Concentration in Product and Geographic Space: A View Through the Lens of U.S. Multinationals

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July 30, 2026

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Motivation: Transformation of the U.S. Economy

Over the last twenty five years ...

- Across nearly all industries, economic activity became more **concentrated** in large firms Go to Autor
- Sales weighted mark-ups rose nationally Go to MarkUps
- U.S. firms **concentrated** their production in fewer industries (deconglomerization) Go to Focus
- Investment in intangible assets overtook investment in plant and equipment Go to Intangibles
- Executive pay skyrocketed (Gabaix & Landier, 2009) Go to CEOpay

This Paper: Theory

- **Premise**: Firm heterogeneity reflects the interaction of
  - Intangible assets (**knowledge**) and
  - Management (**organizational capital**)
    - Management faces **limited span of control** at industry level
    - Induces firms to **diversify** across geographic & product space
- **Predictions**: Tech change that increases the span of control (e.g. ICT) means
  - **Increasing concentration** of sales in top firms **within industries**
  - **Increasing concentration** of sales in core industries **within firms**
  - Greater mark-up dispersion across firms

This Paper: Empirics

- Panel data on the global operations of U.S. multinationals (MNEs) over the period 1994 - 2019
  - **Lots of variation** in
    - Reliance on intangible assets
    - Geographic range & product space
- **Document** growing heterogeneity across MNEs and **decompose** this variance into components identified in theory
- **Key finding**: model consistent w/ evolving structure of economic activity across geographic & product space
  - Extend model to explain additional features of changing firm heterogeneity

Literature

- *Geographic Portability of Intangible Assets*: Yeaple (2010), Keller and Yeaple (2013), Bilir and Morales (2020)
- *Sources of Firm Heterogeneity*: Yeaple (2005), Nocke and Yeaple (2007, 2008), Bernard et al (2022), Argente et al. (2025)
- *Sources of Growing Industry Concentration*: Autor et al. (2020), De Loecker, Eeckhout, and Mongey (2021), Hsieh and Rossi-Hansberg (2023), Ekerdt & Wu (2024)
- *Management and Span of Control:* Lucas (1978), Garicano and Rossi-Hansberg (2006), Bloom and co-authors, Gabaix and Landier (2009), Nocke and Yeaple (2014), Yeaple (2023)

Road Map

1. Introduction
2. **Theory**
3. Decomposition Strategy
4. Decomposition Main Results
5. Extension
6. Conclusions

Model Overview

- Firms decide **industry** and **country** to produce their varieties
  - Heterogeneous in organizational capital ('management') and intangible ('technology')
- Intangible: **non-rival** across countries but **rival** across industries
- Management: **partially rival** across countries and industries
- Management and intangible are **complements**

Environment: Preferences and Countries

- **Markets**: Two industries, $i = 1, 2$, and two countries, H, F endowed with labor

- **Preferences**:

$$U = \beta_0 \ln q_0 + \sum_i \beta_i \ln \left(\int_{\omega \in \Omega_i} a_i(\omega)^{\frac{1}{\sigma_i}} q_i(\omega)^{\frac{\sigma_i - 1}{\sigma_i}} d\omega \right),$$

with
- $\sigma_2 > \sigma_1 > 1$ elasticity of sub of varieties
- ω index for variety
- $a_i(\omega)$ and $q_i(\omega)$ quality & quant of variety ω of good i

  - Given monopolistic competition, good 1 is high mark-up good

Variable & Fixed Management Costs

- **Multinationals**: Fixed mass of firms capable of producing **either good** in **either country**
- **Organizational Capital**: Firms differ in their OC, denoted $\boldsymbol{T}$
- **Intensive Margin**: OC cost of managing a measure of varieties of good i in terms of org capital, t_i

$$m_i = t_i^{\theta}, \qquad \text{w/ } \theta \, \epsilon \, (0,1) \text{ span of control}$$

- **Non-rivalness (Extensive Margin)**: Fixed cost f in terms of T allows to produce in **extra industry** or **extra country**
- Org Capital used for production or for access: $(y+z)f + t_1 + t_2 \leq T$
  - y : indicator $(0/1)$ that firm produces in **second industry**
  - z : indicator $(0/1)$ that firm produces in **second country**

Technology & Profits

- **Core competence**: a_i: **intangible** of firm in industry i
  - Half of firms $a_1, a_2 = \{a, 1\}$, other half $a_1, a_2 = \{1, a\}$
    - $a > 1$, so core competency in ind 1 **or** ind 2

- Assumption: Comp fringe & free entry
  - Pins down demand B, linear lab costs, wage norm'd to 1

- Firm's var. profits from producing good i allocating t_i of OC:

$$\pi_i(t_i) = B\, a_i\, t_i^{\theta},$$

$\Longrightarrow$ Managem't (t_i) and intangible (a_i) are **complements**

Optimization and Equilibrium Outcomes

- Firm maximizes profits

$$\pi(T) = \arg\max_{y,z,t_1,t_2} B(1+z)\left(a_i t_i^{\theta} + y\, a_{-i} t_{-i}^{\theta}\right)$$

