

Exploring nativity segregation in Sweden with big geolocation data on human mobility

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Yuan Liao^{*,1}, Jorge Gil², Sonia Yeh¹, Laura Maria Alessandretti³, Rafael H. M. Pereira⁴
*yuan.liao@chalmers.se | @TheYuanLiao

1 Department of Space, Earth and Environment, Chalmers University of Technology, Sweden

2 Department of Architecture and Civil Engineering, Chalmers University of Technology, Sweden

3 Department of Applied Mathematics and Computer Science, Technical University of Denmark, Denmark

4 Institute for Applied Economic Research (Ipea) - Brazil, Department of Urban, Regional and Environmental studies and policies (DIRUR), Brazil



Forskning visar på att segregationen i Sverige ökar. Vad känner du inför det?

6% Jag tror inte på den forskningen

12% Det är allvarligt, men jag tror på framtiden

16% Jag bryr mig inte

66% Jag känner en oro och/eller frustration

How can cities become more inclusive?

Segregation

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Segregationen i Sverige har ökat kraftigt sedan 1990-talet och låginkomsttagare är de som lever mest segregat. Olika områdestyper i landet är så pass stora att de har en betydelse för människors livschanser. Det visar Delmos (Delmos) idag i sin nya årsrapport.

Unga känner oro inför den ökande

SEGREGATIONEN



Järfällas skattebetalare ska inte finansiera modersmål!



Wilhelm Eriksson
Ordförande, SD Järfälla



Nativity distributions in Sweden (2019)

<https://yuanliao.shinyapps.io/InteractiveVisiSegSweden/>



Socio-economic, mobility, and segregation statistics in Sweden (2019)

Please select area category:

- All
- Urban
- Rural/Suburban

Please select one statistic to show on the map:

- Share of native-born pop.
- Share of pop. in the lowest income group
- Residential nativity segregation
- Visiting nativity segregation
- Experienced nativity segregation
- Population size
- Car ownership (/capita)
- Transit stop density (/km²)
- Pedestrian network density (km/km²)

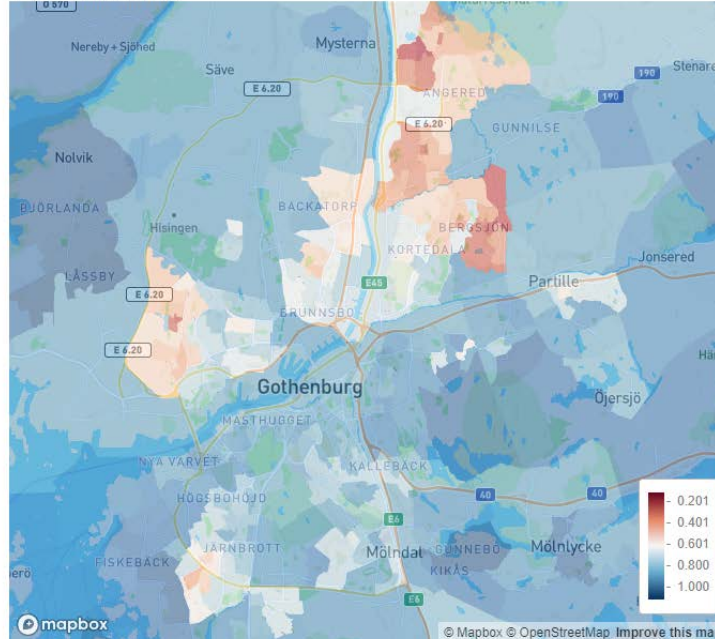
Map it

Author: Yuan Liao

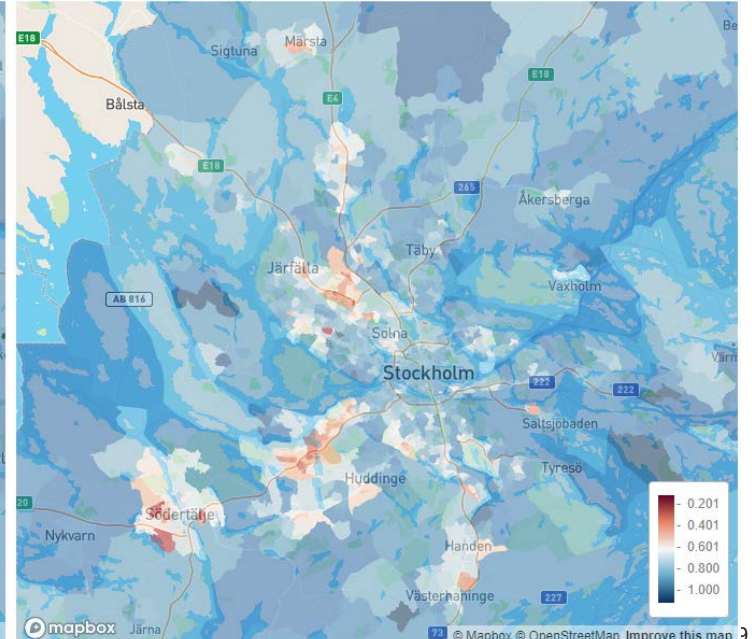
Code generating the data: GitHub

Overall DeSO zones.

