The spatial de-concentration of scientific production activities: what about citations? A world-scale analysis at city level (1999-2011)

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Context

- Continuous growth of research activities and publications a proliferation of sites of activity (Shofer & Meyer, 2005)
- an increase in the number of higher education personnel (UNESCO, 2010)
- a re-balancing of the global scientific output over the last thirty years:
- - at the country level to the detriment of the traditional hegemony of the US (Adams & Pendlebury, 2010 ; Royal Society, 2011)

  - and at the city level to the detriment of the traditional biggest spots (Inhaber, 1977; Grossetti et al., 2014)
- an increasingly multi-centric structure of scientific collaboration (Glänzel et al, 2008; Henneman et al, 2012; Maisonobe et al, 2016)

What about research quality/visibility ?

- Did the territorial redistribution observed in the geography of scientific production between 2000 and 2011 translated into a redistribution of the geography of citations ?

- Are publications from formerly marginal locations able to influence researchers based in “central locations”, or is their impact mostly “provincial”?

Source and methods

- the geocoding of *Web of Science* publication data clustered by urban areas (see Ekert et al., 2013; Jégou; 2014; Grossetti et al., 2014; Maisonobe et al., 2016)

- Whole normalized counting (Gauffriau et al., 2008)

- the number of citations received by all publications released between 1999 and 2011 over a three-year window→ for 2011 publications, we looked at the number of citations received as of 2014 (the last year considered by this study)

Change in the global concentration of citations by classes of cities

Most cited cities	Share of the global total of citations (%)*					
	2000	2003	2007	2010	2013**	Trend
Top 10	23.5	21.1	18.5	17.3	16.6	
Top 20	33.4	30.6	27.5	25.9	24.9	
Top 30	39.5	36.9	33.8	32.2	31.1	
Top 50	49.4	46.8	43.6	41.8	40.9	
Top 100	64.1	61.3	57.7	56.1	55.2	
Top 200	80.2	77.5	74.6	72.9	71.7	
Top 500	94.9	93.6	92.00	90.8	89.7	
Top 1000	98.7	98.1	97.5	97.0	96.6	
Total	100	100	100	100.0	100.0	

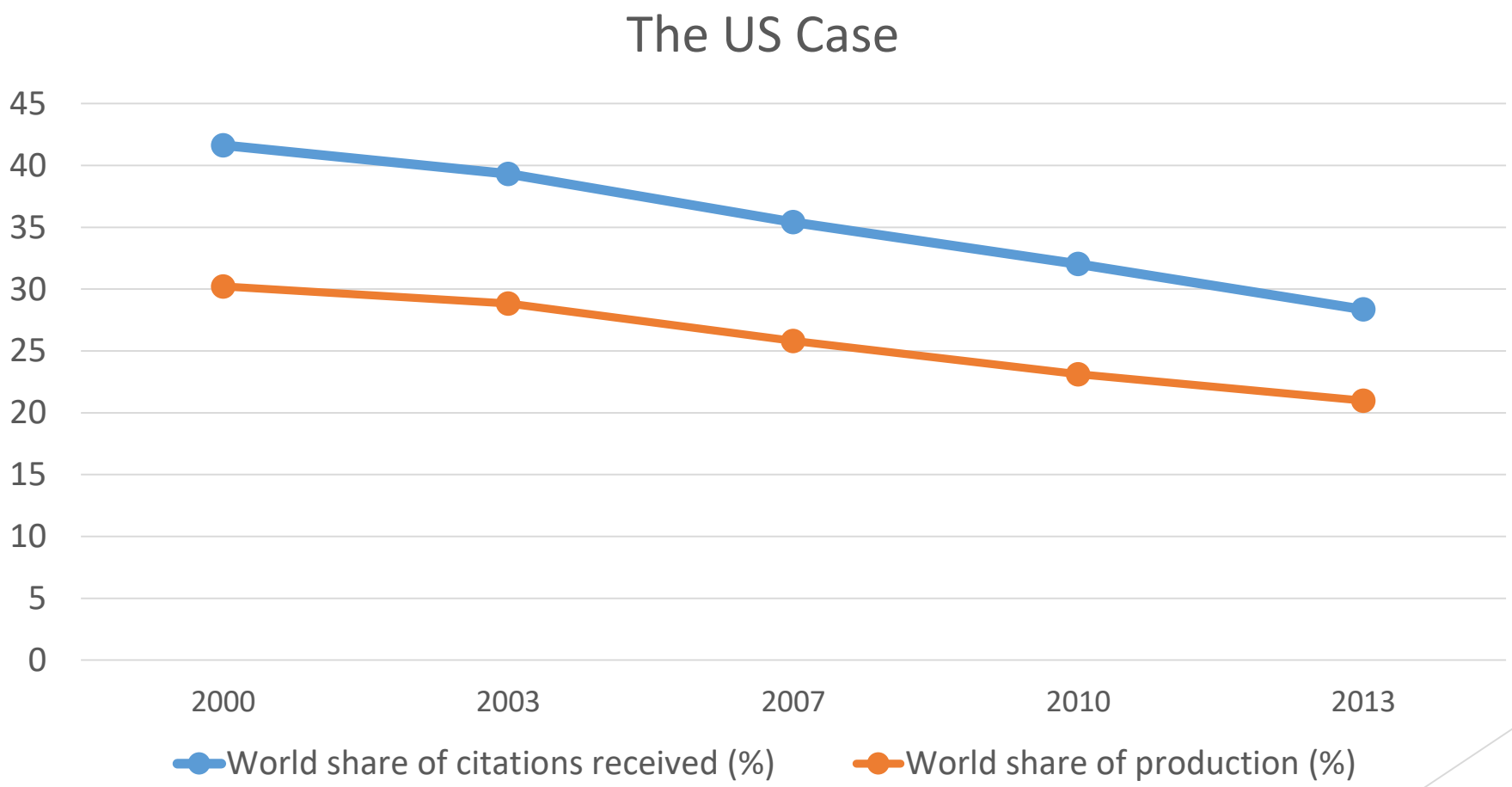
Source : Web of Science (articles. reviews and letters)

