Supplementary Material
Memory Matters for Cities

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(Dated: December 2, 2019)

CONTENTS

In this Supplementary Material, we provide details on ideas of model formulation, methodology, proofs, and empirical tests for the Letter Memory Matters for Cities.

DETAILS ON THE SIMULATIONS

The simulation results presented here are obtained in the following way. Instead of conducting the designed protocol, we do it in a equivalent way by stretching timeline to events labeled in integer. At each time step, we first decide if we add a new city, with probability $p(S)$, or a new meta-population to the existing city, with probability $1 - p(S)$. The probability $p(S)$ is determined by the total

PHASE ONE: FREE GROWTH PHASE

derivation for Zipf's law of urban rank sizes

proof for Clark's law

Numerical verifications

SPATIAL COHERENCE

RELATIVE RELATIONSHIP BETWEEN URBAN MEMORY AND URBAN SIZE

We give a numerical tests for this discussion.

PHASE TWO: RESOURCE RESTRICTIONS

superior switching

urban shrinkage

The urban development is a sequel of the spatial distribution of existing resource. Thus the preferential attachment is not only performed among people, but also on urban land-use. The concentration of urban resource result in urban shrinkage, indicating that the popular definition of resource distribution, say Gross Democratic Product (GDP), may not be the best indicator of regional furtune.

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