Competition, Markups, and Inflation: Evidence from Australian Firm-Level Data

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Motivation

- *How much of recent inflation is due to market power?*

- *Are rising profit margins a source of inflation amplification?*

- Against a background of declining product market competition, increased sales concentration, etc.

- A bit vague. But can identify at least two hypotheses of interest:

  (i) **strong version:** recent shocks provide firms with the 'cover' that allows them to pass on costs more than 1:1, thereby amplifying inflation

  (ii) **weak version:** market structure (e.g. concentration) contributing to an amplification of shocks, including inflationary shocks

This Paper: Two Contributions

(1) *Reduced-form evidence* from Australian micro data

- changes in industry-level prices vs. changes in industry-level markups
  (as in Conlon, Miller, Otgon and Yao 2023 AEA P&P)
- changes in firm-level prices and profits
- impulse responses of prices to unexpected changes in costs
  (as in Bräuning, Fillar and Joaquim 2022wp)

(2) *Model* parameterized to match key features of Australian micro data

- heterogeneous firms with endogenously variable markups, sticky prices
  (as in Baqaee, Farhi and Sangani 2023 JPE)
- key parameters estimated using model-implied cross-sectional relationship between firm-level market shares and markups
  (as in Edmond, Midrigan and Xu 2023 JPE
- estimated markups using production function techniques
  (as in De Loecker and Warzynski AER 2012; Hambur 2023 Econ Record)

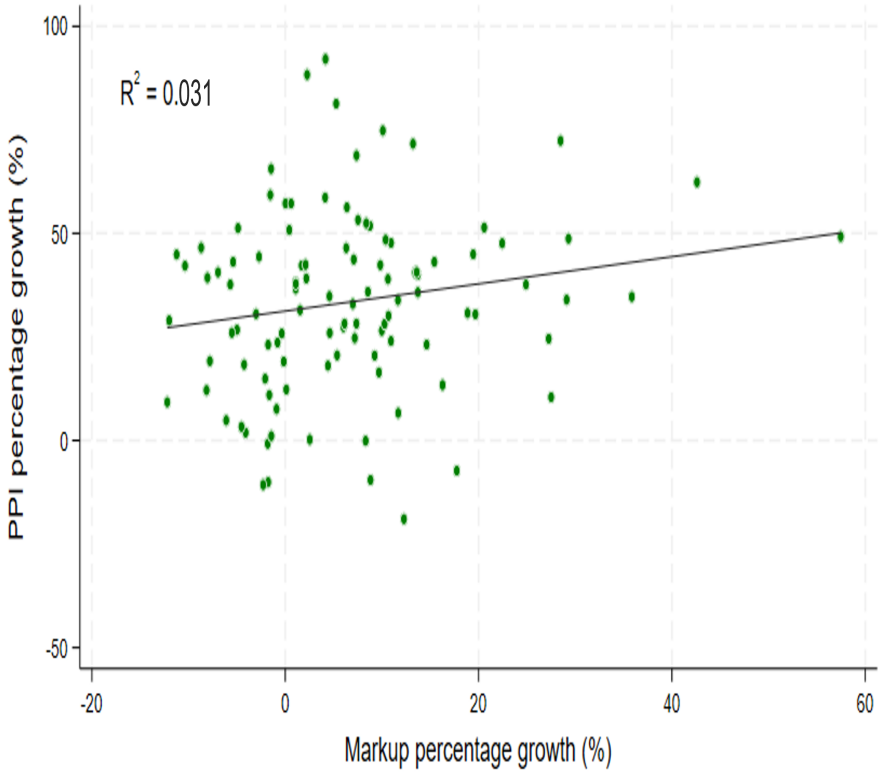
Evidence from Micro Data

Industry Markups and Prices

- Estimate firm-level markups (Hambur 2023).
- Take industry average markups, sales weighted average of firm markups.
- Compare change in industry average markup to change in PPI.
- **Pros:** based on administrative tax data with very high coverage, so representative *within* any industry.
- **Cons:** but PPI only covers a relatively small share of industries

