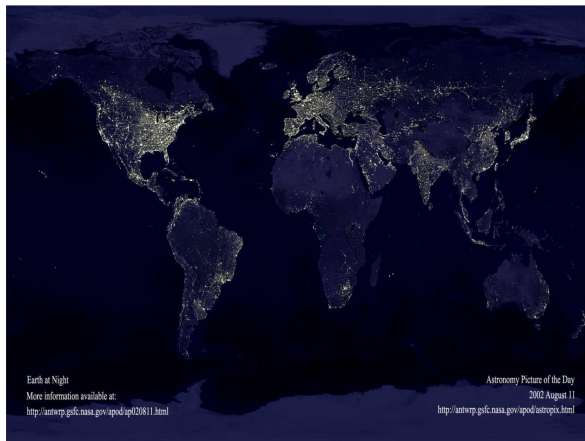


Sticky capabilities: agglomeration economies, regional diversification and structural transformation

Matte Hartog (matte_hartog@hks.harvard.edu)

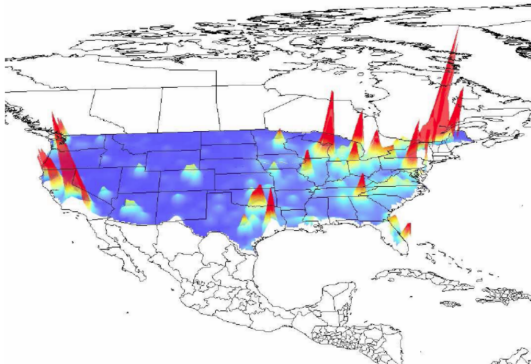
Production and wealth are unevenly distributed across countries

- ▶ Henderson et al. (2012) Measuring Economic Growth from Outer Space. American Economic Review 102 (2), pp. 994 - 1028

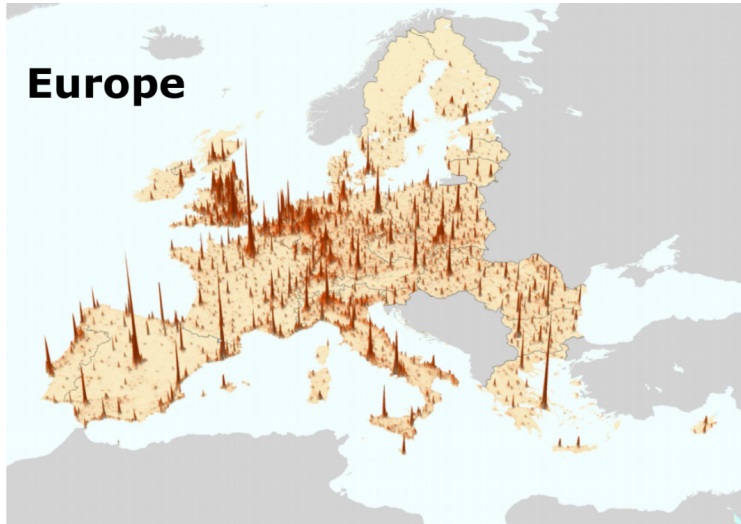


USA: GDP per km²

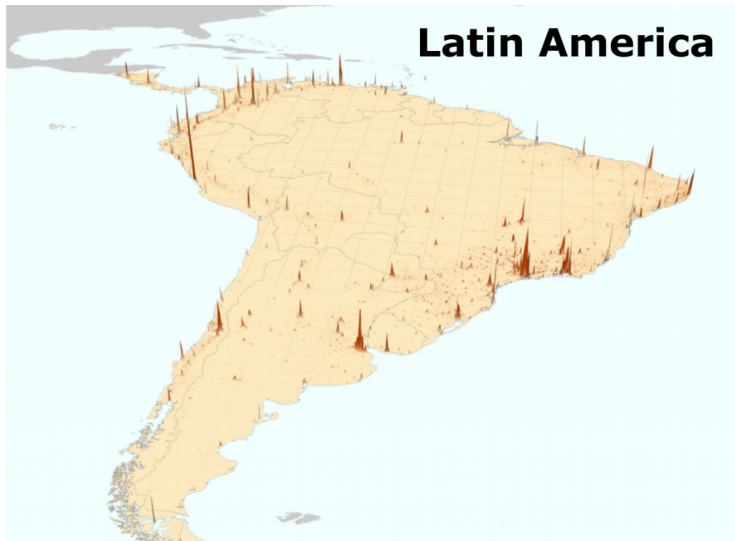
USA: Gross Domestic Product (GDP) per km²



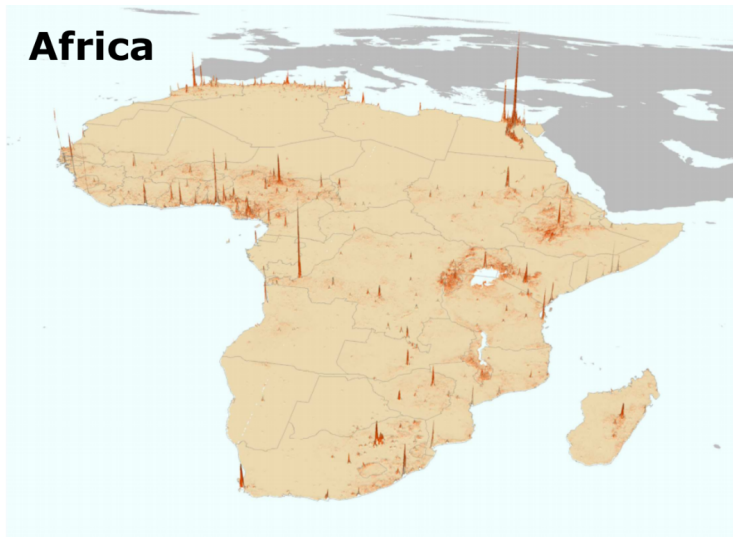
Europe: GDP per km²



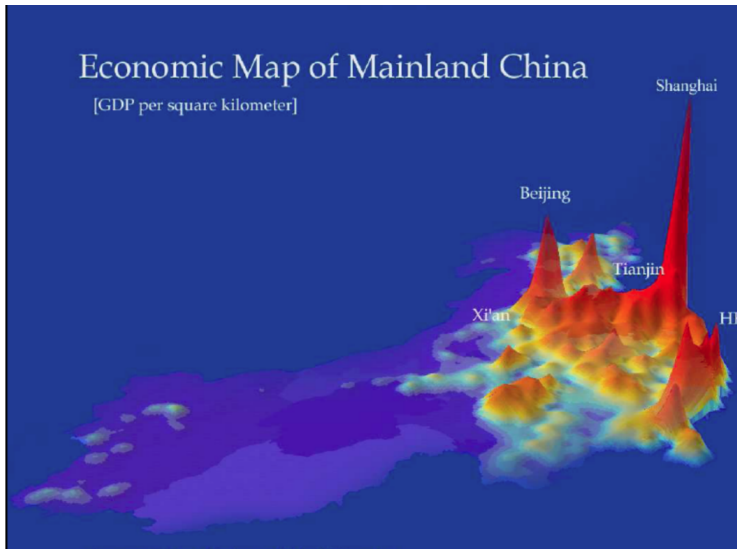
Latin America: GDP per km²



Africa: GDP per km²



China: GDP per km2

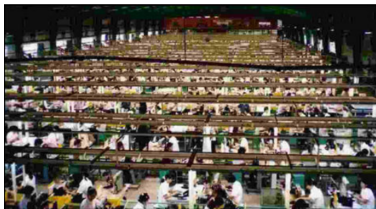


Spatial concentration of production

- ▶ Datang (China): Sock City
- ▶ 100.000 people produced > 25.000.000.000 pairs of socks in 2014 world)



Sock city



- “In Roaring China, Sweaters Are West of Socks City”

Spatial concentration of production

- ▶ City Wenzhou in China: more than 500 lighter producers
- ▶ Produce more than 500.000.000 lighters a year (95% of world production)



Spatial concentration of production

Qiatou (China): Button and Zip Town

- ▶ 15 billion buttons per year
- ▶ 200 million meters of zippers per year (80% world production)
 - ▶ 5000 times around the earth



Spatial concentration of production

- ▶ Watch valley in Swiss
- ▶ 30.000.000 watches per year (95% of world's watches over \$1000)

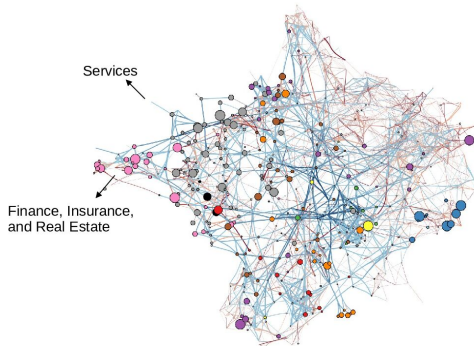


Spatial concentration of production

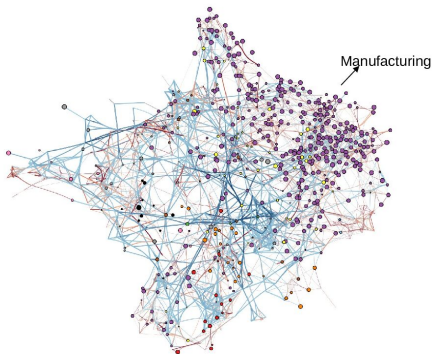
- ▶ Silicon Valley (San Francisco)
- ▶ Facebook, Google, Apple, Microsoft, Yahoo, HP, Ebay etc.



