

Towards an Explanation of the Location Pattern of a Banking System in the Intrametropolitan Space: a case study of Toluca, Mexico

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Contributions and objectives of this Paper

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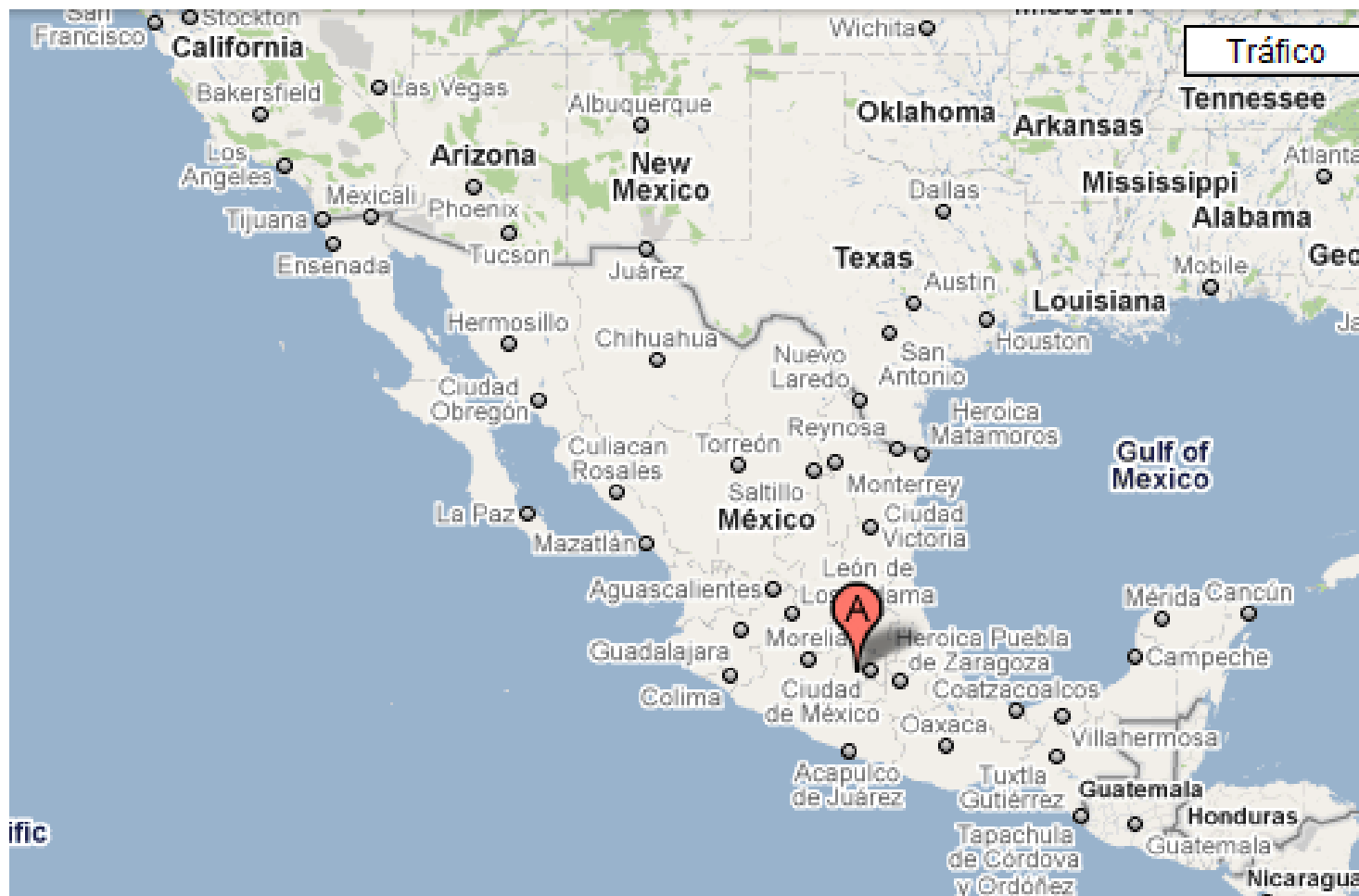
- For the purposes of this paper, two central issues are emphasized:
- **i. The influence of *demand* characteristics on the spatial localization of banking services** (e.g. which population or employment characteristics have more influence on the location of bank branches?);
and...

Contribution and objectives of this paper

- **ii.** The effects of existing *supply* of banking services on the location of new bank branches (e.g. do existing bank branches attract, reject or have no effect on the location of new bank branches entering the intrametropolitan market?).
- This second question has been much less **studied** than the first one.

Study Area:
The Toluca Metropolitan Zone

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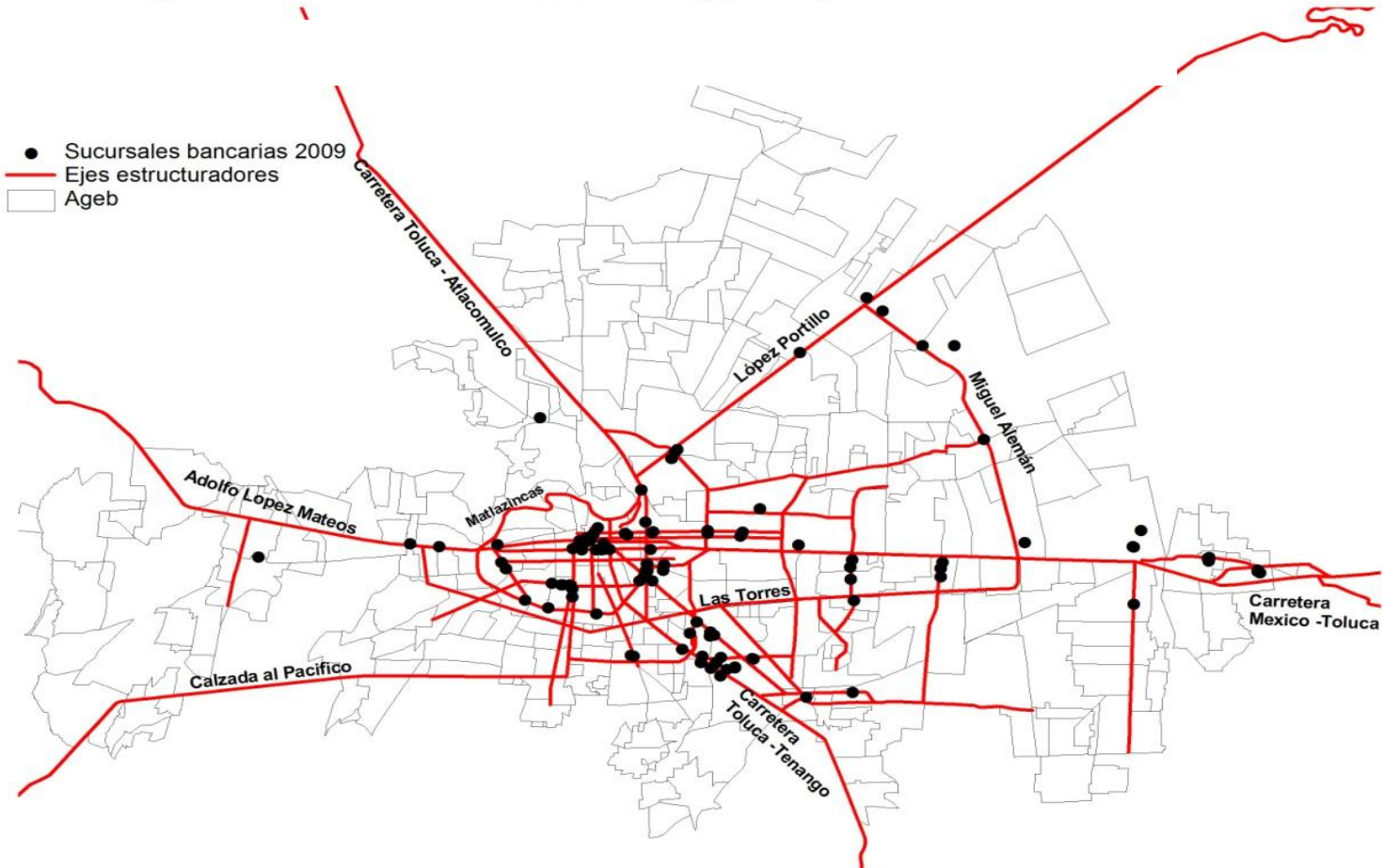


