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February 12, 2020

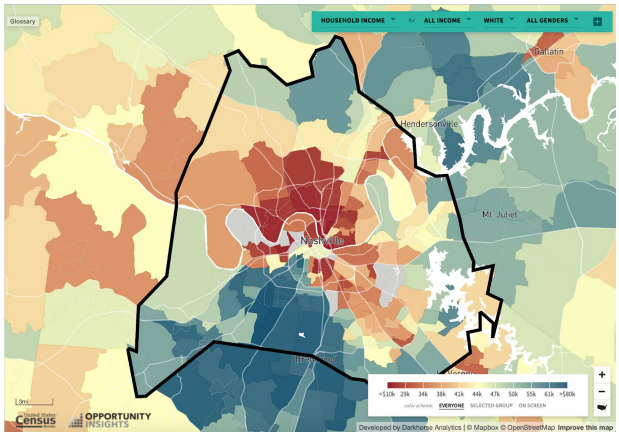
Economics 50
Empirical Project 1 Part 1

Upward Mobility in Nashville, Tennessee

Many people recognize Nashville, Tennessee for its world-renowned country music and hot chicken. But what many don't know about is Nashville's recent spike in urbanization and economic growth. According to CityLabs, Nashville is on the list of "Top 10 Fastest Growing Job Markets", as major businesses continue to create new offices and thousands of new job opportunities around Nashville. Nashville's infrastructure also follows this trend, with over half of Nashville's skyscrapers having been built in just the last ten years. But despite Nashville's rapid growth, many parts of the metropolitan area still suffer from widespread income inequality. Nashville is similar to many other major cities in the South in that its income inequality is especially prevalent amongst different racial groups. Nashville's income inequality stems from its long history of racial segregation throughout the early 20th century.

This investigation analyzes factors that may have a correlational effect on upward mobility and income inequality across different neighborhoods around Nashville. A comprehensive data set containing relevant information for this investigation originates from "The Opportunity Atlas", a visual representation of upward mobility across different regions and subgroups. Specifically, the average household income of each census tract from 1978-1983 is calculated and compared to that of other census tracts on a percentile rank. Using data from tax returns and dependency forms, The Opportunity Atlas displays the percentile rank of the average household income of children (born in 1978-1983) whose parents were originally in the 25th income percentile rank at the time. This percentile rank is represented on the map visually using

a color scheme. Green- and blue-colored census tracts indicate neighborhoods with higher levels of upward mobility whereas red and orange regions indicate neighborhoods with lower levels of upward mobility. It is interesting to see the widespread differences in upward mobility levels across various census tracts, even throughout tracts directly neighboring each other. This fact shows that the exact location where a child grows up can have a huge impact on his/her ability to move up on the income ladder. Specific properties or variables such as the racial or income composition of a neighborhood help distinguish which neighborhoods are likely to promote stronger levels of upward mobility.



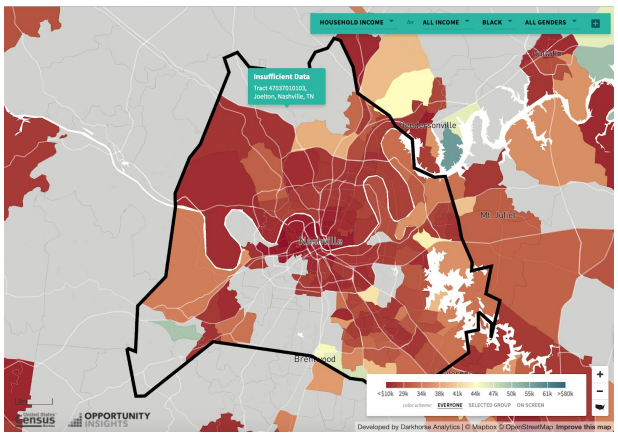
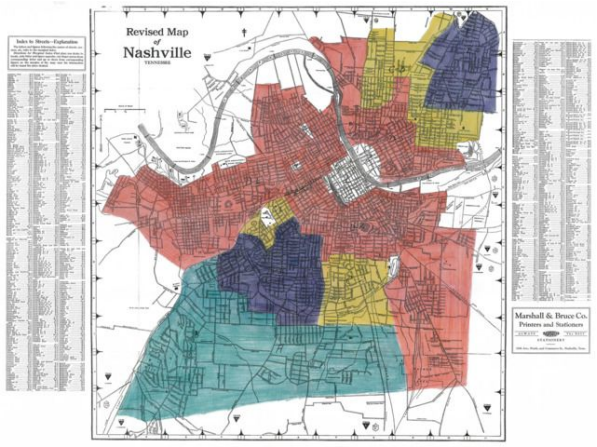


Figure 1: Average Upward Mobility for Whites in Davidson County
Figure 2: Average Upward Mobility for Blacks in Davidson County



