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

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Disclaimer: The views expressed are those of the authors and do not necessarily reflect those of the Reserve Bank of Australia, Australian Treasury or the Australian Government. All errors are our own.

Disclaimer

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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.

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- 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)

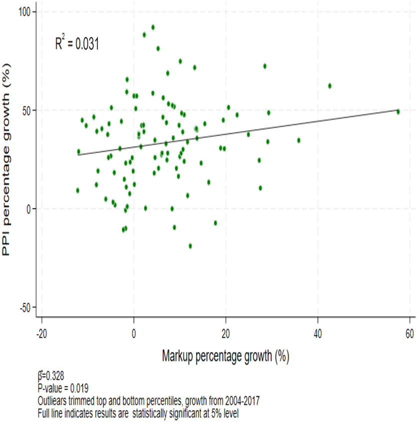
Evidence from Micro Data

Industry Markups and Prices

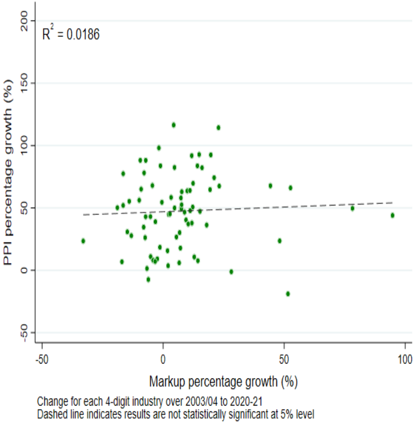
- Estimate firm-level markups (Hambur 2023).
- Take industry average markups, sales weighted average of firm markups.
- Compare change in industry average markup to change in PPI.
- **Pros:** based on administrative tax data with very high coverage, so representative *within* any industry.
- **Cons:**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

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

Industry Markups and Prices



2004–2017



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

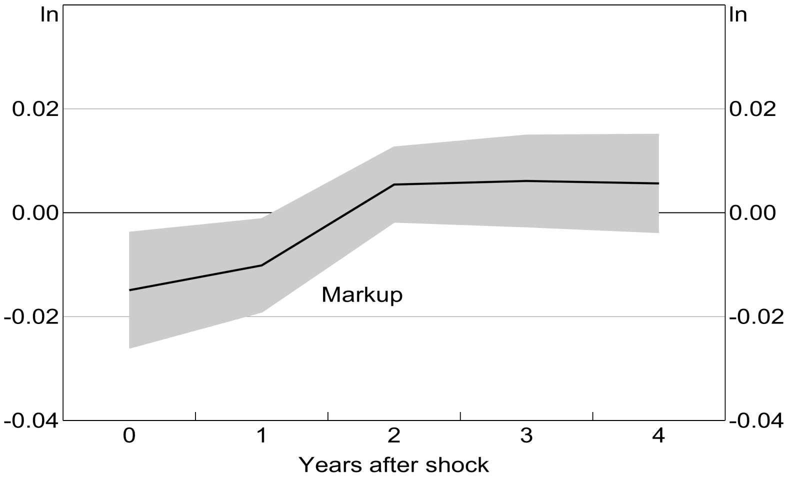
Quarterly firm-level regression of gross profit margin on average price change for continuing items. Includes year fixed effects, excludes small firms below threshold for expense reporting.

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.

