Urban Systems:

City size, location, specialisation and urban evolution

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Preliminary remarks about cities

➔ Definition issue

➔ Data issue

Stylised facts 1 to 3: size

Stylised fact 4: location

Stylised Fact 1. *Cities are growing over time.*

Population growth:

Black and Henderson (1999) for the US:

Median urban population in 1900: 18,000 inhab.

Median urban population in 1990: 26,000 inhab. (+40%)

Mean urban population in 1900: 130,000 inhab.

Mean urban population in 1990: 530,000 inhab. (+300%)

Urbanisation rate in 1900: 40.5%; in 1960: 70.0%; in 1990: 75.1%.

Physical growth:

'Urban sprawl' (US vs. Europe)

Figure 1: Urbanisation in the USA 1975-95

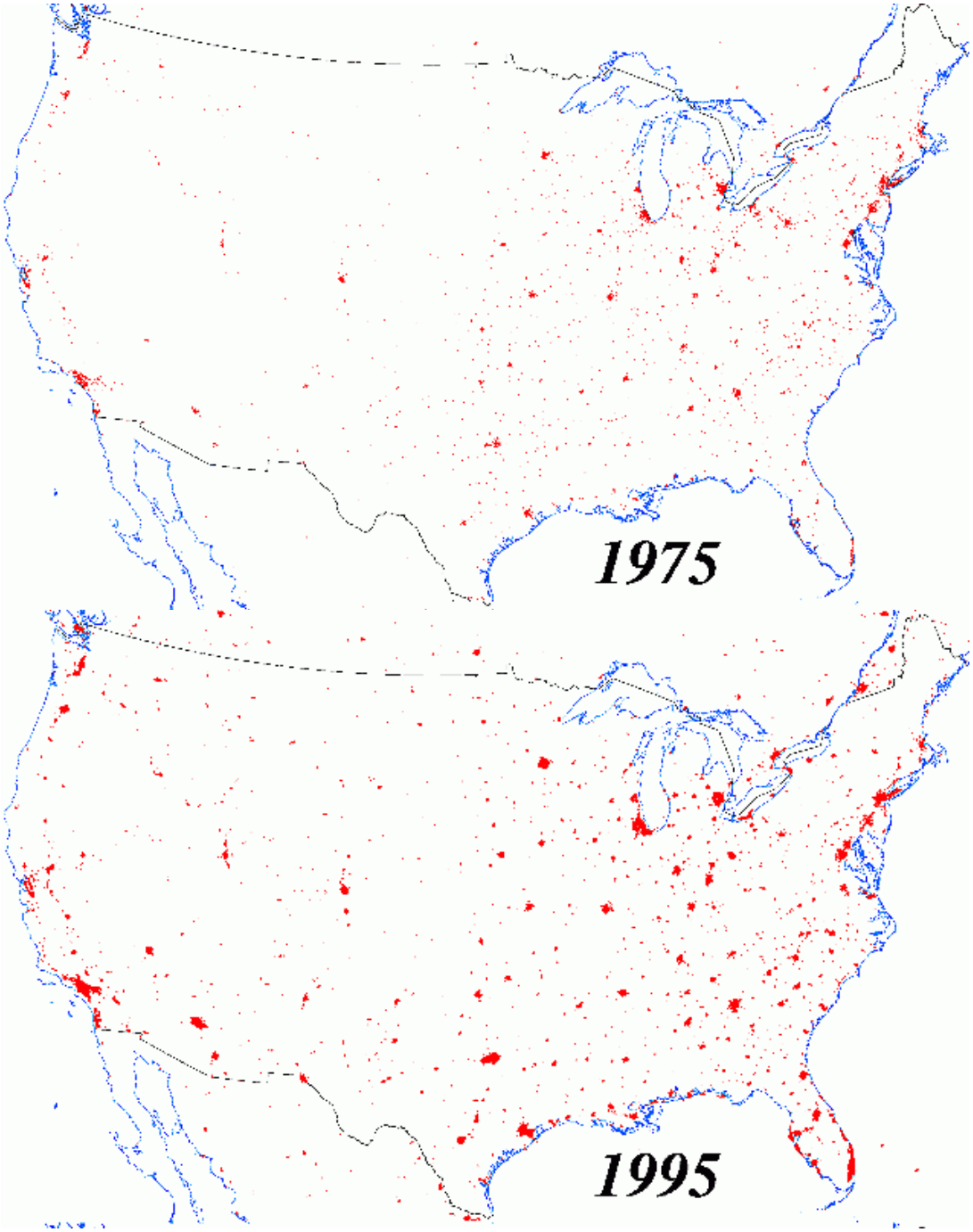
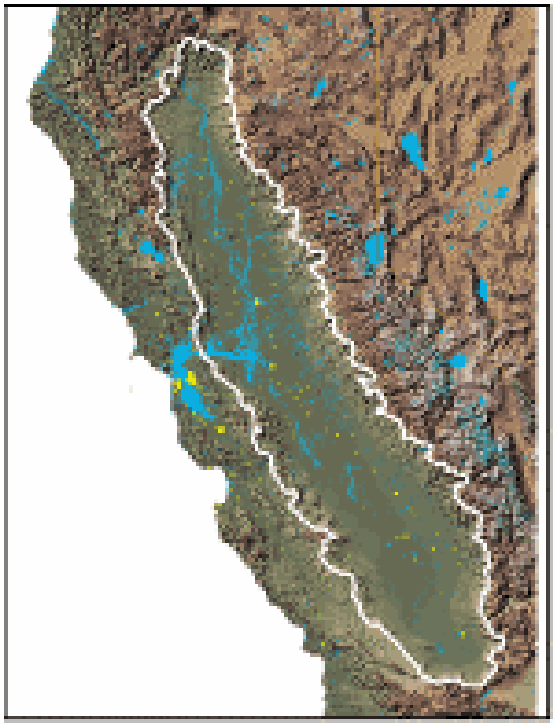
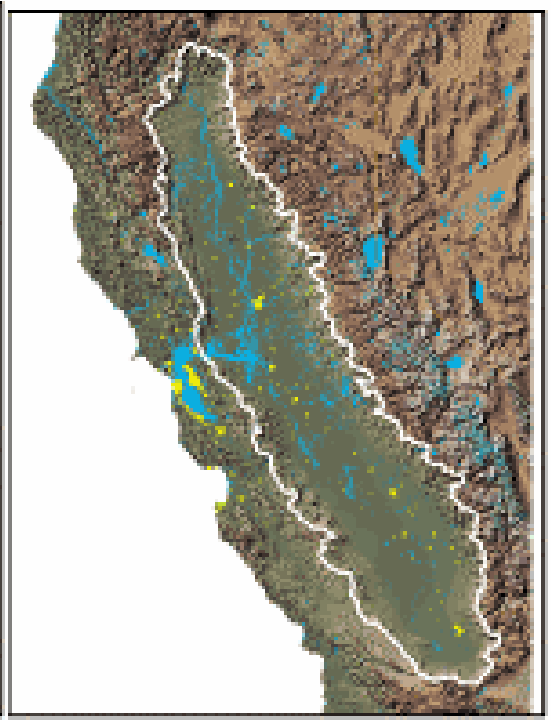