*Counted as a fraction of citations received over a 3-year period. mobile average over 3 years

The US case

- From 40% of all citations received by publications of 2000 to 35% of all citations received by publications of 2007
- This 5-pts decrease in the share of citations received is superior to the 4-pts decrease in the US's share of the global production of publications
- The US impact is slightly decreasing but in 2007 the US were still securing a third of all citations with just a quarter of the global production

The difference between the share of citations received and the production share is reducing

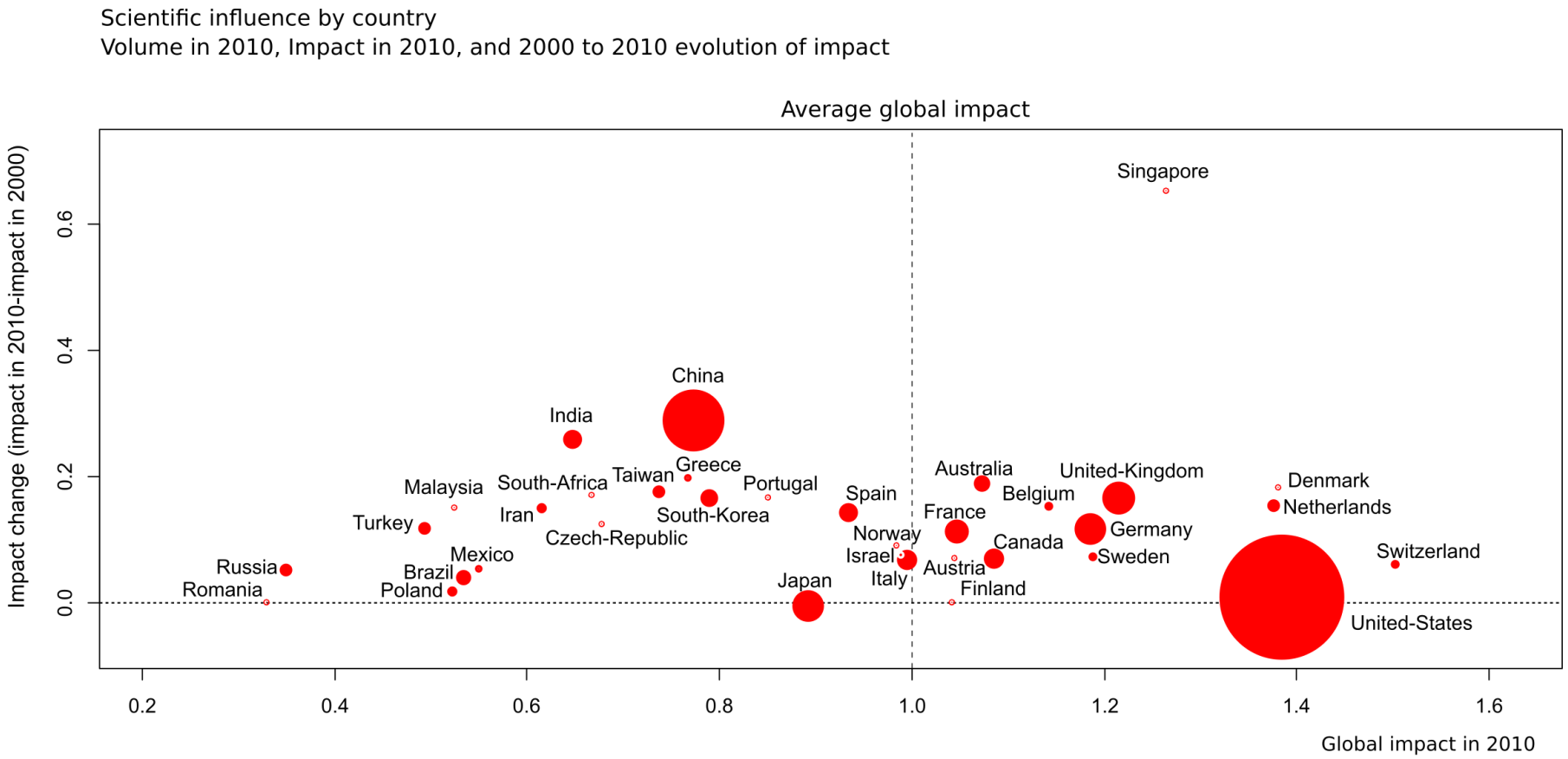


The trend goes on: in 2013: US citation share = 28%; US production share = 21%

Measuring the scientific “influence”/ “impact” of countries/cities

- the ratio of “share of citations received” to “share of publications produced”
- The closer this ratio becomes to 1, the closer the average number of citations received by a published article gets to the global average rate
- This global rate: from 3.7 citations per published article in 2000 to 4.44 in 2010
- It results from an increase in the number of references per article, and of a decrease in the number of non-cited articles (Larivière et al., 2009; Lozano et al., 2012)