$$\text{such that}$$

$$(y+z)\, f + t_1 + t_2 \leq T$$

- 3 possibilities for firm w/ core competency in industry 1

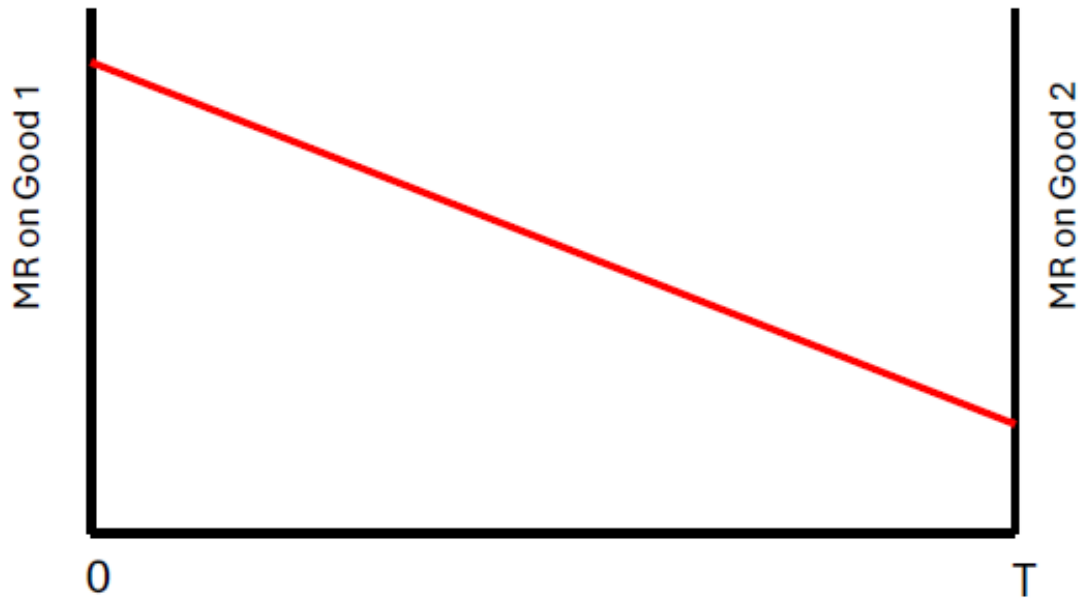
	Indicators	Profits
National Firm	$y = 0, z = 0$	$\pi_1^N(T) = BaT^{\theta}$
Single-Industry MNE	$y = 0, z = 1$	$\pi_1^M(T) = 2Ba\,(T-f)^{\theta}$
Multi-Industry MNE	$y = 1, z = 1$	$\pi_{1,2}^M(T) = 2B(T-2f)^{\theta}\left(a^{\frac{1}{1-\theta}} + 1\right)^{1-\theta}$

Results: Org Capital and Firm Size & Scope

As a firm's T increases:

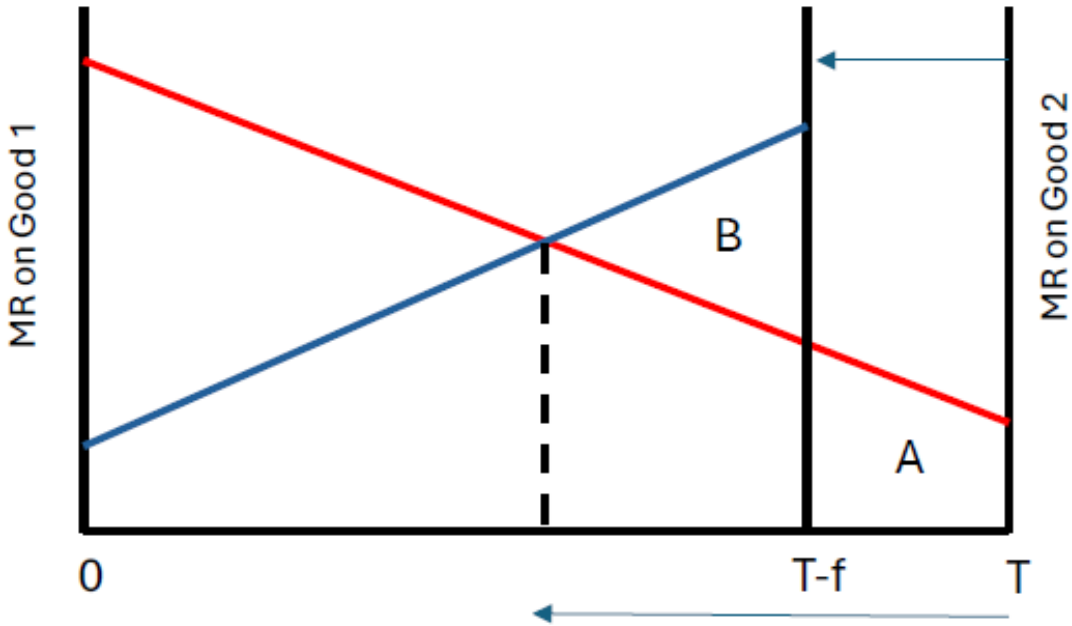
- **R1:** Global **sales rise**
- **R2:** Firm expands
  - **Across countries** (geographic space)
  - **Across industries** (product space)
    - Progressively, firm adds smaller markets

Single Product Firm's Allocation of Org Capital



- All org capital ('management') allocated to good 1
  - Fixed cost for good 2 not paid
  - Area under curve: total profits from all good-1 varieties

When Does Firm Add Second Industry?



- **Con**: Good-2 fixed costs eat up org capital
- **Pro**: Varieties of good 2 have low variable costs ($1 < a$)
- If B $>$ A, firm optimally adds good-2 varieties
  - Becomes multi-industry ('conglomerate')
- Rising $T \Leftrightarrow$ firm expansion into prog smaller industries & countries

Mark-up and Scale Vary w/ Industrial Composition

- **R3:** Firms vary in their average mark-ups:
  - Highest for firms specialized in good 1, lowest for firms specialized in good 2
  - Among conglomerates
    - **Mark-ups** of firms w/ core comp in good 1 **higher** than firms with core in good 2

- **R4**: Core competence in **high mark-up** industry associated with **lower average scale**

Comparative Static: Increase in Span of Control

- **What if** the firm, for a given org capital investment, can **produce more** varieties?
  - Increase in **span of control** θ ; recall $m_i = t_i^\theta$
- Leading example: Info & comm tech advances since 1990s
  - Leveraging management as technology (Bloom, van Reenen, Sadun,...)
  - Firm organization (Lucas, Garicano, Rossi-Hansberg, Hsieh, ...)
  - Rise of MNEs and offshoring (Antras, Rossi-Hansberg, Autor,...)
- Higher span of control means **lower costs**, so ... firm **scales up all** activities??