Figure 2: Urban Growth in California's Central Valley

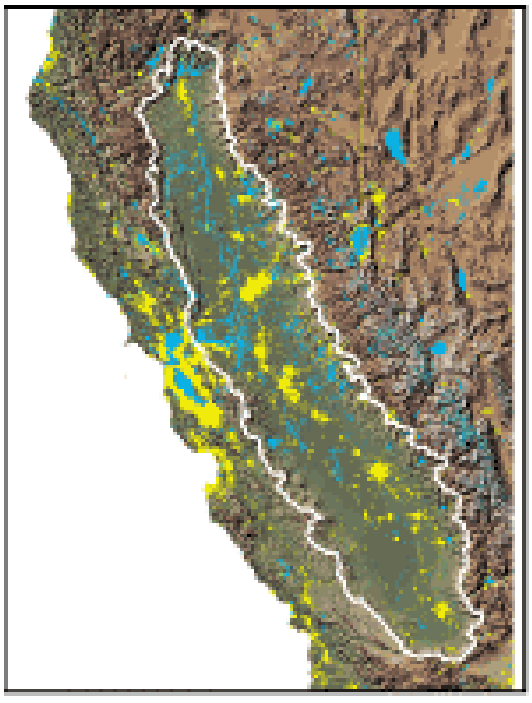
1900



1940



1975



1996

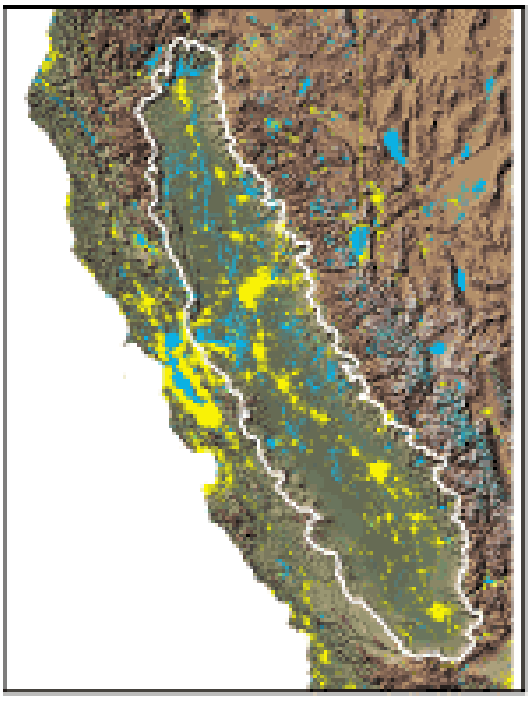
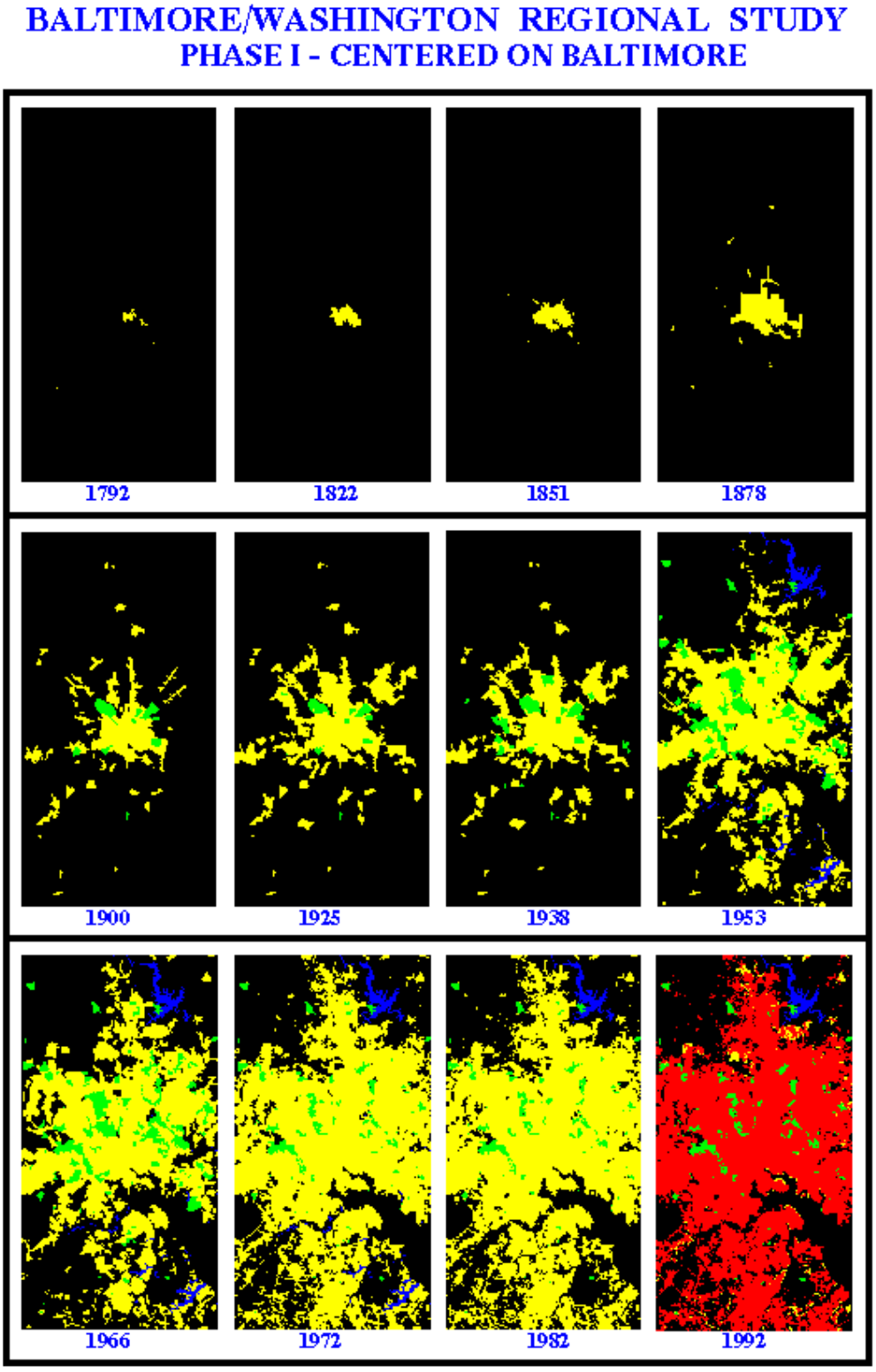


Figure 3


BALTIMORE/WASHINGTON REGIONAL STUDY
PHASE I - CENTERED ON BALTIMORE
1792
1822
1851
1878
1900
1925
1938
1953
1966
1972
1982
1992

Stylised Fact 2. *City-size distribution is well represented by Zipf's Law and this persists over time*.