Scientific influence by country

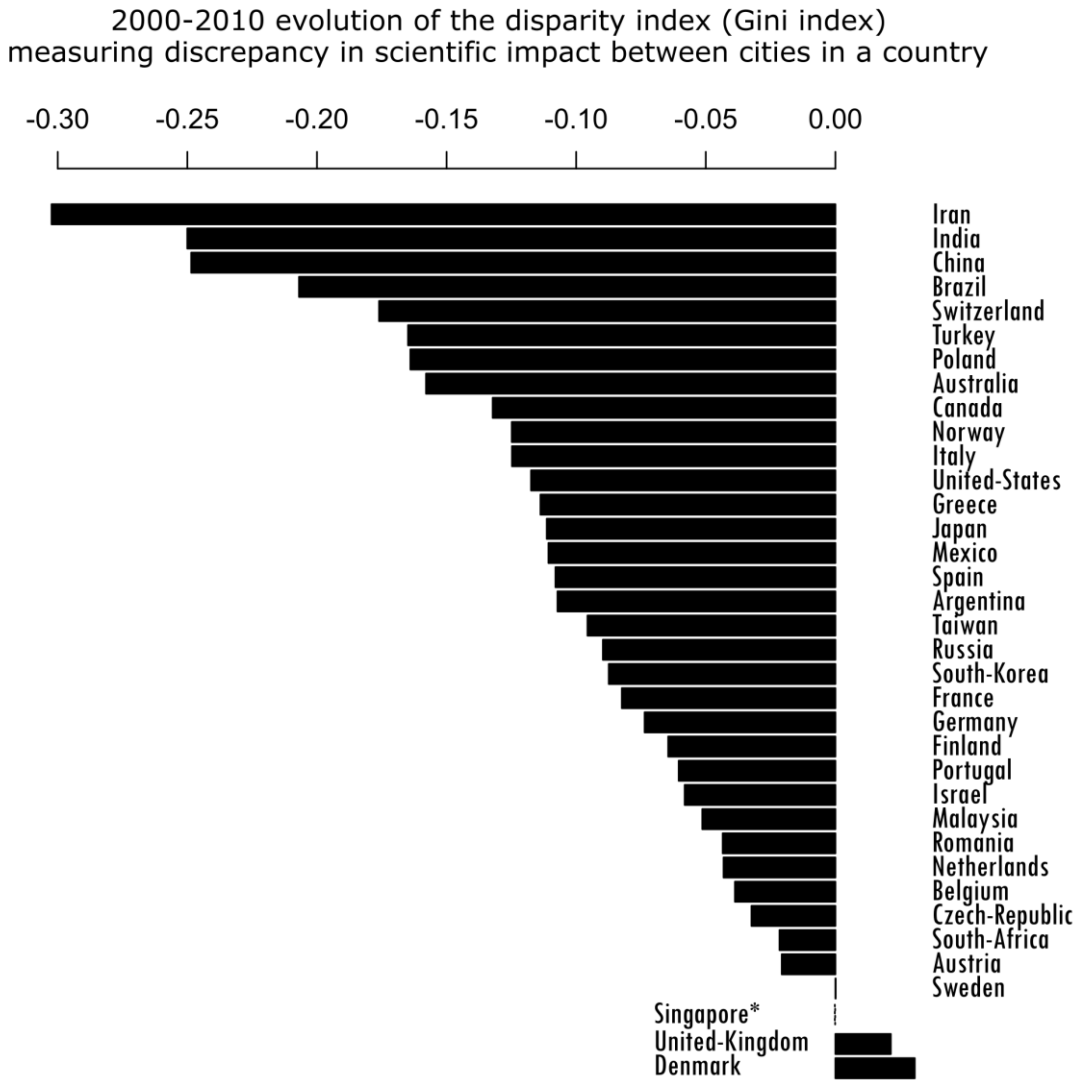


Scientific impact equals the ratio of the share of global citations to the share of global publications.
In 2010 the 36 top publishing countries concentrated 94% of production and 96% of received citations.
The sizes of circles is proportional to the number of publications produced per country in 2010.

Hypothesis

- The variations of impact are currently diminishing not also between countries but also **between disciplines as well as between cities in a same country**

