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Geographical Concentration of Inter-Organizational Collaborations

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Research Question

How important is the geographical distance in creative activities?

- We know the importance of face-to-face communication.
- Knowledge is transmitted through communication.
- Does the importance of distance change due to prevalence of internet communication?
- “Distance puzzle” is pointed out in global trade despite the reduced transport cost.
- Both knowledge spillover and transport cost forces industrial agglomeration.

Research Background

Industrial Agglomeration

- Industrial agglomeration is a universal phenomena observed in many countries.
- External economies are pointed out theoretically.
  - Reduction of transport cost
  - knowledge spillover
  - labor pooling

  Marshall（1890），New Economic Geography （NEG)
- Cluster policy was introduced based on the theory.

Research Background

– Existence of the external economies is examined empirically.
  - For each industry, the extents of external economies and the extent of agglomeration are quantitatively measured by using data.
  - The relation between the extents is examined.
  - Importance of distance is examined **indirectly**.

  Rosenthal and Strange (2004, JUE)

  Ellison, Glaeser and Kerr (2010, AER)

Research Background

Knowledge spillover

- Knowledge spillover is usually measured by using patent citation data in previous studies.
  - Jaffe, Trajtenberg and Henderson (1993, QJE)
  - Thomson and Fox-Kean (20005, AER)
  - Murata, Nakajima, Okamoto and Tamura (2010)
- We use patent collaboration data in this research.
- Explicit knowledge vs Implicit knowledge
  - Knowledge measured by

    patent citation: Explicit

    patent collaboration: Implicit

Problems of previous studies

Importance of distance is examined indirectly.

- The relation between the extents of external economies and agglomeration is examined.

Distance-based method was introduced.

- Duranton & Overman (2005, RES)

Distances of localizations are examined

- Knowledge spillover is usually measured by using patent citation data
- Distance of patent citation is much larger than distance of location. (Murata et al. (2010))

Explicit knowledge spillover → Location localization ???

Our Focus

Localization of Inter-organizational collaboration

- We regard Inter-organizational collaboration as a source of implicit knowledge spillover.
- Our analysis:
  - Statistical test of collaboration localization
  - Geographical distance of the collaboration

    Comparison of collaboration with location and citation
  - Extent of the localization

    Change with time

    Firm-border effect

    Firm-size effect

Origin of location localization

Origin of collaboration localization

Patent Data

Patent data published from 1993 to 2010

Data Contents:

Publication date, Application date, Technology class,

Name and address of assigner and inventor

Application date is from 1986 to 2005

(Application date is closer to collaboration time.)

Address of organization can be converted to a set of longitude and latitude using geocoding system provided by Center of Spatial Information Science, Univ. of Tokyo.

Example of Patent Data

(12)【公報種別】公開特許公報（A）
(11)【公開番号】特開平５－１
Publication date (43)【公開日】平成5年（1993）1月8日
(54)【発明の名称】作業機のローリング制御装置
Technology class (51)【国際特許分類第5版】
A01B 63/10 A 9124-2B
A01C 11/02 320 S 7704-2B
B 7704-2B
【審査請求】未請求
【請求項の数】1
【全頁数】3
(21)【出願番号】特願平3－151255
Application date (22)【出願日】平成3年（1991）6月24日
(71)【出願人】
【識別番号】000001052
Name of assigner【氏名又は名称】株式会社クボタ
Address of assigner【住所又は居所】大阪府大阪市浪速区敷津東一丁目2番47号
(72)【発明者】
Name of inventor【氏名】越智 竜児
Address of inventor【住所又は居所】大阪府堺市石津北町64番地 株式会社クボタ堺製造所内