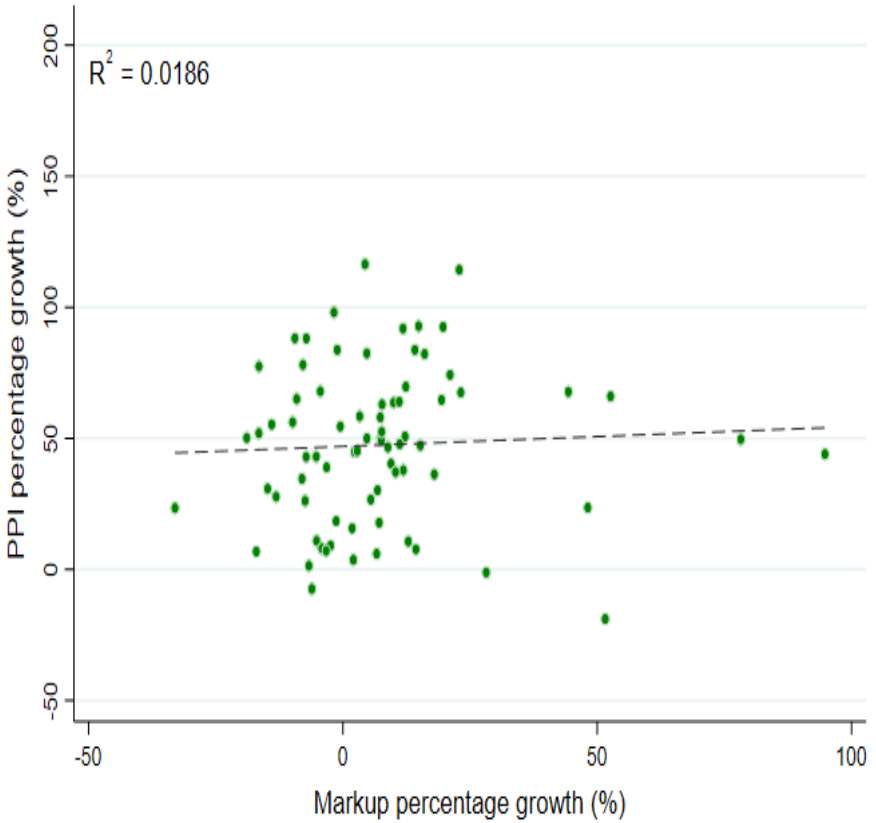
  $\sim$ 1/3rd, mainly in manufacturing

Industry Markups and Prices



β=0.328
P-value = 0.019
Outliears trimmed top and bottom percentiles, growth from 2004-2017
Full line indicates results are statistically significant at 5% level

2004–2017



Change for each 4-digit industry over 2003/04 to 2020-21
Dashed line indicates results are not statistically significant at 5% level

2004–2021

Firm Prices and Profits

- Recently merged firm-level prices for ~ 50 retailers
  - linked to tax filing, reported firm profits
  - more timely, so can look at 2022, but far smaller sample
- Regress firm profits on average firm prices changes each quarter.
- Are price increases associated with increased profits at the firm level?
- If so, may be suggestive of more than 1:1 passthrough from costs to prices.

Firm Prices and Profits

	full sample	split sample
price change	-0.147***	-0.137
	(0.044)	(0.225)
price change*2019		0.0235
		(0.261)
price change*2020		0.056
		(0.245)
price change*2021		-0.178
		(0.241)
price change*2022		0.102
		(0.234)
R-squared	0.011	0.047
observations	742	742

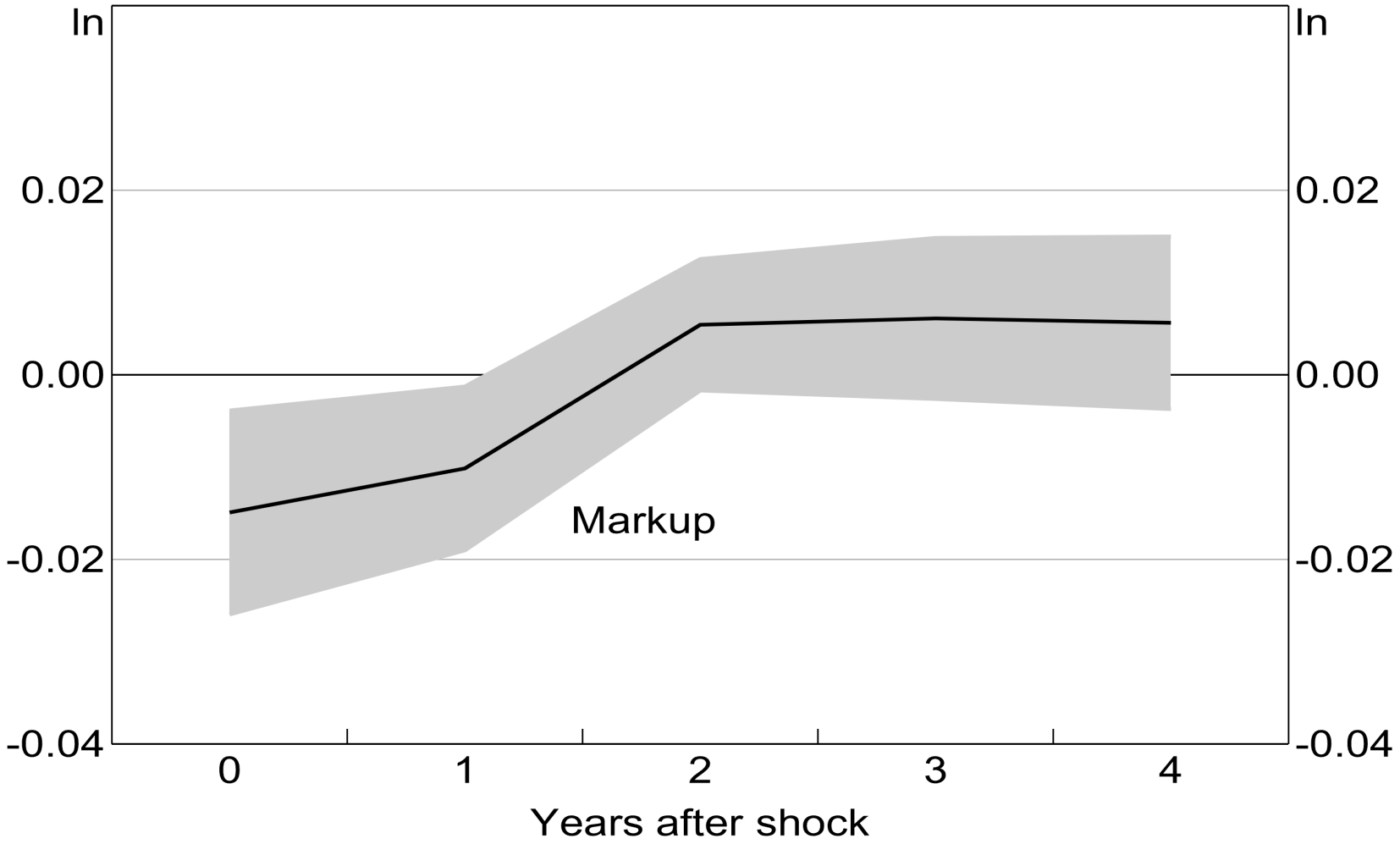
Quarterly firm-level regression of gross profit margin on average price change for continuing items. Includes year fixed effects, excludes small firms below threshold for expense reporting.

