

Industrial Organization and *The Rise of Market Power*

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Draws on research with Chris Conlon, Hendrik Döpper, Alex MacKay, Matt Osborne, Tsolmon Otgon, Gloria Sheu, Gretchen Sileo, Joel Stiebale, Matt Weinberg, Yi Yao

Also on research by Klaus Adam, Enghin Atalay, Rémi Avignon, Germán Bet, Steve Bond, Jimbo Brand, Keith Brand, Zarek Brot-Goldberg, Allan Collard-Wexler, Zach Cooper, Stuart Craig, Jan De Loecker, Ulrich Doraszelski, Chris Edmond, Jan Eeckhout, Lucia Foster, Erika Frost, Sharat Ganapati, Chris Garmon, Etienne Guigue, John Haltiwanger, Arshia Hashemi, Paul Grieco, Jordi Jaumandreu, Greg Kaplan, Lev Klarnet, Virigiliu Midrigan, Charlie Murry, Sam Peltzman, Devesh Raval, Tobias Renkin, Ted Rosenbaum, Paul Scott, Alan Sorensen, Chris Sullivan, James Traina, Cody Tuttle, Gabriel Unger, Achim Wambach, John Weche, Daniel Xu, Ali Yurukoglu, Wanjia Zhu, Piotr Zoch, Gabriel Züllig

Disclosure: I regularly consult on antitrust matters with antitrust authorities and other clients. In 2022, I testified on behalf of the DOJ in a case involving airlines. I have had no consulting relationship in the past three years related to the other industries discussed in these slides.

What Is *The Rise of Market Power*?

Based on research suggesting increases in **concentration** and **markups** over decades

- Pretty esoteric concepts—how about the price, quality, and diversity of products, or the availability of jobs with good wages?
- But still, could point to market power problems that hold back growth, amplify inequality, reduce labor share, etc.
- Parallel concerns among policy-makers: more *political* interest in antitrust than at any time that I can remember



JULY 09, 2021

Executive Order on Promoting Competition in the American Economy



BRIEFING ROOM

PRESIDENTIAL ACTIONS

By the authority vested in me as President by the Constitution and the laws of the United States of America, and in order to promote the interests of American workers, businesses, and consumers, it is hereby ordered as follows:

Section 1. Policy.

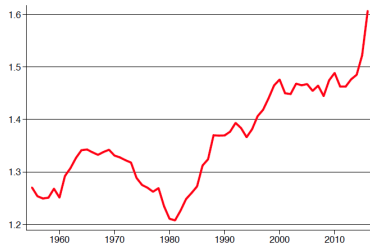
A fair, open, and competitive marketplace has long been a cornerstone of the American economy, while excessive market concentration threatens basic economic liberties, democratic accountability, and the welfare of workers, farmers, small businesses, startups, and consumers.

The American promise of a broad and sustained prosperity depends on an open and competitive economy. For workers, a competitive marketplace

Rising Markups — De Loecker et al (2020) [“DLEU”]

Short overview of the DLEU article:

- Estimate production functions for publicly-traded firms in the US
- Combine output elasticities with FOCs for cost minimization to recover markups (p/c)
- Revenue-weighted average markups increase from 1.2 to 1.5 over 1980-2015
- Driven by upper tail (e.g., median markup flat), reallocation of revenue to high-markup firms
- Markup changes correlate with changes in profitability (e.g., measured by dividends)



Average Markups Over Time

Hugely influential for research and policy

Rising Markups — De Loecker et al (2020)

Several papers probe the methodology of DLEU. Three of the main concerns:

1. Using revenues/expenditures not quantities can be problematic (e.g., Bond et al [2020])
2. Proxy function approach to production function estimation is vulnerable to demand-side heterogeneity (e.g., Doraszelski and Jaumandreu (2021))
3. Implementation details (Edmond et al [2023], Traina [2018], Foster et al [2022], Raval [2023])

Rising Markups — De Loecker et al (2020)

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1. **Using revenues/expenditures not quantities can be problematic (e.g., Bond et al [2020])**