MNE Operation w/ Higher Span of Control

- No, firms do not scale up all activities
- **R5**: An increase in θ means
  - Smaller multi-product MNEs **consolidate their product space** and **close plants**
  - **Mark-up dispersion** across MNEs increases
  - Global **sales dispersion** among MNEs increases
- B/c higher span of control **lowers variable rel to fixed costs**
  - Optimal firm structure: fewer industries & focus on core comp
- More broadly: firm expansion w/ intangibles turns on
  - **How rival** intangibles are, and **in what dimension** (geography, industry, ...)

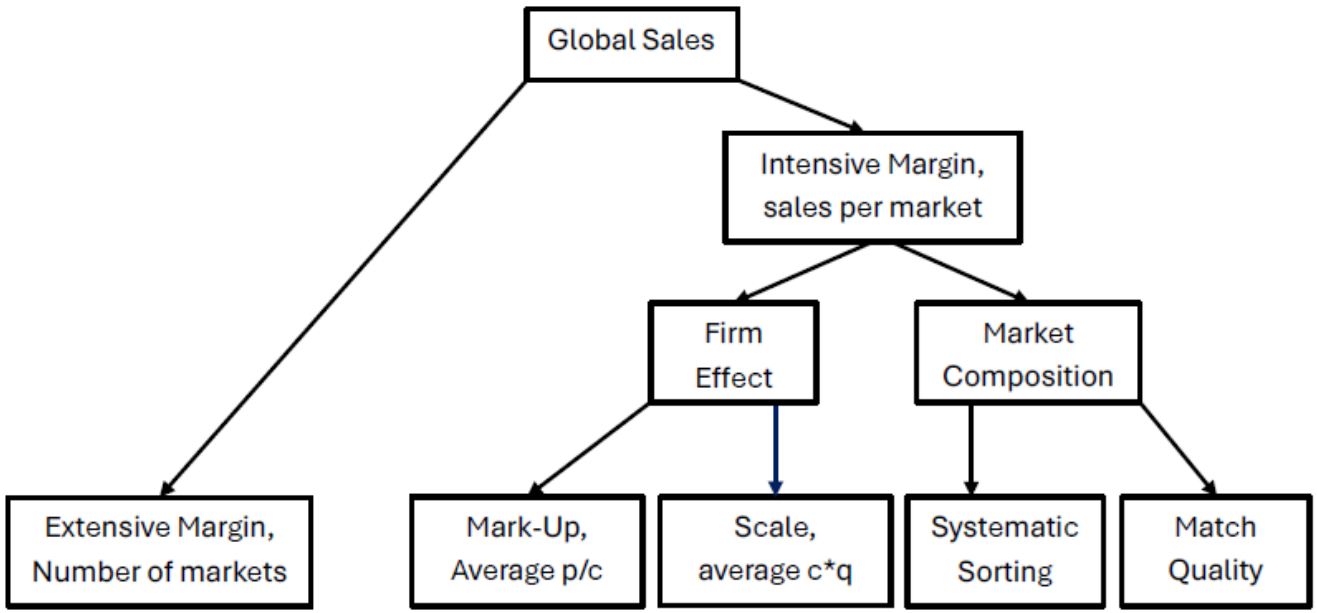
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Empirical Strategy

- Decompose MNEs' global sales into theory-relevant components
- Identify how firms have grown different or similar
- Use model to interpret evolution

Decomposition



Decomposition:

$$R_f = N^f \times \tilde{\mu}_f \times \tilde{s}_f \times MS_f \times AMQ_f$$

▸ Go to Details

Data Global Operations of US Multinationals

- Matched firm-plant data for 58 countries plus U.S.
- 9,000 parents and all affiliates
- Source: BEA Benchmark Surveys: 1994-2019
- Observe
  - locations, main-line of businesses, top industry classifications
  - arm's length and intra-firm sales, employment numbers and wages, capital stocks

Decomposition Strategy

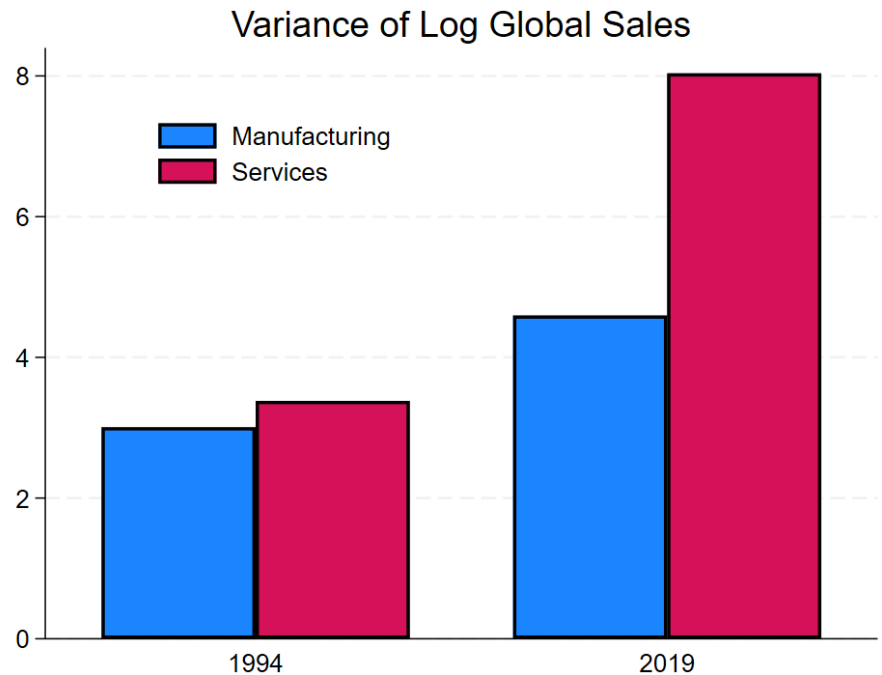
- Follow Abowd, Kramarz, Margolis '99 to identify common component, $(\tilde{\mu}_f \times \tilde{s}_f)$, market sorting, and average match quality Go to SDecomp

