

Sectoral Reallocation and the Firm Life-Cycle

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The views expressed in this paper are solely those of the author and not necessarily those of the U.S. Bureau of Economic Analysis or the U.S. Department of Commerce.

Introduction

Goal: Investigate the interaction between sectoral reallocation (structural change) and firm dynamics (business dynamism) since the 1980s/1990s.

- Sector i expands relative to sector j if:
 1. Incumbent firms in i grow relative to incumbent firms in j
 2. The marginal entrepreneur enters in i relative to j
- How did each margin contribute to observed changes in employment shares?

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 - **Today:** Quantify forces underlying first channel using simple structural model
 - **Future:** Produce new estimates of trends in firm dynamics by sector/cohort. Model entry decision across sectors.

Introduction (cont.)

Methodology:

1. Document new facts about firm employment growth across the life cycle
 - Average establishment size at entry ↓ in recent cohorts, no change in exit rates
 - Trend stronger in manufacturing relative to service sector
2. Estimate firm dynamics model to uncover contributing structural factors
 - Study changes in the following forces at the sector level:
 - i. Fixed costs of production [De Ridder, 2024]
 - ii. Fixed costs of entry [Gutiérrez et al., 2021; Kozeniauskas, 2024]
 - iii. Persistence of firm-level productivity [Decker et al., 2020]
 - iv. Dispersion of firm-level productivity [Barth et al., 2016; Decker et al., 2020]
3. Decompose structural change → vary (hold constant) parameters in sector i (j)

Introduction (cont.)

Findings:

1. Sector-level trends defy aggregate trends in firm dynamics
 - Estimated fixed costs decrease in both services and manufacturing sectors
 - Estimated entry costs increase (decrease) in services (manufacturing) sector
 - Productivity persistence decreases in both services and manufacturing sectors
2. Fixed costs and entry costs explain very little of within-sector trends
 - Changes in output mostly driven by changes in productivity process
3. Sector-level firm dynamics work against aggregate structural change
 - Only within-sector forces $\implies$ growth in manufacturing relative to services

Roadmap

1. Motivating Evidence
2. Firm Dynamics Model
3. Estimation and Decomposition

Roadmap

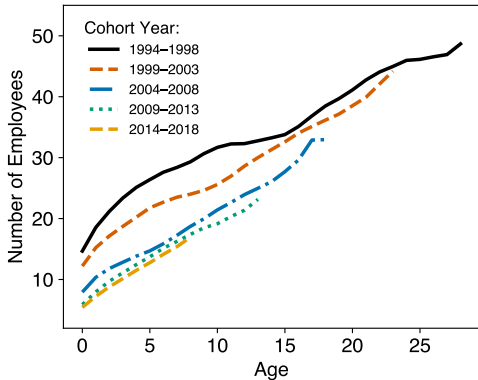
1. Motivating Evidence

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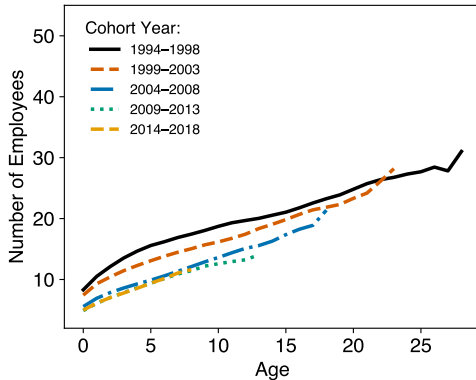
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Trends in Average Establishment Size by Cohort

