Comments on "Innovation Growth Accounting" by Peter Klenow and Huiyu Li

Comments by John Haltiwanger

Overview

- Innovative growth accounting framework motivated by quality ladder model of innovation
- Distinguishing features:
  - Indirect method of quantifying creative destruction, own innovation, and new varieties from growth rate distribution of all private sector establishments in the U.S.
    - Distinct from more direct approaches using patents, R&D, or new product introduction
    - Establishments are products
  - Permits heterogeneity in own innovation, arrival rate of creative destruction, step size by groups of establishments classified by firm age and firm size classes.
  - Creative destruction (CD) is random. Rate of loss from CD is the same across all firm groups.
  - Obsolescence threshold the same across all firm groups.

Many Interesting Results – Highlighting two:

- New and young firms punch more than their weight. Almost 50% of aggregate productivity growth accounted for by firms age<5 even though they account for only about 16% of employment.

- Surge in productivity in mid 1990s and then slowdown thereafter accounted for by older firms. Key component: own innovation.

Comment 1: Structural Change in Sectoral Composition for Reasons Outside Scope of Model Impacts Key Moments by Firm Age And Firm Size

Employment Shares by Sector

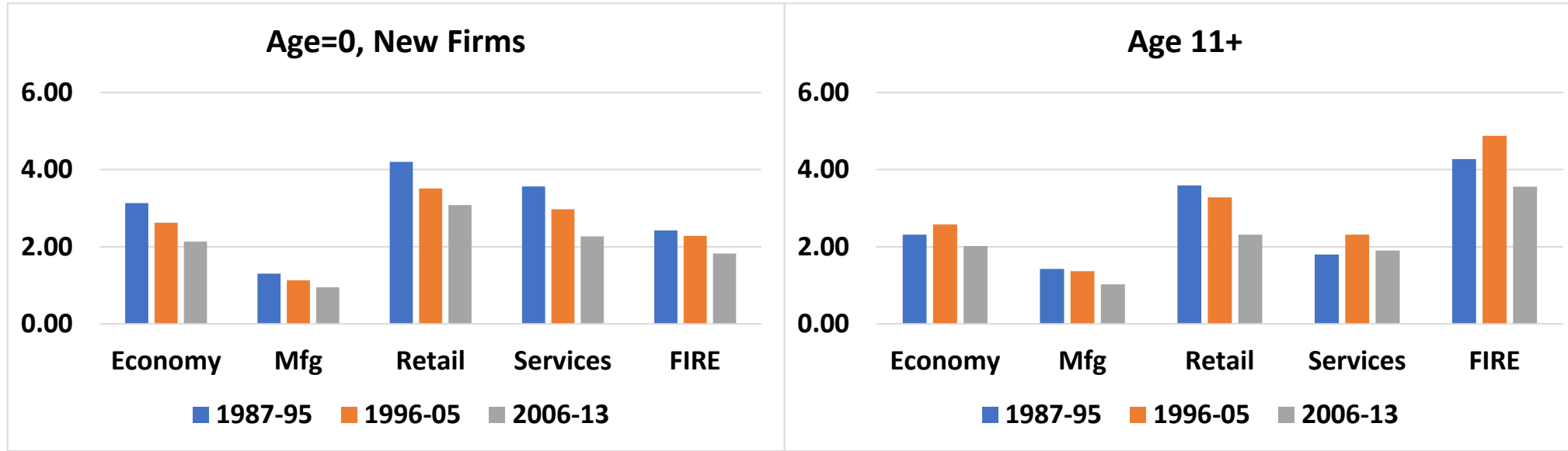**Employment Share, Age 11+**
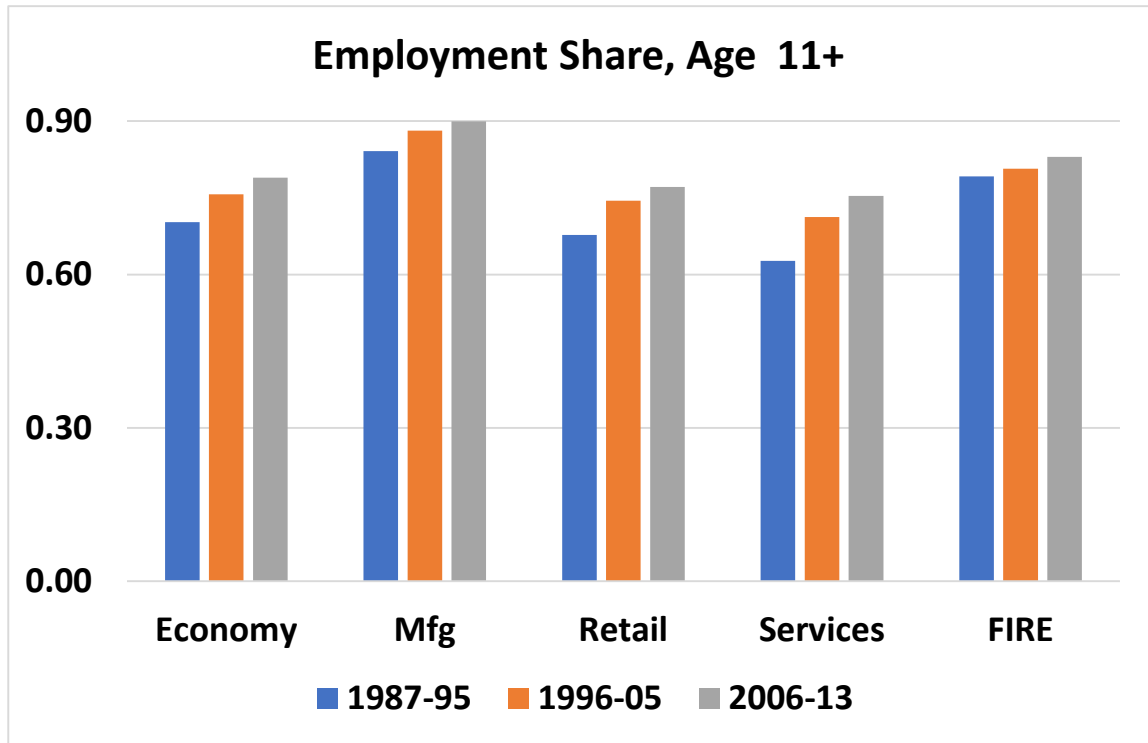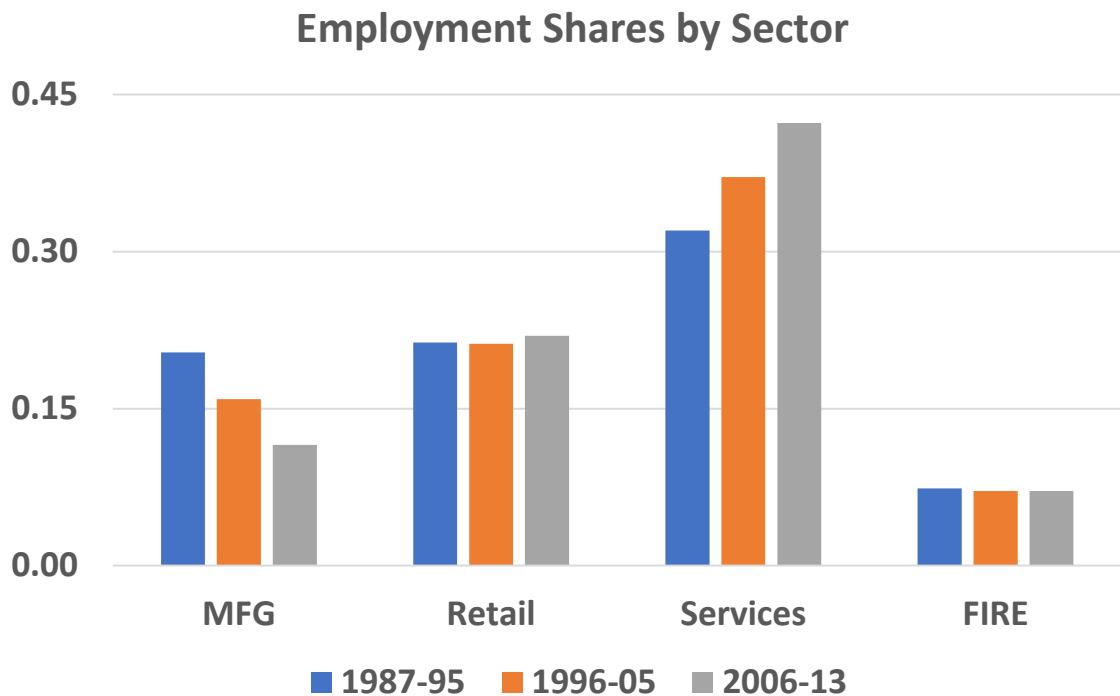
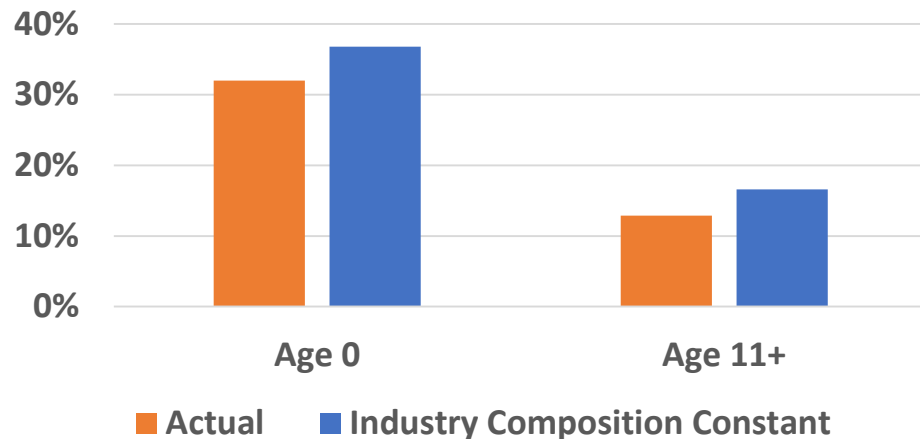Shift from goods to services interacts with changing age (and size) distribution.

