Rising Markups or Changing Technology?

By

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Overview

- Evidence of measured rising markups in the U.S. 1980s-post 2010 (DeLoecker, Eeckhout, Unger (DEU); QJE, 2020).
- Key components of their findings:
  - Use indirect "production" or "ratio" approach
  - Most evidence for publicly traded firms
  - Economic Census results provide supportive sensitivity analysis
- We explore the possibility that rising measured markups reflects changing technology.
  - Use 1972-2014 unbalanced panel of manufacturing establishments (2.2 million establishment-year observations).
  - We find that permitting more flexible variation in estimated output elasticities (across establishments and time) that increase in measured markups is substantially reduced if not eliminated.
  - We find that this sensitivity is consistent with differences in changing technology across establishments being important.

Key DEU Results: Increases in Sales-Weighted Markups

COMPUSTAT (Private sector) output elasticities: control function estimation, 2-digit 5-year rolling window, CD
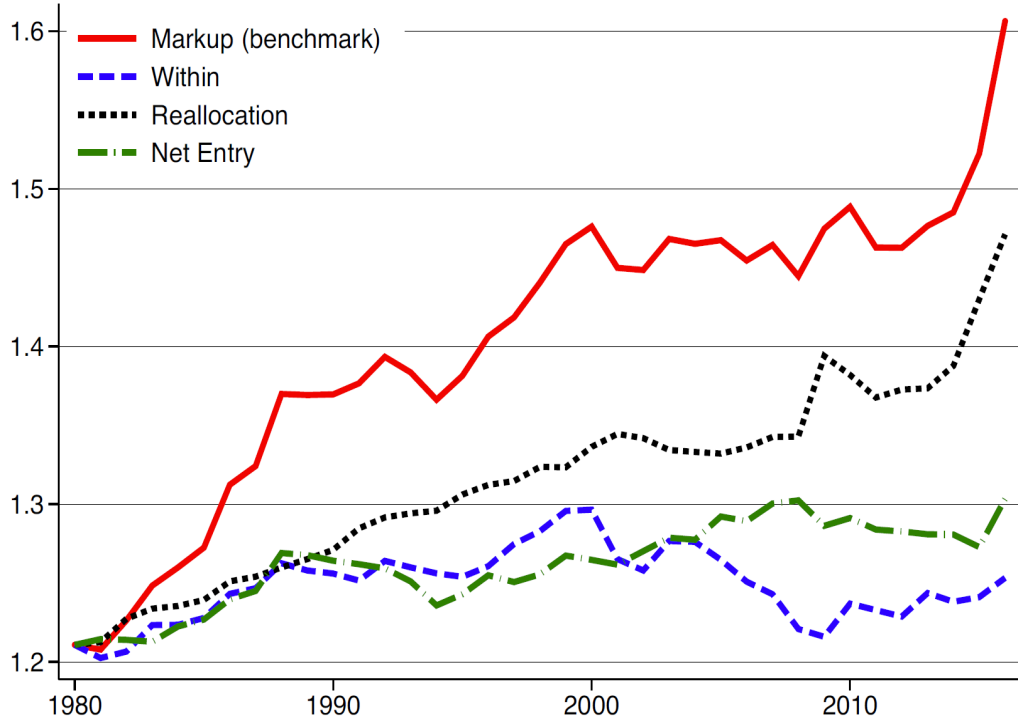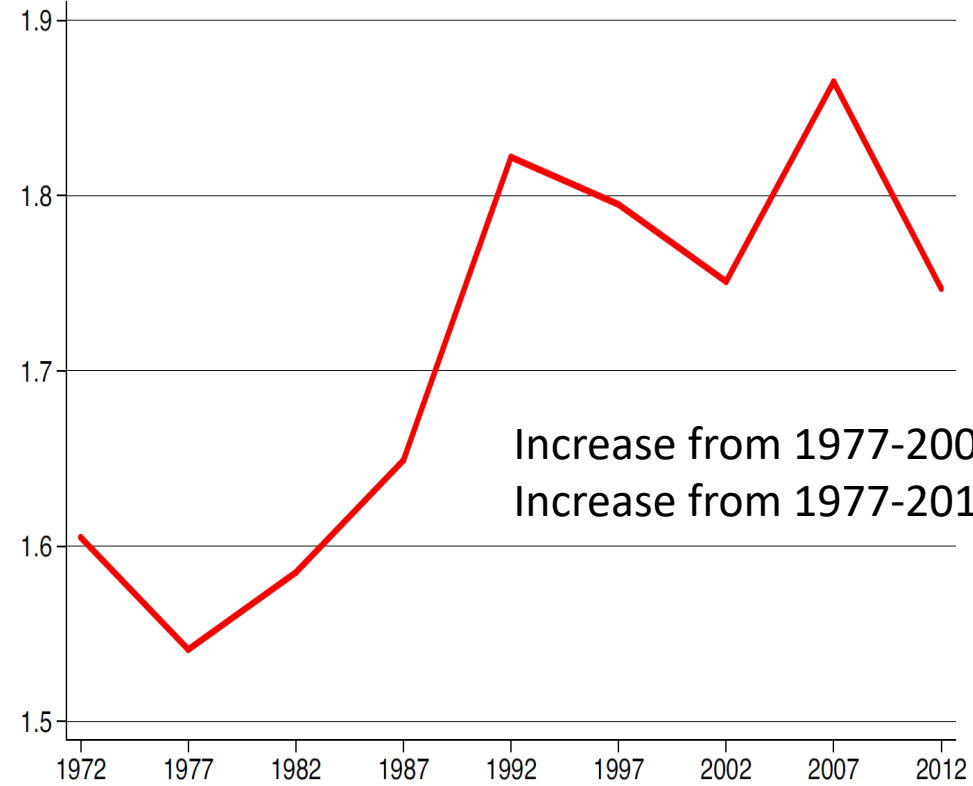
Economic Census (Manufacturing) output elasticities: 1 year, 4-digit, cost share approach

