

Stylised facts about cities

GY 404

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2006—A major Landmark

Some time this year, **half** of the world population will be urbanised

Main sources

- **Duranton**
 - “Urban evolutions” (2005)
- Duranton and Puga
 - Urban Studies (2000)
- Holmes and Stevens
 - Handbook of Urban and Regional Economics, vol. IV (2004)
- Combes and Overman
 - Handbook of Urban and Regional Economics, vol. IV (2004)

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- **Introduction**
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Core-Periphery patterns

- Uneven distribution of population
- Uneven distribution of income
- Multi-scale phenomenon:
 - Continental (Europe and US vs. rest of the world)
 - Large regions within continents (e.g., Manufacturing belt, Europe's blue banana, etc)
 - Regions within countries (e.g., Japan's Kanto region, Germany's Ruhr, Ile de France, etc).

Core-Periphery patterns

- Production is spatially concentrated
 - **East Asia:** pop=1.6 billion in 1990
 - Japan: 3.5% of land area, 7.9% of pop...
... but 72% of GDP and 67% of manufacturing GDP
 - Core=3 metro areas (Tokyo, Osaka, Nagoya)
 - The five prefectures represent 5.2 % of area of Japan
 - but 33% of its pop.
 - 40% of its GDP
 - 31% of manufacturing employment
 - .18% of East Asia area but 29% of its GDP!

Core-Periphery patterns

- *Production is spatially concentrated*
 - **US: 100 most active counties**
 - 1.5% of US land area
 - 41.2% of US manufacturing employment
 - **France: Ile-de-France (Paris metro area)**
 - 2.2% of area, 18.9% of its population, 30% of its GDP
 - Inside Ile-de-France, only 12% of available land used for housing, plants and roads
 - (88% forests, agriculture, natural activities)
- **Our focus: Cities**

What is a city?

- Variety of definitions
- Usually two thresholds (bar **UK**)
 - Minimum size
 - **US**: 2,500 inhabitants; **France**: 5,000
 - Minimum density
 - **US**: 1,000 per sq mile; **France**: 2 constructions < 50m
- Economic vs. administrative definitions
- Metro areas vs. cities
 - Commuting patterns

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Stylised fact 1

- Productivity gains increase with the size of agglomeration

→ It must be beneficial for firms and households to cluster

- Holds across a number of efficiency measures: output per worker, TFP, wages, etc (Rosenthal and Strange, 2004)
- Standard elasticities in the 2 – 6 % range
- E.g. Doubling city size increases manufacturing productivity by around 6%
 - NYC (10 M) ~ 50% more productive than city of 50,000

Stylised fact 3

- Urbanised areas are growing over time

	1950	1970	2000	2006	2025
<i>Africa and Asia</i>		25%	<40%		
Latin America		50 – 60 %	±70%		
<i>Europe and N. America</i>		>60%	>70%		
World	30%			50%	60%

Urban growth

- Very similar experiences in most countries
 - But for "physical" growth, there are large differences
- US: 'sprawl'
 - Burchfield, Overman, Puga, and Turner (2006)
- Europe: 'containment'
- Rest of the world: in-between