Broad sector is crude -- substantial changes in composition of industries within these broad categories.

Note: Source: BDS, First Subperiod differs from paper (avoid imputation of 6-10/11+ in 1982-86)

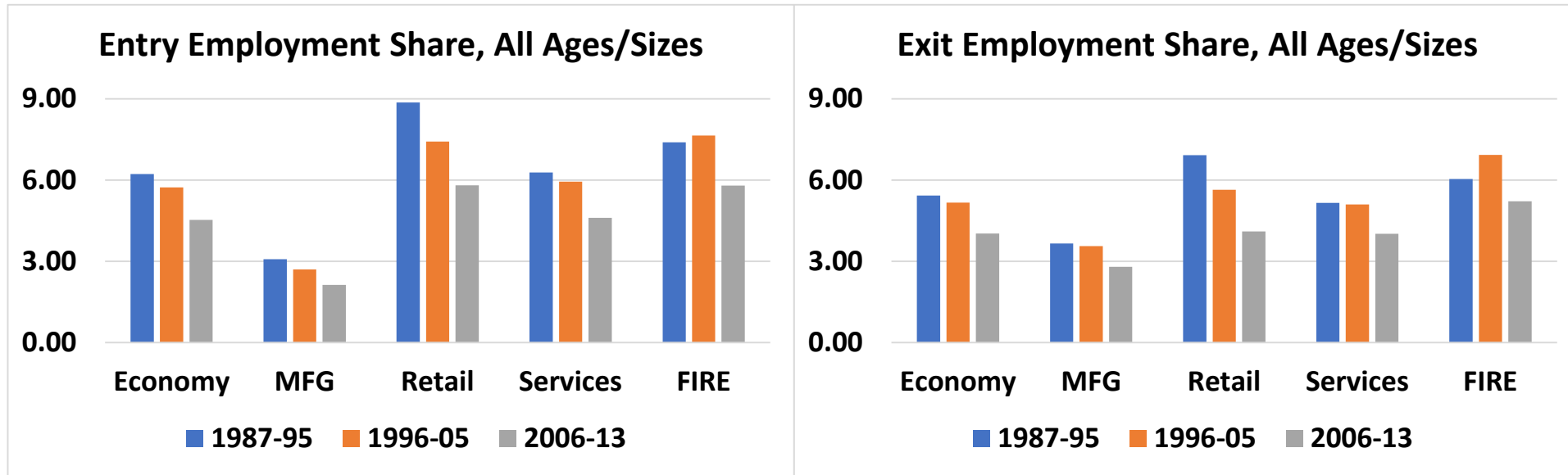**Entry Employment Share =Employment from new establishments/Total employment for all ages in industry.**

Age=0, New Firms

6.00
4.00
2.00
0.00

Economy   Mfg   Retail   Services   FIRE

■ 1987-95   ■ 1996-05   ■ 2006-13

Age 11+

6.00
4.00
2.00
0.00

Economy   Mfg   Retail   Services   FIRE

■ 1987-95   ■ 1996-05   ■ 2006-13

Decline in Economy Entry Employment Share from 1987-95 to 2006-13

40%
30%
20%
10%
0%

Age 0   Age 11+

■ Actual   ■ Industry Composition Constant

Holding industry composition constant even at 1 digit level yields non-trivial differences in decline in entry employment share over time that differs across age groups.

Davis et. al. (2006) and Decker et. al. (2016) find economy-wide employment dispersion/reallocation measures decline by 20 percent more than actual holding detailed industry composition constant.

Source: BDS

Comment 2: Creative Destruction is not random.

Entry Employment Share, All Ages/Sizes

Legend: 1987-95, 1996-05, 2006-13
X-axis: Economy, MFG, Retail, Services, FIRE

Exit Employment Share, All Ages/Sizes

Legend: 1987-95, 1996-05, 2006-13
X-axis: Economy, MFG, Retail, Services, FIRE

Source: BDS

A new retail establishment is not directly competing with existing manufacturing establishments in terms of product innovation

