Statistical Investigations on Real Data

Technical Note

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Abstract

We describe empirical investigations to be done on real data, through statistical analysis. We formalize therein various hypothesis to be tested.

1 Introduction

2 Context Formalization

2.1 Variables

Description We assume a dynamic transportation network $n(\vec{x},t)$ within a dynamic territorial landscape $\vec{T}(\vec{x},t)$, which components are to simplify population $p(\vec{x},t)$ and employments $e(\vec{x},t)$. Data is structured the following way :

- Observation of territorial variables are discretized in space and in time, i.e. the spatial field $\vec{T}$ is summarized by $\mathbf{T} = \left(\vec{T}(\vec{x}_i, t_j^{(T)})\right)_{i,j}$ with $1 \leq i \leq N$ and $1 \leq j \leq T$. They concretely correspond to census on administrative units (*communes* in our case) at different dates.
- Network has a continuous spatial position but

Definitions

2.2 Accessibility

The notion of accessibility has been central to regional science since its introduction and systematization in planning around 1970.

Existence of accessibility An elegant axiomatic definition is derived in [Weibull, 1976]. Starting from expected properties of an accessibility function A that associate a value to *attraction* a and distance d, defined on the set of discrete spatial configurations $\mathcal{C} = \cup_{n\in\mathbb{N}}(d_i, a_i)_{1\leq i\leq n}$. These properties include (among technical others with no thematic meaning) :

1. A is invariant regarding the order of the configuration
2. A decrease with distance at fixed attraction and increase with attraction at fixed distance
3. A is invariant when adding null attractions and constant configurations

Continuous approach and accessibility potential

3 Statistical Tests

3.1 Bivariate linear models

3.2 Autocorrelated univariate models

3.3 Autocorrelated multivariate models

3.4 Granger causality tests

[Xie and Levinson, 2009] use Granger causality to link transit with land-use changes.

3.5 Autoregressive multivariate models

3.6 Autoregressive autocorrelated multivariate models

References

[Weibull, 1976] Weibull, J. W. (1976). An axiomatic approach to the measurement of accessibility. *Regional Science and Urban Economics*, 6(4):357–379.

[Xie and Levinson, 2009] Xie, F. and Levinson, D. (2009). How streetcars shaped suburbanization: a granger causality analysis of land use and transit in the twin cities. *Journal of Economic Geography*, page lbp031.