- Disentangle mark-up $(\tilde{\mu}_f)$ from scale $(\tilde{s}_f)$ applying logic of De Loecker and Warnzynski to multi-location firms. Go to DMarkUp

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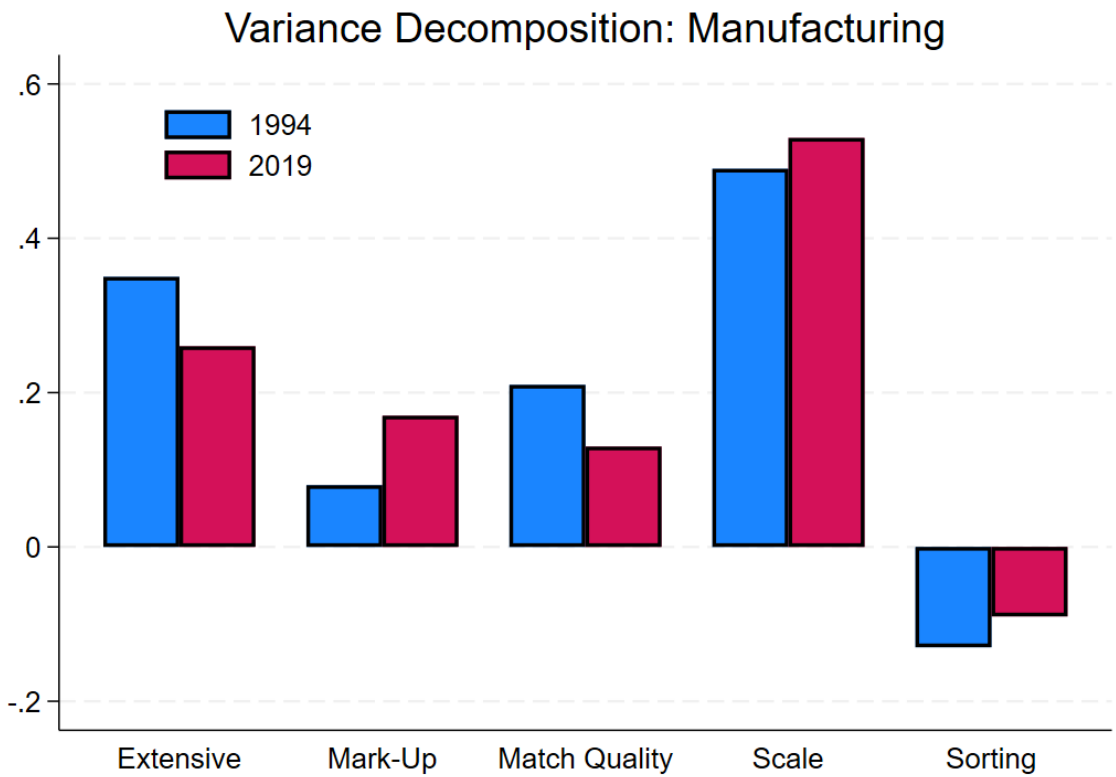
Evolving Firm Heterogeneity, 1994-2019



- Massive increase in heterogeneity especially, in services

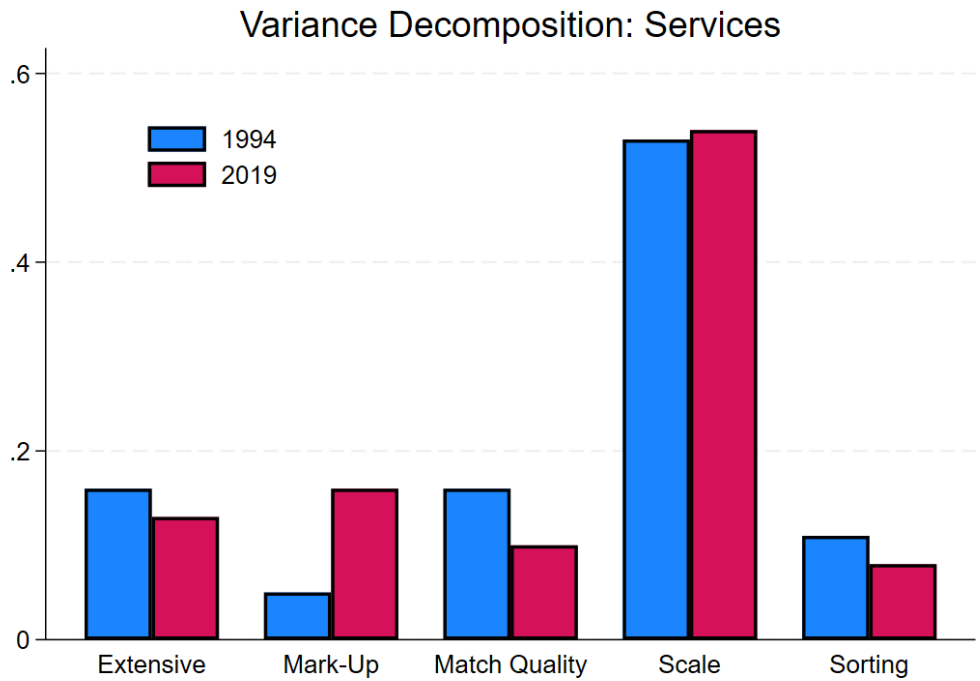
Explaining Increasing Sales Heterogeneity: Manufacturing

