SEGIS Project: Ethnic Restaurants and Immigrant Populations

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Contents

Project Introduction

Ethnic restaurants appear in many areas of the Atlanta Metro Area. These ethnic restaurants play a part in Atlanta being nationally recognized as a city with great food options. Atlanta also, coincidentally (or not), has a sizable immigrant population from many countries. Often, immigrants in America make a living and share their birth nation culture through starting restaurants that serve the foods of their origin nation. Additionally, immigrant populations in America may tend to frequent and generate demand for food from their origin nation in their new locale. A theory that this project explores is that there is a relationship between the physical prescence of immigrant populations and ethnic restaurants in Atlanta. In the future, it would be interesting to think about how investing in immigrants could stimulate ethnic restaurant economic and cultural activity in a region. This project looks to answer three questions. 1. Where are ethnic restaurants located in Atlanta? 2. Where are immigrant populations residing in Atlanta? 3. Is a statistically significant relationship between the population of ethnic restaurants and immigrant population residences in Atlanta?

Data Sources and Descriptions

There are two data sources for this project. The first is the US Census Bureau. The 5-year ACS 2021 Survey is utilized to obtain Foreign-Born populations in the Atlanta region by census tract (US Census Bureau, 2021a). Census tracts were chosen for their balance of area resolution and ease of computation. The data was obtained using Social Explorer for their ease of data organization. Additionally, Cartographic Boundary Files from the US Census Bureau were used to obtain the 2021 Census Tract geometries (US Census Bureau, 2021b). For this particular dataset, it is of note that many Foreign-Born residents may not want to disclose their origin nation especially if they are illegal immigrants for the time being. Therefore, this particular data may have larger margins of error than other US Census datasets. As a disclaimer, the term immigrants will be used in place of the term Foreign-Born residents in this report for briefness even though not all Foreign-Born residents are permanent residents.

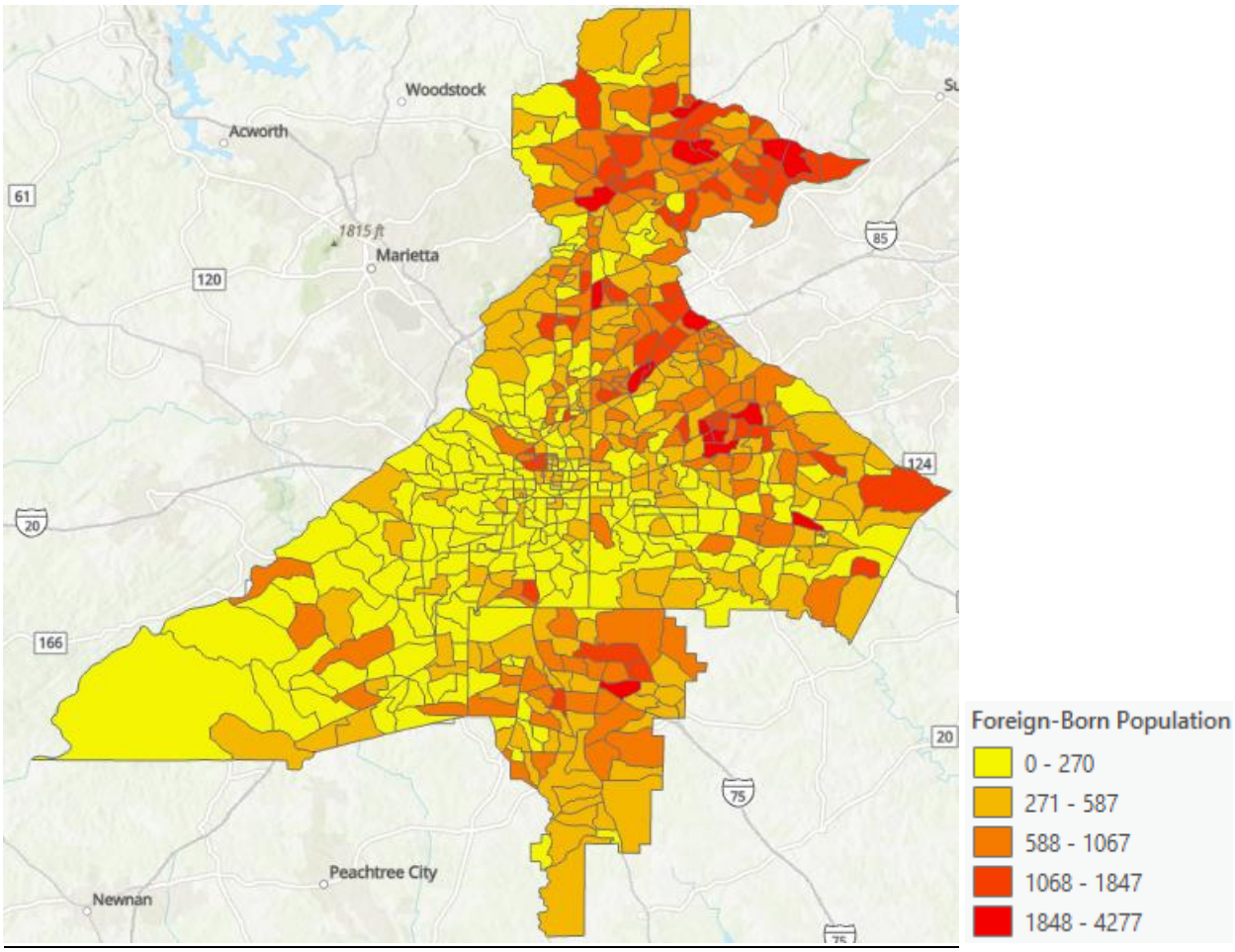

Figure 1: Map of Foreign-Born Population by Census Tract in Fulton, DeKalb, and Clayton Counties using ACS 5-Year 2021 Data (US Census Bureau, 2021a)