Name of firm

Name of organization

Identification of Organizations

- Identification of firm, organization, and their relation

  Firm: name and address of assigner

  Organization: address of inventor

  Firm to which the organization belongs: address of inventor

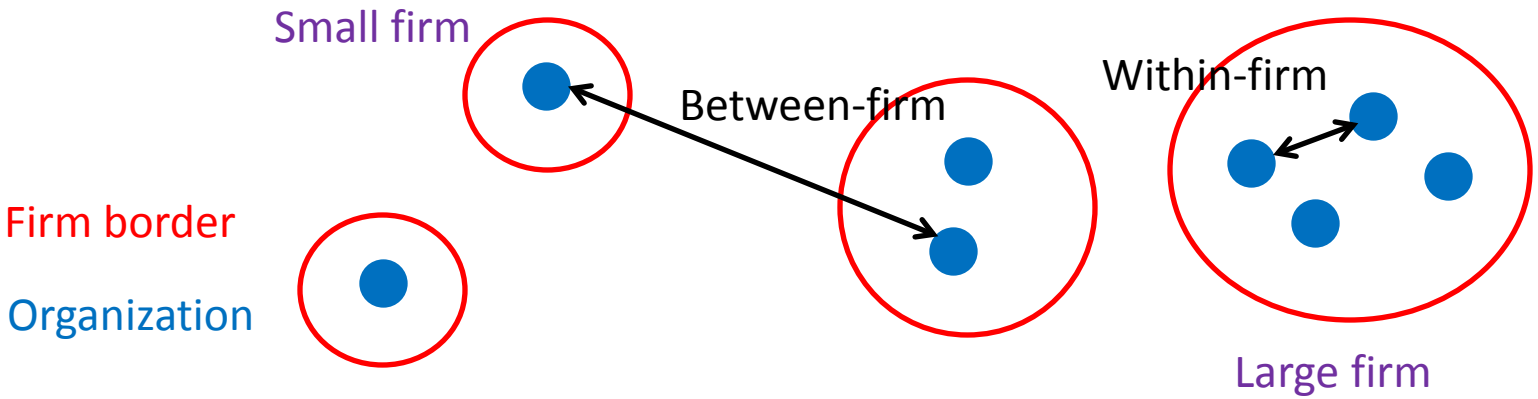
- Firm border effect on collaboration

  Identification of within-firm and between-firm collaborations

- Firm size effect on collaboration

  Small firm: firm with only single organization

  Large firm: firm with more than one organization



Previous studies on collaboration

Previous studies:

- Collaboration between firms
- Collaboration between inventors
- Identification of firm and inventor

  Firm: name and address of assigner

  Inventors: name and address of inventor

Our focus:

- Collaboration between organizations
- Organization identified by the address of inventor has not been focused.
- The distance between collaborating partners can be measured easily.
- We can compare the within-firm collaboration and between-firm collaboration.

Summary of data

- Number of organizations : 74,452

Number of firms which have single organization : 46,904 (82.9%)
(number of corresponding organizations : 46,904 (63.0%))
Number of firms which have more than one organizations: 9,688 (17.1%)
(number of corresponding organizations : 27,548 (27.0%))

- Number of patents: 1,189,261

Ratio of collaboration patents : 7.9%

- Number of collaborations (links) : 177,453

Ratio of within-firm collaborations: 35.5%
Ratio of between-firm collaborations : 64.5%

Methodology

- Collaboration Localization is examined.

Distance distribution of actual collaboration ⇔ Potential collaboration
(Location pattern)

Definition of potential collaborating partner:

1. All the organizations
2. All the organizations with the same technology
3. All the collaborating organizations with the same technology

We get similar results for all definitions. Results are shown using definition 2.

We use two methods.

- Statistical test of localization and Geographical distance of localization following Duranton & Overman's method
- Extent of collaboration localization
  Relative Density(d) = Actual Collaboration Density(d) / Potential Density(d)

Duranton & Overman's method

distance-based method

Location Localization is examined.

Firm's micro location data (longitude and latitude) is used.

Location pattern is examined using pair-wise distance distribution.