London

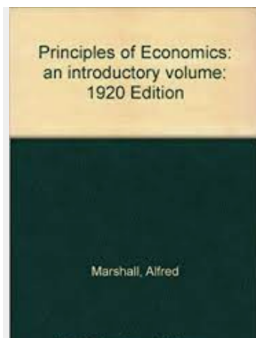


Shanghai



Spatial concentration of industries: why?

- ▶ Region-specific natural advantages
 - ▶ Chile, Atacama Desert: “Astronomer’s paradise” (Smithsonian, 2015): lack of precipitation, clear skies, no light pollution etc.
- ▶ Localization economies or ‘Marshall externalities’ (Alfred Marshall 1920): Input-output linkages, labor market pooling, knowledge spillovers



- ▶ 'Regional branching': spinoffs (Steven Klepper, et al.), exits of firms

Marshall externalities: 1. Input-output linkages

- ▶ Firms trade off costs involved with moving goods from suppliers and to customers
- ▶ Rhinelander Sugar House (nowadays headquarters NY Police Department)
- ▶ Marshall 1920: spatial clustering of sugar refining industry in New York - largest industry in 1870: why?



Marshall externalities: 2. Specialized labor market pooling

- ▶ Firms able to tap into workers with highly specialized skills
- ▶ Krugman Obstfeld 1998 “International Economics”:
 - ▶ 2 film studios that hire experts in computer animation
 - ▶ High demand: both studios want to hire 150 experts but they cannot do so if the studios are located in different cities with 100 experts each
 - ▶ Low demand for workers in one firm may be offset by higher demand of other firms in same location
- ▶ Engineer in Silicon Valley, quoted in Saxenian 1994, p. 35: *“It wasn’t that big a catastrophe to quit your job on Friday and have another job on Monday. . . . You just drove off in another direction on Monday morning.”*
- ▶ Knowledge diffusion through labor mobility

Marshall externalities: 3. Knowledge spillovers

- ▶ Marshall 1920: “The mysteries of the trade become no mystery, but are as it were in the air”
- ▶ Annalee Saxenian 1994 book: “Regional Advantage: Culture and Competition in Silicon Valley and Route 128”
- ▶ Engineer Silicon Valley (Saxenian 1994):

“Every year there was some place, the Wagon Wheel, Chez Yvonne, Rickey’s, the Roundhouse, where members of this esoteric fraternity, the young men and women of the semiconductor industry, would head after work to have a drink and gossip and trade war stories about phase jitters, phantom circuits, bubble memories, pulse trains, bounceless contacts, burst modes, leapfrog tests, p-n junctions, sleeping sickness modes, . . .”

- ▶ What Storper and Venables (2004) call 'local buzz':
Geographical proximity important to transfer tacit knowledge

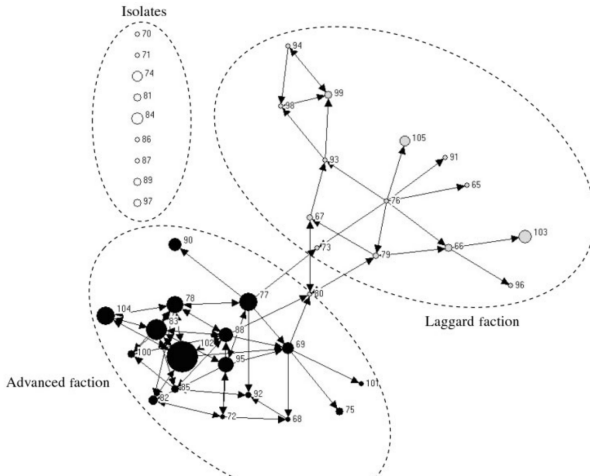
Importance of physical proximity

“Physical proximity is important to just about everything we do. I have better relationships with Silicon Valley companies that I have even with my own company. The level of communication is much higher when you can see each other regularly. . . . It’s very hard to work together long distance. You don’t have a feel for who the people are, they are just disembodied voice. If you’re not tripping over the guy, you’re not working with him, or not working at the level that you optimally could if you co-located”

(Digital Electronics Corporation CEO, quoted by Saxenian 1994, p.157).

Knowledge spillovers: wine producers in Bolgheri

- ▶ Network literature on spillovers
- ▶ Giuliani (2007) The Selective Nature of Knowledge Networks in Clusters: Evidence from the Wine Industry. *Journal of Economic Geography* 7(2):139-168



Importance of different localization economies

- ▶ Century of research since Marshall 1920: see Beaudry, Schiffauerova 2009
- ▶ Diodato Dario, Neffke Frank, Clery Neave O' (2018). Why do industries coagglomerate? How Marshallian externalities differ by industry and have evolved over time. Journal of Urban Economics 106, p. 1-26.

- ▶ Data: Employment in US counties and metropolitan areas, traded industries (IPUMS 1910 - 2010)
- ▶ Co-agglomeration of industries: correlation between industries' locational employment vectors:

$$LC_{ij} = \text{corr}(s_{ir}, s_{jr})$$

- ▶ Data: Employment in US counties and metropolitan areas, traded industries (IPUMS 1910 - 2010)
- ▶ Co-agglomeration of industries: correlation between industries' locational employment vectors:

$$LC_{ij} = \text{corr}(s_{ir}, s_{jr})$$

- ▶ (Co-agglomeration of industries EG-index):

$$EG_{ij} = \frac{\sum_{r=1}^R (s_{ir} - x_r)(s_{jr} - x_r)}{1 - \sum_{r=1}^R x_r^2}$$

where

$$s_{ir} = \frac{E_{ir}}{\sum_{r'=1}^R E_{ir'}}$$

- ▶ Value-chain linkages: Use input-output data (from US Bureau of Economic Analysis)

$$P_{ij}^{IO} = \max \left(\frac{IO_{ij}}{\sum_k IO_{kj}}, \frac{IO_{ji}}{\sum_k IO_{kj}}, \frac{IO_{ij}}{\sum_k IO_{ik}}, \frac{IO_{ji}}{\sum_k IO_{ik}} \right)$$

- ▶ Labor market pooling: Industry-occupation data from US Occupational Employment Statistics (OES) + IPUMS:

$$P_{ij}^L = \text{corr}(E_{io}, E_{jo})$$

- ▶ Sharing know-how: Technological similarity (patents linked by the NBER to industries):

$$P_{ij}^T = \max \left(\frac{C_{ij}}{\sum_k C_{kj}}, \frac{C_{ji}}{\sum_k C_{kj}}, \frac{C_{ij}}{\sum_k C_{ik}}, \frac{C_{ji}}{\sum_k C_{ik}} \right)$$

Diodato et al. results

- Labor and I-O are most important to predict spatial clustering of industries

	(1) OLS State	(2) OLS City	(3) OLS County	(4) IV State	(5) IV City	(6) IV County
EG index - all traded						
Input-output	0.227 (0.042)	0.149 (0.026)	0.125 (0.028)	0.244 (0.048)	0.128 (0.033)	0.105 (0.036)
Labor	0.144 (0.012)	0.109 (0.010)	0.077 (0.009)	0.173 (0.034)	0.166 (0.023)	0.080 (0.023)
Technology	-0.001 (0.010)	-0.028 (0.008)	-0.026 (0.009)	-0.003 (0.011)	-0.030 (0.008)	-0.024 (0.008)
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► Labor and I-O, heterogeneity across industries

10

D. Diodato et al./Journal of Urban Economics 106 (2018) 1–26

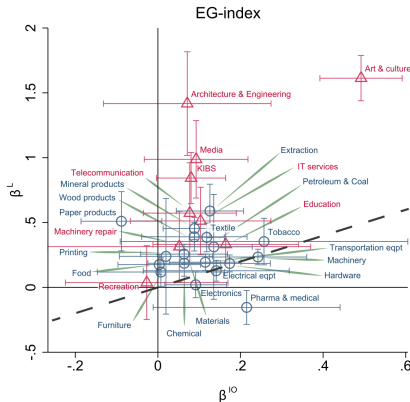
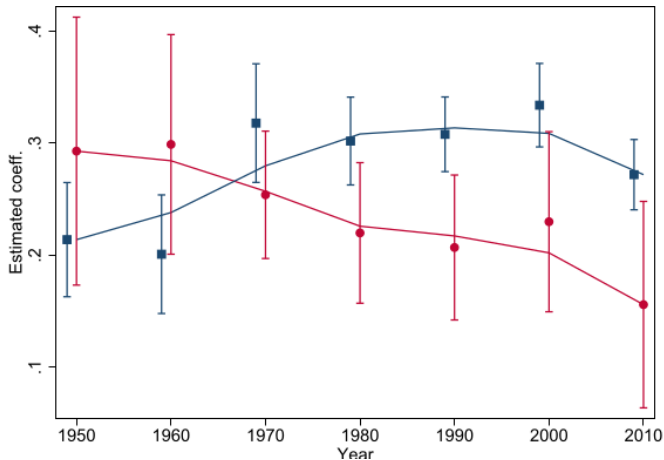


Fig. 3. Coagglomeration effects for 27 subsectors (EG-index).

