0.47^{***}	0.19^{***}	0.024^{***}	0.72^{***}	0.59^{***}	0.48^{***}
	(0.019)	(0.005)	(0.001)	(0.020)	(0.001)	(0.001)
income_{rt}				0.74^{***}	0.69^{***}	0.74^{***}
				(0.017)	(0.012)	(0.013)
Barcode FE	✗	✗	✗	✗	✓	✓
Time FE	✗	✗	✗	✗	✗	✓
R^2	0.01	0.02	0.01	0.03	0.66	0.67
N	315,130	315,130	315,130	315,130	315,130	315,130

back

Households' Trade-Offs

- Define the **marginal** price of real consumption as

$$\tilde{p}(c, \boldsymbol{p}) \equiv p(c, \boldsymbol{p}) + \frac{\partial\, p(c, \boldsymbol{p})}{\partial\, c}\, c$$

- The FOC for labor supply is

$$-\frac{u_h(c_t, h_t)}{u_c(c_t, h_t)} = \underbrace{\frac{(1-\tau)\, w_t\, e_t}{\tilde{p}(c_t, \boldsymbol{p}_t)}}_{\text{Marginal Real Wage}}$$

- The FOC for savings is

$$1 = \mathbb{E}_t \left[\beta \, \frac{u_c(c_{t+1}, h_{t+1})}{u_c(c_t, h_t)} \underbrace{\frac{\tilde{p}(c_t, \boldsymbol{p}_t)}{\tilde{p}(c_{t+1}, \boldsymbol{p}_{t+1})} (1 + r_t)}_{\text{Marginal Real Interest Rate}} \right]$$

back

Equilibrium is a vector $(r, w, \boldsymbol{p}, \pi, T)$ such that...

- Given $(r, w, \boldsymbol{p}, \pi, T)$ consumers behave optimally with
  - consumption policy $c_q(a, e)$ for all q
  - savings policy $a'(a, e)$
  - labor supply policy $h(a, e)$
  - stationary distribution $\Gamma(da, de)$
  - spending policy $y(a, e) \rightsquigarrow G(dy) = \Gamma \circ y(da, de)^{-1}$
- And we have clearing of
  - capital markets $r\,\bar{p} \int a\,\Gamma(da, de) = \alpha \sum_q z_q^{-1} \left(\frac{w}{1-\alpha}\right)^{1-\alpha} \left(\frac{r\,\bar{p}}{\alpha}\right)^{\alpha} \int c_q(a, e)\,\Gamma(da, de)$
  - labor markets $w \int e\,h(a, e)\,\Gamma(da, de) = (1-\alpha) \sum_q z_q^{-1} \left(\frac{w}{1-\alpha}\right)^{1-\alpha} \left(\frac{r\,\bar{p}}{\alpha}\right)^{\alpha} \int c_q(a, e)\,\Gamma(da, de)$
  - a Nash-equilibrium on product markets $p_q = \mu_q(\boldsymbol{p}, G)\, z_q^{-1} \left(\frac{w}{1-\alpha}\right)^{1-\alpha} \left(\frac{r\,\bar{p}}{\alpha}\right)^{\alpha}$ for all q
  - as well as a balanced government budget $\tau\, w \int e\,h(a, e)\,\Gamma(da, de) = T$

back

Automatic Stabilization Through Low-Quality Subsidies

- **Product market intervention:** Automatic stabilization via low-quality subsidy $\boldsymbol{\tau}_{\text{low}} \cdot \Theta_t$

