# Understanding Functional Changes and the Boundaries of Polycentric Metropolitan Areas with New Tools: the Case of Florence

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I- Topic and background

II- Research question

III- Research approach

IV- Conclusions and future developments

# The topic and its relevance

- ✓ Defining territorial boundaries is, in general, a **central issue** because defining the perimeter of issues we want to govern is central to policy effectiveness.

- ✓ This aspect is central especially for European metropolitan areas in which the main share of population, production and consumption is concentrated.

- ✓ These metropolitan areas do not fit well within administrative boundaries.

- ✓ The transition from a typically urban development model to one where the regional urbanization has produced the phenomena of a "multi-scalar regional urbanization" overcomes the typical metropolitan development model which puts this issue in a (re)new central position.

# Background

✓One of the many spatial structures associated with nexus between globalization and urban change has been the development of a **new type of urban form**, formally known under a **wide range of labels**: Polycentric Urban Region, Functional Urban Region, Polycentric Metropolis, Mega-City Region, Polynuclear Urban Region, Polycentric Network, Edgeless City, Endless City, City-Region, Regional City, (Gillham 2002; Hall Pain, 2006; Keil 2011; Kloosterman, Musterd 2001; Lang 2003; Roy 2009; Scott 2001)

✓These terms, placing themselves beyond that of cities and metropolises (Soja 2011) describing the extreme **instability** of the **cognitive categories** and **tools** used today.

✓From this arises the need for tools to explore and develop innovative concepts that can describe the metropolitan dimension and thus draw the boundaries in terms of identification of the relations between cities.

# Research approach: the double prespective

From the **evocative** point of view, the metropolitan area is a relatively **simple concept** but from an **analytical point of view the concept is complex** and needs further theoretical clarification and empirical assessment to investigate the appropriate complexity.
A metropolitan area is certainly a large urbanization but also a dense **network** of linkages that refer to notions of integration in several forms (functional, institutional and social).

In order to identify actual metropolitan areas it is necessary to study settlements in two separate, but complementary, approaches:

1. DIMENSIONS
2. FORM
3. FUNCTIONS

**FUNCTIONAL-MORPHOLOGICAL LOGIC**:
Stock and endowment changes

4. RELATIONS
5. CONNECTIVITY
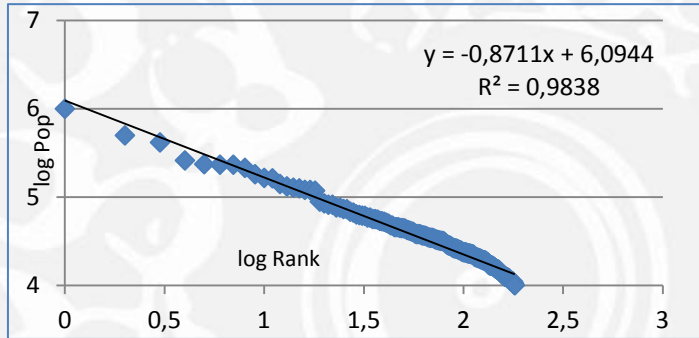6. HIERARCHY

**NETWORK LOGIC:**
**Interconnection and flow changes**

The Florence metropolitan area offers an interesting case study to investigate the relationships between cities. It is composed of several medium-sized cities, some authors have recognized it as a polycentric spatial structure (Meijers E. et. al., 2017).
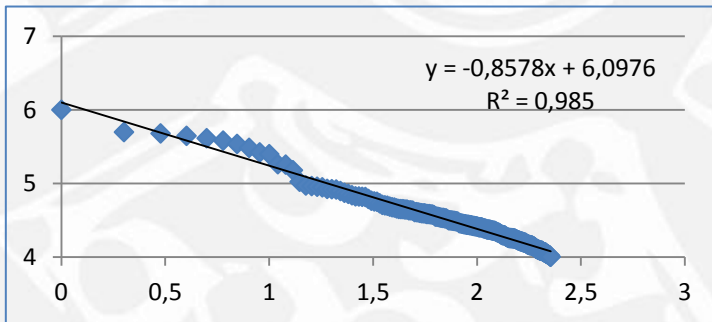
# Settlement pattern in Italy: rank size regression 2015

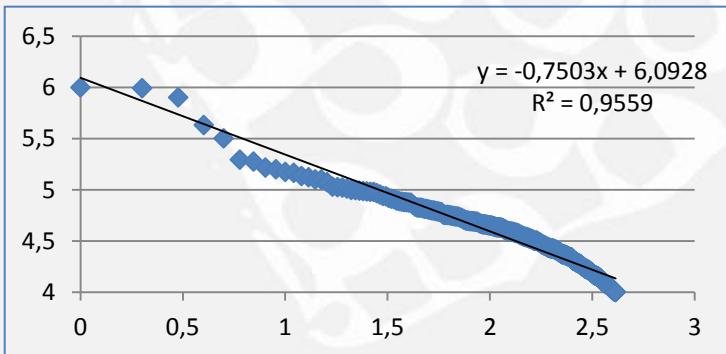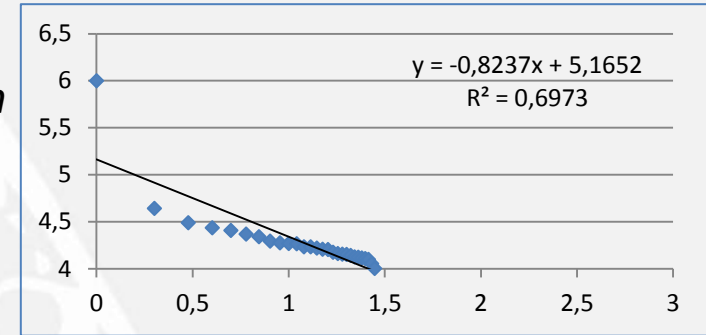Rank-size rule: "clear, theoretically founded definition of polycentricity" (Meijers, 2008.)
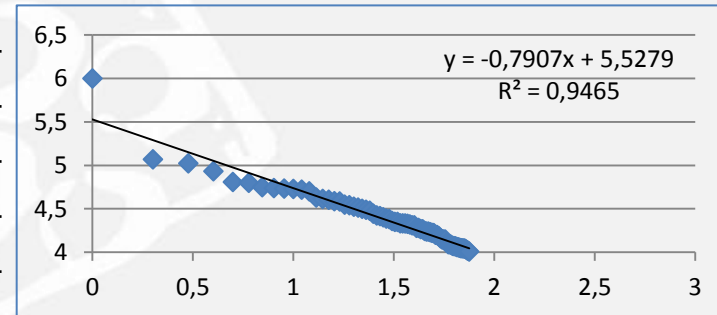
*Polycentric region*
*Versus*
*Monocentric region*