Average point estimates for industries in 27 subsectors (see [Appendix D](#) for results by industry) of labor pooling effects (vertical axis) and value chain effects (horizontal axis) on EG coagglomeration index, using OLS regression. Estimates for services are marked with red triangles, for manufacturing industries with blue circles. The crosshairs represent 95% confidence intervals for these averages, based on robust standard errors.

Diodato et al. results

- ▶ Labor is increasingly important
 - ▶ (blue = labor, red = I-O)

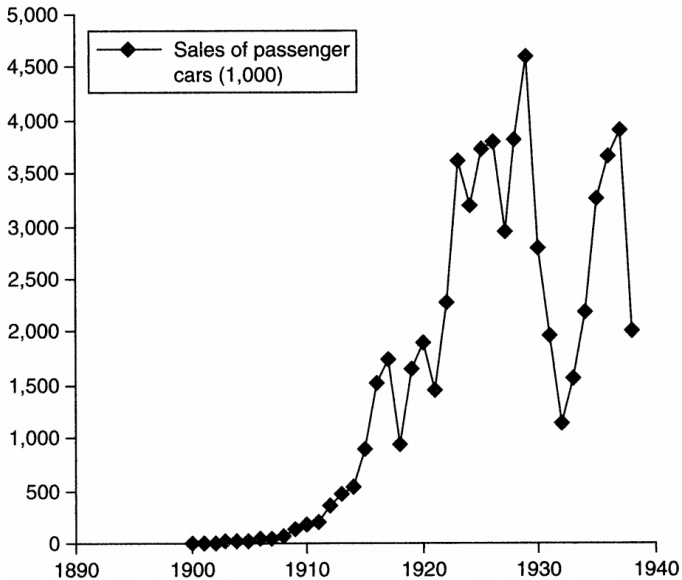


Spinoffs

- ▶ Complementary / alternative explanation for spatial clustering along the life cycle of an industry:
 - ▶ spinoffs: Steven Klepper
 - ▶ Steven Klepper (2007) Disagreements, Spinoffs, and the Evolution of Detroit as the Capital of the U.S. Automobile Industry. *Management Science* 53(4):616-631.
 - ▶ exit dynamics

Car industry

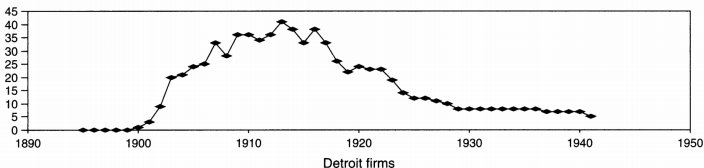
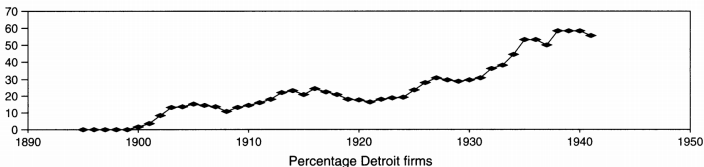
Figure 2 Annual Sales of Passenger Cars, 1900–1938



Detroit

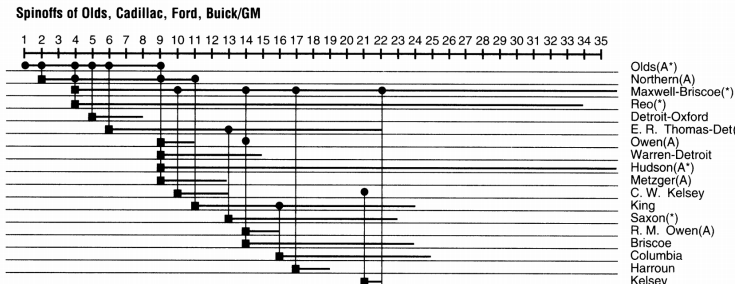
Klepper (2007) Disagreements, Spinoffs, and the Evolution of Detroit as the Capital of the U.S. Automobile Industry.

- Data on all automobile firms over time



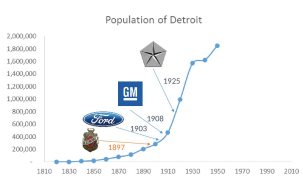
Detroit: spinoffs

- ▶ Information on background of founders of new companies
 - ▶ Spinoffs: companies founded by persons with previous experience in industry
 - ▶ Entrepreneurs without previous experience
- ▶ Genealogy of the car industry:



Detroit

- ▶ Old Motor Works located in Detroit 1898, followed by Ford GM Cadillac
- ▶ These companies spawned many succesful spinoffs



What explains survival of automobile firms?

Table 3 Coefficient Estimates of the Hazard Model

Variable	Model 1	Model 2
Constant	-1.5145*** (0.1046)	-1.5376*** (0.1046)
<i>t</i>	0.0601*** (0.0143)	0.0587*** (0.0141)
Detroit	-0.2928** (0.1297)	0.0163 (0.1530)
Experienced firms	-0.4146*** (0.1467)	-0.4098*** (0.1467)
Experienced entrepreneurs	-0.5015*** (0.1524)	-0.5360*** (0.1532)
Spinoffs	-0.5639*** (0.1217)	-0.3917*** (0.1287)
<i>C1</i>	-0.1505 (0.1357)	-0.1522 (0.1350)
<i>C2</i>	0.0332 (0.1291)	0.0152 (0.1291)
<i>C1 * t</i>	-0.0878*** (0.0162)	-0.0852*** (0.0160)
<i>C2 * t</i>	-0.0490*** (0.0175)	-0.0413*** (0.0176)
<i>C, b, e firms</i>	-0.4052** (0.1928)	-0.4145** (0.1928)
<i>C, b, e entrepreneurs</i>	-0.2408 (0.2023)	-0.2341 (0.2023)
Detroit spins		-0.7826*** (0.2590)

Detroit

- ▶ Spatial clustering due to: brains moving, success breeds success:
 - ▶ The Big Four (Old Motor Works, Ford, GM, Cadillac) happened to locate in Detroit.
 - ▶ The Big Four spawned many spinoff companies
 - ▶ Spinoffs perform better than the average firm in the industry
 - ▶ Spinoffs locate close to where their parents are located
 - ▶ Better performing spinoffs spawn better performing spinoffs
- ▶ Brains moving tacit knowledge, jumping to nearby trees
- ▶ Spatial concentration in Detroit just an accident? Happened to get early entrants
- ▶ Location-specific features may be absent, or even have a negative impact

Spinoffs in Silicon Valley

54 out of 56 Silicon Valley companies with known background are spinoffs



Firm	Years (through 1986)	# Spinoffs
<i>Silicon Valley producers</i>		
Fairchild	1957-1986	28
National	1967-1986	9
Intel	1968-1986	6
Signetics	1961-1975	5
Intersil	1967-1981	4
Synertek	1973-1985	4
Semi Processes	1975-1985	4
AMI	1966-1986	3
AMCC	1979-1986	3
Seeq	1981-1986	3
Amelco	1961-1986	2
Micro Power	1971-1986	2
Raytheon/Rheem	1961-1986	1
Siliconix	1963-1986	1
Avantek	1965-1986	1
AMD	1969-1986	1
Exar	1971-1986	1
Cal-tex	1971-1975	1
Nitron	1972-1985	1
Zilog	1974-1986	1
Supertex	1976-1986	1
Exel	1983-1986	1

Most of them are
connected to Fairchild

Source: Klepper, Steven. "The origin and growth of industry clusters: The making of Silicon Valley and Detroit." *Journal of Urban Economics* 67, no. 1 (2010): 15-32.