Study area: **The Toluca Metropolitan Area**

- With a population of 1.6 million, **it is one of the five largest cities in Mexico** (and now perhaps it is the fourth one).
- In terms of the **supply of banking services**, by the end of 2009 ten banking firms were operating in the TMA with a total of **107 bank branches**.

Study area: The Toluca Metropolitan Area

Figura 5. AMT: Sucursales bancarias y principales vialidades 2009



Basic Geostatistical Area: the smallest spatial unit reported in the census in Mexico.

Demand as a Determinant of
Bank Branches
Location Strategy

Demand as a Determinant of Bank Branches Location Strategy

- To explore the determinants of location strategy for bank branches as related to *demand*, we conducted a **standard multiple linear correlation analysis**.
- The **dependent variable** was the accessibility of each AGEB to the bank branches, estimated by a **gravity accessibility index** in the following manner :

Demand as a Determinant of Bank Branches Location Strategy

$$I_i = \sum_j \left(\frac{S_j}{O_{tot}} \right) C_{ij}^{-b}$$

Where S_j is the service supply in the service unit “j” (as defined by the number of teller stations in each bank branch, rather than by using the branch size); O_{tot} is the population demanding banking services in the study zone (population older than 15 years and total employed population in each AGEb); C_{ij} are the transportation costs between the origin i (the centroid of each AGEb) and the destination bank branch j ; and $-b$ is the friction parameter of the distance.

Demand as a Determinant of Bank Branches Location Strategy

- So, the dependent variable is **a cuasi spatial continuous data** which considers:
 - the **whole city...**
 - **at the same time,...**
 - because **it focus on...**
 - the **total spatial distribution of banking branches and potential customers...**
 - **simultaneously.**

Demand as a Determinant of Bank Branches Location Strategy

- In the other side, the **independent variables** were ***population*** (“*where population lives*”) and ***employment*** (“*where population works*”).

Demand as a Determinant of Bank Branches Location Strategy

- So, the **questions** are:
- “Bank branches **follow population** or **follow employment** or **follow both**?”
- And: if they follow both, what group is **more important** as an attractor of bank branches: **population or employment** and **what kind** of population and employment are the most important in attracting bank branches?”

Demand as a Determinant of Bank Branches Location Strategy

- To identify the variables most closely associated with the changes in **accessibility** to the bank branch system in the TMA, the *Stepwise* method was applied.
- We calculated **correlation coefficients** (adjusted R^2) and **partial coefficients**, both standardized and non-standardized, for each variable selected in the **final model**.

Demand as a Determinant of Bank Branches Location Strategy

- **All the standard tests** were conducted to ensure the significance of the results (and **prevent colinearity** between the independent variables: correlations between the independent variables, variance analysis (ANOVA), *F* and *t* tests, and calculation of both Tolerance and Variance Inflation Factors (VIF) for each estimated model...).
- The statistical package used was **SPSS**.

Demand as a Determinant of Bank Branches Location Strategy: Results

- The variables statistically most strongly correlated with **accessibility to the banking system** in the TMA were **in order of importance**:...
 - *(The order of importance of each variable was estimated according to the **Standardized Beta Coefficients**).*

Demand as a Determinant of Bank Branches Location Strategy: Results

- i. Government Activities (**0.345**);
- ii. Population with the highest income (**0.339**);
- iii. Total Population 15 years and older (**-0.303**);
- iv. Other Services Excluding Government Activities (**0.277**); and,
- v. Retail Commerce (**0.146**).

Demand as a Determinant of Bank Branches Location Strategy: Results

- Together these variables explained **0.625** (Adjusted R^2) of the behavior of **accessibility** to the city's banking system!!!
- In other words, these variables are the key inputs of the **demand algorithm**, we presume, banks use to locate their branches in the TMA!!!

Supply as a Determinant of
Bank Branches
Location Strategy

Supply as a Determinant of Bank Branches Location Strategy

- International references contains very few examples of **intrametropolitan location pattern analysis** for bank branches.
- However, there is **evidence** that the intrametropolitan location of banking services, **at least in some US cities**, tends towards **spatial concentration**, although the precise reasons for this locational behavior are only known **within the banking firms.**

Supply as a Determinant of Bank Branches Location Strategy

- **Warning:** It is an accepted fact that if the spatial pattern of economic units **cannot be reliably measured**, it becomes very difficult **to understand their spatial behavior**.

Supply as a Determinant of Bank Branches Location Strategy

- In this paper two types of *Ripley's K-function* are used because they are considered **some of the most robust techniques** for **simultaneously** analyzing **point patterns** at **numerous spatial scales**.

Methodology:
Spatial analysis with
K-Functions

Methodology: The K-function

- The *planar K-function* was applied to reveal the location pattern of bank branches in the study area, that is, to establish if the pattern is predominantly..
 - **agglomerated,**
 - **dispersed** or
 - **random.**

Methodology: The K-function

- While the results of the *Plannar K-Function* showed a **strong general tendency towards spatial agglomeration**, the *Plannar K-function* does not produce information on whether this agglomeration is **homogeneous** across all branches of **competing banks in the city**, or if it is **more or less intense** between **certain banks (firms)**.

Methodology: The K-function

- Therefore to explore the spatial relationship between branches of different banks we estimated the *Cross K-function*.
- *Cross K-function* shows that there are banking firms whose branches have higher spatial interrelationships.

The Planar and the Cross K-function

- The mathematical details of the *Planar and Cross K-functions* are widely reported in the international literature (i.e. Bailey and Gatrell, 1995; Diggle, 2003; Lu and Chen, 2006; Ripley, 1976; Ripley, 1981; Yamada and Thill, 2004; among many others). **Do not worry I am not so cruel to present them here!** (better see our paper).

The Planar and the Cross K-function

- **Here it is enough to say that:** Given a point distribution in a specific area of study, the planar K-function compares the observed value of K at a some distance (K_{obs}) with the expected or theoretical value of K at the same distance (*generated by Monte Carlo simulations under Complete Spatial Randomness conditions*).