Start with a standard Cobb-Douglas production function

$$q_{it} = \theta^L l_{it} + \theta^K k_{it} + \omega_{it} + \epsilon_{it}$$

Add and subtract output & input prices and rearrange—obtain regression equation:

$$\underbrace{p_{it} + q_{it}}_{\text{log revenue}} = \theta^L \underbrace{\left(p_{it}^L + l_{it}\right)}_{\text{log expend on L}} + \theta^K \underbrace{\left(p_{it}^K + k_{it}\right)}_{\text{log expend on K}} + \underbrace{\omega_{it} + \epsilon_{it} + \left(p_{it} - \theta^L p_{it}^L - \theta^K p_{it}^K\right)}_{\text{wedge in prices contributes to unobservables}}$$

Rising Markups — De Loecker et al (2020)

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1. Using revenues/expenditures not quantities can be problematic (e.g., Bond et al [2020])
2. **Proxy function approach to production function estimation is vulnerable to demand-side heterogeneity (e.g., Doraszelski and Jaumandreu (2021))**
 - ▷ Typical approach controls for ω_{it} using control function of investment (or equivalent)
 - ▷ But profit-maximizing investment depends on markups and this can cause problems
 - ▷ Let $i_t = f(\omega_t, k_t, \mu_t)$ for markups μ_t and $f(\cdot)$ increasing in ω_t
 - ▷ Then the control function, $\omega_t = f^{-1}(i_t, k_t, \mu_t)$, depends on markups
 - ▷ Risk is that identification can become circular
 - ▷ Best practices may shift when demand-side heterogeneity is significant

Rising Markups — De Loecker et al (2020)

Several papers probe the methodology of DLEU. Three of the main concerns:

1. Using revenues/expenditures not quantities can be problematic (e.g., Bond et al [2020])
2. Proxy function approach to production function estimation is vulnerable to demand-side heterogeneity (e.g., Doraszelski and Jaumandreu (2021))
3. **Implementation details (Edmond et al [2023], Traina [2018], Foster et al [2022], Raval [2023])**
 - ▷ Edmond et al (2023). Weighted averages constructed using costs (not sales)
 - ▷ Traina (2018). Include SG&A in variable costs
 - ▷ Foster et al (2022). Narrower industry codes, in manufacturing
 - ▷ Raval (2023). Choice of variable input for proxy function

Rising Markups — De Loecker et al (2020)

Several papers probe the methodology of DLEU. Three of the main concerns:

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3. Implementation details (Edmond et al [2023], Traina [2018], Foster et al [2022], Raval [2023])

Still, some evidence the production function approach can get similar markups to demand approach (De Loecker and Scott [2022]). The literature is still developing

And, *at a minimum*, DLEU show a growing gap between revenue and variable cost, could indicate rising market power. Obtained straight from the census data. We need to learn more—

A Challenge for Industrial Organization

Market power is what defines industrial organization as a field

- How could we have missed this?
- DLEU challenge us to apply our methods, rigorously, at scale

Examine 8 empirical contributions, spanning 6 industries, involving 20 authors. Identify commonalities, understand differences

While each is impressive on its own, is the whole greater than the sum of the parts?

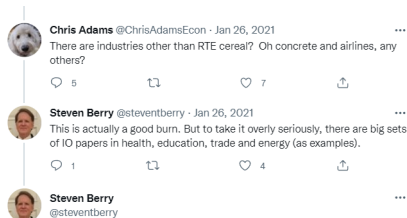
- Do we verify the trends and learn about mechanisms?
- Or, like the industry studies of long ago, is generalization elusive?

What Empirical IO Does Best

Focusing on “model industries” allows us to study mechanisms in familiar settings

- **Consumer packaged goods** (Brand [2021], Atalay et al [2023], Döpper et al [2023])
- **Cement** (Miller et al [2023])
- **Wholesalers** (Ganapati [2021])
- **Steel** (Collard-Wexler & De Loecker [2015])
- **Automobiles** (Grieco et al [2023])
- **Airlines** (Bet [2021])

Most apply “the demand approach.” Estimate demand, recover markups from pricing FOCs



Replying to @steventberry @ChrisAdamsEcon and 2 others

To take it less seriously, I was reading about "model organisms" in biology research. Maybe RTE cereal, airlines and cement are IO's model industries—our versions of mice, fruit flies and tapeworms (I won't match each organism to an industry!)