Passthrough from Cost Shocks to Prices

- *Do cost shocks have larger effects when competition is weaker?*
- Use Bräuning, Fillar and Joaquim (2022) method
  - local projections of industry-level 'cost shocks' on PPI
  - evaluate how results change with amount of competition
  - cost shocks constructed using granular instrumental variable (GIV) approach, *aggregating firm-level residuals from cost regressions*, that is, unexpected changes in costs
- Key assumption: these are cost shocks, not regression misspecification etc.

$$\ln PPI_{t+h,i} = \alpha_i^h + \alpha_t^h + \beta_h * GIV_{i,t} + \beta_{h,mu} * GIV_{i,t} * \mu_{i,t} + \gamma * X_{i,t} + \epsilon_{i,t}$$

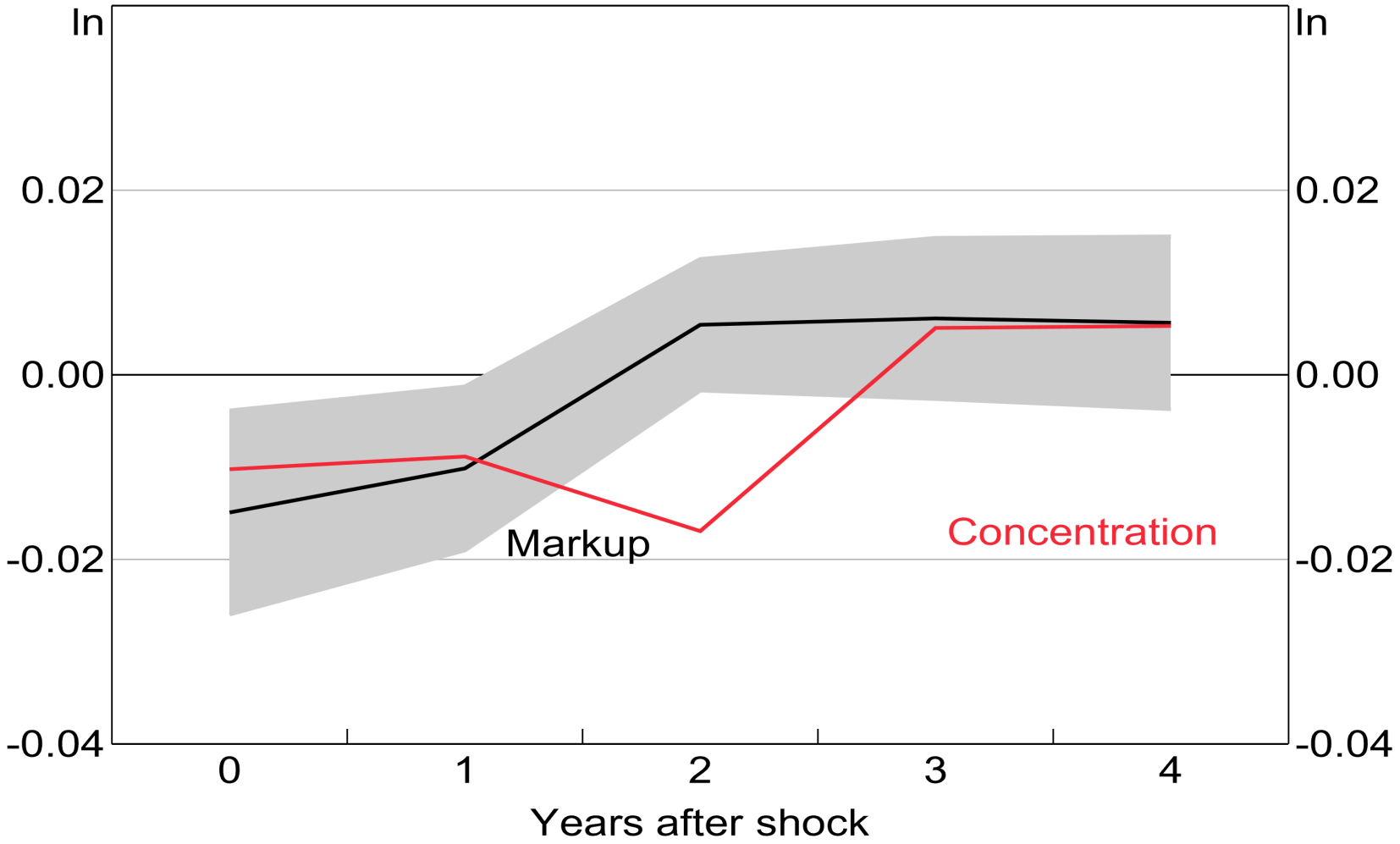
Effect of Higher Markups on Passthrough



* Shaded region shows 90 per cent confidence intervals

Interaction coefficient of industry-level markups on industry-level passthrough controlling for industry-by-year fixed effects and lagged PPI. One standard deviation shock.