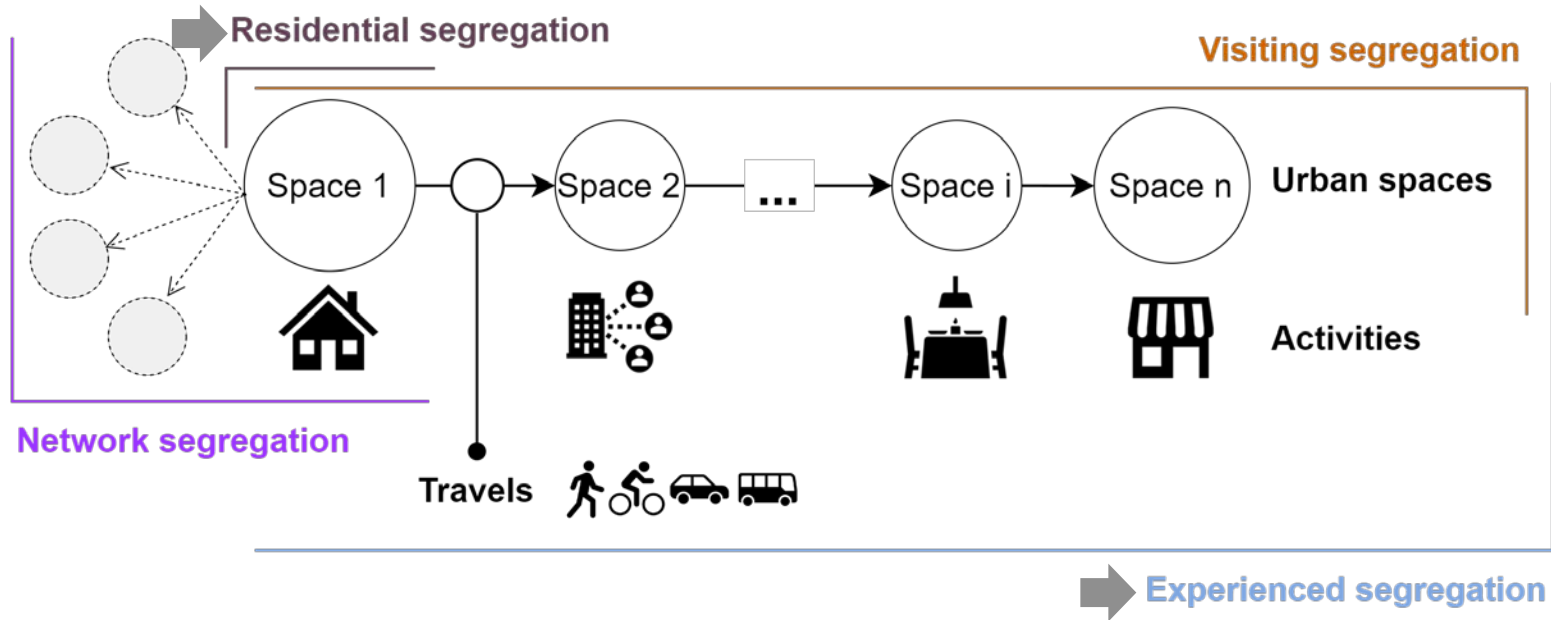
Share of native-born pop.



