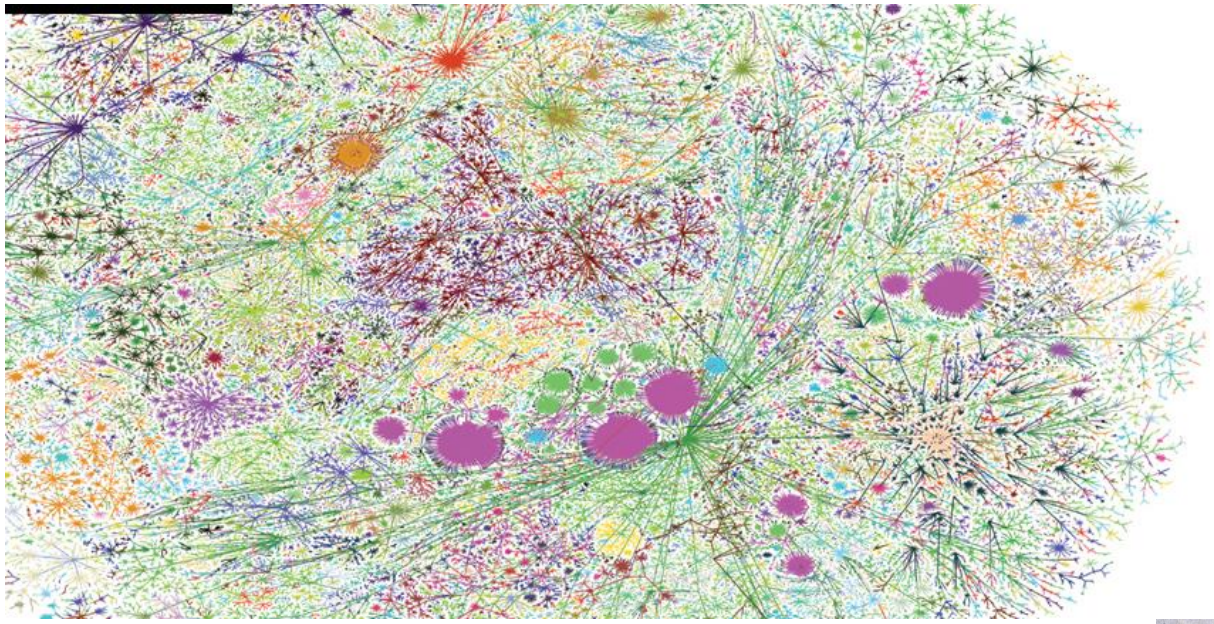
Decentralization

John Van Reenen

Organizational Economics, 2020



Last lectures

- Looked at heterogeneity in performance at the micro (firm & plant) and economy wide level (across countries & overtime within a country). Focused on **productivity**.
- Emphasized role of **management** practices (& to some extent “hard technologies”) in explaining this heterogeneity
- We builds on this, but whereas some types of management have a clear <u>vertical</u> dimension (good for productivity in a wide variety of contexts), we now focus on <u>horizontal</u> aspects of organizations (e.g. decentralization)
  - Impact on performance much more contingent on environment

Thinking about Decentralization

- Authority & Power in organizations (Max Weber). Organizational “politics” (influence activities)
- Capitalism (decentralized) vs socialism (centralized): Von Hayek (1945, AER) vs. Lange (1936, ReStud). Externalities
- Political Economy/Public Finance (Fiscal Federalism)
- Monetary Policy (delegation to Central Bank)
- IO/Regulation – How should a natural monopoly be efficiently regulated?

Why decentralize? Gibbons, Matouschek & Roberts (2013, Handbook)

1. Make better use of employee information
2. Limited Resources, so fosters specialization
3. Pay workers less because they value decentralization
4. Motivation
5. Learn about employee tastes or ability
6. Develop human capital – Alfred Sloan
7. CEOs inefficiently “hoard” power

1. *Why decentralize?* Decentralizing to make use of employee information

- Decentralization means efficient use of local information (don’t need to codify, analyze & transfer upwards)
- Classic trade off of costs of agency vs. benefits of local information (e.g. Holmstrom, 1977, 1984; Jensen & Meckling, 1992).
  - Discuss Aghion & Tirole (1997)

Aghion & Tirole (JPE 1997)

Superior often "rubber-stamps" subordinate's proposal

Shareholders → CEO → Plant Manager → Worker

Q: Why (and how) would actor with formal authority cede real authority/power?

– Agent thinks of private benefits (e.g. ignore externalities in pricing decisions). *Imperfect "congruence"*

A: Knows that other actor has better **information.** Delegation can be optimal if agent has (sufficiently) similar preferences

– i.e. agency incentive problems don't overwhelm local informational advantage

Overview

1. **Factors influencing decentralization - overview**
2. Cross section: volatility (Acemoglu et al, 2007)
3. Time series: volatility (Aghion et al, 2016)
4. Some other factors – complexity; skills; competition

Some Factors influencing Decentralization

"Driver"	Measure	Effect on Decentralization
Technology	Size	Positive
Technology	Information Technology	Positive
Technology	Communication Technology	Negative
Technology/Economic	Volatility/uncertainty	Positive
Economic	Competition	Positive
Economic	Human Capital	Positive
Culture	Trust	Positive
Culture	Rule of Law	Positive
Culture	Hierarchical Religion	Negative

Decentralization & volatility

- Key part of Aghion-Tirole (1997) is the trade-off between **agency problem** & **local information**
- **Idea:** when environment becomes more uncertain/heterogeneous/turbulent it becomes harder for principal to observe local information compared to agent
  - Greater benefits from decentralizing to agent to make decisions
- **Acemoglu et al (2007)** consider this in a learning model & exploit **cross- industry** heterogeneity
- **Aghion et al (2017)** consider this in business cycle model where "bad times" bring uncertainty & increase returns to decentralization. Look at firm panel data **over time**

Aside: The Prendergast Puzzle (JEL, 1999)

- Prendergast survey “Provision of Incentives Within Firms”
- Within firms contracts **don’t seem to** correspond to a basic contract theory prediction
  - Expect to see low powered incentives when uncertainty greater because of insurance-incentive trade off
  - But if anything the opposite
- Prendergast (2002) explanation: when uncertainty is greater, importance of local information higher so give more decision rights to agent. But to align incentives need to increase high powered contracts
- **Slade & Lafontaine** (JEL survey, 2007) look at VI = vertical integration (e.g. direct control vs. franchising). Expect more VI when uncertainty greater, but again studies find opposite
  - Lafontaine & Bhattacharyya (1995)

Overview

1. Factors influencing decentralization - overview

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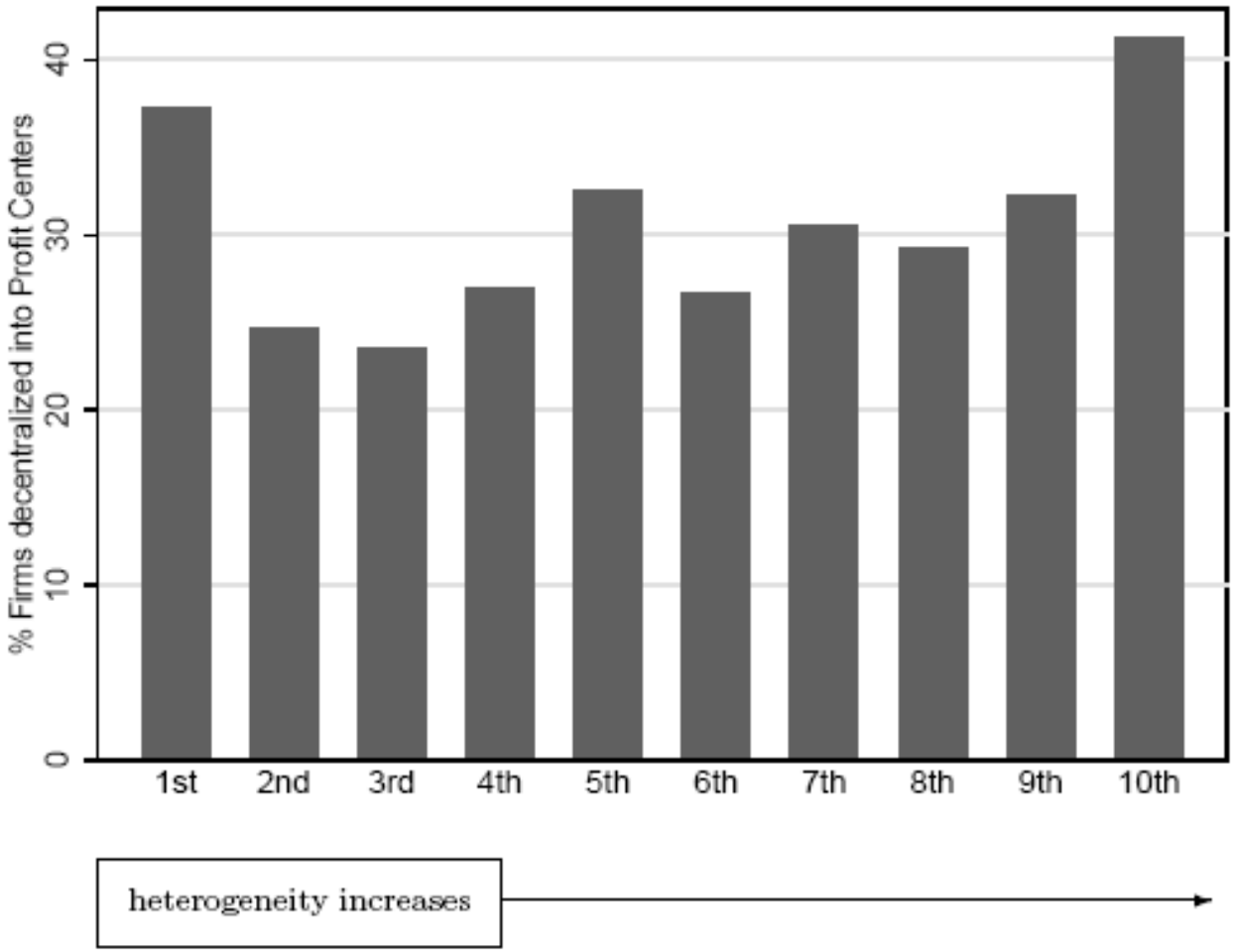
Acemoglu, Aghion, Lelarge, Van Reenen & Zilibotti (2007, QJE) rational learning model