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

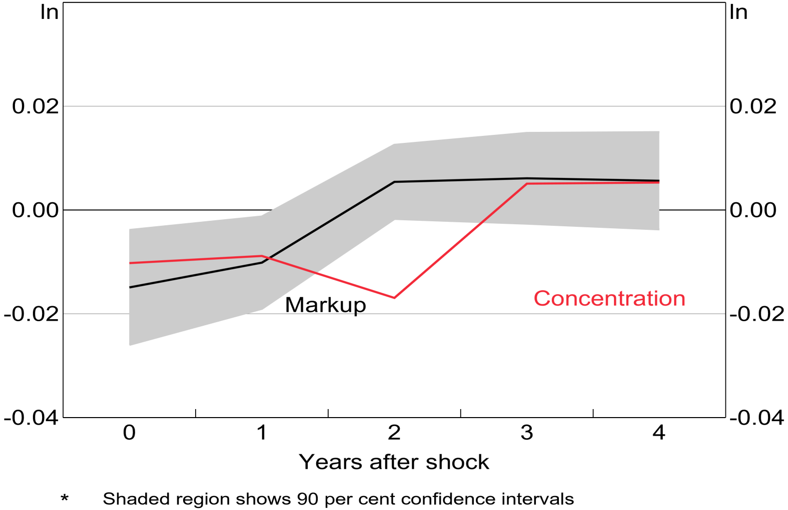
Effect of Higher Markups on Passthrough



*   Shaded region shows 90 per cent confidence intervals

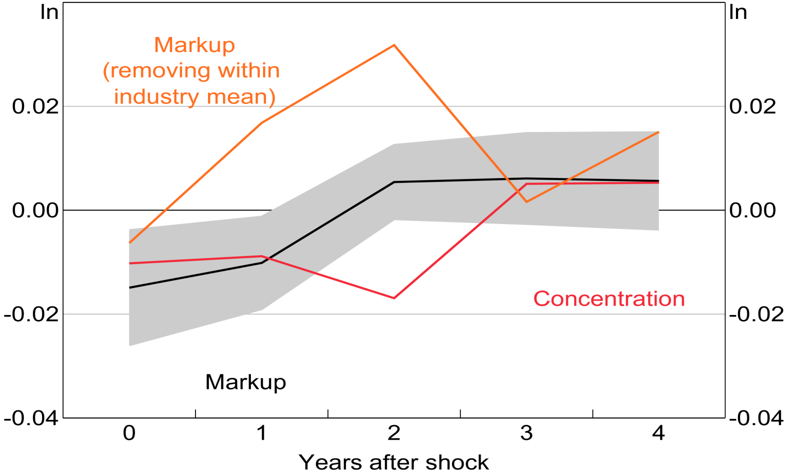
Interaction coefficient of industry-level markups on industry-level passthrough controlling for industry-by-year fixed effects and lagged PPI. One standard deviation shock.

Effect of Higher Concentration on Passthrough



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



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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.

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- **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.

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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

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

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*

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

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

- 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.

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- 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.

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- 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?

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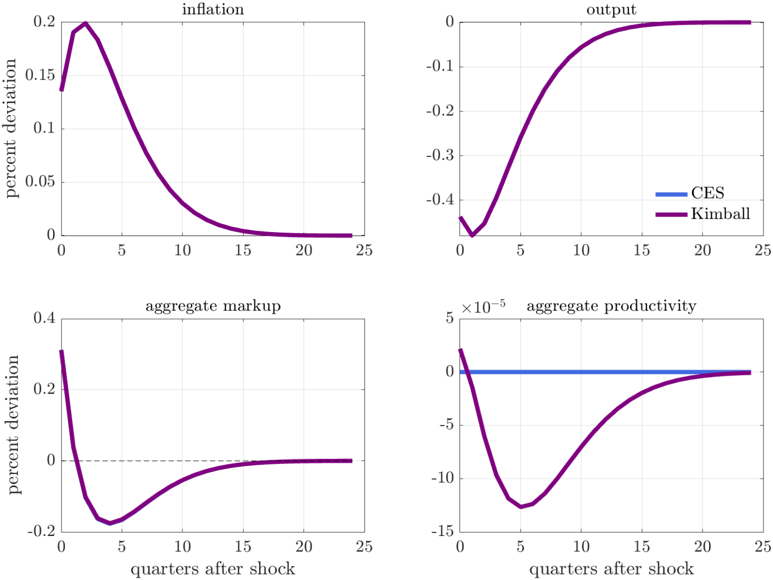
- With Kimball demand and firm heterogeneity, markups vary both because of sticky prices and because of variation in ‘desired’ markups.
- *How much amplification does this mechanism generate?*
- Compare results to same model but with CES demand.
- Model lacks features needed to generate realistic impulse 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

