Pricing Inequality

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Fiscal expansions and prices

- **Standard theory of fiscal expansions and inflation**
  - Increase in demand requires more labor
  - "Hot labor market" drives up wages, marginal cost, prices
- **Seems unsatisfactory given the pandemic period**
  - 2021-2022 inflation surge was from a *"shock to prices given wages"* Bernanke Blanchard (2025)
- **Need a better quantitative theory of fiscal expansions and markups**
  - Develop a new quantitative theory that links:
  - Fiscal expansion $\rightarrow$ Improvement in household balance sheets $\rightarrow$ Higher aggregate markup

What we do

Theory consistent with recent measurement

- Rich households are less price sensitive than poor households, and buy high priced varieties
- Larger firms have higher markups, while selling higher quality goods to more customers

Parsimonious model

- Macro - Heterogeneous agent incomplete markets model
- IO - Additive random utility (discrete choice) model of demand

Two results

1. Deficit financed fiscal expansions have a significant effect on the aggregate markup
   - Accounts for more than 40% of the increase in P/W in the pandemic
2. Household heterogeneity is the main determinant of markup differences across firms
   - Accounts for more than 58% of markup differences between large and small firms

Simple choice model - Rich indulge their tastes, Poor respond to prices

- Two types of households $i \in \{1, 2\}$ with wealth $a^i \in \{a^L, a^H\}$
- Consume one of two goods $j \in \{1, 2\}$, $p_1 > p_2$
- Problem
  1. Draw tastes for each good

$$\zeta_1^i \sim \Gamma\left(\zeta\right) \quad , \quad \zeta_2^i \sim \Gamma\left(\zeta\right), \quad \text{where} \quad \log \Gamma\left(\zeta\right) = -e^{-\eta\zeta}$$

  2. Choose which good to consume

$$\max \left\{ V\left(a^i, p_1\right) + \zeta_1^i \quad , V\left(a^i, p_2\right) + \zeta_2^i \right\}$$

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3. Intensive margin

$$V\left(a^i, p_j\right) = u\left(q_j^i\right) \quad \text{subject to} \quad p_j q_j^i = a^i$$

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2. Choose which good to consume Quality: $\phi_1 > \phi_2$

$$\max \left\{ V\left(a^i, p_1\right) + \zeta_1^i + \frac{1}{\eta} \log \phi_1 \, , \, V\left(a^i, p_2\right) + \zeta_2^i + \frac{1}{\eta} \log \phi_2 \right\}$$

3. Intensive margin

$$V\left(a^i, p_j\right) = u\left(q_j^i\right) \quad \text{subject to} \quad p_j q_j^i = a^i$$

Key formula

- Extensive margin of demand

$$\rho_1^i = \frac{\phi_1 \exp\left\{\eta V(a^i, p_1)\right\}}{\phi_1 \exp\left\{\eta V(a^i, p_1)\right\} + \phi_2 \exp\left\{\eta V(a^i, p_2)\right\}}$$

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- Extensive margin elasticity of demand

$$\varepsilon_1^{\rho,i} = \underbrace{\frac{\partial \log \rho_1^i}{\partial V(a^i, p_1)}}_{\text{Size-based market power}} \times \underbrace{-\frac{\partial V(a^i, p_1)}{\partial \log p_1}}_{\text{Household heterogeneity}}$$

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- Extensive margin elasticity of demand

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- Rich households

✓ Are less price sensitive

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  - ✓ Are less price sensitive
  - ✓ Consume higher priced goods within the same market

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$$\varepsilon_1^{\rho,i} = \underbrace{\eta\left(1 - \rho_1^i\right)}_{\text{Size-based market power}} \times \underbrace{\left(q_1^i\right)^{-(\sigma-1)}}_{\text{Household heterogeneity}}$$

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  - ✓ Are less price sensitive
  - ✓ Consume higher priced goods within the same market