The second data source used is less statistically robust, as it is a combination of crowd-sourced data and institutional data from Yelp. As such, there are not provided margins of error like there are in Census Data. Yelp provides its data free for public use, up to a certain limit, through the Yelp Fusion API service (Yelp, n.d.). This data was obtained using R scripting. The data itself is created through business owners registering their establishments, Yelp users leaving reviews, and Yelp employees monitoring the data inputs. Through this process of data creation, it is not guaranteed that every or even most restaurants will appear in this dataset with accurate information. The information that is especially relevant to this project are the category tags applied to each restaurant on Yelp. These tags are how these restaurants were selected to be analyzed in this project. The tags that were selected for inclusion in this project where any avaliable tags on the Yelp Fusion API that would indicate a primarily non-American originating food palate establishment. The tags included were the following: Afghan, African, Senegalese, South African, Arabian, Argentine, Armenian, Asian Fusion, Australian, Austrian, Bangladeshi, Basque, Belgian, Brasseries, Brazilian, British, Bulgarian, Burmese, Cambodian, Caribbean, Dominican, Haitian, Puerto Rican, Trinidadian, Catalan, Chinese, Cantonese, Dim Sum, Hainan, Shanghainese, Szechuan, Creperies, Cuban, Czech, Eritrean, Ethiopian, Filipino, Fish, Chips, Fondue,

French, Mauritius, Reunion, Georgian, German, Gluten-Free, Greek, Guamanian, Halal, Himalayan, Nepalese, Honduran, Hong Kong Style Cafe, Hot Pot, Hungarian, Iberian, Indian, Indonesian, Irish, Italian, Calabrian, Sardinian, Sicilian, Tuscan, Japanese, Conveyor Belt Sushi, Izakaya, Japanese Curry, Ramen, Teppanyaki, Kebab, Korean, Kosher, Laotian, Latin American, Colombian, Salvadoran, Venezuelan, Malaysian, Mediterranean, Falafel, Mexican, Tacos, Middle Eastern, Egyptian, Lebanese, Mongolian, Moroccan, Nicaraguan, Noodles, Pakistani, Pan Asia, Persian, Iranian, Peruvian, Pizza, Polish, Polynesian, Portuguese, Poutineries, Russian, Scandinavian, Scottish, Singaporean, Slovakian, Somali, Spanish, Sri Lankan, Sushi Bars, Syrian, Taiwanese, Tapas Bars, Tapas, Small Plates, Thai, Turkish, Ukrainian, Uzbek, Vietnamese.

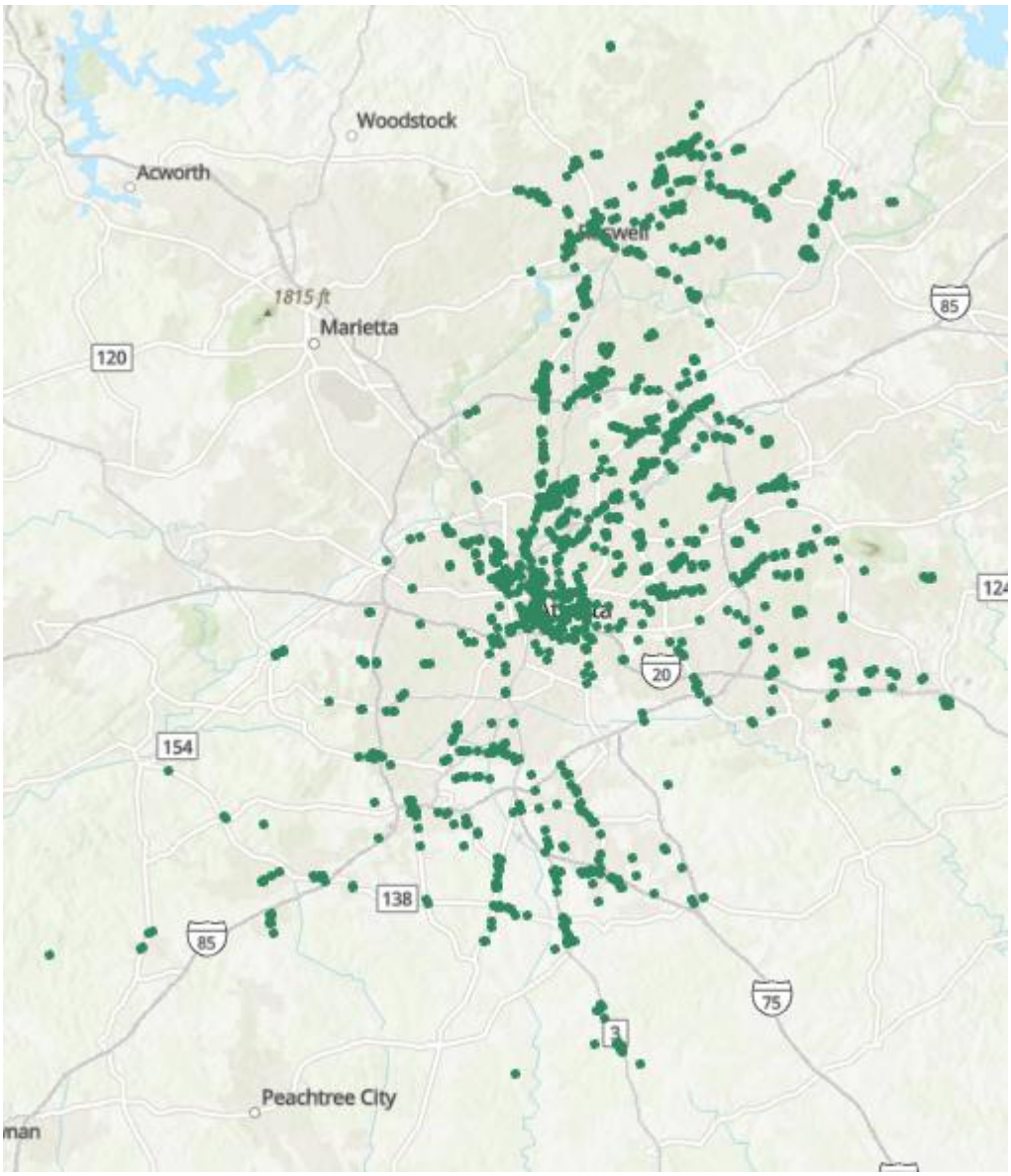

Figure 2: Ethnic Restaurants in Fulton, DeKalb, and Clayton Counties from Yelp Fusion API (Yelp, n.d.)