Variance Decomposition (covar X and log sales/var log sales)



- Scale and extensive margin dominant
- Extensive ⇓, Mark Up ⇑, consistent with **(R5) increased focus/specialization**

Increasing Sales Heterogeneity: Services



- Similar decrease in extensive margin and increase in intensive margin

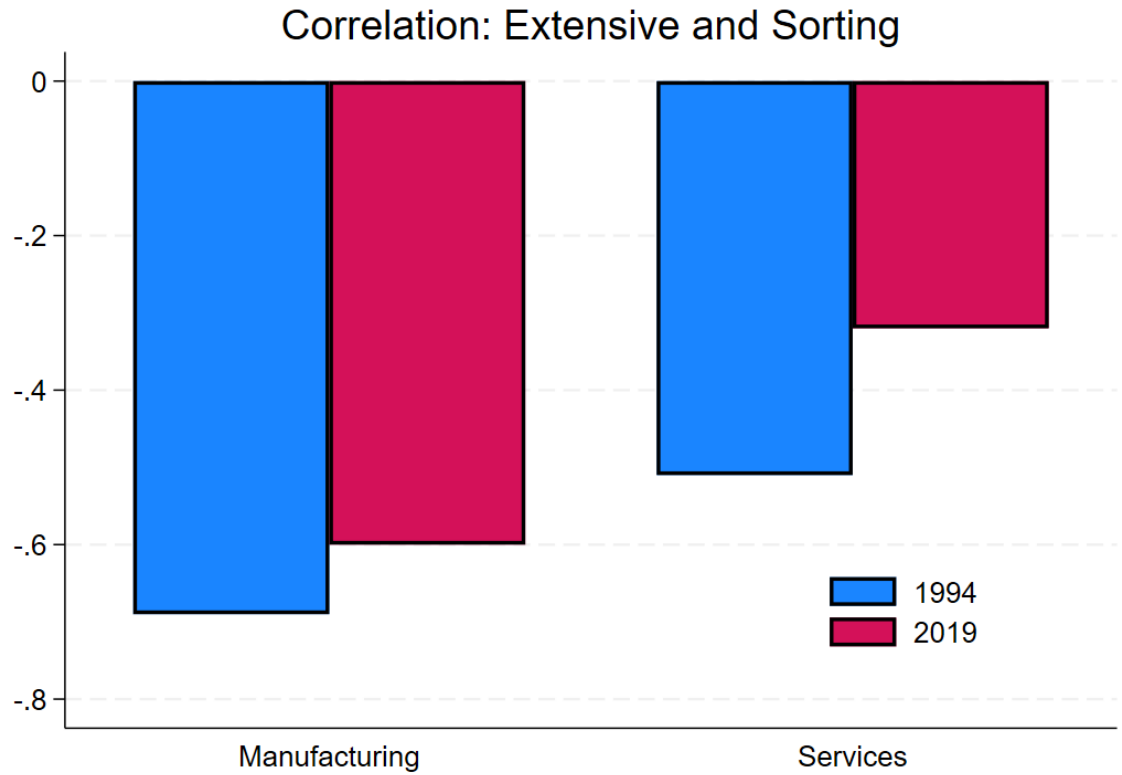
Focus Explains Extensive Margin

- Additional Results Support **R5**
  - Average Effective Number of Industries at parents has dropped (**industrial focus** $\Uparrow$).
  - Higher ENI predicts more affiliates ▸ Go to Qualitative
  - **Firms dropping products are dropping affiliates/countries**
  - Affiliates dropped are **non-core** industries
    - Share of affiliates with same main line of business of parent's almost doubled.

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Focus: Systematically Dropping Smaller Markets

