Market Asymmetry and Monetary Policy

IHEID Brown Bag Lunch

Gregory Auclair
allan.auclair@graduateinstitute.ch

Outline

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Why Does Market Asymmetry Matter?

- Some firms have substantial pricing power
  - How does this affect aggregate price dynamics?
  - Do these firms respond differently to shocks?

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- Some firms have substantial pricing power
  - How does this affect aggregate price dynamics?
  - Do these firms respond differently to shocks?
- Markup dispersion implies households allocate income inefficiently
  - Does monetary policy directly affect allocative efficiency?
- There are many indications large firms are getting larger
  - Large firms tend to be efficient, which is good
  - If markets become uncompetitive, then problematic
  - How do we evaluate the tradeoffs?

This Paper

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- Solves a NK model where market position influences pricing behavior
  - Includes strategic interaction between firms
- Establishes a relation between aggregate price dynamics and concentration
  - Compares both margins: (i) fewer firms in an industry and (ii) domination of an industry by one firm
- Evaluates how shocks affect the dynamic allocative efficiency of the economy
  - Helps quantify the welfare loss from price distortions
  - Shows strategic complementarity can play a role under certain conditions

What Is the Typical Market Structure?

Fact 1: A Few Firms Control Most Market Share in an Industry

- In both Europe and the US, an HHI over 2000 seems typical for an industry
- A value of 2500 is considered "highly concentrated"
- Benkard et al. (2021) finds 44% of local markets in the US have an HHI over 2500, based on consumer survey data
- Top two firms usually control around 60% of market share within narrowly defined markets (both EU and US)

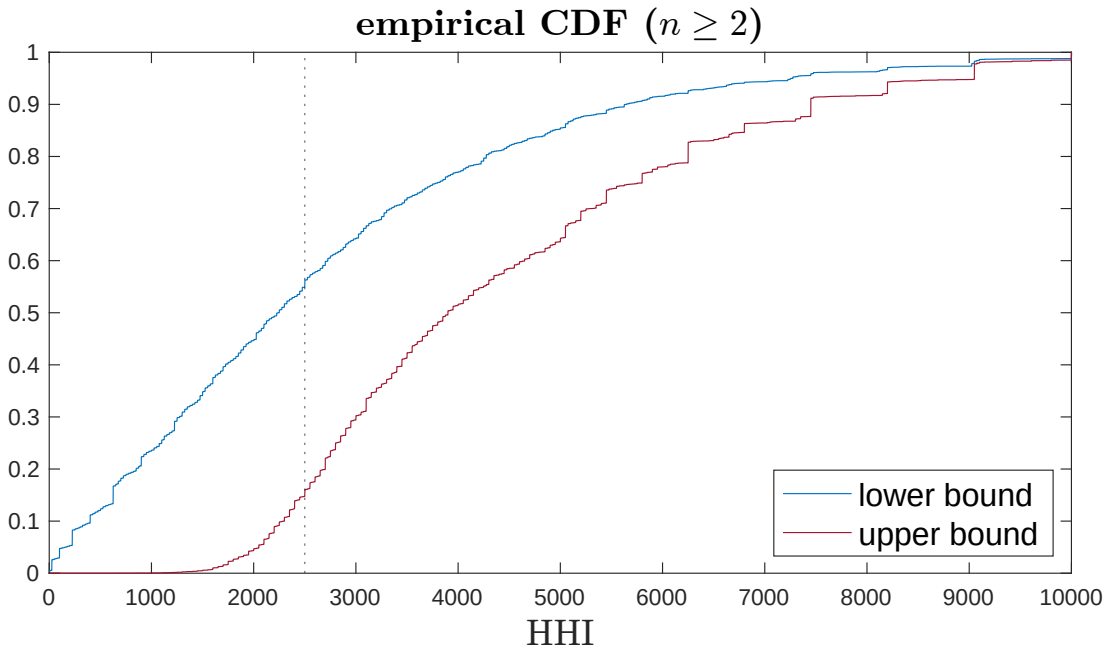
Fact 2: Leading Firm in an Industry Has a Large Advantage

- Controls 1.5x-2x the market share of the nearest rival
- Hottman et al. (2016) finds the markup is large: 24 to 100% higher than the sector average (depending on approach)

Evidence for High Concentration in EU

- HHI = sum of squared market shares across firms in an industry
  - Range goes from 0 (perfect competition) to 10,000 (monopoly)
- EU Commission collects information on the market share of firms and competitors as part of its merger review process
- Affeldt et al. (2018) collects cases and the resulting database provides information on 10,000 antitrust markets

Figure: Antitrust Market HHIs from Affeldt et al.