$R(N) = A.N^{-a}$ with $A = (N_{Max})^{a}$

$\Rightarrow \quad ln\, R(N) = ln\, A - a\, ln\, N$

Zipf's Law: $a = 1$

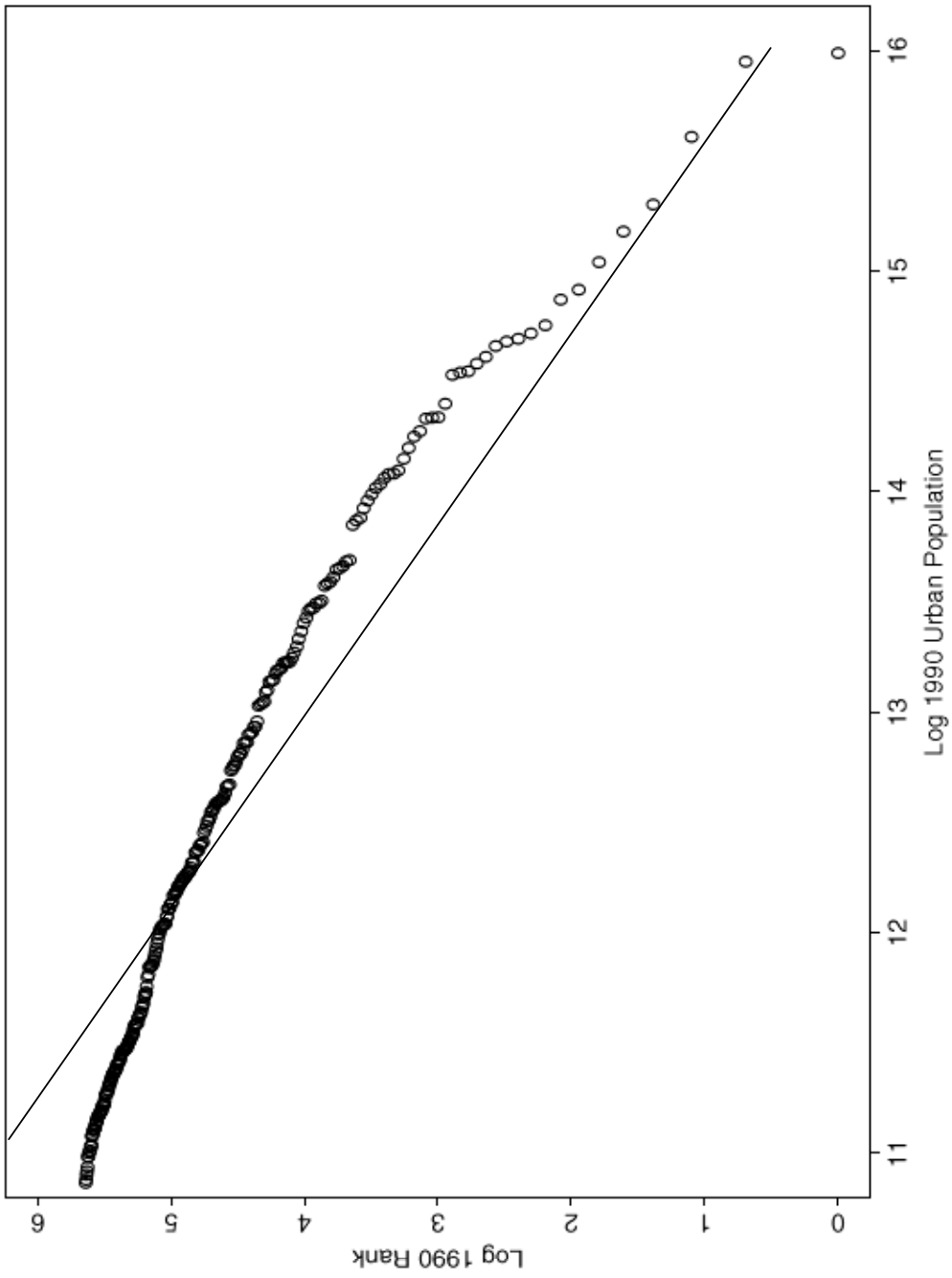
$\Rightarrow \quad ln\, R(N) = -ln\, N + Ct$

Historical discussion of Zipf's Law - Rosen and Resnick's evidence