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

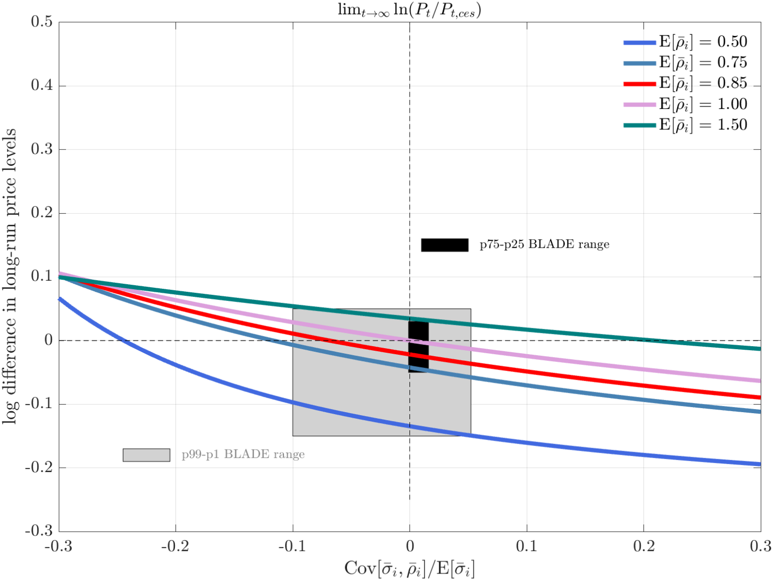
relative to same model but with CES demand.

- Benchmark parameterization: negligible amplification of cost shock.

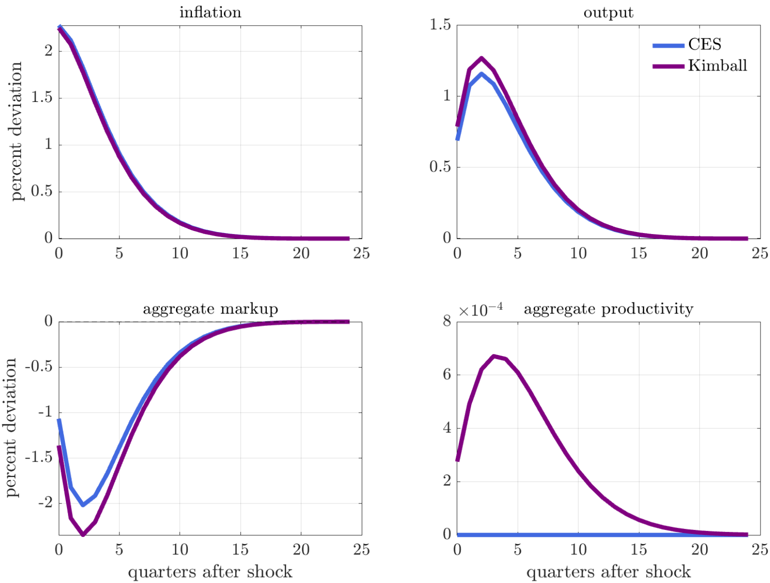
- Assess sensitivity by calculating amplification as function of key moments