**Toscana**



$y = -0{,}8711x + 6{,}0944$
$R^2 = 0{,}9838$

log Pop
log Rank

**Lazio**



$y = -0{,}8237x + 5{,}1652$
$R^2 = 0{,}6973$

**Emilia Romagna**



$y = -0{,}8578x + 6{,}0976$
$R^2 = 0{,}985$

**primacy index**

**(rank city 1/α)**

| | |
|---|---|
| Toscana | 0.912 |
| Emilia | 0.984 |
| Veneto | 0.985 |
| Lazio | 1.162 |
| Piemonte | 1.085 |
| Lombardia | 1.106 |

**Piemonte**



$y = -0{,}7907x + 5{,}5279$
$R^2 = 0{,}9465$

**Veneto**



$y = -0{,}7503x + 6{,}0928$
$R^2 = 0{,}9559$

**Lombardia**



$y = -0{,}6755x + 5{,}4251$
$R^2 = 0{,}959$
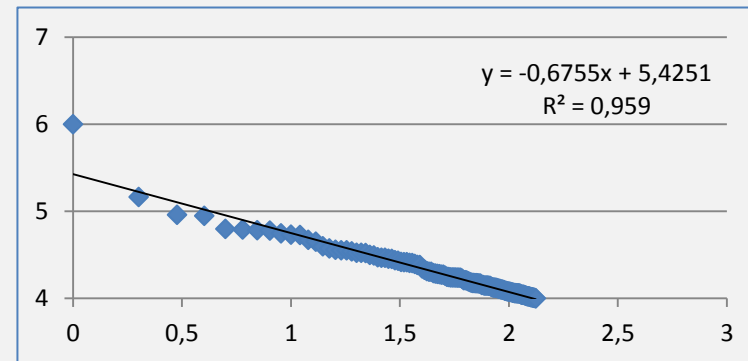
# Settlement pattern in Tuscany: rank size regression : 1971 e 2011



**1971**

$y = -0,8016x + 5,9042$
$R^2 = 0,9558$

Florence, Livorno, Prato, Pisa, Lucca, Pistoia, Arezzo, Carrara, Siena, Massa

log Pop — Rank



1978
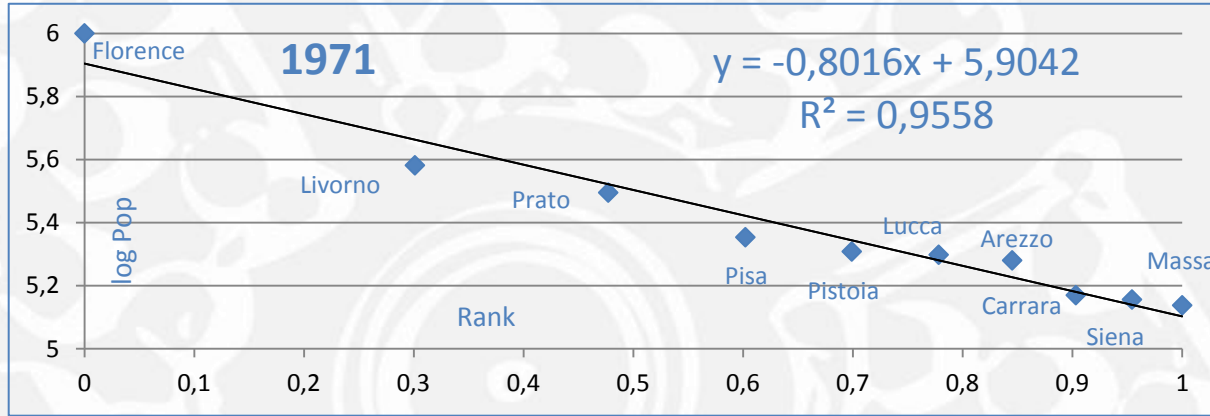
The polycentric organization of settlements in Tuscany is a historical feature but it has also been interconnected with some changes that involve the rank of some cities as well as a flow system.