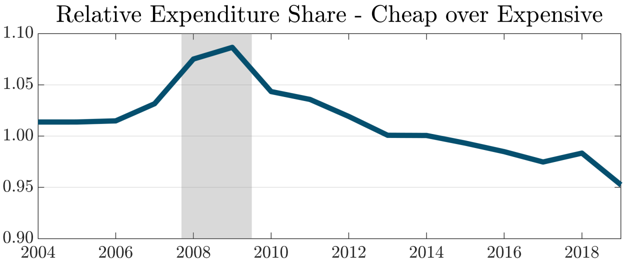
$$p^{\text{cons}}_{t,\text{low}} = \underbrace{\exp\left(\boldsymbol{\tau}_{\text{low}}\Theta_t\right)}_{\text{Subsidy}} \overbrace{\underbrace{\frac{\int \tilde{\varepsilon}_{\text{low}}(y,\boldsymbol{p}_t)\, G_t(dy)}{\int \tilde{\varepsilon}_{\text{low}}(y,\boldsymbol{p}_t)\, G_t(dy) - 1}}_{\text{Markup}} \underbrace{\frac{1}{z_{\text{low}}\exp(\Theta_t)} \left(\frac{w_t}{1-\alpha}\right)^{1-\alpha} \left(\frac{r_t\bar{p}_t}{\alpha}\right)^{\alpha}}_{\text{Marginal Cost}}}^{\text{Producer Price } p^{\text{prod}}_{t,\text{low}}}$$

- The high-quality price is $p^{\text{cons}}_{t,\text{high}} = \exp\left(\boldsymbol{\tau}_{t,\text{high}}\right) p^{\text{prod}}_{t,\text{high}}$ where $\boldsymbol{\tau}_{t,\text{high}}$ adjusts such that

$$\exp\left(\boldsymbol{\tau}_{\text{low}}\Theta_t\right) \sum_{\text{low}} C_{t,q} + \exp\left(\boldsymbol{\tau}_{t,\text{high}}\right) \sum_{\text{high}} C_{t,q} = 0$$

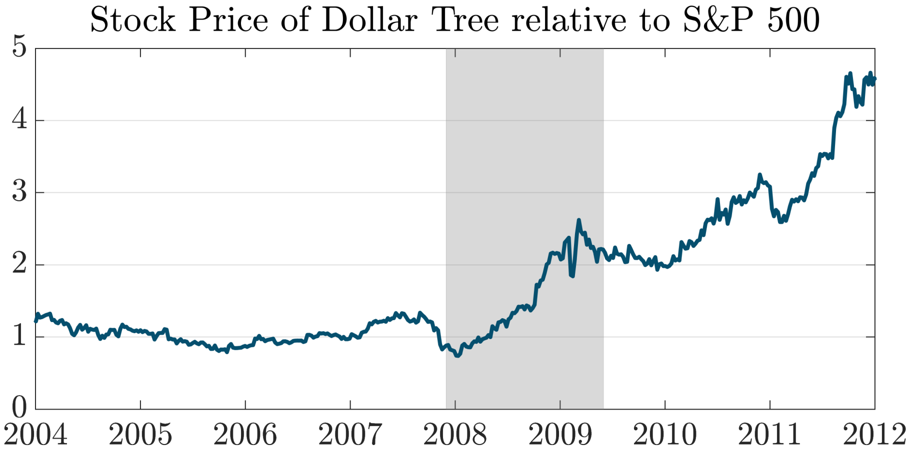
Direct Evidence - Expenditure Switching

- Expenditure switching in Nielsen



- Jørgensen and Shen (2019) find that in times of economic hardship:
  - Rich and middle-class households smooth along the quality margin
  - Poor households adjust consumption quantities

Motivating Evidence - Discount Outlets during the Recession



Retail Markups

- Finite set of retailers $r \in \{1, 2, \ldots, R\}$ each with product assortment $i \in \{1, 2, \ldots, N\}$
- Homothetic CES preferences and EV choice of retailers such that real consumption is

$$c(y_h) = \max_r \left\{ \frac{y_h}{P_r} + \frac{\psi_r \, y_h}{\theta} \right\} \quad \text{with} \quad P_{hr} = \left(\sum_{i=1}^{N} p_{ir}^{1-\sigma_h} \right)^{\frac{1}{1-\sigma_h}}$$