4:54 PM · Jan 26, 2021 · Twitter Web App

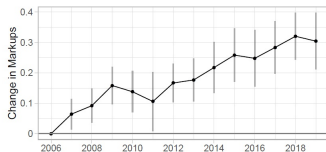
Consumer Packaged Goods

Consumer packaged goods seem like natural place to start

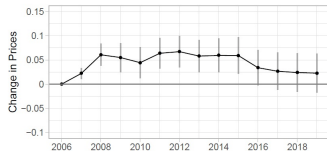
- Ready-to-eat cereal, yogurt, shampoo... these are canonical setting for discrete choice demand, differentiated-products Bertrand competition
- Three papers each apply this framework at scale to Nielsen scanner data
 - ▷ Brand (2021) — 9 categories, 2006 & 2017, RC logit, exogenous prices
 - ▷ Atalay et al (2023) — 72 categories, 2006-2018, nested logit, Hausman instruments
 - ▷ Döpper et al (2023) — 133 categories, 2006-2019, RC logit, covariance restriction
- Obtain similar high-level trends, consistent with rising markups
- Will pull from Döpper et al (2023) for the following slides

Consumer Packaged Goods — Döpper et al (2023)

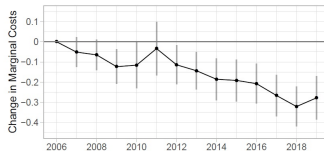
(a) Markups



(b) Prices



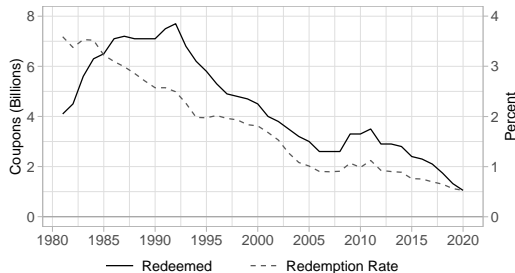
(c) Marginal Costs



Average markups increase by about 25% on average. Real prices rise somewhat, then fall. Marginal costs fall and this accounts for most of the markup trend.

Consumer Packaged Goods — Döppler et al (2023)

- Brands make large investments in productivity → cost trend expected
- Puzzle: Why not lower prices?
 - ▷ Partly, incomplete pass-through
 - ▷ But more important, consumers appear to have become less price sensitive—perhaps stronger brand preferences or less time to shop
 - ▷ Mergers, consolidation, etc. appear to play less of a role
- Corroborates (in one setting) *The Rise of Market Power*. But seems rather benign...



Putting *Industrial* Back in IO

Cereal, yogurt, and beer are so stereotypical for IO ...

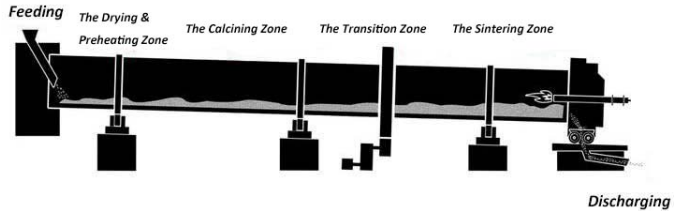
... how about **cement**?

- Miller et al (2023) focuses on the cement industry over 1974-2019

What you already know about cement

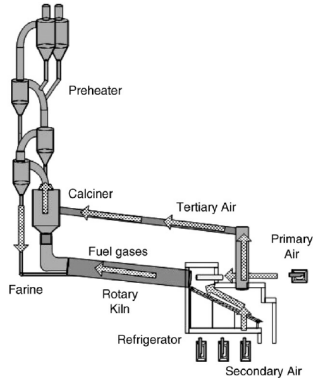
- Cement is a powder, input to concrete
- Transportation costs are important
- Around 100 plants in US
- Buyers: concrete plants, construction firms
- Large rotary kilns

Cement — Miller et al (2023)



Old Kiln Technology

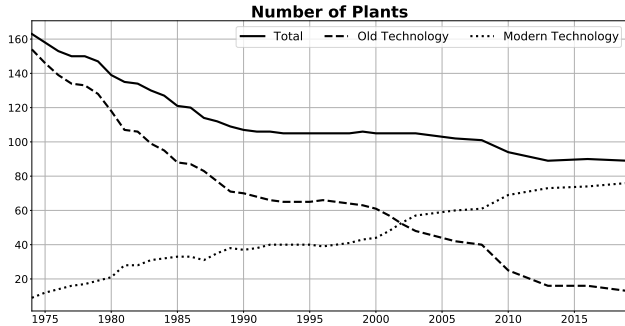
Cement — Miller et al (2023)