(a) Manufacturing



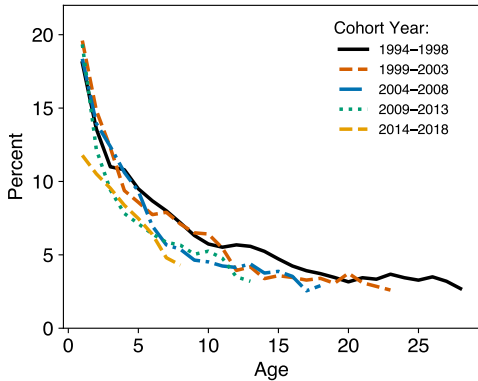
(b) Services



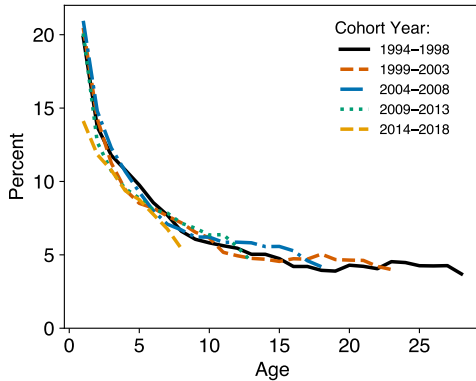
Source: Bureau of Labor Statistics (BLS) Business Employment Dynamics.

Trends in Exit Rate by Cohort

(a) Manufacturing



(b) Services

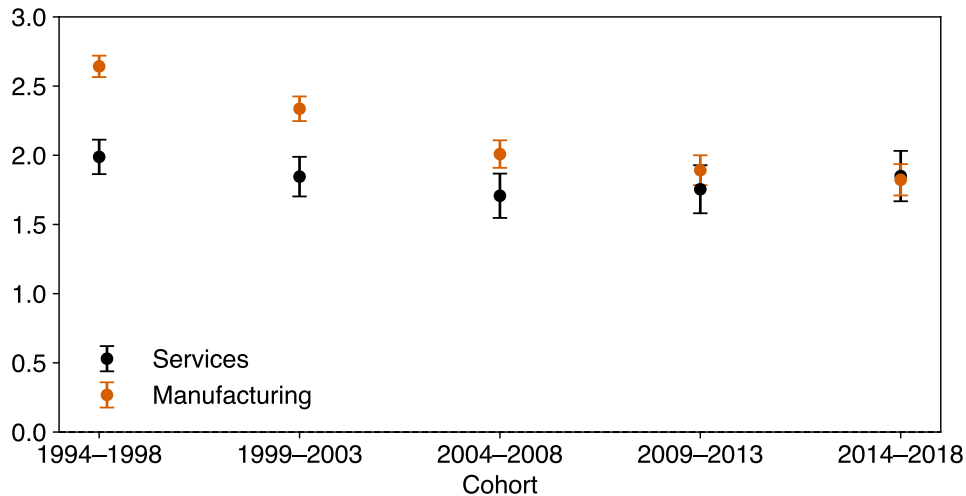


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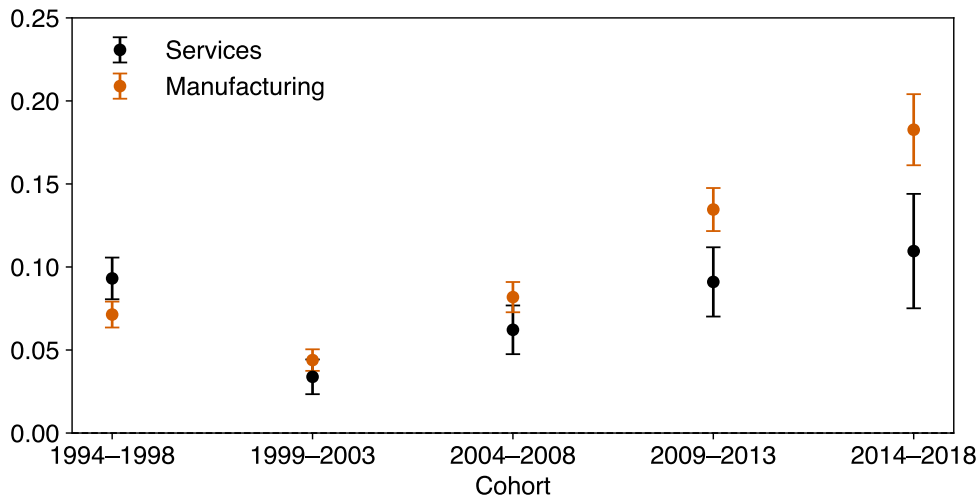
Regression Evidence