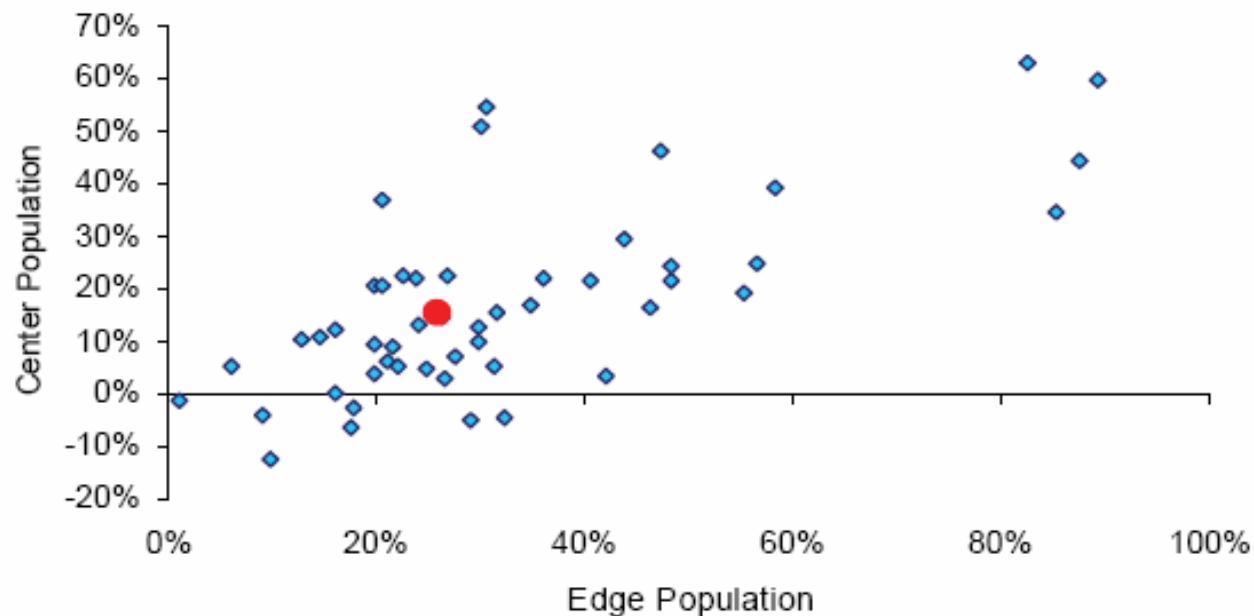
US Sprawl

[Click here for map \(4.276 Kb \)](#)
http://diegopuga.org/papers/sprawl_poster.pdf

US Sprawl ?

- 1980 – 1990 : 50 largest US Metro Areas
 - Population increased in all but Pittsburgh (-.4 %)
 - Average: 21.3%; Maximum: Orlando (+70%)