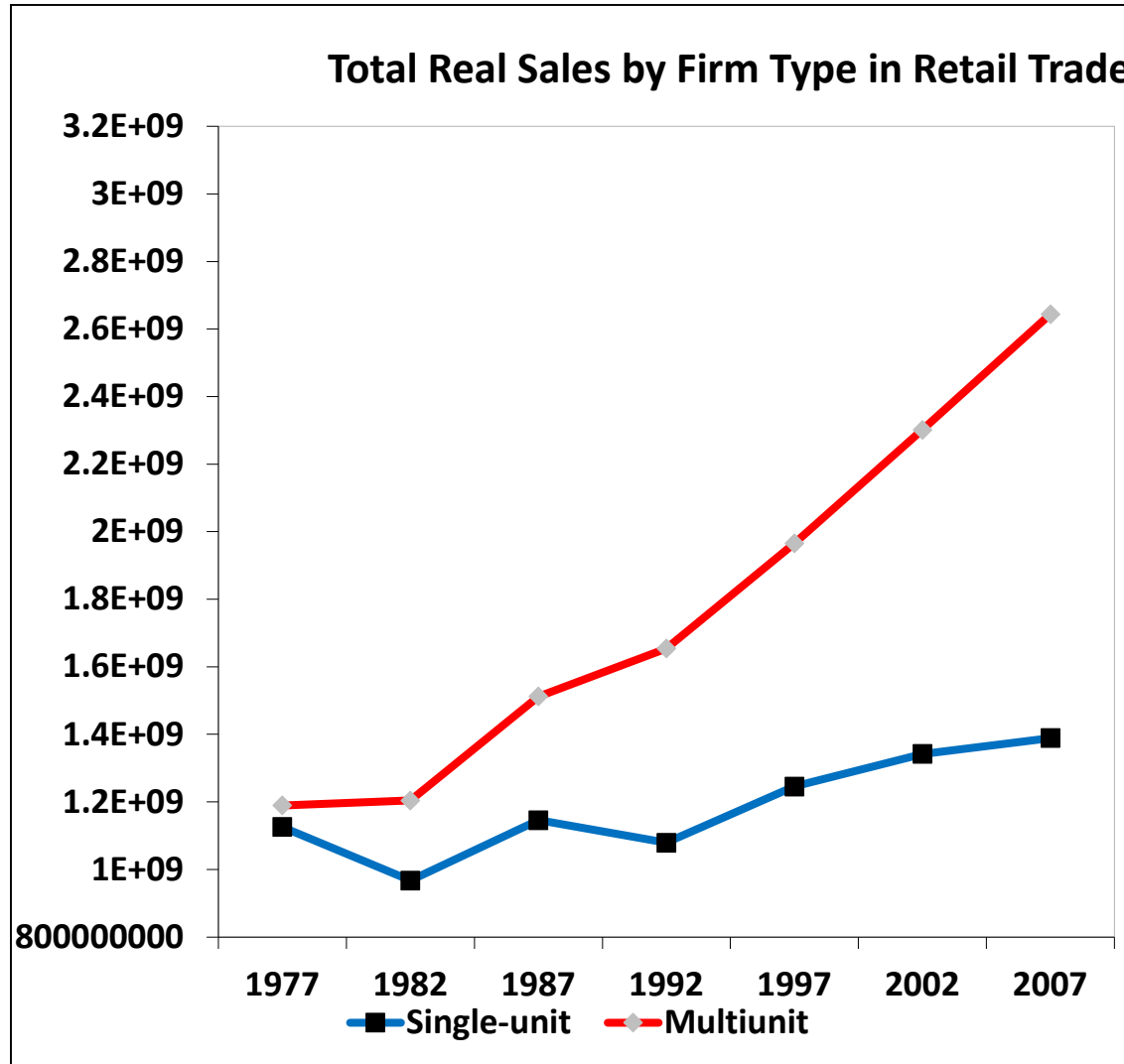Especially for retail, effects are detailed industry specific and local:

When a Big-Box retailer in General Merchandise (e.g., Wal-Mart) enters a specific location:
-- Exit rates of single unit and small chain general merchandise stores increase especially in 1-5 mile radius.
-- Entry increases and exit declines for restaurants in the immediate area.
(Haltiwanger, Krizan and Jarmin, 2010)

Comment 3: Change in Business Model in Retail Trade -- Within vs. Between Firm Differences in Revenue Productivity

Total Real Sales by Firm Type in Retail Trade

(chart y-axis values: 3.2E+09, 3E+09, 2.8E+09, 2.6E+09, 2.4E+09, 2.2E+09, 2E+09, 1.8E+09, 1.6E+09, 1.4E+09, 1.2E+09, 1E+09, 800000000)

(chart x-axis values: 1977, 1982, 1987, 1992, 1997, 2002, 2007)

Legend: ■ Single-unit   ◆ Multiunit

Source: Foster et. al. (2016)

This paper: Wal-Mart/Amazon have exhibited substantial increases in scale but apparently little gains in Revenue Per worker.
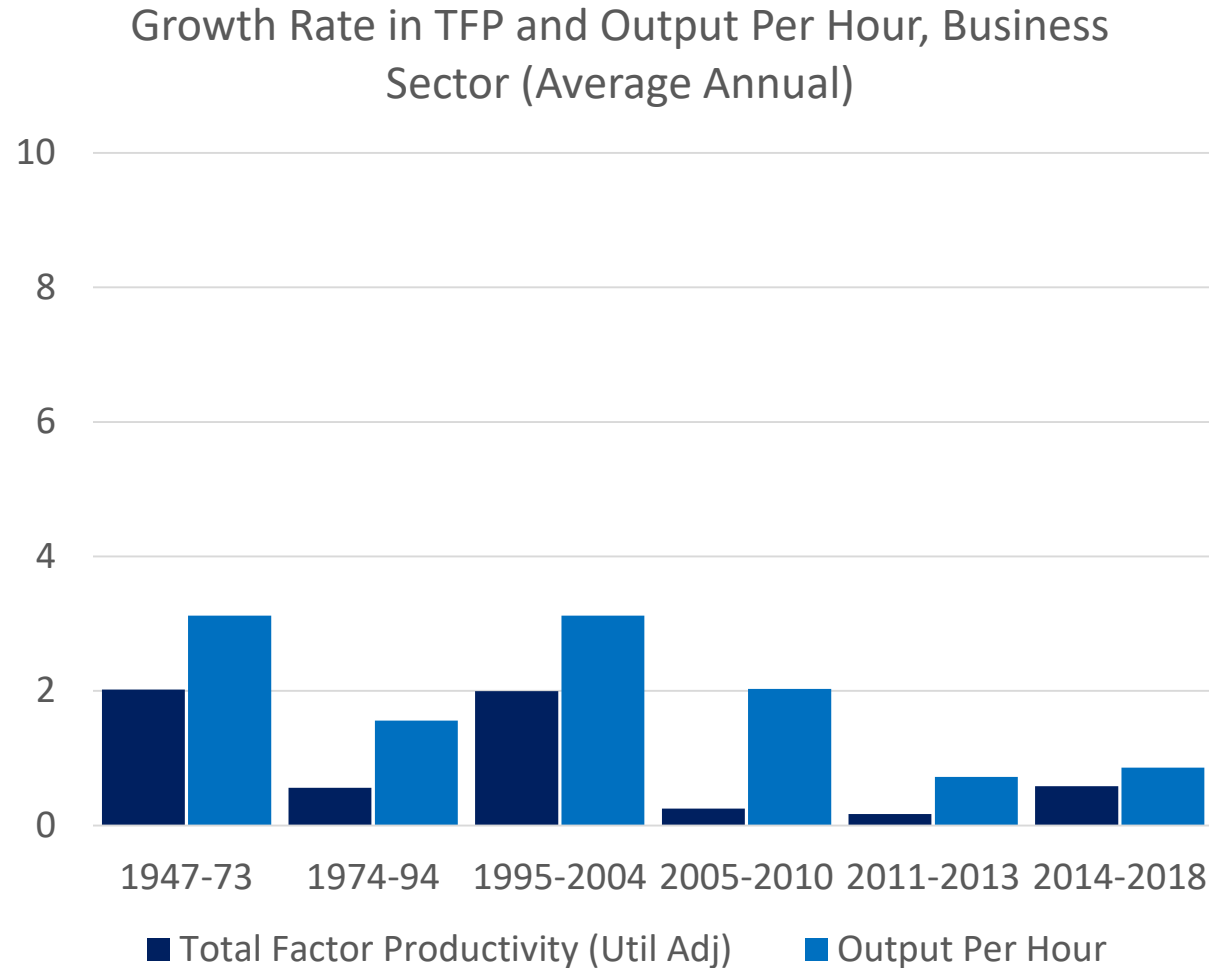
Is this the right comparison?

