

# Population concentration

## Quantitative characterization by concentration indexes

Ricardo Alvira<sup>1</sup>

The exponential population growth since the Industrial Revolution in the late 18th century has been accompanied by a progressive depopulation of rural areas and population concentration in some cities. The emergence of greater job opportunities in cities, along with the scarcity of opportunities and harsh conditions in rural areas, has led to significant migration from the countryside to urban areas, forming large urban agglomerations and emptying rural populations. In response to this emerging reality, from the 19th century, several experts have alerted on several negative impacts on societies of this trend, and proposed several approaches to understand it, to halt it, and even reverse it. In broad terms, we find three approaches to population distribution across the territory. Firstly, a formal (normative) approach, which can be traced back at least to Plato and Leonardo Da Vinci, from which models of how the territory should be occupied are proposed. It is from this perspective that, in trying to improve the quality of cities<sup>2</sup>, which were accumulating high environmental pollution and poor sanitation, in the framework of the 19<sup>th</sup>-century hygienist movement proposals, in 1898, Ebenezer Howard<sup>3</sup> proposed a cluster for the spatial organization of the population in the territory. He aimed to improve the internal quality of cities and to balance and integrate cities with the agricultural environment and economy. The cluster should be replicated throughout the territory through its aggregation.

(Figure 1)

Second, an empirical-statistical approach, which begins with the German Auerbach (1913)<sup>4</sup> who reviews the settlement system of Germany and compares it with those of other countries, eventually detecting the existence of an underlying "law" that connected these settlement systems and implied logarithmic rules (i.e., involving non-additive and higher-order relationships). Subsequently, this perspective was popularized by Zipf (1949). Thirdly, an approach that combines issues from the previous two, which can be traced back at least to the French Reynaud (1841), that reviews the phenomenon by focusing on the more geographical aspects of territorial scale through the theory of location, attempting to detect patterns through the observation of reality that would allow for the formulation of laws. This perspective was later developed by authors such as Galpin (1915)<sup>5</sup> and popularized by Christaller (1933)<sup>6</sup>. It proposes the existence of underlying hexagonal patterns in the distribution of settlements, with hierarchies of nuclei positioned at different locations within the pattern.

Yet the issue still remains unsolved. While, it is still asserted the need to reverse the depopulation in rural areas so as to promote a territorial redistribution of the population, which should be sustainable over time, no widely accepted formula has been proposed that enables analysis and set of redistribution goals. To contribute to this debate, this communication proposes that understanding the biased nature of population distribution in different settlements requires moving beyond the paradigm of the proportion between urban and rural populations and advancing toward its characterization through measures of concentration. Based on this characterization, three samples are reviewed: several formal models proposed throughout history; the evolution of Spain's population throughout the last two and a half centuries; and the current state of population distribution in several European countries. The goal is to determine the validity of concentration indices to measure and analyse population concentration, to compare it with other relevant variables, and to set concentration objectives.

(Figure 2)

### Notes

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<sup>1</sup> Universidad de Murcia. Email: ricardo.alvira@um.es

<sup>2</sup> Fariña, J. & Alvira, R. (forthcoming)

<sup>3</sup> Howard, E. 1898. *To-Morrow. A peaceful way to social reform.*

<sup>4</sup> Auerbach, F. 1913. *The Law of Population Concentration.* Translated by Antonio Ciccone. EPB: *Urban Analytics and City Science*, 2023, Vol. 50(2) 290–298

<sup>5</sup> Cited in Robic, M.-C.. 1982. Cent ans avant Christaller... Une théorie des lieux centraux. In: *Espace géographique*, tome 11, n°1, 1982. pp. 5-12;

<sup>6</sup> King, Leslie J. 1985. *Central Place Theory.* Regional Research Institute. West Virginia University

Images:

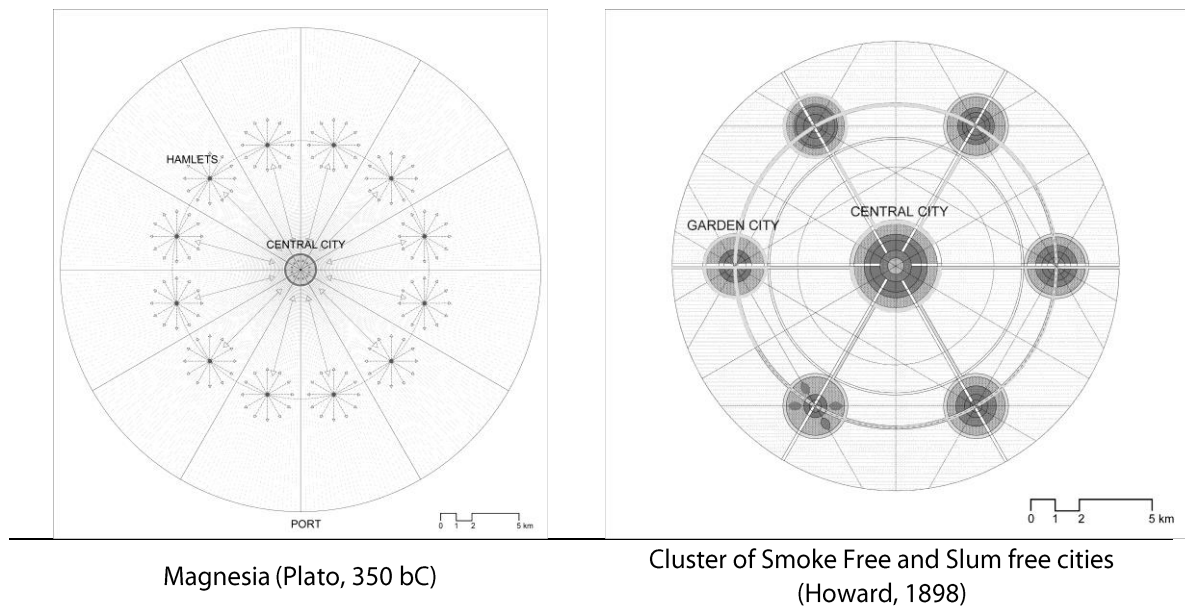
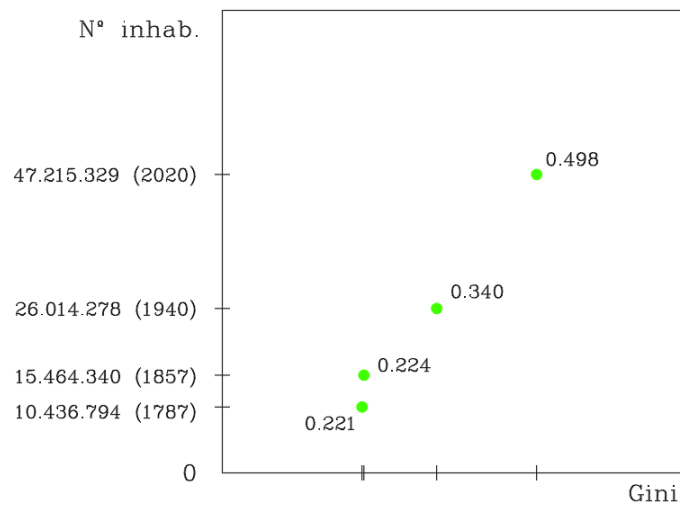


Image source: Magnesia by Alvira & Fariña (forthcoming). Cluster of Smoke Free and Slum free cities by Fariña & Alvira (forthcoming) based on Howard 1898.

**Fig. 1. Normative approaches to settlements spatial organization by Plato and Howard.**



Note: provinces have been used as unit for measuring concentration

**Fig. 2. Relationship between Population increase and Population concentration as measured by the Gini coefficient in the 1787-2020 period in Spain**