FIGURE IV

Decomposition of Markup Growth at the Firm Level

Increase from 1977-2007: 18%
Increase from 1977-2012: 12%

(A) Manufacturing: average

Rising Markups or Changing Technology

$\mu_{it} = \frac{\theta_{it}^V}{\alpha_{it}^V}$ (Markup = (Output elasticity of V)/(Cost Share of Revenue of V))

- One equation in two unknowns. Perhaps the observed variation in measured markups reflects changes in technology.
    - Closely related to measuring wedges as in Hsieh and Klenow (2009)
- Cost share methods and proxy/control function methods.
    - DEU:
        - Use control function in baseline COMPUSTAT analysis, 5-year rolling estimates of output elasticities at 2-digit level with Cobb Douglas production function. DEU method recognizes revenue (not output) function estimation.
        - Use cost-share method with Economic Census data, 1-year 4-digit elasticities.
    - Our paper:
        - Use same control function specification as DEU with 5-year rolling estimates at 4-digit level with Cobb Douglas and translog.
        - Use cost-share method with 1-year, plant-level elasticities ("accounting markup")

Markups Estimated Using Cost Shares (CS)

Increase in baseline (1977-2012): 25%
Increase in more flexible (1977-2012): 15%
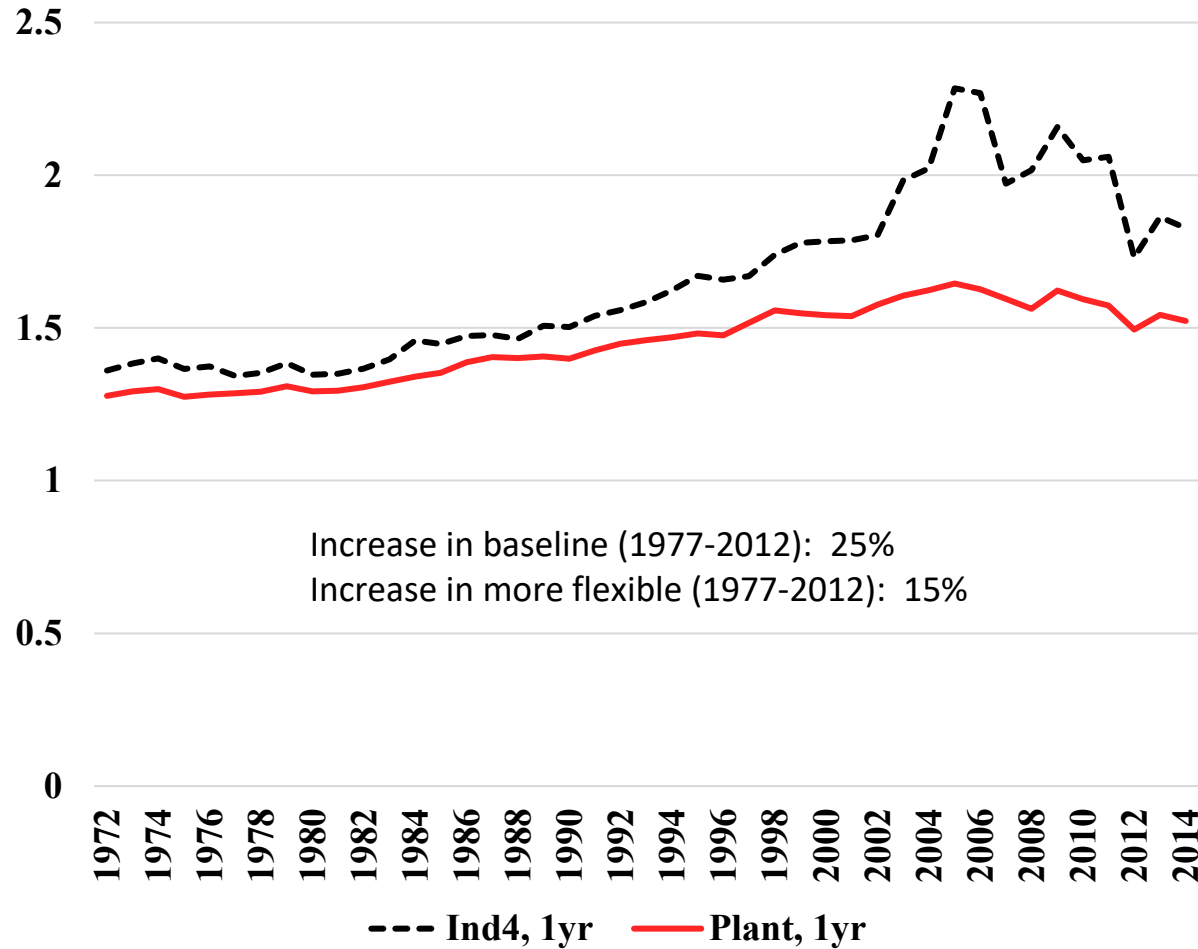
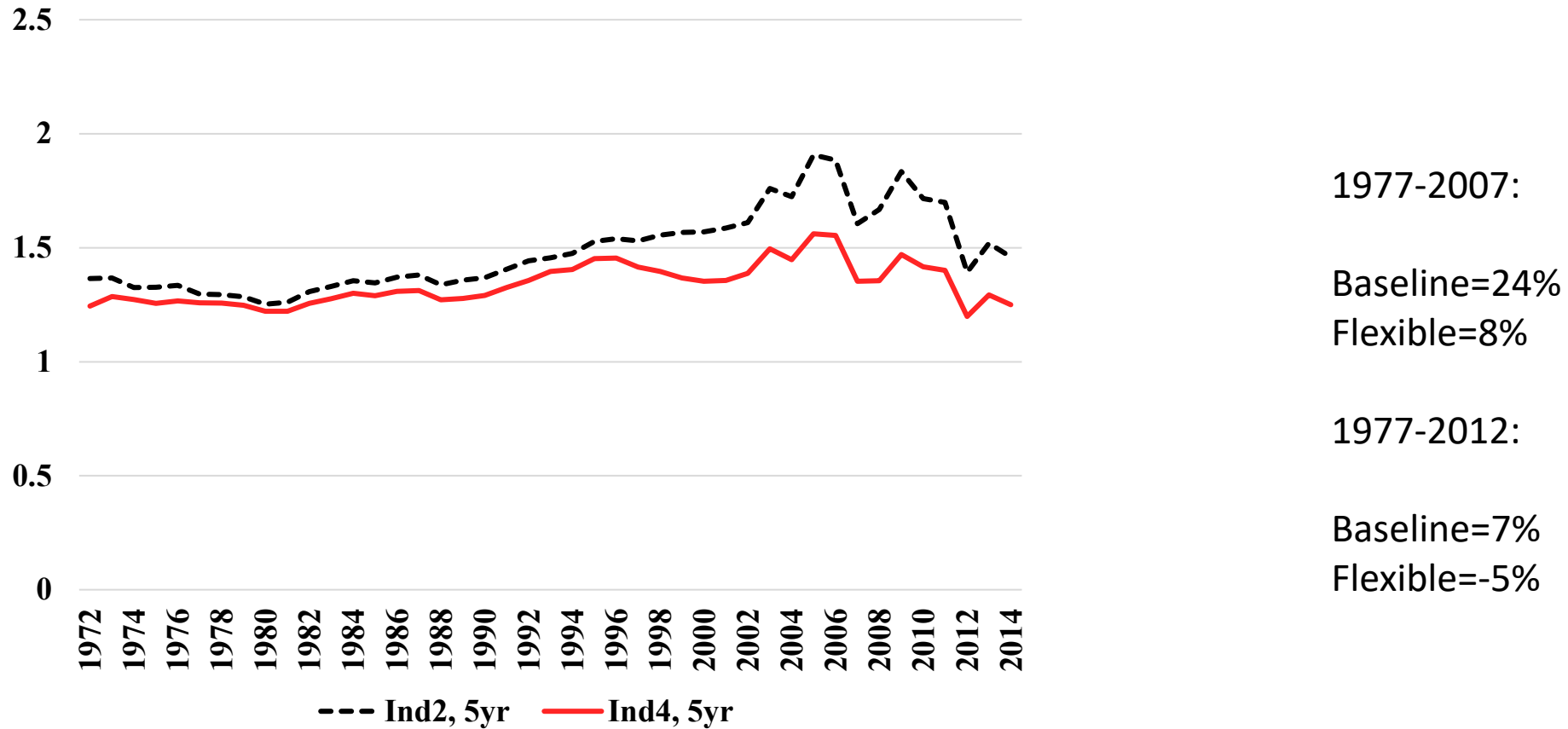DEU baseline for Economic Census is 4-digit, 1 year.