Adding Market Structure to NK Model

- NK model typically uses a CES aggregator to describe demand
  - In this case, continuum of identical firms all have equal market power
- Nested CES (N-CES) adds competition within an industry
  - Firms are discrete, prices and market share can vary
- N-CES implies a link between market share and pricing power
- When firms are asymmetric, price elasticity of demand differs

$$\frac{\partial \log(y_{sjt})}{\partial \log(p_{sjt})} = (\varphi - \sigma) x_{sjt} - \varphi \quad \text{where} \quad x_{sjt} \equiv \frac{p_{sjt} y_{sjt}}{\sum_{s=1}^{n} p_{sjt} y_{sjt}} \tag{1}$$

$$= \frac{\varphi - \sigma}{n} - \varphi \quad \text{(if firms are identical)} \tag{2}$$

Evidence on Firm Pricing Behavior

Fact 1: Large Firms Limit Pass-Through of Cost Shocks

- There is strong empirical evidence for this, but most papers are from the trade literature: e.g. Berman et al. (2012), Auer and Schoenle (2016), Amiti et al. (2019)
- Esitmates sugggest large firms pass through 50-60% of cost shocks, small firms have full pass through

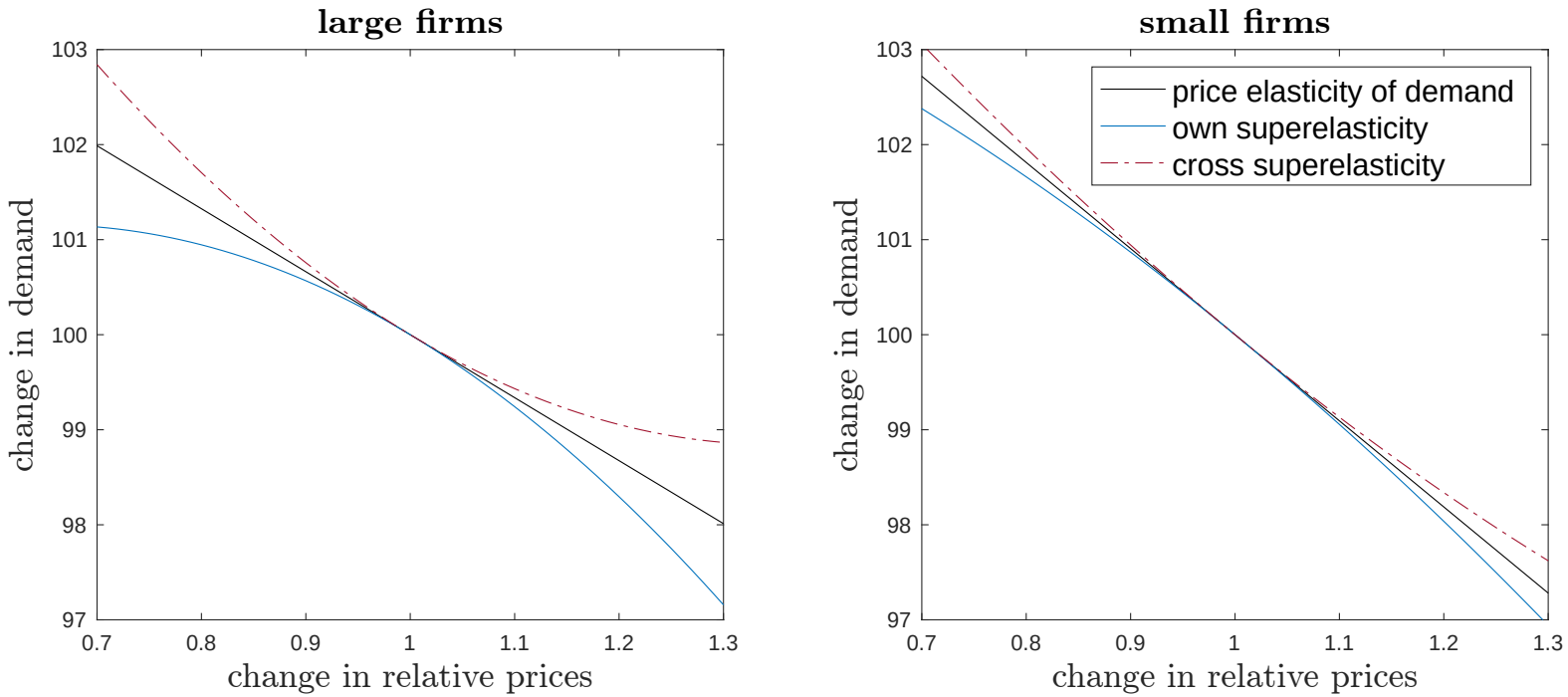
Fact 2: Large Firms Are Strategic

- Rival prices typically a top response on research surveys looking at motivation for price changes
- Amiti et al. suggests large firms match around 50% of price increases by rival firms
- Small firms do not appear strategic

Price Elasticity of Demand

- The slope of the price elasticity of demand sets the markup
- The curvature determines the pass-through of cost shocks
- Strategic interaction also affects the curvature