Modern Precalciner Technology

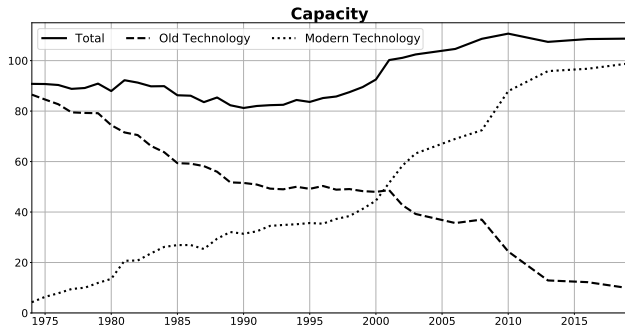


Cement — Miller et al (2023)



Industry shakeout occurs.
Number of plants nearly
halves. By 2019, nearly all
are precalciner plants

Cement — Miller et al (2023)

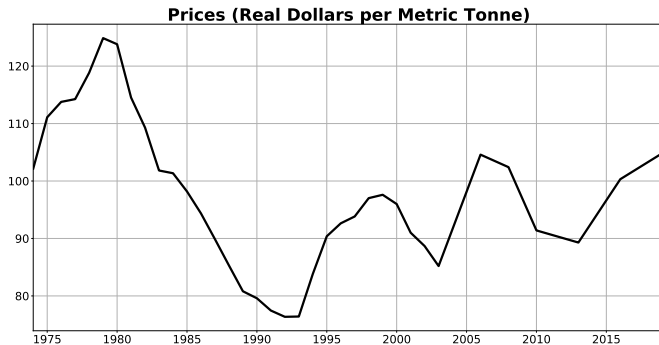


Yet total industry capacity *increases*

Economic tradeoff: more efficient production vs. less competition

Cement — Miller et al (2023)

Prices fluctuate (factor prices & macro) but similar in 1974 and 2019



But local market concentration and markups are unobserved → use modeling to recover them. Also obtain fixed costs for analysis of scale economies

Cement — Miller et al (2023)

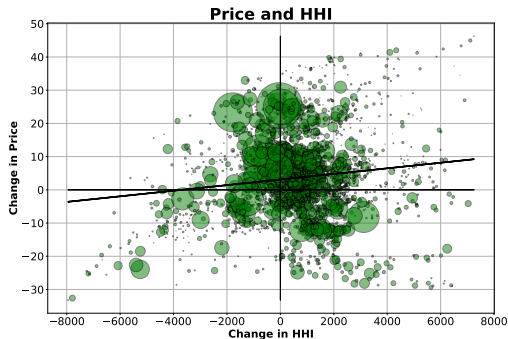
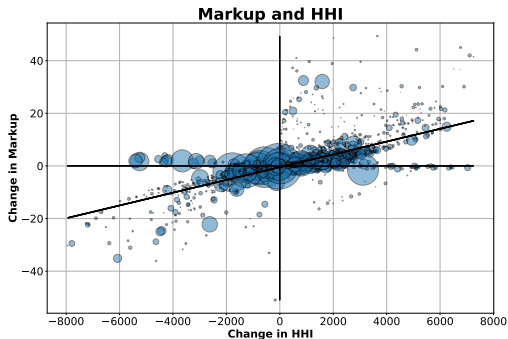
Model competition among cement plants for business throughout the counties of the US

- Buyers procure cement with a parametric second-score auction
- Suppliers differentiated by location and a (nested) logit shock
- Incorporate competition from fringe of importers and an outside good

Estimation with GMM — seems to capture industry reasonably well

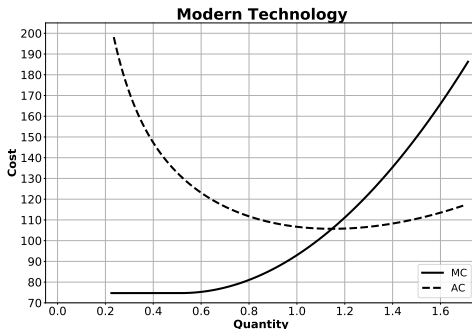
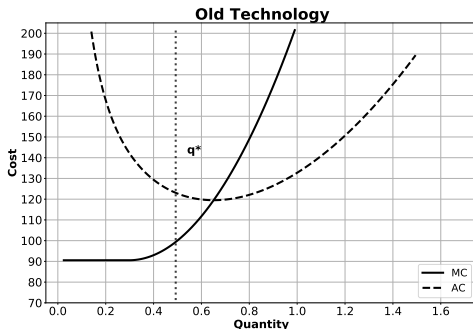
Recover fixed costs of operation using bounds approach of Eizenberg (2014), apply engineering estimate of capital costs for precalciner adoption