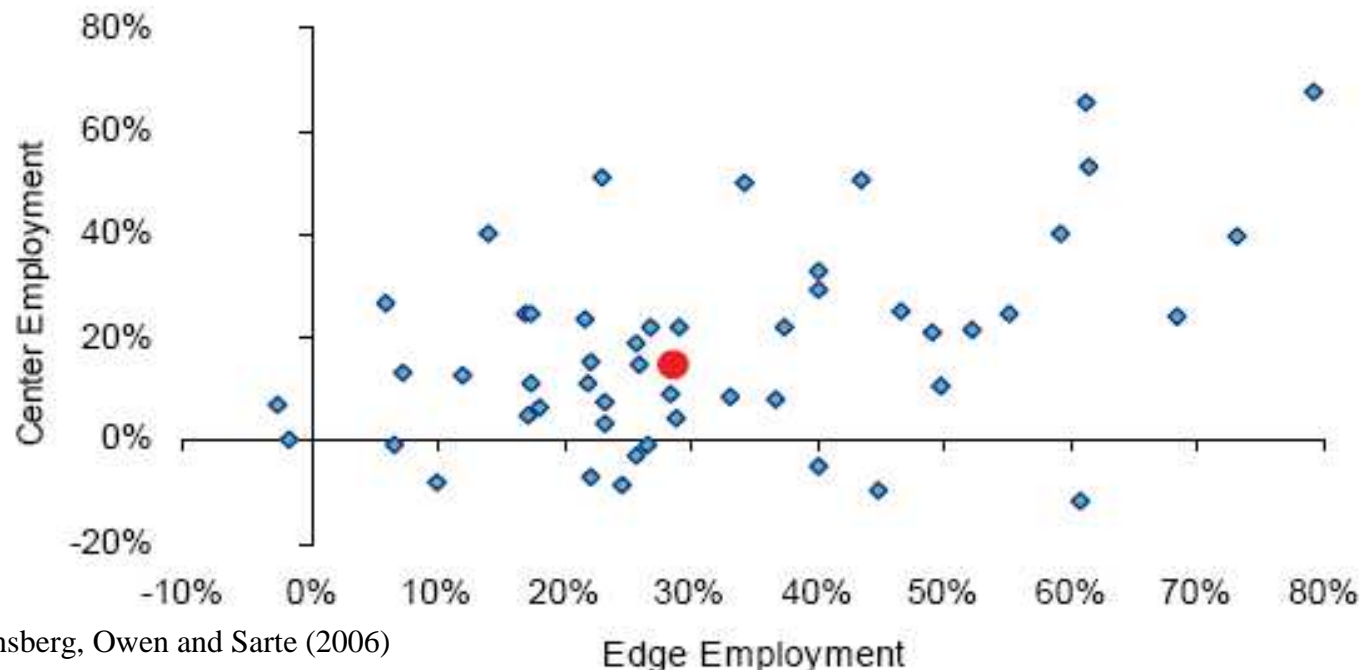
Figure 2: Population Growth, 1980-1990



US Sprawl ?

- Population grew both at centres and edges
 - Las Vegas: +50% in the centre and +80% at edges
 - Employment grew both at centre & in edge counties

Figure 3: Employment Growth, 1980-1990



Source: Rossi-Hansberg, Owen and Sarte (2006)

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Stylised fact 4

- Cities vary considerably in terms of population size
 - In the US:
 - NY: 18 million
 - Kansas City: 1.8 million
 - Lafayette (IN): 180,000
 - Los Alamos (NM): 18,000