Figure: Price Elasticity of Demand for Large and Small Firms



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Asymmetric Specification

- Model is limited to the interaction of small and large firms
- Market share is function of prices

$$x_{sjt} = \left(\frac{p_{sjt}}{p_{jt}} \right)^{1-\varphi} \tag{3}$$

- The industry price index is given by

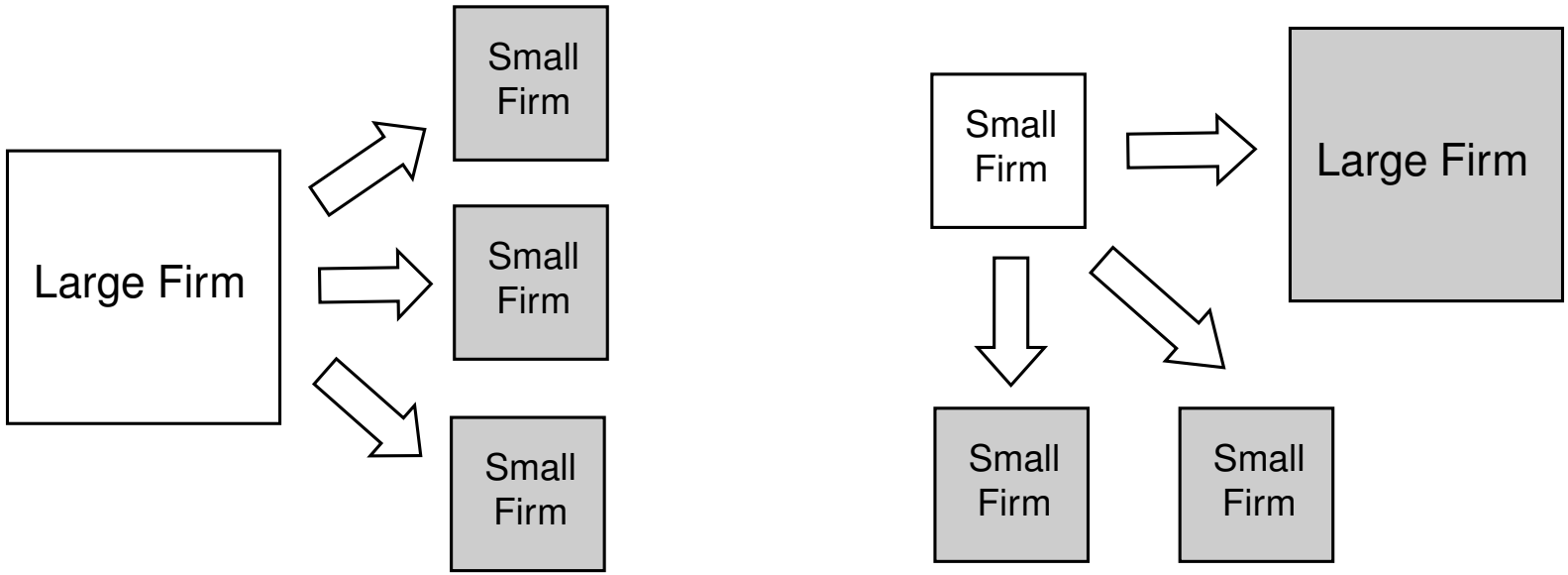
$$p_{jt} = \left[\underbrace{(p^{i}_{sjt})^{1-\varphi}}_{\text{own price}} + \underbrace{(n_s - 1)(p^{-i}_{sjt})^{1-\varphi} + n_{-s}(p^{-i}_{-sjt})^{1-\varphi}}_{\text{rival prices}} \right]^{\frac{1}{1-\varphi}} \tag{4}$$

- Firm considers number of rivals when setting prices
- Price $\uparrow$ or number of rivals $\uparrow$ $\implies$ market share $\downarrow$