Data source: Statistics Sweden (SCB). DeSO – Demografiska statistikområden

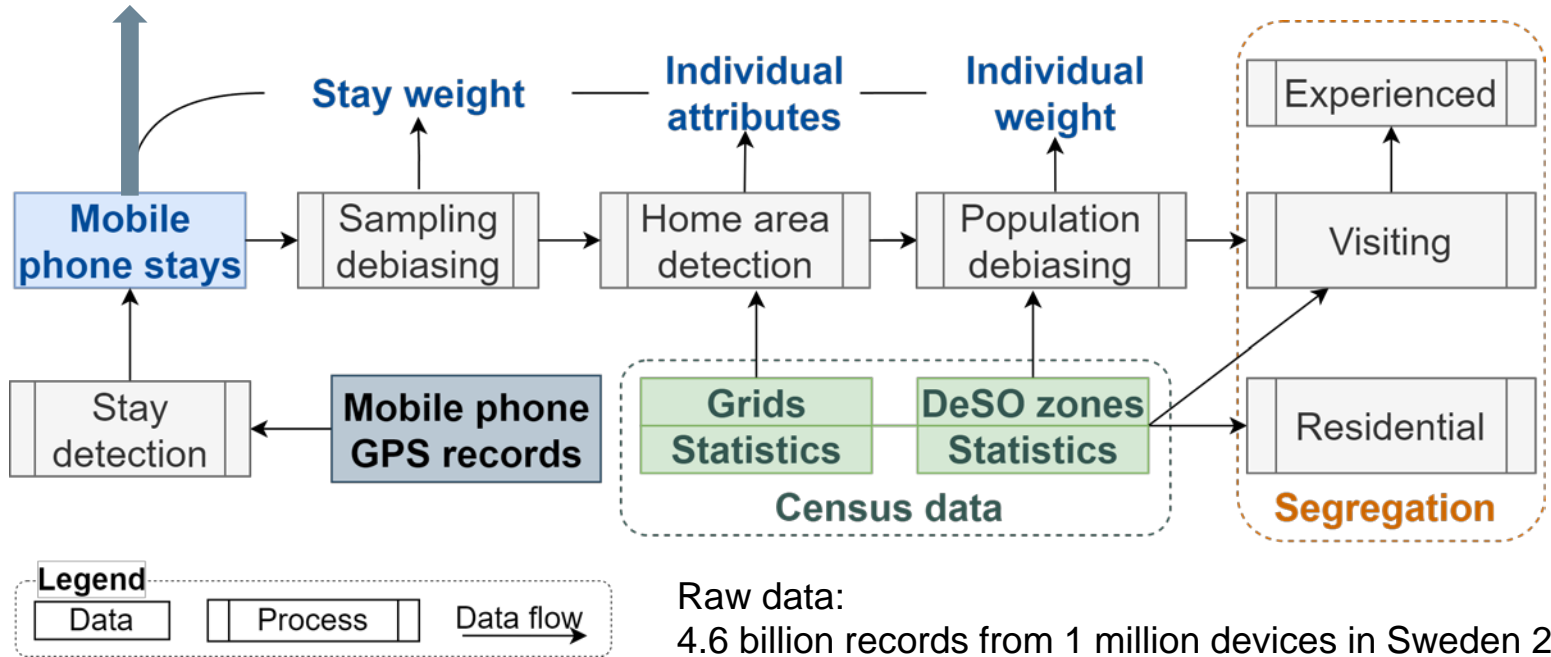


Beyond residential segregation: a conceptual framework



Methodology

Applied data: 30.5 million stay points from 323 thousand devices in Sweden, 2019



Raw data:
4.6 billion records from 1 million devices in Sweden 2019

Quantify nativity segregation

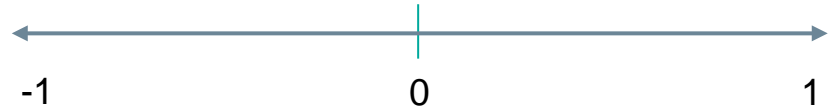
Adjusted Indicator of Concentration at Extremes (ICE)*

$$ICE_j = \frac{\frac{D_j}{w_D} - \frac{F_j}{w_F}}{\frac{D_j}{w_D} + \frac{F_j}{w_F} + \frac{O_j}{w_O}}$$



High concentration
of foreign-born
(outside Europe, F)

High
concentration of
native-born (D)



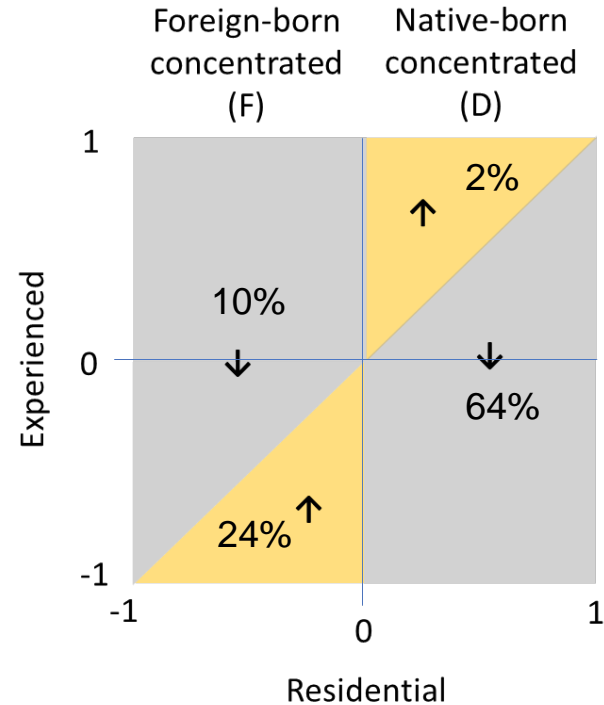
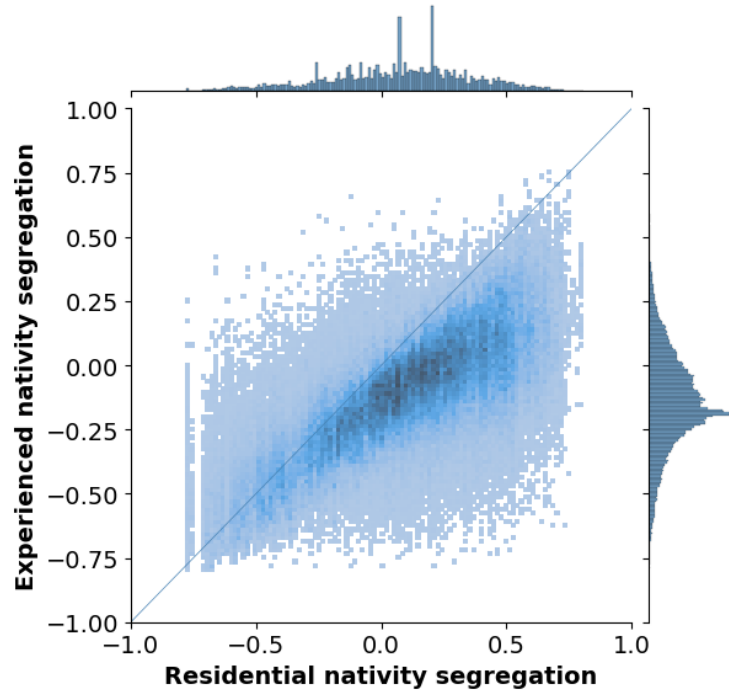
National average
(11% foreign-born
outside Europe in 2019)