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

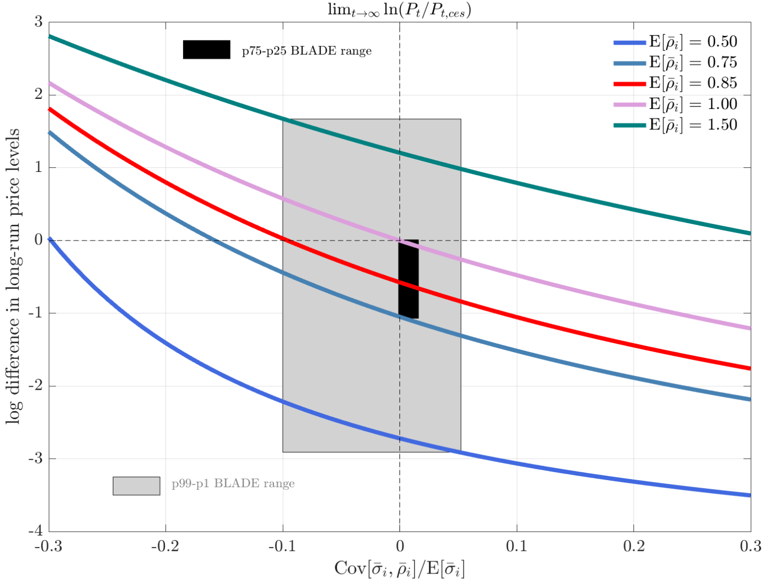
Inflation Amplification: Cost Shock



Response to Demand Shock: Median BLADE



Inflation Amplification: Demand Shock



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- 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*'].

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- 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*

Summary and Conclusions

- **Reduced-form evidence from micro data:**
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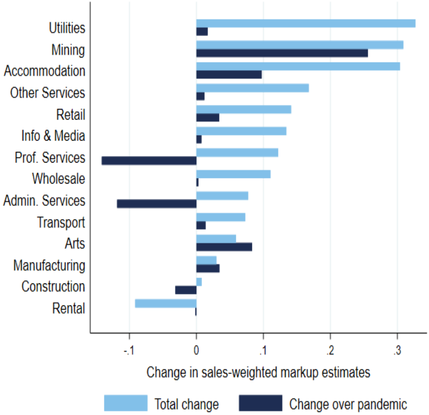
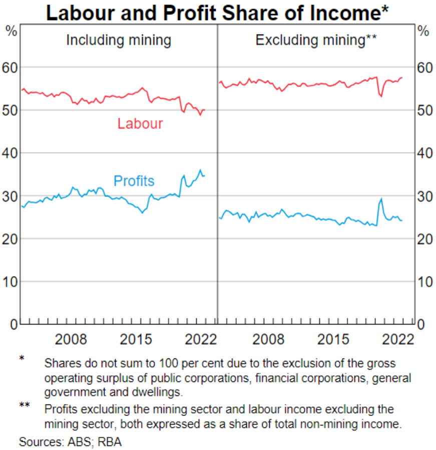
    - some evidence passthrough has risen recently, but still < 1
  - typically *passthrough is lower in less competitive industries*

- **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

Spares

Australia: Average Markups and Labour Share





Average Markups, 2004–2021

Labour Share

Motivation

- Work examining looking at the link between competition and inflation in Australia isn't entirely new

Essays in Empirical Macroeconomics

by

John A. Simon

Submitted to the Department of Economics
on 15 May 2000, in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy in Economics

Abstract

lusive behavior is then presented. The critical channel in this model is that the variance of cost shocks increases with inflation. Higher inflation and the concomitant increase in the variance of cost shocks makes the maintenance of collusive arrangements harder and, thereby, leads to a lower average markup.

THE RELATIONSHIP BETWEEN THE MARKUP AND INFLATION IN THE G7 ECONOMIES AND AUSTRALIA

Anindya Banerjee and Bill Russell*

that is integrated of order 1. It is also shown that the markup in each case co-integrates with inflation and that higher inflation is associated with a lower markup in the long run.

Australian context

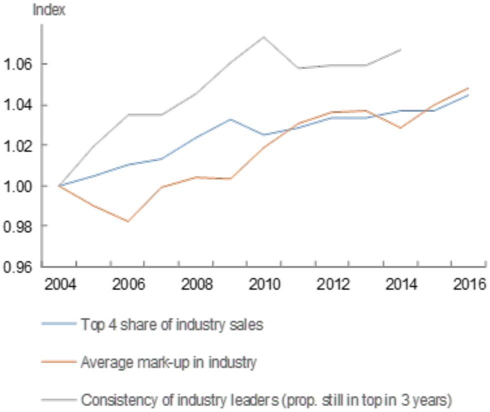


Figure: Measures of competition in Australia

Source: Hambur (2023)

Pass-through of cost shocks to prices

- Focus more on mechanism: Do cost shocks have larger effects where weaker competition?
- Use local projections with granular instrumental variables to estimate dynamic pass-through of cost shocks into prices and how that is affected by higher markups
  - Recover firm-level idiosyncratic cost shocks as the residuals from a regression of firm-level log cost on various fixed effects and controls
  - Compute the weighted average of the firm-level residuals by industry
  - Use local projections to estimate pass-through of cost shocks to prices
  - Augment specification to account for the role of rising markups
- Coefficient of interest measures effect of cost shock on price h periods ahead, measured as the per cent deviation from local trend growth.

