

# Vicissitudes of Cities driven by Redistributive Growth

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Empirical evidence suggests that the evolution of urban systems is not only determined by local conditions, but also is constrained by regional status. We propose an out-of-equilibrium model of emerging cities within a given region, which explains the spatial transitions of developmental focus and urban shrinkage phenomenon in developed cities. Meanwhile the model analytically keeps the classical results such as Clark's law for urban population density, and Zipf's law for cities' rank size distributions. We derive that these classical properties are valid for developing areas, or equivalently, most of the present cities; and the second phase of our model predicts the inevitability of various urban diseases given the limited regional resource.

## INTRODUCTION

Modeling urban growth dynamics through spatial models have drawn tons of concerns in the science of cities. Various significant properties of urban systems, namely Zipf's law for city's size distributions, or Clark's law for the spatial distribution of population within a city, have been addressed by models associated with promising underlying mechanisms. With such models we can further predict what equilibrium an urban systems will reach with unexpected forces such as conflagrations or

pandemics.

## DISCUSSION

In this letter, we have proposed a simple mechanism, spatial preferential growth with finite seeds, to simulate the emergence of cities and reveal the scaling laws as well as how ecological dilemma would lead to spatial transitions.

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