How a given zone deviates from the population composition at national average

*Iyer, Nandini, Ronaldo Menezes, and Hugo Barbosa. "Mobility and Transit Segregation in Urban Spaces." arXiv preprint arXiv:2304.07086 (2023).

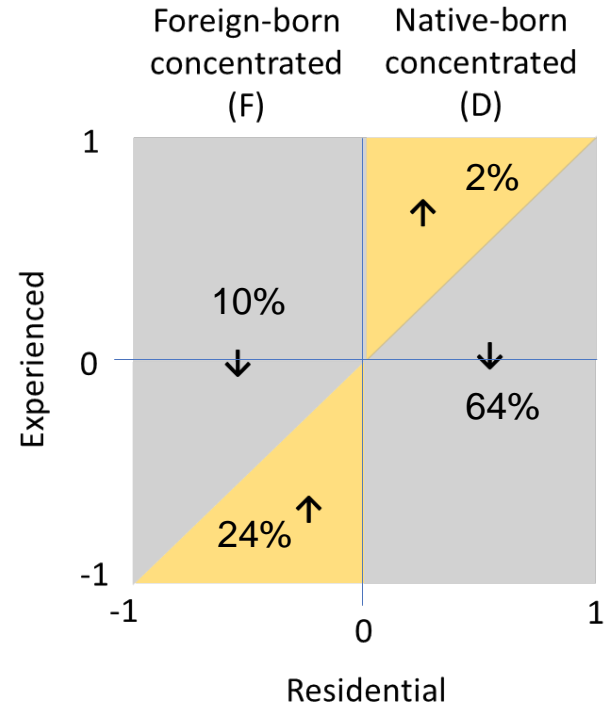
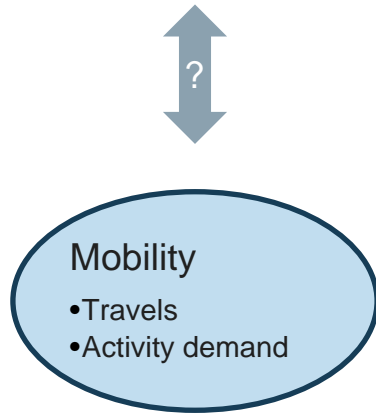
$$ICE_j = \frac{D_j - F_j}{D_j + F_j + O_j}$$

Experienced vs. residential nativity segregation: change patterns



Experienced vs. residential nativity segregation: change patterns

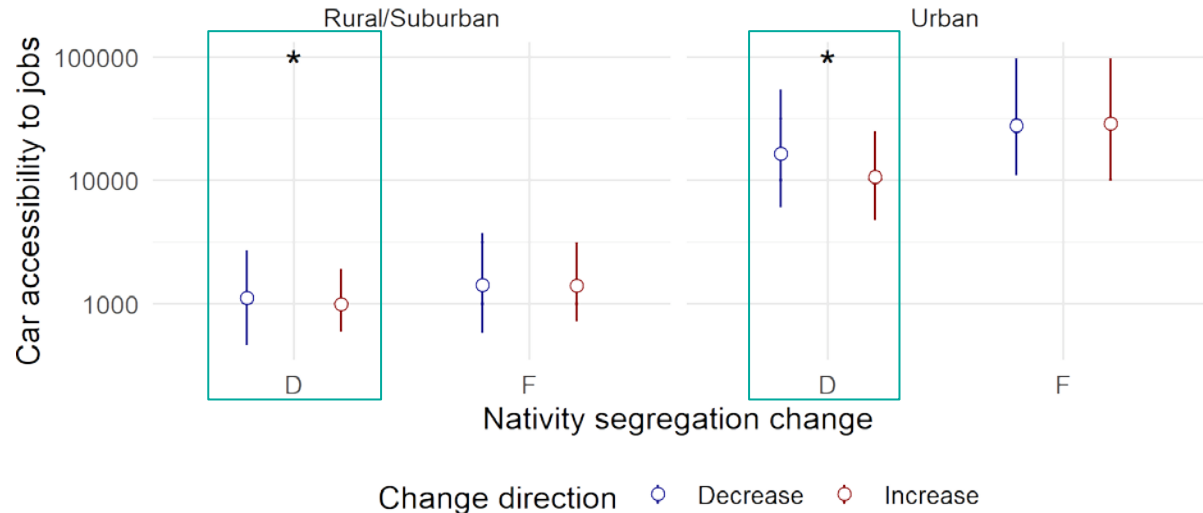
ICE change from residential to experienced



