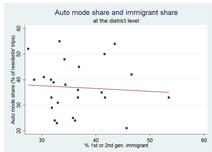
The Immigrant Effect on Mode Choice in Munich, Germany:

Are immigrants less likely to drive?

Introduction

Economists have long recognized that the travel habits of immigrants differ from those of the native-born in perplexing ways – a wide variety of studies have established that immigrants are less likely to drive alone and more likely to use sustainable modes such as walking, biking, or transit, even when controlling for other factors relevant to mode choice.



In Munich, Germany, the share of immigrants in a district is only marginally negatively correlated with the auto mode share ($\rho = -0.07$). This analysis nevertheless seeks to quantify these immigrant effects by identifying districts with high concentrations of immigrants where the auto mode share is higher and districts where the auto share is lower than expected, given their non-immigrant-related demographic and built environment characteristics.

Methods

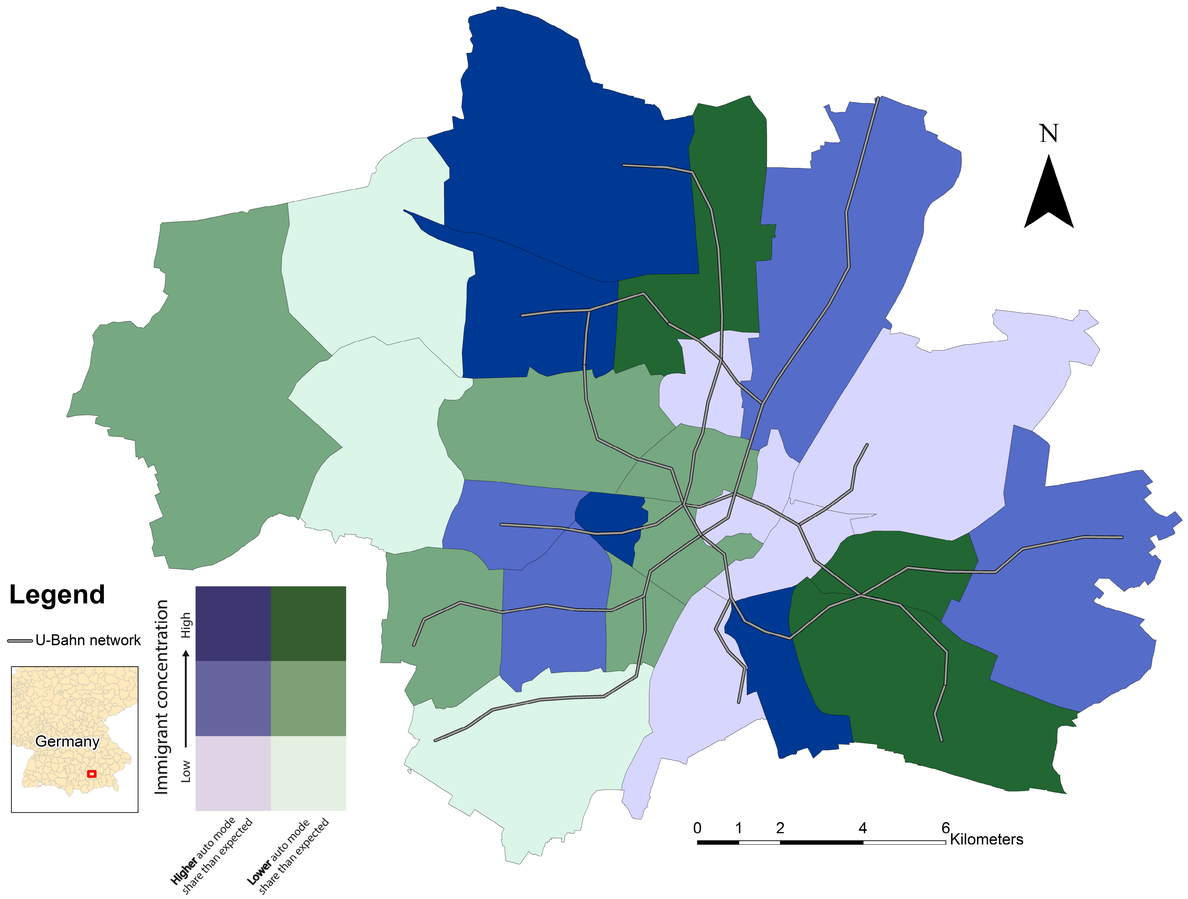
1 Characterization of built environment and transit by district