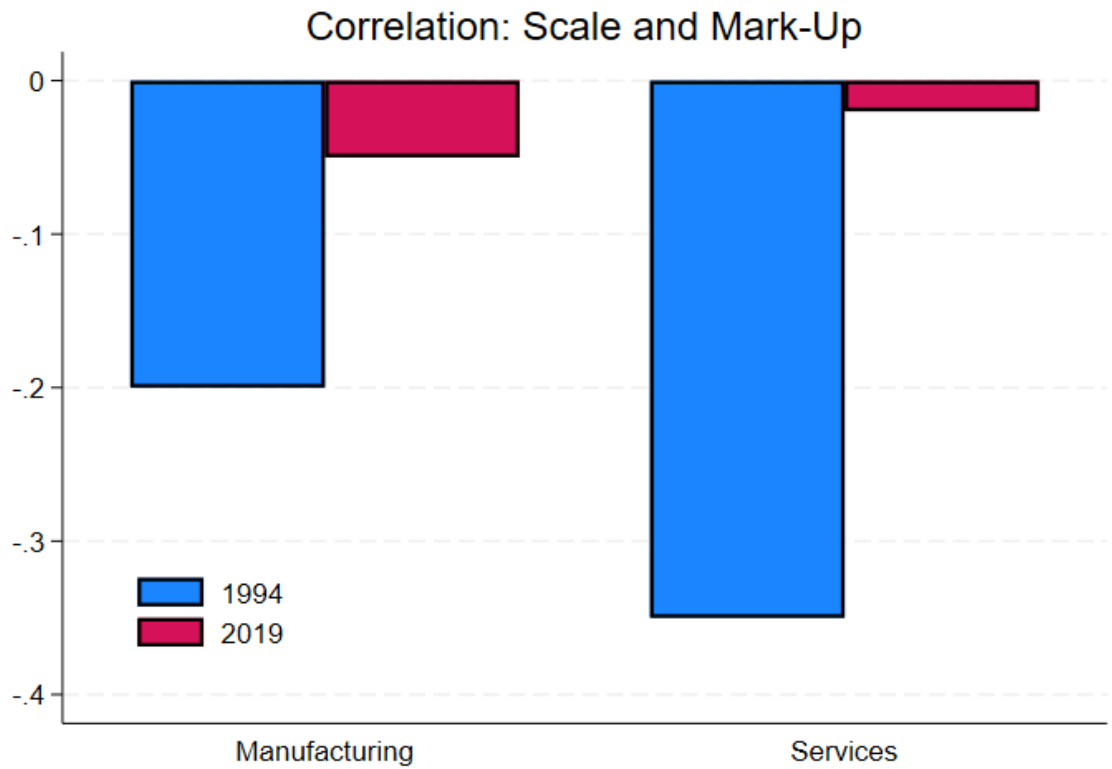


- Consistent with **R1** and **R2**, largest firms expand into least attractive markets
- Increased focus means dropping less attractive markets

Model Extensions: Breaking Symmetry 1

- **Fact:** Firms that expand extensively across markets shedding smaller markets
- **Model adjustments**:
  - (1) add multiple markets differing in attractiveness,
  - (2) make span of control increase conditional on bearing large fixed cost
- **Implication:** the most diversified firms shrink by dropping the most unattractive markets

Niche Firms Disappearing



- Consistent with **R4**, high mark-up multinationals used to be small scale multinationals
- This is now **much** less likely

Model Extension: Breaking Symmetry 2

- **Fact**: High mark-up, low scale firms once common are becoming increasingly rare
- **Model Adjustment:** Competitive advantage in high mark-up industry negatively correlated with org. capital but correlation breaks down over time
- **Implication:** Scale and mark-up is negatively correlated but becomes less so over time

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Conclusions

- Globally, economic activity has become more concentrated in large multi-product, multinationals
- U.S. firms have concentrated on fewer, high mark-up products even as firms more heterogeneous in size
- Focusing on core products means consolidating geographic footprint
- A simple model of heterogeneous **organizational capital** subject to a **industry-level span of control** goes far explaining the evolution of firms' geographic and product concentration (implications **R5**)
- Adding simple asymmetries helps rationalize wider set of facts

Supporting Materials

Growing Concentration

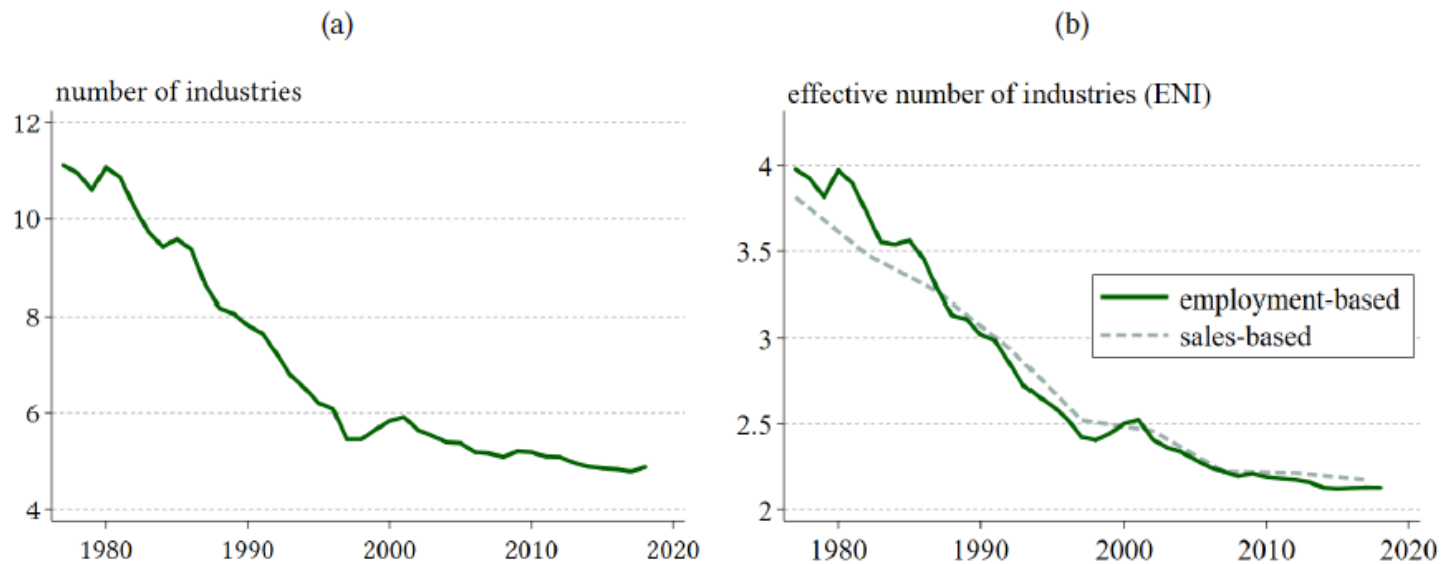
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Source: Autor et al (2020)

Go to motive1

Firms' Industrial Consolidation

Figure 1: Aggregate firm diversification in U.S. manufacturing, 1977-2017

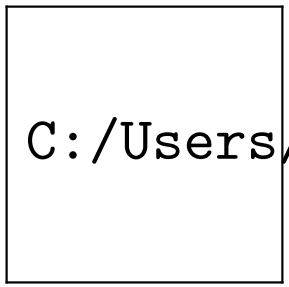


Notes: Panel (a) depicts the employment-weighted average number of industries. Panel (b) depicts the sales-weighted average sales-based ENI and the employment-weighted average employment-based. Data for the number of industries and employment-based ENI are from the LBD. Data for sales-based ENI are from the CMF.