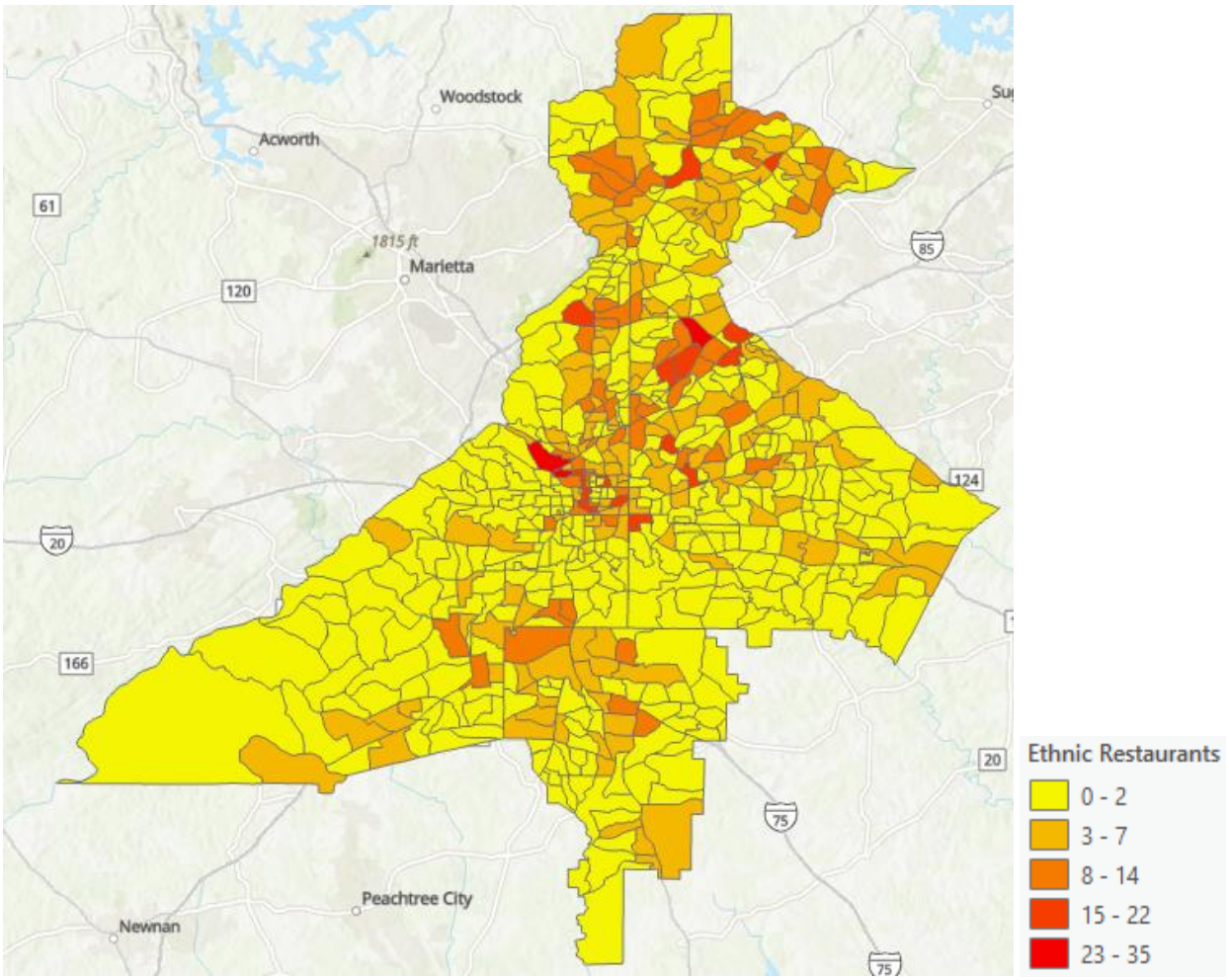

Figure 3: Ethnic Restaurant Population by 2021 Census Tract Boundaries (Yelp, n.d.)

For data computation time reduction, data was only collected for counties fitting the strictest sense of the Atlanta area were selected. Those counties were Fulton, Dekalb, and Clayton. This study could be replicated to include more counties of interest in the future. Sizable immigrant populations like in Cobb and Gwinnett Counties. Those counties would be interesting to include in a future study. The Atlanta area in this report will reference Fulton, Dekalb, and Clayton specifically.

Analysis Techniques

A multitude of analysis techniques were used to answer the project questions. The first question is “Where are ethnic restaurants located in the Atlanta area?” It would be helpful to know which areas of Atlanta have large clusters of ethnics restaurants to answer this question. Therefore, a hotspot analysis using Getis-Ord Gi* is conducted on the ethnic restaurant population by census tract. Inverse distance squared in Euclidean space was chosen for the conceptualization of spatial relationships as a mix between local and regional analysis is desired for the three included countries of the dataset.

To answer the second question “Where are immigrant populations residing in the Atlanta area?”, the same analysis method of a hotspot analysis using Getis-Ord Gi* was used except with the Foreign-Born Population dataset from the ACS 2021 5-Year on census tracts. Additionally, to answer these two questions, it would be revealing to see where the mean center of the ethnic restaurants are compared to the mean center of Foreign-Born residents. Both the mean center of the ethnic restaurant points and the mean center of census tracts weighted by Foreign-Born residents were calculated along with their first standard deviation distribution ellipses.

While the hotspot analysis sheds some light on the clustering of immigrants and ethnic restaurants, exploring the spatial autocorrelation of immigrants and ethnic restaurants also reveals if immigrant residences tend to cluster with themselves. A spatial autocorrelation analysis using Moran’s I was performed for immigrant populations and ethnic restaurant populations.