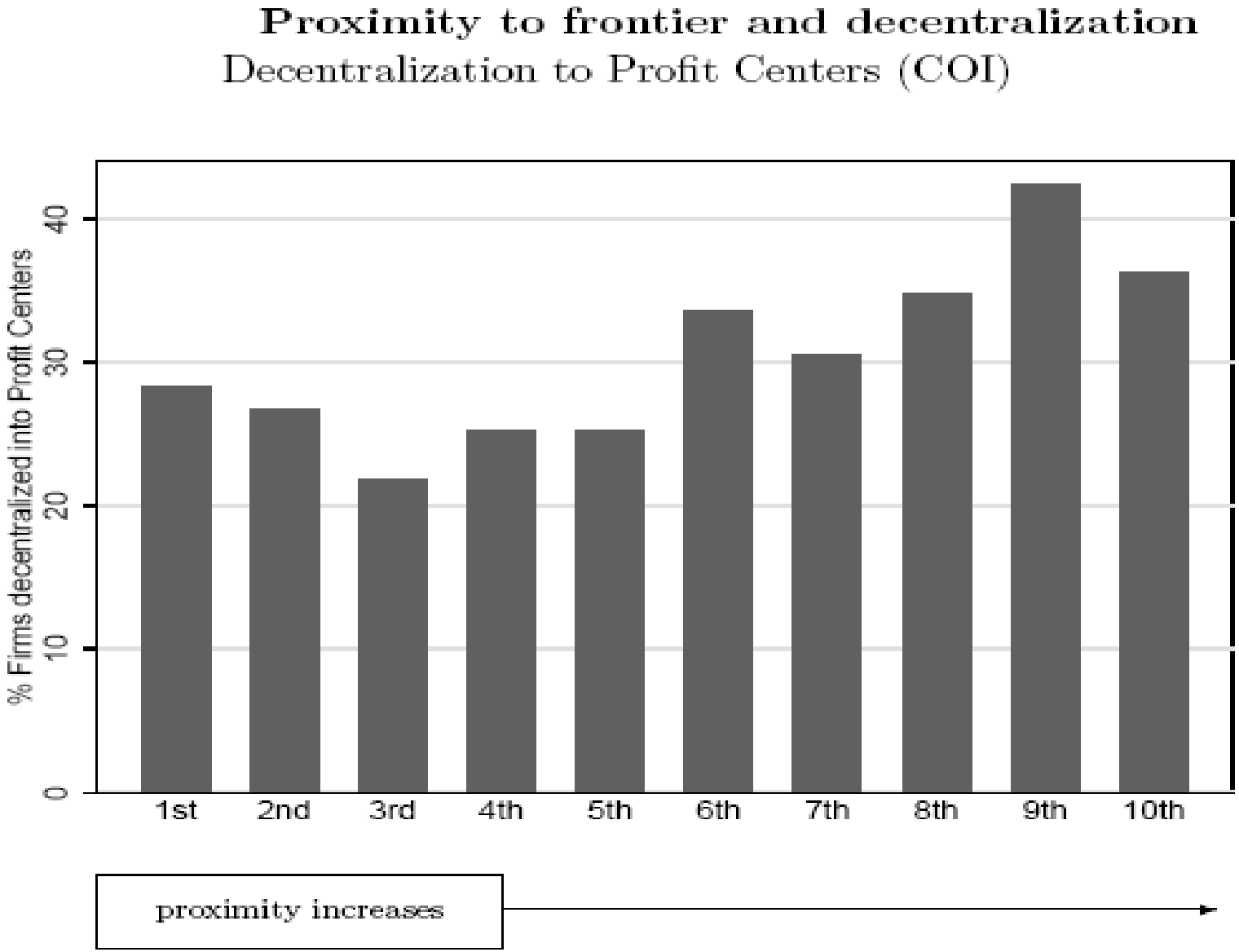
- **Firm adopts/develops a new technology**
  - Agent (plant manager) is informed about usefulness of technology (pay-off heterogeneous between firms)
  - Principal (CEO) is correctly aligned with owners' incentives
    - Principal learns about likely profits of adoption based on public history of profits from others' use
- **Q: When does CEO decentralize tech decision to agent?**
- **Predictions: Decentralization more likely:**
  1. For more **volatile/heterogeneous** industries (because harder to learn from others). Use variance of productivity growth across firms (at industry level)
  2. Firm is closer to the **technological frontier** (less to learn from other firms when you're at the top)
  3. For **younger** firms (less to learn from past experience)

Result I - Firms in more heterogeneous/volatile industries are more likely to be decentralized (into profit centers)



Source: Acemoglu, Aghion, Lelarge, Van Reenen and Zilibotti (2007)

Result II - Decentralization is higher when plants are closer to the TFP frontier



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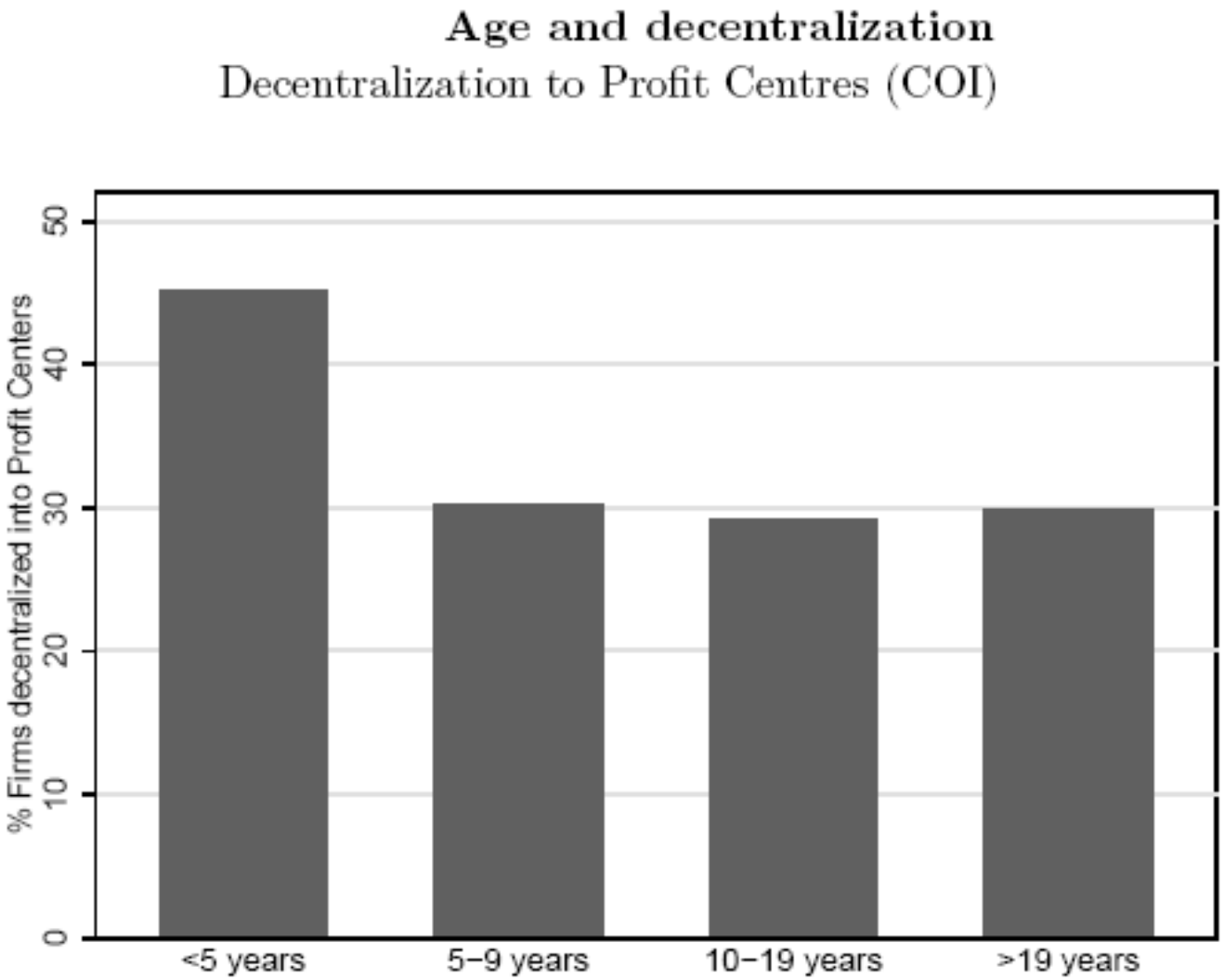
Result III - Decentralization is higher in younger firms



Source: Acemoglu, Aghion, Lelarge, Van Reenen and Zilibotti (2007)

Robustness

- Effects stronger in high tech industries (where learning about innovation likely to be more important)
- Similar results in UK data (WIRS)
- **Problems**
  - Analysis is purely cross sectional
  - Conditional correlations: no exogenous variation
  - **Idea:** use a big shock, such as the Great Recession which increased uncertainty (Bloom, 2009). Prediction is that in a big downturn value of decentralization increases
    - But countervailing forces – maybe need to centralize in order to make tough decisions on co-ordination?
  - Aghion, Bloom, Sadun, Lucking & Van Reenen (2017)

General Question: Is it better to be centralized or decentralized in an economic crisis?