Car accessibility vs. segregation change

Better car accessibility <->
reduced nativity segregation*

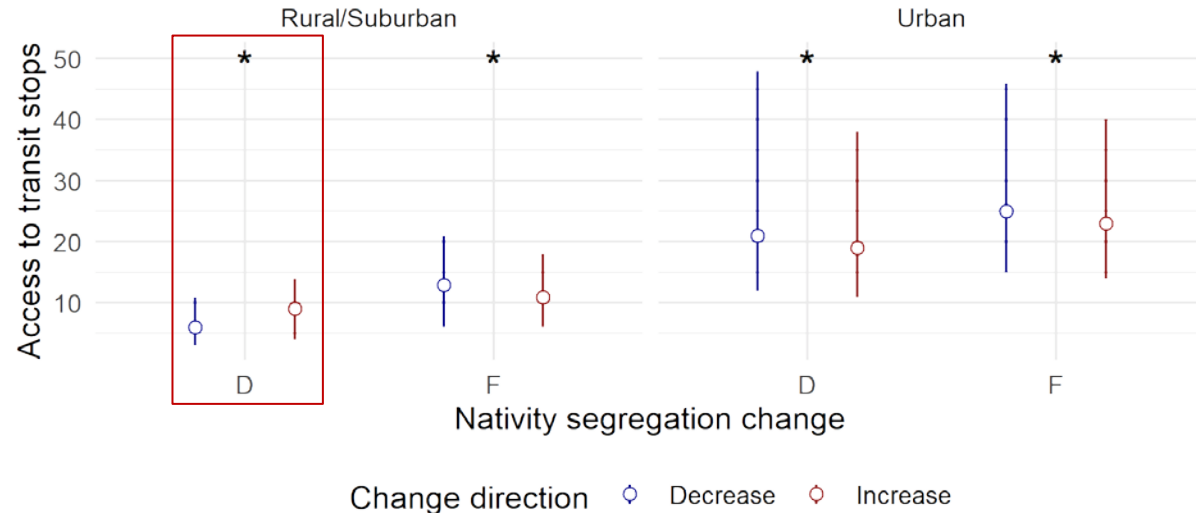
*only for those living in native-born concentrated areas (D)



Car accessibility – Number of jobs within 1.5 km by driving from residence (0.5-1 km square grid)

Transit service vs. segregation change

Better access to public transit stops
 <->
 reduced nativity segregation*



Access to transit stops - Number of transit stations within 800m by walking from residence (0.5-1 km square grid)

Summary

- **When considering mobility, individual's experienced nativity segregation deviates from his/her residential segregation**
 - Most native-born concentrated residents have *decreased* experienced nativity segregation than residential one (64% vs. 2%).
 - More foreign-born concentrated residents have *increased* level of nativity segregation than those have decreased (24% vs 10%).
- **Decreased nativity segregation compared with residential measuring is associated with *better transport access*.**
 - But car and transit have different association patterns depending on foreign/native-born.
- Develop robust models to better understand the relationship between mobility-aware measuring of social segregation, mobility, built environment, and housing.

Appendix 1 – Conceptual framework



Perspective	Aspect	Subject of measuring	Time dimension
Urban space	<u>Residential</u>	Residents	Year
	Network		
	Visiting	Visitors	Second-minute
<u>This study</u>	<u>Experienced</u>	Travels (move)	Second-minute
		Activities (stay)	

Appendix 2 – Adjusted ICE

Adjusted Indicator of Concentration at Extremes (ICE)*

$$ICE_j = \frac{\frac{D_j}{w_D} - \frac{F_j}{w_F}}{\frac{D_j}{w_D} + \frac{F_j}{w_F} + \frac{O_j}{w_O}}$$



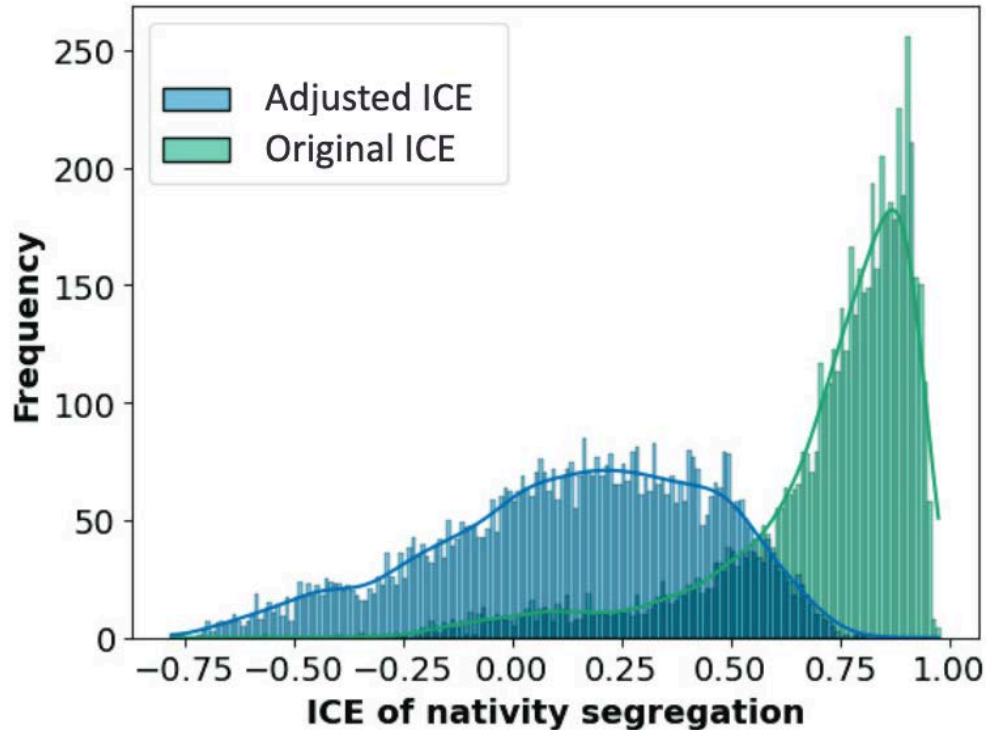
How a given zone deviates from the national average population composition