Firm price setting

- Demand

$$x_1 = \rho_1^L q_1^L + \rho_1^H q_1^H$$

- Pricing

$$p_1^* = \frac{\varepsilon_1}{\varepsilon_1 - 1} \overline{mc} \quad , \quad \varepsilon_1 = \sum_i \left(\frac{\rho_1^i q_1^i}{x_1} \right) \varepsilon_j^i$$

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- Large firms
  - ✓ Sell higher quality goods
  - ✓ To more customers
  - ✓ At higher markups

    Size-based market power: Higher quality $\rightarrow$ Higher market share $\rightarrow$ Higher prices

    Household heterogeneity: Higher prices $\rightarrow$ Less elastic customers $\rightarrow$ Higher prices

Quantitative model extends to Nested logit and Bewley

Nested logit

- Many markets $m \in \mathcal{M}$, each has J firms $j \in \{1, \ldots, J\}$ $\boldsymbol{\eta}, \boldsymbol{\theta}, J$
- Pareto distribution of quality ϕ_j $\boldsymbol{\xi}$

Bewley

- CRRA utility $\boldsymbol{\sigma}$
- Stochastic income We_t^i, quarterly
- Labor income tax τ, receive transfers T and profits lump-sum
- Save in government debt

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- Stochastic income We^i_t, quarterly
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- Save in government debt

$$\frac{\partial V\left(a^i, p_j\right)}{\partial \log p_j} \implies \frac{\partial V\left(a^i_t, e^i_t, p_{jm}\right)}{\partial \log p_{jm}}$$

Calibration

1. Follow Kaplan Violante (2024)
   - Income process, borrowing constraint, taxes, transfers, r, β

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2. Replicate calibration strategy in Edmond Midrigan Xu (2023)
   - Firms-per-market J, Pareto tail of quality distribution ξ, Taste distribution η, θ
   - Moments: Concentration, Average markup
   - Important: Positive empirical relationship between Firms' share of sales and Markups

Calibration

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   - Moments: Concentration, Average markup
   - Important: Positive empirical relationship between Firms' share of sales and Markups
3. Replicate regressions in Auer, Burstein, Lein, Vogel (2024)
   - Households with **3**$\times$ less income have elasticities that are higher by **2.4**
   - Requires $\sigma = \mathbf{2.6}$

Model consistent with other important statistics

Disciplined by recent measurement

- ✓ Rich households are less price sensitive than poor households, and buy high priced varieties
- ✓ Larger firms sell higher quality goods to more customers, at higher markups

Model consistent with other important statistics

- How firms' markups respond to changes in household wealth
  - An increase in wealth increases markups

    Stroebel Vavra (2019)

- Which firms are exposed to which households
  - High price goods within a market sold more to high income households

    Jaimovich Rebelo Wong Zhang (2019)

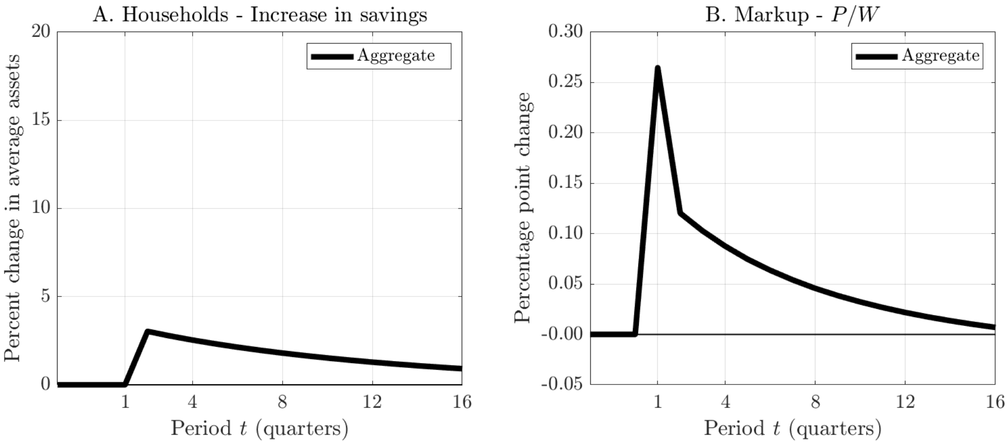
  - High sales firms within a market sell more to high income households