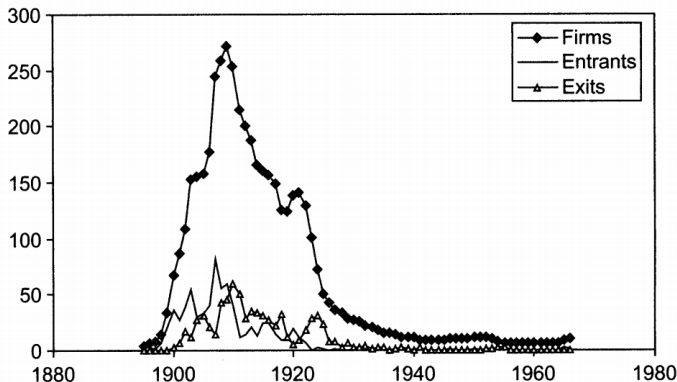
Spinoffs: moving brains

- ▶ Spinoffs: moving brains, tacit knowledge, rather than moving knowledge across brains

Spatial evolution along the industry cycle

- ▶ Entry, growth, shakeout
- ▶ Spatial concentration of an industry: what about the shakeout?

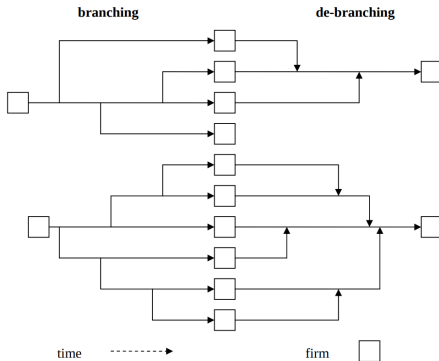
Figure 1 Entry, Exit, and Number of Firms



Spatial diffusion of capabilities within industry over time

► Industry life cycle and shakeout

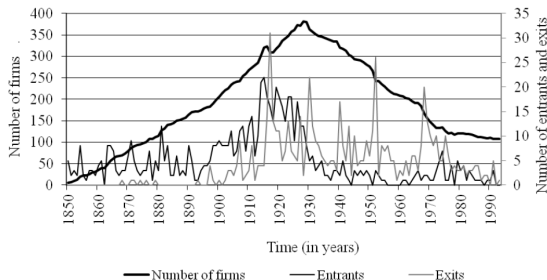
Figure 7. Branching (through spinoff process) and de-branching (through M&A activity) of organizational routines



Study on spatial evolution of banking sector in The Netherlands

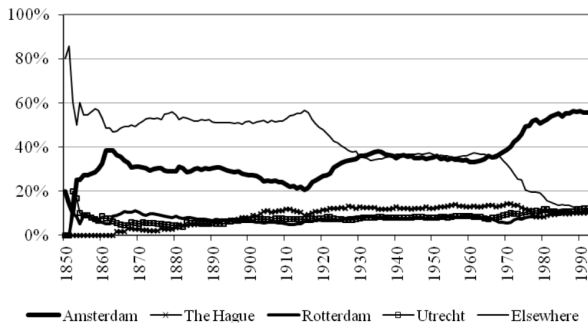
- ▶ Why did banking industry concentrate in Amsterdam?
- ▶ Mid 19th century onwards: emergence of modern Dutch banking sector (particularly Bank Act of 1863)
- ▶ Collected data on all banks in The Netherlands from 1850 onwards (year entry, location, background founder etc.)
- ▶ Also: type of exit

Figure 4.1: The number of firms, entrants and exits in the Dutch banking industry, 1850–1993



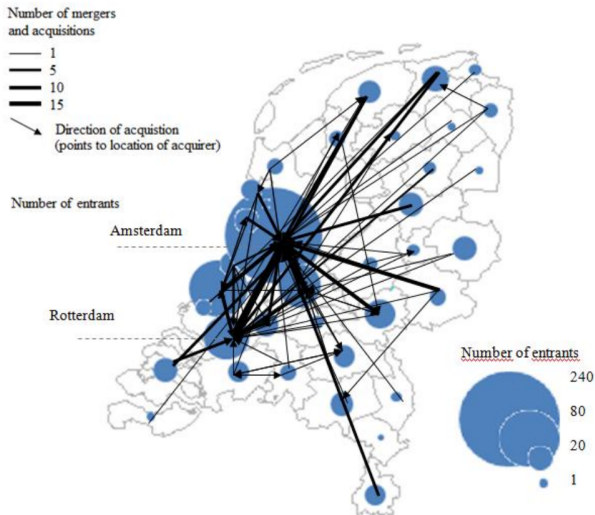
Spatial concentration in Amsterdam

Figure 4.4: Shares of the four major urban Dutch regions in total number of banks, 1850–1993

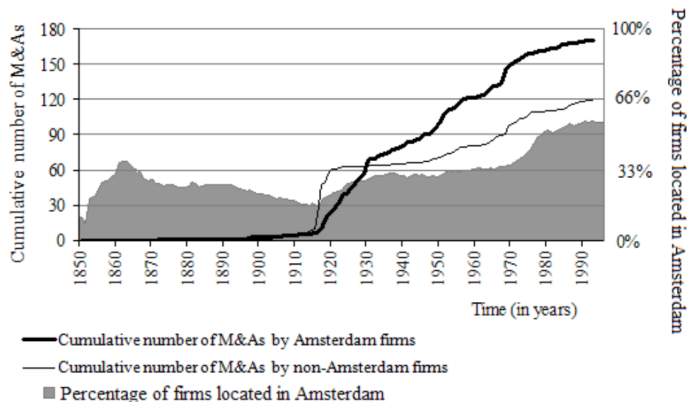


Spatial concentration in Amsterdam

Figure 4.6: Spatial distribution of M&As in Dutch banking industry, 1850–1993.



M&As during shakeout of industry



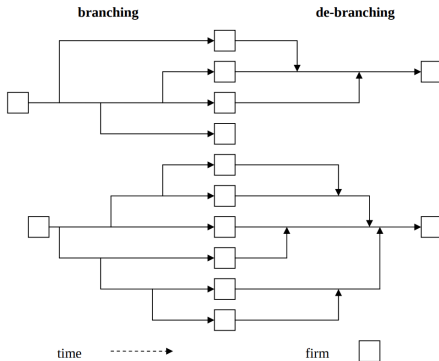
M&As and survival

<i>Variable</i>	<i>Dependent Variable: Probability of Exit Due to Failure</i>	<i>Dependent Variable: Probability of Exit Due to Acquisition</i>
Ln_cumM&A	-0.689** (0.271)	0.168 (0.118)
Amsterdam	0.330** (0.135)	-0.682*** (0.182)

Spatial diffusion of capabilities within industry over time

- M&As: moving 'words' across regions rather than 'letters'

Figure 7. Branching (through spinoff process) and de-branching (through M&A activity) of organizational routines



Mechanisms of industry concentration

- ▶ De Vaan, Frenken, Boschma (2017): Spinoffs matter first, localization economies matter at a later stage

978 • De Vaan et al.

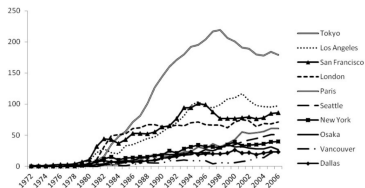


Figure 5. Annual number of firms in the top 10 regions worldwide.

972 • De Vaan et al.

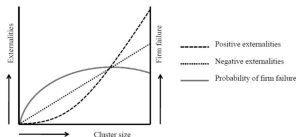


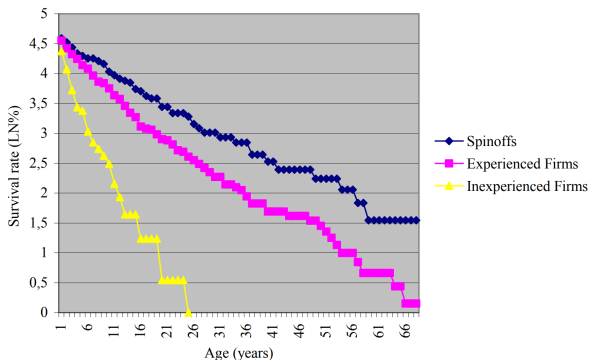
Figure 1. Expected relation between cluster size, externalities and firm failure.

- ▶ 'Window of locational opportunity' (Michael Storper's work) closes over time for firms

Mechanisms of industry concentration

- ▶ Boschma Wenting (2007): why did British car industry concentrate in Birmingham Coventry?
 - ▶ Not just spinoffs but *related* experience (bicycle / coach making) that mattered, especially in the early stage

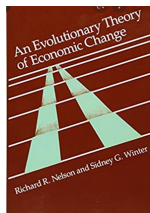
Figure 4. Survival curves by entrepreneurial background.