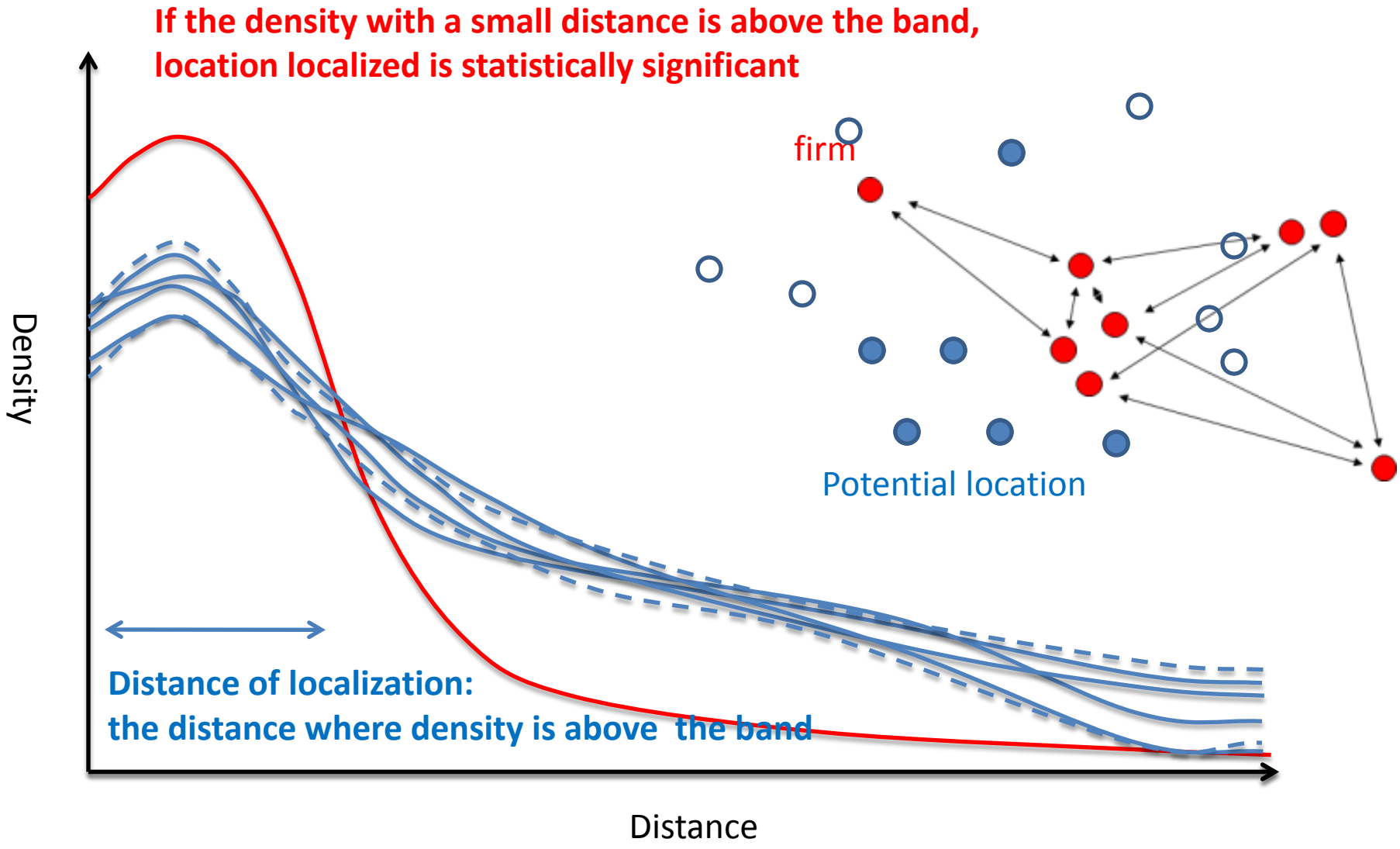
Location Localization is tested statistically.

Actual location pattern ⇔ Potential location pattern

1. Choose potential locations
2. calculate distances
3. get pair-wise distance distribution

Confidence bands are derived after many trials of these procedures.

Duranton & Overman's method



Application to collaboration

distance-based method

Collaboration Localization is examined.

Firm's micro location data (longitude and latitude) is used.

Localization is examined by distance distribution between collaborating partners.