	Population size	Population share (national average)
Foreign-born outside Europe	F_j	w_F (0.111)
Native-born	D_j	w_D (0.804)
Other	O_j	w_O (0.085)
Zone	j	

*Iyer, Nandini, Ronaldo Menezes, and Hugo Barbosa. "Mobility and Transit Segregation in Urban Spaces." arXiv preprint arXiv:2304.07086 (2023).

$$ICE_j = \frac{D_j - F_j}{D_j + F_j + O_j}$$

Appendix 2 – Adjusted ICE



Appendix 3 – Research questions



- 1) How is experienced nativity segregation different from residential income segregation?
- 2) What are the impacts of income level and transport accessibility on experienced nativity segregation by individuals?

Dimension	Levels	Definition
Nativity	Foreign-born, Native-born	Foreign-born population was born outside Europe.
Income level	Q1, Q2, Q3, Q4	< 25%, 25%-50%, 50%-75%, >75% (0.5-1 km square grid)
Transport aspects	Accessibility by car	Number of jobs within 15 km by car from residence (0.5-1 km square grid)
	Availability of transit services	Number of transit stations within 800m by walking from residence (0.5-1 km square grid)

Appendix 4 – Segregation change ΔICE_p

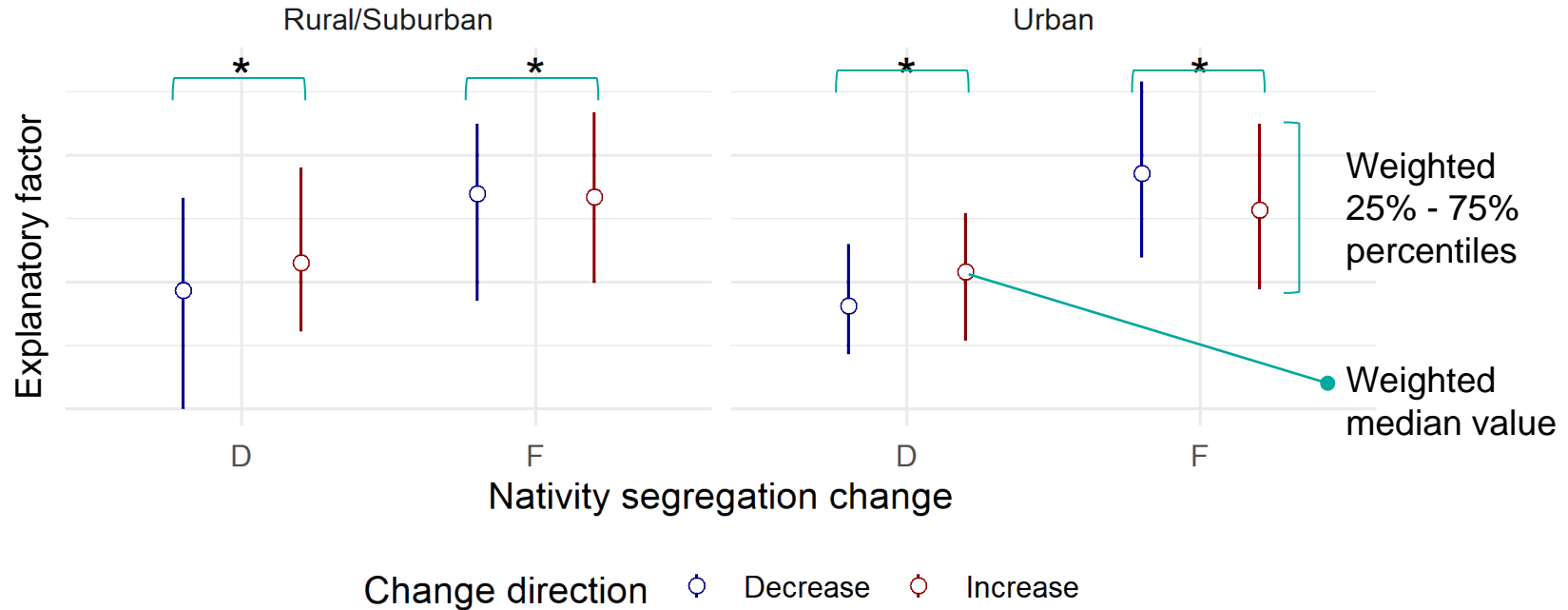
$$\Delta ICE_p = \begin{cases} ICE_{p,e} - ICE_{p,r} & , ICE_{p,r} \geq 0 \\ -(ICE_{p,e} - ICE_{p,r}) & , ICE_{p,r} < 0 \end{cases}$$