During this period of dramatic change in the business model in Retail trade:

Revenue Per Worker of Establishments of Large, National Chains persistently 25 log points Higher on average than establishments of Single-Unit Establishment Firms in the same detailed industry.
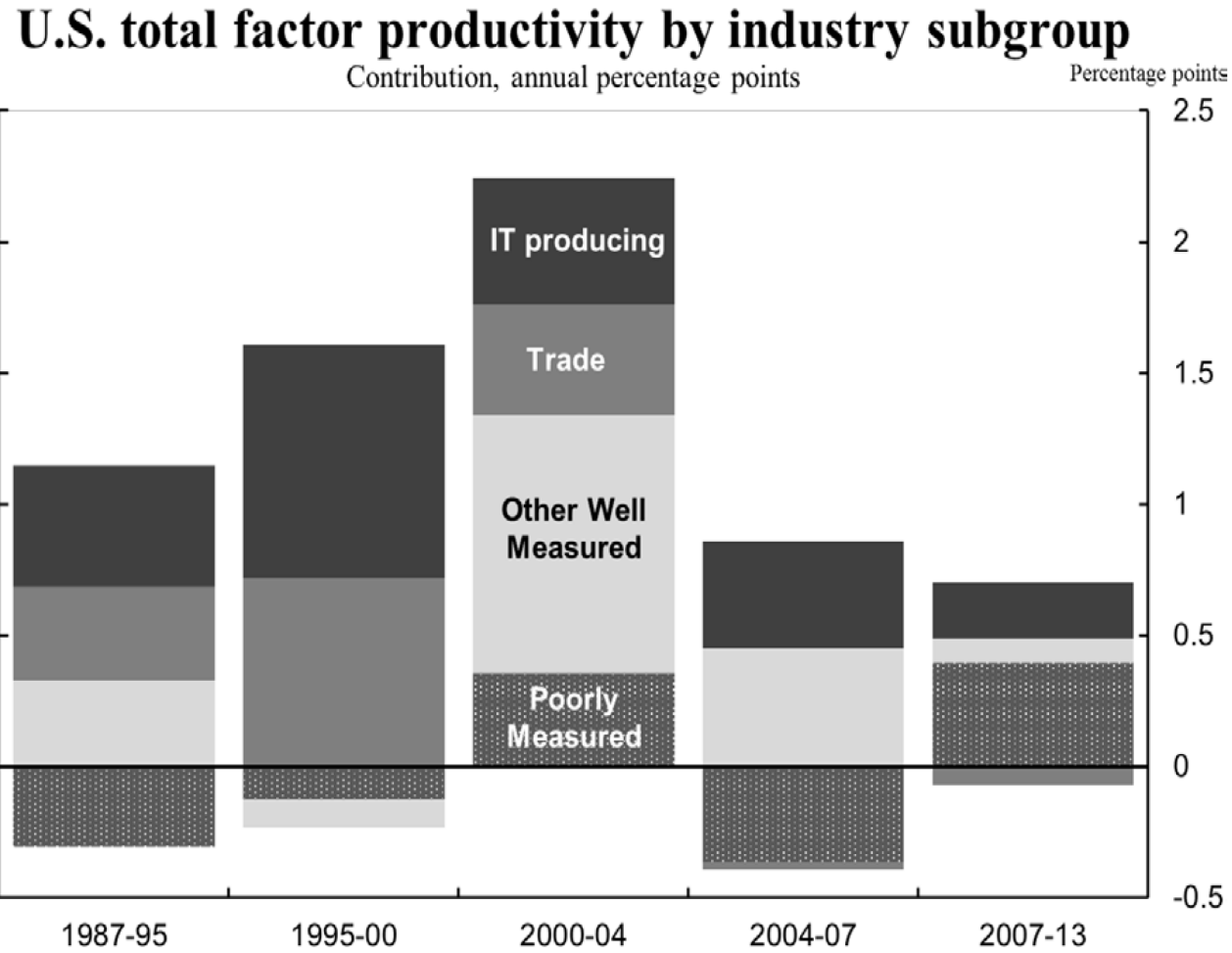
Comment 4: Surge and Slowdown in Productivity dominated by High Tech (ICT) . Young Firm dynamics Distinct for ICT compared to overall economy.

Growth Rate in TFP and Output Per Hour, Business Sector (Average Annual)

Growth Rate in Output Per Hour (Average Annual)
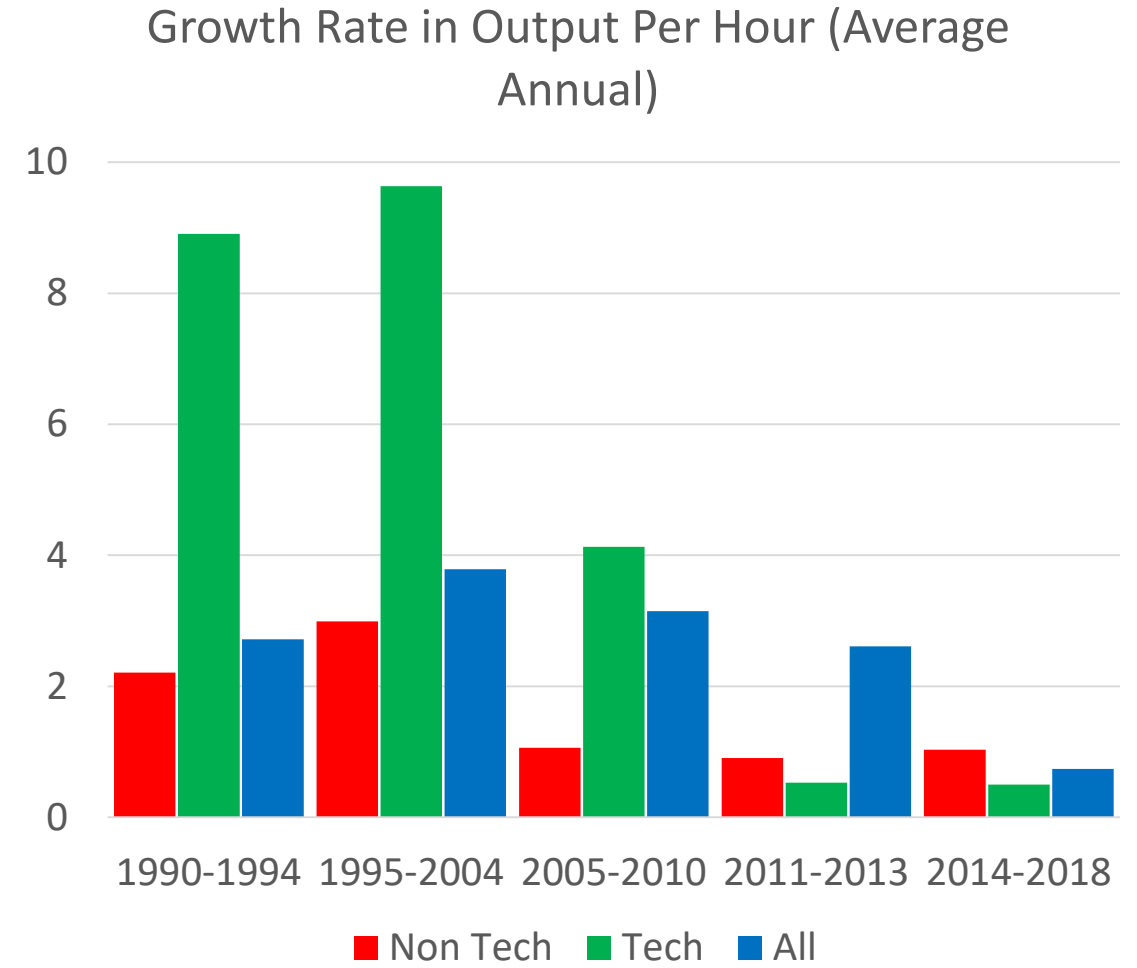
Source: Left Panel from Fernald, SF Fed. Right Panel from Aggregated 4-digit industries from BLS

Putting the pieces together: ICT producing (and in turn intensive ICT using) dominates productivity Surge and Decline. Surge initially in producing and then in intensive ICT using.