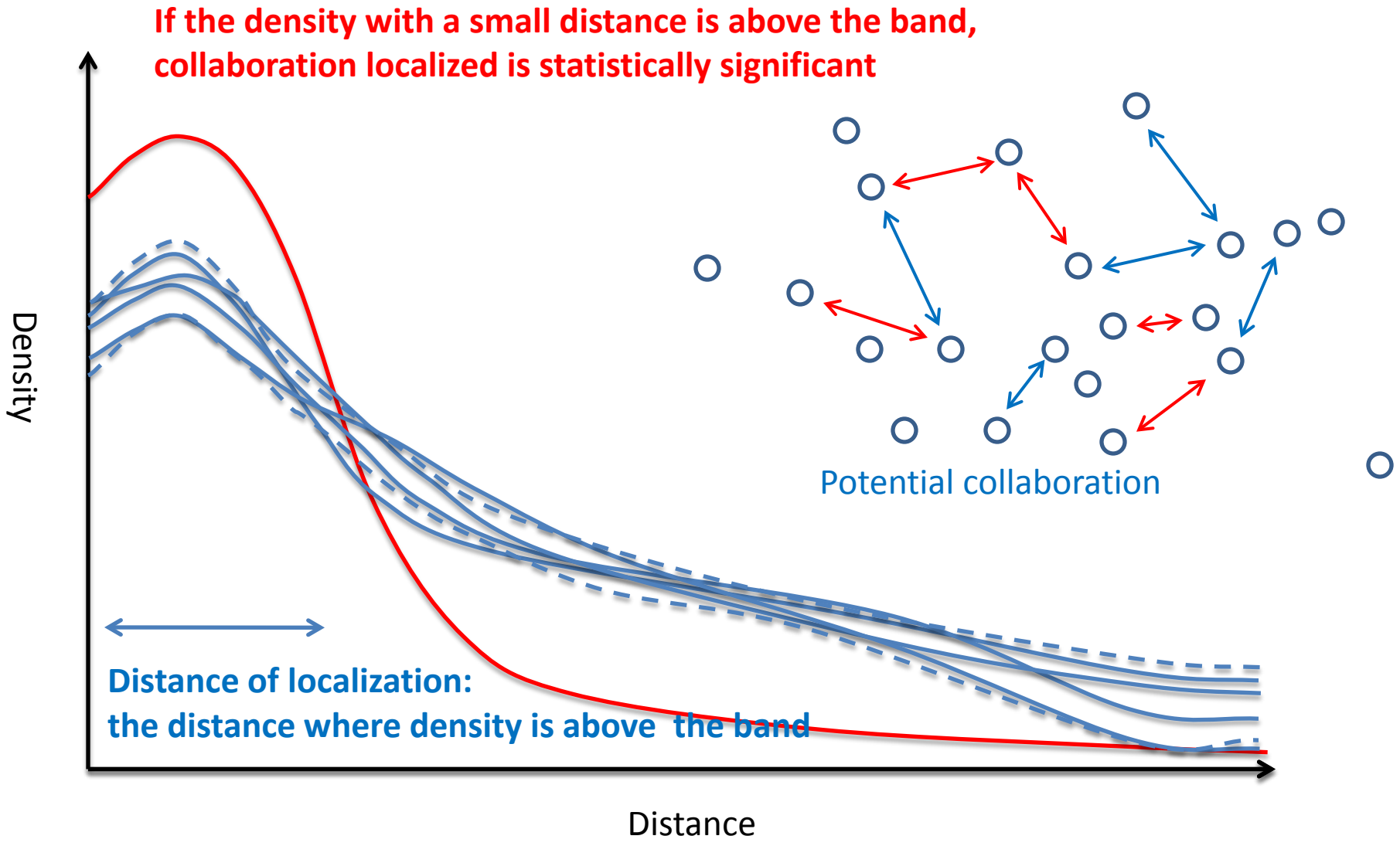
Collaboration Localization is tested statistically.

Actual collaboration ⇔ Potential collaboration

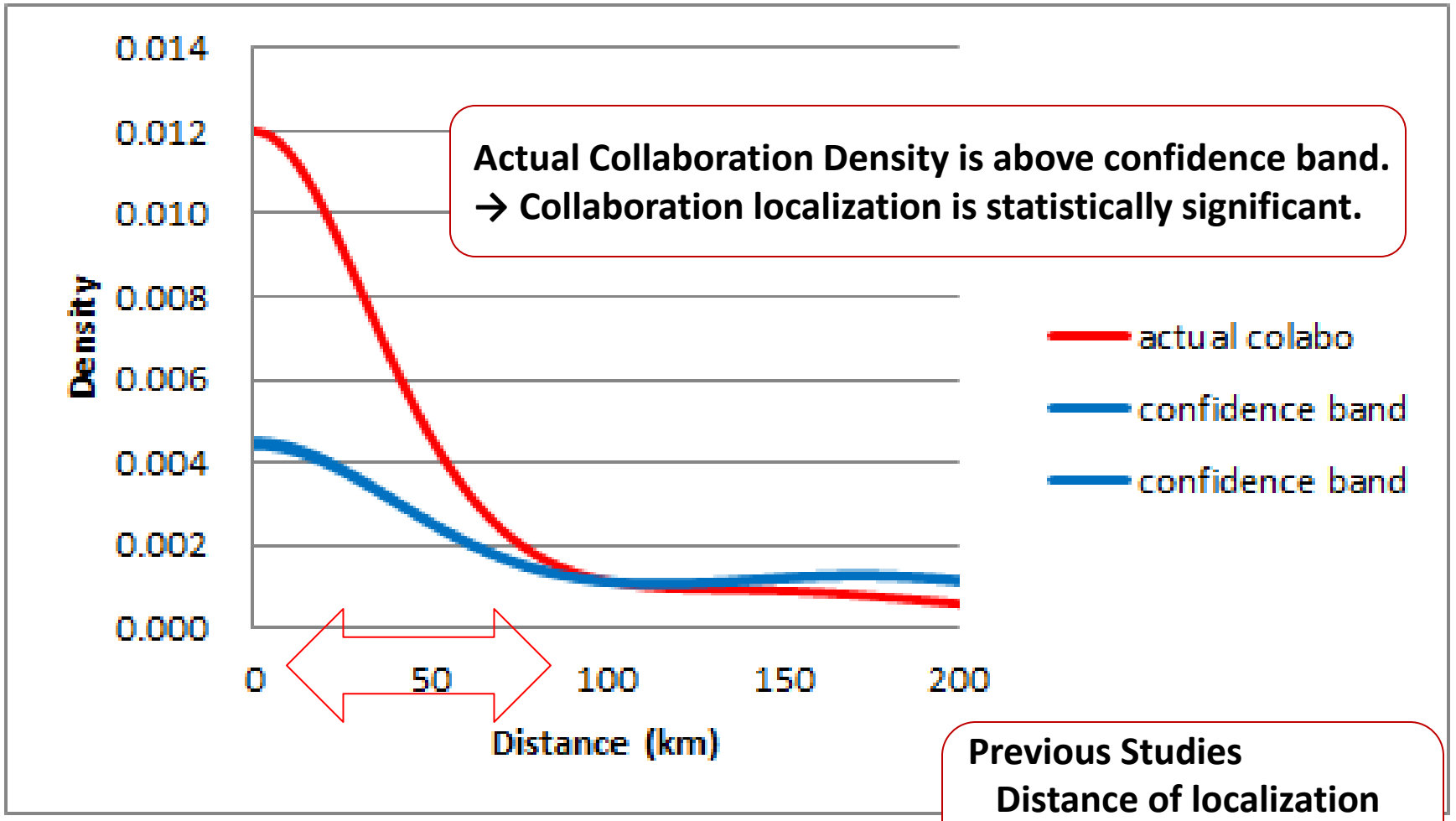
1. Choose potential collaborating partner
2. calculate distances
3. get distance distribution