US in 1990: Figures 4,5 and 6 from Black and Henderson (1999)

Stability: Figure 7 from Black and Henderson (1999)

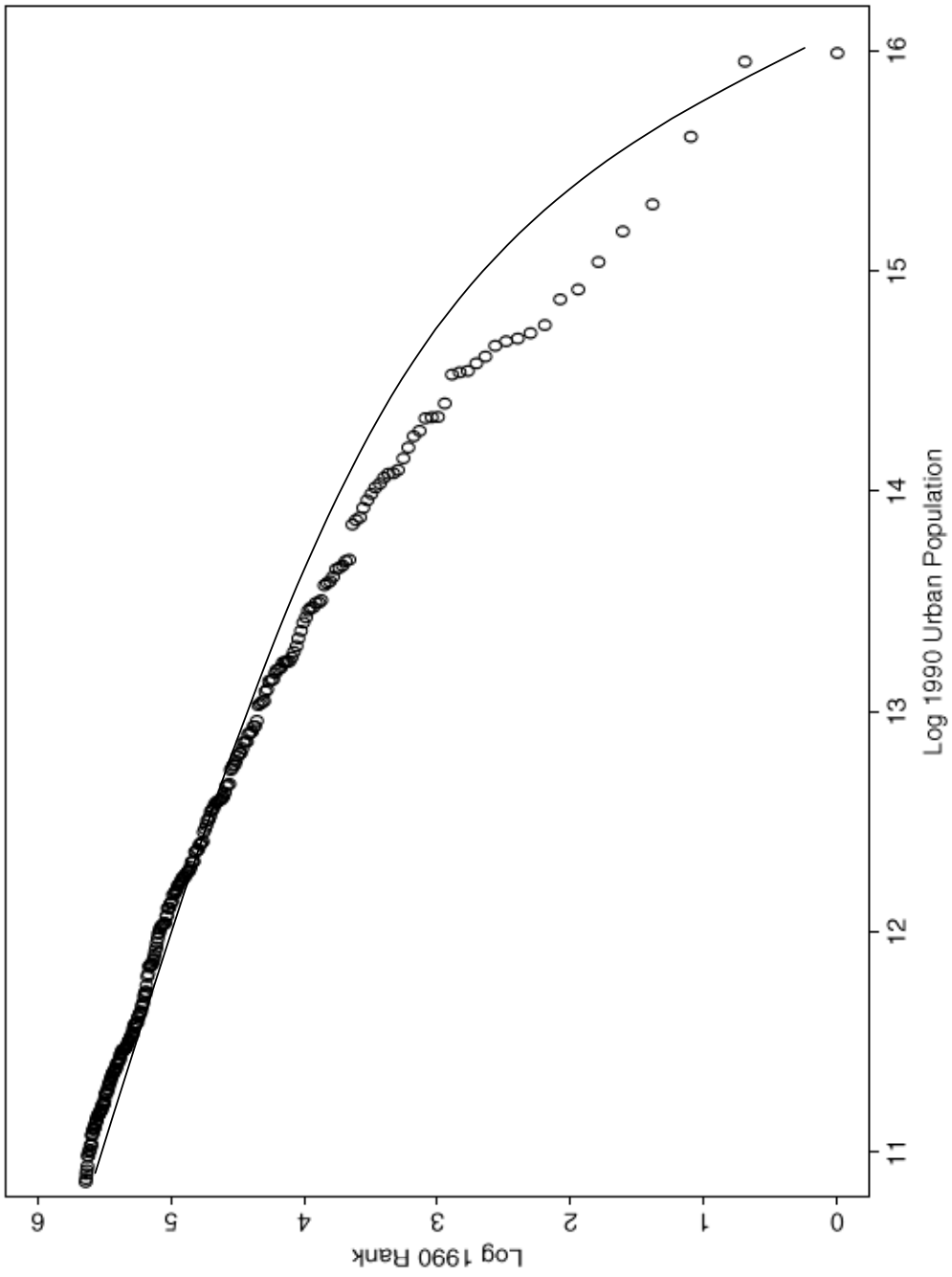
Figure 4: US City Size Distribution (1), 1990