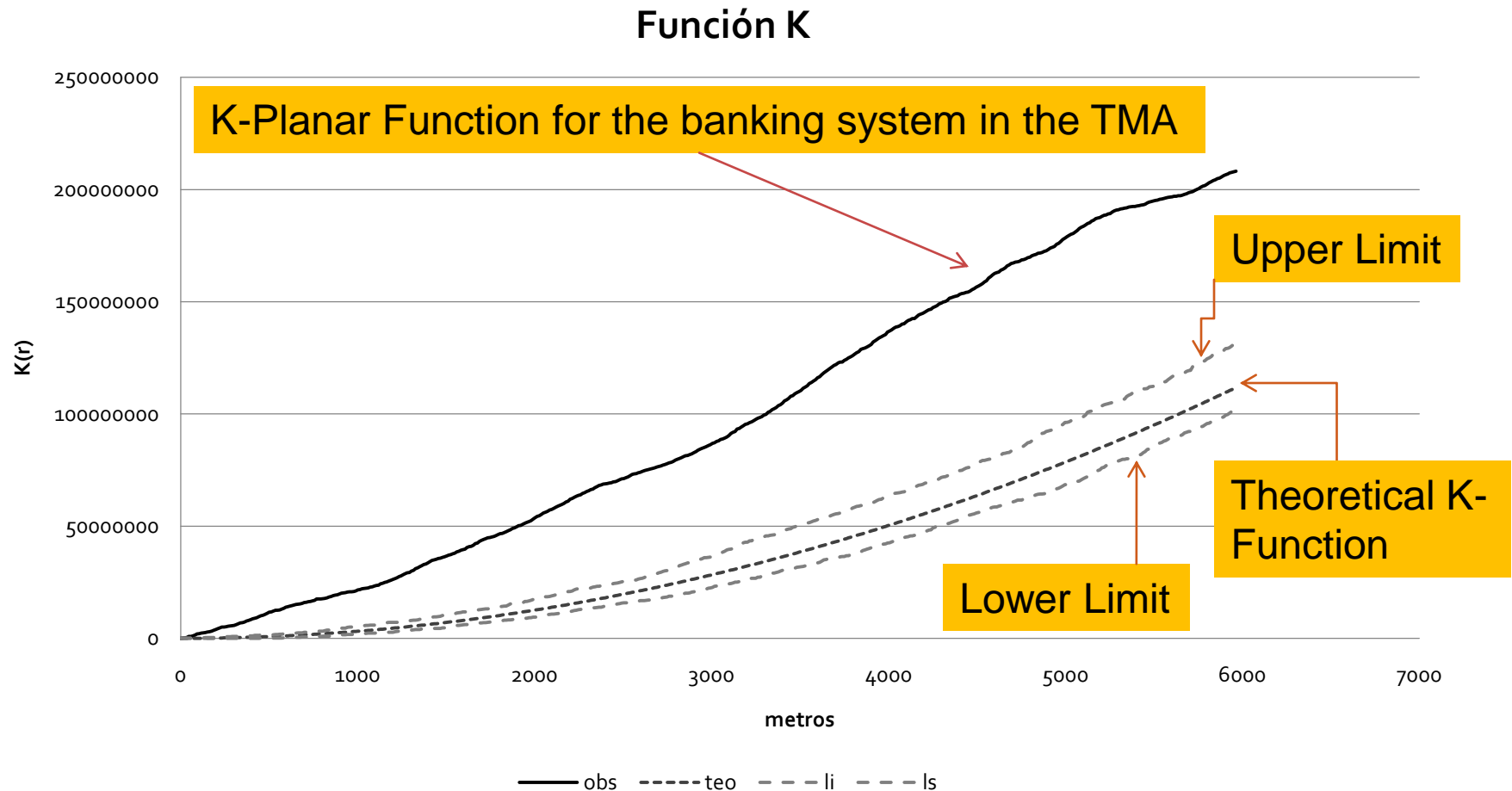
Some Results:
The Plannar K-Function

K-planar Function: Results

- Next figure shows that it is clear that the **spatial pattern** of the bank branches in the TMA is **strongly agglomerated** at any distance, since the **observed K-function** is **above the upper confidence limit** determined by the Monte Carlo simulations (the so-called *theoretical K-function*) for all values of *distance* (or, in other words: *at any scale*).

- **Remember:** If the *calculated Planar K-function* is...
 - Above Upper Limit = **Spatial Concentration**
 - Below Lower Limit = **Dispersion/Rejection**
 - Between Limits = **Randomness**

K-planar Function: Results



Some Preliminary Comments on The Cross K-Function

Spatial Attraction, Rejection or Indifference Between Branches of Competing Firms?

- ***Cross K-function*** allows to evaluate the spatial relationship between units of different firms (e.g. branches of different banks), to see if they ***agglomerate***, if they ***reject each other***, or if they distribute themselves ***at random*** in space.

- In other words, the *Cross K-function* proves **whether or not the spatial distribution of a set of points** (e.g. branches of a particular bank) **is related to the spatial distribution of another set of points** (e.g. branches of other banks)

Spatial Attraction, Rejection or Indifference Between Branches of Competing Firms?

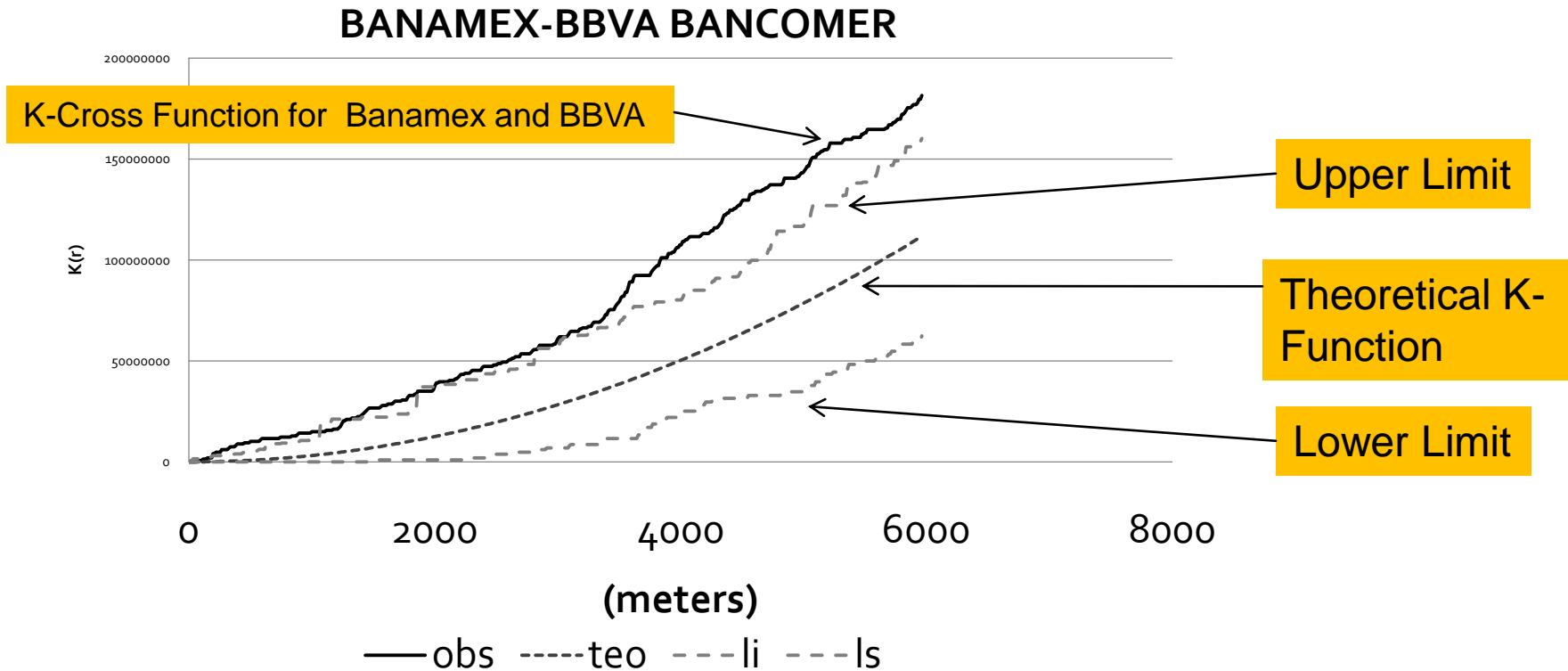
- **Remember:** If the Cross K-function of points i and j are:
 - Above Upper Limit = **Spatial Concentration/Attraction**
 - Below Lower Limit = **Dispersion/Rejection**
 - Between Limits = **Randomness**