Competition within an Industry

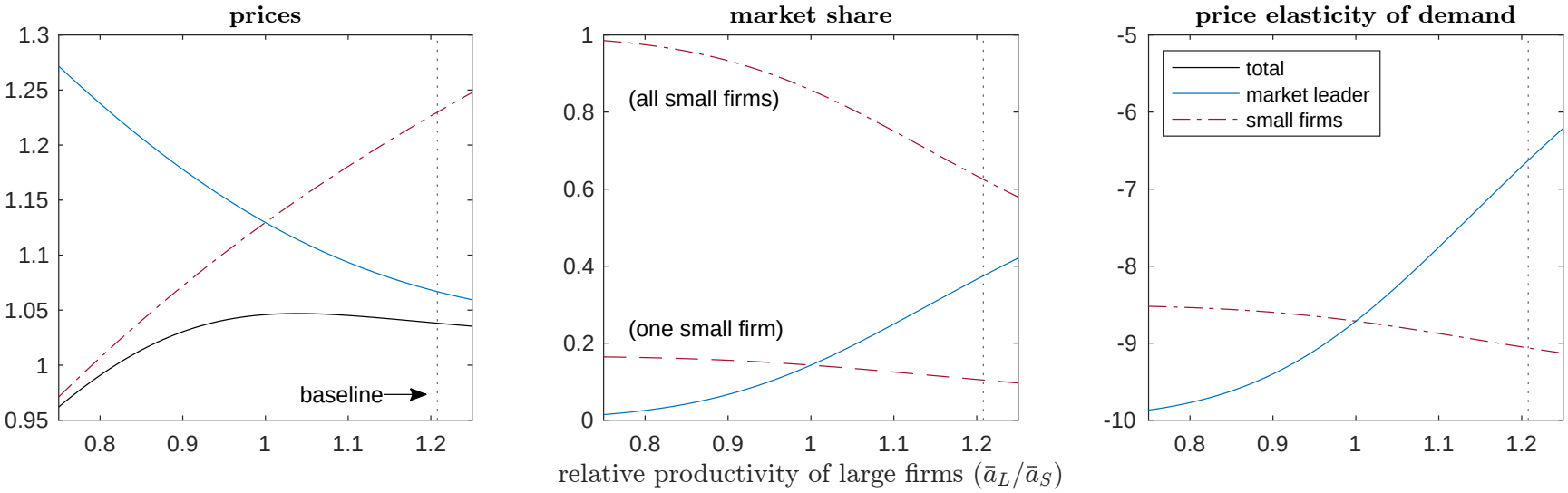
- The model specifies one large firm in a sector and multiple small firms
- Differences in prices are explained by a productivity wedge

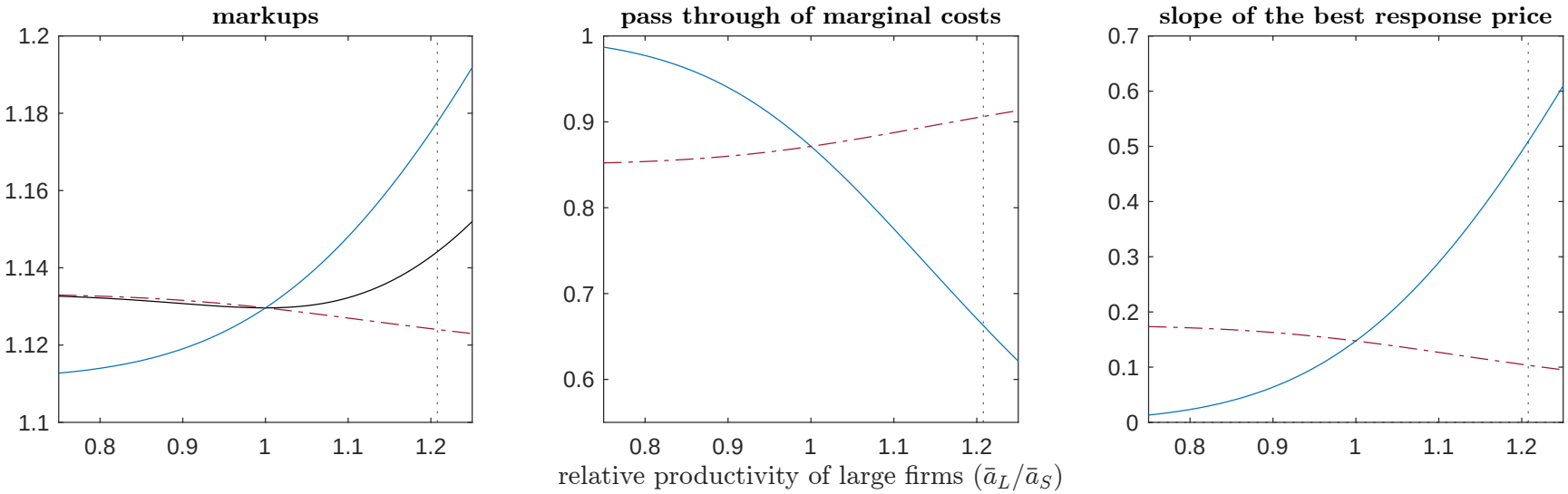
Figure: Competition from the Firm's Perspective



- Under flexible prices, the firm's problem is $\Pi_{st} = (p_{st} - \mathcal{C}_{st})y_{st}$

Flexible Price Equilibrium





Dynamic Problem with Sticky Prices

- Rotemberg price adjustment costs introduced

$$\frac{\Theta_s}{2}\left(\frac{P^i_{st}}{P^i_{st-1}}-1\right)^2 Y_t \quad \text{where} \quad \Theta_s = x_s\Theta \tag{5}$$