Slope of the OLS line: around -0.85

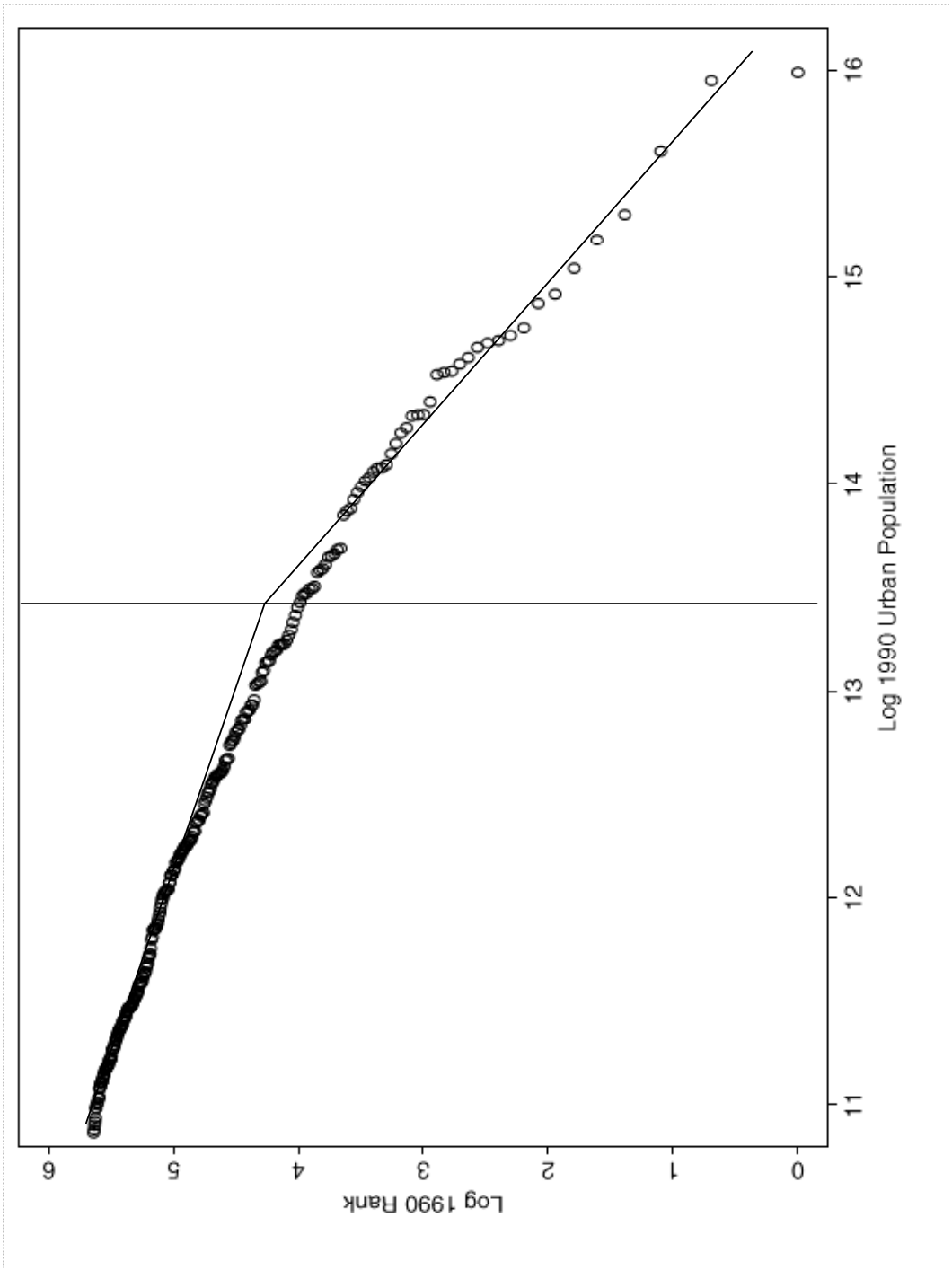
Source Black and Henderson, 1999

Figure 5: US City Size Distribution (2), 1990



Source Black and Henderson, 1999

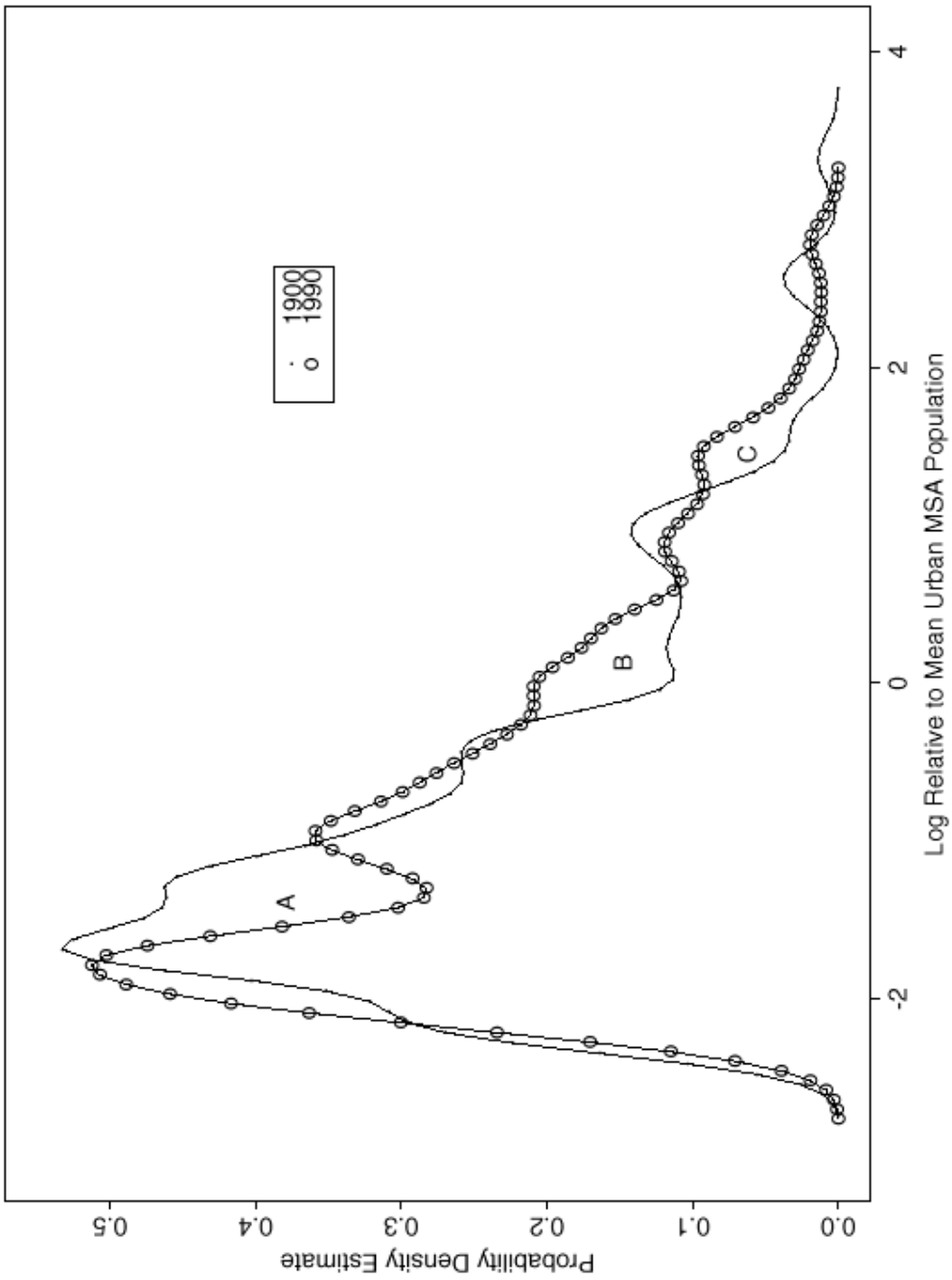
Figure 6: US City Size Distribution (3), 1990



Cut-off point around 600.000 inhabitants. Slope of the first OLS line around 1 and slope of the second OLS line around 0.7.

Source Black and Henderson, 1999

Figure 7: Density Functions for US City Size



Source Black and Henderson, 1999

Stylised Fact 3. *Cities move slowly within the distribution.*

Henderson and Black (1999) build a matrix with cut-offs for the top 10%, next 10%, 15%, 30% and 35%.