The Cross K-Function: Some Results

Cross K-Function: Results

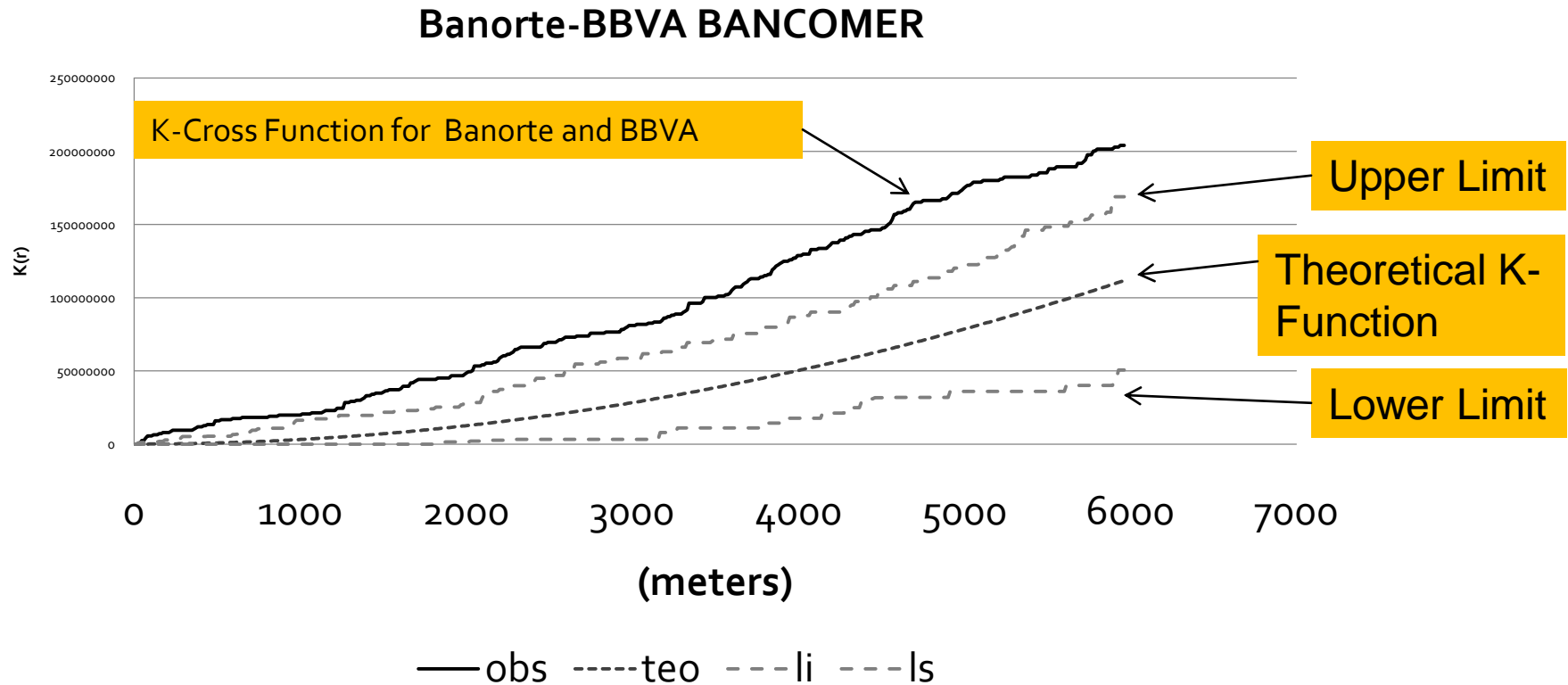
- The results of the Cross K-function show a clear tendency towards agglomeration....
- even when considering **sets of bank branches differentiated by the banking firm** to which they belong.

Cross K-Function: Results



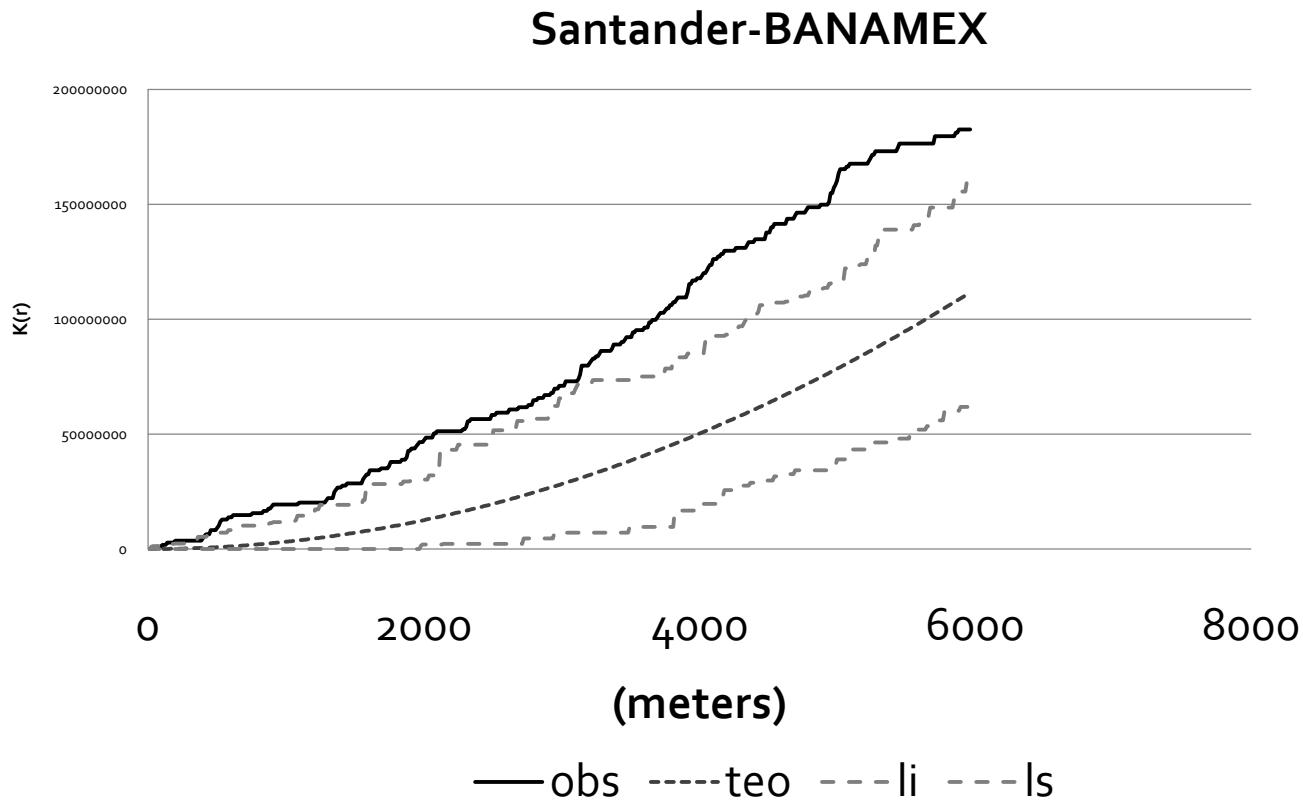
- Oscillation between light agglomeration and independence at distances smaller than 3km.
- Agglomeration at the remaining distances.