- Θ gives the adjustment cost, which is firm-specific
- Each firm's problem becomes

$$\mathcal{L} = \mathbb{E}_t \sum_{k=0}^{\infty} \Lambda_{t+k}\left[\left(p_{st+k}-\mathcal{C}_{st+k}\right) y_{st+k} - \frac{\Theta_s}{2}\left(\pi_{t+k}\frac{p_{st+k}}{p_{st+k-1}}-1\right)^2 P_{t+k}Y_{t+k}\right] \tag{6}$$

- Stochastic discounting follows from the household Euler equation

$$\Lambda_{t+k} = \beta^k \frac{P_t}{P_{t+k}}\frac{C_t}{C_{t+k}} \tag{7}$$

Solution Method

- The solution to the firm's optimization problem is log-linearized
- The resulting decision rule is given by

$$\tilde{p}^{i}_{st} = \Gamma_s \tilde{p}^{i}_{st-1} + (1 + \Gamma'_s)\widetilde{c}^{\,i}_{st} + \Gamma^*_s \tilde{p}^{-i}_{-st} + \widehat{\Gamma}_s \tilde{\pi}_t \tag{8}$$

- The Γ's collect all time-invariant terms
- The full solution incorporates the rival's decision rule

$$\tilde{p}^{i}_{st} = \underbrace{\frac{\Gamma_s}{1 - \Gamma^*_s \Gamma^*_{-s}}}_{\Upsilon_s} \tilde{p}^{i}_{st-1} + \underbrace{\frac{\Gamma^*_s \Gamma_{-s}}{1 - \Gamma^*_s \Gamma^*_{-s}}}_{\Upsilon^*_s} \tilde{p}^{-i}_{-st-1} + \underbrace{\frac{1 + \Gamma'_s}{1 - \Gamma^*_s \Gamma^*_{-s}}}_{\Upsilon'_s} \widetilde{c}^{\,i}_{st} + \underbrace{\frac{\Gamma^*_s (1 + \Gamma'_{-s})}{1 - \Gamma^*_s \Gamma^*_{-s}}}_{\Upsilon''_s} \widetilde{c}^{\,-i}_{-st} + \underbrace{\frac{\widehat{\Gamma}_s + \Gamma^*_s \widehat{\Gamma}_{-s}}{1 - \Gamma^*_s \Gamma^*_{-s}}}_{\Upsilon^{\pi}_s} \tilde{\pi}_t$$

- Rival past prices and marginal costs are included
- The solution for each type of firm is different

General Equilibrium

- Necessary to solve for the response of aggregate output and inflation to shocks
  - Two shocks are included: monetary policy and productivity
- Also necessary to solve for relation between firm-specific marginal costs and output
- Approach:

Parameter Settings

Table: Baseline Parameter Values

Parameter	Value	Description
β	0.99	Household time discount
α	0.30	Capital share
σ	1	Elasticity of substitution across goods
φ	10	Elasticity of substitution across varieties
Θ	125	Rotemberg price adjustment costs
n_L	1	Number of large firms in an industry
n_S	6	Number of small firms in an industry
$\bar{a}_L$	0.91	Productivity of large firms
$\bar{a}_S$	1.09	Productivity of small firms
ϕ_π	1.50	Monetary policy inflation reaction
ϕ_y	0.125	Monetary policy output gap reaction
ρ_m	0.85	Persistence of monetary policy shocks
ρ_a	0.90	Persistence of productivity shocks

- Value for Θ implies an average price duration of 8 months

Calibration: Targets and Model Results

Table: Industry-Level Targets

Description	Large firms Target	Large firms Value	Small firms Target	Small firms Value	Source
Targeted					
Market share	0.35	0.37	0.12	0.10	Affeldt et al. (2018)
Pass-through	0.65	0.66	0.97	0.91	Amiti et al. (2019)
Slope of best response price	0.48	0.51	0.00	0.10	Ibid.
Markup ($\mu - 1$)	0.24	0.18	0.16	0.12	Hottman et al. (2016)
Implied					
Log price	–	0.06	–	0.21	–

Table: Aggregate Targets

Description	Target (range)	Value	Source
Targeted			
Median Industry HHI	2045 - 2360	2060	Benkard et al. (2021)
Aggregate Markup ($\mu - 1$)	0.13 - 0.16	0.14	IRS SOI
Slope of the Phillips curve	0.33 - 0.50	0.36	Tetlow (2022)
Implied			
Price dispersion (std. dev.)	–	0.07	–
Markup dispersion (std. dev.)	–	0.02	–