    Faber Fally (2022)

From here

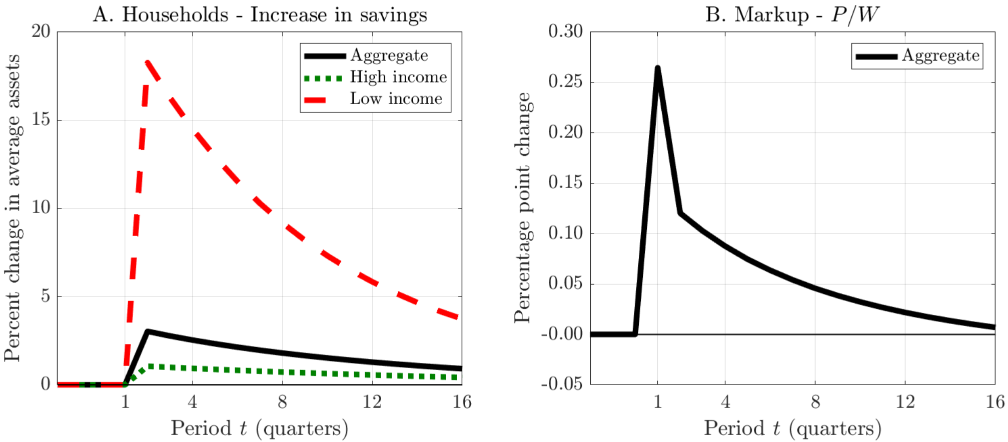
1. Compute the elasticity of the aggregate markup to a fiscal transfer
   - Deficit financed one-time increase in transfers T by 1% of GDP
   - Holding $\overline{G}$ and $\overline{r}$ fixed
   - Increase labor income taxes to smoothly repay debt
2. Apply this to the increase in transfers in 2020-2021
3. How the data disciplines this result

1. Fiscal expansion increases aggregate markup



- Elasticity of aggregate markup P/W is **0.26**.

1. Fiscal expansion increases aggregate markup



- Consistent with excess savings of households in the pandemic (Ganong et al, 2024)