**2011**

$y = -0,7377x + 5,9486$
$R^2 = 0,9613$

Florence, Prato, Livorno, Arezzo, Pistoia, Pisa, Lucca, Grosseto, Massa, Carrara

log Pop — Rank



2012
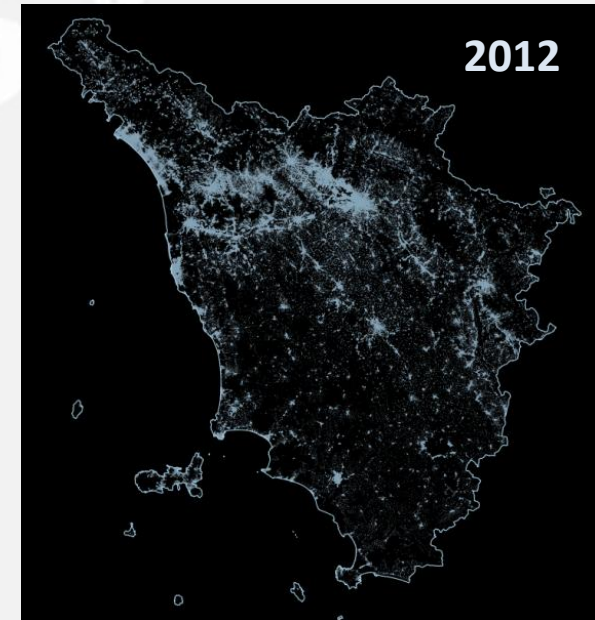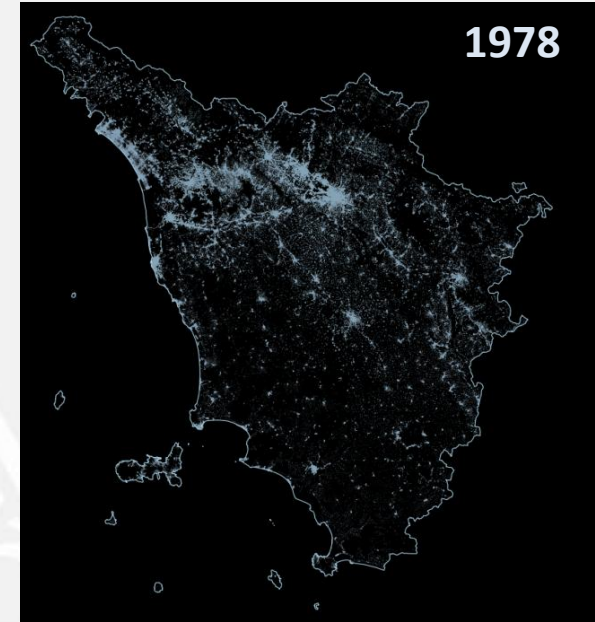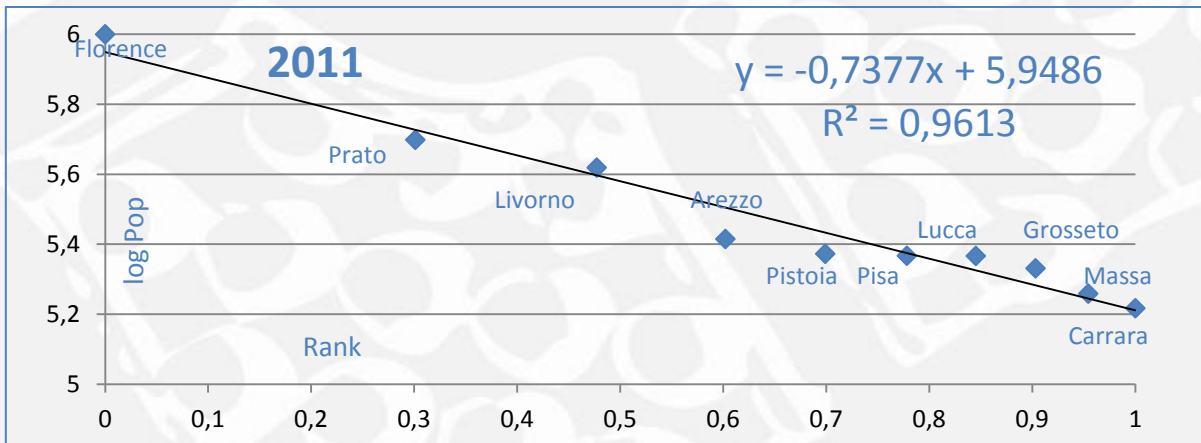
A certain path dependency, as Batty stressed (Batty 2001), is evident in Tuscany although it is subject to the action of forces that reconfigure it, such as hierarchies (in terms of functional specialization) and urban boundaries.
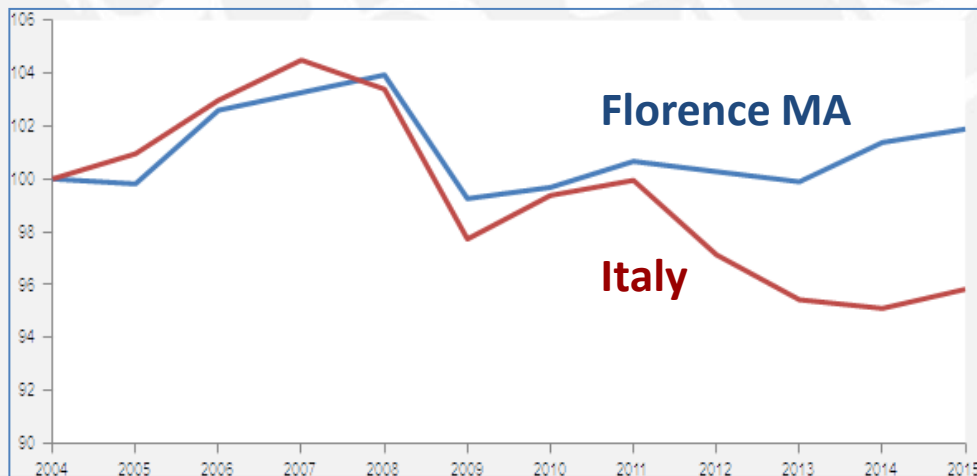
# Florence Metropolitan Area