To answer the third question “Is a statistically significant relationship between the population of ethnic restaurants and immigrant population residences in the Atlanta Area?”, an OLS regression analysis is performed. A general OLS regression is performed on census tract geometries with the dependent variable being the population of ethnic restaurants and the explanatory variable being the population of Foreign-Born residents. Having more statistically significant explanatory variables beyond just foreign-born residents would make the regression model more trustworthy for analysis. Since this project is not concerned with the other possible explanatory variables, they are omitted from the model. A more in-depth regression using different ethnic groups of foreign-born residents as explanatory variables is also performed to see if any particular ethnic group has larger influence on the population of ethnic restaurants. The included ethnic groups were European, Asian, African, Oceania, Americas(excluding the US).

Finally, a hotspot Getis-Ord Gi* analysis is used on the residual regression output to identify clusters of places that have more or less ethnic restaurants than expected based off the immigrant resident population.

Analysis Results

The immigrant hotspot analysis in Figure 4 reveals that foreign-born populations tend to reside in the northeast parts of the Atlanta area and small portions living in the south below the airport and the east of Atlanta. The ethnic restaurant hotspot analysis in Figure 5 shows that ethnic restaurants reside primarily in the northeast of the Atlanta region, the center of Atlanta near Midtown, and a smattering in the south/southwest. The shared regions of overlap seem to be the northeast regions and a small portion of southern Atlanta. The mean centers in Figure 6 show more clearly that the foreign-born population is spatially located more to the northeast than ethnic restaurants are. However, both share similar spatial distributions over the Atlanta area. It is interesting to note that there are no cold spots for foreign-born populations or ethnic restaurants in Figures 4 and 5 in Atlanta which means there is some sort of base level of foreign-born population and ethnic restaurants that is shared in all tracts of the Atlanta study area.