Mean transition cell 5 to cell 1: 500 years.
Mean transition cell 1 to cell 5: 5,500 years.

Proportion going from cell 1 to cell 1 in a typical decade: 85%.
Proportion going from cell 1 to cell 2 in a typical decade: 15%.
Proportion going from cell 2 to cell 2 in a typical decade: 79%.
Proportion going from cell 2 to cell 1 in a typical decade: 8%.
etc.

'Dangerous examples': Phoenix and Detroit or Pittsburgh.

Good predictors of relative growth: average human capital and climate.

Stylised Fact 4. *Weak evidence on the importance of the relative locations of cities.*

Harris-Dobkins and Ioannides (1998): larger cities tend to grow at a slower pace. But they favour the development of neighbours. Then for cities located at a medium distance (80-500 kilometres), they tend to hinder growth whereas for cities located even further, they tend to favour growth again.

Black and Henderson (1998): own-size effect is negative but external market potential effect has first a positive effect and then a negative effect. If we think of total market potential as the sum of external market potential and own size, the effect is negative for large cities and ambiguous for the others.

Overman and Ioannides (1999) – very weak link between the location of a city and its growth for the late 20^{th} century.

Link with first nature geography and transport networks??
(more research needed)

Stylised Fact 5. *Co-existence of specialised and diversified cities*.

Specialisation index $\overline{S}_i$:

$$\overline{S}_i = \underset{j}{Max}\left(S_{ij}\right)$$

where S_{ij} is the share of industry *j* in city *i*. Relative specialisation $\overline{RS}_i$:

$$\overline{RS}_i = \underset{j}{Max}\left(S_{ij} / S_j\right)$$

where S_j is the share of industry *j* in national employment.

Two-digit level for U.S. cities in 1992:

Tobacco cities: Richmond, VA; Macon, GA; Owensboro, KY.
Petroleum cities: Galveston, TX; Corpus Christi, TX; Cheyenne, WY.
Leather cities: Laredo, TX; Bangor, ME; Lewinston, ME.
Textile cities: Burlington, NC; Danville, VA; Anderson, SA.
Cities with no specialisation: Cincinnati, OH; Oakland, CA; Atlanta, GA.

Diversity: a Hershman-Herfindahl index:

$$DI_i = \frac{1}{\sum_j S_{ij}^2}$$

Relative diversity index:

$$RDI_i = \frac{1}{\sum_j \left| S_{ij} - S_j \right|}$$

Figure 9: Most Specialised and Diversified US Cities

	Specialisation		Diversity	
Rank	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: Black and Henderson data set

Table 1. Most and least specialised and diversified US cities in 1992

Source: Duranton and Puga (2000)

Is it random? No (Ellison and Glaeser, 1997)

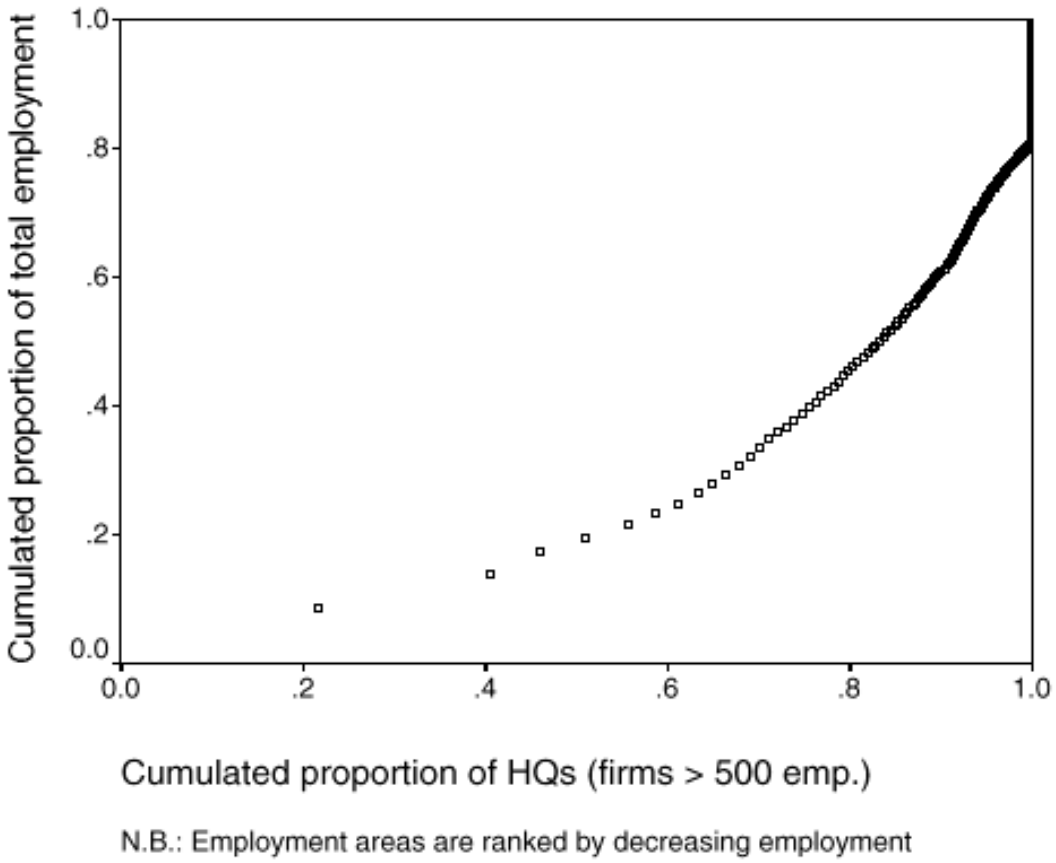
Localised comparative advantage? No (Henderson, 1997a, panel data econometrics)

Localisation economies vs urbanisation economies.