Confidence bands are derived after many trials of these procedures.

Application to collaboration



Statistical test of localization

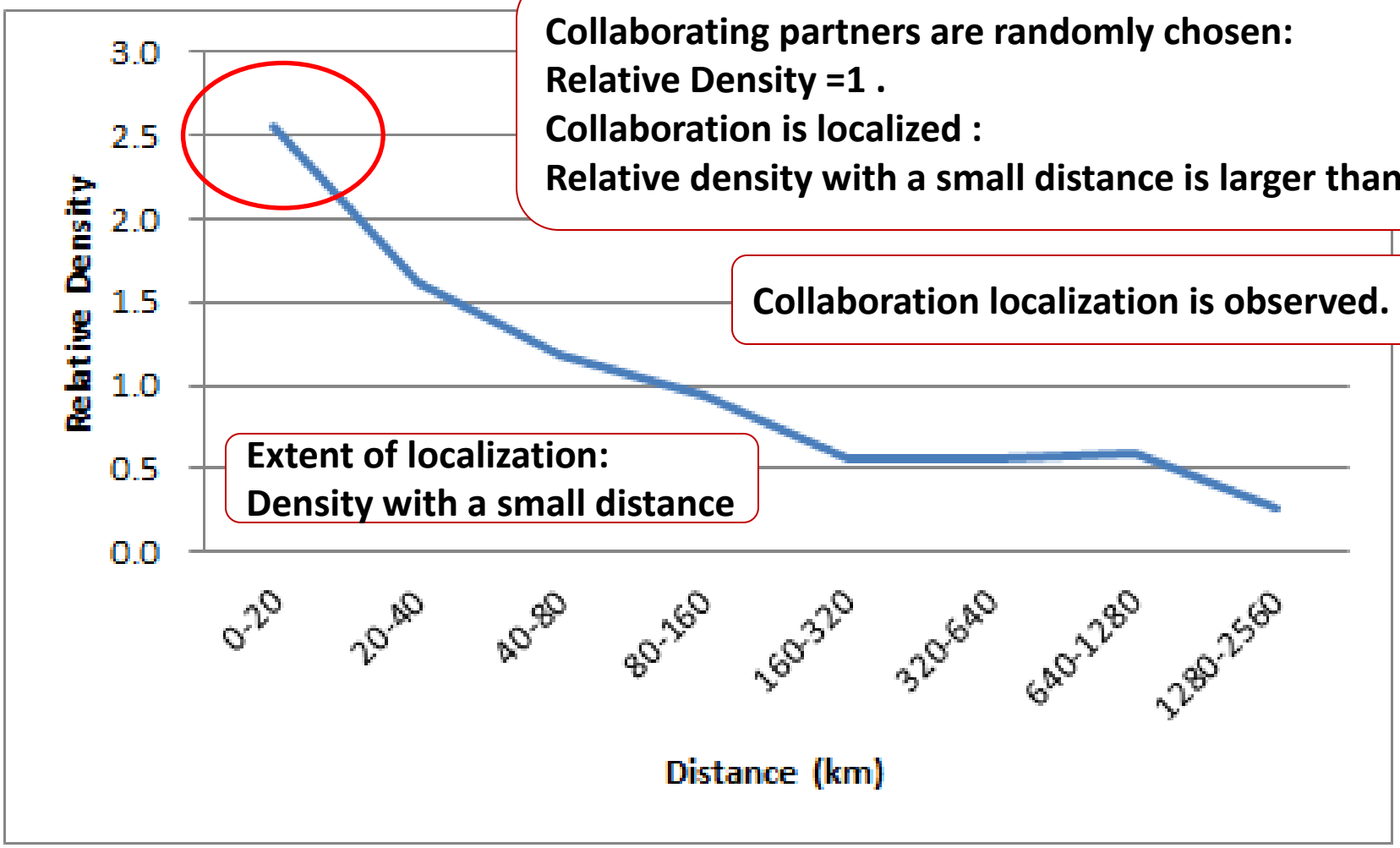


Distance of localization for collaboration: 100km