Cross K-Function: Results



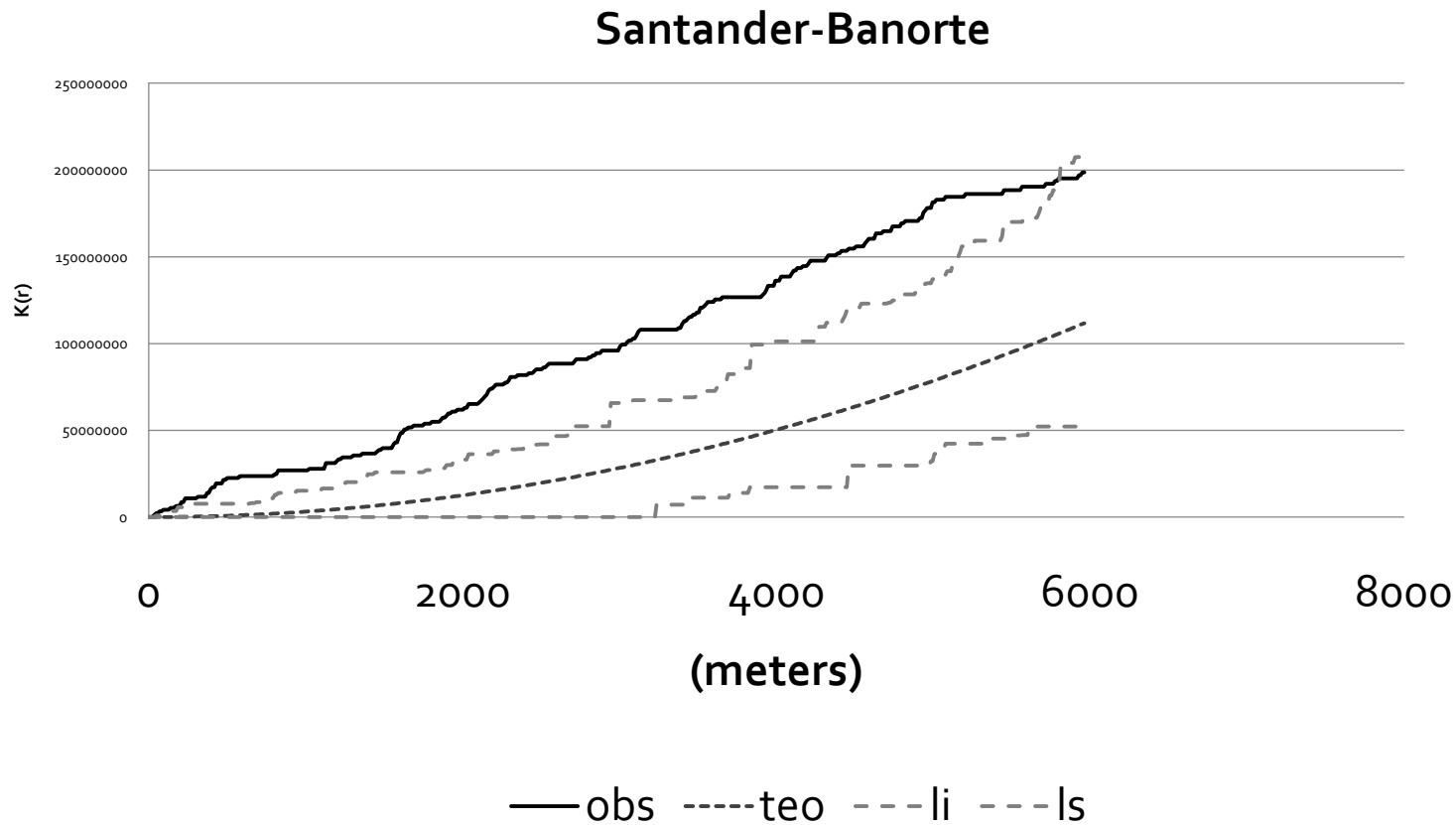
- Agglomeration at all distances.

Cross K-Function: Results



- Agglomeration, particularly at medium distances from 3.1km.