Observe even for baseline peaks in mid 2000s.

Plant, 1 year is what Autor et. al. (2020) call the accounting markup:
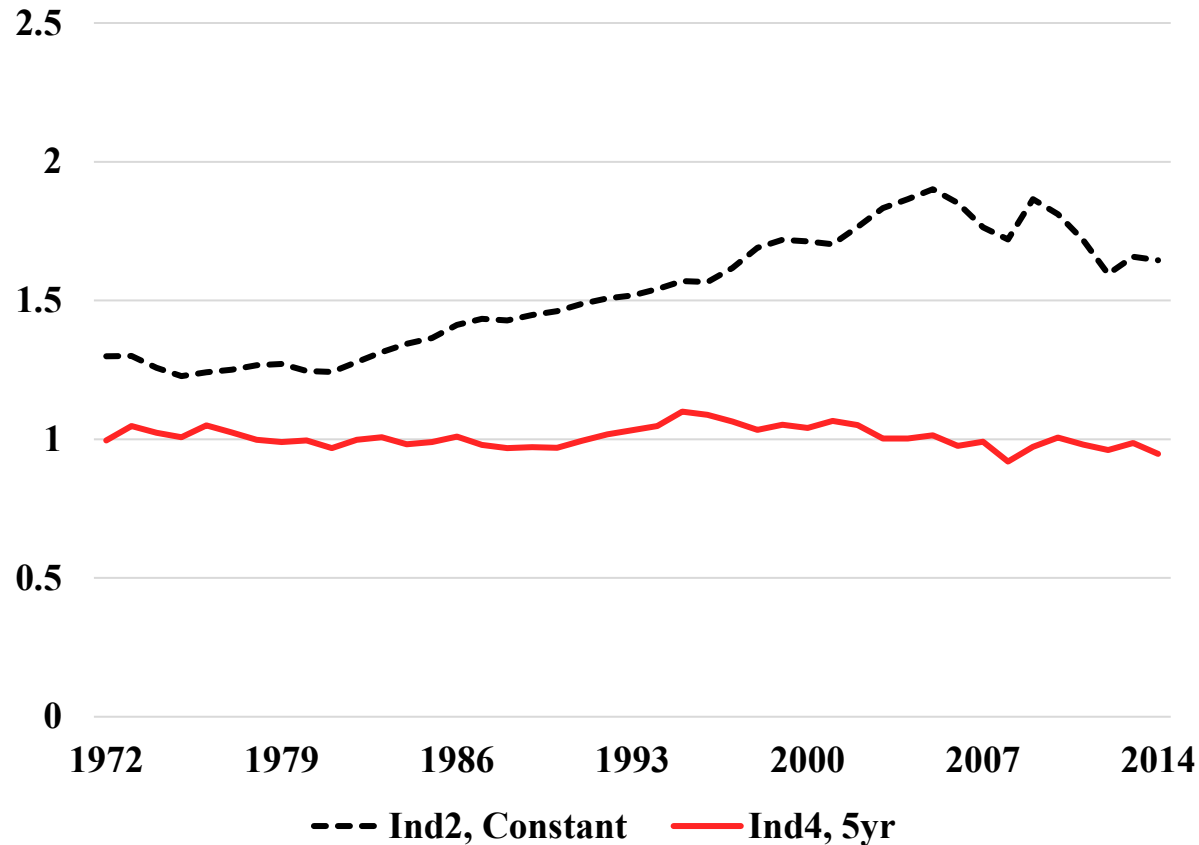
$$\mu_{it} = \frac{R_{it}}{TC_{it}}$$