The Florence MA is an high-density zone with a high concentration of economic activities and services that is crucial for the economic development of the whole region.
During the crisis Florence MA has performed better than the rest of Tuscany and than Italy.
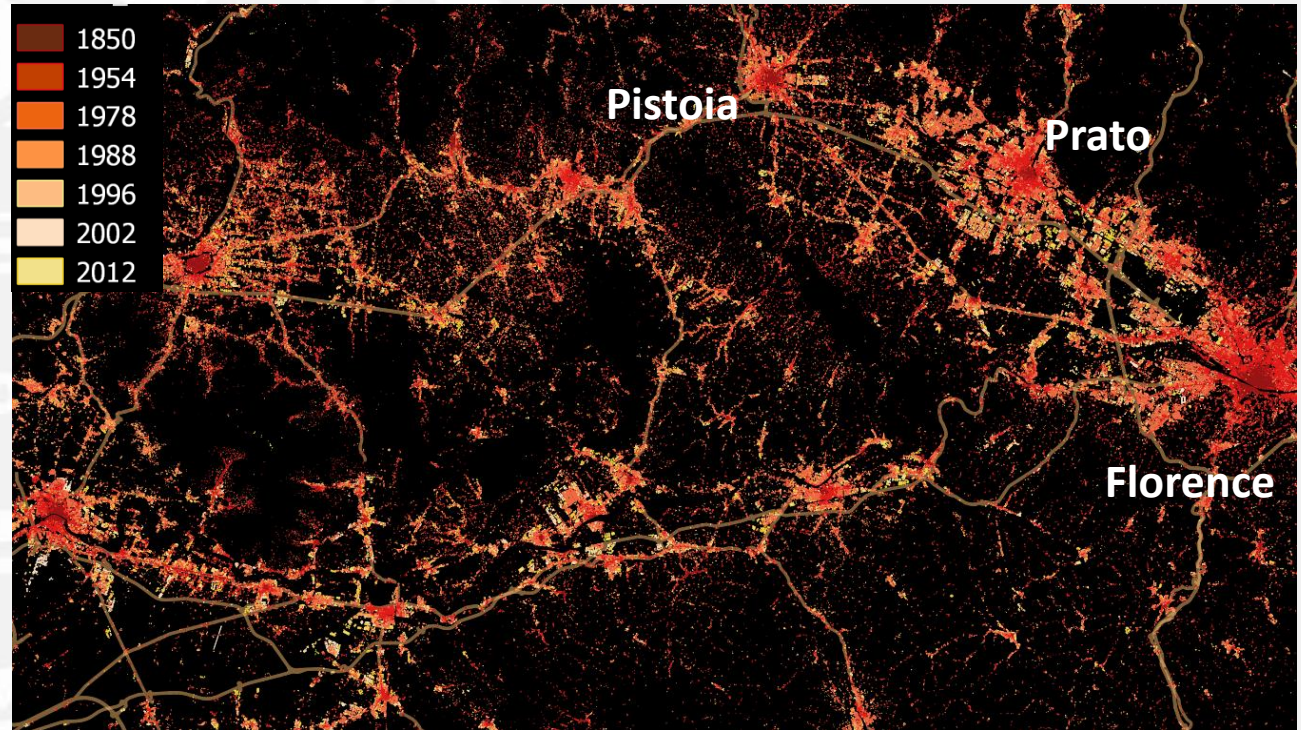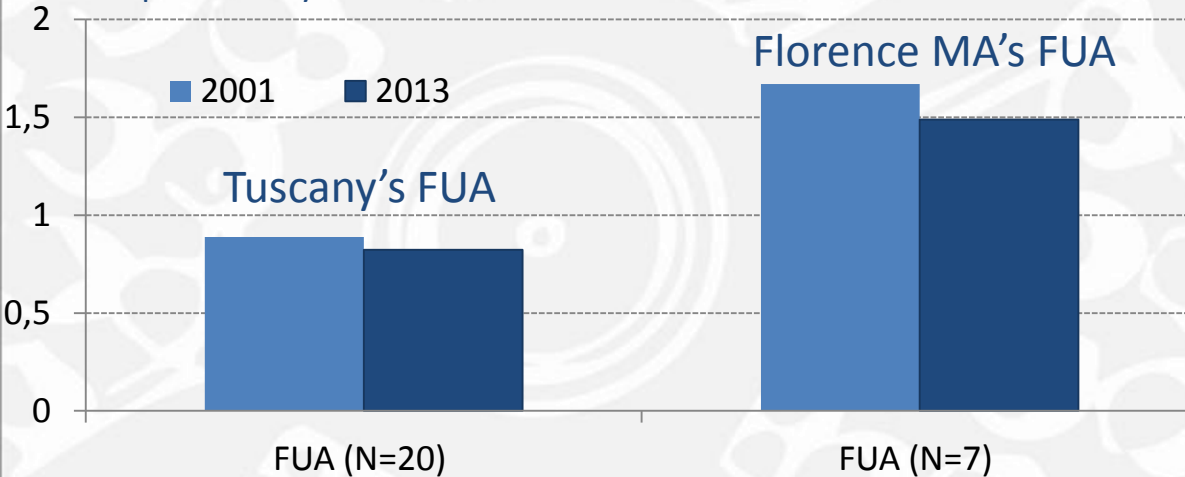


GDP, 2004-2015.



From a settlement point of view we can highlight an evident path dependency even if combined with relevant functional changes in progress.
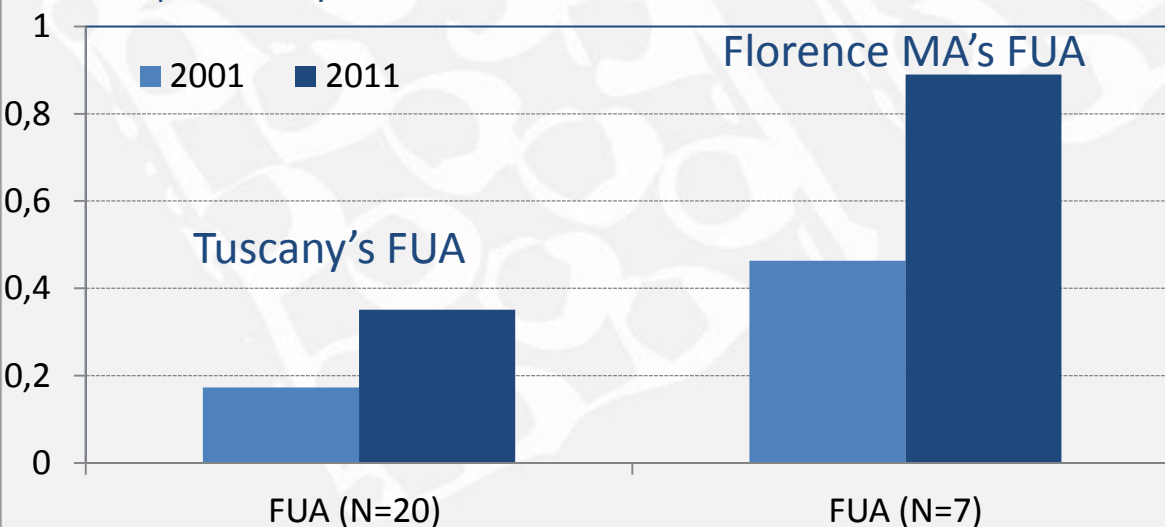
**Sectorial specialization trend**. Fua, 2001 - 2013

Complementary ratio



Florence MA's FUA

Tuscany's FUA

- 2001
- 2013

FUA (N=20)    FUA (N=7)

**Fuctional specialization trend**. Fua, 2001 - 2011

Complementary ratio



Florence MA's FUA

Tuscany's FUA

- 2001
- 2011

FUA (N=20)    FUA (N=7)

The economic profile of tuscan urban areas, in terms of **sectorial specialization** (*where people work*), is becoming **less differentiated**, especially in the central metropolitan area .

This is a general trend for the cities: some studies argue that cities are increasingly distinguished by their **functional specialization** (*what people do*) rather than their sectorial specialization.

This is true also for the central metropolitan area of Tuscany, that increases its fuctional specialization (top-level jobs rather than unskilled manual workers).

# Florence Metropolitan Area and boundary

Its functional form does not correspond with any precise administrative boundary.