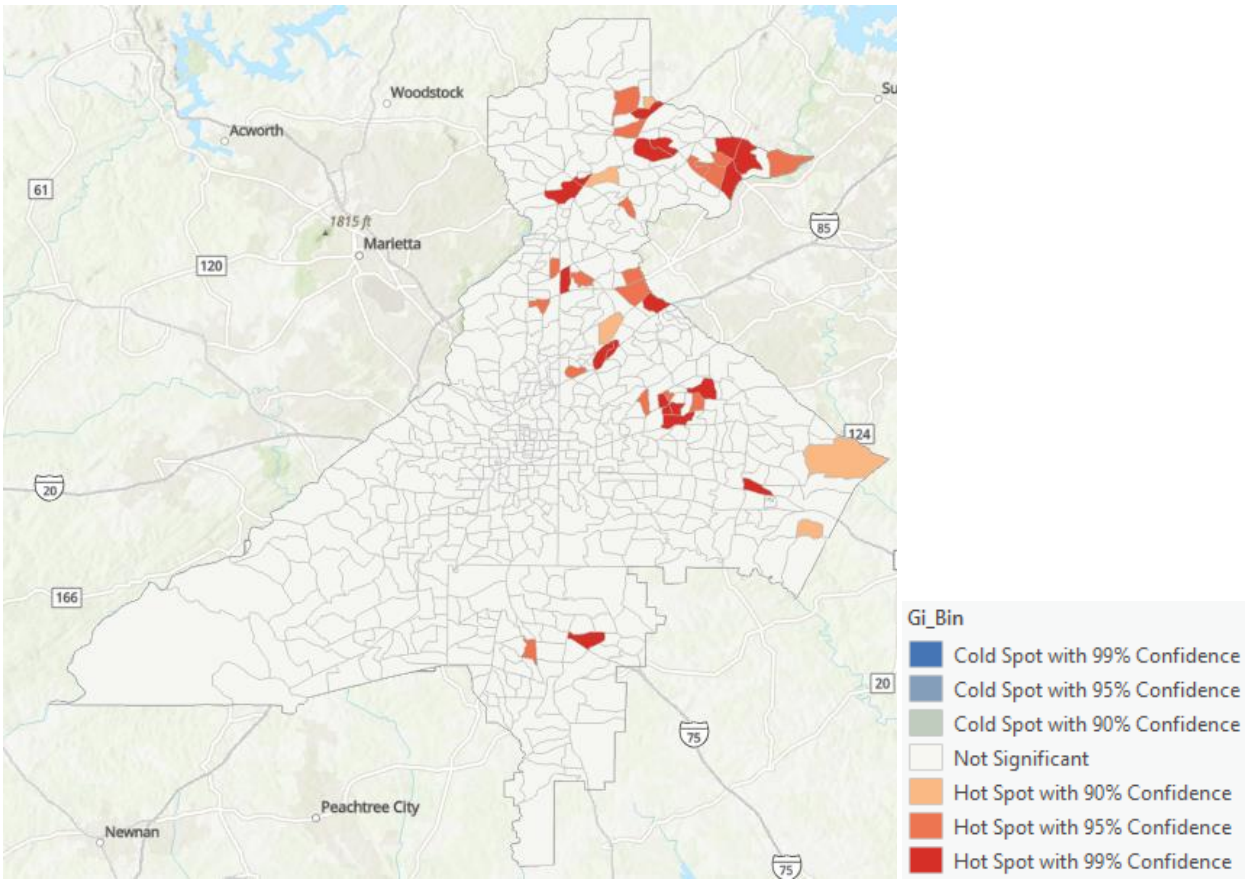

Figure 4: Hotspot Analysis of Foreign-Born Population

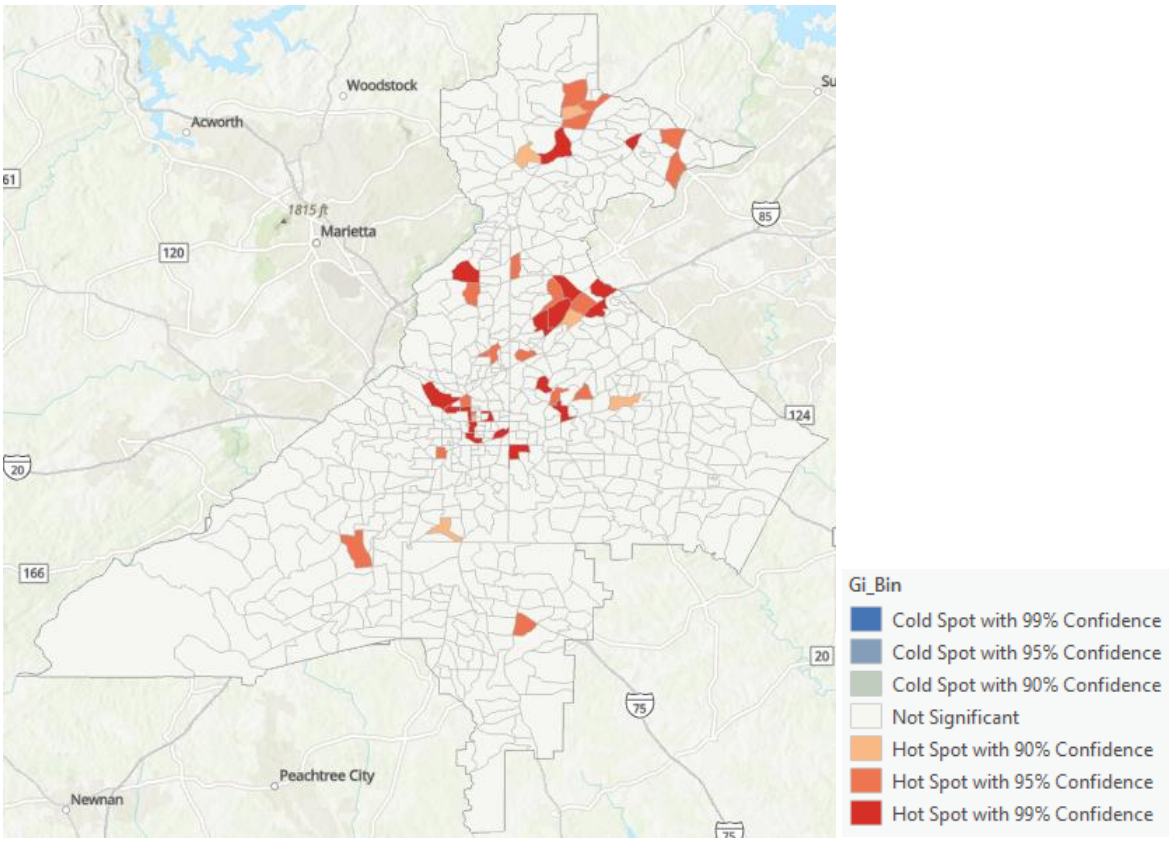

Figure 5: Hotspot Analysis of Ethnic Restaurants

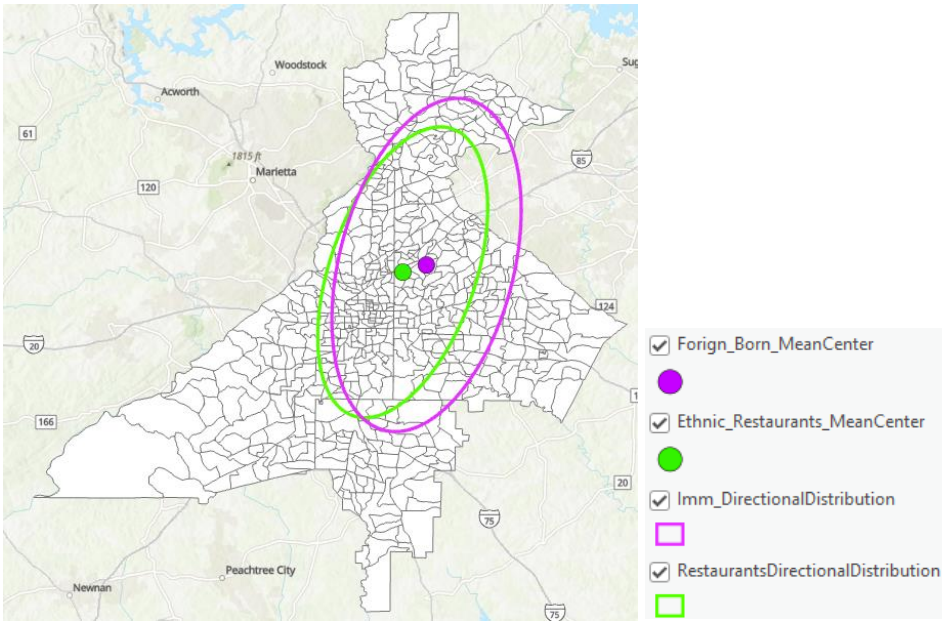

Figure 6: Mean Center and First Standard Deviation Distribution Between Foreign-Born Populations and Ethnic Restaurants

Looking at the Foreign-Born Population locations, it appears such populations do exhibit some spatial autocorrelation due to the Moran's Index being 0.32 as shown in Table 1. The spatial autocorrelation is positive as the Moran's Index is positive. These results are statistically significant at a 95% confidence level because the z-score is 37.32 which is over the rule of thumb threshold value of 1.96. The ethnic restaurant locations also exhibit some sort of spatial autocorrelation due to the Moran Index being 0.1 as shown in Table 2. However, the spatial relationship is less strong compared to the foreign-Born population. The spatial autocorrelation just barely exists and is positive as well. The result is statistically significant as with the z-score being 11.83. This means that for both foreign-born populations and ethnic restaurants they tend to locate themselves next to other foreign-born populations or ethnic restaurants. Although, this observation is less strong for ethnic restaurants. This might make sense as other profit making factors may motivate their location.