Source: Ekerdt and Wu (2024)

▸ Go to motive1

Rise of Intangible Assets



Source: Haskell and Westlake (2022)

▸ Go to motive1

Rising Mark-Ups

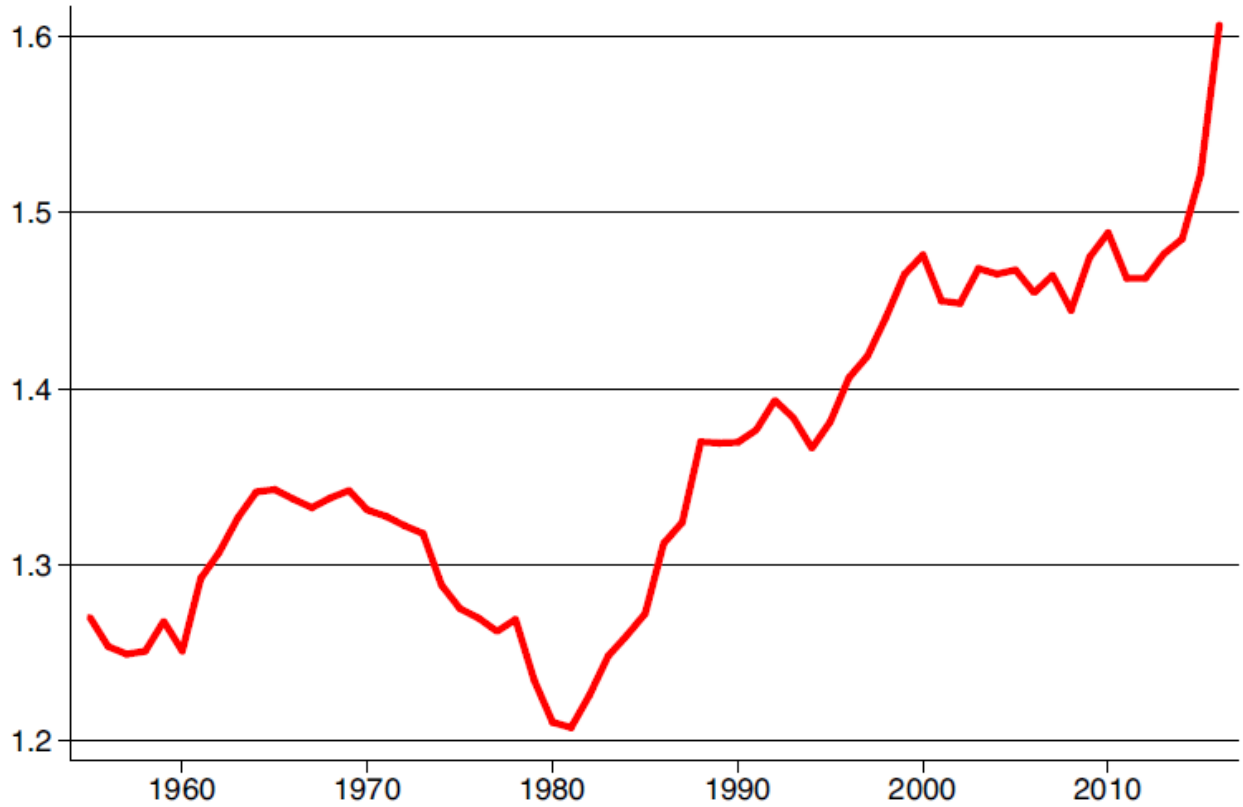


FIGURE I

Average Markups

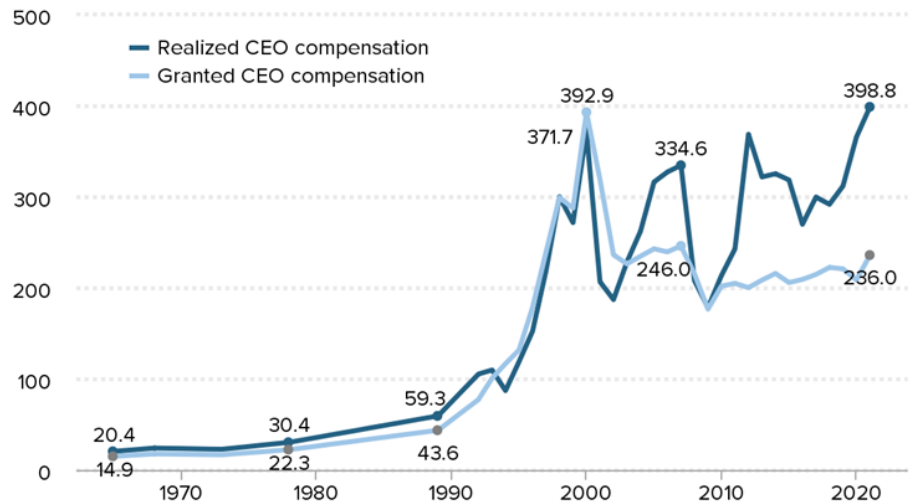
Source: DeLoecker, Eeckhout, and Unger (2020)

▸ Go to motive1

US CEO Pay

CEOs make 399 times as much as typical workers

CEO-to-worker compensation ratio, 1965–2021



Notes: Average annual compensation for CEOs is for CEOs at the top 350 U.S. firms ranked by sales. Typical worker" compensation is the average annual compensation (wages and benefits of a full-time, full-year worker) of production/nonsupervisory workers in the industries that the top 350 firms operate in.