- Estimate sector-specific establishment dynamics by cohort (year of entry)
 - Let $j \equiv$ sector, $k \equiv$ cohort, $t \equiv$ year
 - Group cohorts into 5-year bins
- Parameterize as quadratic in establishment age
 - (1) $\ln(\text{Average Establishment Size})_{j,k,t} = \alpha_k^j + \beta_k^j \text{Age} + \gamma_k^j \text{Age}^2 + \delta_t + \varepsilon_{j,k,t}$
 - (2) $\text{Exit Rate}_{j,k,t} = a_k^j + b_k^j \text{Age} + c_k^j \text{Age}^2 + d_t + e_{j,k,t}$

Estimates: Average Firm Size (α_k)



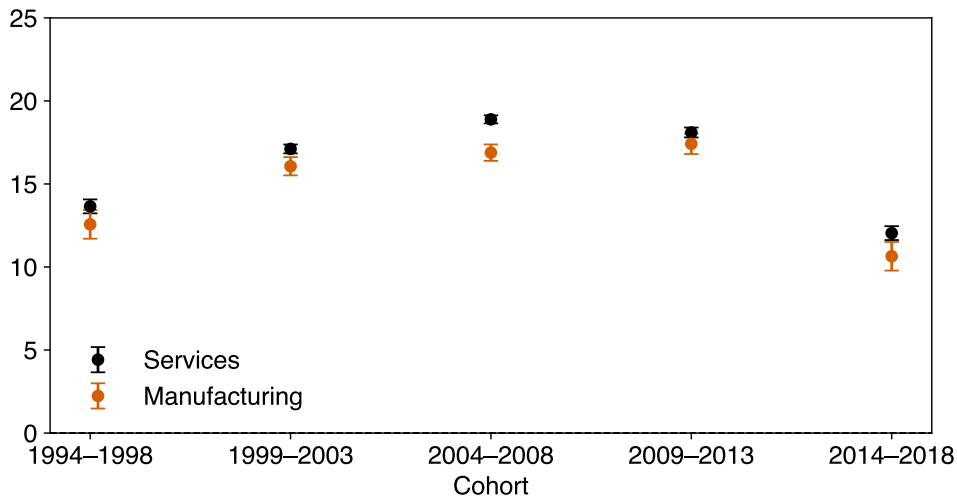
Estimates: Average Firm Size (β_k)



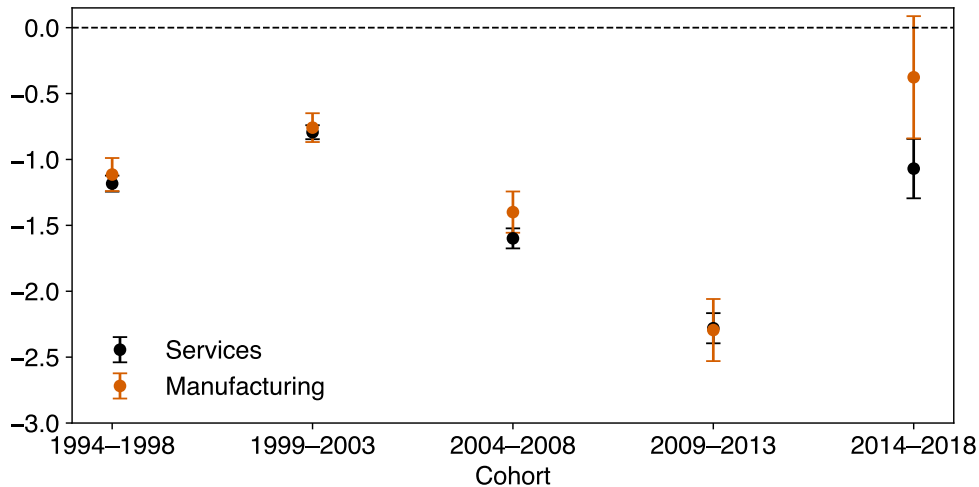
Estimates: Average Firm Size (γ_k)