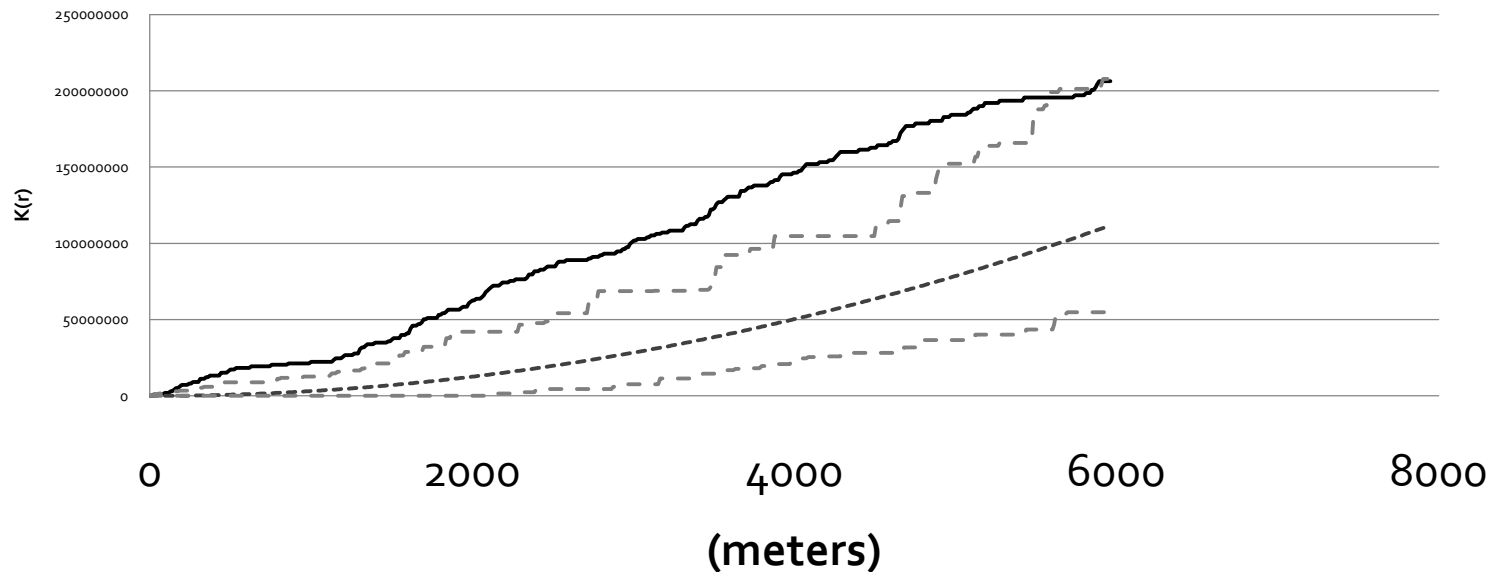
Cross K-Function: Results



- Agglomeration with tendency to independence from 5.8km.

Cross K-Function: Results

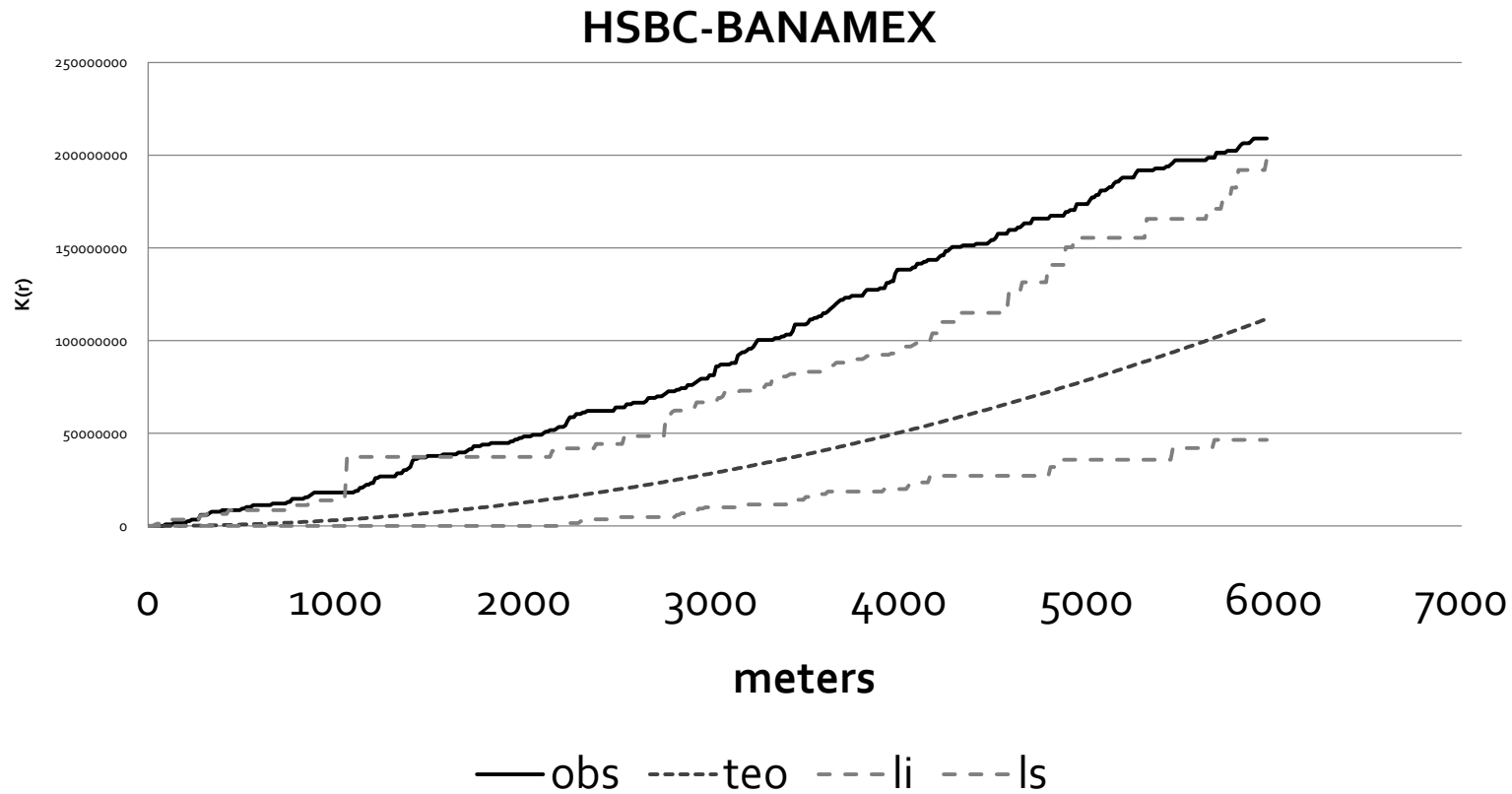
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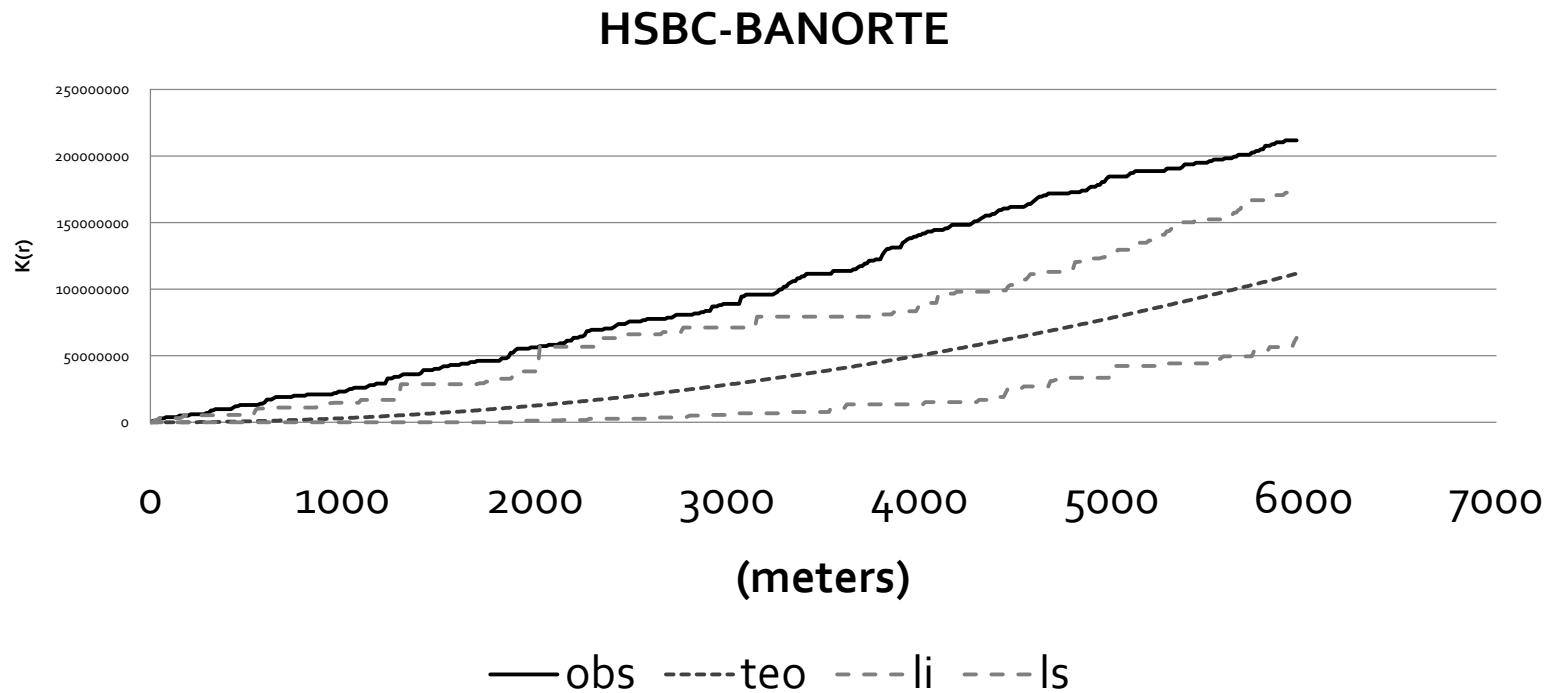
Agglomeration with tendency to independence from 5.9km.