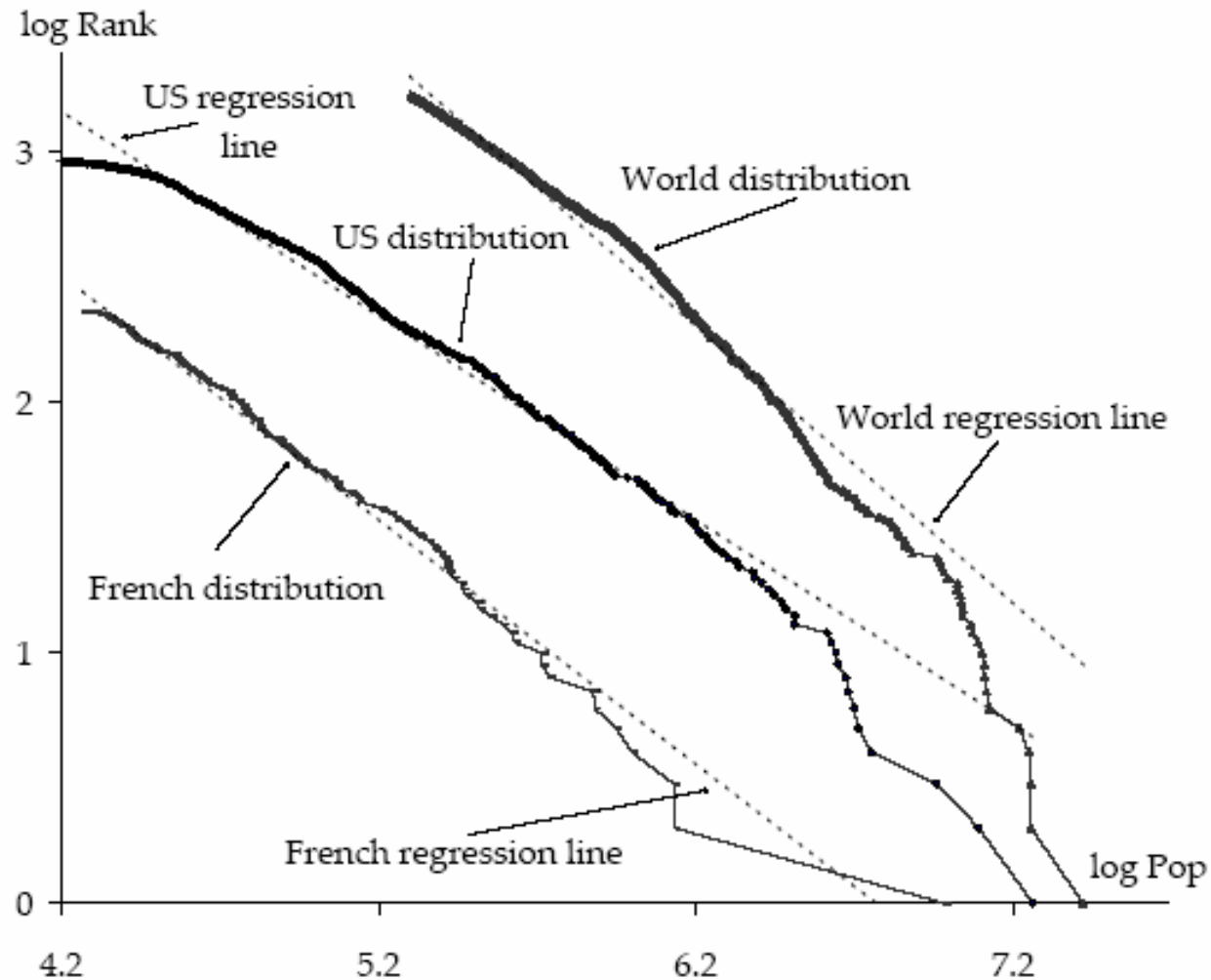
The rank size rule debate

- City size distribution is well approximated by the rank size rule [controversial]
 - Pareto distribution :

$$Rank(i) = \left(\frac{\max Size(i)}{Size(i)} \right)^a$$

- Zip's law: $a \simeq 1$

The rank size rule debate



The rank size rule debate

- Mixed evidence
 - France: $a=.97$
 - USA: $a=.85$
 - World: $a=1.11$
 - 73 countries: See Soo (2005)
- Deviations from ‘rule’
 - Urban primacy
 - Thick and thin lower tails
 - Rotations over time

Stylised fact 5

- City rankings and relative city sizes change slowly over time

Exceptions :

- Pittsburgh (demise of steel industry), Detroit
 - Lost half of their population over 1950 – 1990
 - San Jose (rise of internet-related industries)
 - Phoenix's population increased almost by a factor 10
- Changes in US metropolitan areas are mostly caused by local shocks at the industry level