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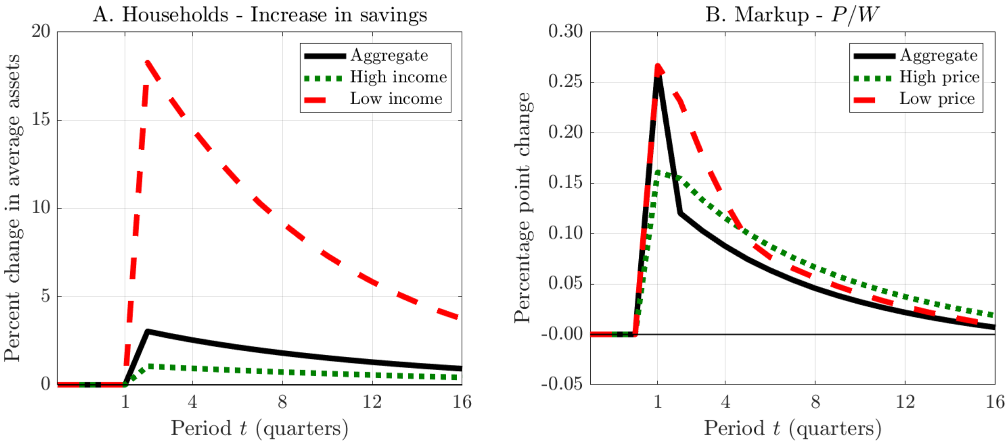
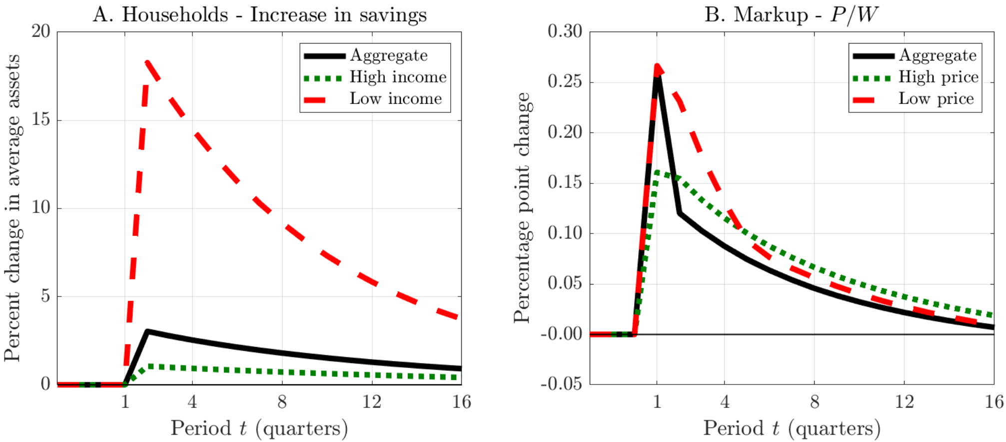


- Consistent with ‘cheapflation’ (Cavallo, Kryvstov, 2024)

1. Fiscal expansion increases aggregate markup



- McDonald's CEO, late 2022 - *"Resilient customers... strategic price increases"*

2. Applied to 2020-2021 fiscal expansion

- 2020 - 2021
  - Increase in transfers: 9.3% of GDP
  - Increase in savings: 8.8% of GDP
- 2022
  - P/W peaks at 5.9% above trend
  - PCE price level P is 7.2% above trend
- Applying our elasticity
  - Increase in transfers of 9.3% of GDP increases the aggregate markup P/W by 2.5%
  - Accounts for **41%** of the 5.9% increase in P/W

3. How the data disciplines this result

$$\varepsilon^{\rho\, i}_{jg} = \underbrace{\left[\theta\, \rho^{i}_{j|m} + \eta\left(1 - \rho^{i}_{j|m}\right)\right]}_{\text{Size based market power}} \quad \underbrace{\left(q^{i}_{jm}\right)^{-(\sigma-1)}}_{\text{Household heterogeneity}}$$

	Baseline
Moments	
Elasticities by Income - Auer et al (2024)	2.42
Concentration, Average markup, Markups-by-Market-share	
Parameters	
CRRA - σ	2.6
Substitutability between / within	$\theta < \eta$
Results	
1. Aggregate markup response to fiscal expansion	
Share of empirical increase in P/W	41 %
2. Decomposition of large vs. small firm markups	
Share due to household heterogeneity	58 %

3. How the data disciplines this result

$$\varepsilon^{\rho\, i}_{jg} = \underbrace{\left[\theta\, \rho^{i}_{j|m} + \eta\left(1-\rho^{i}_{j|m}\right)\right]}_{\text{Size based market power}} \quad \underbrace{\left(q^{i}_{jm}\right)^{-(\sigma-1)}}_{\text{Household heterogeneity}}$$

		Baseline	
Moments			
Elasticities by Income - Auer et al (2024)	0	2.42	2.88
Concentration, Average markup, Markups-by-Market-share	— Same as baseline —		
Parameters			
CRRA - σ	1	2.6	3.4
Substitutability between / within	$\theta < \eta$	$\theta < \eta$	$\theta = \eta$
Results			
1. Aggregate markup response to fiscal expansion			
Share of empirical increase in P/W	0 %	41 %	66 %
2. Decomposition of large vs. small firm markups			
Share due to household heterogeneity	0 %	58 %	100 %

Conclusion

New quantitative theory

- Flexible framework that integrates IO into frontier HA macro
- The key link between the two is the endogenous marginal value of wealth

1. New perspective on fiscal policy - Expansionary policies produce ‘markup shocks’

- Policies studied in incomplete markets settings have markup implications

  Child Tax Credit expansion, UBI, Medical insurance, Tax progressivity, Debt relief, ...