Table 1: Foreign-Born Population Spatial Autocorrelation Results

Global Moran's I Summary

Moran's Index	0.322201
Expected Index	-0.001669
Variance	0.000075
z-score	37.318224
p-value	0.000000

Table 2: Foreign-Born Population Spatial Autocorrelation Results

Global Moran's I Summary

Moran's Index	0.100902
Expected Index	-0.001669
Variance	0.000075
z-score	11.830045
p-value	0.000000

The results of the OLS regression to investigate the relationship between foreign-born populations and ethnic restaurants are shown in Figure 7 and 8. It seems that the foreign-born population is not great at explaining the ethnic restaurant population in its census tract. The R squared value if 0.07 meaning that the model explains 7 percent of the result output. However, there is a statistically significant relationship between foreign-born population as an explanatory variable for the ethnic restaurant population. The t-value is 6.86 which at a confidence level of 95% is larger than 2. This can also be somewhat visually confirmed in Figure 7 as the regression line does follow a positive trend as the data points also generally do in the chart. This means that there is a relationship between foreign-born populations and ethnic restaurants, but foreign-born populations alone are not good exact predictors of ethnic restaurant density in the same area. Figure 8 displays the residuals which show that about half of the census tracts are within 0.5 standard deviations which seems decent given the low explainability of the regression. A quarter of the tracts, especially those near the center and northeast, show higher deviations/inaccuracy.