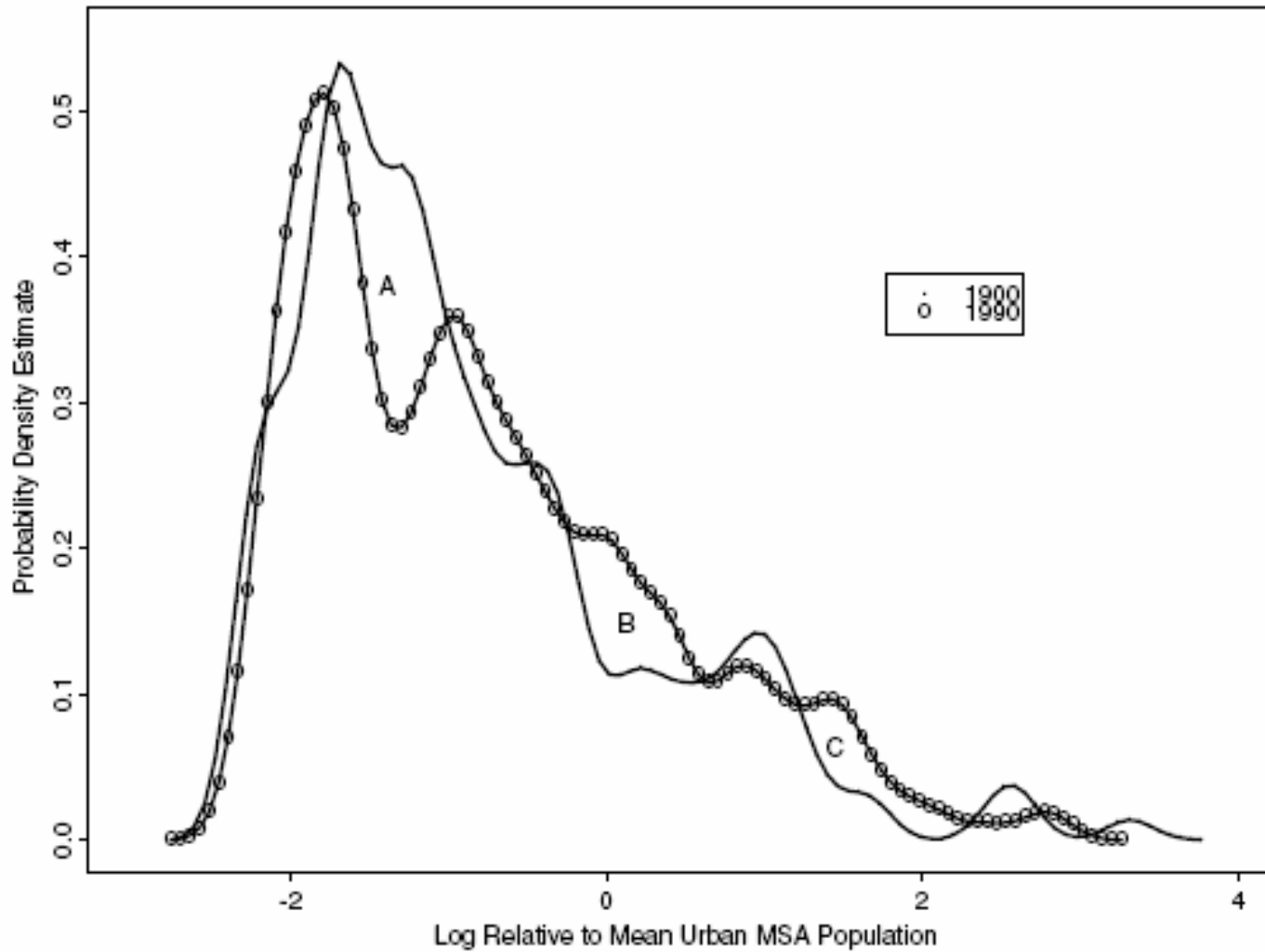
Stability of city rankings

- Parallel urban growth (distribution ~ ergodic)
- Black Henderson (2003) build a transition probability matrix for the US 1900 – 1990

In a typical decade :

- 15% of cities change quintile
- Proportion remaining in top 10% of distribution: 85%
- Proportion in top 10% moving down 10-20% range: 15%
- Proportion remaining in 10-20% range: 79%
- Proportion in 10-20% range moving up to 10%: 8%

Stability of city rankings



Source: Black and Henderson

Stability of city rankings

- Duranton (2005) builds transition probability matrices for the US and France
- Mean first passage from bottom quartile to top quartile
 - France : 320 years
 - USA : 695 years
- Eaton and Eckstein (1997) : pattern of stability is stronger for France and Japan than for the US

Stylised fact 6

- Relative location does not seem to matter
 - Weak evidence on the importance of the relative locations of cities to explain growth
- Dobkins and Ioannides (2000)
 - Larger cities tend to grow at a slower pace
 - But favour the development of neighbours
 - Then negative effect for cities located at a medium distance (80-500 km)
 - Finally, positive effect above 500 km

Relative location

- Black and Henderson (2003)
 - Own-size effect is negative
 - But external market potential effect has first a positive effect and then a negative effect.
- Overman and Ioannides (2001)
 - very weak link between the location of a city and its growth for the late 20th century
- Link with first nature geography and transport networks?
 - (more research needed)

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Stylised fact 7

- Specialised and diversified cities co-exist
 - Most specialised cities in US
 - Tobacco cities: Richmond, Macon, Owensboro
 - Petroleum cities: Galveston, Corpus Christi, Cheyenne
 - Leather cities: Lewiston, Bangor, Laredo
 - Textile cities: Burlington, Danville, Anderson
 - Industrial machinery and equipment cities: Rochester
 - Transport equipment: Flint
 - Least specialised cities: Cincinnati, Buffalo, Chicago, Oakland, Atlanta
 - Most diversified cities: Cincinnati, Oakland, Atlanta, Philadelphia, Salt Lake City, Buffalo