U.S. total factor productivity by industry subgroup

Contribution, annual percentage points   Percentage points

Source: Byrne et. al. (2016)

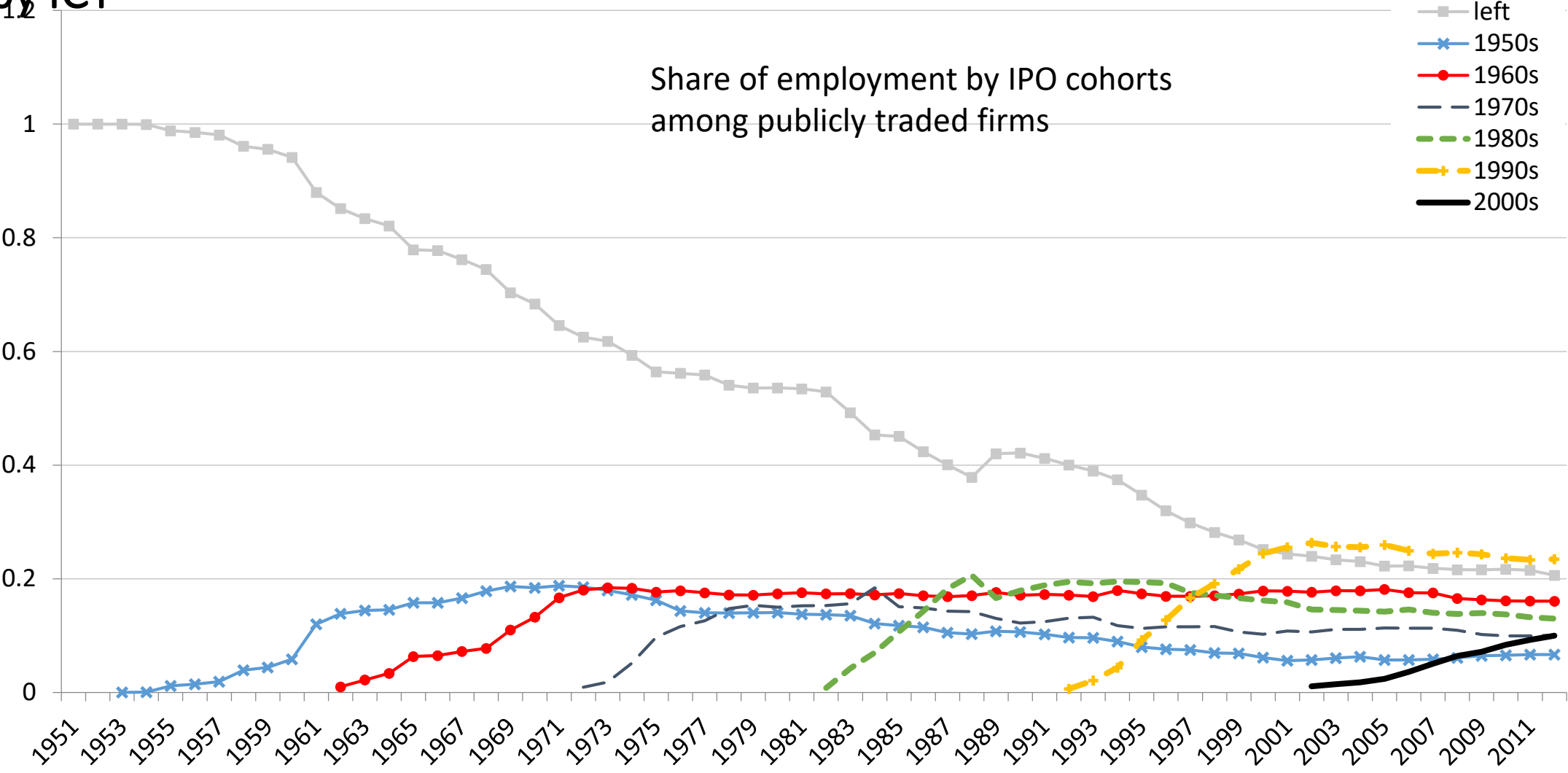# Share of Activity at Young (Less than 5 years Old) Firms, U.S. Private Sector and High-Tech
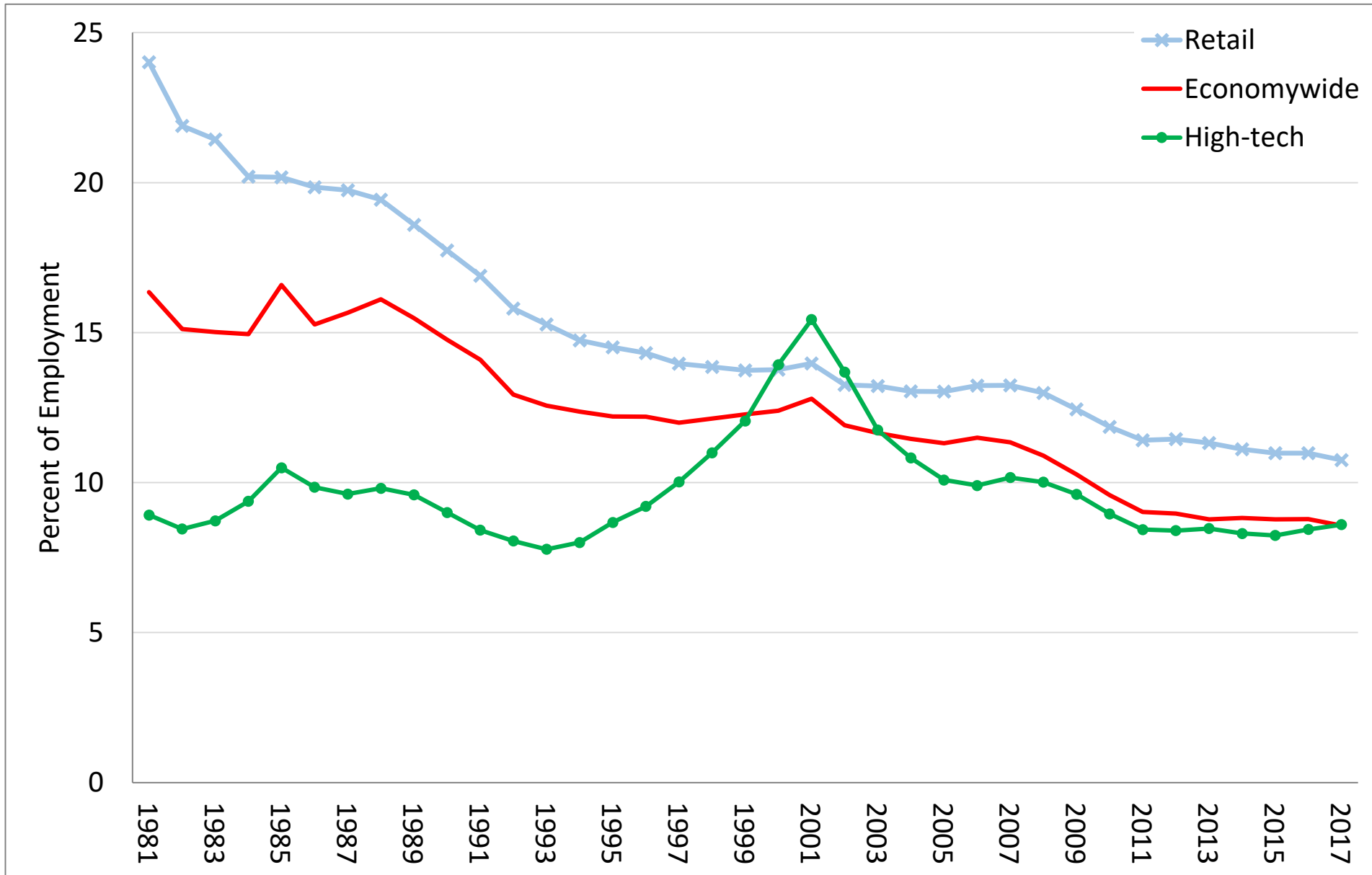
High Tech
Had surge
Of entry and
Young firms
During
Productivity
Surge.

Was
Productivity
Surge and
Decline in High
Tech driven
By mature firms?