"Redlining" - Housing Segregation Policies in the 1930s

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Jim Crow Laws and other forms of racial segregation have had long-lasting effects on the differences in opportunities for different racial subgroups in Nashville. Differences in upward mobility levels between Whites and Blacks are evident in the sharp contrast between Figures 1 and 2. Visually, the upward mobility for Blacks is much redder (lower) than that of Whites around Nashville. One interesting observation is that there is a lack of data in the upward mobility levels of Blacks (gray areas) in affluent neighborhoods such as Green Hills, Forest Hills, and Franklin. This lack of data likely results from the extremely low number of Blacks living in those areas. This form of de facto segregation may have arisen from a racist housing policy in the 1930s known as "redlining", which allowed specific neighborhoods to thrive based on their racial composition. As seen in the image above, certain areas (primarily those with black residents) were deemed "hazardous", making it difficult for residents in those areas to receive housing loans. The disparities in housing loans between different racial groups accumulated over time, leading to widespread income inequality between neighborhoods that were separated through this "redlining" process. From observing the Opportunity Atlas, I hypothesize that historical racial segregation in Nashville has impacted the upward mobility for different racial groups, leading blacks to have lower upward mobility rates than whites today.

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Table 1: Average Upward Mobility across Census Tracts in Different Regions amongst Different Racial Groups

	US (mean of all census tracts)	Tennessee (mean of all census tracts)	Census Tract 47037016900 (Belmont/Hillsboro)
All Races (kfr_pooled_pooled_25)	0.4285864	0.3797611	0.3836115
White (kfr_white_pooled_25)	0.4629801	0.4110008	0.4454095
Black (kfr_black_pooled_25)	0.3398718	0.3216771	0.3324606
Hispanic (kfr_hisp_pooled_25)	0.4370138	0.3992314	*Not Available

Figure 3: Histogram of Average Upward Mobility amongst Whites in Davidson County
Figure 4: Histogram of Average Upward Mobility amongst Blacks in Davidson County
Figure 5: Histogram of Average Upward Mobility amongst Hispanics in Davidson County

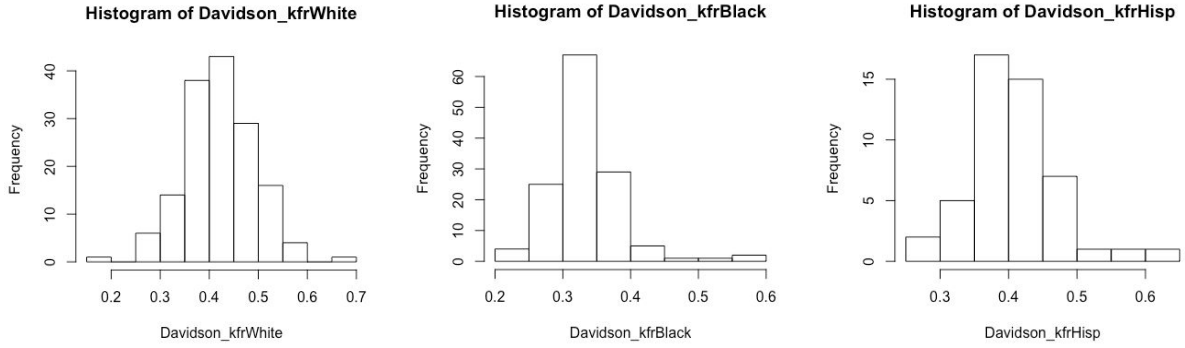
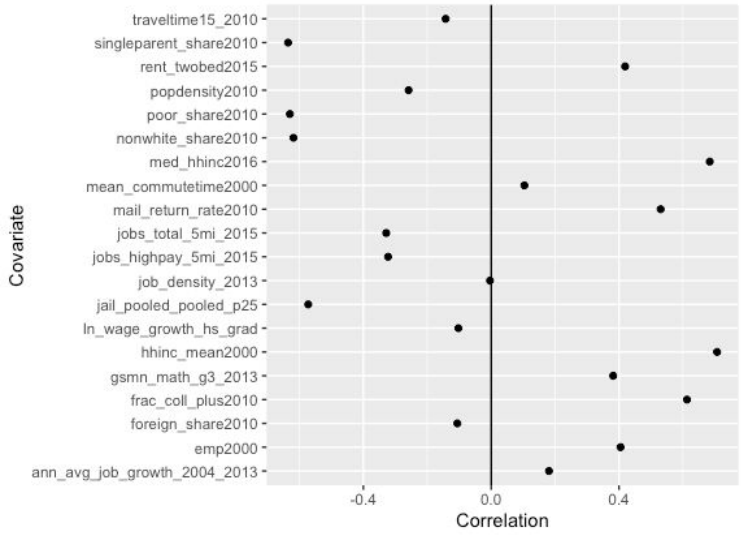


Figure 6: Correlation Coefficients between Upward Mobility and Other Variables
(see Appendix at the end for a detailed description each factor)