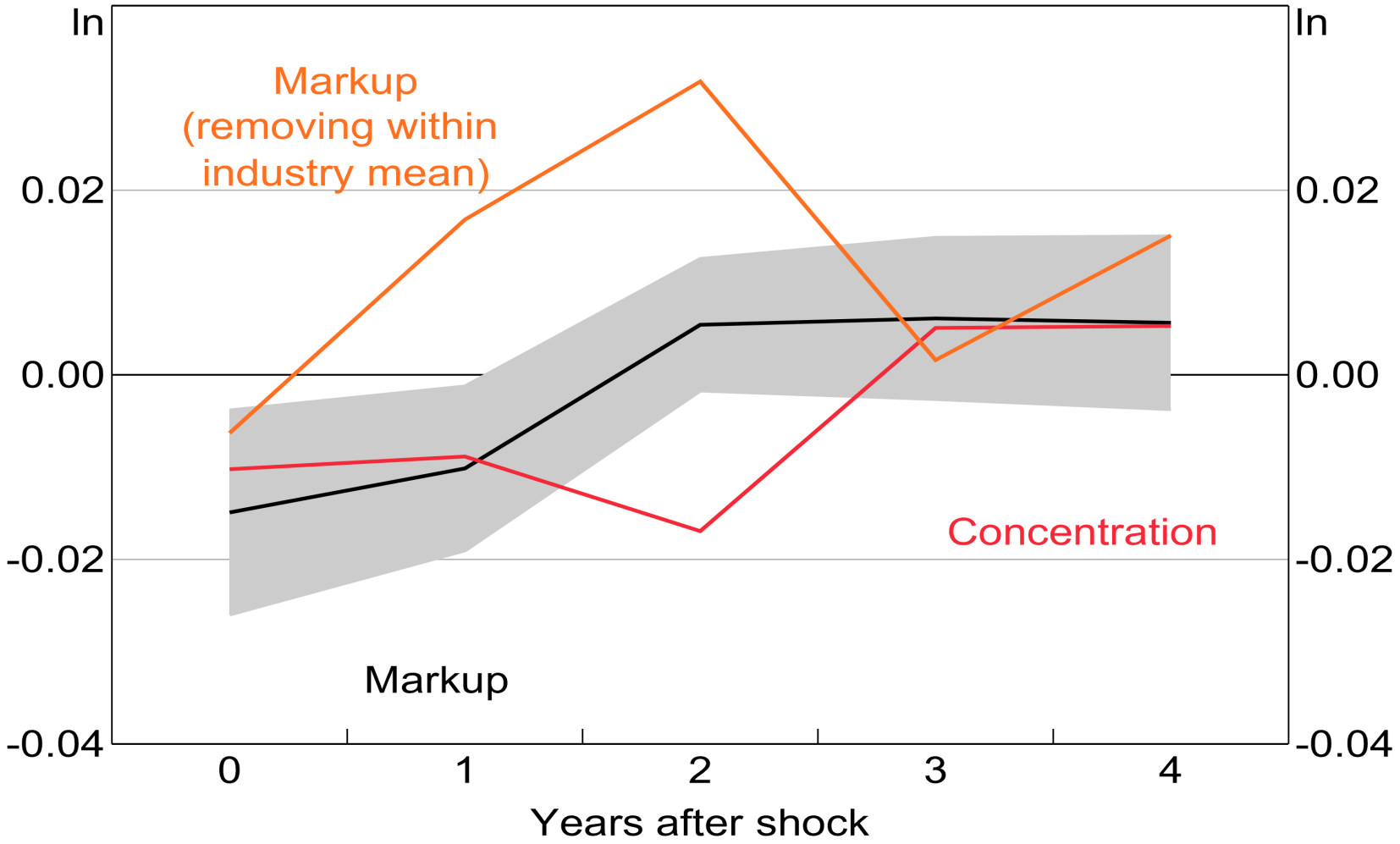
Effect of Higher Concentration on Passthrough



* Shaded region shows 90 per cent confidence intervals

Interaction coefficient of industry-level HHI on industry-level passthrough controlling for industry-by-year fixed effects and lagged PPI. One standard deviation shock.

Effect of Relative Markups on Passthrough



* Shaded region shows 90 per cent confidence intervals

Interaction coefficient of *demeaned* industry-level markups on industry-level passthrough controlling for industry-by-year fixed effects and lagged PPI. One standard deviation shock.

Model

Model Overview

- **Goal:** supplement reduced-form evidence with results from model.

- **Setup:**
  - ex ante heterogenous firms, endogenous markups [Kimball demand]
  - sticky prices [Calvo friction]

- **Key mechanisms:**
  - *strategic complementarities* in price setting, affects average passthrough
  - *endogenous TFP dynamics*, due to reallocation between firms

- Calibrated to Australian firm-level data.

Firms: Final Good

- Final good produced by competitive firms using bundle of intermediates.
- Kimball aggregator

$$\int_0^1 \Upsilon\left(\frac{y_i}{Y}\right) di = 1$$

where $\Upsilon' > 0$, $\Upsilon'' < 0$. CES is special case Υ a power function.

- Price and demand index given by

$$P = \int_0^1 p_i \, q_i \, di, \qquad D = \left(\int_0^1 \Upsilon'(q_i) \, q_i \, di \right)^{-1}$$

Firms: Intermediate Producers

- Monopolistically competitive intermediate producers, productivity z_i.
- **Flex-price markups**
  - inverse demand curve facing intermediate $i \in [0,1]$ given by

$$\frac{p_i}{P} = \Upsilon'(q_i)\, D, \qquad q_i := \frac{y_i}{Y}$$

  - *demand elasticity* and *markup* vary with size

$$\sigma(q_i) := -\frac{\Upsilon'(q_i)}{\Upsilon''(q_i) q_i}, \qquad \mu(q_i) = \frac{\sigma(q_i)}{\sigma(q_i) - 1}$$

  - *passthrough coefficient* varies with markup and size

$$\rho(q_i) = \frac{1}{1 + \sigma(q_i) \frac{\mu'(q_i) q_i}{\mu(q_i)}} = \frac{1}{1 - \mu(q_i) \frac{\sigma'(q_i) q_i}{\sigma(q_i)}}$$

Sticky Prices

- Log-linear model with Calvo friction, reset price for firm of size q_i

$$\ln p_{it}^* = (1-\theta\beta)\left[\bar{\rho}_i \ln \Psi_t + (1-\bar{\rho}_i)(\ln P_t + \ln D_t)\right] + \theta\beta \mathbb{E}_t\left[\ln p_{it+1}^*\right]$$

  where $\bar{\rho}_i$ denotes steady-state passthrough for firm of size q_i.