**Flows of mobility (Census data)**
**(commuting, origin-destinatio matrix)**

**Settlmentes**
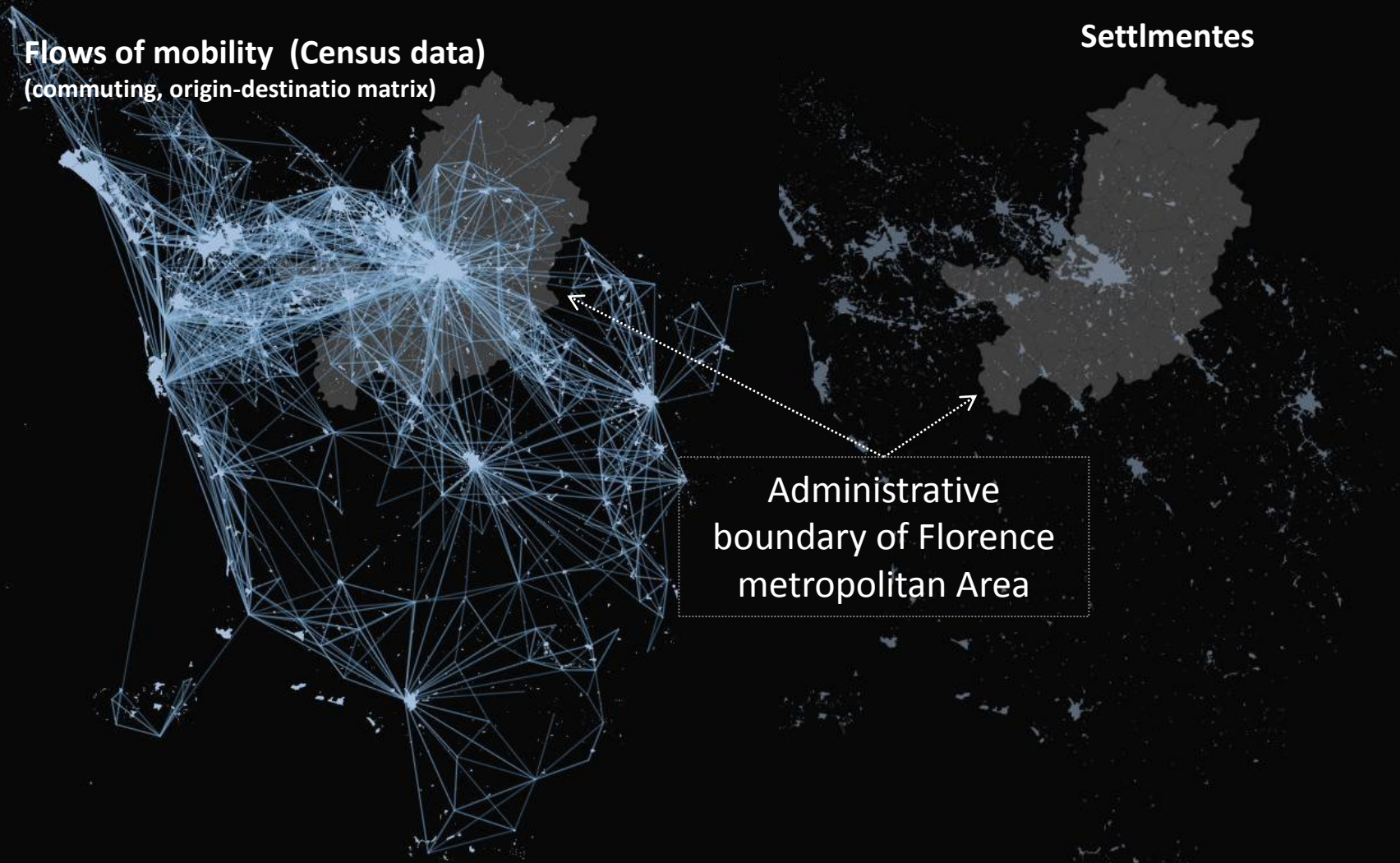
Administrative boundary of Florence metropolitan Area

The administrative boundaries do not fit well with the system of home-work mobility flows and do not fit well with the shape of settlements.
This suggests rethinking administrative boundaries and expanding the understanding tools.

# Mapping linkages between cities through New Data on mobility

IT proliferation has led to the diffusion of sensors able to track human activity.
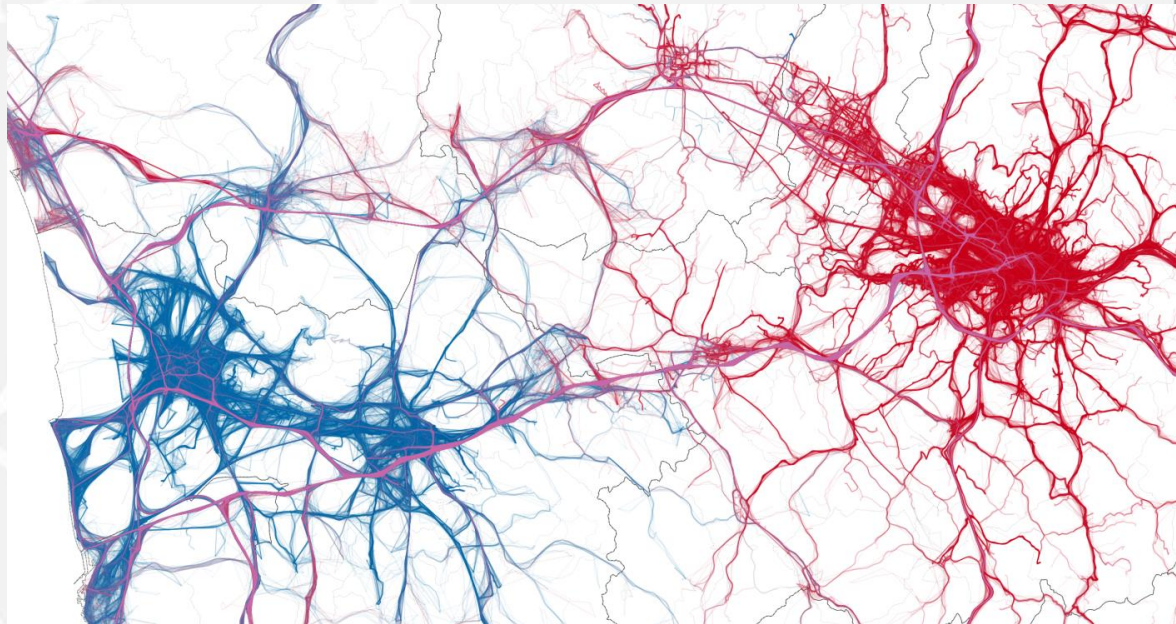
- **GPS traces of vehicles mobility**