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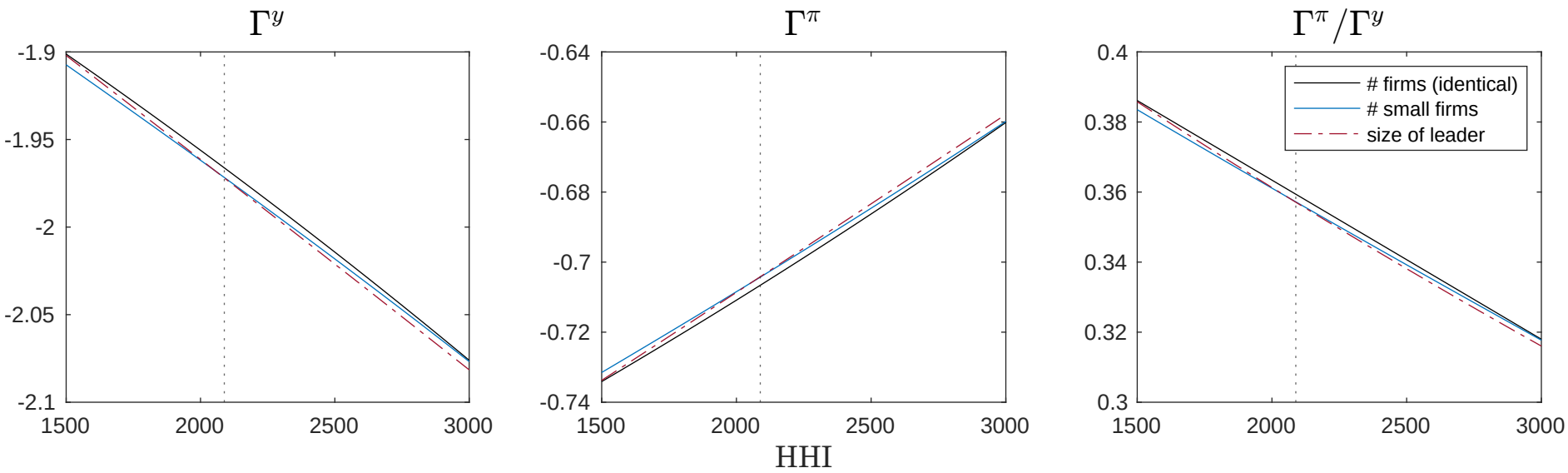
Slope of the Phillips Curve