Specialised and diversified cities

Rank	Specialisation		Diversity	
	City (sector)	RZI	City	RDI
1	Richmond, VA (tobacco)	64.4	Cincinnati, OH	166.6
2	Macon, GA (tobacco)	55.0	Oakland, CA	161.2
3	Lewiston, ME (leather)	49.6	Atlanta, GA	159.4
4	Galveston, TX (petroleum)	49.1	Philadelphia, PA	151.4
5	Bangor, ME (leather)	45.6	Salt Lake City, UT	120.8
6	Owensboro, KY (tobacco)	44.4	Buffalo, NY	110.1
7	Corpus Christi, TX (petroleum)	37.6	Columbus, OH	108.3
8	Cheyenne, WY (petroleum)	33.4	Portland, OR	94.1
315	Buffalo, NY (rubber and plastics)	1.6	Lawton, OK	2.4
316	Cincinnati, OH (chemicals)	1.5	Richland, WA	2.4
317	Chicago, IL (metal products)	1.5	Steubenville, OH	2.4

Source: Duranton and Puga (2000), using Black and Henderson's dataset

Specialised and diversified cities

- Absolute **specialisation** index

$$ZI_h = \max_j (s_{hj})$$

– where s_{hj} is the share of industry j in city h

- Relative **specialisation** index

– (some sector account for a larger share of national employment than others)

$$RZI_h = \max_j (s_{hj} / s_j)$$

– where s_j is the share of industry j in national employment

Specialised and diversified cities

- Absolute **diversity** index (inverse of HH index)

$$DI_h = 1 / \sum_j s_{hj}^2$$

- Relative **diversity** index

$$RDI_h = 1 / \sum_j |s_{hj} - s_j|$$

- (This index increases as the composition of activities in the city mirrors more closely the diversity of the national economy)

Specialised and diversified cities

- Note : a city can be simultaneously diversified and specialised
- In practice, the two measures are correlated

Diversified and specialised cities coexist

- Why—Random allocation?
 - Ellison and Glaeser (1997): Most four-digit sectors in the US are too concentrated for their distribution to be random
 - Duranton and Overman (2005): comparable result for the UK
- Why—Localised comparative advantage?
 - Ellison and Glaeser (1999): only one-fifth of the concentration is attributable to observable natural advantages
- Henderson (1997a), using panel-data econometrics:
 - even when fixed effects are accounted for, externalities are important
- Localisation versus urbanisation economies
 - More below

Stylised fact 8

- Industries are mobile
- Evidence of ‘churning’ for France and US (Duranton 2005)
 - Changes in employment at the level of cities and industries are about 10% per year
 - whereas the growth rate of urban population is only about 3% per year

Mobility of industries

- A wealth of extreme cases
 - Flight of textile during the 18th century from the cities of Leiden and Haarlem in Holland to Manchester and Sheffield in the UK (Brezis and Krugman, 1997)
 - "Restructuring" of many industrial cities (e.g., Pittsburgh, Sheffield, etc.)

Mobility of industries

- Mobility of many high-tech industries

Black and Henderson (1999):

- Much faster transitions than population across cities

Henderson (2003) studies 4 high-tech industries and 5 machinery industries 1963–1992

- The leading city in seven out of nine industries has changed
- although specialisation patterns have tended to persist over time

Mobility of industries

- Evidence of simultaneous dispersion and concentration:

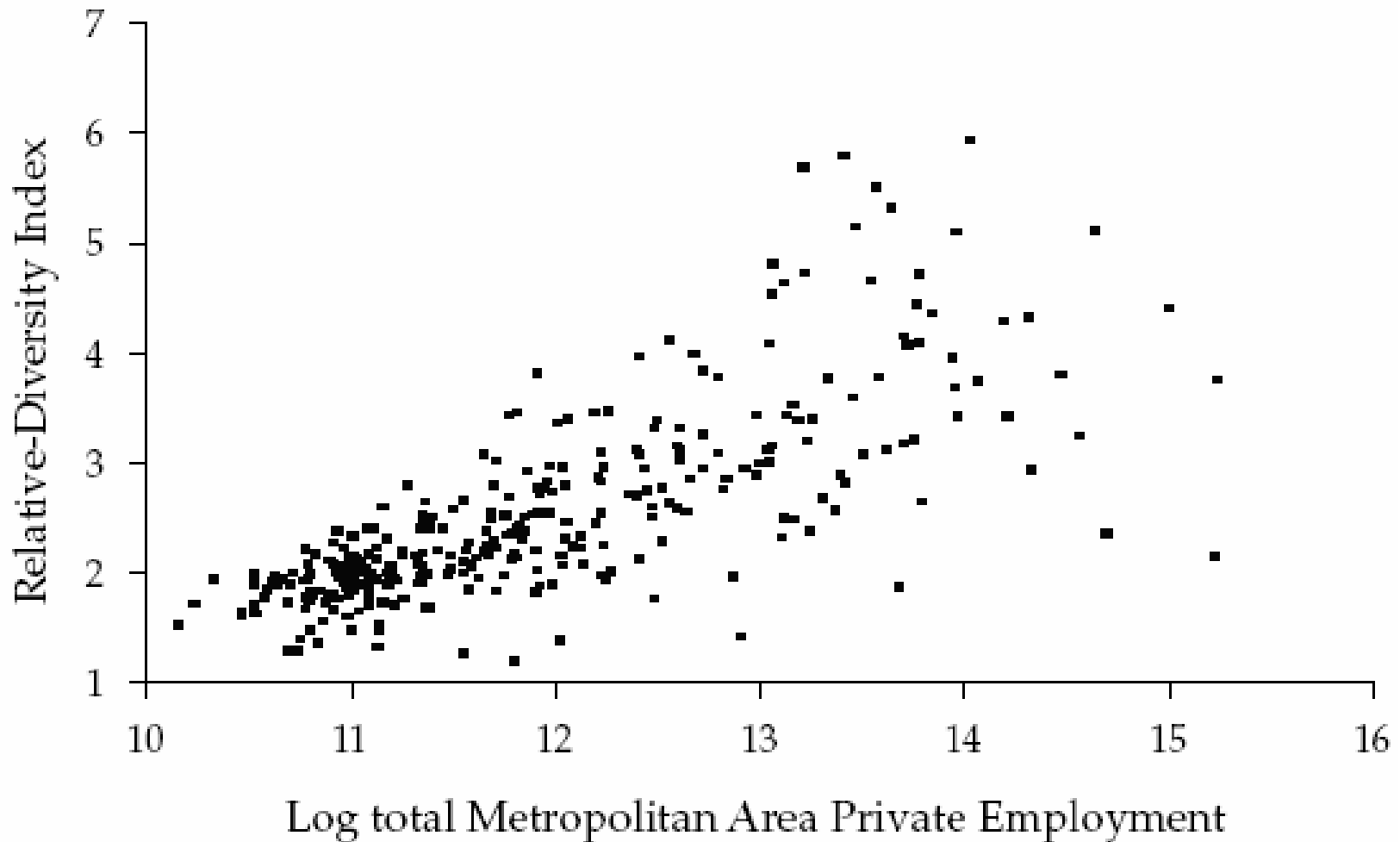
Dumais, Ellison, and Glaeser (2002)

- There is a high rate of plant turnover (about 10% per year)
- Nearly 3/4 of the plants existing in 1972 were closed by 1992
- More than half of all US manufacturing employees in 1992 worked in plants that did not exist in 1972
- New plants are created away from existing centres in an industry: Entry implies dispersion
- Exit of plants reinforces concentration

Stylised fact 9

- Larger cities tend to be more diversified
- Cities of similar diversification are of similar size
 - The relationship between size and diversity is not very strong (partly because all cities have a large component of employment in non-tradeable activities)

City size and diversification



Source: Duranton and Puga (2000), using Black and Henderson's dataset

City size and diversification

- Henderson (1997b): Qualitative differences

Large cities (>500,000) :

- More specialised in **services** (finance, insurance, and real estate sectors) and less in manufacturing

Medium-sized cities (50,000-500,000) :

- More specialised in **mature industries** (textiles, food, pulp and paper) and less in new industries (electronic components, instruments)

- Black and Henderson (2003)

- Looking at US cities 1900-1990 :
- cities can be classified into groups of similar size/specialisation

Stylised fact 10

- From sectoral to urban specialisation

Duranton and Puga (2005)

- Cities have gone from specialising mainly by sector to specialising mainly by function
 - headquarters and business services disproportionately clustered in larger cities
 - production plants clustered in smaller cities