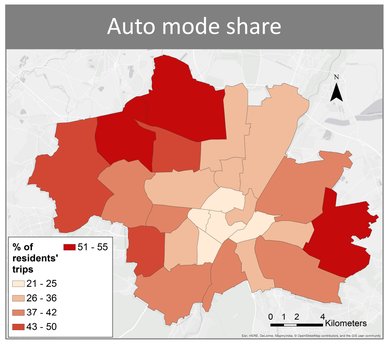
First, the density of commercial, retail, and civic institutions in each district is calculated, since mixed-use development facilitates walking, biking, and transit use. The density of three and four-way intersections in each district proxies for the walkability of the street grid. Bus and tram stop density provides a measure of surface transit access; the Network Analyst extension then allows the calculation of the percentage of a district's area within an 800m walking distance of an U– or S-Bahn station.

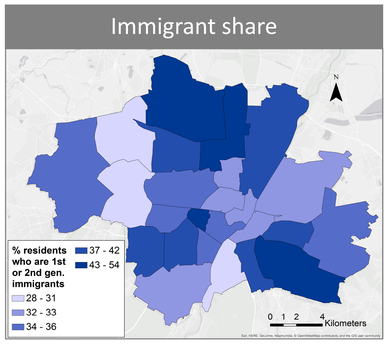
2 Predictive OLS regression

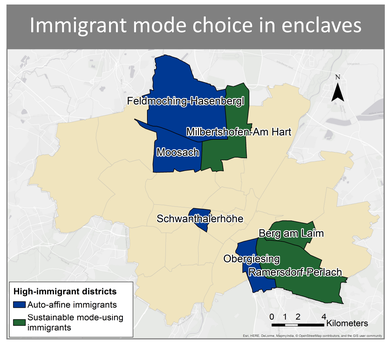
Auto mode share by district is then regressed on the available demographic, built environment, and transit service-related variables, omitting immigrant share:

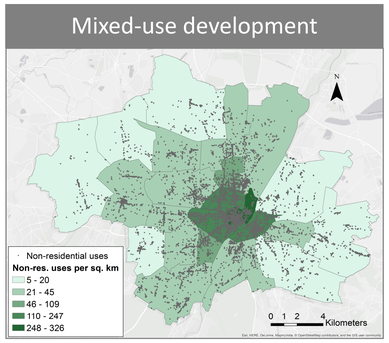
Auto mode share $= \beta_0 + \beta_1$ *intersection density* $+ \beta_2$ *mixed-use density* $+ \beta_3$ *bus/tram stop density* $+ \beta_4$ *% of area within walking distance of U/S-Bahn stations* $+ \beta_5$ *% over age 65* $+ \beta_6$ *average years lived at current address* $+ \beta_7$ *population density* $+ \beta_8$ *% of households with children* $+ \beta_9$ *auto density* $+ \beta_{10}$ *% on welfare* $+ \beta_{11}$ *% female* $+ \beta_{12}$ *mobility rate*