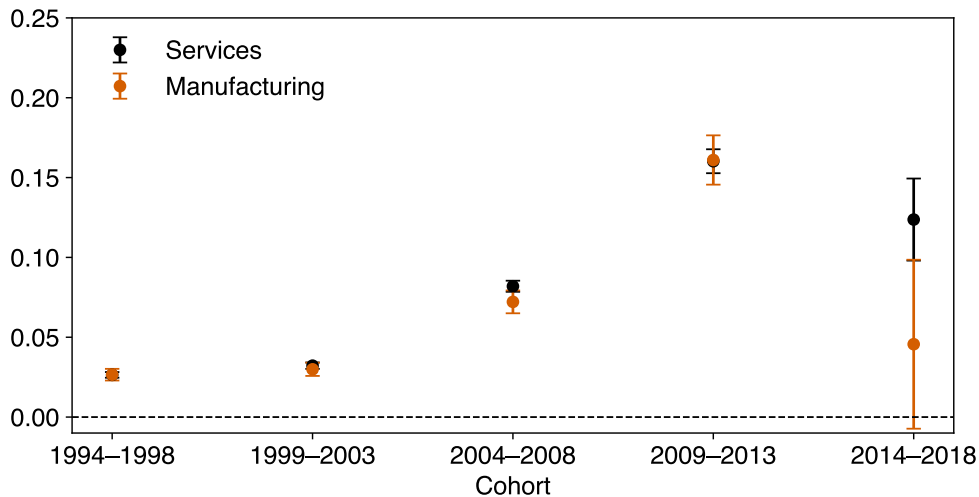
Estimates: Exit Rate (a_k)



Estimates: Exit Rate (b_k)



Estimates: Exit Rate (c_k)



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Model: Setup

- Each sector is its own island → Hopenhayn (1992) economy
- Representative household
 - Consumes final output Y and supplies labor L inelastically
- Heterogeneous firms
 - Differ in productivity level z that evolves according to $P(z'|z)$
 - Produce using labor ℓ only, no adjustment costs
 - Operate decreasing returns to scale production function $y = z\ell^\alpha$, $\alpha < 1$
 - Incumbent firms pay per period fixed costs c_f
 - Potential entrants pay fixed entry cost c_e to enter market, draw z
 - Distribution of firms $\mu(z)$ determined in equilibrium

Model: Firm Problem

- Firm chooses labor input policy $\ell(z; p)$ and exit policy $\chi(z; p)$ to maximize

$$V(z; p) = \max_{\ell} [pz\ell^{\alpha} - w\ell - c_f] + \beta \max\{E[V(z'; p)], 0\}$$

- Assume productivity z is AR(1) in logs

$$\ln(z') = \rho_z \ln(z) + \varepsilon; \quad \varepsilon \sim N(0, \sigma_z)$$

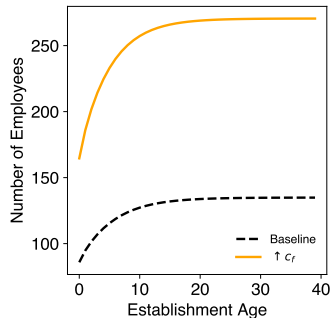
- Free entry condition

$$\beta \int V(z; p) g(z) dz = c_e$$

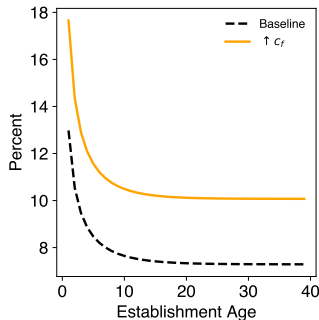
where $g(z)$ is stationary distribution of $P(z'|z)$