- As in Baqaee, Farhi and Sangani (2023 JPE), implies inflation dynamics

$$\Delta \ln P_t = \beta \mathbb{E}_t\left[\Delta \ln P_{t+1}\right] + \lambda\left(\mathbb{E}_\omega[\bar{\rho}_i]\Big(\underbrace{\ln \Psi_t - \ln P_t}_{\text{real marginal cost}}\Big) + \big(1-\mathbb{E}_\omega[\bar{\rho}_i]\big)\ln D_t\right)$$

  where $\mathbb{E}_\omega[\bar{\rho}_i]$ denotes the sales-weighted average

$$\mathbb{E}_\omega[\bar{\rho}_i] := \int_0^1 \bar{\rho}_i\, \omega_i\, di, \qquad \text{and} \qquad \lambda := \frac{(1-\theta)(1-\theta\beta)}{\theta}$$

- Collapses to usual inflation dynamics if complete passthrough.

Aggregate TFP Dynamics

- Dispersion in markups lowers aggregate TFP — *misallocation*

$$\ln Z_t = \ln \mathcal{M}_t - \mathbb{E}_\omega \Big[\ln \mu_{it} \Big]$$

- Baqaee, Farhi and Sangani (2023 JPE) show that, for this setup, aggregate TFP dynamics are given by

$$\Delta \ln Z_t = \beta \mathbb{E}_t \big[\Delta \ln Z_{t+1} \big] - \lambda \ln Z_t + \lambda \bar{\mathcal{M}} \frac{\mathrm{Cov}_\omega [\bar{\sigma}_i, \bar{\rho}_i]}{\mathbb{E}_\omega [\bar{\sigma}_i]} \left(\ln \Psi_t - \ln P_t - \ln D_t \right)$$

- Heterogeneous passthrough $\Rightarrow$ endogenous TFP response — *reallocation*.

Key Cross-Sectional Moments

- Coefficients of log-linear model depends on *key cross-sectional moments*

$$\mathbb{E}_\omega[\,\bar{\sigma}_i\,], \qquad \mathbb{E}_\omega[\,\bar{\rho}_i\,], \qquad \mathrm{Cov}_\omega[\,\bar{\sigma}_i\,,\,\bar{\rho}_i\,]$$

- To estimate these moments in BLADE data we need more structure.
- Edmond, Midrigan and Xu (JPE 2023) show that with Klenow-Willis (2016) version of Kimball aggregator, can write

$$f(\mu_i) = a + b\,\ln\omega_i, \qquad b = \frac{\varepsilon}{\bar{\sigma}}, \qquad f(\mu) := \frac{1}{\mu_i} + \ln\left(1 - \frac{1}{\mu_i}\right)$$

- If '*superelasticity*' $\varepsilon/\bar{\sigma} > 0$, higher markup firms have lower passthrough.
- Estimate $\varepsilon/\bar{\sigma} = \hat{b}$ using cross-sectional relationship between market share ω_i and Hambur (2023) estimated markups $\hat{\mu}_i$ [administrative tax data]
- Use estimated markups $\hat{\mu}_i$ and $\varepsilon/\bar{\sigma} = \hat{b}$ to recover $\hat{\sigma}_i, \hat{\rho}_i$ for each industry.

Key Moments from BLADE

	$\varepsilon/\bar{\sigma}$	$\mathbb{E}_\omega[\hat{\rho}_i]$	$\mathbb{E}_\omega[\hat{\sigma}_i]$	$\mathrm{Cov}_\omega[\hat{\sigma}_i, \hat{\rho}_i]$
preferred production function $\hat{\mu}_i$ estimates (Hambur 2023)				
weighted mean	0.11	0.87	2.56	0.010
weighted percentiles				
25	−0.01	0.75	2.14	−0.001
50	0.13	0.85	2.47	0.001
75	0.26	1.01	2.90	0.016
simple cost-share $\hat{\mu}_i$ estimates				
weighted mean	0.10	0.80	5.16	0.270

How Much Amplification?

- With Kimball demand and firm heterogeneity, markups vary both because of sticky prices and because of variation in 'desired' markups.