- The “Tsarist view” – power should be centralized
  - Facilitate coordination and execute tough decisions

- The “Localist view” – power should be decentralized
  - Exploit local information and foster engagement

Datasets

- Two “org” datasets
  - WMS ~1,300 firms (double-blind phone interviews) in 10 OECD countries
  - MOPS ~9,000 US plants (Census survey)

- Match this decentralization data to performance and other firm demographic data

- Use large cross-industry differences during the Great Recession to run “diff-in-diff” type estimations

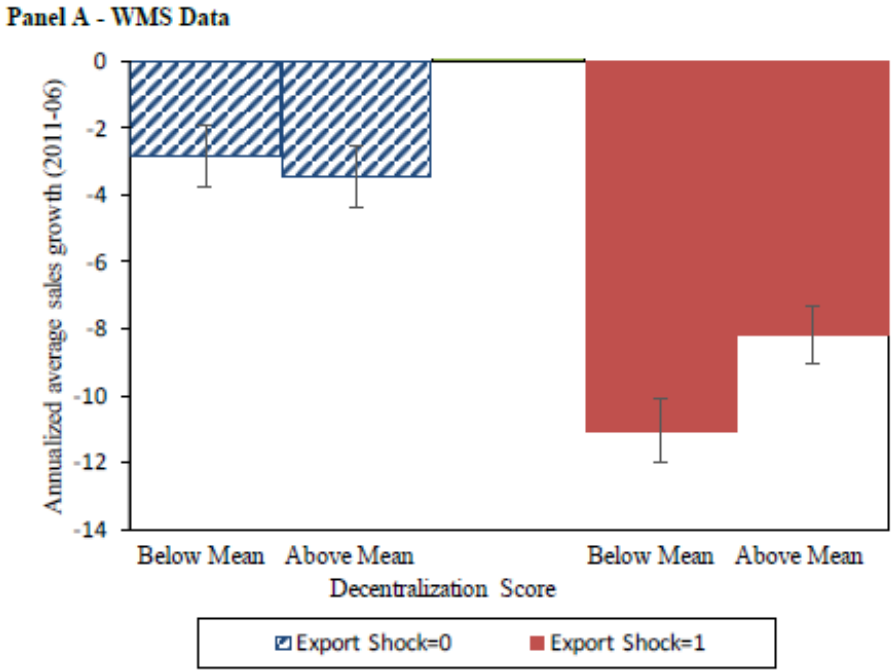
- Simple model of decentralization with economic crisis and uncertainty (based on Aghion and Tirole, 1997)

WMS: Empirical decentralization measure

- Main measure averages the z-score (scores normalized to mean 0, standard-deviation 1) of each variable:
  - Hiring senior employees (discrete, 1 to 5)
  - Maximum Capital expenditure (continuous, in $)
  - Introduction of new products (discrete, 1 to 5)
  - Sales and marketing (discrete, 1 to 5)

- Average 4 measures & z-score the average to get decentralization index

- **MOPS:** Same 4 questions + 2 more on pricing and pay increases.



Diff in Diff: Decentralization appears relatively <u>more</u> valuable in <u>downturns</u>

Notes: Change in log firm sales from 2006-2008 to 2009-2011 (5% confidence interval shown); Export shock are industry*country pairs with drop in exports 2008/09 compared to 2006/7.

Source: Aghion, Bloom, Sadun, Lucking & Van Reenen (2017)

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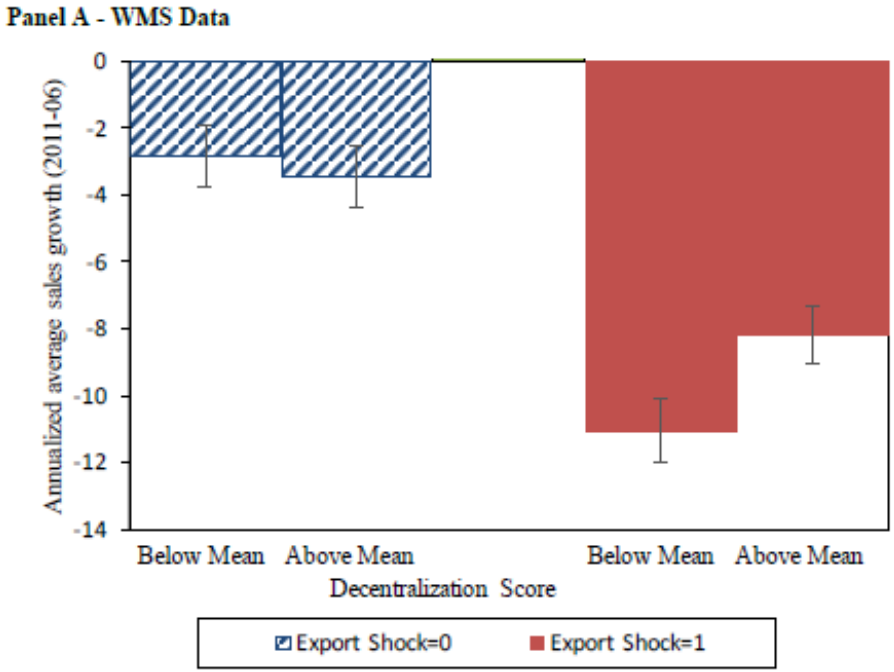

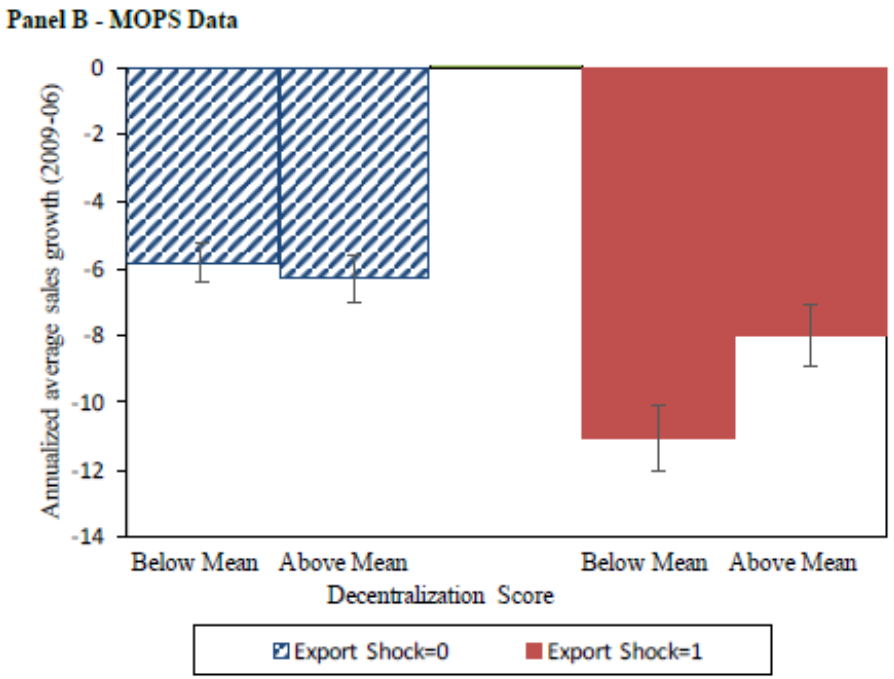

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Econometric Model

Main dependent variables is Sales growth (also look at TFP, profits, market value, survival)

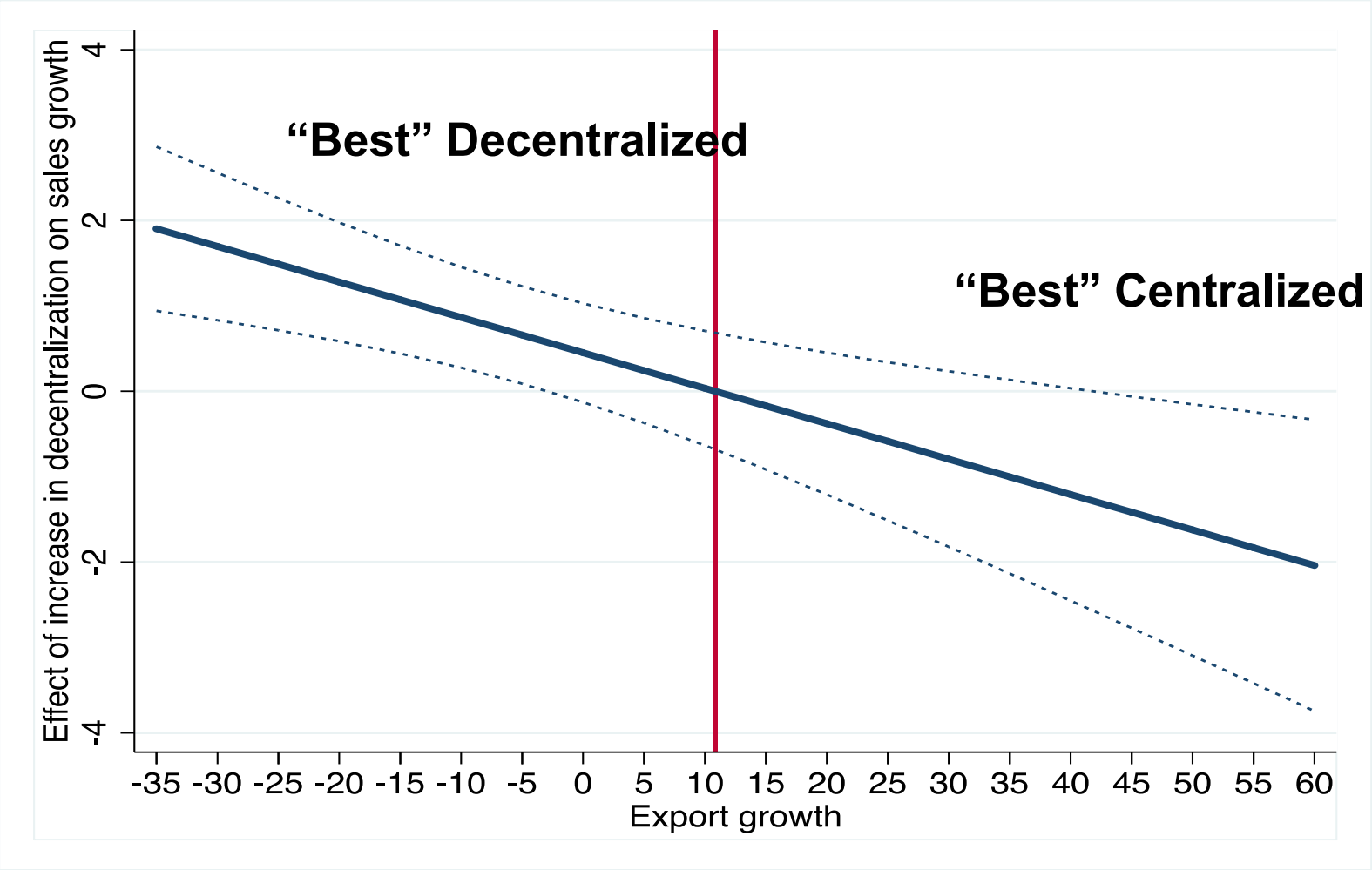
$$\Delta \ln Y_{ijct} = \alpha DEC_{i0} + \beta\left(DEC_{i0} * SHOCK_{jk}\right) + \gamma SHOCK_{jk} + \delta x_{i0} + \theta_c + \phi_j + \tau_t + \varepsilon_{icjt}$$