Notes: The markups above are estimated using materials as the variable input. Aggregate markups are revenue-weighted means.

Markups Estimated Using Cobb-Douglas (CD)

1977-2007:

Baseline=24%
Flexible=8%

1977-2012:

Baseline=7%
Flexible=-5%

Legend: - - - Ind2, 5yr   —— Ind4, 5yr

Notes: The markups above are estimated using materials as the variable input. Aggregate markups are revenue-weighted means. Long differences are log differences.

Markups Estimated Using Translog (TL)

1977-2007:
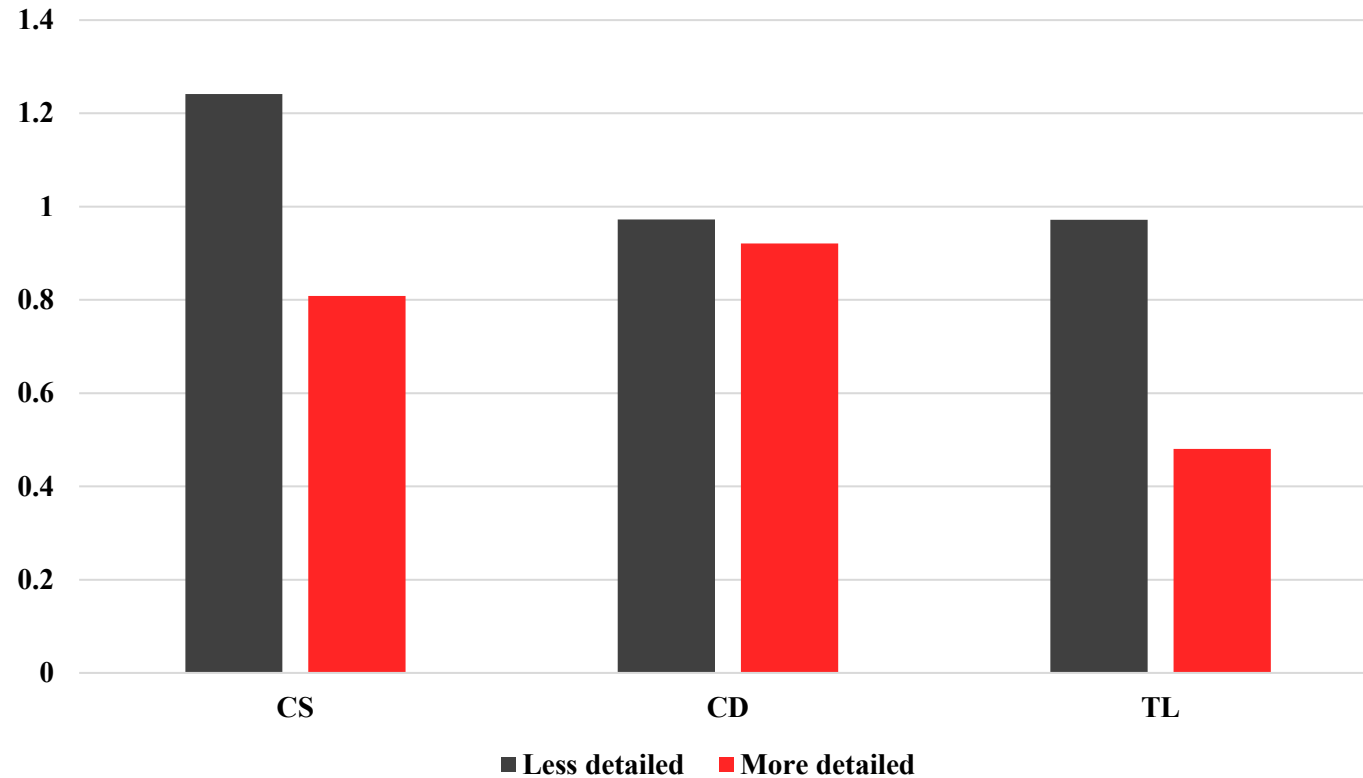
Baseline=41%
Flexible=-3%

1977-2012:

Baseline=27%
Flexible=-6%

Notes: The markups above are estimated using materials as the variable input. Aggregate markups are revenue-weighted means. Long differences are log differences.

Increase in Dispersion of Markups Diminished with More Flexible Specifications for Production

Long difference in standard deviation 1980-2014

Dispersion in output elasticities across establishments much larger under more flexible (more detailed) specifications.

Baseline versus Flexible: Observable Changes in Technology?

- We use detailed (6-digit NAICS) industry information on:
  - Changes in computer investment per worker
  - Changes in K/L
  - Changes in diversification (activity in non-manufacturing)
    - Motivated by Fort et. al. (2018) factoryless production
  - Most measures more readily available in Census Years (years ending 2 and 7).
  - **Use long differences at industry-level (1977-2077) to classify industries above and below (sales-weighted) median long run change.**

- We are not restricting changes in markups to those from between industry alone.

- Rather, we are investigating whether the difference between less and more detailed markups are related to industry-level changes.