2. New perspective on markups - Household heterogeneity is central

- Counterfactuals studied in incomplete markets settings have markup implications

  Income inequality, Income shocks, Financial instruments, ...

APPENDIX SLIDES

Relaxing the one-good per-period assumption

Answers to important questions

The restriction to a single good each period is not important

- Appendix has important variations with infinitely many purchases per quarter:

  Continuous time model - Shrink the period length. Keep the basket size

  Shopping cart model - Keep the period length. Expand the basket size

The divisibility of the good is not important

- Consider utility over an ‘outside’ good $u(c^i)$
- Then $u'(c^i)$ shows up in elasticity formula

$$u\left(c^i\right) + \psi_{jm} + \zeta^i_{jm}$$
$$c^i + p_{jm} + a^{i\prime} = \ldots$$

Calibration: ABLV / JRWZ

Parameters - Disciplining σ

Auer et al (2024) - *Unequal Expenditure Switching: Evidence from Switzerland*

Data

$$\log\left(\frac{b^i_{Mt}}{b^i_{Dt}}\right) = \beta_0 - \beta_1 \log\left(\frac{p_{Mt}}{p_{Dt}}\right) + \beta_2 \log e^i \log\left(\frac{p_{Mt}}{p_{Dt}}\right) + \varepsilon_{it} \quad , \quad \widehat{\beta}_2 = 2.20$$

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Model

- Compare shares on goods $\{M, D\} \in g$ across low / high income $i \in \{L, H\}$
- To a first order around p_{Dg} then e_L:

$$\log\left(\frac{b^H_{Mg}}{b^H_{Dg}}\right) - \log\left(\frac{b^L_{Mg}}{b^L_{Dg}}\right) = \underbrace{\varepsilon^L_{Dg}\left(\frac{\partial \log c^L_{Dg}}{\partial \log e^L}\right)\left(-\frac{\partial \log \varepsilon^L_{Mg}}{\partial \log c^L_{Mg}}\right)}_{\text{Coefficient estimated in ABLV}} \underbrace{\log\left(\frac{e^H}{e^L}\right) \log\left(\frac{p_{Mg}}{p_{Dg}}\right)}_{\text{Interaction term}}$$

Parameters - Disciplining α

JRWZ (2019) - *Trading Up and the Skill Premium*

Data - Within-market-time, Across-household differences in prices paid

$$\log P^i_{mt} = \lambda_{mt} + \sum_{\mathrm{q}=1}^{Q} \beta_{\mathrm{q}} \mathbb{1}\left[q^i_{dt} = \mathrm{q}\right] + \eta^i_{mt} \quad \text{, where} \quad \log P^i_{mt} = \sum_{u \in \{m,t\}} \omega^i_{umt} \log \overline{P}_{umt} .$$

Refine their approach

- Define markets m as $Module \times DMA$
- Compute average unit prices $\overline{P}_{umt}$ of UPC's u within these markets
- Rank households by *total annual expenditure quantiles* q^i_{dt} within each $DMA \times Year$
- Result - $\widehat{\beta}_5 - \widehat{\beta}_1 = 0.144$