Evolution of discrepancy of scientific impact between cities per country

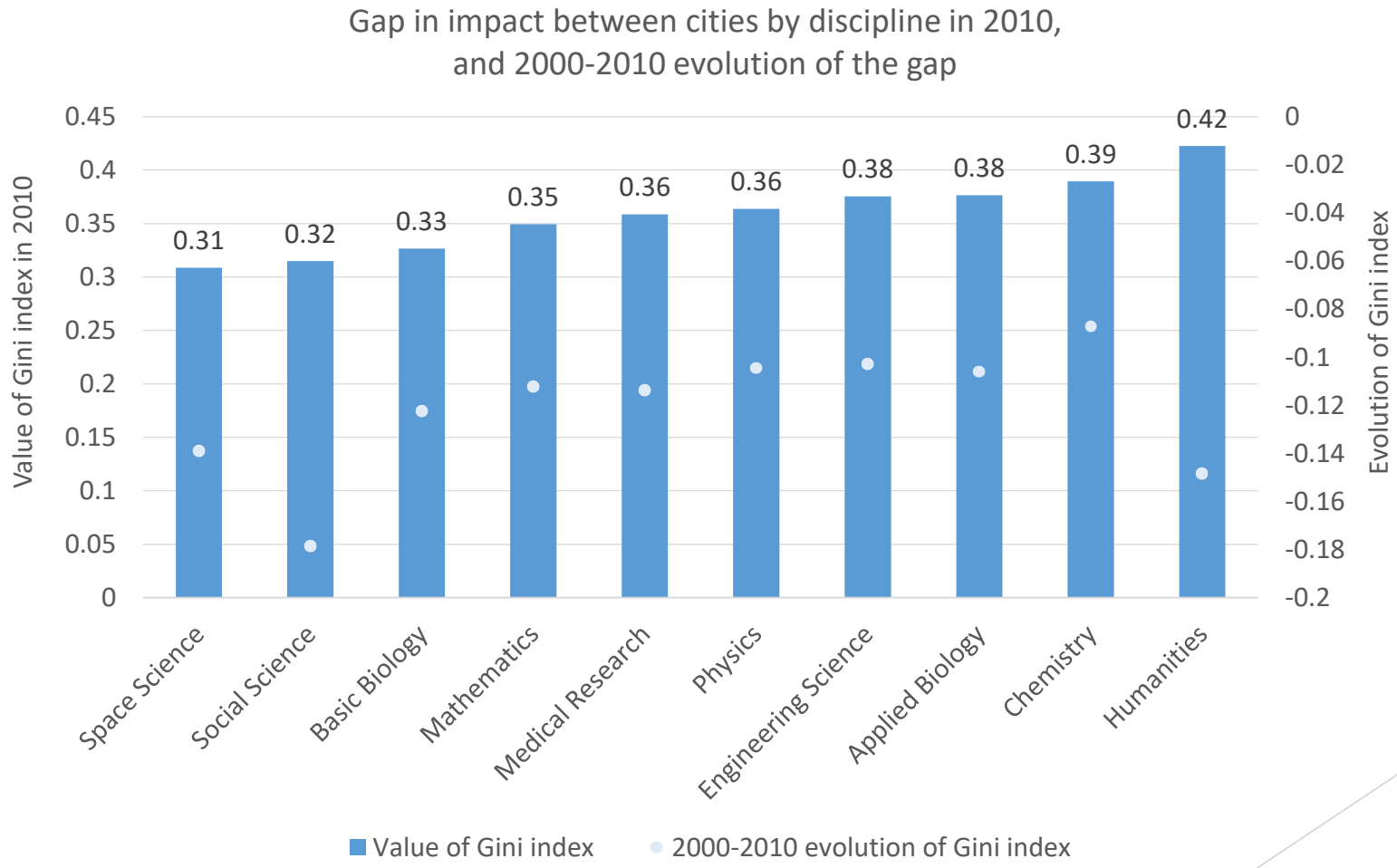


A city's scientific impact equals their share of citations divided by their share of publications

In 2010 the 36 top publishing countries accounted for 94% of production and 96% of citations received

*Only one city since Singapore is a city-state

Gap in impact between cities for main disciplines



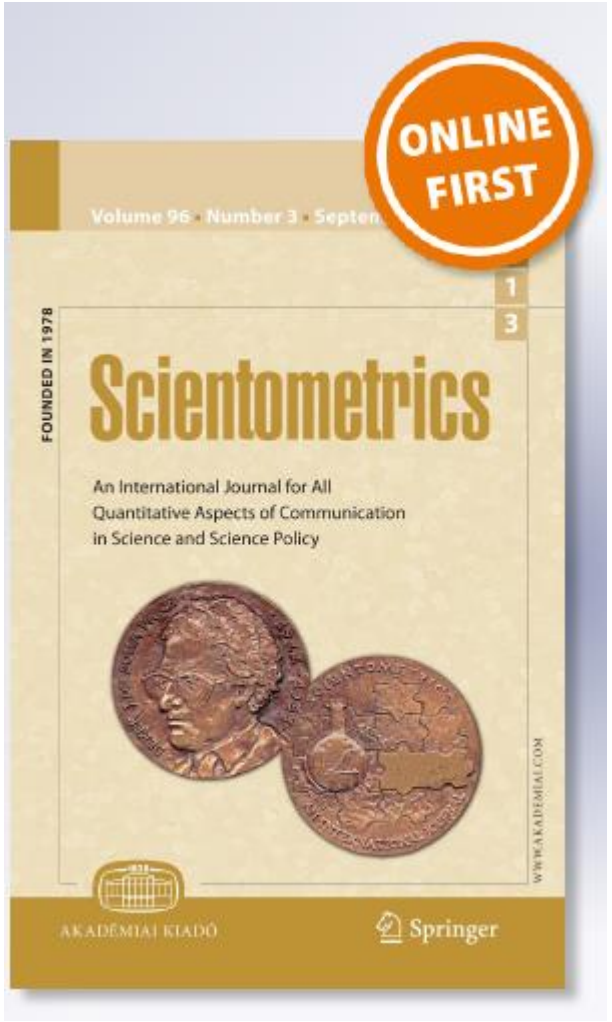
Conclusion

- a growing convergence between the geography of scientific production and that of scientific citations
- While Singapore, China, India and Iran suffered from a deficit of visibility in 2000, their level considerably improved by 2010
- In almost all countries of the world, except for two (United-Kingdom and Denmark), a decrease in the discrepancy between cities' scientific visibility has been observed
- The gap between the share of citations and the share of publications has decreased across all disciplines

Policy implications

- De-concentration of production + of citations // concentration of resources
- Langfeldt et al. (2015) shows that research policies should allocate more resources to sites whose level of visibility has so far been inferior to their level of production
- Our results show that deciding to deprive these sites of resources on the assumption that only the main centres have the capacity to produce research of a good standard is unjustified (eg. in Japan Oba, 2011)
- Research activities are distributed in geographic space much more evenly than they were in the past, and it would be logical for research resources to be allocated accordingly, to adapt to this new geography

Thank you for your attention !