Comparative Statics: Rise in Fixed Costs c_f

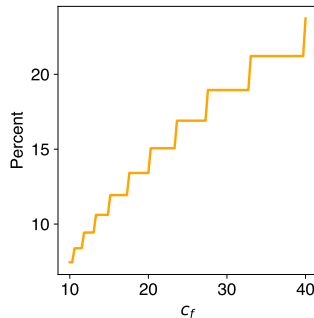
(a) Average Employment by Age



(b) Exit Rate by Age

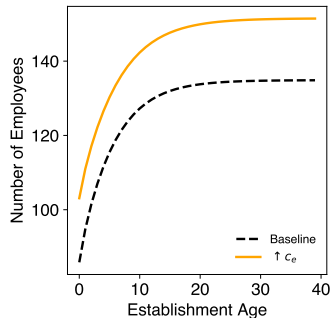


(c) Entry Rate

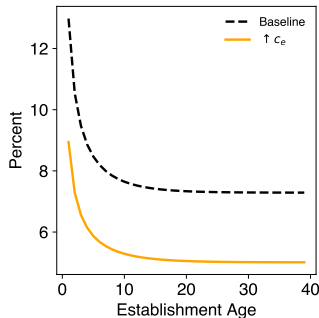


Comparative Statics: Rise in Entry Costs c_e

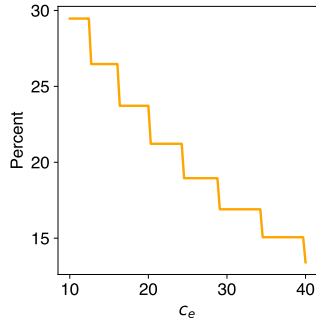
(a) Average Employment by Age



(b) Exit Rate by Age



(c) Entry Rate



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Estimation: Overview

Strategy:

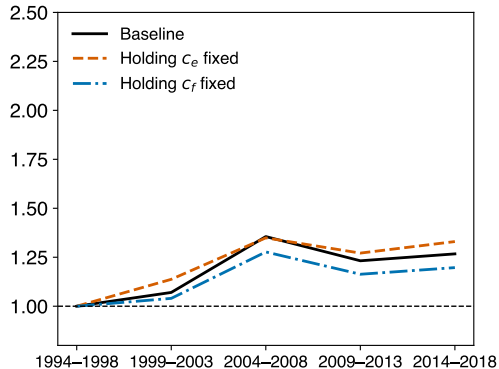
- Group years into 5-year bins:
 - {1994–1998, 1999–2003, 2004–2008, 2009–2013, 2014–2018}
- For each year bin y and sector j , estimate the following parameters:
 - $c_f \rightarrow$ fixed cost
 - $c_e \rightarrow$ entry cost
 - $\rho_z \rightarrow$ productivity persistence
 - $\sigma_z \rightarrow$ productivity dispersion
- Match the following moments for each (y, j) pair:
 - i. Average employment by age
 - ii. Exit rate by age
 - iii. Entry rate
 - iv. Employment size distribution

Estimation: Results

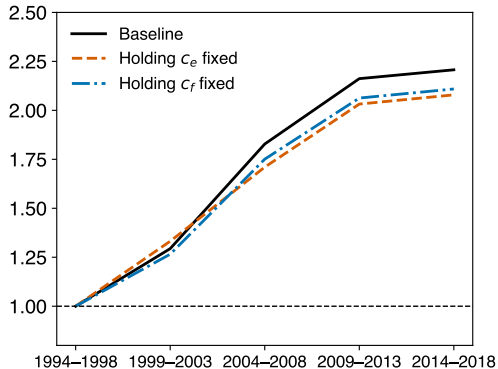
	Services				Manufacturing			
Year	C_f	C_e	ρ_Z	σ_Z	C_f	C_e	ρ_Z	σ_Z
1994–1998	1.183	4.316	0.968	0.180	1.095	11.117	0.970	0.202
1999–2003	0.815	5.453	0.956	0.221	0.555	12.208	0.969	0.233
2004–2008	0.544	4.240	0.952	0.252	0.255	9.011	0.968	0.258
2009–2013	0.567	4.854	0.926	0.303	0.243	9.140	0.946	0.351
2014–2018	0.571	5.179	0.905	0.349	0.350	9.152	0.917	0.439