Source: Authors' analysis of data from Compustat's ExecuComp database, the Bureau of Labor Statistics' Current Employment Statistics data series, and the Bureau of Economic Analysis NIPA tables.

Economic Policy Institute

▸ Go to motive1

AKM Results

	Mark-up		Local Sales	
Capital/Labor	0.199**	0.200**		
	(0.006)	(0.006)		
Intra x Taxhaven	1.194**	1.228**		
	(0.167)	(0.167)		
Interaction		−0.181**		−0.041**
		(0.019)		(0.003)
R^2	0.488	**0.490**	0.650	**0.651**

Notes: All U.S. parents and affiliates, 1994-2014; N = 121,561; clustering by firm-country-year. ** sig at 1%

- Linear firm- and country FE effects: Half (mark-up) to two-thirds (sales) of variation
  - **Non-linear** terms increase Rsq only **minimally**

Qualitative Results (Sign and Significance)

	Sales		Number of Affiliates	
	(1)	(2)	(3)	(4)
K/L	+***	+*	+***	-
R&D Intensity	+***	-	+***	+***
ENI	+***	-	+***	+***
Shared Industry	+**	+***		
RD*Shared	+*	+		
Ctry-Ind-Yr FE	YES	YES	YES	YES
Firm FE	NO	YES	NO	YES
N	121K	121K	5K	5K

All continuous variables are in logarithms.

Auxiliary Regressions

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- R&D increasingly predicts greater sales via mark-up and scale
- Vertical Integration has become less associated with global scale across margins

Decomposition: Details

- Firm f has N^f affiliates in set L^f markets indexed by c (country-industry pair)
- **Global Revenue**: $R_f = \sum_{c \in L^f} \mu_{ic}^f s_{ic}^f$, where
  - **Mark-up:** $\mu_{ic}^f = \tilde{\mu}_f \tilde{\mu}_c \varepsilon_{fc}$
  - **Scale:** $s_{ic}^f = C_{ic}^f q_{ic}^f = \tilde{s}_f \tilde{s}_c \eta_{fc}$
- **Market Sorting:** $MS_f = \frac{1}{N^f} \sum_{c \in L^f} \tilde{\mu}_c \tilde{s}_c$
- **Average Match Quality**: $AMQ_f = \sum_{c \in L^f} \frac{\tilde{\mu}_c \tilde{s}_c}{\sum_{c' \in L^f} \tilde{\mu}_{c'} \tilde{s}_{c'}} \varepsilon_{fc} \eta_{fc}$
- **Decomposition:**

$$R_f = \underbrace{N^f}_{\textit{Extensive}} \times \underbrace{\tilde{\mu}_f \times \tilde{s}_f \times MS_f \times AMQ_f}_{\textit{Intensive}}$$

▸ Go to Decomp

Decomposition: Sales

- Sales are **log-additive** (c.f. Abowd, Kramarz, Margolis '99)

$$\ln S_{fc(f)t} = \alpha^s_{ft} + \psi^s_{c(f)t} + \varepsilon_{fc(f,t)t},$$

- S_{fct} : log global unaff sales, firm **f**, in market (country-industry) c, year t
- α^s_{ft} is **firm**(-year) fixed effect, $\psi^s_{c(f,t)t}$ **market** FE
  - Firm FE = capabilities common to all plants ("fully portable" $\tilde{\mu}_f \cdot \tilde{s}_f$)
  - Market FE used to construct sorting (MS_f)
  - residual = components of market composition (AMQ_f) ▸ Data

Decomposition: Mark-Up

- Cost minimization: log mark-up of firm f in country c at time t

$$\ln \mu_{fct} = \ln \frac{S_{fct}}{w_{ct} L_{fct}} + \ln \theta_{fct},$$

  with S_{fct} sales, $w_{ct} L_{fct}$ wage bill, and θ_{fct} the labor output elasticity (Hall '88, De Loecker-Warzynski '12)

- Mark-up equals BEA data –sales over wage bill– adjusted for labor output elasticity
  - Need θ_{fct} but no info on market structure

Decomposition: Mark-Up

- Elasticity θ_{fct} captured by plant capital-labor ratio and country-industry-year fixed effects

$$\ln \theta_{fct} = \eta_{c(f,t)t} + \lambda \ln \left(\frac{K}{L} \right)_{fct}$$

  - Allows for non-neutral technology
  - Capital-labor ratio of the enterprise in c

- Error ε_{fct} reflects outsourcing, transfer pricing, and measurement error

Decomposition: Mark-Up

- $\tilde{\mu}_{ft}$: mark-up, defined as total sales to labor comp
  - De Loecker-Warzynski '12

$$\mu_{fc(f,t)t} = \alpha^m_{ft} + \psi^m_{c(f)t} + \beta' X_{fct} + u_{fc(f)t},$$

  - interpret α^m_{ft} as μ^f the rest as output elasticity and idiosyncratic variation in mark-up
  - X: Captures output elasticity and outsourcing
    - Output elasticity of labor: plant K/L (instrumented by capital-labor ratio of firm's other plants)
    - Outsourcing/Transfer Pricing: Intrafirm Tradeshare x Tax Haven 0/1 ▸ Data