Previous Studies
Distance of localization
Patent citetion:1200 km
Location: 60 km

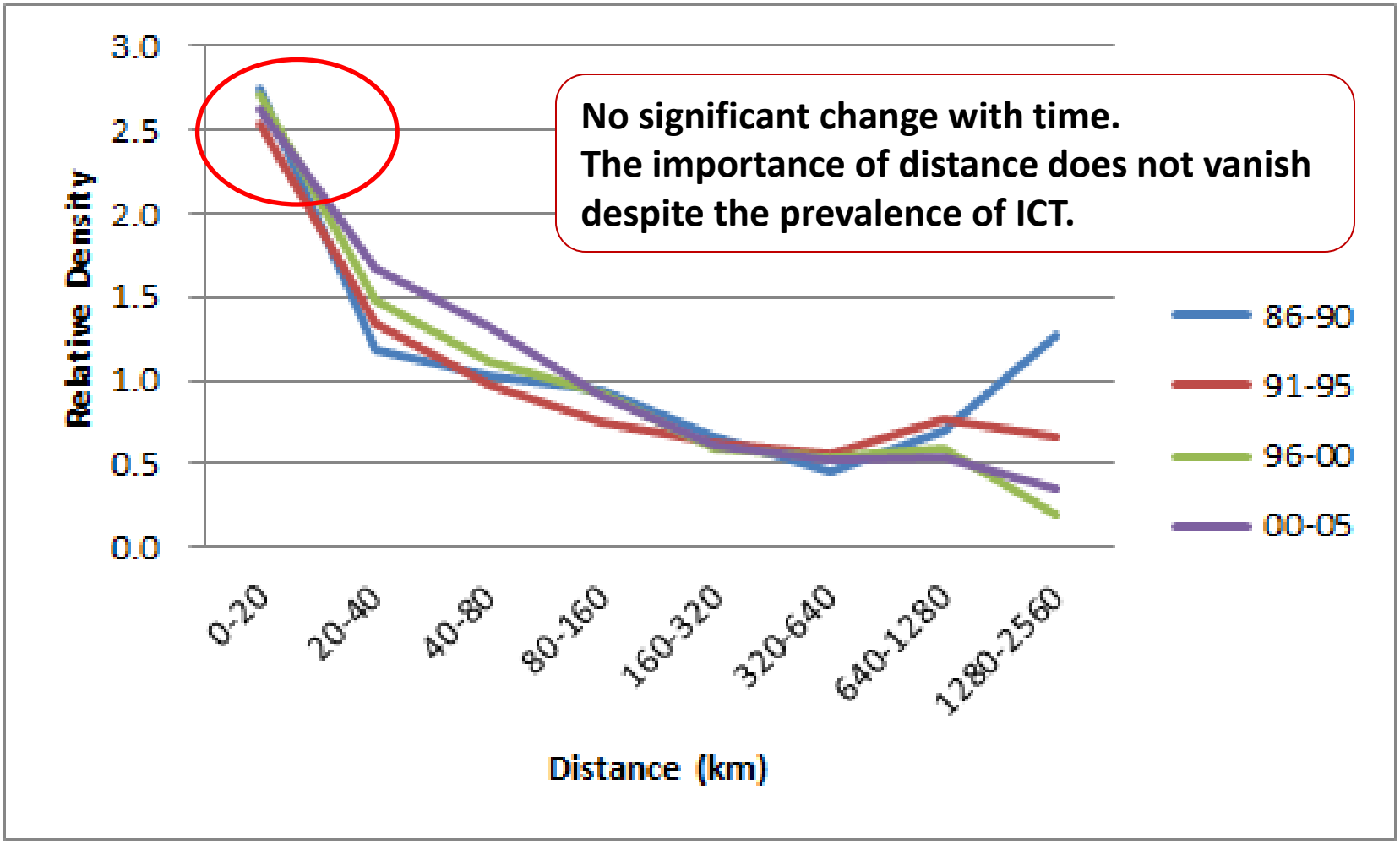
Extent of localization

Relative Density(d) = Actual Collaboration Density(d) / Potential Density(d)