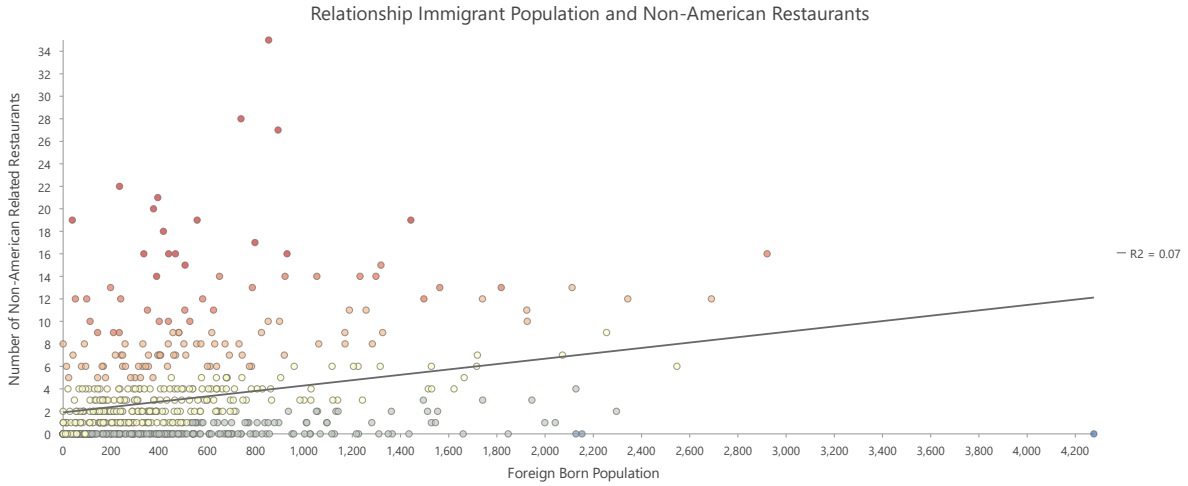

Figure 7: Regression Chart of Ethnic Restaurant Model

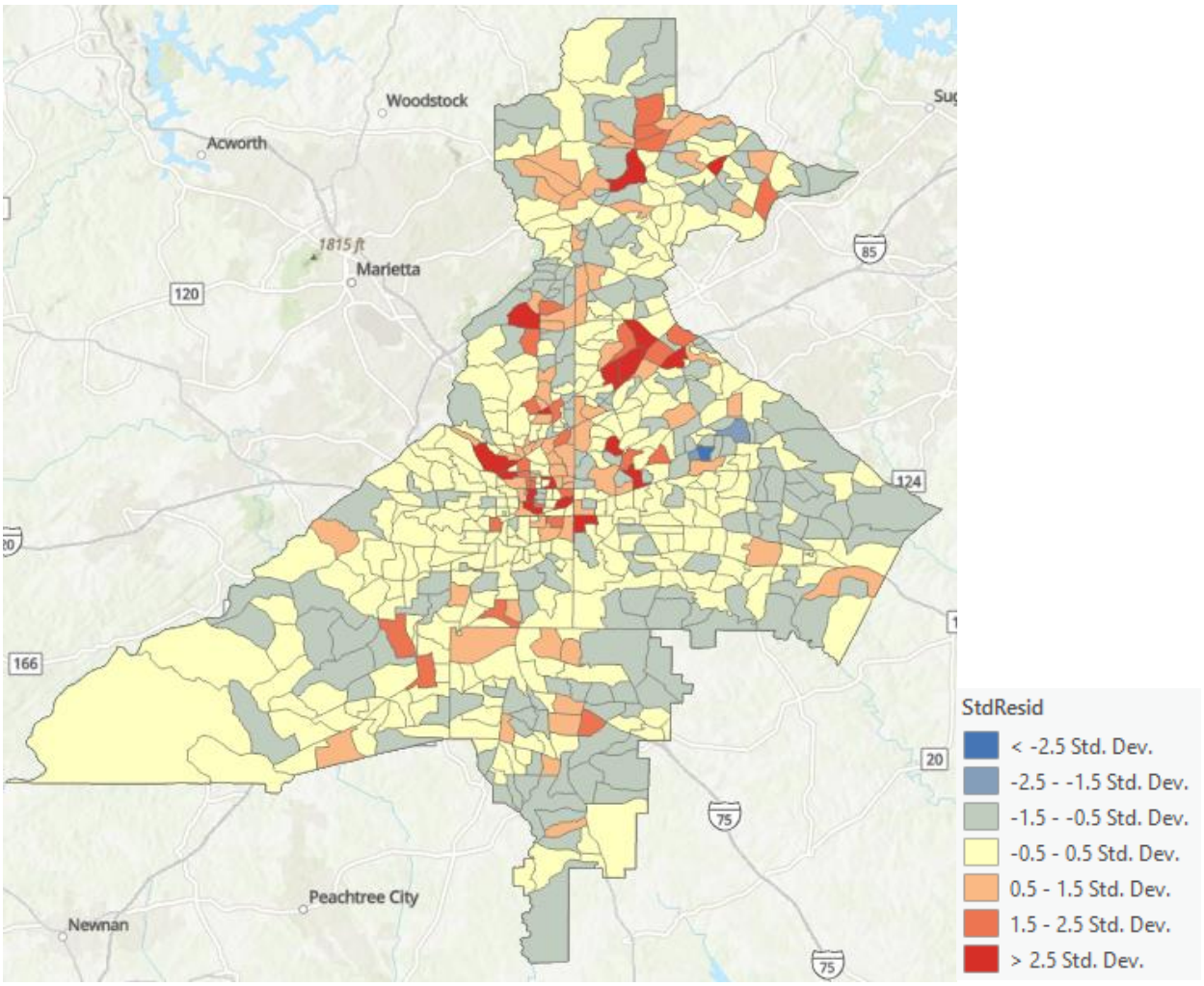

Figure 8: OLS Regression Residuals Mapping for Foreign-Born Populations

Another OLS Regression model was created, but with a deeper dive on foreign-born populations as the explanatory variable. A different explanatory variable was created for each ethnic division, and the results are displayed in Table 3 and Figure 9. It seems that this attempt at a deep dive of which ethnic groups specifically affect ethnic restaurant populations is unsuccessful. It appears that the t-score for all specific ethnic group variables is below 2 or greater than -2. This means that all the explanatory variables have no statistically significant relationship at the 95% confidence level to ethnic restaurant populations. The adjusted R-squared value of this OLS regression is 0.063 which is not much less than the OLD regression with just the total foreign-born population. However, it seems using specific ethnic foreign-born populations is both not statistically significant and has less explainability.

Table 3: Detailed Foreign-Born Population OLS Regression Results per Ethnic Population Factor

Variable	Coefficient [a]	StdError	t-Statistic
Intercept	6802.532954	4113.344525	1.653772
PCT_SE_A07	-67.993064	41.133348	-1.652991
PCT_SE_A_1	-67.971113	41.133214	-1.652463
PCT_SE_A_2	-68.011442	41.133602	-1.653428
PCT_SE_A_3	-67.825723	41.137979	-1.648737
PCT_SE_A_4	-68.005622	41.133426	-1.653293
PCT_SE_A_5	0.044430	0.023498	1.890754

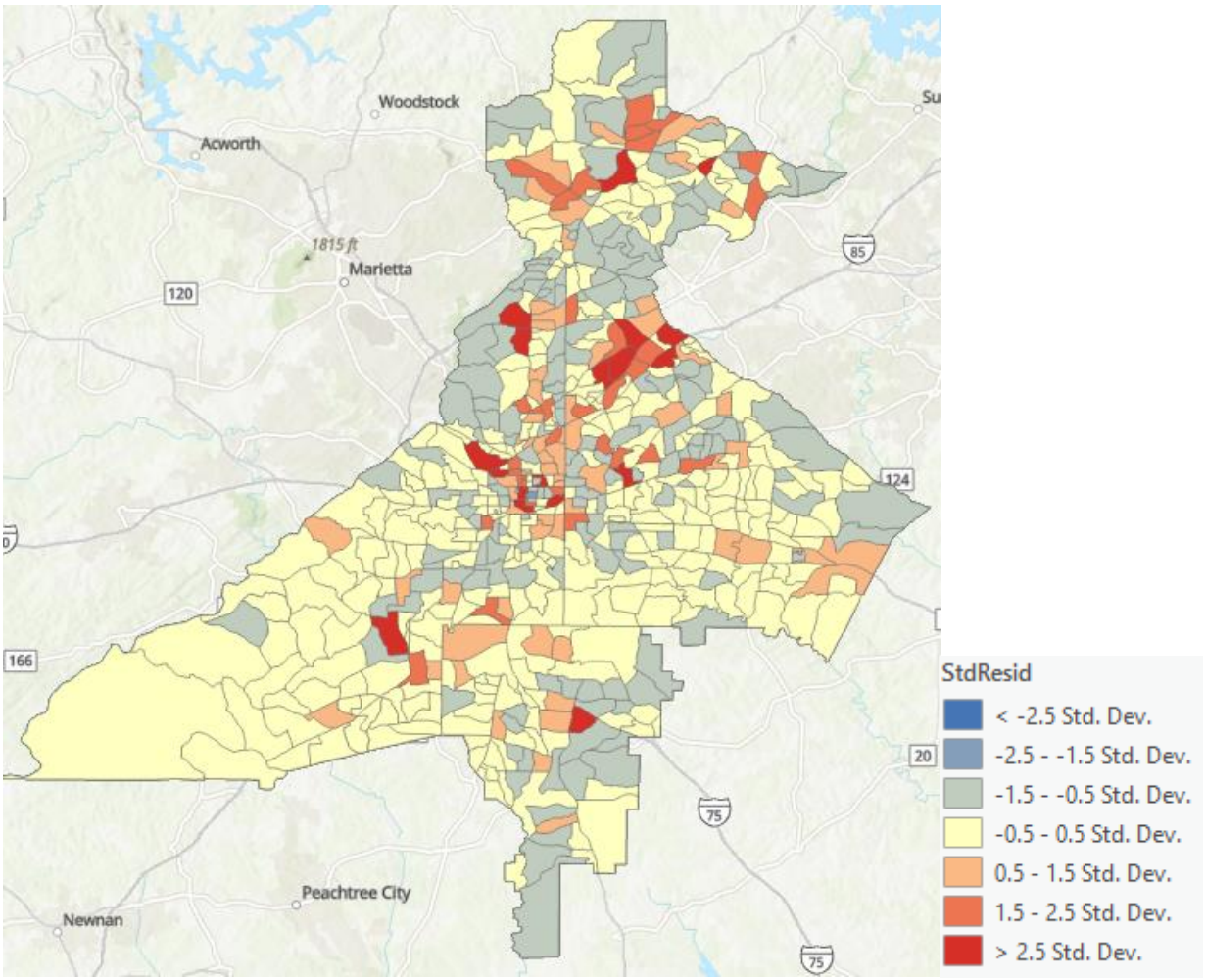

Figure 9: OLS Regression Residuals Mapping for Detailed Foreign-Born Populations

The final finding is an analysis of the residuals of foreign-born populations from Figure 8. The hotspot analysis of the residuals is shown in Figure 9. The hotspots of the residuals show tract clusters where more ethnic restaurants are located than the amount of ethnic restaurants that are predicted by the foreign-born population-based regression model and vice versa with the cold spots. It could be interesting to think about what other factors could cause these spots to have more ethnic restaurants beyond foreign-born population factors. For example, some of these clusters are located near midtown. This could be due to factors such as establishment frequenting by target customer populations being attractive factors for ethnic restaurants to locate near midtown.

