Thesis Progress Meeting

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Achieved Work (by projects)

- Cybergeo [1.6w] (ETA 1.5w)

- Gibrat-interaction [1.7w] (ETA 1.5w)

- Spatial Statistics [0.5w]

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Network Necessity

Simple toy models to test theoretical assumption of network necessity

$\rightarrow$ Extended Gibrat model for population growth within a city system (simplified Favaro-Pumain model or projected Cottineau-1.y.z model) with interactions. *Idea :* Test if physical Network (feedback of physical flows) allows a better fit.

Rq. : a lot of confusion on Gibrat Model :

1. Under classical independence assumptions, $Law(P)$ is known at any t whatever the distribution of growth rates : no need to simulate).

2. Furthermore, various formulation are possible : independent realizations across cities of the same random process $P(t)$ with varying non-stationary parameters $\mu(t)$, with interdependence captured in recurrence relation between successive expectancies ; or multi-dimensional random process $(P_i(t))$ with covariance structure $\text{Cov}[P_i, P_j]$ estimated in time.

First Modeling Results

Interaction model with $\mathbb{E}\left[\vec{P}(t+1)\right] = (r_0 \cdot \mathbf{Id} + \mathbf{R})\,\mathbb{E}\left[\vec{P}(t)\right]$, specified with gravity interactions $(\mathbf{R}[\cdot])_{ij} = \frac{1}{V_0} \cdot \left(\frac{\mathbb{E}[P_j]\,\mathbb{E}[P_i]}{P^2}\right)^{\gamma} \cdot \exp\left(-\frac{d_{ij}}{d_0}\right)$ (note : taking $\gamma = 1$ yields linear formulation).

Exploration

Gravity Only

Exploration

Feedback Only

Exploration

Feedback with fixed gravity : first evidences of network effects

Calibration

Gravity only

Calibration

Feedback only

Calibration

Full Model, Iterative Calibration

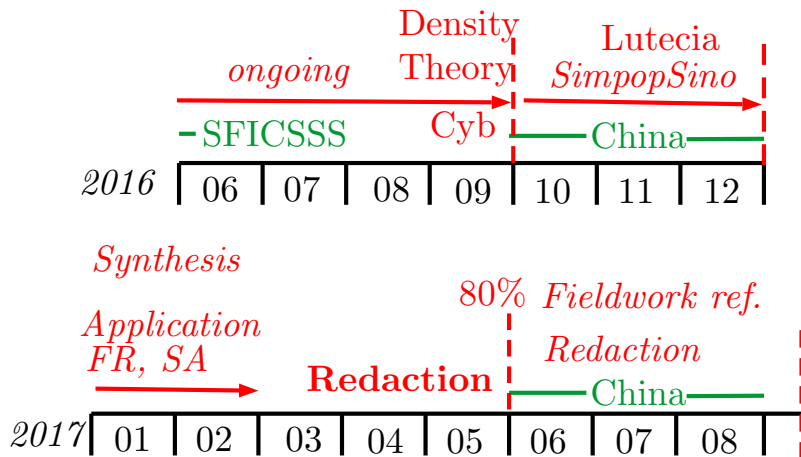# Calibration

Full Model

Profiles

Full Model

Temporal moving window

Calibration by normalized periods (no war, same number of data points)

Temporal moving window

Thesis Organisation

Next steps (until August 30th 2016)

- SFICSSS [4w] (+ holidays [2w])

- Cybergeo Paper [1w]

- Density Paper [1w]

- Theoretical Paper [1w]

- Static Correlations (presentation at RGS conference on 31th) [1w]

- China project [1w]