**OCTO**

**Feb-Mar 2014**

Time period

**150K** Vehicles

**12 mln** Trips

The academic literature and institutions recognize the intrinsic value of this kind of data but lack a systematic approach in its use. We need to define shared and rigorous procedures to estimate and validate the data.
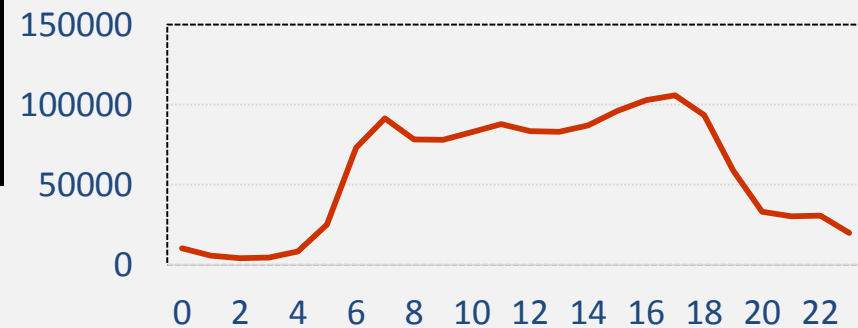
STEPS:
Data estimation and validation
Pilot projects for tool testing
Integration and systematization
of all available data
Regional and urban level analysis