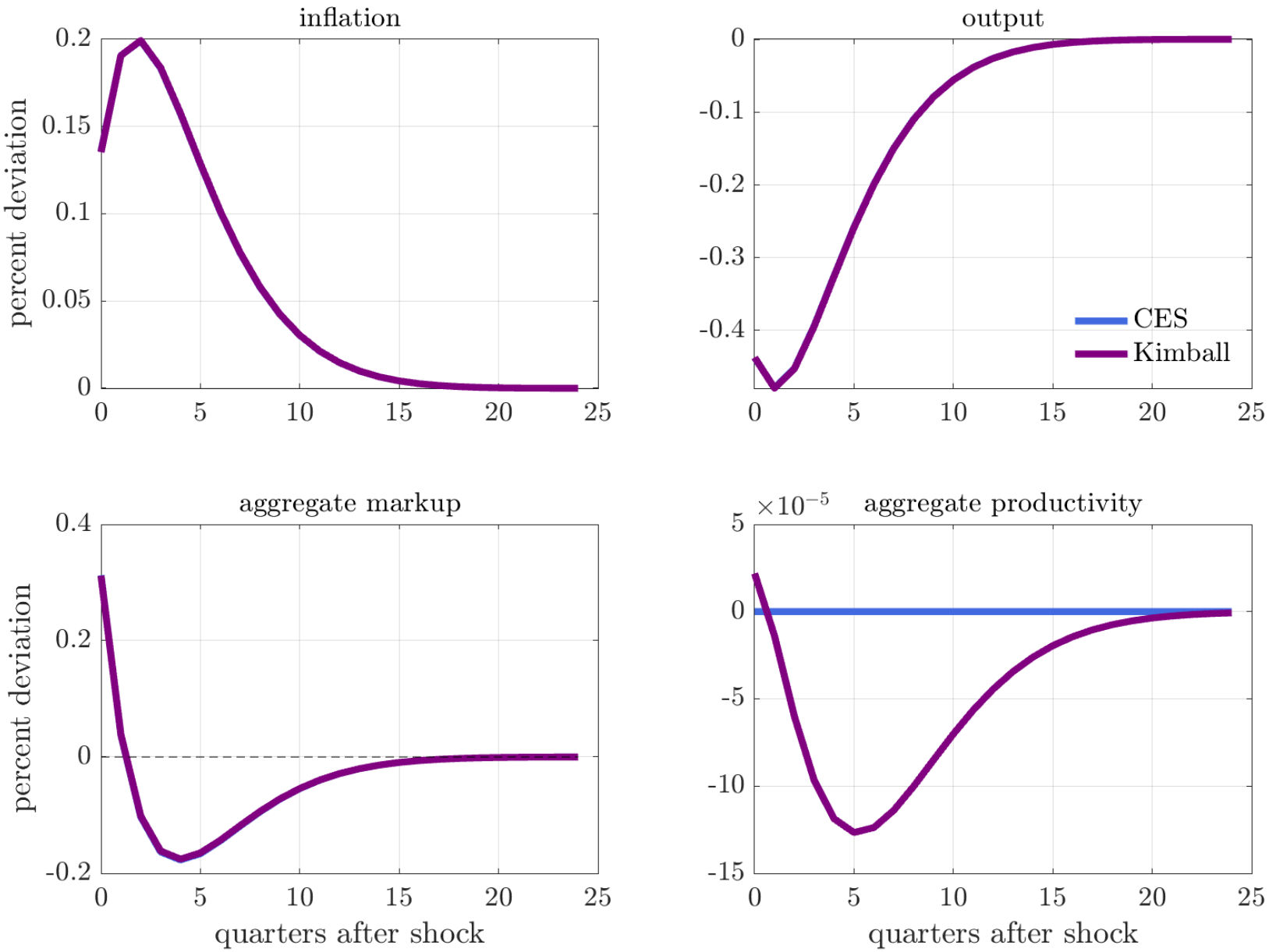
- *How much amplification does this mechanism generate?*

- Compare results to same model but with CES demand.

- Model lacks features needed to generate realistic impulse responses.

- Goal is to assess whether variable markups, when calibrated to Australian firm-level data, are a basic source of amplification of inflation dynamics.

Response to Cost Shock: Median BLADE



How Much Amplification?

- Measure inflation amplification by long run difference in log price levels

$$\lim_{t\to\infty} \ln \frac{P_t}{P_{t,ces}}$$

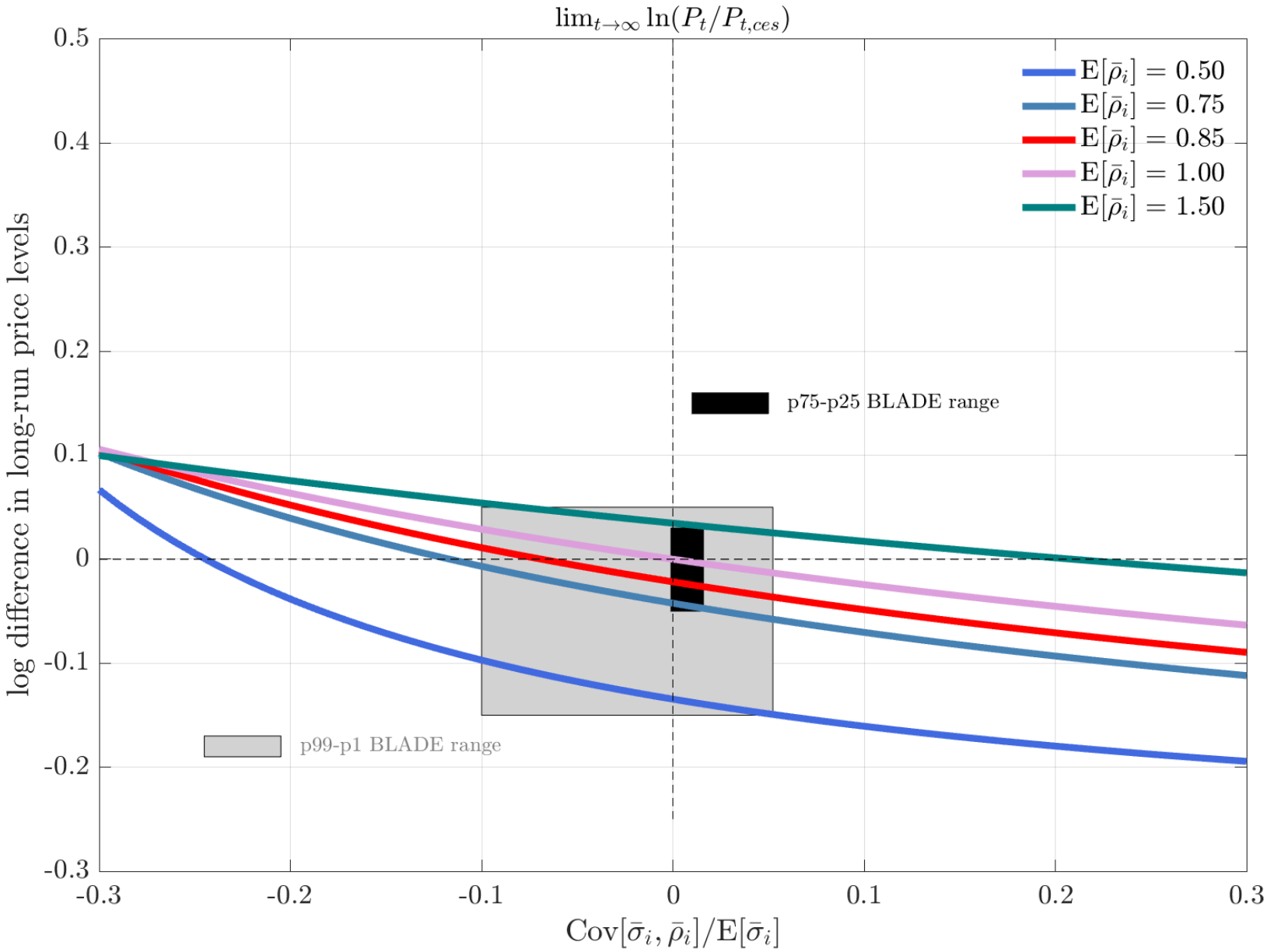
relative to same model but with CES demand.