Cross K-Function: Results



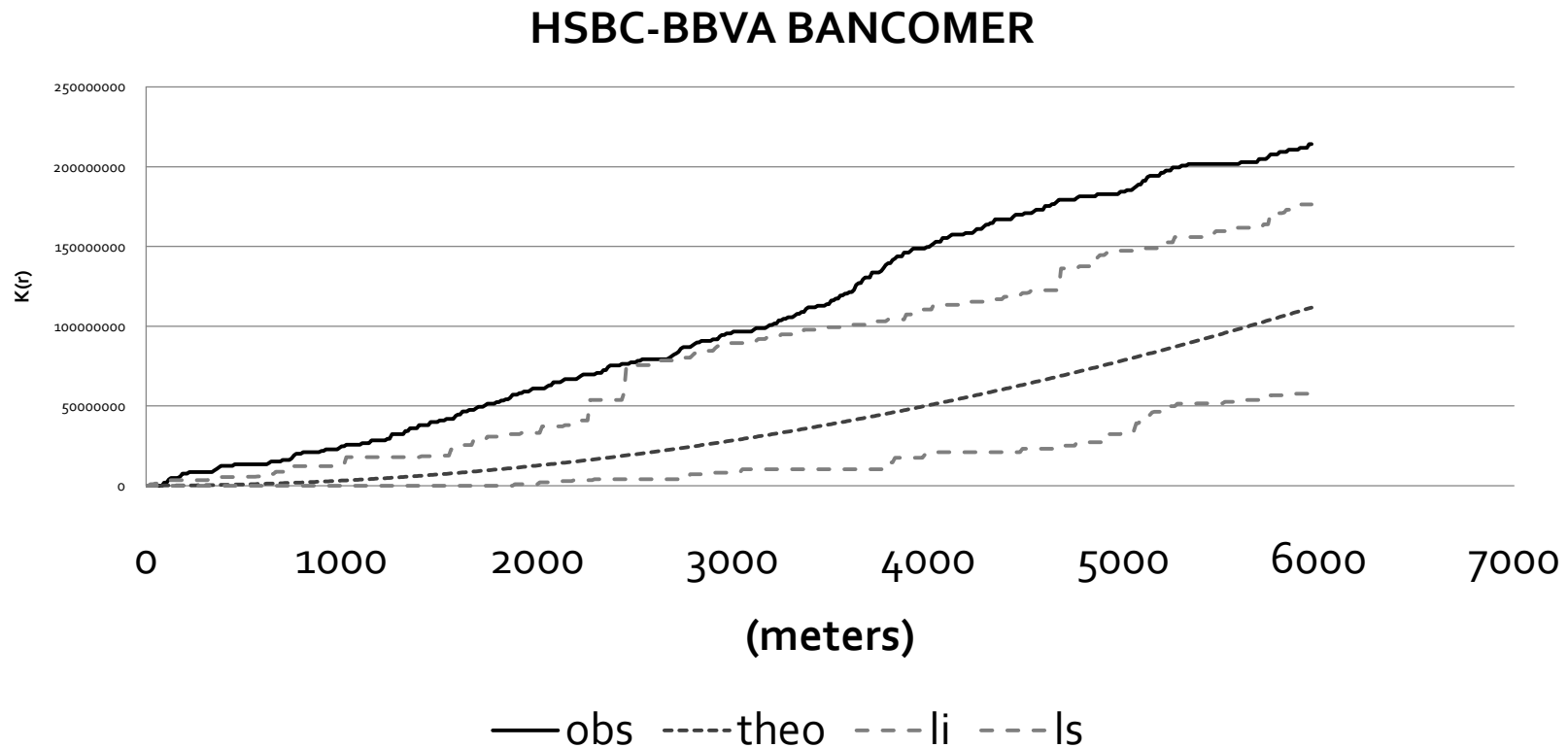
Agglomeration from 1.5km. There is no dependency at smaller distances.

Cross K-Function: Results



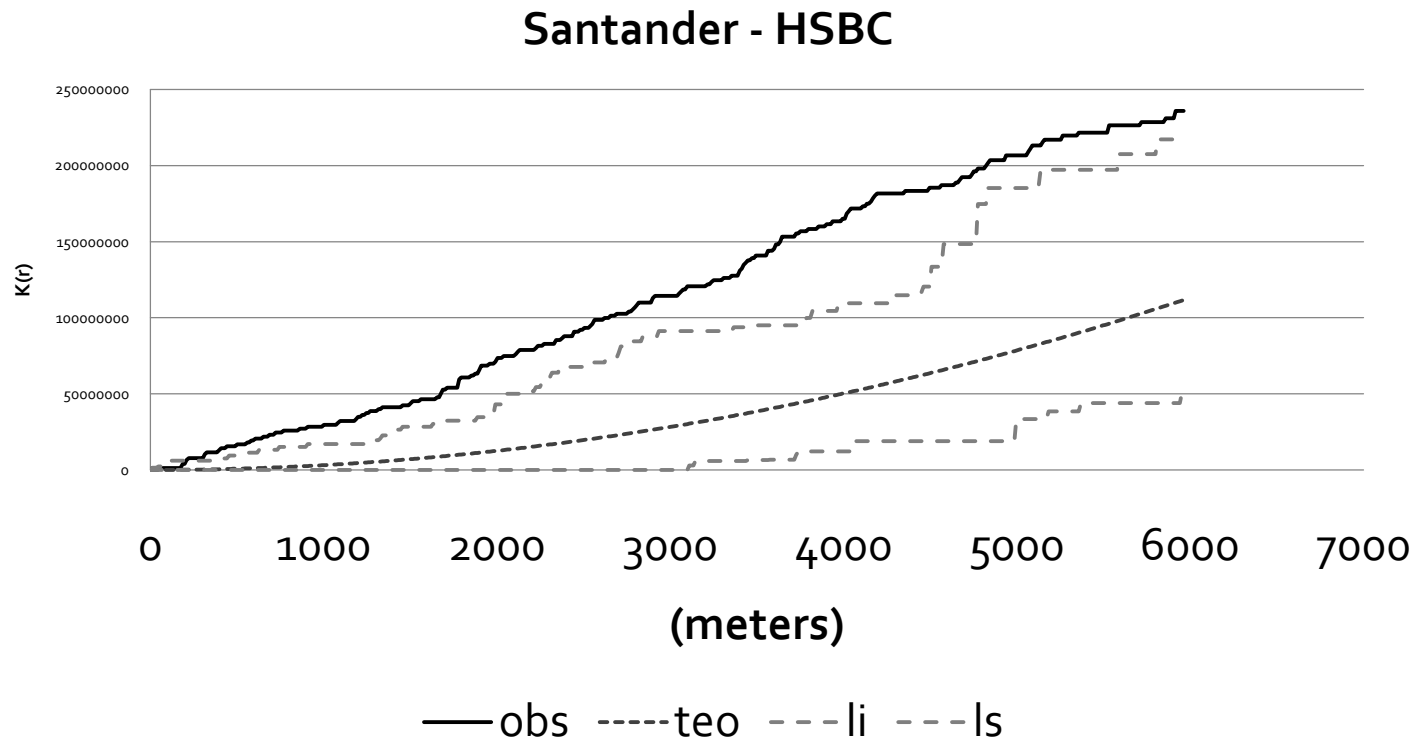
Agglomeration, particularly from 2.0km.