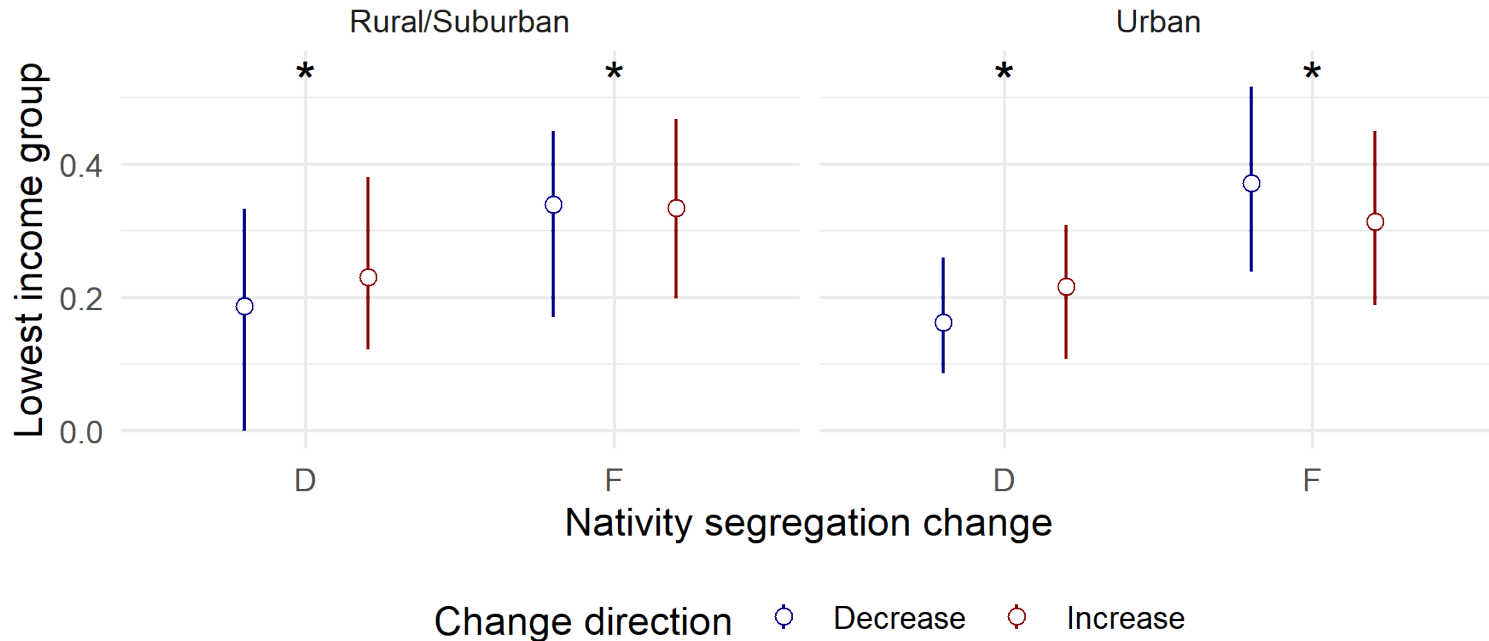
Segregation type	Population size
Residential	$ICE_{p,r}$
Experienced	$ICE_{p,e}$

When considering mobility, how an individual's experienced nativity segregation change from his/her residential segregation