Changes in Technology and Less-More Detailed Markups
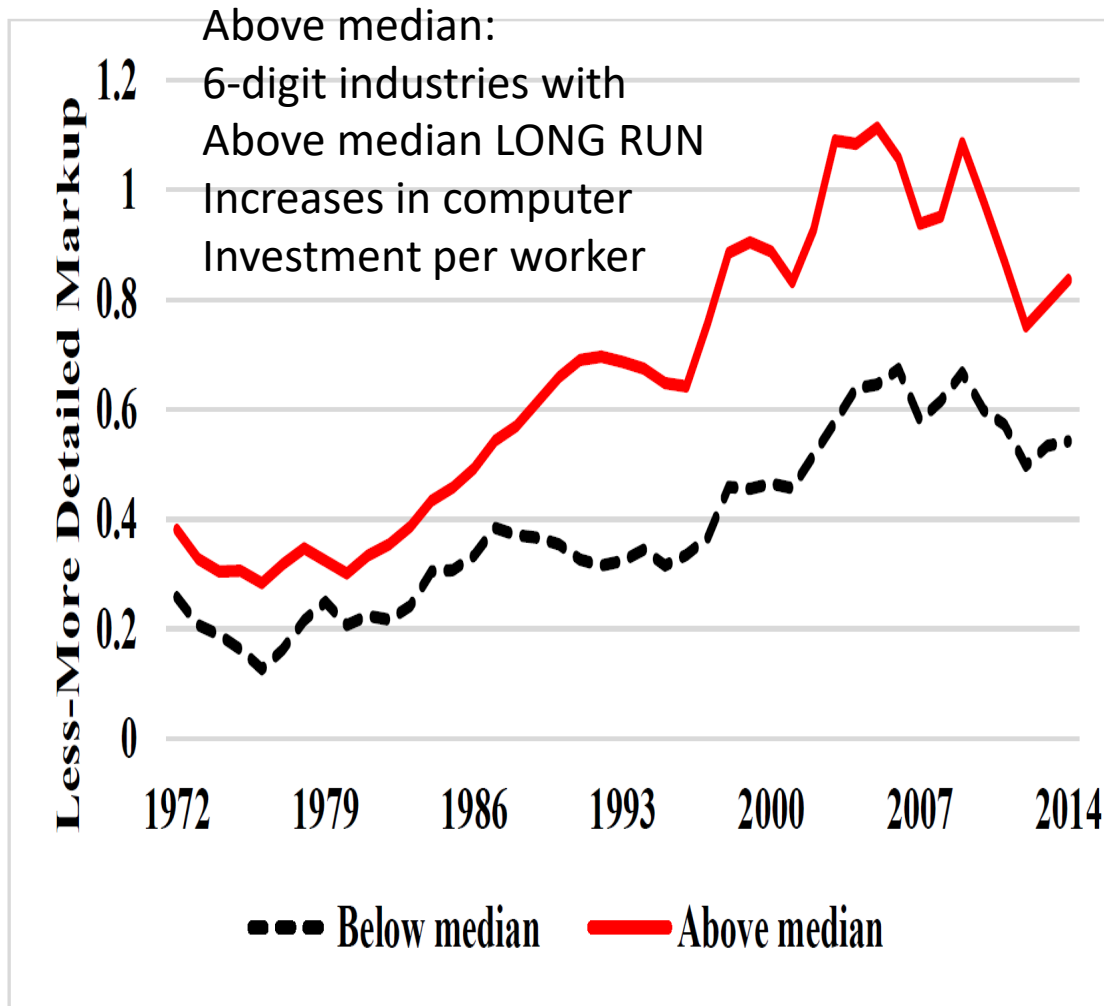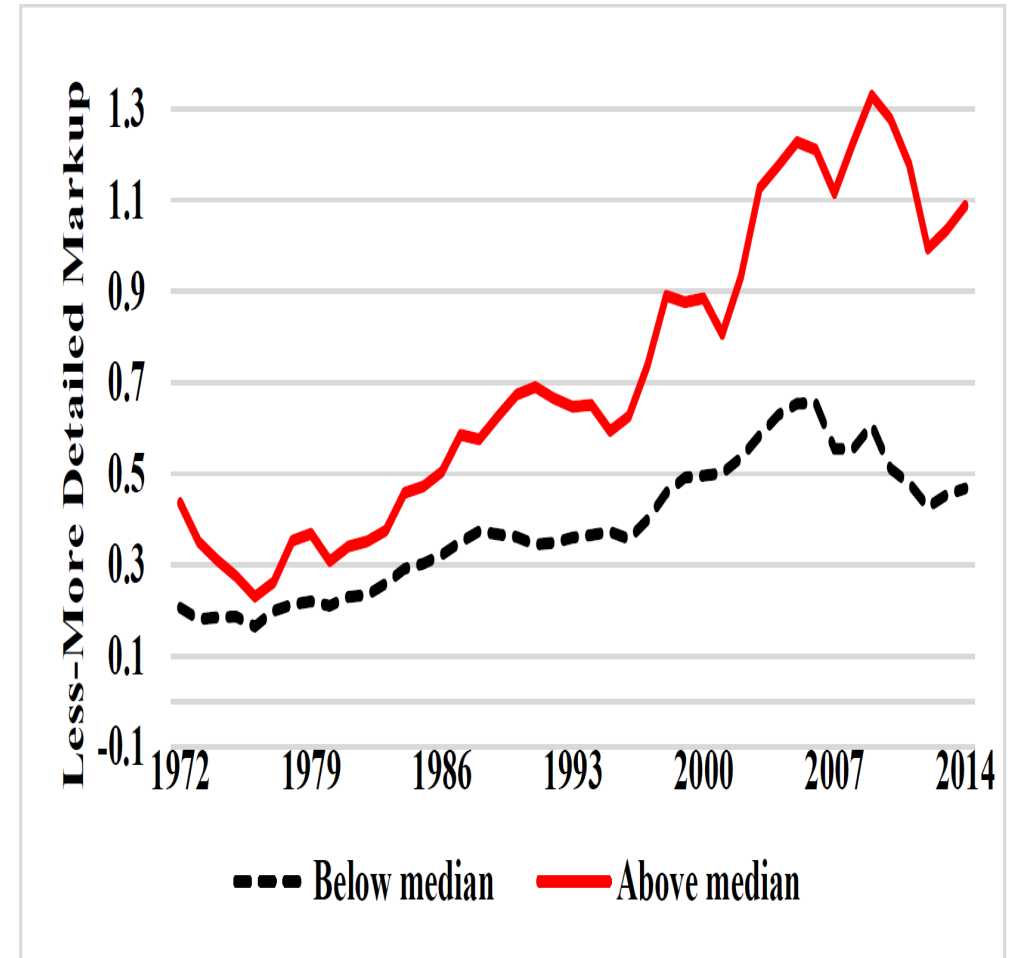
Figure 10. Markups and Changes in Computer Intensity

Above median:
6-digit industries with
Above median LONG RUN
Increases in computer
Investment per worker

- - - Below median —— Above median

Figure 11. Markups and Changes in Capital per Worker

- - - Below median —— Above median

Less-more=Difference in sales-weighted baseline – flexible. Using translog less and more detailed estimates.