From sectoral to urban specialisation

Local population	Sectoral specialisation			Functional specialisation in management against production			
	1977	1987	1997	1950	1970	1980	1990
5,000,000 – 19,397,717	.375	.369	.348	+10.2%	+22.4%	+30.8%	+39.0%
1,500,000 – 4,999,999	.287	.275	.257	+ 0.3%	+16.7%	+21.7%	+25.7%
500,000 – 1,499,999	.352	.338	.324	-10.9%	-10.0%	- 5.0%	- 2.1%
250,000 – 499,999	.450	.409	.381	- 9.2%	- 9.7%	-10.9%	-14.2%
75,000 – 249,999	.499	.467	.432	- 2.1%	- 6.6%	-12.7%	-20.7%
67 – 75,000	.708	.692	.661	- 4.0%	-33.7%	-40.4%	-49.5%

$$E_j^{\text{Management}} / E_j^{\text{Production}} - E_{\text{US}}^{\text{Management}} / E_{\text{US}}^{\text{Production}}$$

Source: Duranton and Puga (2005)

Executives and managers vs. precision production, fabrication and assembly

Firm fragmentation and urban patterns

- City edges and fragmentation of production

Rossi-Hansberg, Sarte and Owen (2006)

- City Centres: Reduction in its *shares* of Population, Employment and #Establishments
 - Both Services and Manufacturing
- City centres specialise in management and administrative tasks
- Decline in the size of establishments
 - Both at centre and edge

Stylised fact 11

- Individual city growth is related to specialisation and diversity

Glaeser, Kallal, Scheinkman, and Schleifer (1992) :

- Diversity fostered urban employment growth in US cities between 1956 and 1987

City growth, specialisation and diversity

Henderson, Kuncoro, and Turner (1995) :

- Urban diversity is important to attract new and innovative sectors
- A history of similar past specialisation appears to matter more for mature industries

Combes (2000) : France 1984 – 1993

- Finds comparable results
- Service sectors and more innovative manufacturing sectors benefit from diversity

Stylised fact 12

- Most innovations take place in particularly diversified cities and most new plants are created there
- Most relocations are from diversified to specialised cities

Nursery cities

- Jacobs (1969)
- Feldman and Audretsch (1999)
 - data set of 3969 U.S. product innovations in 1982
 - 96% of the innovations in metropolitan areas (30% of population)
 - Regress the number of innovations in sector-cities with diversity within underlying scientific base (++), specialisation (-) and size (+)
- Fujita and Ishii (1998)
 - Japanese electronics MNEs
- Duranton and Puga (2000, 2001)
 - on firm creation in France and firm relocation in France, resp.

Nursery cities

- Duranton and Puga (2001)

	Percentage of relocations from diversified to specialised areas ^e	Relocations as a percentage of the stock ^b	Geographic concentration ^c
R&D	93.0	8.1	0.023
Pharmaceuticals and cosmetics	88.3	6.4	0.020
IT and consultancy services	82.1	7.3	0.030
Business services	75.8	5.0	0.015
Printing and publishing	73.3	5.4	0.026
Aerospace, rail and naval equipment	71.6	3.3	0.026
Electrical and electronic equipment	69.1	4.2	0.011
Motor vehicles	62.5	2.7	0.020
Electrical and electronic components	60.9	5.9	0.007
Textiles	46.4	2.5	0.024
Chemical, rubber and plastic products	38.3	3.9	0.009
Metal products and machinery	37.6	3.2	0.005
Clothing and leather	36.3	3.4	0.013
Food and beverages	34.6	0.8	0.007
Furniture and fixtures	32.6	2.7	0.008
Wood, lumber, pulp and paper	30.6	1.7	0.009
Primary metals	30.0	2.5	0.009
Non-metallic mineral products	27.3	2.0	0.012
Aggregate	72.0	4.7	

Source: Authors' calculations based on the SIRENE and ESE data sets.

^ePercentage of all establishments relocating across employment areas that move from an area with above median diversity to an area with above median specialisation.

^bEstablishment relocations across employment areas as a percentage of the average number of establishments.

^cEllison and Glaeser (1997) geographic concentration index.

Summary

- Cities are growing
- Cities are diverse
- Macro stability
 - E.g. distribution of city sizes is stable
- Micro dynamism
 - Individual cities grow at different rates and may decline
 - Creation and destruction in individual cities

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