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Editorial

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Urban inequalities and sustainability

This editorial introduces a special collection on urban inequalities and sustainability, encompassing thirteen papers across continents and disciplines. Using Zipf's Law to analyze recurring themes, it highlights the centrality of population, poverty, climate, housing, and digital divides in shaping urban disparities. The collection underscores cities' dual role as engines of growth and sites of inequality, offering evidence and reflections to guide policies for more equitable and sustainable urban futures.

Setting the scene

The pervasive global process of urbanization has been found to be inextricably associated with economic growth[1]. Urban economics explains this process through the lens of agglomeration economies: cost savings or productivity increases associated with denser populations, and accruing (to different extents) to firms and consumers alike[2]. Yet, increasing population densities are also associated with rising income inequalities within urban areas[3], as well as with rising urban-rural gaps[4]; in their turn, within-city inequalities are also associated with the uneven distribution of skills[5], and give rise to phenomena of discontent[6]

At the same time, despite representing an engine of growth, cities also contribute decisively to global pollution[7], and often offer unpleasant environments to live, due to warmer temperatures (urban heat island effect[8]), racial segregation[9], and gender disparities[10].

Within this complex framework of rising within- and between-cities inequalities along so many dimensions, the guest editors of this collection set out to invite contributions from different disciplines, focusing on the common element of urban inequalities: their determinants, as well as their effects on sustainability. With the last article accepted for publication in July 2025, the special collection launched on *npj Urban Sustainability* on Oct. 22, 2022 has come to an end, and we can now take stock of the evidence collected.

The main results of this collection

The collection comprises 13 papers on various issues associated with cities and their internal and external inequalities. Papers cover many disciplinary approaches and present evidence collected for all continents (Table 1).

Given the complexity of the topics addressed in these papers, we will offer a more synthetic and critical review of the results discussed in this special collection, rather than going through each single paper's conclusions as often done in other editorials. To this end, we resort to the original use of the Zipf's Law (also known as the rank-size distribution; henceforth, RS), often forgotten in Urban Economics studies, which typically use it to describe the regularity linking a city's positioning in a Country's population distribution and its size[11]. In fact, Zipf's law was originally conceived as a means to uncover regularities in the frequency with which words are used in spoken language: "*Zipf's law states that given a vocabulary of word types, the frequency of occurrence f of a word type is inversely correlated with the rank r of that word type in an ordered frequency distribution*"[12] [p. 77].

Zipf's law[13] posits that, in a Zipf distribution, the log of the frequency of words in a book or complex speech should depend on the log of the rank in the words' distribution, with a correlation equal to −1. To verify this hypothesis in our special collection, we first pooled all words in the thirteen papers collected, and then calculated their relative frequency. We then tested the following specification (Eq. (1)) on the basis of a simple OLS regression:

$$\ln(Freq) = \alpha + \beta \ln(Rank) \qquad (1)$$

where *Freq* is the relative frequency with which words appear in the special collection, and *Rank* their positioning in the cardinal order of the words. Results of these estimates are presented in Table 2.

Table 2 suggests that the average slope of the Zipf's Law in the case of the special collection is equal to -0.71 (Column 1 in Table 2); hence, slightly less step than theoretically expected. This testifies to a rather homogeneous distribution of topics addressed by the papers in the collection. As many of the words included in the special collection include technical terms (such as conjunctions), or generic terms (such as "city"), Column 2 in Table 2 shows the results of running the same regression on the subset of words that are deemed to be more specific.

Results suggest a further decrease in the slope of the RS distribution, suggesting the recurrency of several concepts that draw the attention of many papers included in the collection. The RS distribution is graphically represented in Fig. 1.

Top ten recurring words in the published papers include population, energy, poverty, climate, housing, income, social, transport, digital, and risk. Taken together, these depict the portrait of inequalities affecting cities in numerous dimensions: from more traditional features (income, internal and external accessibility) to social, technological, and climate risk exposure traits.

Concluding remarks

The articles included in this collection offer a broad view of the many elements making life in cities unequal and calling for sound policies. At the same time, the testify to the capacity of cities to attract population from rural areas, with a consequent increase in internal inequalities that the papers published in this collection document for all institutional contexts.

The evidence presented in the articles of this collection provide food for thought for addressing the costs associated with the pervasive process of urbanization characterizing the first urban century[14]. Far from providing a gloomy view of cities, they are the result of the love of the authors of the papers for cities, and the goal to offer solutions to open questions[15].

The guest editors of this collection hope the readers will enjoy these papers as much as they did!

Table 1 | List of SI papers, continental context for which evidence was collected, and Google Scholar citations received as of Sep. 12, 2025

Special collection paper	Evidence collected for	Cumulative citations as of Sep. 12, 2025
16	*Africa*	15
17	*Asia*	19
18		3
19	*Europe*	8
20		59
21		23
22		–
23	*North America*	25
24		5
25		6
26	*Oceania*	4
27	*Global*	55
28		30

Total number SI papers were cited as of Sep. 12, 2025: 252.

Table 2 | Rank-size rules estimates

Model	(1) All words	(2) Only non-technical words
Log rank of the word	−0.709***	−0.636***
	(−82.65)	(−48.84)
Constant term	7.719***	7.337***
	(138.26)	(91.41)
N	1500	420
Adj. R^2	0.977	0.984

* = significant at the 90% level. ** = significant at the 95% level. *** = significant at the 99% level.

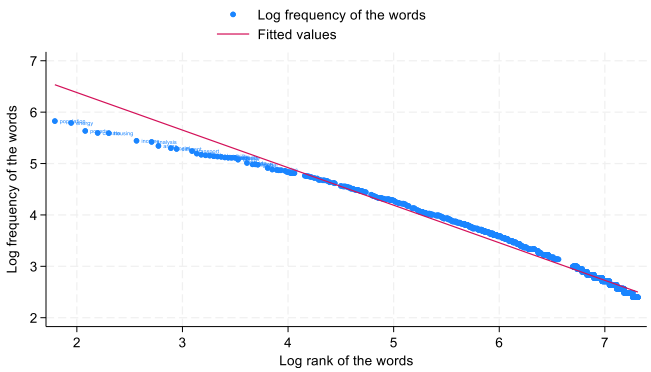

Fig. 1 | Rank-size rule for the words of the special issue.

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Author contributions

All three authors (A. Caragliu, C.F. Del Bo, and S. Bandyopadhyay) are equally responsible for all stages of this editorial. All authors have read and approved the manuscript.

Competing interests

A.C., C.F.D.B., and S.B. are Guest Editors of *npj Urban Sustainability*. The authors declare no other competing interests.