- Benchmark parameterization: negligible amplification of cost shock.

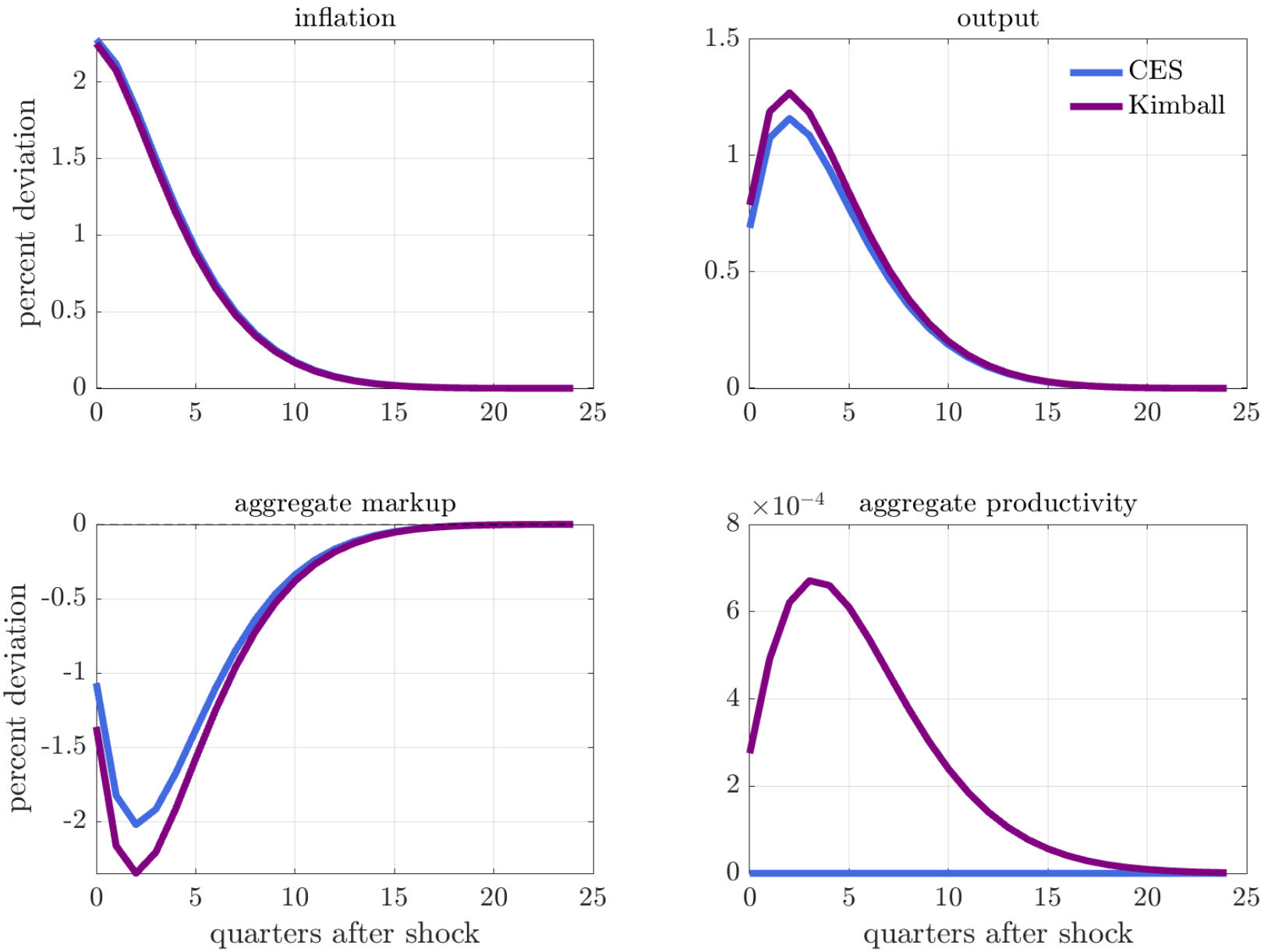
- Assess sensitivity by calculating amplification as function of key moments

$$\frac{\mathrm{Cov}_\omega[\bar{\sigma}_i, \bar{\rho}_i]}{\mathbb{E}_\omega[\bar{\sigma}_i]} \quad \text{and} \quad \mathbb{E}_\omega[\bar{\rho}_i]$$