Where: *i* = firm; *j* = industry; *k* = country; *t* = year

- Right hand side: measures of Great Recession SHOCK (e.g. export growth) interacted with pre-crisis Decentralization (DEC)

- Since need 2006 initial data WMS limited to France, Germany, Greece, Italy, Japan, Poland, Portugal, Sweden, UK & US

Coefficients imply on average centralization better for growth pre- Great Recession, but decentralization better in the crisis



Notes: WMS - Implied coefficients based on column (3) of Table 2

Mechanisms

- Recessions are associated with greater uncertainty
- In environments when uncertainty higher, the information of plant manager is more valuable, so the benefits from uncertainty are greater
  - e.g. Acemoglu et al (2007)

Mechanisms

- Take model to the data using industry level changes in **product churn** as measure of uncertainty (& cross check with others such as stock market volatility)
  - Barnard and Okubo (2015)
  - Important margin of adjustment during a crisis

- **Implications**
  - More churn in sectors more highly shocked
  - In Great Recession, Decentralization most valuable in high churn sectors
  - Decentralization of sales/marketing more important than other types

In MOPS, augment basic econometric model with change in CHURN & its interaction with Decentralization

$$\Delta \ln Y_{ijct} = \alpha DEC_{i0} + \beta\left(DEC_{i0} * SHOCK_j\right) + \gamma SHOCK_j + \delta x_{i0} + \varphi_j + \varepsilon_{ij}$$

$$\Delta \ln Y_{ijc} = \alpha DEC_{i0} + \beta\left(DEC_{i0} * SHOCK_j\right) + \gamma SHOCK_j + \eta \Delta \mathrm{CHURN}_{\mathrm{j}} + \underbrace{\mu(DEC_{i0} * \Delta \mathrm{CHURN}_{\mathrm{j}})}_{} + \delta x_{i0} + \varphi_j + \varepsilon_{ij}$$

Model suggests that this term should be positive & driving results on β

Conclusion on decentralization & volatility/heterogeneity

- Support for some basic predictions that when environment becomes more volatile, decentralization more valuable
  - Better use of local information when crisis increases uncertainty
- **Cross section:** volatility/heterogeneity associated with decentralization
- **Over time:** decentralized firms coped better with the Great Recession

- **Issues**
  - What exogenous variation causes difference in decentralization?

Decentralization & Trust

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Some Factors influencing Decentralization

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TRUST AND DECENTRALIZATION: THEORY

- Market societies are decentralized systems, but their efficient functioning depends on people obeying contracts
- Since Hayek, recognised that formal legal systems are insufficient. Monitoring/punishments insufficient to get all to obey laws – needs to be founded in culture of trust
- Similar notion of “sub-economy” of a firm. Incomplete contracts mean that formal authority structures may not be followed. Relational contracts matter.
- Does trust facilitate decentralization in society and in firms?

Overview

1. **Decentralization & Trust: theory**
2. Measurement & Identification
3. Results on decentralization
4. Results on aggregate productivity (& firm size)
5. Conclusions

TRUST AND DECENTRALIZATION: THEORY

- Trust may affect optimal decentralization
  - Agent is less likely to “steal”
  - Facilitate cooperative solutions in repeated game settings: e.g. Baker, Gibbons and Murphy (1999)
  - Proxy the congruence of incentives: e.g. Aghion and Tirole (1997)

- Bloom, Sadun & Van Reenen (2012, QJE) find evidence of robust <u>positive</u> relationship between trust in region where headquarters is located and decentralization to plant

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MEASUREMENT AND IDENTIFICATION

- Measure trust using the World Value Survey, from the question:

  "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?"

  Trust <u>by region</u> (in country) defined as % of people answering "yes" to first part of the trust question

- Experimental studies show this question linked with trust/trusting behavior (Glaeser et al, 2000, Sapienza et al, 2007)

- Extensively used in prior social capital literature: e.g. Knack & Keefer (1997); Guiso, Sapienza, Zingales (2004);

<u>Trust</u> from World Value Survey across regions within countries

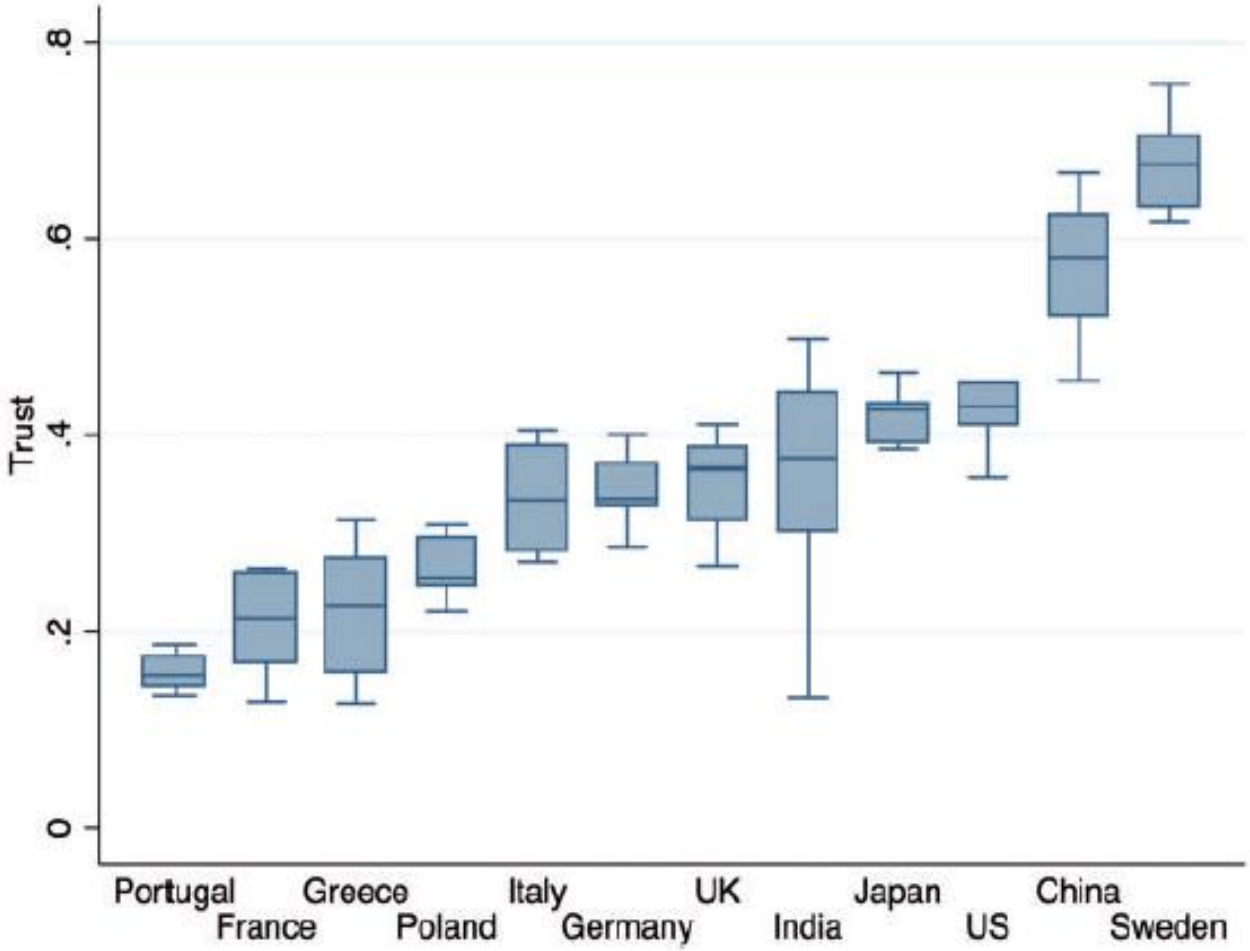


FIGURE II

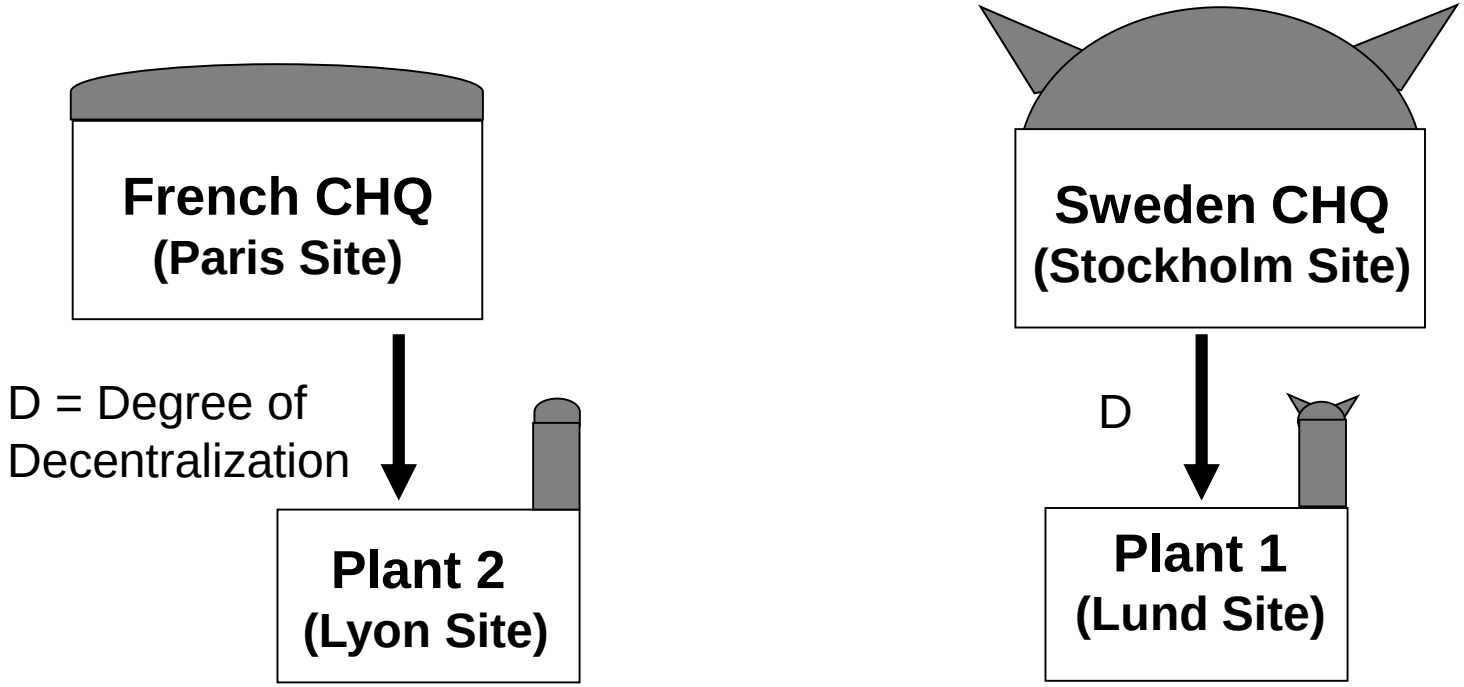
Trust by Country (across Regions)