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The global geography of scientific visibility: a deconcentration process (1999–2011)

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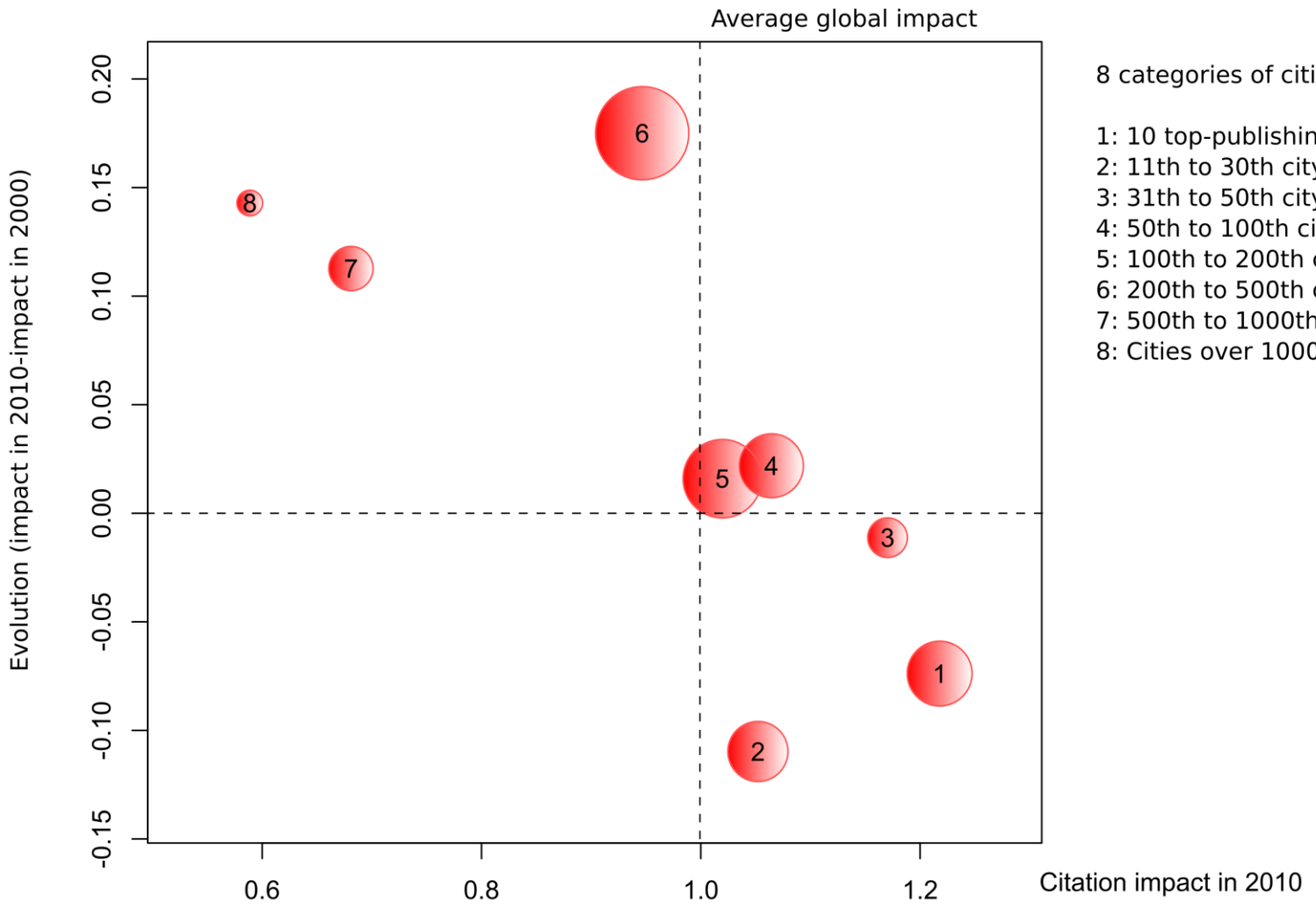
Scientific influence of the world's cities
Volume in 2010, impact in 2010, and 2000 to 2010 evolution of impact



8 categories of cities:

1: 10 top-publishing cities
2: 11th to 30th city
3: 31th to 50th city
4: 50th to 100th city
5: 100th to 200th city
6: 200th to 500th city
7: 500th to 1000th city
8: Cities over 1000th

A city's scientific impact equals the ratio between their share of global citations and their share of global publications. Il is calculated for each category of cities, presented in descending order of the number of publications. The size of circles is proportional to the number of publications produced per category in 2010.

Comparison between the evolution of the national and global impact of major world cities