County-Level HHIs Correlate with Markups (Not Prices)



Consistent with precalciner technology lower marginal costs and inducing shakeout of plants. Both would increase markups and concentration. But they have opposing effects on prices.

Cement — Miller et al (2023) — Cost Functions

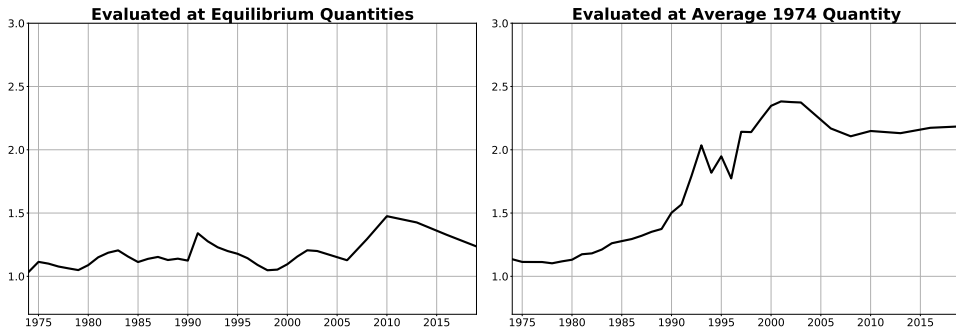


Efficient level of output: 0.65MM \rightarrow 1.15MM metric tonnes.

Average cost at the efficient level: \$120 \rightarrow \$106 (relative to price of \$114).

Average cost at 1974 quantity: \$123 \rightarrow \$134

Cement — Miller et al — Scale Elasticities (AC/MC)



Left panel shows that the median scale elasticity (AC/MC) increases from 1.03 to 1.23. But *scale elasticities are endogenous and depend on output*.

Right panel shows that, holding output fixed at 1974 levels, the scale elasticity increases to 2.18. MC *much* lower than AC → significant reshaping of cost functions.

Marginal Costs and Scale Economies

With cement, technology lowers marginal cost and drives a *Rise of Market Power*

- Scale-increasing: shift to “lower MC, higher FC”
- More concentration, higher markups in long run equilibrium
- Lower costs and reduced competition offset → prices don’t increase

Wait, is there a connection to **John Sutton’s endogenous sunk cost** models?

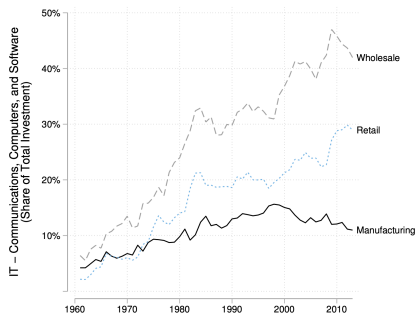
- Larger markets rationalize greater investments in scale (R&D, advertising...)
- Probably not in the US because cement is largely non-tradable
- ... but with globalization, the **wholesaling** industry is another matter

The Modern Wholesaler — Ganapati (2021)

Analyzes Census data over 1992-2012

- Markups and concentration up
- But prices decrease (costs fall by more), quantities increase, and wholesalers provide more variety → seems like a good thing
- Expenditures on IT approach 50% of total investment, provide new **scale economies**
- With globalization, firms can support greater fixed/sunk expenditures because input/output markets are larger
- Might expect this mechanism to influence outcomes in other tradable industries

Figure 3: Information Technology Share of Total Investment



Source: BEA Investment Data

Collecting Results

| | Market Power? | Higher Prices? | Lower Costs? Better Quality? | Greater Scale? | Mainly Tech Change? |
|-------------------|------------------|-------------------|---------------------------------|-------------------|------------------------|
| Consumer Products | more | no | yes | yes | yes |
| Cement | more | no | yes | yes | yes |
| Wholesalers | more | no | yes | yes | yes |
| Steel | | | | | |
| Automobiles | | | | | |
| Airlines | | | | | |