Notes: Within country (across region) trust levels. Interquartile range shown with Box & Whisker plot (with min and max).

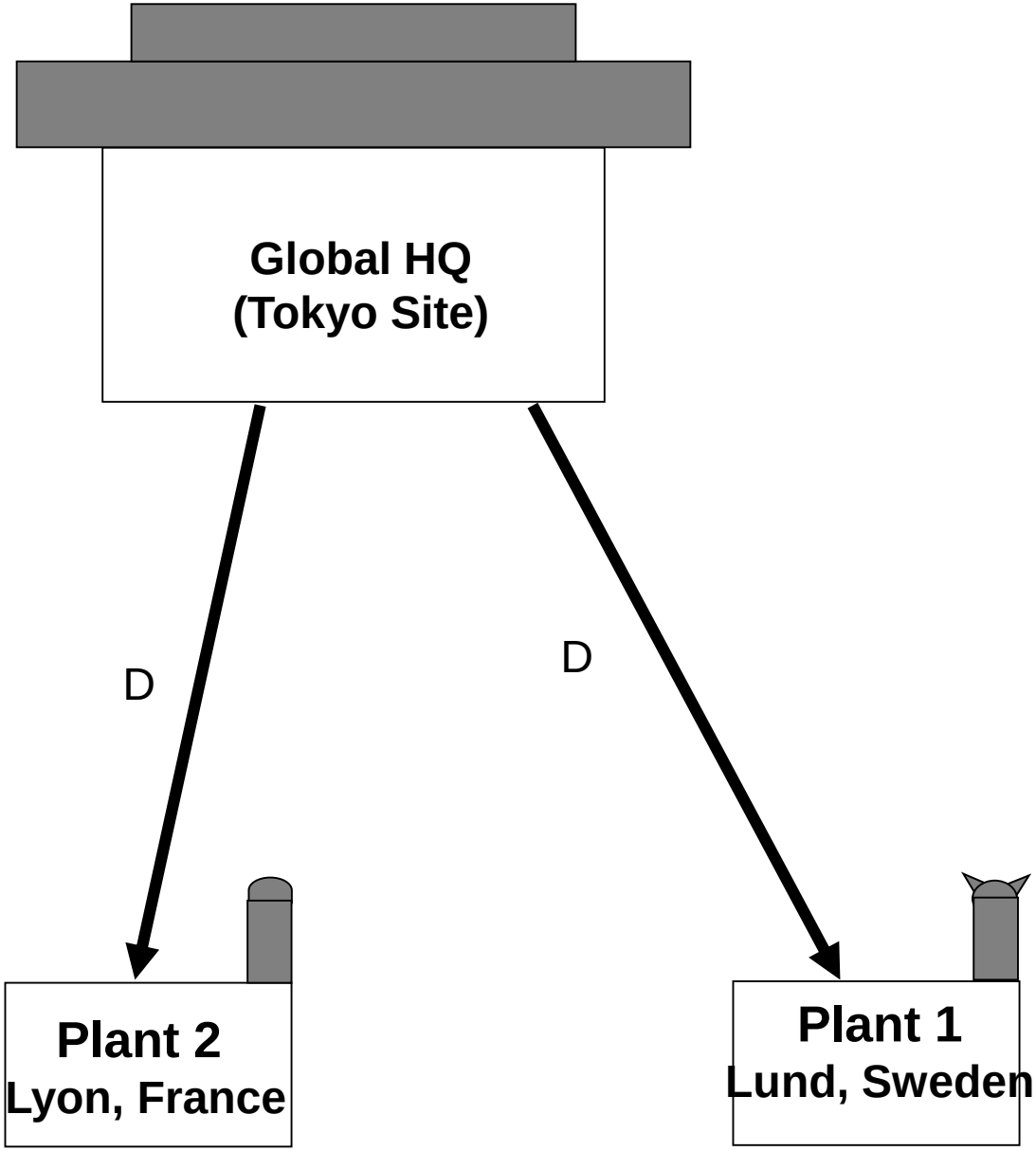
MEASUREMENT AND IDENTIFICATION

- Use trust in region (from WVS) around Headquarters of firm that owns the plant
  - Usually the same as we have medium sized firms
  - But for multi-plant firms can be different
  - And some multi-plant firms are multinationals which opens up identification possibilities using different levels of trust across *countries*.

Example of two WMS Domestic Firms



Example of WMS multinational (e.g. (Japanese)



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USE MULTINATIONALS AS A SECOND TEST FOR IMPORTANCE OF TRUST

- Is there bias due to trust proxying for other country/regional variables?

- Look at affiliates of foreign multinationals and investigate whether trust in their <u>home country</u> also matters
  - Can control for region of location dummies

- Also use EuroBarometer survey which asks individuals in all European countries how much they trust people in other countries (inc Japan and US) <u>Bilateral trust</u>
  - Control for region of location & CHQ country of origin
  - IV strategies based on religious & somatic distance

TAB 2: DECENTRALIZATION & TRUST IN MULTINATIONALS

Sample:	CHQ in different region	CHQ in different region	Foreign MNEs OLS	Foreign MNEs OLS	Foreign MNEs IV
Trust (CHQ region)	0.606** (0.270)	0.579** (0.284)	-0.219 (0.471)		
Trust (bilateral from origin country to location country)			1.765*** (0.619)	1.669** (0.789)	3.071** (1.253)
Regional of location dummies	No	Yes	No	Yes	Yes
Country CHQ dummies	No	No	No	Yes	Yes
Clustering	Region	Region	CHQ by plant location	CHQ by plant location	CHQ by plant location
Observations	1,094	1,094	422	422	422

Notes: Controls are country & SIC3 dummies, noise controls (interviewer dummies, Interviewee tenure & seniority, etc.), public listing, CEO onsite, plant size, regional GDP/head, Regional population, multinational status. IV is religious distance

Source: Bloom, Sadun & Van Reenen (2012)

TWO CHANNELS FOR THE IMPACT OF DECENTRALIZATION

<u>Firm size:</u>

Early work on the structure of firms argued that decentralization was critical for large firms, Penrose (1959) & Chandler (1962)

Indeed, see that larger firms are more decentralized

Essential for productivity growth as reallocation - which accounts for ≈1/2 of US TFP growth - needs productive firms to grow

Also important in development as low productivity due to lack of reallocation as “too few” large firms: e.g. Banerjee & Duflo (2004); Hsieh & Klenow (2008); Hsieh & Olken (2014)

Hence, factors driving decentralization – trust, rule of law, competition – also drive growth via facilitating decentralization

TRUST ENABLES FIRMS TO GROW LARGER
Dependent variable is average firm size in region

Sample:	All	Foreign MNEs
Trust (CHQ region)	2.270**	
	(0.826)	
Trust (bilateral from origin cty to location cty)		5.578***
		(1.477)
Observations	110	292
Regional controls	Yes	yes
Country dummies	Yes	yes

Notes: Regional controls are GDP per capita, population in the region and % of employees with a degree.

CONCLUSIONS

- Strong intuition that high trust environments facilitate decentralization across a range of models
- Brings sociological & economic concepts together
- Some evidence in line with theory & basic intuition
- Challenge is to find exogenous changes in trust/social capital across firms & over time
  - Long-term shifts
  - Changes in ownership structure?
  - Changes in senior leadership

- How much do organizational factors matter for the aggregate importance of social capital in economic success?