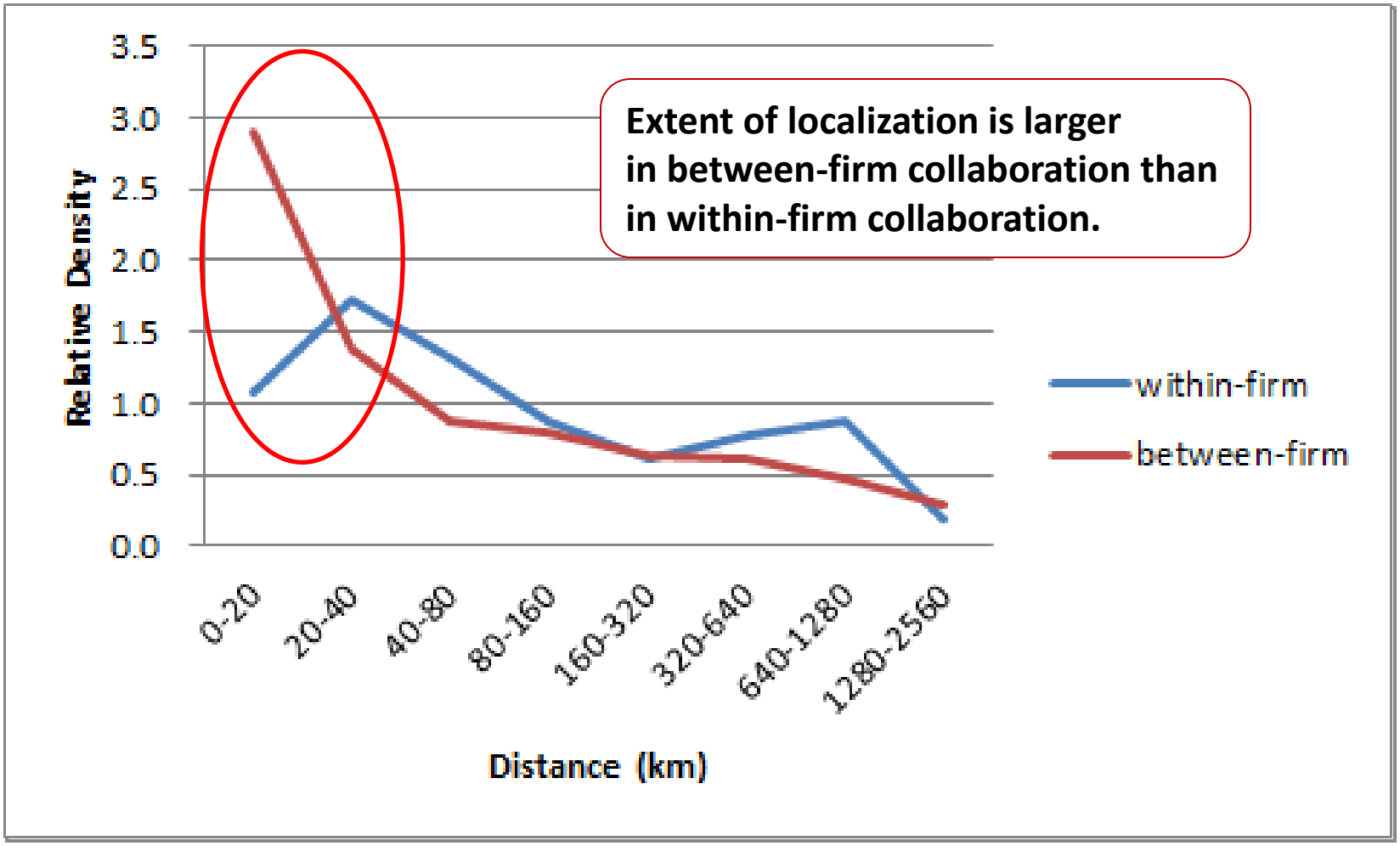
Change in Relative Density with time

Relative Density(d) = Actual Collaboration Density(d) / Potential Density(d)