- With identical firms, the slope of the Phillips is given by

Figure: Response of Output and Inflation to a Monetary Policy Shock



Response to a Monetary Policy Shock

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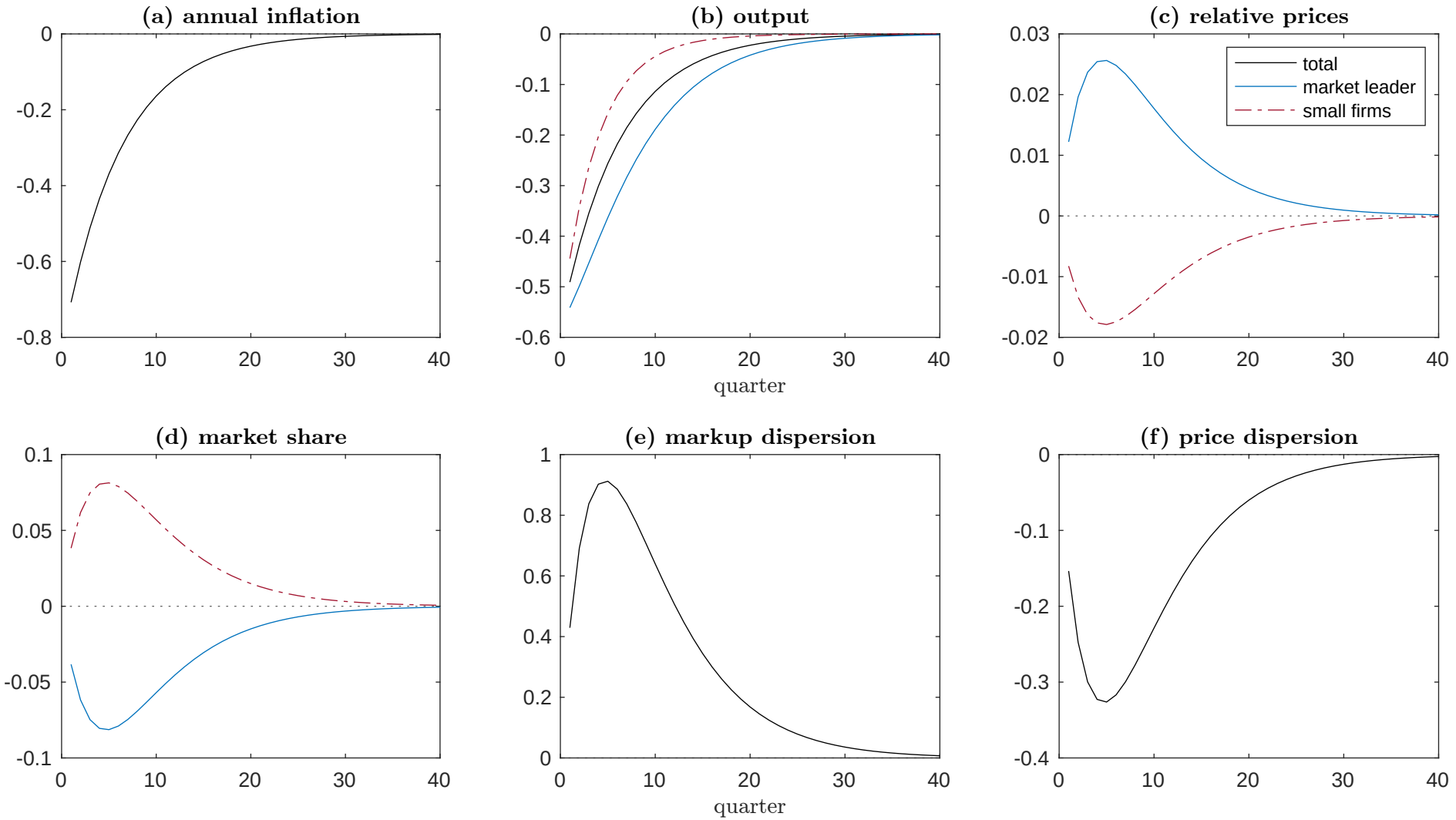
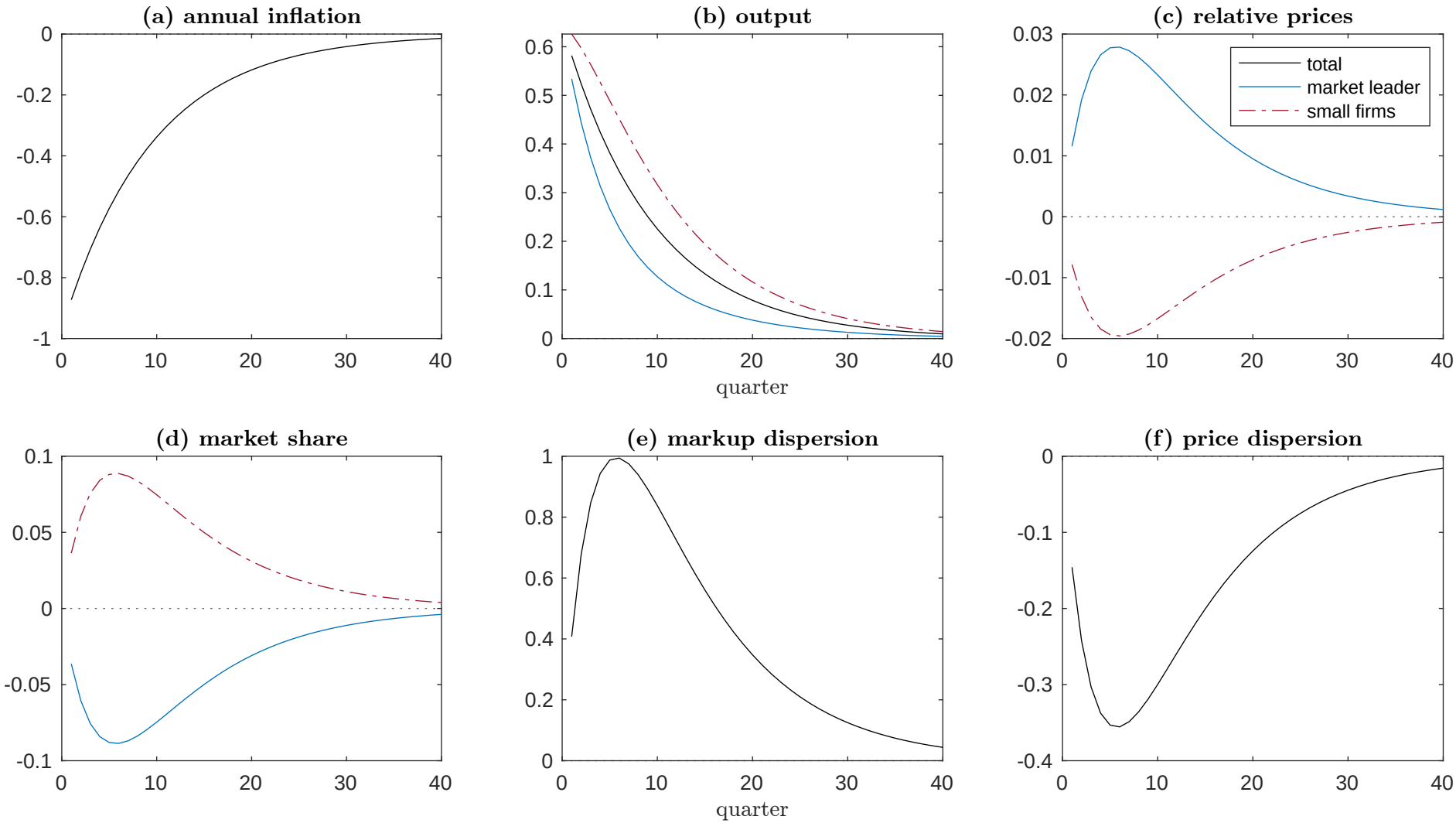