Back Up

Decentralization – Skills, competition & other factors

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Some Factors influencing Decentralization

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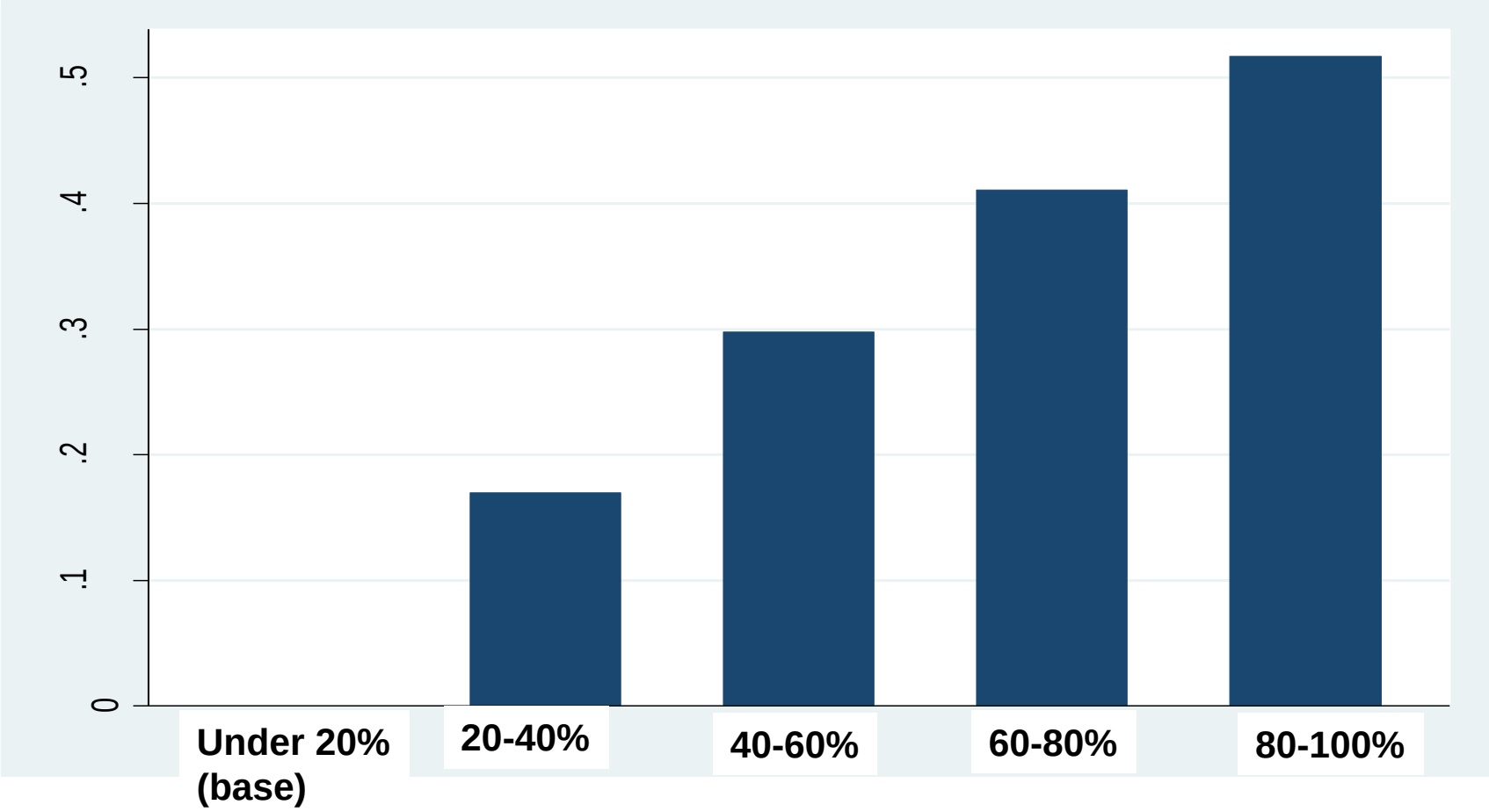
Plants with more skilled workers are more decentralized



Proportion of employees with a college degree

Source: WMS Data

“Skill biased Organizational Change?” Do increases in skill supply increases decentralization?

- Does human capital complement decentralization?
  - From cognitive viewpoint skilled workers less likely to make mistakes (but counter-arguments)
- More broadly: are there complementarities between organization and human capital?
  - General issues of complementarity econometrics later
- Particular context: Fall in computer prices leads to complementary organizational changes (decentralization) & increased demand for more skilled workers (lower demand for routine tasks). Implies:
  - More inequality
  - Higher productivity (1995-2004 US productivity miracle)

STANDARD APPROACH TO COMPLEMENTARITIES: EXAMPLE OF A 3 FACTOR MODEL

- A firm's production (Q) function depends on 2 types of labor skills (*H* = high, *L* = low) and organizational capital (e.g. Decentralization) denoted "*ORG*"

- Competitive market price for 3 factors
  - W^L factor price of low-skilled labor (unskilled wage)
  - W^H, factor price of high-skilled labor (skilled wage)
  - W^{ORG}, factor price of organizational capital

- Easy to include additional factors, just labelling

$$Q = AF(H, L, ORG)$$

Three implications of <u>complementarity</u> between human capital and decentralization

1. **Organization equation**
   - Decentralization more likely when supply of human capital increases, e.g. do higher relative prices of skilled workers inhibit decentralization?
2. **Skill demand equation**
   - Does decentralization increase demand for more skilled workers?
3. **Production or cost function**
   - Positive interactions between skills and organization in the production function

- Blundell et al (2016); Bresnahan, Brynjolfsson and Hitt (2002, QJE); Caroli & Van Reenen (2001, QJE) supportive of these predictions

SUMMARY ON DECENTRALIZATION AND HUMAN CAPITAL

- Evidence for complementarity of decentralization & human capital from a range of datasets and techniques
- Measures of decentralization rather crude though
- Many more about decentralization of workers
- Most don’t control for fixed effects
- How does technology fit in? IT also appears to be another compelment
- Still issue of endogenous decentralization (although looking directly at organization as an outcome in some approaches)

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SUMMARY OF DECENTRALIZATION LECTURE

• Decentralization a key organizational trait of firms

• Varies by country – Northern Europe and North America decentralized, Southern Europe and Asian centralized

• Systematically varies by firm (& all positively linked to decentralization)

- Turbulence/uncertainty;
- Trust (& culture more generally)
- Human Capital
- Competition
- Size, complexity

• Important for reallocation: firms need to decentralize to grow, and firm growth required for productivity enhancing reallocation

BACK UP

CAROLI AND VAN REENEN (2001) – IMPACT OF ORG CHANGE ON SKILL DEMAND

TABLE II

CHANGES IN WAGE BILL SHARES IN BRITAIN: EFFECTS OF ORGANIZATIONAL AND TECHNOLOGICAL CHANGE

	1984–1990 Change in wage bill share of:					
Mean of dependent variable	−.012	−.001	−.014	−.005	−.005	.037
	Unskilled manuals	Semi-skilled manuals	Skilled manuals	Clerical workers	Supervisors & foremen	Managers & technical staff
A. Basic controls						
OC	−0.047	−0.001	0.014	0.025	0.015	−0.005
	(0.018)	(0.018)	(0.016)	(0.019)	(0.008)	(0.021)
B. Basic controls and technology						
OC	−0.049	0.001	0.022	0.025	0.013	−0.012
	(0.018)	(0.019)	(0.016)	(0.019)	(0.008)	(0.021)
TECH	0.032	−0.021	−0.060	−0.056	−0.003	0.108
	(0.038)	(0.040)	(0.035)	(0.040)	(0.017)	(0.044)
ΔIND_TECH	−0.028	−0.006	−0.076	0.050	0.056	0.004
	(0.050)	(0.052)	(0.045)	(0.053)	(0.023)	(0.058)
ΔCOMP	−0.023	0.004	−0.009	−0.019	0.010	0.037
	(0.014)	(0.014)	(0.012)	(0.014)	(0.006)	(0.016)

OC = organizational change (e.g. Decentralization)

Notes: 378 plants, controls for unions, financial performance, Ownership, JCC, size, weighted OLS

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ΔIND_TECH	−0.028	−0.006	−0.076	0.050	0.056	0.004
	(0.050)	(0.052)	(0.045)	(0.053)	(0.023)	(0.058)
ΔCOMP	−0.023	0.004	−0.009	−0.019	0.010	0.037
	(0.014)	(0.014)	(0.012)	(0.014)	(0.006)	(0.016)

Organizational change has large negative association With the least skilled workers

CAROLI AND VAN REENEN (2001) – IMPACT OF ORG CHANGE ON SKILL DEMAND. UK

TABLE II

CHANGES IN WAGE BILL SHARES IN BRITAIN: EFFECTS OF ORGANIZATIONAL AND TECHNOLOGICAL CHANGE

	1984–1990 Change in wage bill share of:					
Mean of dependent variable	−.012	−.001	−.014	−.005	−.005	.037
	Unskilled manuals	Semi-skilled manuals	Skilled manuals	Clerical workers	Supervisors & foremen	Managers & technical staff
A. Basic controls						
OC	−0.047	−0.001	0.014	0.025	0.015	−0.005
	(0.018)	(0.018)	(0.016)	(0.019)	(0.008)	(0.021)
B. Basic controls and technology						
OC	−0.049	0.001	0.022	0.025	0.013	−0.012
	(0.018)	(0.019)	(0.016)	(0.019)	(0.008)	(0.021)
TECH	0.032	−0.021	−0.060	−0.056	−0.003	0.108
	(0.038)	(0.040)	(0.035)	(0.040)	(0.017)	(0.044)
ΔIND_TECH	−0.028	−0.006	−0.076	0.050	0.056	0.004
	(0.050)	(0.052)	(0.045)	(0.053)	(0.023)	(0.058)
ΔCOMP	−0.023	0.004	−0.009	−0.019	0.010	0.037
	(0.014)	(0.014)	(0.012)	(0.014)	(0.006)	(0.016)

Technological change (e.g. Computerization) has large positive association with the most skilled workers

CAROLI AND VAN REENEN (2001) – ORG CHANGE REDUCES THE DEMAND FOR LEAST SKILLED WORKERS (FRANCE)

TABLE IV

CHANGES IN WAGE BILL SHARES IN FRANCE: EFFECTS OF ORGANIZATIONAL CHANGE (DELAYERING) AND TECHNICAL CHANGE

	1992–1996 Change in wage bill share of:				
Mean of dependent variable	−.026	0	−.008	.022	.012
	Unskilled manuals	Skilled manuals	Clerical workers	Middle Managers & Technicians	Senior managers
A. Basic controls					
OC	−0.015	0.017	−0.002	0.003	−0.003
	(0.007)	(0.009)	(0.004)	(0.005)	(0.004)
B. Basic controls +					