RESULTS - NESTED CALIBRATIONS

Result 2 - Household heterogeneity accounts for markup differences

		Baseline	**Log model**	**Monopolistic competition**
			$(\sigma = 1)$	$(\eta = \theta)$
		(1)	(2)	(3)
A. Household parameters				
Curvature in consumption	σ	2.6	1	
Taste dispersion - Within markets	η	8.9	2.12	
- Across markets	θ	0	0	
B. Firm parameters				
Tail parameter of Pareto	ξ	10.9	4.1	
Decreasing returns	α	0.63	0.66	
C. Moments				
Firms - Top 4 sales share		0.30	0.30	
Firms - Average markup	$\mathbb{E}[\mu_j]$	1.25	1.25	
Firms - Markups and sales shares	β_{EMX}	0.03	0.03	
Households - Elasticities and income	β_{ABLV}	2.20	0	
Households & Firms - Sorting	$\beta^5_{JRWZ} - \beta^1_{JRWZ}$	0.14	0	
Price dispersion	$\text{Std.}[\log p_j]$	0.14	0.14	
Share of elasticity variation due to h'hold heterogeneity		58	0	

Note: All economies have the same interest rate (r), with other parameters recalibrated to match the same level of total differentiated goods expenditure $(\overline{Z})$, labor income taxes (τ) and transfers (T) to GDP, average assets to average income (β)

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		(1)	(2)	(3)
A. Household parameters				
Curvature in consumption	σ	2.6	1	$\uparrow$ 3.4
Taste dispersion - Within markets	η	8.9	2.12	11.7
- Across markets	θ	0	0	
B. Firm parameters				
Tail parameter of Pareto	ξ	10.9	4.1	14.7
Decreasing returns	α	0.63	0.66	0.64
C. Moments				
Firms - Top 4 sales share		**0.30**	**0.30**	**0.30**
Firms - Average markup	$\mathbb{E}[\mu_j]$	**1.25**	**1.25**	**1.25**
Firms - Markups and sales shares	β_{EMX}	**0.03**	**0.03**	**0.03**
Households - Elasticities and income	β_{ABLV}	**2.20**	0	$\uparrow$ 2.62
Households & Firms - Sorting	$\beta^5_{JRWZ} - \beta^1_{JRWZ}$	**0.14**	0	$\uparrow$ 0.17
Price dispersion	Std.$[\log p_j]$	0.14	**0.14**	**0.14**
Share of elasticity variation due to h'hold heterogeneity		58	0	100

Note: All economies have the same interest rate (r), with other parameters recalibrated to match the same level of total differentiated goods expenditure $(\overline{Z})$, labor income taxes (τ) and transfers (T) to GDP, average assets to average income (β)

Results - Welfare effects of markups

Role of consumer heterogeneity - Welfare effects of markups

Who gains from competitive product markets?

- Follow exercise in Edmond, Midrigan, Xu (2023)

- Implement optimal quantity subsidy $S_j = s_j^* y_j$:

$$p_j^* = \frac{\varepsilon_j^*}{\varepsilon_j^* - 1}\left[mc_j^* - s_j^*\right] \quad , \quad s_j^* = \frac{mc_j^*}{\varepsilon_j^*}.$$

- Financed by lump-sum tax on households: $S = \sum_j S_j$

Role of consumer heterogeneity - Welfare effects of markups

Who gains from competitive product markets? **Poor households.**

		Baseline	Optimal Subsidy
A. Statistics	Interest rate	2.00%	1.67%
	Average markup	24%	25%
	EMX slope	0.034	0.078
B. Firms	**Total quantities**		
	Low quality goods		-1.66
	High quality goods		4.31
C. Households	**Average quality -** ϕ_j		
	Poor		2.2
	Rich		-0.9
	Average consumption		
	Poor		-7.9
	Rich		3.5
	Average welfare - $\overline{V}(a, e)$		
	Poor		46.2
	Rich		-21.9

Note: Firms split by top / bottom quintile of sales in baseline. Households split by top / bottom half of cash-on-hand in baseline. All values are log changes expressed in log points.