Estimating the Superelasticity $\varepsilon/\bar{\sigma}$

- Edmond, Midrigan and Xu (2023) show that this demand system implies

$$f(\mu_i) = a + b\,\ln\omega_i, \qquad b = \frac{\varepsilon}{\bar{\sigma}}$$

where

$$f(\mu) := \frac{1}{\mu_i} + \ln\left(1 - \frac{1}{\mu_i}\right)$$

- Equipped with preferred markup estimates $\hat{\mu}_i$, take transformation $f(\hat{\mu}_i)$ and regress on observed sales share ω_i.

- Estimated superelasticity is the slope coefficient $\varepsilon/\bar{\sigma} = \hat{b}$.

Recover Passthrough Coefficients

- Given markup estimates, demand elasticities are

$$\hat{\sigma}_i = \frac{\hat{\mu}_i}{\hat{\mu}_i - 1}$$

- Given markup estimates and superelasticity estimate $\hat{b} = \varepsilon/\bar{\sigma}$, estimated passthrough coefficients are

$$\hat{\rho}_i = \frac{1}{1 + \hat{b}\hat{\mu}_i}$$

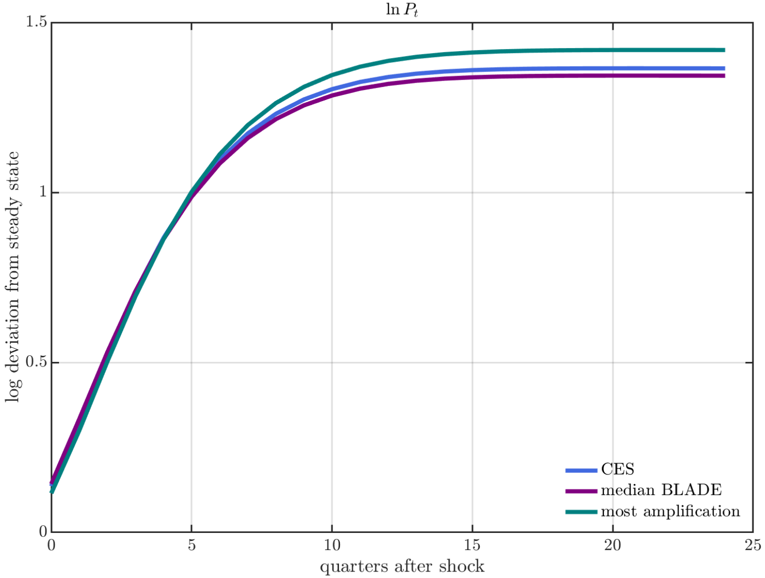
- Calculate the key cross-sectional moments that enter log-linear model

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

Benchmark Parameterization: Median BLADE

superelasticity	$\varepsilon/\bar{\sigma}$	0.13
average passthrough	$\mathbb{E}_\omega[\bar{\rho}_i]$	0.85
average demand elasticity	$\mathbb{E}_\omega[\bar{\sigma}_i]$	2.47
covariance	$\mathrm{Cov}_\omega[\bar{\sigma}_i, \bar{\rho}_i]$	0.001
aggregate markup	$\bar{\mathcal{M}}$	1.15
elasticity of output wrt nonlabor input	α	1/3
discount factor	β	0.99
intertemporal elasticity of substitution	$1/\gamma$	1
Frisch elasticity	$1/\varphi$	1
Calvo probability no price change	θ	2/3
interest rate rule coefficient inflation	ϕ_π	1.5
interest rate rule coefficient output	ϕ_y	0.5/4

Amplification Cost Shock



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