Response to a Monetary Policy Shock

Response to a Productivity Shock

Figure: Reponse of Output and Inflation to a Productivity Shock



Response to a Productivity Shock

Allocative Efficiency

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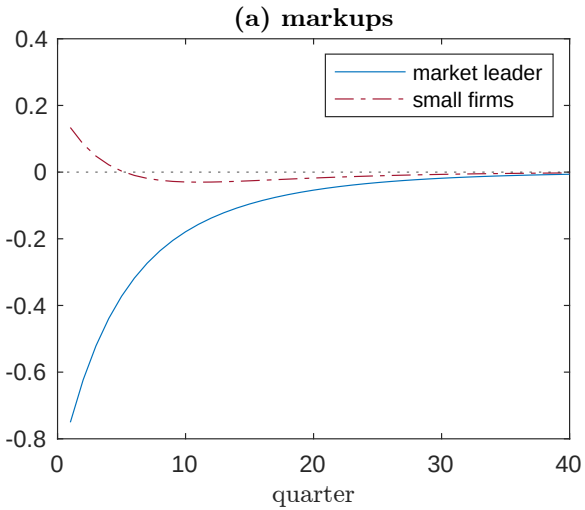

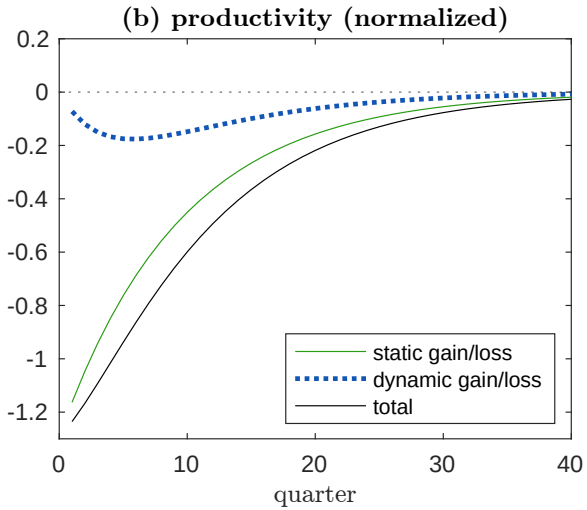

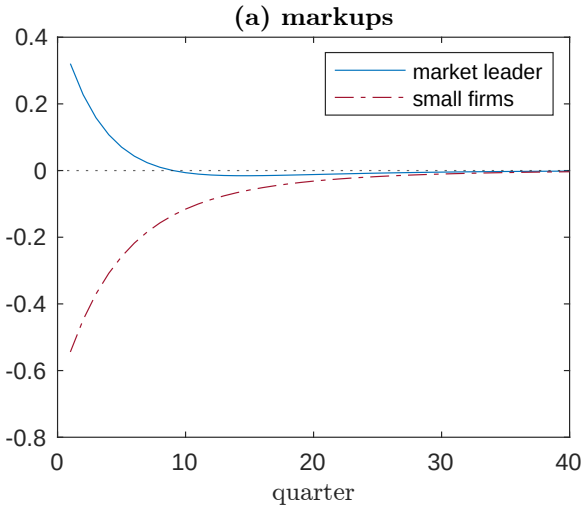

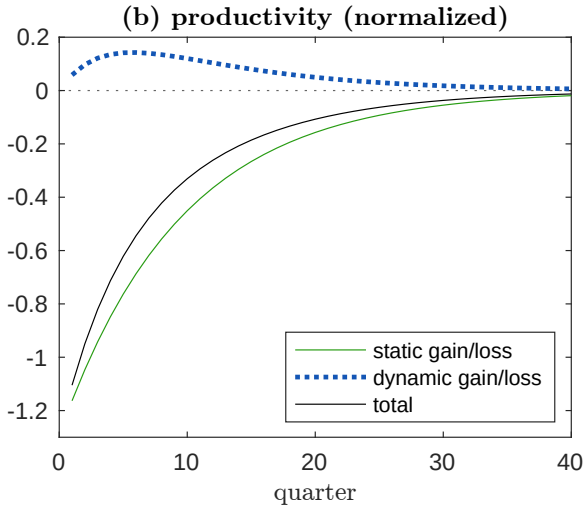

Allocative Efficiency

Comparison with Standard NK Model

Table: OLS Regression of Price Dispersion on Inflation Following a Productivity Shock (Simulated Data)

Price dispersion	NK Model (1)	Baseline (2)
Inflation	0.612***	0.027***
	(0.054)	(0.003)
Constant	-0.001***	0.069***
	(0.000)	(0.000)
R-squared	0.769	0.616

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Main Takeaways

Future Research Directions

- DiSP database on productivity differences
- Analysis of disersion in PPIs within an industry