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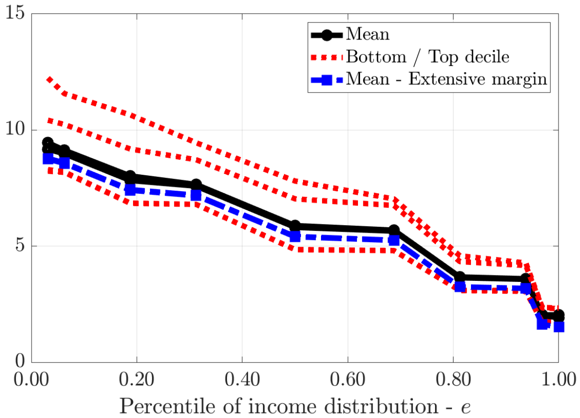
A. Statistics	Interest rate	2.00%	2.00%
	Average markup	24%	25%
	EMX slope	0.034	0.077
B. Firms	**Total quantities**		
	Low quality goods		-1.30
	High quality goods		4.83
C. Households	**Average quality -** ϕ_j		
	Poor		2.3
	Rich		-0.6
	Average consumption		
	Poor		-8.0
	Rich		2.9
	Average welfare - $\overline{V}(a, e)$		
	Poor		46.1
	Rich		-23.0

Note: Firms split by top / bottom quintile of sales in baseline. Households split by top / bottom half of cash-on-hand in baseline. All values are log changes expressed in log points.

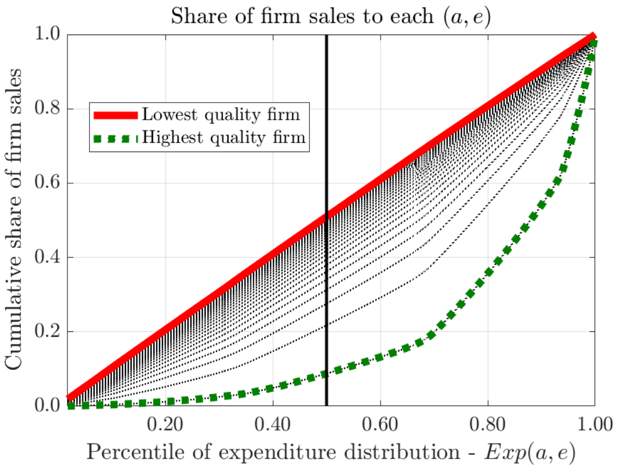
Results - Cross-section

1. Elasticities



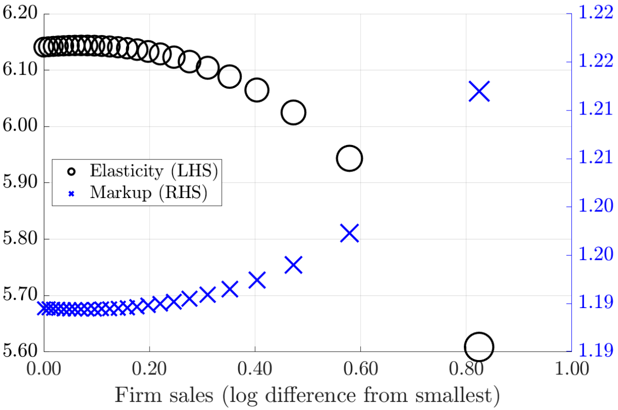
- Simple regression: $\mathbb{E}\left[\varepsilon^i|e\right] = \beta_0 - \beta_1 \log e, \quad \widehat{\beta}_1 = 2.19$
- Nakamura Zerom (2010) - 'Coffee paper' - *A household with an income 1 s.d. above the mean has a price elasticity about 20% [18.1%] below the price elasticity of the median consumer [8.34].*

2. Sorting



- At the low quality firm, >50 percent of sales to below median expenditure households
- At the high quality firm, <15 percent of sales to below median expenditure households

3. Markups



- High quality firms have: Higher sales, Higher prices, Lower elasticities, Higher markups