# Mapping flows mobility between cities
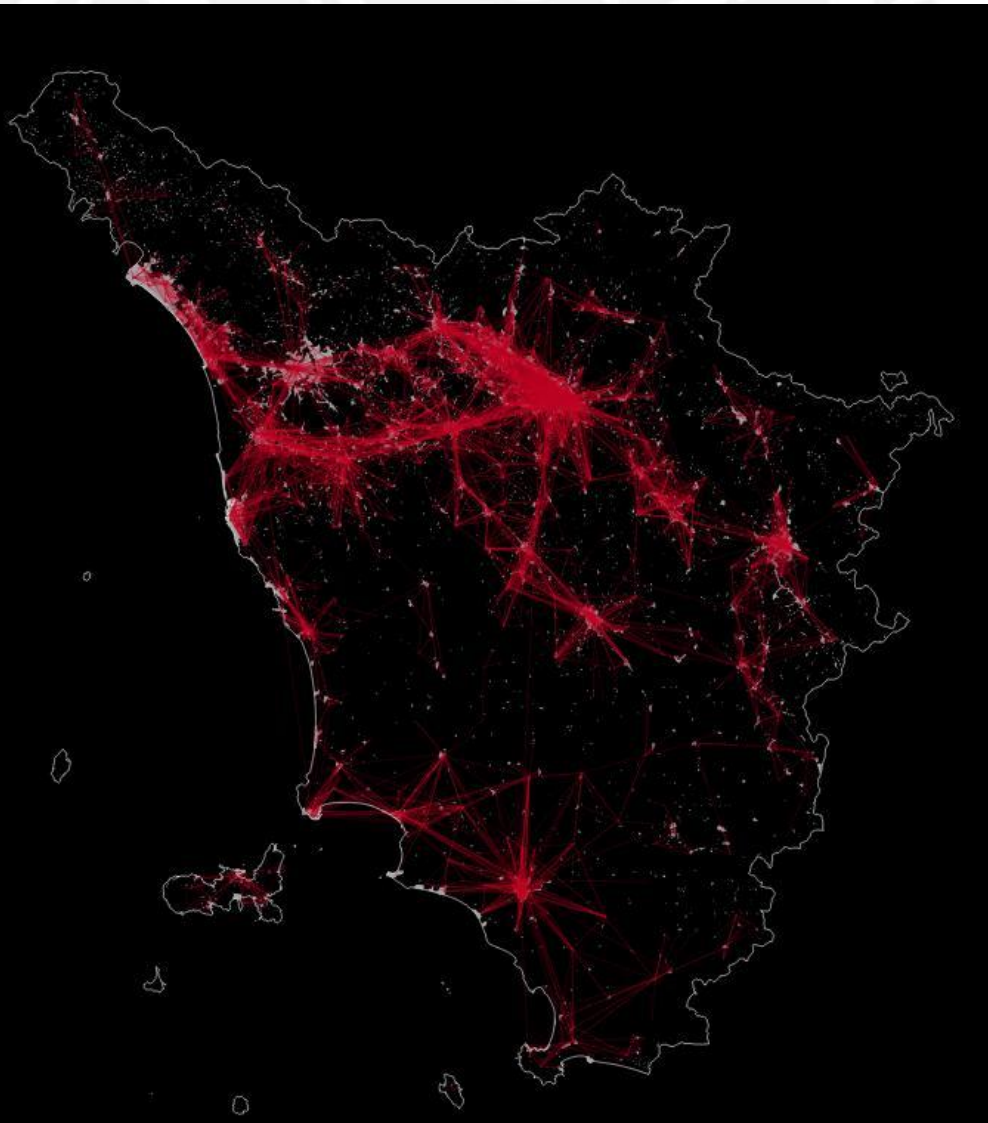


**Flows of all kind of mobility (GPS origin-destinatio matrix)**

Time slot distribution (trajectories with origin and destination to Florence)
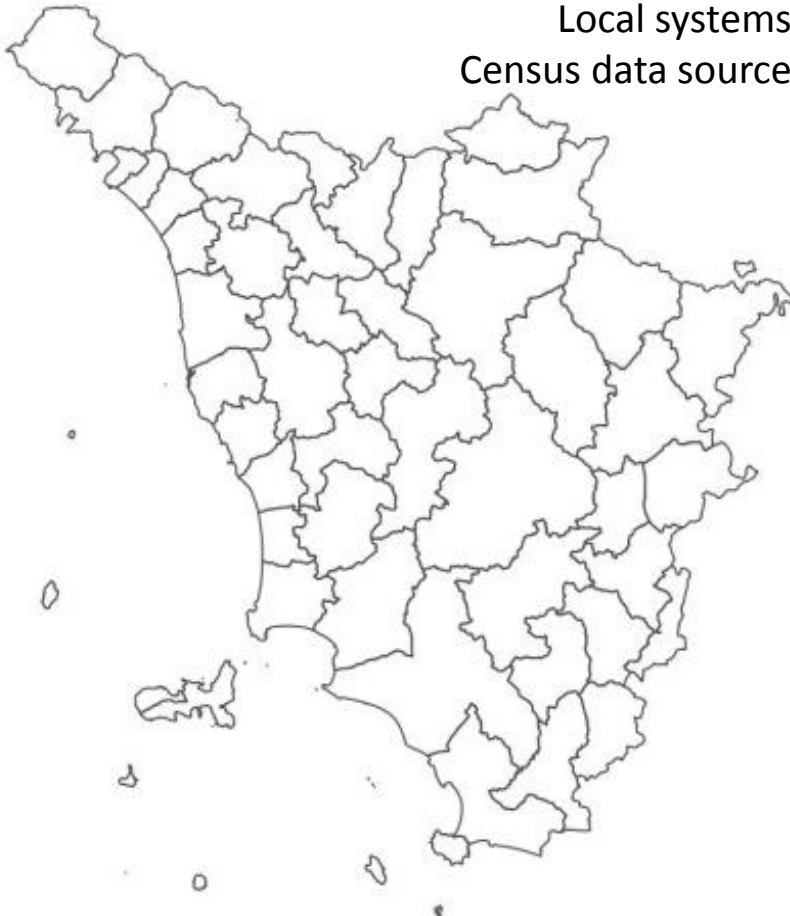
# Self-containing in local systems: compare systematic and non systematic mobility
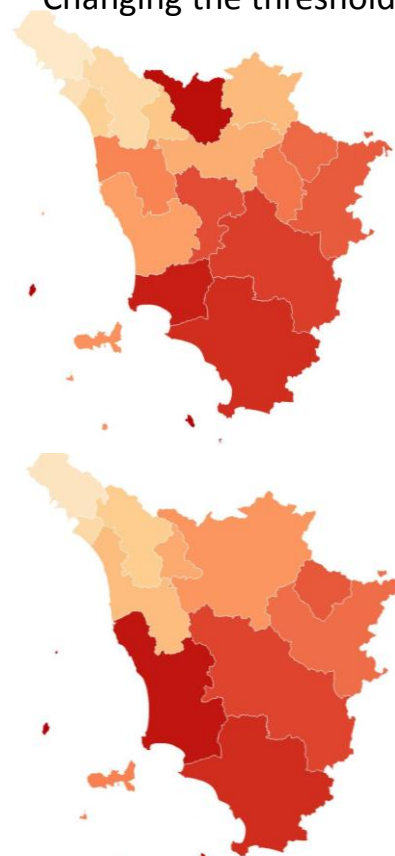
Local systems calculated on the basis of self contained labour areas (census data, systematic mobility).

Self-cointained areas calculate with GPS data source (using the same algorithm as the local systems calculated with the census data).