Declining
Economy-wide
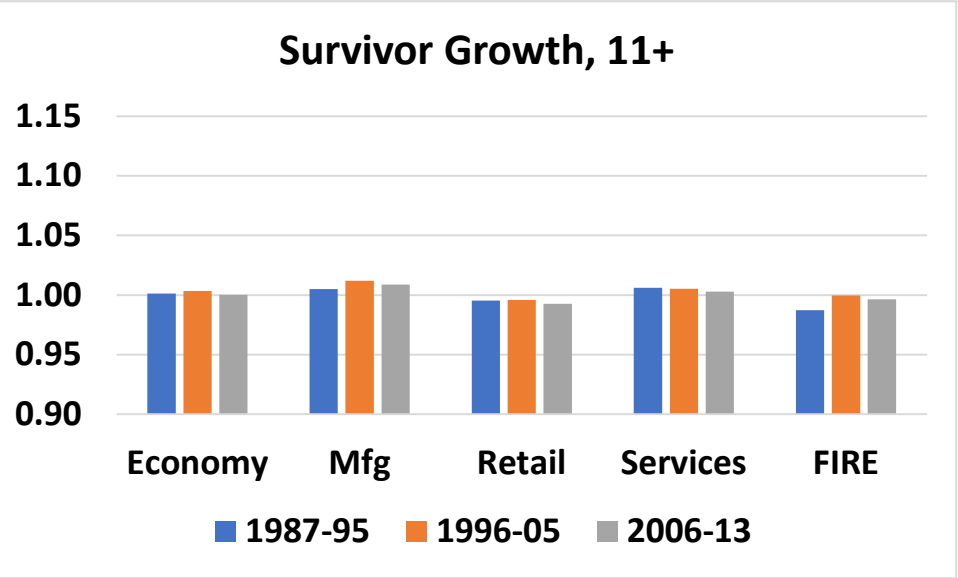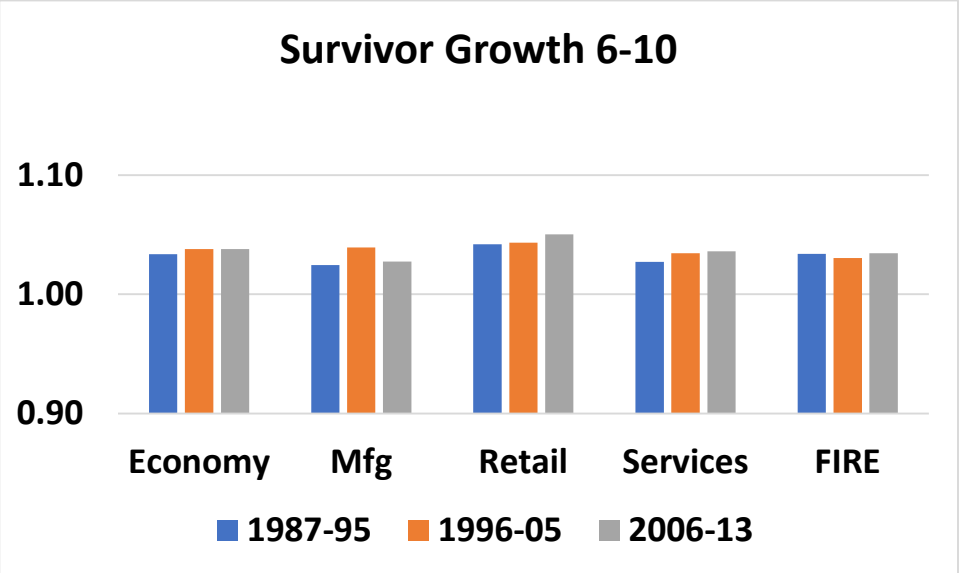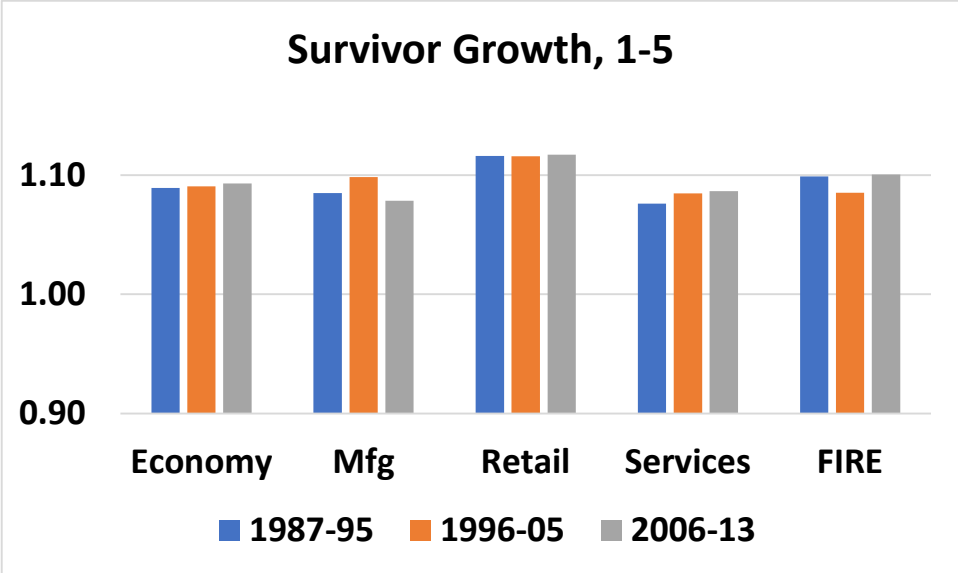Young Firm Share
dominated by
Retail Trade

Source: Tabulations from LBD (Census) by Decker et. al. (2017) spliced with Business Employment Dynamics (BLS)

1990s cohort of IPOs large and rapidly growing contribution – dominated by ICT

Share of employment by IPO cohorts among publicly traded firms

Legend:
- left
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s

Source: Decker et. al. (EER, 2016) and Ritter (2016)

Comment 5: What moments are driving the finding of surge and decline in own innovation for older firms?

Survivor Growth, 1-5

Survivor Growth 6-10

Survivor Growth, 11+

Survivor Growth=Continuing establishments employment share in t divided by share in t-1

Survivor growth highest (and above one) for young firms.

Survivor growth lower (and below one) for older (age 11+) firms.

Only modest increase in survivor growth over time for age 11+.

Source: BDS

Taking stock and possible next steps

- Applying innovation accounting model to pooled private sector growth rate distribution of establishments has significant limitations:
  - Changing age and size structure partly driven by structural change outside scope of accounting framework.
  - Creative destruction is directed (at least within sector)
  - Pooled moments on employment growth distribution and aggregate productivity miss the outsized role of ICT and its distinct firm dynamics (with a surge of entry and fast growing young firms in the 1990s)
- Possible next steps:
  - Use accounting model at a detailed sectoral level.
  - Aggregate likely not using CES (or at least nested CES). Hottman, Redding and Weinstein (2016) use CES within each detailed product group and then Cobb-Douglas to aggregate across product groups.
  - Still not clear how this would capture spillover effects of innovations in general purpose technology from ICT.