Decomposition

(a) Services



(b) Manufacturing



Conclusion

Current (preliminary) takeaways:

- In manufacturing sector, establishments entering smaller and staying smaller
 - Trend present in services sector, but to a lesser extent
 - Potentially important moment to discipline theories of structural change
- Within-sector firm dynamics attenuated aggregate structural change

Next steps:

1. Better data/estimates of within-sector changes in firm dynamics using administrative data (e.g. Census LBD)
2. Multi-sector firm dynamics model to account for interaction between sectors

Appendix

Classifying Sectors

Classification	NAICS2 Code	NAICS2 Sector Name
Manufacturing	31	Manufacturing
	22	Utilities
	42	Wholesale trade
	44	Retail trade
	48	Transportation and warehousing
	51	Information
	52	Finance and insurance
Services	53	Real estate and rental and leasing
	54	Professional, scientific, and technical services
	55	Management of companies and enterprises
	56	Administrative and waste services
	61	Educational services
	62	Health care and social assistance
	71	Arts, entertainment, and recreation
	72	Accommodation and food services
	81	Other services (except public administration)

Notes: See BLS definitions: <https://www.bls.gov/iag/tgs/iag07.htm>

Model: Household Problem

Household chooses consumption and labor supply to maximize

$$\max_{C,L} \ln(C) + L \quad \text{subject to} \quad pC = wL + \Pi$$

Implies demand system:

$$C = \frac{1}{p}$$
$$L = 1 - \Pi$$

Model: Aggregation and Market Clearing

- Goods market:

$$\underbrace{C = \frac{1}{p}}_{AD(p)} = \underbrace{\int y(z; p) \mu(z; p) dz}_{AS(p)} = Y$$

- Labor market:

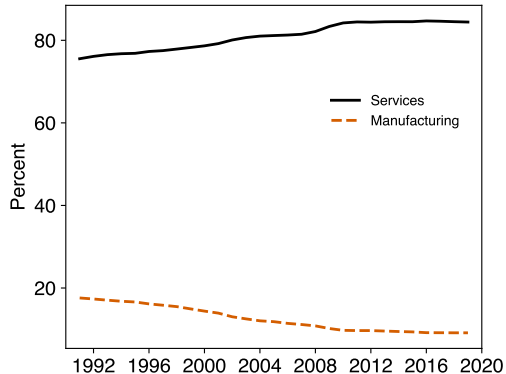
$$L^s = \int \ell(z; p) \mu(z; p) dz = L^d$$

- Firm distribution:

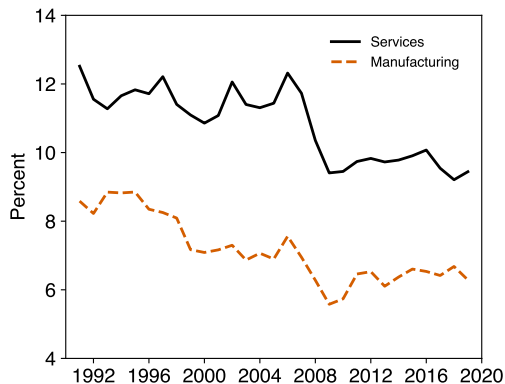
$$\mu(z'; p) = \int P(z'|z) (1 - \chi(z; p)) \mu(z; p) dz + Mg(z')$$

Sectoral Trends in Employment and Entry

(a) Employment Share



(b) Establishment Entry Rate



Source: Census Bureau Business Dynamics Statistics (BDS)