BACK UP

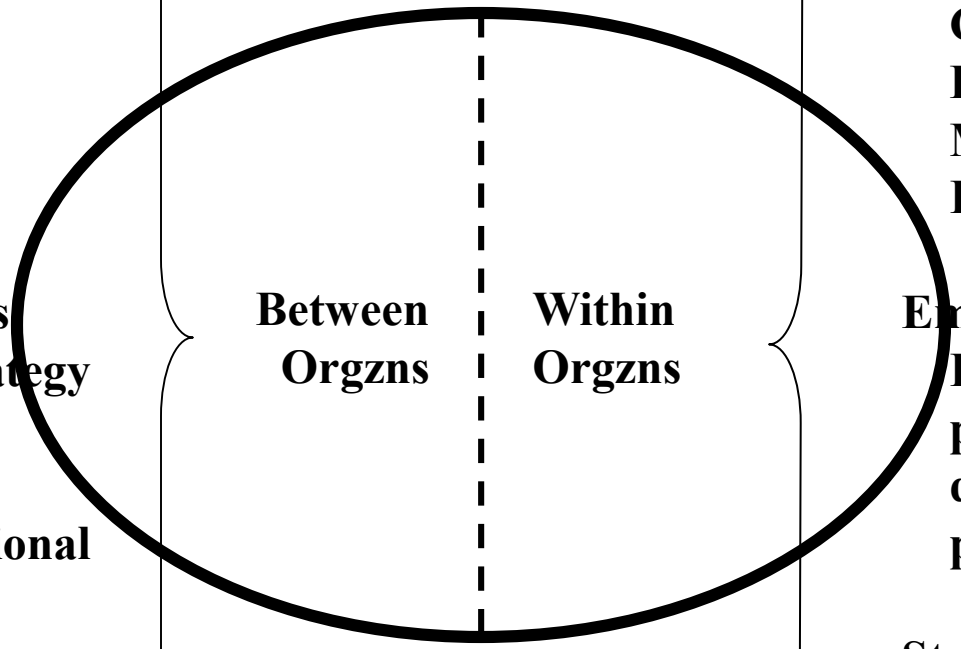
Topics in OE a la Gibbons

Vertical Integration:
Vertical integration; Supply chains

Horizontal Integration:
Conglomerates; Corporate strategy

Contracts:
Formal; Relational

Hybrids:
Alliance; Network; Joint Venture



Beyond Firms:
Communities; States; Agencies; PPPs; …

Decision-Making:
Power & Politics; Culture & Leadership; Mgmt. & Productivity

Employment:
Pay for performance; Skill development; HR practices

Structures & Processes:
Hierarchy; Alternative forms; Resource allocation; Transfer pricing

Rough Plan of Action

1. **Decentralization**
    a. Theory revision
    b. Measuring decentralization;
    c. Volatility/uncertainty/turbulence;
    d. Trust, culture
    e. Other Factors
2. **Knowledge Hierarchies**
    a. Division of labor; Garicano (2000) model and ICT
    b. Assignment and firm size: Lucas (1978) and extensions
    c. Multi-layer hierarchies and shocks: Rossi-Hansberg et al
3. **Relational Contracts: empirics (1)**

Topics in OE a la Gibbons

Vertical Integration:
Vertical integration; Supply chains

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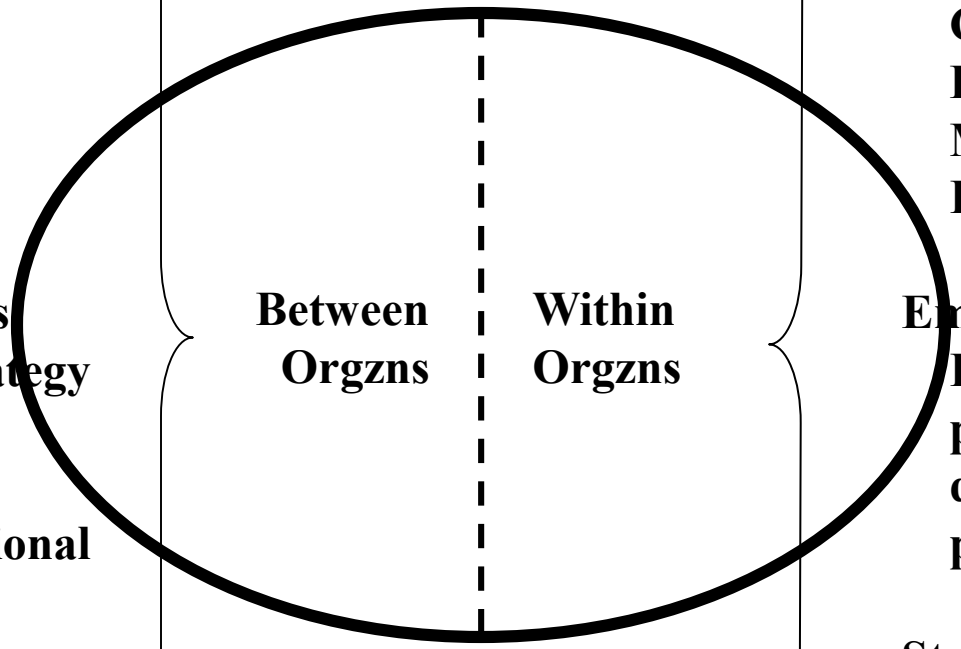


Beyond Firms:
Communities; States; Agencies; PPPs; …

Decision-Making:
Power & Politics; Culture & Leadership; Mgmt. & Productivity

Employment:
Pay for performance; Skill development; HR practices

Structures & Processes:
Hierarchy; Alternative forms; Resource allocation; Transfer pricing

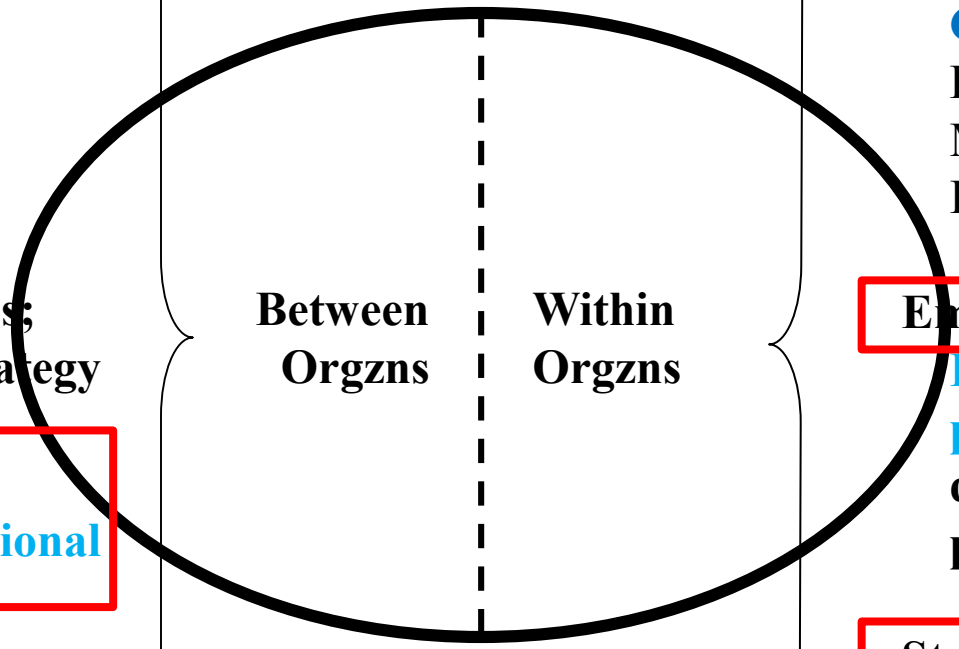
Topics in OE – This semester

Vertical Integration:
Vertical integration;
Supply chains

Horizontal Integration:
Conglomerates;
Corporate strategy

Contracts:
Formal; Relational

Hybrids:
Alliance; Network;
Joint Venture



Beyond Firms:
Communities; States;
Agencies; PPPs; …

Decision-Making:
Power & Politics;
Culture &
Leadership;
Mgmt. &
Productivity

Employment:
Pay for performance; Skill development; HR practices

Structures & Processes:
Hierarchy;
Alternative forms;
Resource allocation;
Transfer pricing

Table I: Organizational Practice and Human Capital Survey Variables

	Range	Variable	N	Mean	Std. Dev.
Variables Measuring Organization					
Team-Based Work Organization					
Use of Self-Managing Teams	1-5	*SMTEAM*	345	2.11	1.13
Use of Employee Involvement Groups	1-5	*QUALCIR*	345	2.85	1.21
Use of Team Building Activities	1-5	*TEAMBLD*	345	2.95	1.17
Promote for Teamwork	1-5	*PROMTEAM*	345	3.59	0.95
Breadth of Jobs	1-5	*BROAD*	345	3.25	0.99
Individual Decision Authority					
Who Decides Pace of Work (3=workers)	1-3	*PACE*	345	1.33	0.37
Who Decides Method of Work (same)	1-3	*METHOD*	345	1.39	0.38

$$WO = \mathrm{STD}(\mathrm{STD}(SMTEAM) + \mathrm{STD}(TEAMBLD) + \mathrm{STD}(PROMTEAM) + \mathrm{STD}(QUALCIR) + \mathrm{STD}(PACE) + \mathrm{STD}(METHOD))$$

Human capital correlated with decentralization

Table VII: Relationship between human capital investment and various measures of information technology, with controls for skill and workplace organization

Dependent Variable	Human Capital Investment	Human Capital Investment	Human Capital Investment	Human Capital Investment	Human Capital Investment	Human Capital Investment
Specification / Variable	OLS	OLS	IV	IV	OLS	OLS
	Col (1)	Col (2)	Col (3)	Col (4)	Col (5)	Col (6)
Computerization log(*ITCAP*/*EMPLOY*)$_{-4}$	.180*** (.0673)	.154*** (.0614)				
Computerization log(*ITCAP*/*EMPLOY*)			.184** (.0735)			
Computerization (COMP)				.994* (.522)		
Computerization log(MIPS/*EMPLOY*)$_{-4}$					.172*** (.0644)	
Computerization log(TOTPC/*EMPLOY*)$_{-4}$						.0812 (.0650)
Work Organization (*WO*)		.419*** (.0589)	.409*** (.0594)	.314*** (.0982)	.403*** (.0607)	.449*** (.0569)
Skills (*SKILL*)	.237*** (.0629)	.0948 (.0607)	.0930 (.0609)	-.240 (.200)	.0911 (.0618)	.100 (.0626)
Industry Controls	Sector Dummies	Sector Dummies	Sector Dummies	Sector Dummies	Sector Dummies	Sector Dummies
N	250	250	250	250	250	250

Key: * - p<.1, ** - p<.05, *** - p<.01
All variables standardized to mean 0, unit variance.
IV: Computerization (*ITCAP*/*EMPLOY* and COMP) instrumented with 4th lagged log(*ITCAP*/*EMPLOY*); all other variables considered exogenous.

