

The map for this final project takes a deep dive into the Spatial Mismatch Hypothesis (SMH) put forward by Thomas W. Sanchez at Texas A&M University, positing that labor market performance is correlated to transit accessibility. Deconstructing the geospatial mismatch between residents in low-income neighborhoods of Chicago and employment centers mostly concentrated in distant neighborhoods, this map aims to explore the SMH in Chicago. With public transit being low-income worker's main mode of transportation, the Chicago Transit Authority's unequal distribution of commuting services across the city combined with the SMH play a key role in the employment outcomes for low-income residents in Chicago. This paper will describe how [this map](#), developed using the Leaflet package, aspires to properly communicate all the aforementioned details through different cartographic web-methods, as well as the map's future durability and current limitations.

In order to gain a specific understanding of how different demographics in Chicago are affected by the SMH, the map draws Census Tract-level data from the U.S. Census Bureau Tables. With information from 2022, only two specific variables are selected: unemployment rate & the share of commuters using public transportation. Vulnerability to the negative effects of the SMH can be drawn from populations who have a high reliance on public transportation and simultaneously exhibit poor labor market outcomes. As a result, a third variable was included into the dataset: a vulnerability index. Higher values indicate a higher vulnerability. Since this may not be intuitive to users, the map includes a panel on the top right explaining the main aspects of the variable. The index was estimated with the following formula:

$$\text{Index} = \text{Unemployment rate} \times (1 - (\text{Share of Public Transit Commuters}))$$

Chicago Census Tracts are shown on the map with their delimited geometries from 2010, coming from the Chicago Data Portal's boundaries. Using their shapefile, the data mentioned above was joined with specific geographic entities. Every Census Tract is delimited with a black line to separate it from other Census Tracts. The fill color's opacity is determined by a specific variable's numeric value, with low values exhibiting higher transparency. Opacity is used as a means of visually communicating different levels across neighboring Census Tracts. The fill colors were specifically chosen to most effectively communicate numerical differences. The map's ability to convey the spatial mismatch hypothesis is reliant on its ability to convey its most essential aspects: transit accessibility & employment. For this reason, the map includes a layer control panel where users can switch between three variables, these being: unemployment rate, share of public transit commuters, & the vulnerability index. For clarity, switching between variables not only changes the opacity of the census tracts according to the selected variable, but it also changes the color of the census tracts to clearly differentiate between variable selection. Visualizing how these variables change depending on every Census Tract only provides a visual intuition for the user. For that reason, the map includes a Pop-up

feature wherein a user can click on a specific Census Tract and extract the specific variable data relating to the selected geographic entity.

Despite all of its features, the map still holds some limitations. Regarding the data format, Census Tracts are not the most user friendly geographic entity, as most people do not even know which Tract they live in. A potential improvement on this feature would be to match specific addresses with Census Tracts so users can look up addresses as they do on Google Maps. Additionally, the map only includes data from 2022. Potential improvements in this direction could be through the integration of data from other years using Leaflet's time features, thus granting users the ability to visualize how the relevant variables evolve through time.

In conclusion, this map effectively illustrates the Spatial Mismatch Hypothesis (SMH) by highlighting the disconnect between low-income neighborhoods in Chicago and distant employment centers. By integrating unemployment rates, public transportation reliance, and a vulnerability index, the map offers an insightful depiction of how public transit disparities contribute to economic disadvantages for low-income residents. Interactive features such as variable layer control, and a pop-up information function enhance the user experience, deepening the understanding of SMH's impact on different demographics. Despite limitations regarding Census Tracts, future enhancements could involve linking specific addresses to make the data more relatable and easier to navigate. Overall, the map stands as a tool for visualizing and employment opportunities, providing valuable insights for policymakers and potential stakeholders.