Steel — Collard-Wexler and De Loecker (2015)

Analyze Census data over 1960-2002

- The minimill (new tech) uses electric arc furnace instead of the blast furnace of integrated mills (incumbent tech)
- Makes some products at lower *average cost*
- But it is a “high MC, low FC” technology — weakens scale economies!
- Lots of minimill entry, more competition, prices fall, inefficient incumbents exit
- **Markups decrease**

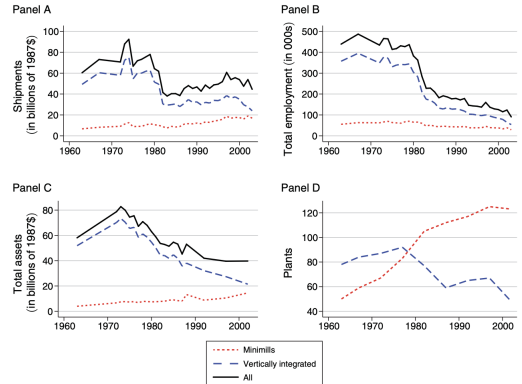


FIGURE 1. EVOLUTION OF THE STEEL INDUSTRY AND VERTICALLY INTEGRATED MILLS AND MINIMILLS

Steel — Collard-Wexler and De Loecker (2015)



Integrated Steel Mill



Minimill

Automobiles — Grieco et al (2023)

Estimate a random coefficients logit demand with Bertrand supply-side, 1980-2018

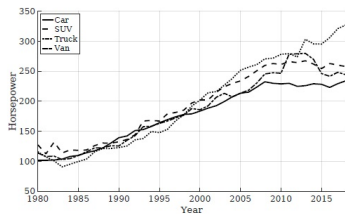
Quick advertisement: this may be the best application to teach PhD students for BLP

Specification allows for unusually rich (and realistic) substitution patterns, yet identification is clean and transparent

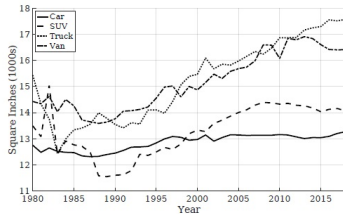
- ✓ Use exchange rate fluctuations to instrument for prices (presence of imports)
- ✓ Micromoments pin down how observed demographics affect tastes
- ✓ 2nd-choice data pin down how unobserved demographics affects tastes

Automobiles — Grieco et al (2023)

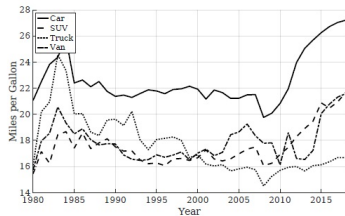
Figure III: Physical Vehicle Characteristics, 1980-2018



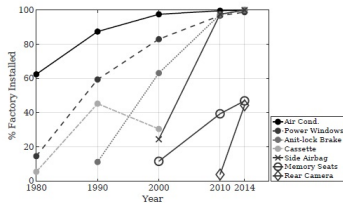
(a) Horsepower



(b) Footprint (length \times width)



(c) Fuel Economy

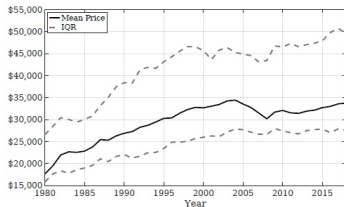


(d) Additional Factory Installed Features

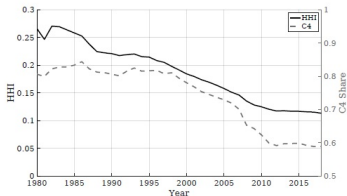
Trend toward higher quality cars in the raw data: power, size, MPG, features (A/C, power windows, antilock breaks, ...)