Extra Slides

Comment 6: Useful to distinguish between employment shares by age (size) and entry/exit patterns by age/size

Exit Employment Share = Employment from Exiting Establishments/Total Employment for all ages in industry

Employment-weighted moments suggest older firms dominate establishment-entry and exit After age=0.
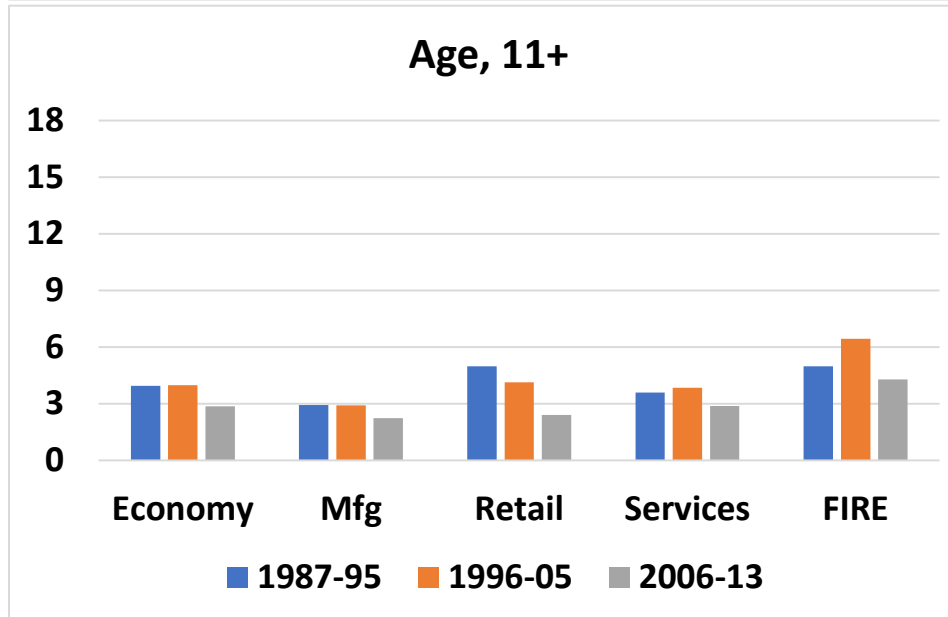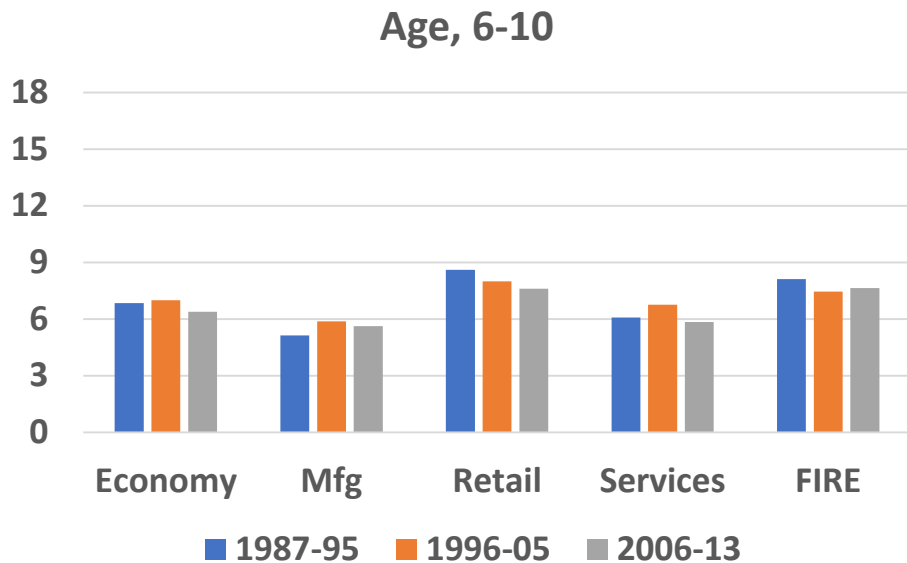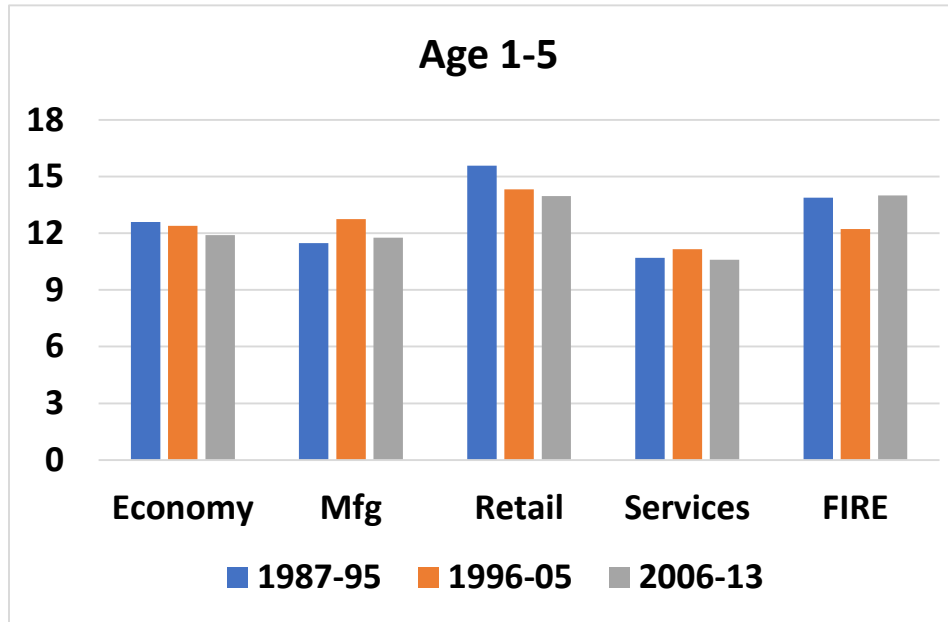
What is driving this is most employment Is with older firms and this is growing.
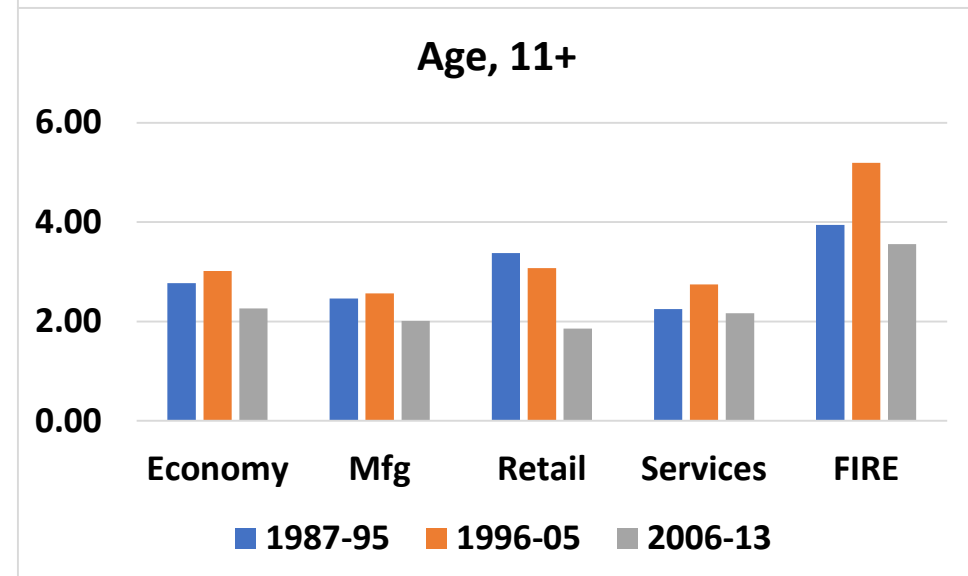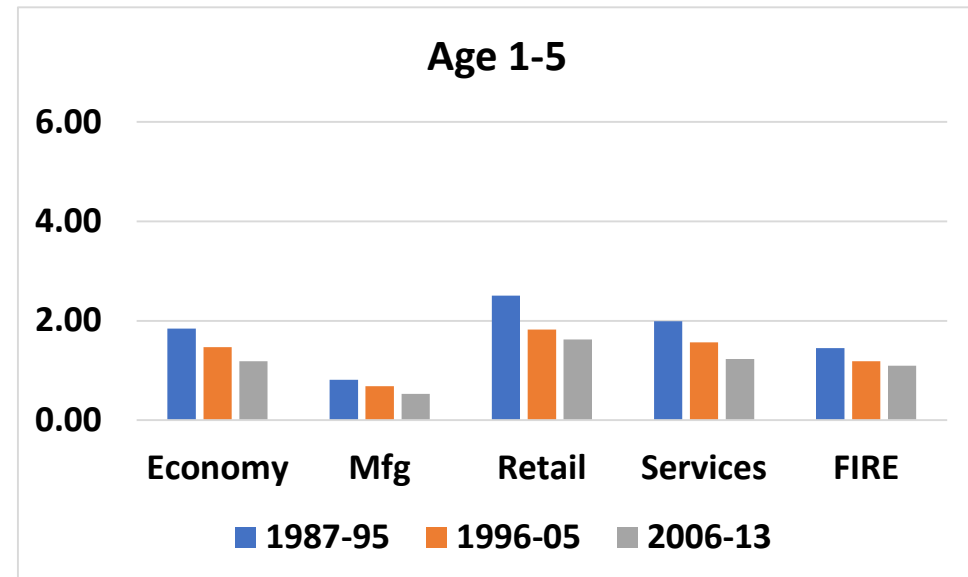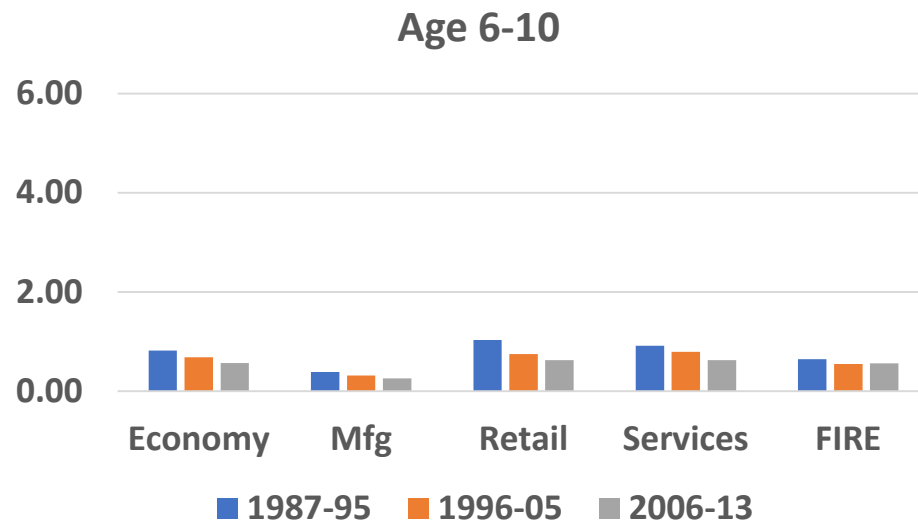
Exit Rate Within Group=Employment from Exiting Establishments/Employment for age group