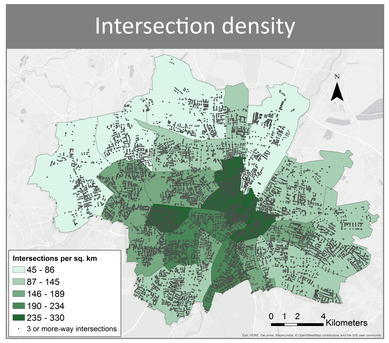


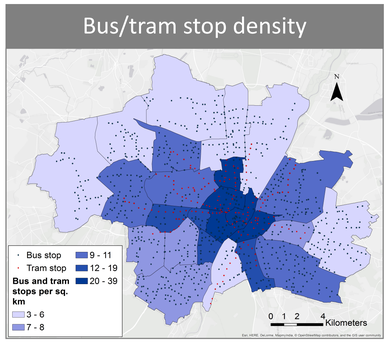


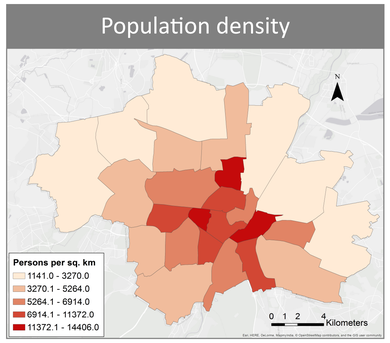


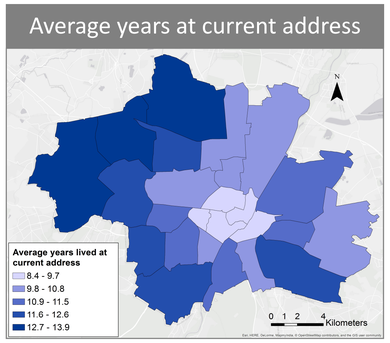


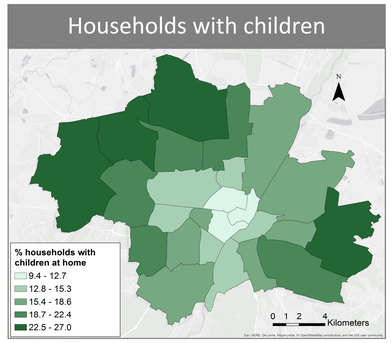












The fitted (i.e. predicted) values from this regression provide the expected auto mode share *based on factors unrelated to immigrant status.*

3 Comparison of predicted and actual auto mode shares

The analysis now focuses on the districts with the highest shares of immigrants. The regression is assumed to control for all relevant factors other than immigrant status; thus, in high-immigrant districts where the actual auto mode share is *lower* than expected, immigrants are ostensibly *less* likely to drive than the general population, hence they are *sustainable mode-using immigrants* (dark green in map at left). Where the opposite is true, immigrants are *more* likely to drive than the average resident, i.e. *auto-affine* (dark blue districts).

Results and Conclusions

According to the above analysis, immigrants in Munich are not uniformly more or less likely to drive than non-immigrants. Immigrants in the high-immigrant-concentration districts of Feldmoching-Hasenbergl, Moosach, Schwanthalerhöhe, and Obergiesing are *auto-affine*. In Milbertshofen-Am Hart, Ramersdorf-Perlach, and Berg am Laim, immigrants are *more likely to use sustainable non-auto modes* than the general population, echoing the "immigrant effect" found in previous studies of US cities.

However, variables omitted from the regression, such as employment locations, could be the true cause of these predictive deviations. Future analyses of immigrant mode choice in Munich should make use of trip-level data or at least data at a greater level of spatial detail in order to better model individual mode choice contexts; considering immigrants' country of origin could also prove interesting.

In any case, transportation planners in Munich could consider whether the three districts where immigrants are more likely to use sustainable modes warrant more transit service or pedestrian and cyclist infrastructure than previously assumed. At the same time, the city could increase outreach to *auto-affine* immigrant districts in order to encourage sustainable mode use.

Cartographer: Lucas Conwell

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Class: CEE 187 - Geographic Information Systems, Fall 2015 - Prof. Laurie Baise

Sources: Münchner Verkehrsgesellschaft (MVG); Michael Bauer Research; Environmental Systems Research Institute; OpenStreetMap; Münchner Verkehrs- und Tarifverbund; City of Munich; GriGun and Holger.Wohrle_JLL via ArcGIS Online; ArcGIS Light Grey Basemap

Coordinate System: DHDN Gauss Kruger Germany Zone 4; Datum: Deutsches Hauptdreieckskreuz; Transverse Mercator Projection