- ▶ Related diversification at regional level
- ▶ Moving brains easier than moving knowledge across brains

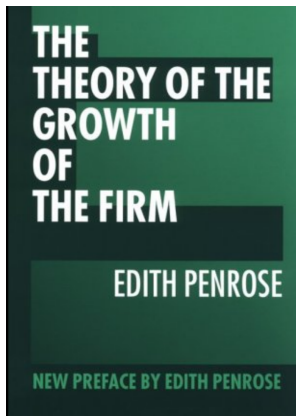
Evolutionary economics and regional branching

- ▶ Regional branching: Field of 'evolutionary economic geography' (Boschma Frenken 2009, 2018)
- ▶ Evolutionary economics
 - ▶ Firms operate on the basis of (tacit, learning-by-doing hard-to-imitate) routines and bounded rationality (Nelson and Winter 1982)
 - ▶ Schumpeterian innovation: competition based on developing new products and technologies that require new routines
 - ▶ e.g. M&As?



Knowledge diffusion and regional branching

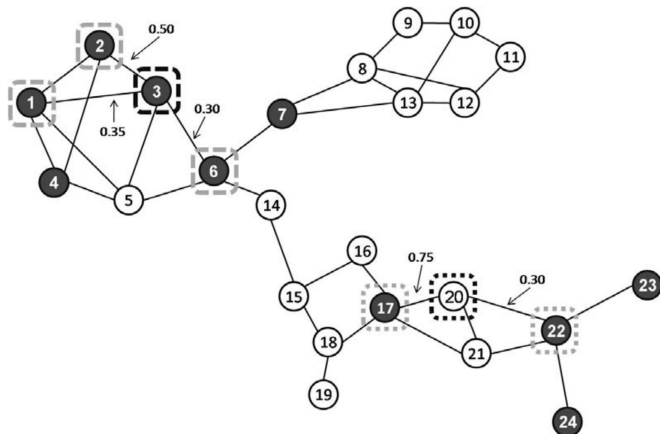
- ▶ Penrose (1959): resource-based view of the firm
 - ▶ Firm search for new opportunities in their local capability space
 - ▶ Firm growth is a process of related diversification
- ▶ Similarly for regional development: study the spatial distribution of routines over time: how do regions acquire new capabilities?



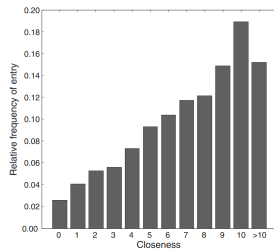
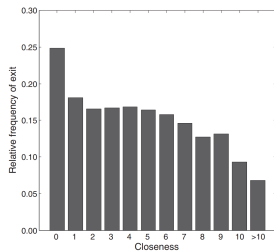
Regional diversification: Sweden

- ▶ Neffke Henning and Boschma 2011: diversification of Swedish regions (entries and exits of industries) between 1969 and 2002
- ▶ They use product data of all plants in Sweden, in every year, for this period

Regional diversification Sweden, regional entries and exits of industries



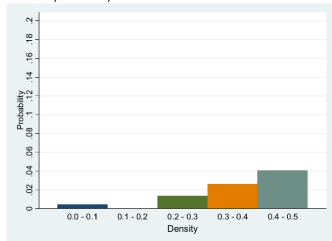
Regional diversification Sweden, regional entries and exits of industries



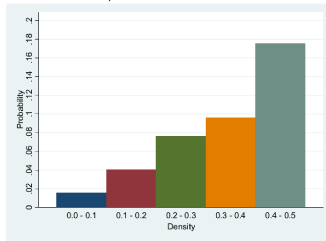
Regional diversification: Density at regional level matters more than country level

- ▶ Boschma, R., Minondo, A. and Navarro, M. (2013), New industries and relatedness in regions. *Economic Geography*, 89: 29-51
- ▶ Probability of transitioning into new products for Spanish provinces, 1988-2008 (5 yr intervals)

3a. Country-level density.



3b. Province-level density.

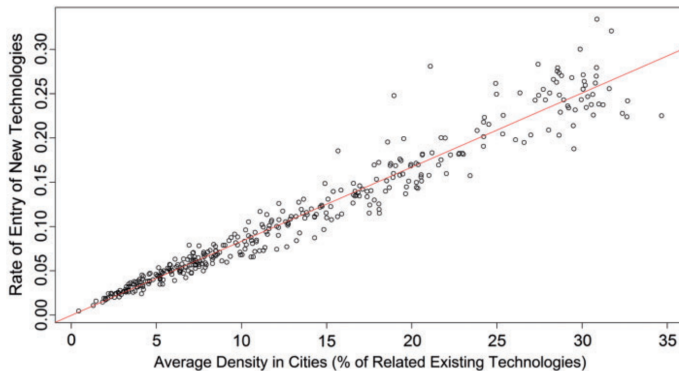


What about new technologies?

- ▶ Boschma, Balland, Kogler, Relatedness and technological change in cities (US 1981 - 2010)
- ▶ 'Technology space' Co-occurrences of patent classes in cities



Technological diversification of cities



- ▶ U.S. cities
 - ▶ Have coherent sets of technologies
 - ▶ Diversify into related technologies
 - ▶ Abandon unrelated technologies

Technological space and re-invention of cities

► Role of agents?

Figure 1: Evolution of normalized patent output by city

The figure depicts a city's share of total US patents in a year, divided by its share of US population between 1850 and 1975, using the HISTPAT dataset and IPUMS Census records.

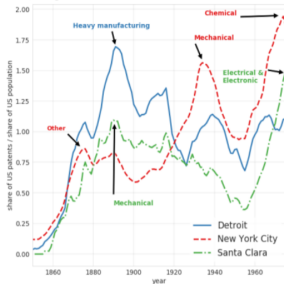


Table 1: Top 5 overrepresented (Location Quotient) technologies in New York City

1873

US315: Electric lamp and discharge devices: systems

US270: Sheet-material associating

US216: Etching a substrate: processes

US150: Purses, wallets, and protective covers

US435: Chemistry: molecular biology and microbiology

1934

US725: Interactive video distribution systems

US360: Dynamic magnetic information storage and retrieval

US377: Electrical pulse counters, pulse dividers, or shift registers: circuits and systems

US358: Facsimile and static presentation processing

US370: Multiplex communications

1975

US314: Electric lamp and discharge devices: consumable electronics

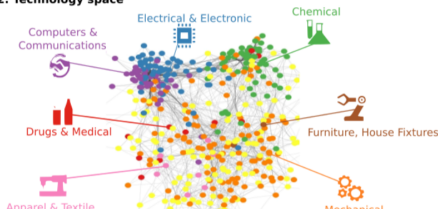
US510: Cleaning compositions for solid surfaces or processes of preparing the compositions

US512: Perfume compositions

US930: Peptide or protein sequence

US518: Chemistry: fischer-tropsch processes

Figure 2: Technology space



Structural transformation

- ▶ How do regions acquire new capabilities? (rather than firms)
- ▶ Regional knowledge base may become obsolete: “Detroit has become a Motor city run out of gas” (Daily Mail 2013)
- ▶ Regions need to reinvent themselves (e.g. ‘Smart Specialization’ policy in European Union)

Agents of structural change in regions

- ▶ Paper with Frank Neffke, Martin Henning, Ron Boschma
- ▶ Which agents are responsible for structural transformation?
- ▶ Swedish administrative records on population
 - ▶ 9 M individuals, captured from age 15
 - ▶ Demographics
 - ▶ Education
 - ▶ Work (establishment of work, wage, etc.)
 - ▶ Activities of establishments
- ▶ Trace plants and career paths, 1994-2010

Structural change

Regions: 110 labor market regions in Sweden, 1994 - 2010

Structural change in regions

	STATIC	DYNAMIC
Activities	Diversity How many different activities are there in a region? How equal is their size distribution? (e.g. entropy measure)	Industrial change To what extent are new activities introduced over time? (Traditional shift and share analyses – e.g. cosine distance measure)
CAPABILITIES	Cohesion How similar are the capabilities used by the various industries in the region? i.e. how related are the industries in a region to one another?	Structural change To what extent does the capability base of regions change over time? Which agents induce structural change?

Structural change

Which diversification is greater?