Source: Bresnahan, Brynjolfsson & Hitt (2002)

BLUNDELL, GREEN & JIN (2017)

employees.[18] We focus on employees' responses to three questions:

"How much influence do you have about the following?"

1) "The range of tasks you do in your job",

2) "the pace at which you work"

3) "how you do your work".

The responses for each question range from 1 "A lot" to 4 "None". These questions are included in the cross-sectional WERS surveys for 1998, 2004, and 2011. Rather than use these questions separately we implement a principal components analysis to compute an index of the ability of workers to influence their own work. We define the index as 4 minus the first principal

METHOD 1: DEPENDENT VARIABLE IS DECENTRALIZATION

TABLE 4—REGRESSIONS OF EMPLOYEE INFLUENCE INDEX

	(1)	(2)	(3)	(4)	(5)	(6)
Current % of BAs	0.573***	0.535**	0.600**	0.642***	1.306**	1.205***
	[0.123]	[0.272]	[0.238]	[0.134]	[0.585]	[0.251]
wave04	0.186***	0.188***	0.185***	0.177***	0.153***	0.152***
	[0.0237]	[0.0261]	[0.0255]	[0.0287]	[0.0353]	[0.0310]
wave11	0.293***	0.298***	0.291***	0.261***	0.185**	0.196***
	[0.0277]	[0.0401]	[0.0335]	[0.0322]	[0.0727]	[0.0415]
% of BAs in 1995-6		0.0626				
		[0.406]				
Current % of HS?			0.0395			
			[0.292]			
Constant	0.398***	0.396***	0.369*	1.073**	0.648***	0.654***
	[0.0241]	[0.0292]	[0.215]	[0.434]	[0.224]	[0.185]
further controls*	no	no	no	yes	yes	yes
instruments	na	na	na	na	cohort structure	4 IVs
Observations	670	670	670	670	670	580
R-squared	0.295	0.295	0.295	0.388	0.365	0.381

Note: All regressions are at the TTWA level, weighetd by employment in the area.
*Further controls include the current proportions of workplaces in the area by industry, by bands of workplace size, and by bands of organization size.
Source: Authors' analysis of the UK Workplace Employment Relations Survey.

COLLEGE (B.A.) SUPPLY IN THE LOCAL AREA (TTWA)

BRESNAHAN, BRYNJOLFSSON AND HITT (2002, QJE)

- US Compustat Data – publicly listed US firms
- Harte-Hanks data with estimate of value of IT capital stock
- Cross sectional information on firm ORG (teamwork, decentralization between plant manager & workers, etc.) and skills from a closed survey
  - Decentralization/Workplace Organization (“WO”)

BRESNAHAN, BRYNJOLFSSON AND HITT (2002, QJE)

- ORG, Skills and IT all positively associated
- For example, Method 2 (labor demand) “human capital investment” equation
  - % workers trained; cross-train (1-5); screening pre-hiring (1-5)
  - ORG positively associated with HC investment

Caroli & Van Reenen (2001, QJE)

- British (1984, 1990) & French (1992, 1996) establishment data on organizational practices. Employer answered questions (roughly, on decentralization of plant manager)
- Three Findings
  - **Organizational Change equation**: Higher price of skilled workers (& lower supply) means less decentralization (like Blundell et al, 2016)
  - **Labor Demand.** More decentralization decreases demand for less skilled workers (like Bresnahan et al, 2002, but with fixed effects)
  - **<u>Production Function</u>.** Skills and decentralization interact positively on right hand side of production function, even after taking out plant fixed effects

BACK TO THE PRIMITIVES - PRODUCTION FUNCTION ESTIMATION.

- Caroli & Van Reenen (2001) use panel data

$$\Delta \ln Q = \alpha_H \Delta \ln H + \alpha_L \Delta \ln L + \alpha_O \Delta \ln ORG$$
$$+\alpha_{HO} \Delta(\ln H * \ln ORG) + \alpha_{LO} \Delta(\ln L * \ln ORG)$$
$$+....$$

PRODUCTION FUNCTION ESTIMATION: LOWER IMPACT OF ORG CHANGE (OC) WHEN MORE UNSKILLED WORKERS

TABLE VII

FIRM-LEVEL PRODUCTION FUNCTIONS FOR FRANCE 1992–1996

Change in Value added 1992–1996 (annualized mean = .01)						
					$OC = 1$	$OC = 0$
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Capital)	0.226	0.227	0.233	0.232	0.237	0.227
	(0.080)	(0.080)	(0.081)	(0.082)	(0.140)	(0.094)
ln(Labor)	0.879	0.875	0.888	0.889	0.807	0.817
	(0.097)	(0.096)	(0.100)	(0.100)	(0.155)	(0.130)
Lagged variables						
OC	0.017	0.037	0.034	0.022		
	(0.012)	(0.016)	(0.017)	(0.030)		
OC *% Unskilled		−0.114	−0.125	−0.115		
		(0.057)	(0.059)	(0.062)		
% Unskilled	−0.031	0.030	0.101	0.097	−0.118	0.026
	(0.029)	(0.043)	(0.051)	(0.052)	(0.054)	(0.038)

Source: Caroli & Van Reenen (2001, QJE)

Competition and decentralization – basic theory

- Theory ambiguous
  - Competition may affect <u>information</u>:
  - – Improves the value of timely responses to local conditions (e.g. Aghion & Tirole, 1997)
  - – But (if more firms implies more competition), reduces value of local information as more firms for the principal to learn from (e.g. Acemoglu et al., 2007)

  - Competition may also affect <u>incentives</u>:
  - – Lower risk of manager abusing autonomy as incentives more aligned with firm (e.g. Schmidt 1997, Vives 2005)
  - – But, less incentive to co-ordinate prices (Alonso et al., 2008)
- Bloom, Sadun & Van Reenen (2010) find net effect of competition positive

Competition increases Decentralization

- The relationship is likely to be **causal**. Guadalupe and Wulf (2010, AEJ)
  - look at Canadian-US Free Trade natural experiment
  - Use Rajan & Wulf (2006) panel data of Compustat/Hewitt firms
  - Find that US firms in industries which faced more competition because of fall in tariffs were more likely to delayer/decentralize

Competition increases Span (associated with Greater Decentralization)

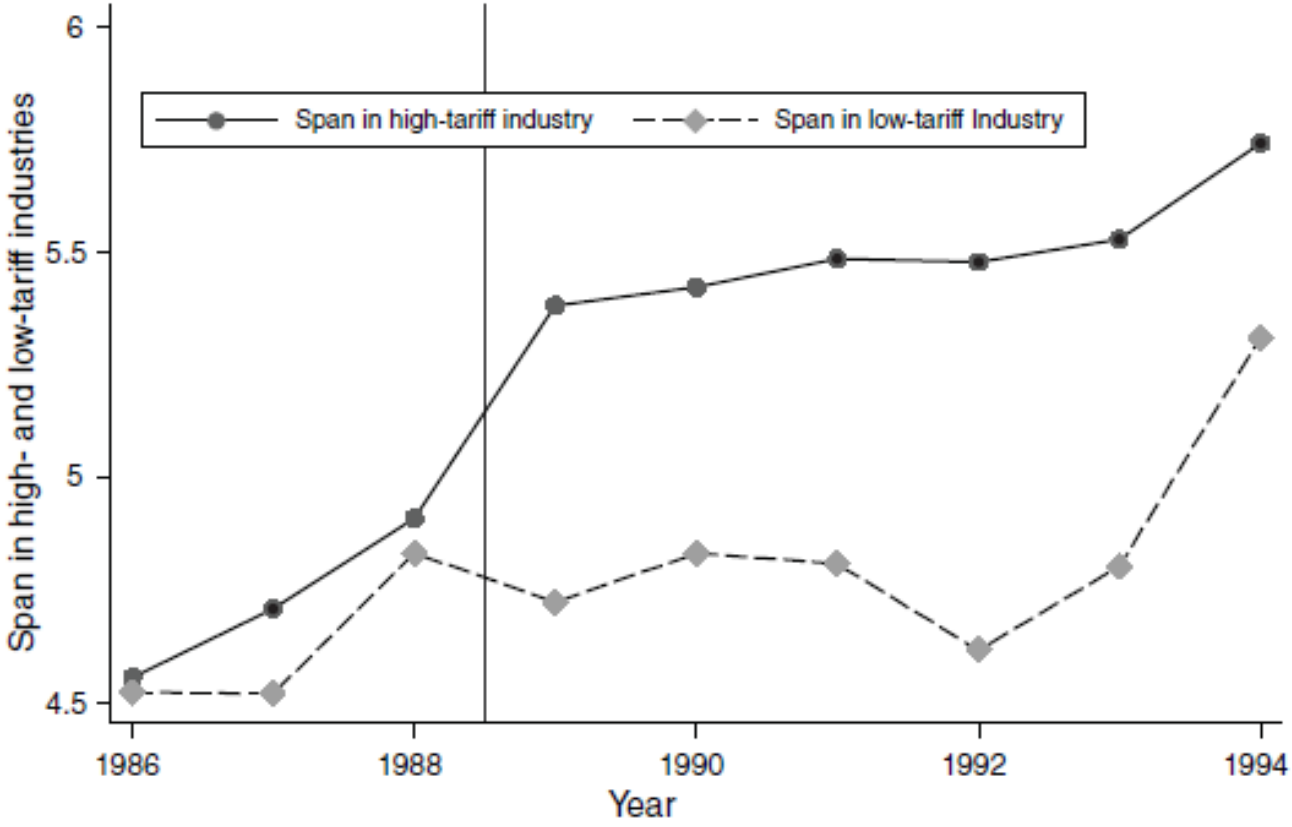


FIGURE 2. THE DIFFERENTIAL EFFECT OF THE FTA ON SPAN, HIGH- VERSUS LOW-TARIFF INDUSTRIES

Source: Rajan and Wulf (2010)