Automobiles — Grieco et al (2023)

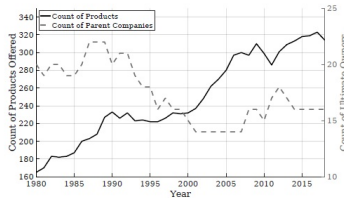
Figure II: Prices and Market Structure, 1980-2018



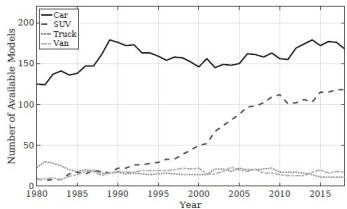
(a) Prices



(b) Measures of Concentration



(c) Products and Manufacturers

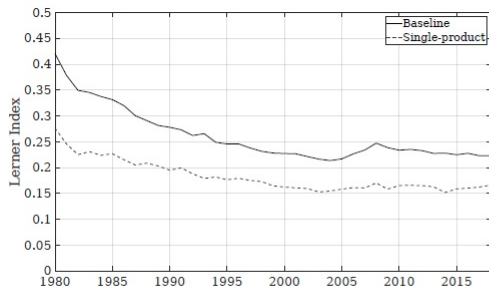


(d) Count of Products by Styles

Also in the raw data,
prices increase, but
HHI decreases

Many more products
available (esp. SUVs)

Automobiles — Grieco et al (2023)



(a) Average Markups

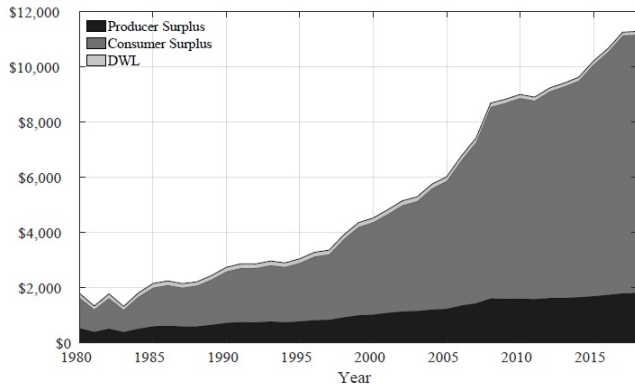


(b) Average Price

Markups fall and prices increase. Consistent with higher quality being more costly to produce, but with competition constraining pass-through. Firms actually become more cost-efficient, conditional on vehicle attributes like fuel efficiency or size

Automobiles — Grieco et al (2023)

Figure XII: Consumer Surplus, Producer Surplus, and Deadweight Loss



Big gains in consumer surplus from better quality & more options, *despite* higher prices

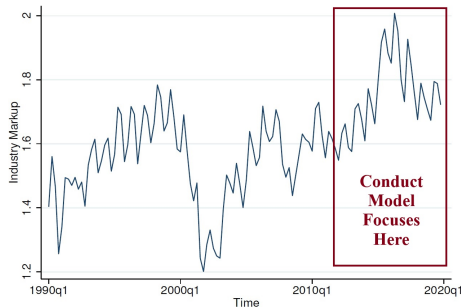
Seems like main result

Collecting Results

| | Market Power? | Higher Prices? | Lower Costs? Better Quality? | Greater Scale? | Mainly Tech Change? |
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| Consumer Products | more | no | yes | yes | yes |
| Cement | more | no | yes | yes | yes |
| Wholesalers | more | no | yes | yes | yes |
| Steel | less | no | yes | opposite | yes |
| Automobiles | less | yes | yes | no | yes |
| Airlines | | | | | |

Airlines — Bet (2021)

1. Focuses on 1990-2019, estimates production function, get markups
 - ▷ Markups increase, decrease, increase more
 - ▷ Predominately reflects changes in marginal costs (not prices). But estimates don't show increase in scale economies
 - ▷ *Complicated*: fuel prices, recession, adjustments to deregulation, broader hub-and-spoke networks, mergers and exit
2. Focuses on 2012-2019, estimates demand/supply, incorporating conduct parameters
 - ▷ A softening of competition among large carriers explains the production function markups—least intense in 2016



Markups over Time

Collecting Results

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| Steel | less | no | yes | opposite | yes |
| Automobiles | less | yes | yes | no | yes |
| Airlines | more | no | partly | no | no |

Collecting Results

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A Challenge for Empirical Industrial Organization

Going back: Is the whole greater than the sum of the parts?

- Have we verified trends and learned about mechanisms?
- Or, like the industry studies of long ago, is generalization elusive?