+



Agents

- ▶ Incumbent plants:
 - ▶ growth
 - ▶ decline
 - ▶ exits
 - ▶ switch activity
- ▶ regional entries (new plants): regional and non-regional entrepreneurs + expanding firms

Measuring relatedness

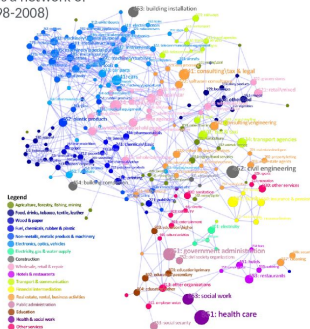
- ▶ Relatedness between industries: 'Skill relatedness measure' by Neffke and Henning (2013):
the extent to which labor flows between industries are excessive, i.e. compared to baseline

$$SR_{ij} = \frac{F_{ij}}{(F_{i.} F_{.j}) / F_{..}}$$

- ▶ Based on 4.5 million job switches in Sweden, 1994 - 2010
- ▶ Skill relatedness:
 - ▶ Input-based rather than output-based
 - ▶ Symmetric
- ▶ Outcome-based relatedness: Does not tell you how activities are related
 - ▶ Is it labor? Capital? Technologies? etc.
- ▶ But: industries can be related in many different dimensions; human capital is just one of these

Alternative: Skill relatedness

The German labor market as a network of human capital linkages (1998-2008)



Neffke/Hidalgo/Otto/Weyh 2013

Measuring structural change

E = emp, i = industry, r = region, t = time , SR = skill-relatedness $SR_{ij} = \frac{F_{ij}}{(F_i, F_j)/F_{..}}$

Related employment in region:

$$E_{irt}^{rel} = \sum_j I(SR_{ij} > 1) E_{jrt}$$

'(Skill) Match' to region

$$LQ_{irt}^{rel} = \frac{E_{irt}^{rel} / E_{.rt}}{E_{i..t}^{rel} / E_{..t}}$$

$$M_{irt} = \frac{LQ_{irt}^{rel} - 1}{LQ_{irt}^{rel} + 1}$$

Regional skill cohesion

$$C_{rt} = \sum_i \frac{E_{irt}}{E_{.rt}} M_{irt}$$

$$C_{rt}^{base} = \sum_i \frac{E_{i..t}}{E_{..t}} M_{irt}$$

Regional structural change

$$S_{rt,T} = \sum_i \frac{E_{irt}}{E_{.rt}} M_{irT}$$

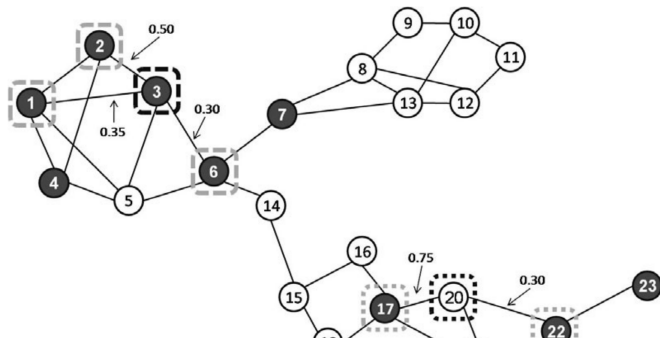
- by agent

$$A_{rt,T}^a = \sum_i \frac{\Delta E_{irt,T}^a}{\Delta E_{.rt,T}^a} M_{irT}$$

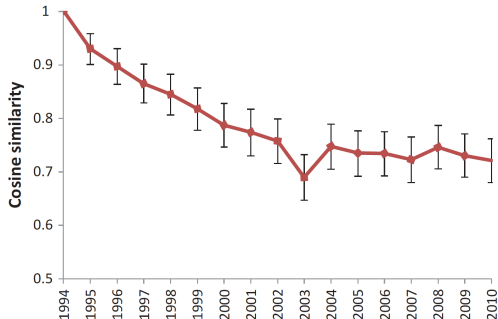
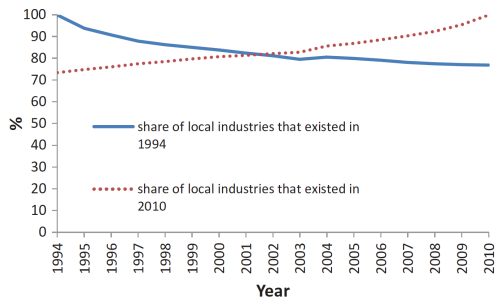
$$A_{rt,T}^a = A_{rt,T}^a - C_{rT}$$

Structural transformation in Sweden, regional entries and exits

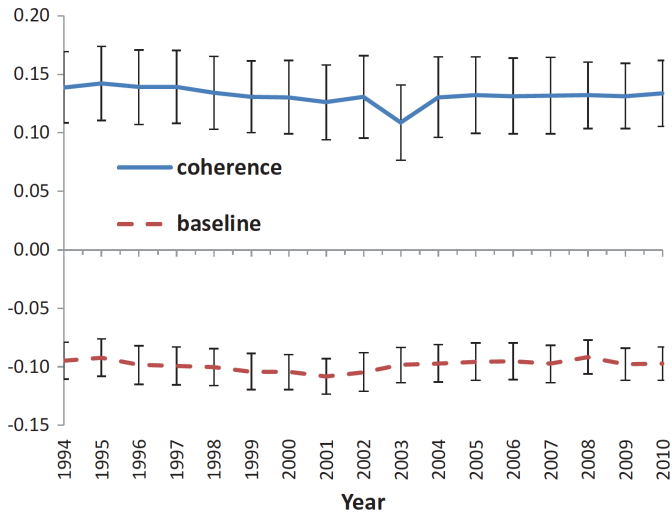
- ▶ New plants in local industries by:
 - ▶ Entrepreneurs, from within the region (local) and elsewhere (non-local)
 - ▶ Existing firms, local and non-local
- ▶ Who enter industries that are unrelated to most of the existing industries in a region (i.e. low 'density')? And how long do they survive there?