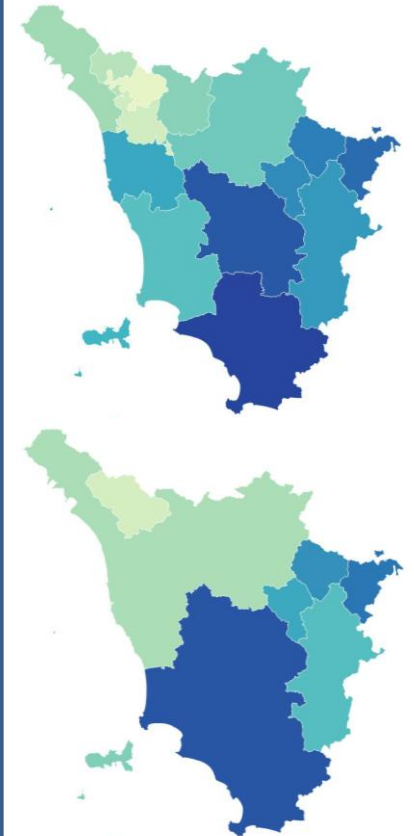
Local systems
Census data source
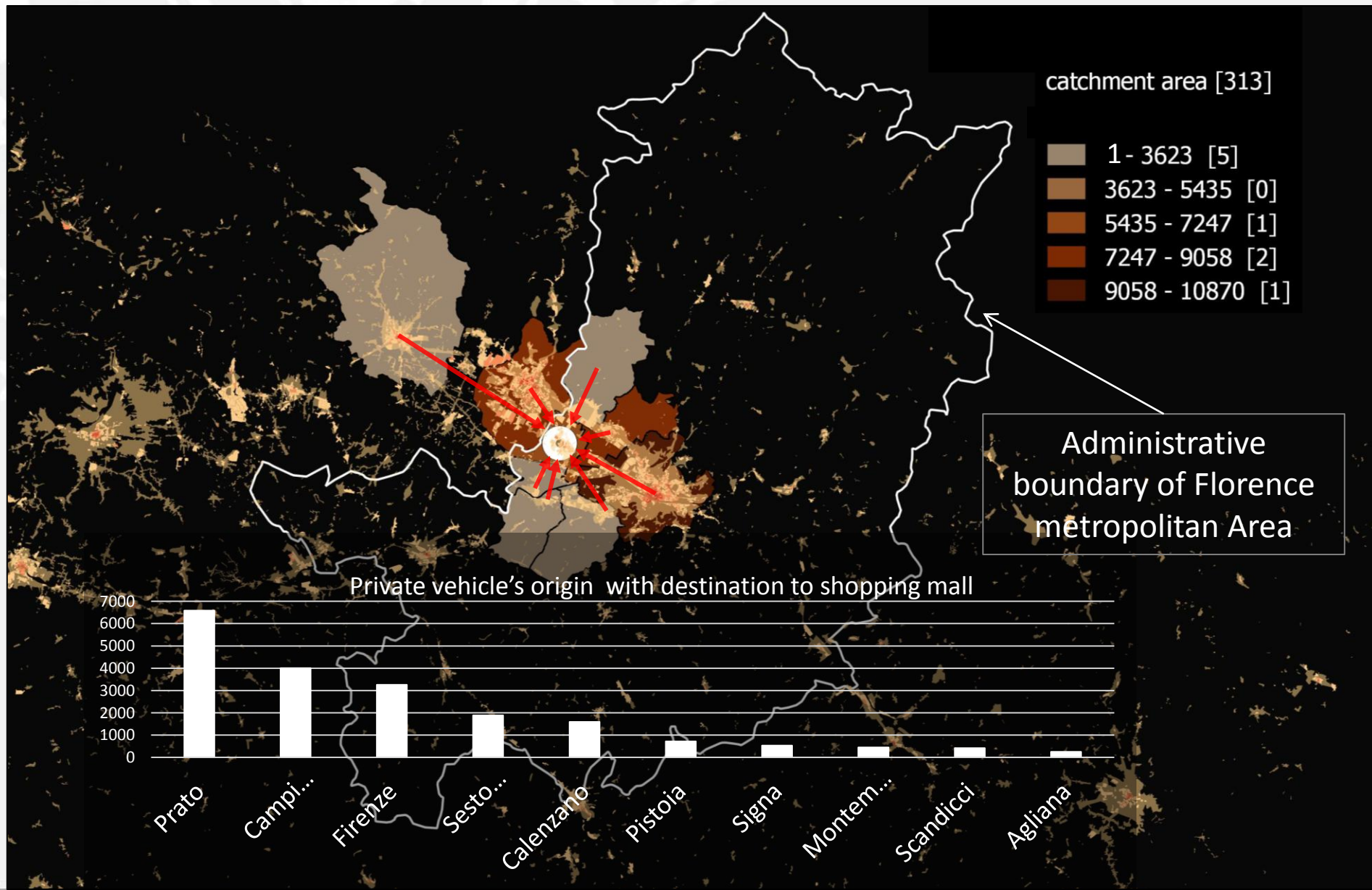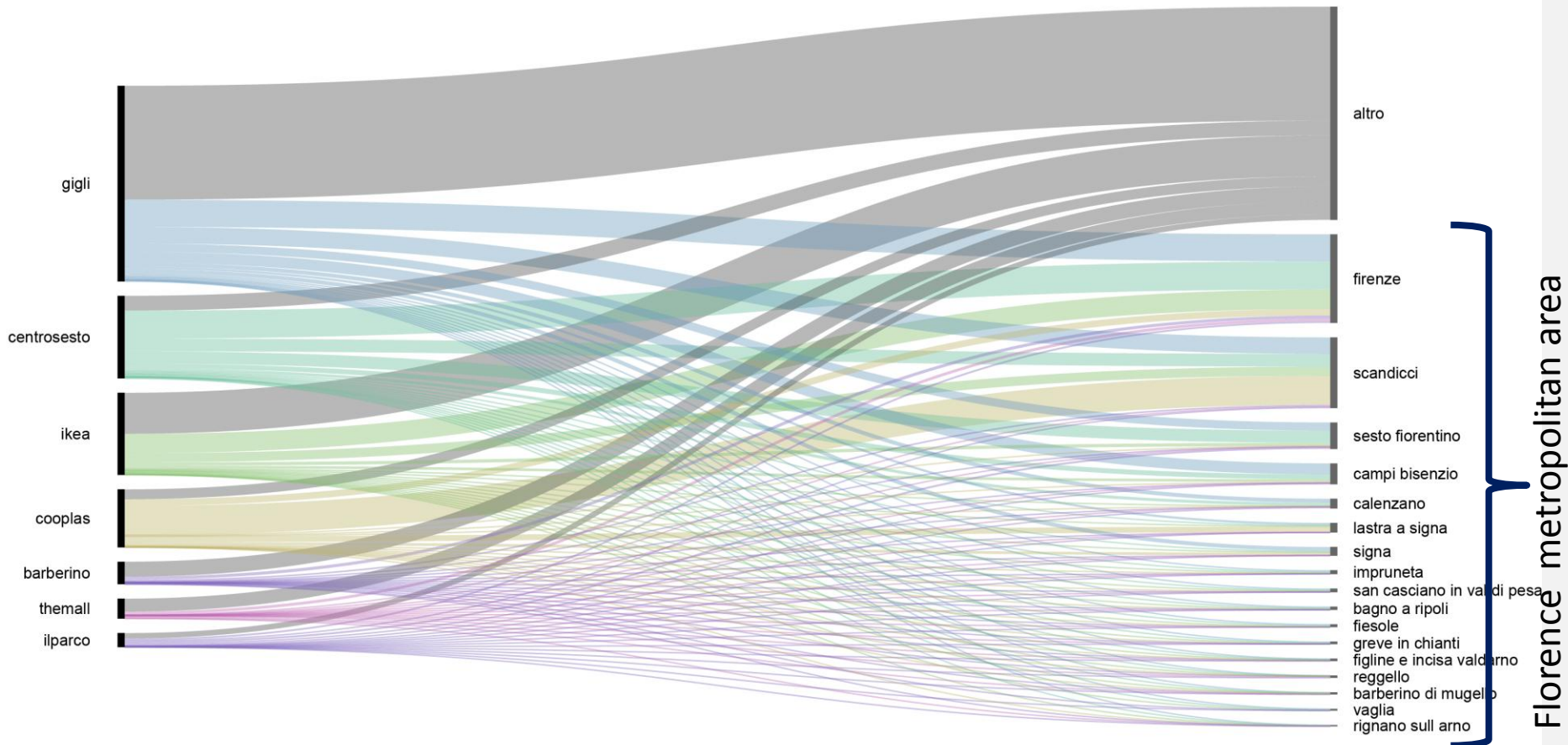
non systematic mobility:
Changing the threshold

systematic mobility:
Changing the threshold

Another application of this kind of data is related to study the attractiveness of metropolitan hubs (shopping mall's catchment area) and his relation with the administrative boundaries.



catchment area [313]

| | | |
|---|---|---|
| ▨ | 1 - 3623 | [5] |
| ▨ | 3623 - 5435 | [0] |
| ▨ | 5435 - 7247 | [1] |
| ▨ | 7247 - 9058 | [2] |
| ▨ | 9058 - 10870 | [1] |

Administrative boundary of Florence metropolitan Area

Private vehicle's origin with destination to shopping mall

(bar chart with y-axis 0–7000, categories: Prato, Campi..., Firenze, Sesto..., Calenzano, Pistoia, Signa, Montem..., Scandicci, Agliana)

# The catchment area of shopping malls in Florence metropolitan Area (origin-destination)



...only a minority part of the flows has its origin in the metropolitan area

# Conclusions and future developments

✓The **polycentric organization** of FM area is a **historical feature** but it has also been interconnected with some **changes** that involve the rank of cities as well as a flow system.
The FM area becoming more homogeneous in terms of sectorial specialization (less hierarchical) but more **hierarchical in terms of functional specialization** ("where people work" *versus "*what people do*")* .

✓About the Florence metropolitan area's boundary: it's **not possible indentify only one boundary** because every function has its own, they have variables perimeters. It's necessary to adopt a multiplex point of view and multi-scale approach.
A reasonable solution for draw boundaries is to take into account **people's mobility, all type of mobility** (systematic and non systematic) and continue to explore new tools and sources (such as GSM data) to better understand the boundaries of cities.

# Thank you for your attention

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