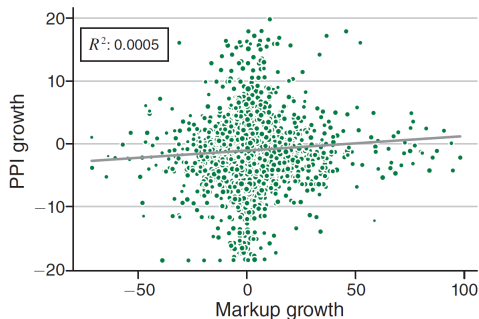
Maybe predictably, the answers seem nuanced

- No single mechanism dominates across all the industries
- But if there is a theme, it is that **the first order changes we observe in industries, measured in decades, have predominately been due to technological innovation**
- This does not imply calls for strict antitrust enforcement are misguided

Can the Structural Models be Corroborated?

Consider the hypothesis that *The Rise of Market Power* exists & is due to lenient antitrust enforcement

- Then markup changes should be correlated with price changes
- Conlon et al (2023) match DLEU markups to industry producer price indices (PPI) using 6-digit NAICS code of COMPUSTAT
- Plot of markup changes vs. price changes: what do *you* expect to see?
- Virtually no relationship between markup growth and price growth over 1980-2018



Rising markups must be attributable to **higher prices** or **lower costs**. Results in Conlon et al (2023) suggest the latter dominates

Stepping Back...

World GDP over the last two millennia

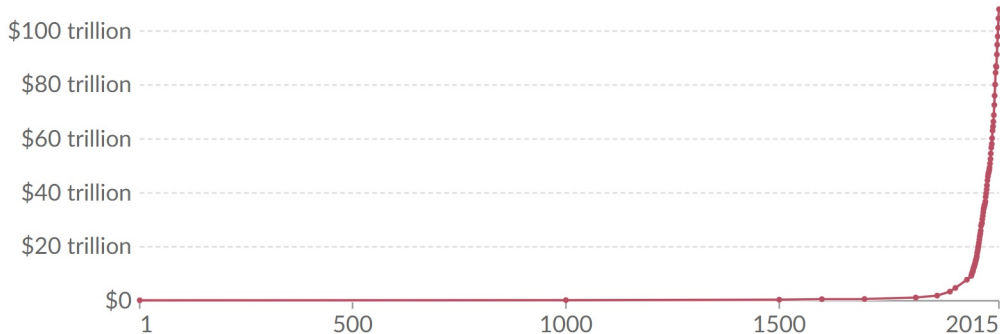
Our World
in Data

Total output of the world economy. This data is adjusted for inflation and differences in the cost of living between countries.

LINEAR

LOG

☐ Relative change



Competition Policy / Antitrust Enforcement

Suppose that *The Rise of Market Power* is due mainly to technological change. Does that imply strict antitrust enforcement is unwarranted?

No, and perhaps the opposite:

- Take the cement example. Fewer competitors → collusion may be easier to sustain. Higher markups → greater adverse “unilateral effects” of mergers
 - Or the automobiles example. Competition is why improvements to quality and gains in productive efficiency accrued mostly to consumers, preserving the efficiency of the market
- It makes sense to be vigilant on competition policy / antitrust enforcement

Competition Policy / Antitrust Enforcement

Of course, antitrust research is much more broad than just these industry studies

- Merger retrospectives find some examples of seemingly anti-competitive mergers (e.g., Miller and Weinberg [2017]) along with others where prices go down (Asker and Nocke [2022])
- Some “false negatives” probably inevitable in antitrust merger review. Important to study, learn, and improve practice
- More worrisome if mergers systematically produce adverse effects in an industry (e.g., see Brand et al [2023] and Brott-Goldberg et al [2023] on hospitals)
- And research points to areas where antitrust practice could be updated (e.g., notification thresholds, potential competition, labor markets, entry as a mitigating factor)

Directions for Research

Should we continue the push to apply IO methods at scale?

- Opportunity to contribute to broader research agendas that touch many fields—such as *The Rise of Market Power*—than is typical with IO
- Need historical data of sufficient quality. Matters for feasibility, also introduces selection issues: newer, growing industries less likely to be amenable to modeling
- Therefore, IO likely to offer only part of the answer. Important to connect findings to those in other fields. Difficult endeavor but I am modestly optimistic
- With regard to *The Rise of Market Power*, studies looking outside the US would seem to have heightened value. The connections between technology adoption and globalization (e.g., endogenous sunk costs), domestic institutions, idea transfers, etc., are ripe for exploration