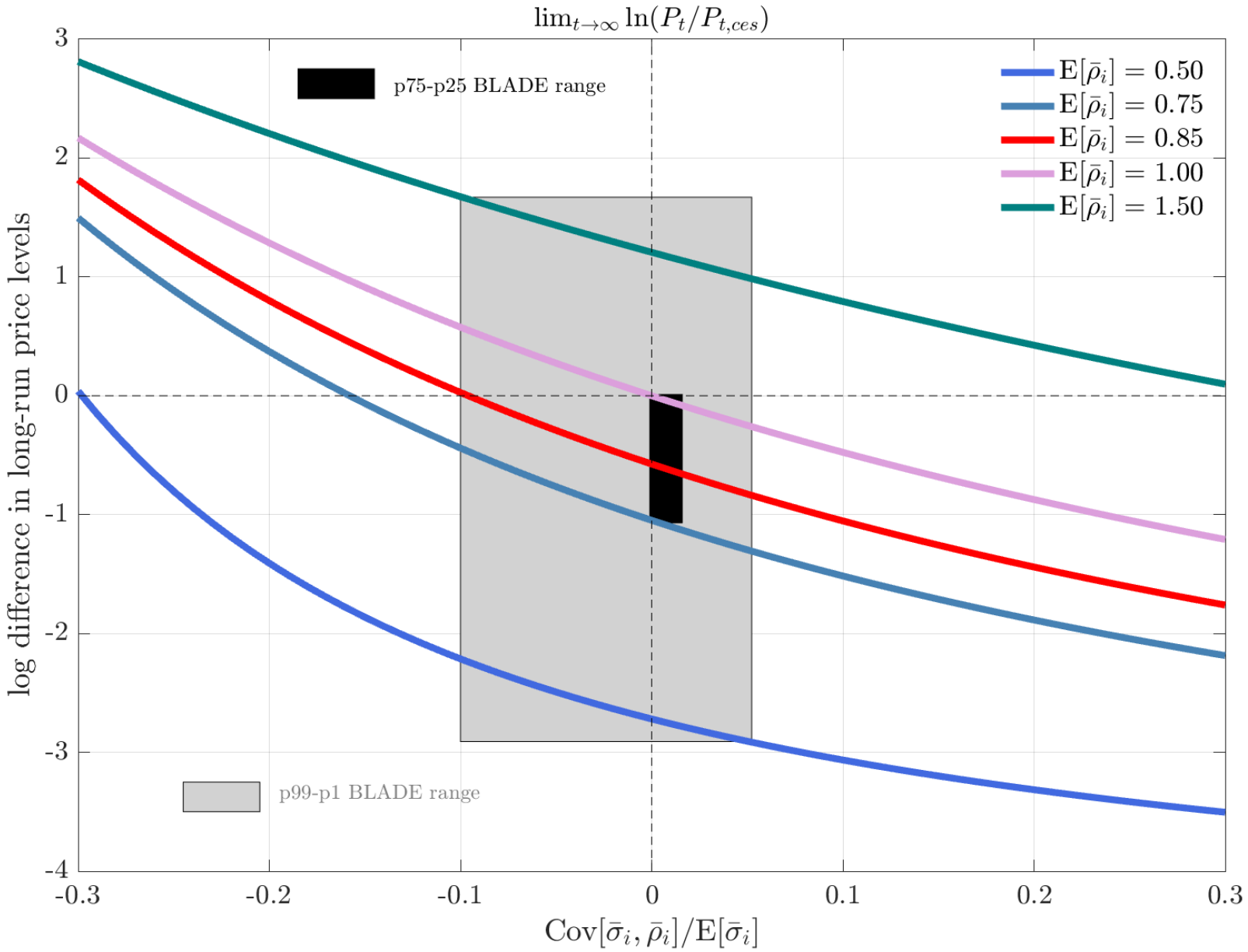
Inflation Amplification: Cost Shock



Response to Demand Shock: Median BLADE



Inflation Amplification: Demand Shock



Discussion

- When calibrated to median BLADE estimates, variable markups mechanism *is not a plausible source of inflation amplification.*

- Can generate inflation amplification, but only for configurations where

$$\frac{\text{Cov}_\omega[\bar{\sigma}_i, \bar{\rho}_i]}{\mathbb{E}_\omega[\bar{\sigma}_i]} < 0 \qquad \Leftrightarrow \qquad \frac{\varepsilon}{\bar{\sigma}} < 0 \qquad \Rightarrow \qquad \mathbb{E}_\omega[\bar{\rho}_i] > 1$$

- Superelasticity $\varepsilon/\bar{\sigma} < 0$ would mean that firms with low demand elasticity also have high passthrough [failure of '*Marshall's 2nd Law of Demand*'].

- Median BLADE estimate $\varepsilon/\bar{\sigma} = 0.13$. Large firms with low demand elasticity have *lower passthrough*, not higher, prevents amplification.

- Lower 25% BLADE estimates are $\varepsilon/\bar{\sigma} < 0$, but it takes lowest 1% estimates to get quantitatively substantial amplification.

Summary and Conclusions

- **Reduced-form evidence from micro data:**
  - passthrough coefficients generally < 1
    - some evidence passthrough has risen recently, but still < 1
  - typically *passthrough is lower in less competitive industries*
- **Model:**
  - embed in sticky price model calibrated to match these facts
  - variable markups not a plausible source of inflation amplification
  - *obtain substantial amplification only if passthrough is higher in less competitive industries*, not what we typically see in the data