Stylised Fact 6. *Economic power is more unevenly distributed than population.*

In most countries, the most important economic functions are concentrated into a very small number of cities (London for the UK, Paris for France, NY in the US).

Figure 10: Distribution of Headquarters in France



Source: Duranton and Puga, work in progress 2000.

- 'World city' phenomena

Stylised Fact 7. *Larger cities tend to be more diversified.*

Relative diversity index (all private employment at the two-digit level) and size.

Figure 11: The Link between Diversity and Size

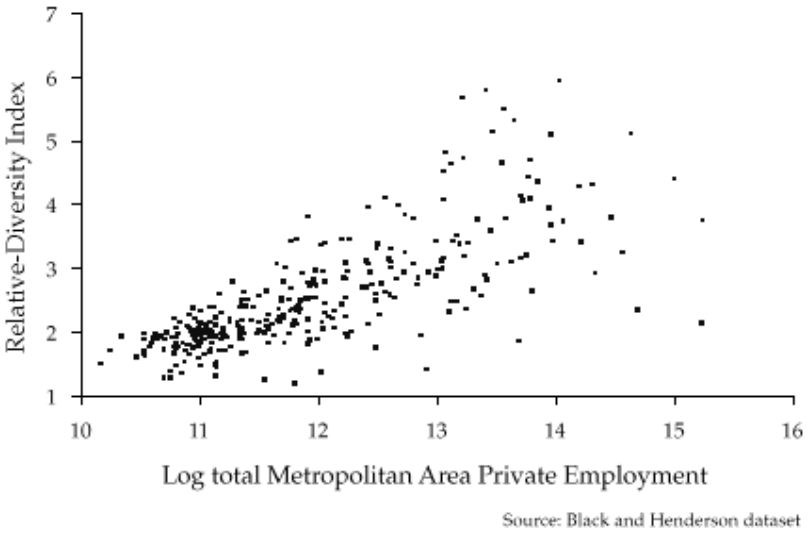


Figure 1. The size-diversity relation for US cities in 1992

Source: Duranton and Puga (2000)

Not extremely strong (most cities are heavily diversified + some large cities are specialised like L.A. in entertainment + smaller cities like Dallas, TX; Columbus, AZ; or Buffalo, NY, are very diversified).

Henderson (1997b): qualitative differences between medium-size cities (50,000-500,000 inhabitants) and large cities (>500,000).

Large cities more into FIRE and less manufacturing.

Medium size cities: more mature industries (textile, food, pulp and paper) and less into new industries (electronic components, instruments, etc).

Henderson (1988): cities specialised in similar activities tend to be of the same size.

Black and Henderson (1999) generate clusters of size-specialisations.

Stylised Fact 8. *Stability of urban production patterns.*

Dumais, Ellison and Glaeser (1997): stability.

Kim (1995): Correlation of the coefficient of regional localisation for two-digit industries in the U.S. between 1860 and 1987 at the state level: 0.64.

Henderson (1997b): more thorough investigation over 30 years shows high persistence.

But…

Stylised fact 8'. Decline in sectoral specialisation and increase in functional specialisation

Local population [a]	Sectoral specialisation [b]			Functional specialisation in management against production [c]			
	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%

Source: Duranton and Puga (2001)

[a] Population by Metropolitan Statistical Area or Non-metro Area (definitions from the Decennial Census of 2000).

[b] Median value for each population class of a Gini index comparing the local and national distributions of employ-ment shares across 2-digit sic manufacturing sectors. Its value is close to one if a city is fully specialised in a sector that is very small at the national level and is equal to zero if local employment is dispersed across sectors in the same way as national employment.

[c] Percentage difference from the national average in the number of executives and managers per production worker (occupied in precision production, fabrication, or assembly).

Stylised Fact 9. *More innovations in more diversified cities.*

Jacobs (1969).

Feldman and Audrescht (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) on japanese electronics MNEs.

Duranton and Puga (2000) on firm creation in France.

Stylised Fact 10. *High rate of firm turbulence (with a spatial bias).*

Dumais et al. (1997): 55% of all manufacturing employees in the U.S. in 1992 were working in plants that did not exist in 1972. Every year around 10% of establishments are closing down in the U.S. - 73% of the plants, which existed in 1972, were closed by 1992.

The birth of new plants (in particular for new firms) tends to reduce the degree of agglomeration whereas the closure of existing plants tends to increase it.

Duranton and Puga (1999): relocations of establishments between employment areas in France => Relocation from diversified to specialised areas.