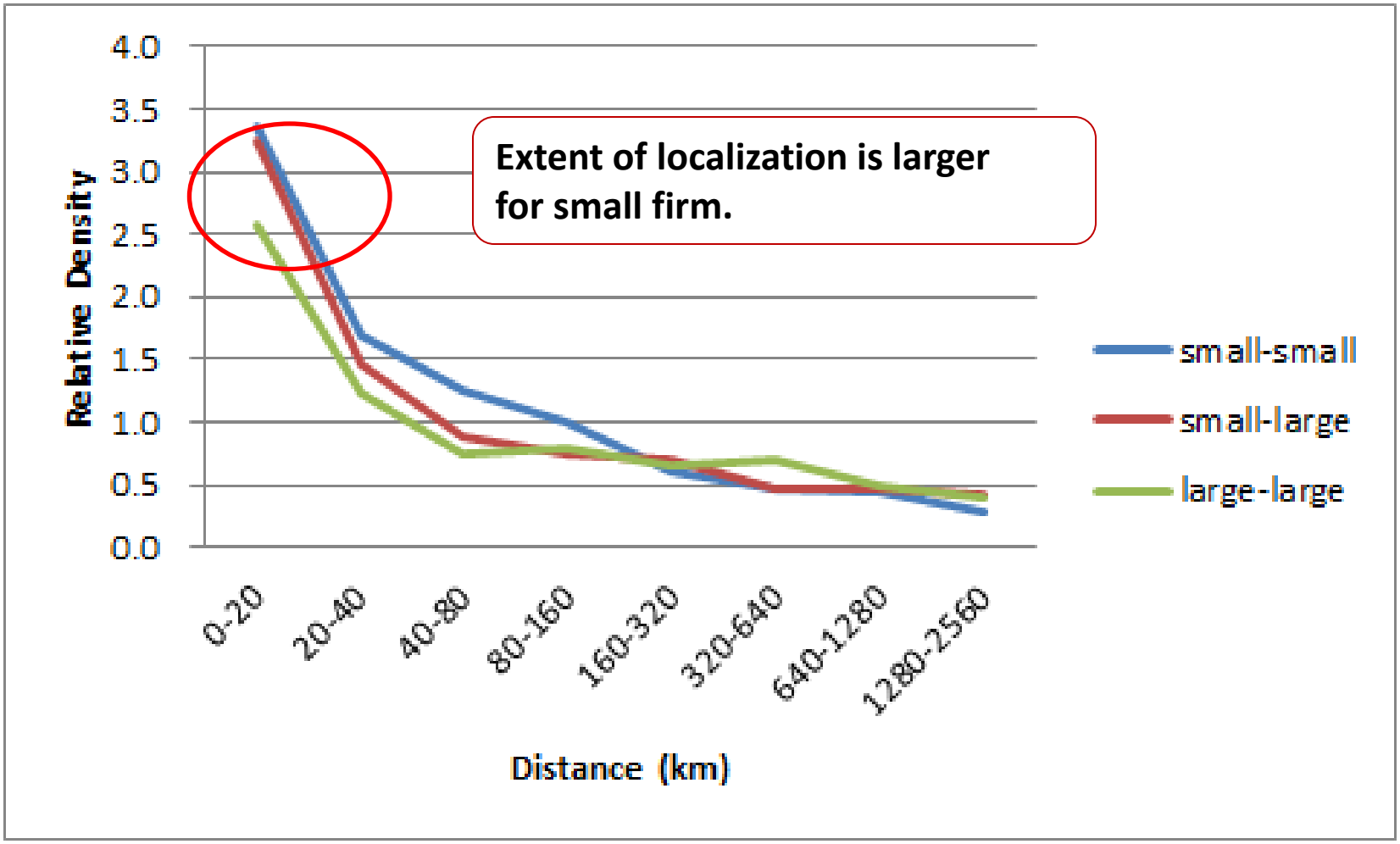
Firm-border effect on collaboration

Within-firm collaboration vs between-firm collaboration



Firm-size effect on collaboration

Small firm vs Large firm



Conclusion and Future Research

Origin of location localization

- Collaboration localization is found to be statistically significant.
- The distance of collaboration is similar to that of location, which is much smaller than that of patent citation, which is often used to measure the knowledge spillover.

→ These results suggest that the implicit knowledge spillover is one of the important factors forcing agglomerations (location localization) if we assume that collaboration causes implicit knowledge spillover while patent citation causes explicit one

- The extent of localization is not weakened during these two decades despite the prevalence of the internet communication technology.

→ Face to face communication is important.

Implicit knowledge spillover can be the origin of location localization.

Conclusion and Future Research

Origin of collaboration localization

- Extent of localization is much larger in between-firm collaborations than in within-firm collaboration.
- Extent of localization is larger in collaborations with small firms which have only single organization.

→ These results suggest that the importance of geographic distance is stronger for the collaboration between firms, especially in smaller firms.

Firm border and firm's limited size can be the origin of collaboration localization.

Future Research

- We will examine whether the importance of distance occurs when finding collaborating partner or continuing collaboration.
- To do so, the difference between localization of first collaboration and that of other collaborations should be examined.