- In equilibrium retailer profits are

$$\pi_r\left(\{p_i^*\}_r, \{p_i^*\}_{-r}\right) = \max_{\{p_{ir}\}} \left\{ \int \frac{\exp\left(\theta P_{hr}^{-1}\right)}{\sum_R \exp\left(\theta P_{hj}^{-1}\right)} \sum_{i=1}^{N} \left(\frac{p_{ir}}{P_{hr}} \right)^{-\sigma_h} \frac{y_h}{P_{hr}} \left(p_{ir} - \lambda_i\right) dh \, \middle| \, p_{ij} = p_{ij}^* \; \forall \; j \neq r \right\}$$

- Equilibrium markups are strictly decreasing in θ

The Marginal Price of Real Consumption

- Define the **marginal** price of real consumption as

$$\tilde{p}\big(c, \boldsymbol{p} \,|\, \omega\big) \equiv p\big(c, \boldsymbol{p} \,|\, \omega\big) + \frac{\partial\, p(c, \boldsymbol{p} \,|\, \omega)}{\partial\, c}\, c$$

- The properties of $\tilde{p}\big(c, \boldsymbol{p} \,|\, \omega\big)$ depend on ω

$$\tilde{p}\big(c, \boldsymbol{p} \,|\, \omega\big) \text{ is } \begin{cases} \text{monotonically decreasing} & \text{if } \omega \leq \min\left\{\xi_q^{-1}\right\} \\ \text{monotonically decreasing} & \text{if } \omega \geq \max\left\{\xi_q^{-1}\right\} \\ \text{hump-shaped} & \text{otherwise} \end{cases}$$

Entry & Exit

- In a given sector s, the fixed-cost f_{qs} of marketing a variety of quality q satisfies

$$\pi_{iqs}(G_{\text{normal}}, \boldsymbol{n}_s + e_q) \leq f_{qs} \leq \pi_{iqs}(G_{\text{normal}}, \boldsymbol{n}_s)$$

- For concreteness, assume that

$$\bar{f}_{qs} = \frac{\pi_{iqs}(G_{\text{normal}}, \boldsymbol{n}_s) + \pi_{iqs}(G_{\text{normal}}, \boldsymbol{n}_s + e_q)}{2}$$

- There is entry iff

$$\pi_{iqs}(G_{\text{recession}}, \boldsymbol{n}_s + e_q) - \bar{f}_{qs} > 0$$

  and exit iff

$$\pi_{iqs}(G_{\text{recession}}, \boldsymbol{n}_s) - \bar{f}_{qs} < 0$$

Multiproduct Firms

Single-Product Firm:

$$\underbrace{\int \left| \frac{\partial c_i^{\text{low}}(y, \boldsymbol{p})}{\partial p_i^{\text{low}}} \right|}_{-} \left(p_i^{\text{low}} - \lambda_i^{\text{low}} \right) = \underbrace{\int c_i^{\text{low}}(y, \boldsymbol{p})}_{+}$$

Multi-Product Firm:

$$\underbrace{\int \left| \frac{\partial c_i^{\text{low}}(y, \boldsymbol{p})}{\partial p_i^{\text{low}}} \right|}_{-} \left(p_i^{\text{low}} - \lambda_i^{\text{low}} \right) = \underbrace{\int c_i^{\text{low}}(y, \boldsymbol{p})}_{+} + \underbrace{\int \frac{\partial c_i^{\text{high}}(y, \boldsymbol{p})}{\partial p_i^{\text{low}}}}_{+} \left(p_i^{\text{high}} - \lambda_i^{\text{high}} \right)$$

$$\underbrace{\int \left| \frac{\partial c_i^{\text{high}}(y, \boldsymbol{p})}{\partial p_i^{\text{high}}} \right|}_{+} \left(p_i^{\text{high}} - \lambda_i^{\text{high}} \right) = \underbrace{\int c_i^{\text{high}}(y, \boldsymbol{p})}_{-} + \underbrace{\int \frac{\partial c_i^{\text{low}}(y, \boldsymbol{p})}{\partial p_i^{\text{high}}}}_{-} \left(p_i^{\text{low}} - \lambda_i^{\text{low}} \right)$$