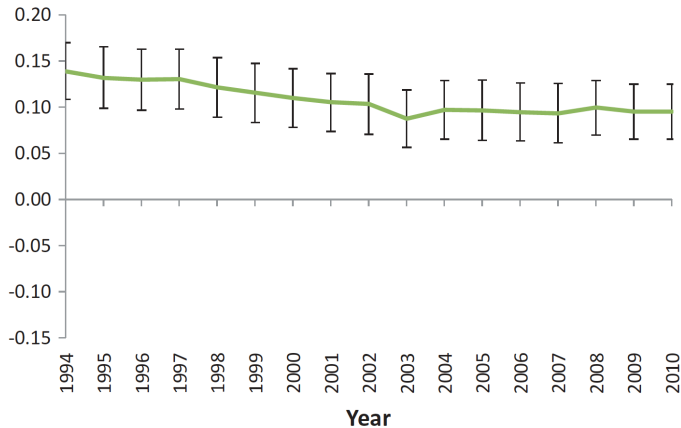
Change in regional activities



Change in regional skill cohesion



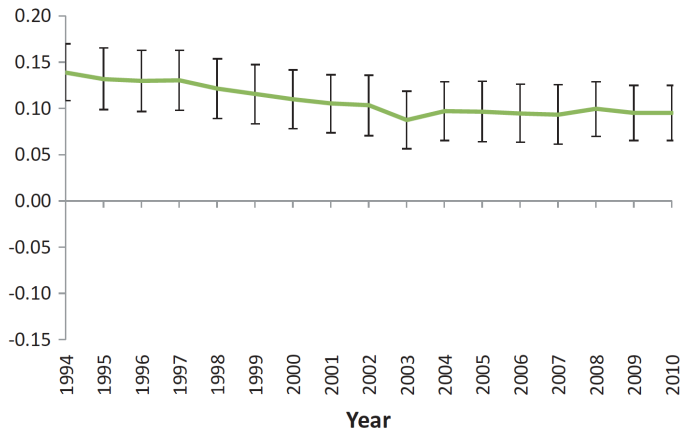
Structural change in regions



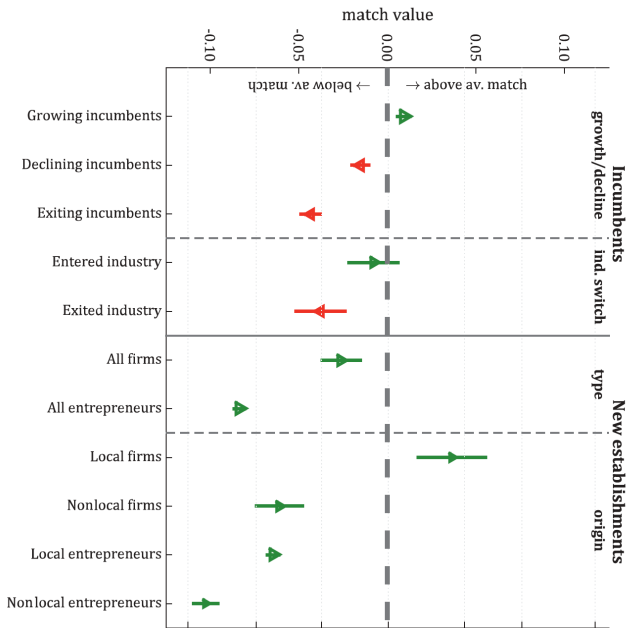
Structural change in regions

► Regional structural change

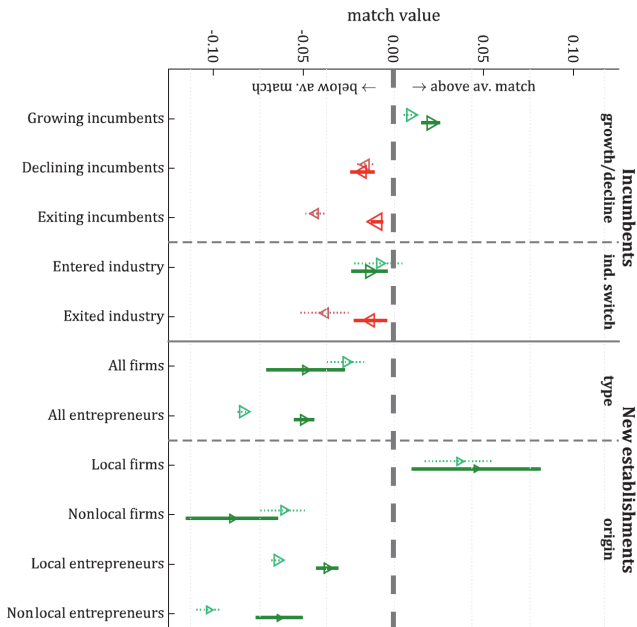
$$S_{rt,T} = \sum_i \frac{E_{irt}}{E_{.rt}} M_{irT}$$



Structural change in regions by agents (1 year)



Structural change in regions by agents (10 years)



Structural change in regions by agents (10 years)

- ▶ New capabilities come from outside the region
- ▶ Non-local firms main agents of structural change

Capability match of agents to where they came from

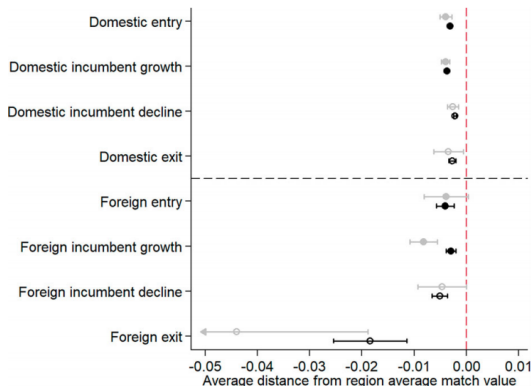
Average Capability Match of Nonlocal Agents to Home and Host Region

Agent Type	Capability Match to:	
	Home Region	Host Region
Nonlocal expanding firms	0.072 (0.004)	-0.019 (0.004)
Nonlocal entrepreneurs	0.001 (0.002)	-0.019 (0.002)

Note: Average capability match to home and host region (standard errors in parentheses). p-value test for capability match to home versus host region.

Foreign firms agents of structural change

- ▶ Zoltán Elekes, Ron Boschma & Balázs Lengyel (2019)
Foreign-owned firms as agents of structural change in regions,
Regional Studies, 53:11, 1603-1613
- ▶ Foreign firms induce more regional structural change than
non-foreign firms



Agents of structural change in regions

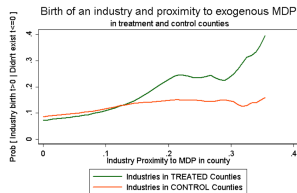
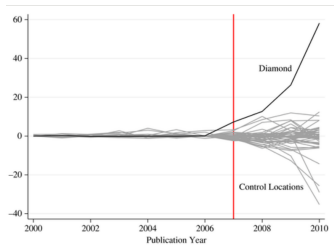
- ▶ Agents of change: Capabilities diffuse through the mobility of entrepreneurs and firms
- ▶ In the long run mainly: non-local firms are main agents of structural change
- ▶ Like Klepper: importance of moving brains

Spillovers from new capabilities entering a region?

- ▶ Hard to study because of endogenous location choices
- ▶ Helmers, C. and Overman, H.G. (2016) My Precious! The Location and Diffusion of Scientific Research: Evidence from the Synchrotron Diamond Light Source. *Economic Journal* 127, 604, pp. 2006-2040.

Impact of Diamond Light Source synchrotron (Helmets, Overman 2016)

- ▶ Establishment of \$380m research facility in 2007 in Oxfordshire
- ▶ Instrumental Variable strategy: 'Runner-up' regions known and creation of synthetic controls
- ▶ N of related publications in surrounding cities



NOTENOTENOTE—

synchrotron = circular particle accelerator

Million dollar plants

- ▶ Greenstone, M., Hornbeck, R. and Moretti, E. (2010) Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings. *Journal of Political Economy* 118 (3), pp. 1-45
- ▶ Again: Runner-up regions known
- ▶ TFP 12 percent higher for incumbents in winning counties
 - ▶ Particularly for those sharing labor and technology with new plant)

Million dollar plants

► Sebastian Bustos & Ricardo

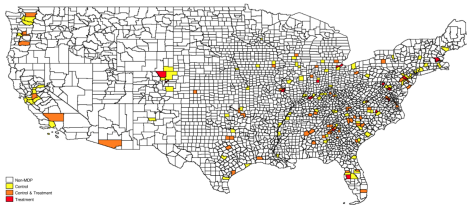
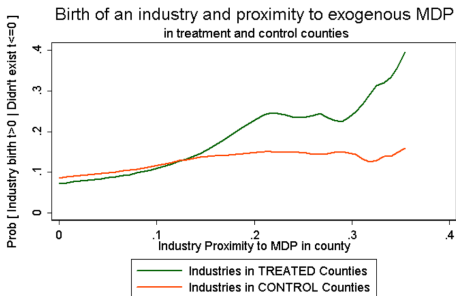


Figure 1. Map of counties in Million Dollar Plants

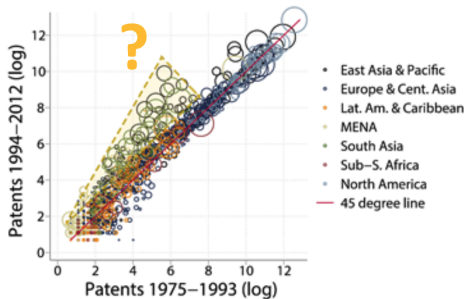


Foreign firms and regional innovation

- Crescenzi, Dyevre and Neffke (2022) Catalysts of Regional Innovation: How foreign firms allow new places join the global innovation contest.

Global inventive activity

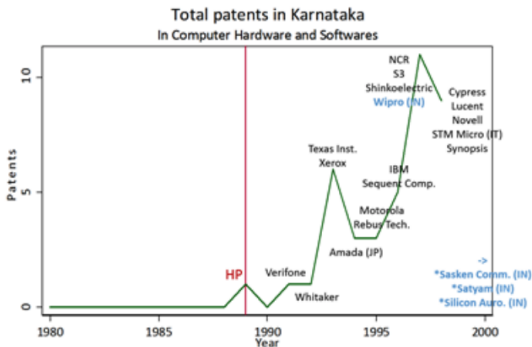
Patents in region before and after 1994



USPTO data

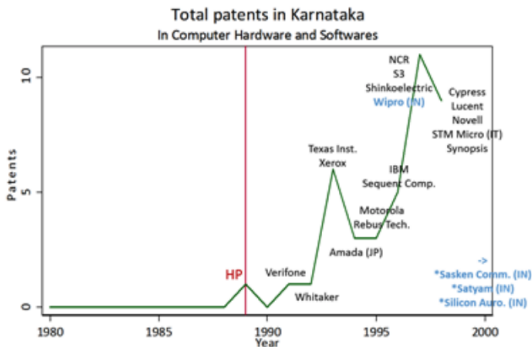
Foreign firms and regional innovation (Crescenzi et al.)

HP in Bangalore



Foreign firms and regional innovation (Crescenzi et al.)

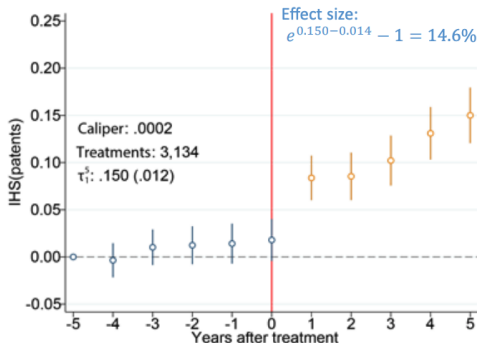
HP in Bangalore



Foreign firms and regional innovation (Crescenzi et al.)