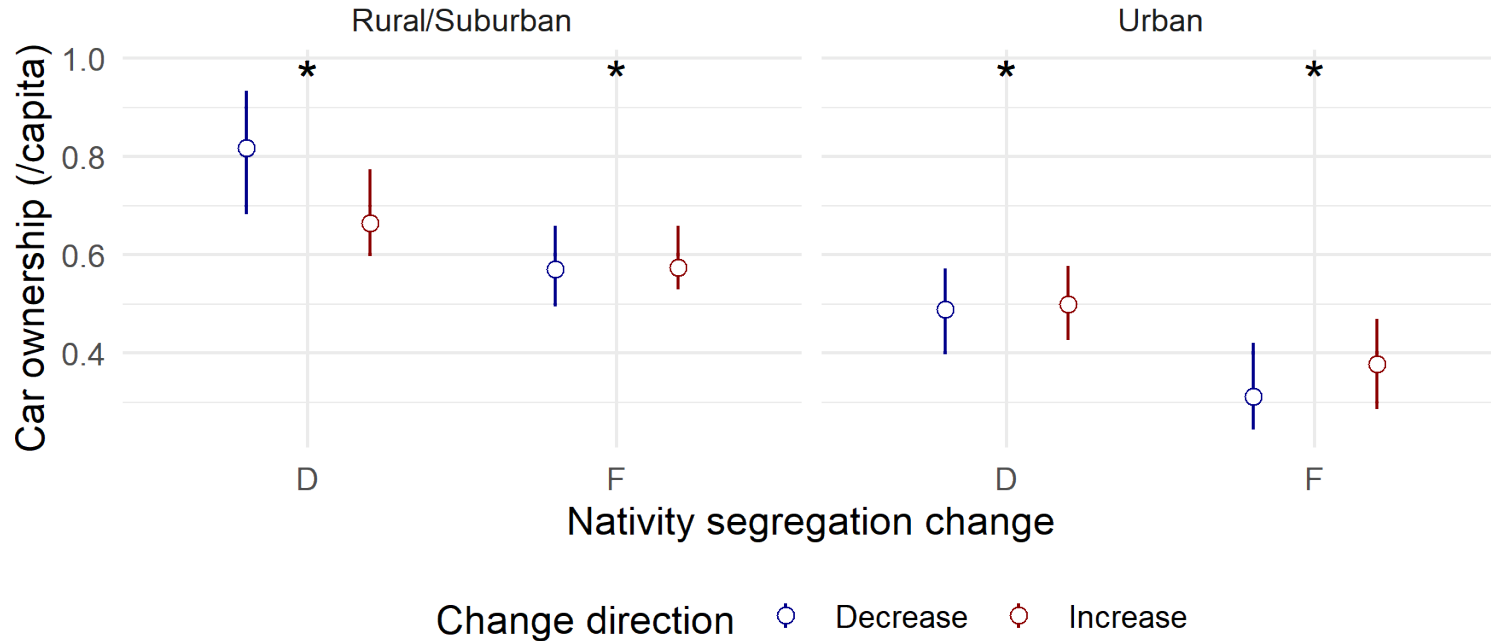
Appendix 5 – Association with explanatory factors: **weighted Mann–Whitney U test**



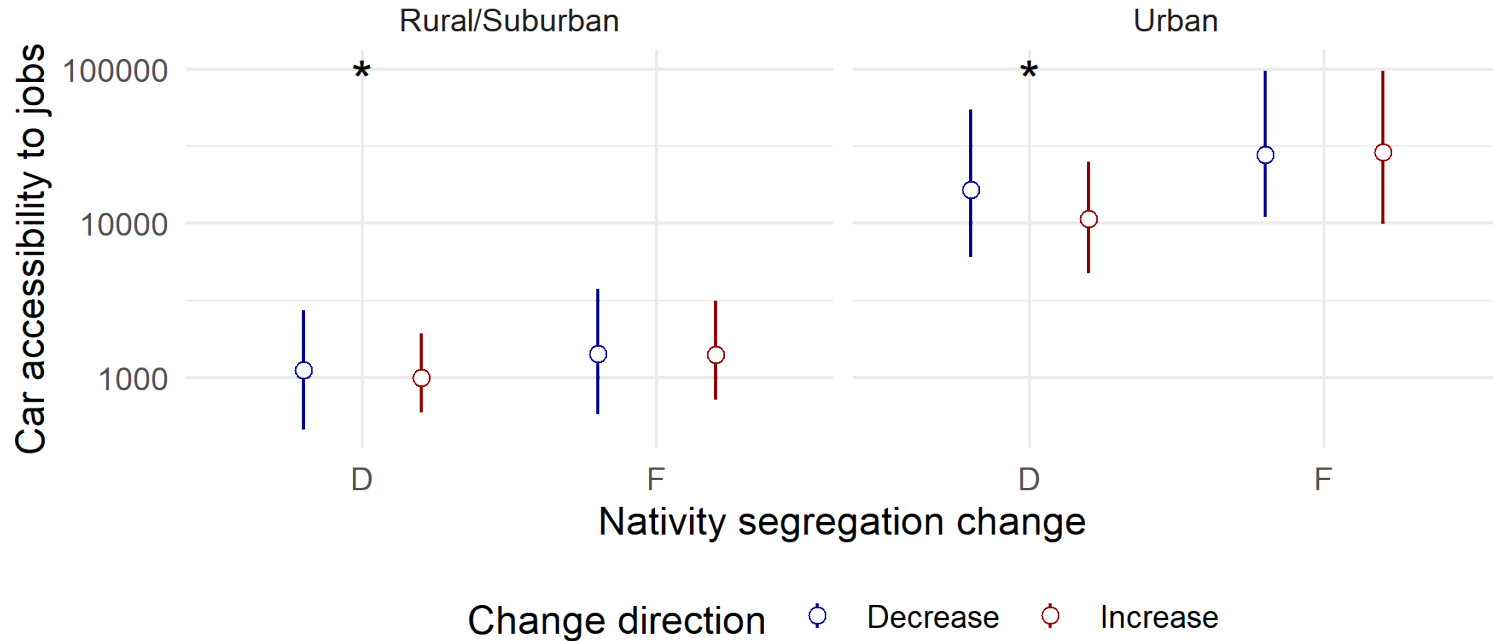
Appendix 5.1 – Association with income



Appendix 5.2 – Association with car ownership



Appendix 5.3 – Association with car accessibility



Appendix 5.4 – Association with public transit services