Cross K-Function: Results



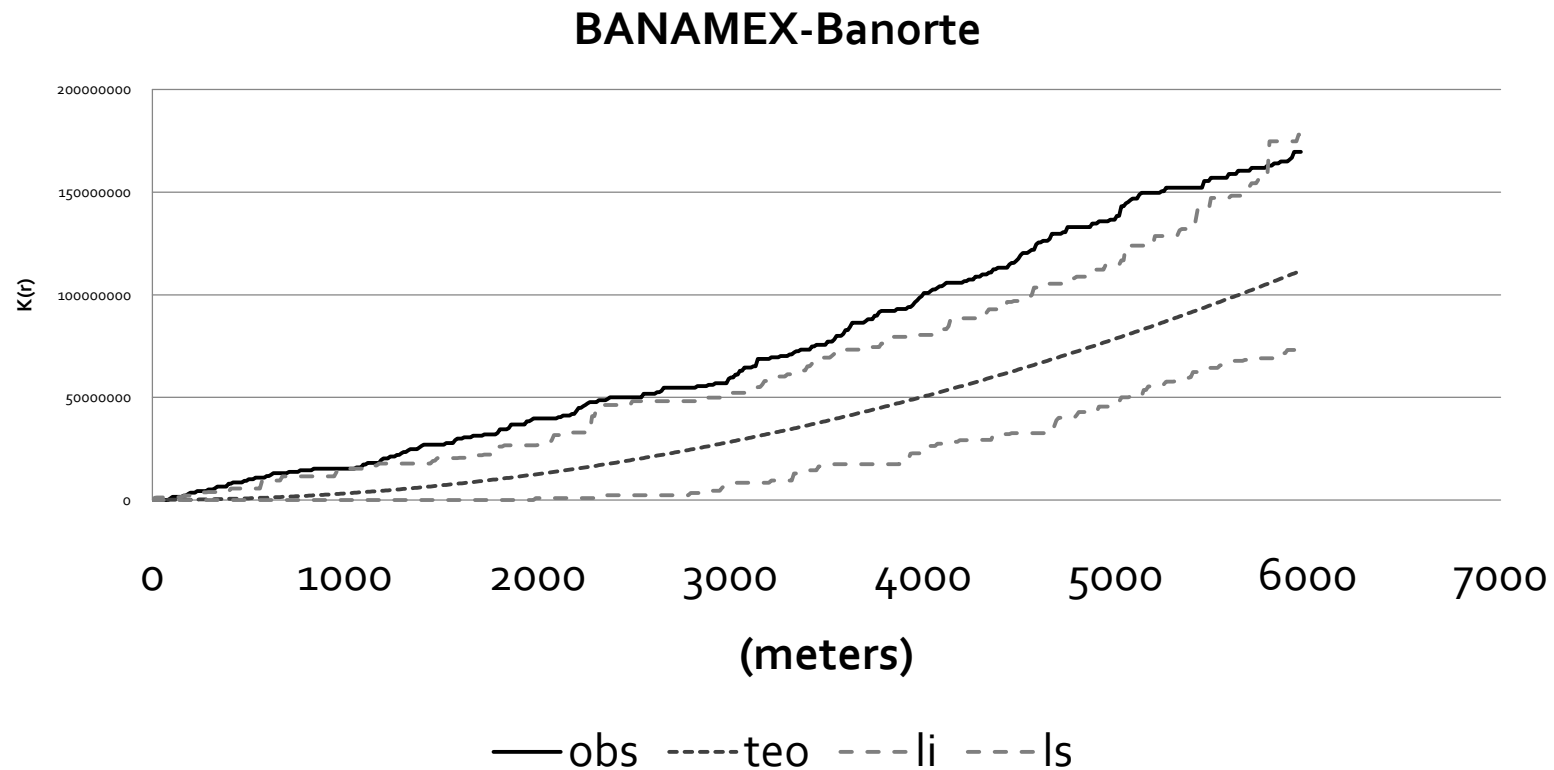
Agglomeration with tendency to independence from 5.8km.

Cross K-Function: Results



Agglomeration from 200 meters.

Cross K-Function: Results



Slight agglomeration with tendency to independence from 5.8km.

Conclusions

- The evidence from our application of the **Planar K-function** clearly **shows the tendency of bank branches to agglomerate within the TMA at any spatial scale of observation.**

Conclusions

- In contrast, results from our estimations of the **Cross K-function** clearly show that **not all banks attract each other equally in the intrametropolitan space.**

Conclusions

- Some banks **strongly attract each other while others less so**, adopting to some degree a “follow the leader” location strategy.

Conclusions

- While the **specific reasons for spatial agglomeration of bank branches** is part of the carefully guarded internal *know-how* of banking firms (Chang et al, 1997), **for the TMA we can propose the following explanations:**

Conclusions

- **i.** Bank branches achieve **economies of agglomeration**, enabling them to lower customer costs of **finding and obtaining** banking services;
- **ii.** Agglomeration economies for bank branches also include the ability **to share services and costs**, in increasingly frequent cases of agglomeration in shopping and business centers (e.g. security, exterior maintenance, lighting);

Conclusions

- **iii. Agglomeration is also a result of “follow the leader” location strategies**, enabling smaller firms to take advantage of the experience, *know-how* and decision-making capability of the leaders (which can in turn create a *spatial rational herding effect*); **and ...**

Conclusions

- **iv. Demand for banking services is agglomerated in the territory**, causing firms to prioritize location decisions that maximize their access to **strategic demand segments**:
 - Government employees and workers in **key** private sector activities; and
 - The high-income population group.

The End

(GRACIAS!)