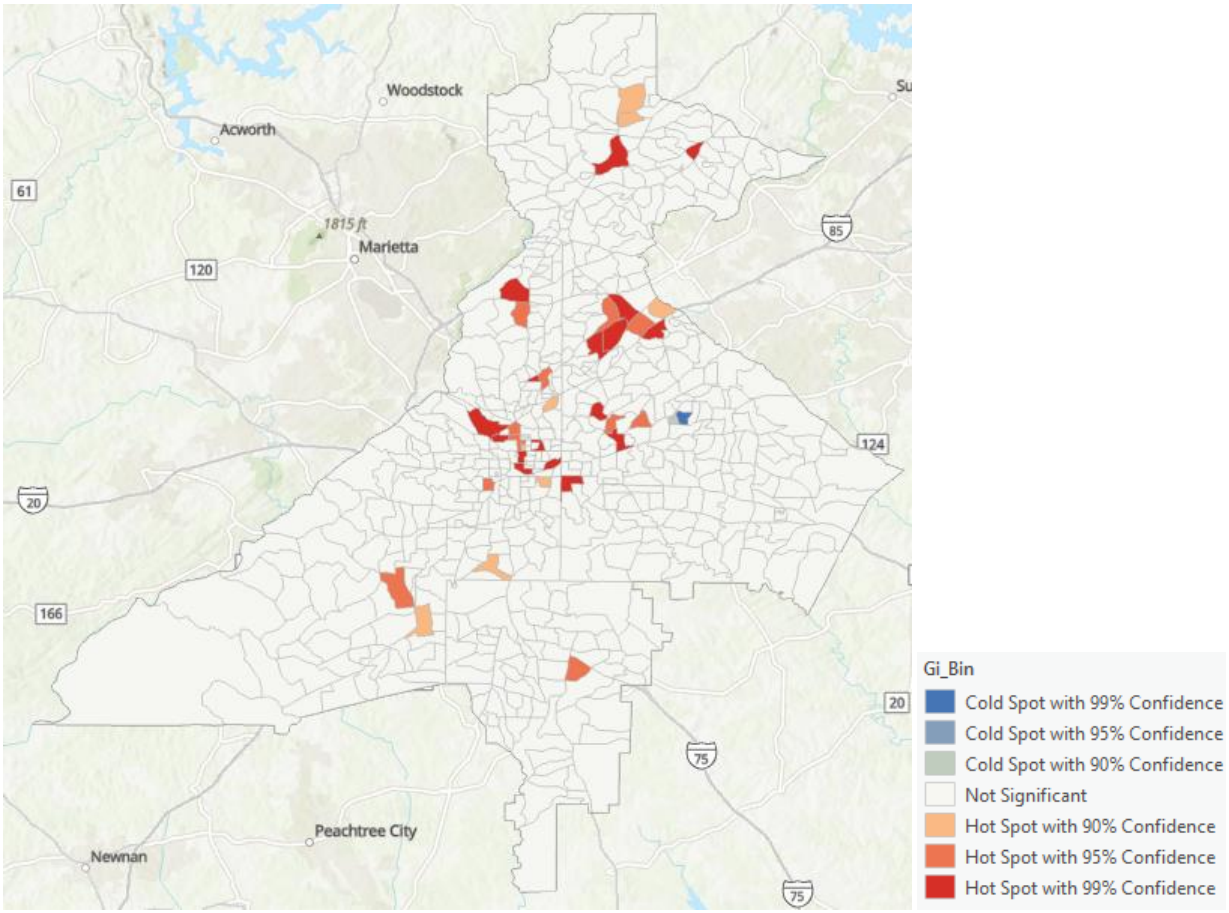

Figure 10: Hotspot Analysis on OLS Regression of Foreign-Born Population Residuals

Conclusion and Discussion

This project set out to answer questions on the locations and distribution of ethnic restaurants in the Atlanta area, the locations and distributions of foreign-born populations in the Atlanta area, and the existence of a statistically significant relationship between foreign-born populations and ethnic restaurant populations within census tracts of the Atlanta area. Using spatial autocorrelation, hotspot, and regression methods, the questions have been answered. Generally, the foreign-born populations reside in the northeast of Atlanta. The ethnic restaurants also follow that same locational trend except with a larger presence in the center of Atlanta as well. There does exist a statistically significant relationship between foreign-born populations and ethnic restaurant populations in the Atlanta area, but foreign-born populations are poor predictors of the number of ethnic restaurants in tract resolution locales in the Atlanta area. These findings using socioeconomic GIS methods are confirmed by experiential and qualitative finding of the prescence of foreign-born populations and ethnic restaurants in the Atlanta area as well. The findings are useful to understand the restaurant and diversity spatial layout of the Atlanta area. Such analysis could be applied to other city regions to gain an understanding of the restaurant and diversity layouts. Additionally, the report finding put more credence towards a theory that immigrants do generate more ethnic restaurants for a region. Such restaurant generation can help not only share diverse food cultures to a city, but also generate economic activity and cultural hotspots. The hotspot analysis does show that, in the Atlanta area, that clusters of these restaurants and immigrant populations do exist. When these hotspots are combined with agglomerative theories, such analysis could also inform planning parameters around immigrant residence populations and restaurants for locales in cities. This project results can be used meaningfully in the ways just listed and in many more ways.

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