Changes in Diversification Outside Manufacturing and Less-More Difference in Markups

Figure 12. Markups and Absolute Changes in Diversification
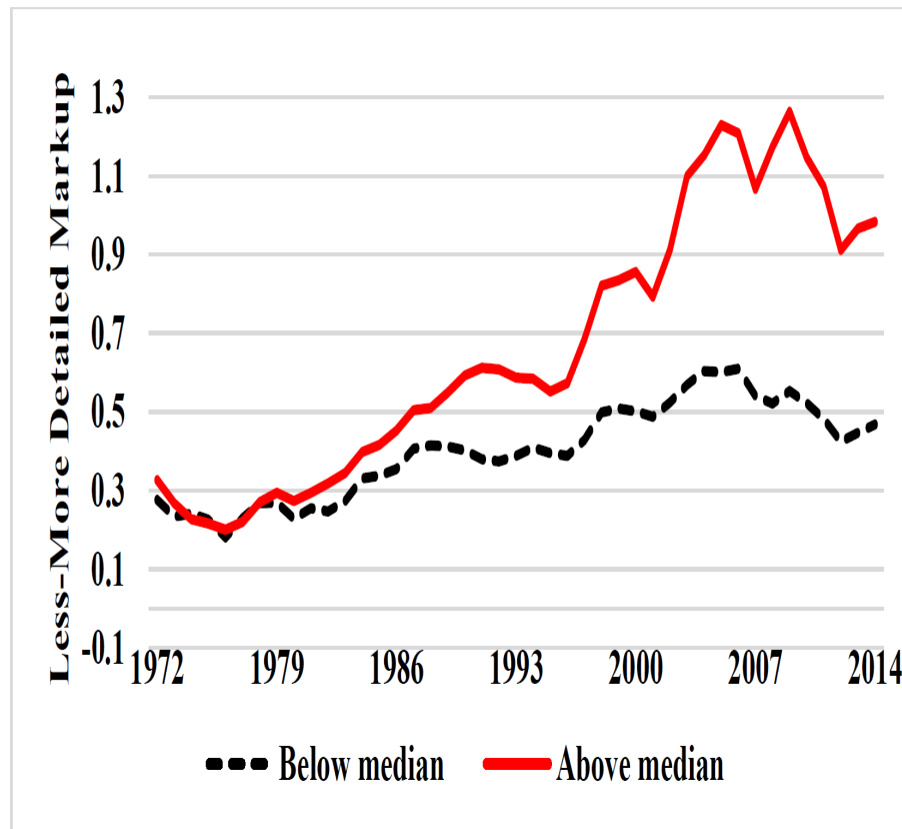
Differences by Computer Investment Per Worker, Capital Intensity and Diversification statistically Different in 1990s and post 2000s

Using translog less and more detailed estimates.

Next Steps (in progress): Exploiting Plant-Level Differences in Technology

- We can measure differences across plants in computer investment per worker, capital per worker, diversification on annual basis.

- Existing literature shows substantial variation across plants within and between industries in such indicators of changing technology.

- We are working on relating this variation to:
  - Differences in estimated output elasticities from less and more flexible specifications (looking directly at relationship between estimated output elasticities and technology).
    - Evidence will be correlations – not causal.
  - Differences in estimated markups from less and more flexible specifications

- Our evidence on LR relationships reflects both impact of changing technology and magnitude of changing technology.
  - We are documenting the extent of changing technology on these dimensions at the plant and industry level.

Broader Issues

- Standard research practice is to assume same technology for all establishments in same detailed industry (sometimes not so detailed).

- Much of the literature (e.g., misallocation/wedge) literature assumes production technology is time invariant.

- To their credit, DEU freed this up some. Our findings suggest perhaps not enough.
  - Substantial variation in output elasticities across establishments and over time.
  - Taking this into account reduces or eliminates increases in measured markups.

- More work needed to open up the black box of heterogeneity in the ways that businesses do business.
  - May of course interact with wedges/markups in interesting ways.