Exit Rates much
higher for establishments
of young firms
compared to old firms.

Useful to distinguish between
Changes within groups
And changes in size of groups

Comment 7: Missing Dynamics: Experimentation, Learning and Shake Out Process

- Gort and Klepper (1982) and Jovanovic (1982) emphasize that periods of innovation lead to:
  - Phase one: Surge of entry and experimentation
  - Phase two: Shake out process
  - Phase three: Successful (high quality/high productivity) entrants grow
- Gort and Klepper track many different innovations (e.g. autos, tv's, computers, lasers) and find these dynamics take many years and vary by innovation.

Evidence from RE-LBD provides support for Gort and Klepper type dynamics in High Tech productivity Surge in the 1990s

Changes in Productivity Dispersion and Growth from a 1% (one time) Increase in Entry Rate (Years 1-3), High Tech

Years 4-6

Years 7-9

■ Dispersion(High Tech)   ■ Growth(High Tech)
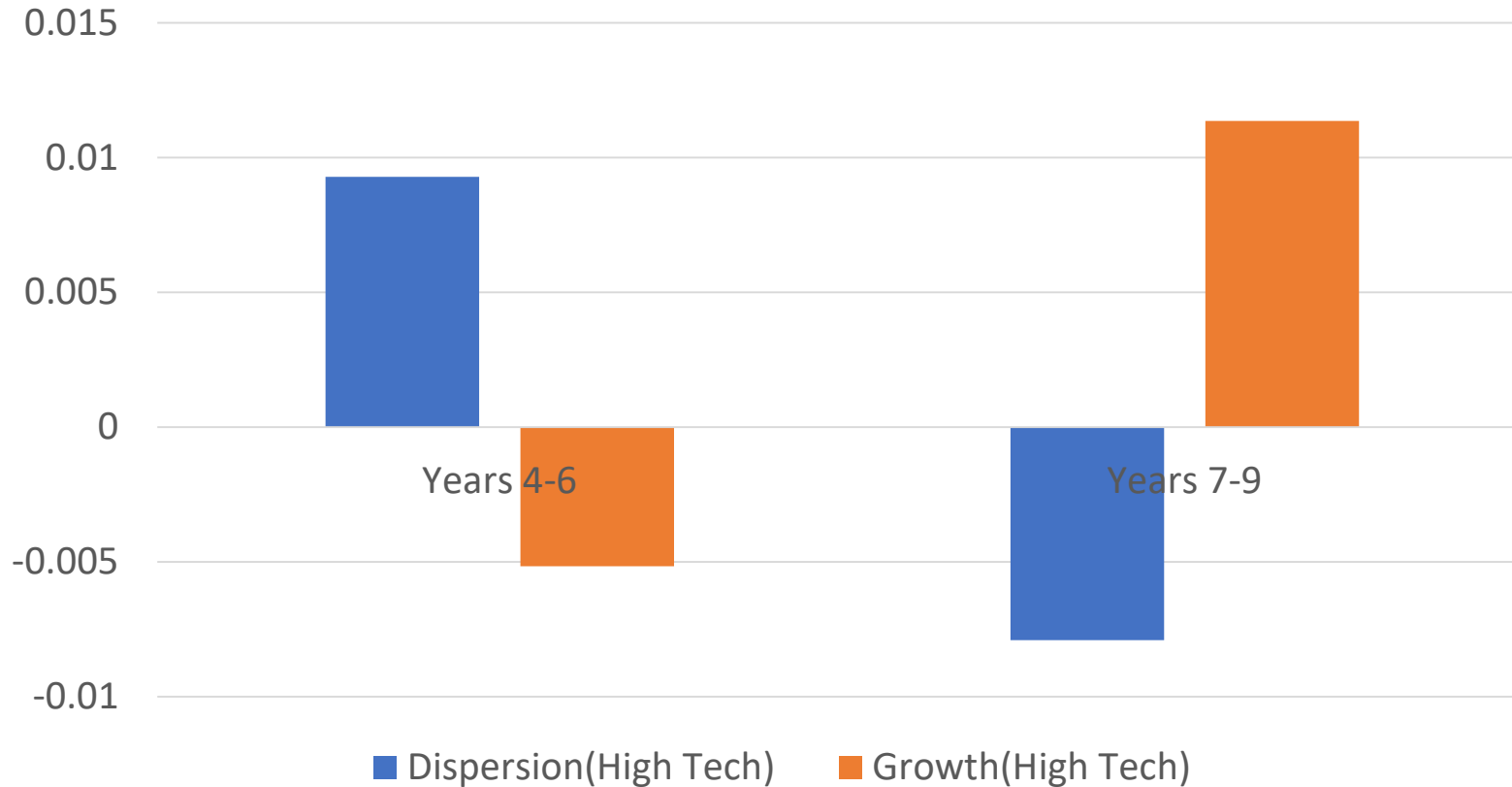
Surge in entry in a given 3-year period leads to:
• Rise in within industry productivity dispersion and decline in industry productivity growth in next 3-year Period
• Decline in within industry productivity dispersion and rise in industry in subsequent 3-year period
• Surge in reallocation following surge in entry as well (not depicted).
• Similar, dampened patterns for Non-Tech

Source: Foster et. al. (2018)

Using 4-digit NAICS data for High Tech sectors (ICT in mfg and non-mfg plus sectors such as Bio Tech)