- Difference-in-difference + propensity score matching regions

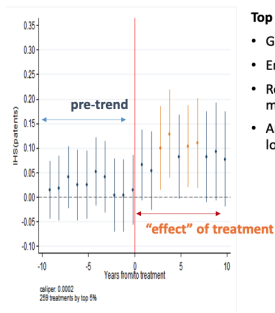
Difference-in-differences *All patents*



Foreign firms and regional innovation (Crescenzi et al.)

Difference-in-Differences

Patents by top 5% firms



Top 5% firms

- Go to less developed regions
- Engage in fewer local alliances
- Rely less on the local labor market and more on internal transfers
- Are less likely to be cited by patents by local firms

Global industry space: Metroverse

- ▶ Developed by Growth Lab team in 2020-2021, launched on June 2 2021

The Metroverse Team



Ricardo Hausmann,
Principal Investigator



Frank Neffke,
Research Director



Yang Li,
Postdoctoral Fellow



Douglas Barrios
Senior Manager,
Applied Research



José Ramón Morales-Arilla,
Research Fellow



Annie White,
Senior Product Manager



Nil Tuzcu,
Information Designer



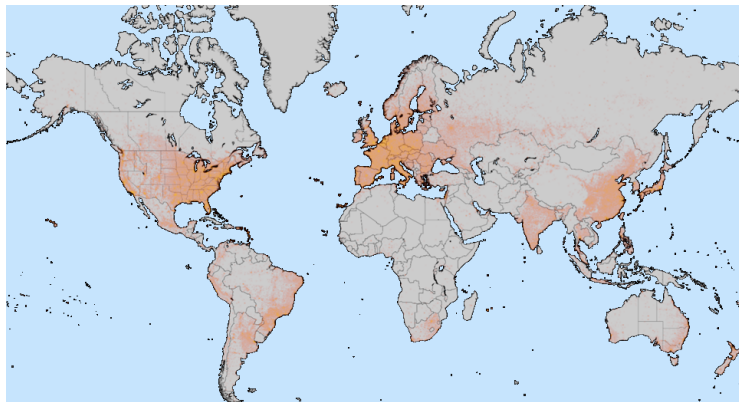
Kyle Soeltz,
Front-end Developer



Brendan Leonard,
Data & Back-end Developer

- ▶ Based on worldwide Dun and Bradstreet data
 - ▶ 170 million establishments
 - ▶ with location (lat lon), industry, employment information

Global industry space: 'Metroverse'



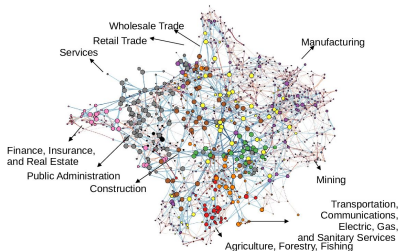
Detroit



Industry space

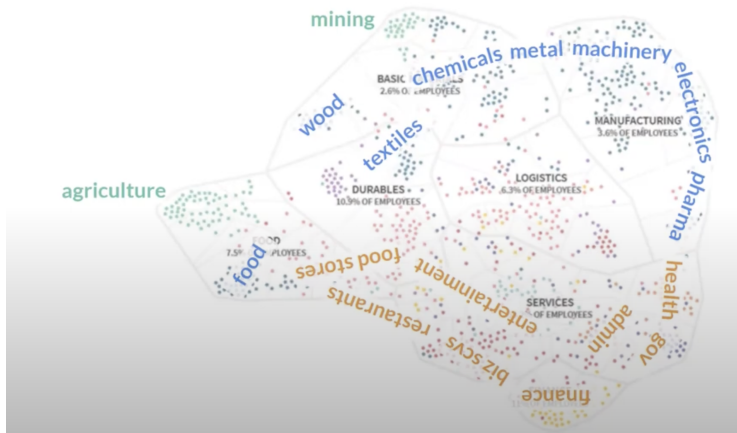
Industry space based on co-production in establishments: Multiple industry codes (6 digit NAICS) per establishment

The global industry space



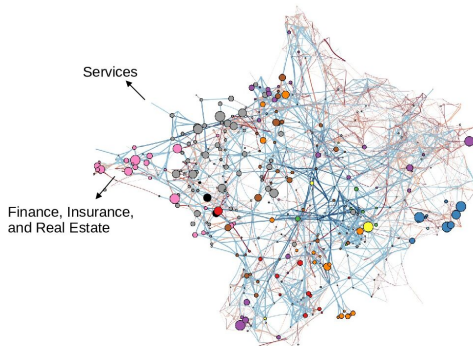
- ▶ Yang Li and Frank Neffke 2022 Grid Search paper:
 - ▶ Relatedness at different levels of aggregation may sometimes be spurious:
e.g. ski resorts and hydroelectric power plants colocating at regional level

The industry space

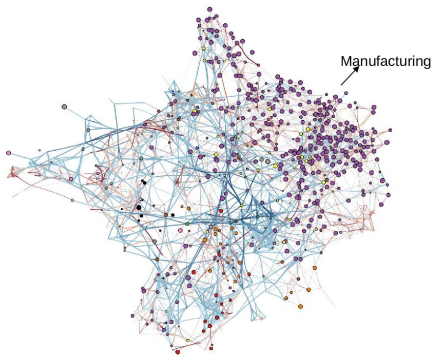


(e.g. blue dots = manufacturing, yellow = services)

London



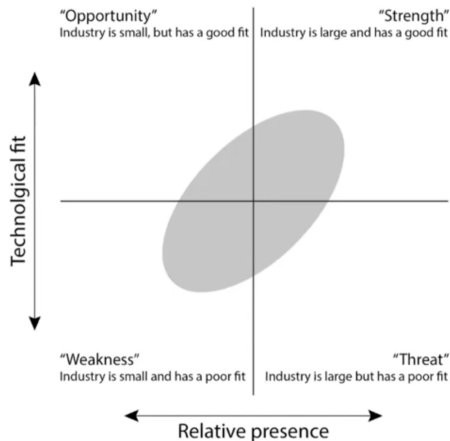
Shanghai



Understanding city potential

- Use to e.g. policy makers

Understanding your city's potential



Link to Metroverse

- ▶ Explore interactively

`https://metroverse.cid.harvard.edu/city/5705/
industry-position?benchmark=global_pop&cluster_
overlay=overlay`
(London)

- ▶ Launch event:

`https://www.youtube.com/watch?v=bh5\_E8Ji8bs`

Subnational Atlases

- ▶ Subnational Atlases:
 - ▶ Colombian Atlas of Economic Complexity
 - ▶ Collaboration between Growth Lab and Colombian government
 - ▶ Mexican Atlas of Economic Complexity
 - ▶ Collaboration between Growth Lab, Mexico's Ministry of Finance, Center for Research and Teaching of Economics (CIDE)
 - ▶ In addition to *Product space*, these Atlases also include the *Industry space* - measured by labor flows (skill relatedness)

Colombian Atlas of Economic Complexity

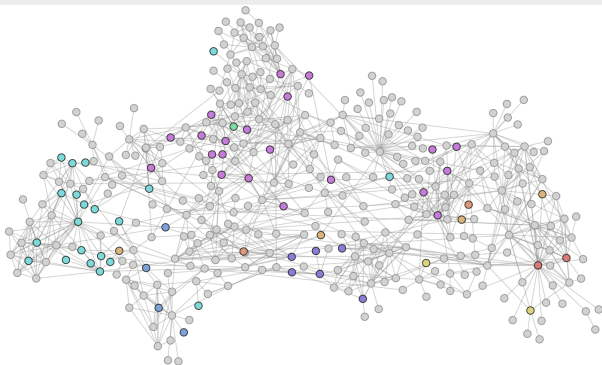
<http://datlascolombia.com/#/location/12/source/industries/visualization/similarity/rca?endDate=2017&locale=en-col&startDate=2017>

- Choco region (gold rush in 19th century)
(bottom right)

Industries with revealed comparative advantage >1 (colored) and <1 (grey): (2017)

Highlight industries on the graph below

Highlight

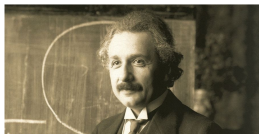


Mexican Atlas of Economic Complexity

`https://datos.gob.mx/complejidad/#/location/378?
locale=en-mex`

Conclusion

- ▶ Importance of geographical proximity: knowledge is sticky, diffusion mechanisms (spillovers, spinoffs, networks etc.) are very local
- ▶ Key to structural transformation is moving brains
- ▶ Important to understand the mechanisms of knowledge diffusion
 - ▶ e.g.: Albanian return migrants, Business travel, Immigrants, New Argonauts (Saxenian), German Jewish émigrés, H1B influx and so on... (next lecture)



Questions?

- ▶ Contact me at matte_hartog@hks.harvard.edu or drop by the fifth floor in the Rubenstein building, office 524.