Analyzing the big data from the Opportunity Atlas helps prove my hypothesis by providing further evidence to suggest that race plays a huge factor in determining upward mobility levels. Apparent from Table 1 and from Figures 3, 4, and 5, the average upward mobility (average child's income for parents at the 25th percentile) of Blacks is significantly lower than that of Whites around the Nashville region. A correlational analysis between upward mobility and other racial factors such as "Share of people who are not white in 2010" supports this hypothesis as well (Figure 6). The magnitude of the correlation coefficient between the average upward mobility and the racial composition across different census tracts in the Nashville commuting zone is 0.618685770, comparatively higher than correlation coefficients between average upward mobility and other covariates. A correlation coefficient between two variables with a higher magnitude means that the two variables are relatively more correlated to each other than two arbitrarily chosen variables are. Therefore, we can conclude that a neighborhood's racial composition is likely to predict its level of upward mobility.

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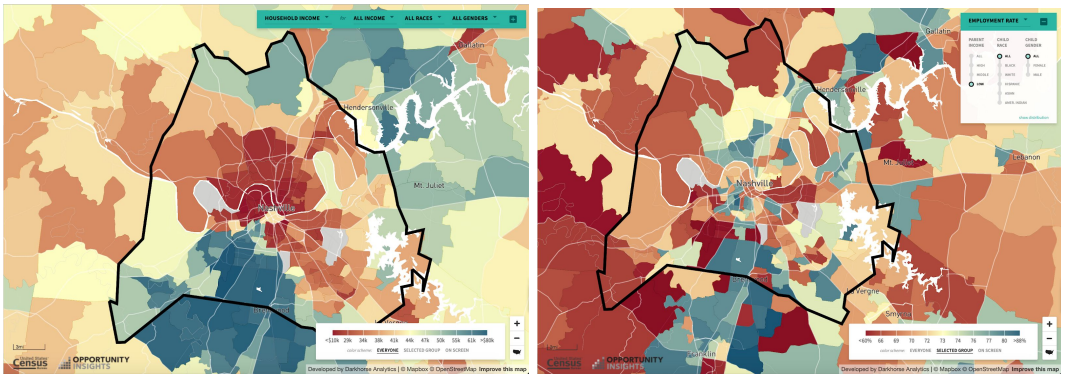


Figure 7: Average Upward Mobility for all races in Davidson County
Figure 8: Employment Rates across different census tracts in Davidson County

One major factor that has led to Nashville's rapid growth is the increase in the quality and quantity of jobs around Nashville. An increase in a neighborhood's job growth usually translates to an increase in average wages. When parents have higher wages, they can usually afford better educational and social opportunities for their kids. Comparing across specific census tracts between Figures 7 and 8, Nashville's employment rate is generally correlative with its level of upward mobility. From this observation, I hypothesize that the rapid growth in the number of jobs and the employment rate in certain tracts around Nashville have contributed to an increase in upward mobility in those areas.

Figure 9: Scatter Plot of Upward Mobility and Employment Rate in Davidson County
Figure 10: Scatter Plot of Upward Mobility and the Number of High Paying Jobs in Davidson
Figure 11: Scatter Plot of Upward Mobility and the Average Annual Job Growth in Davidson

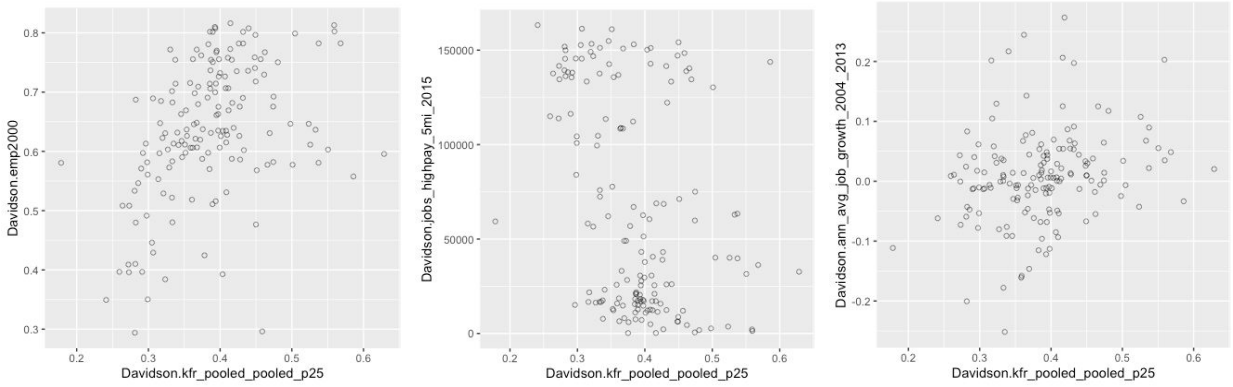
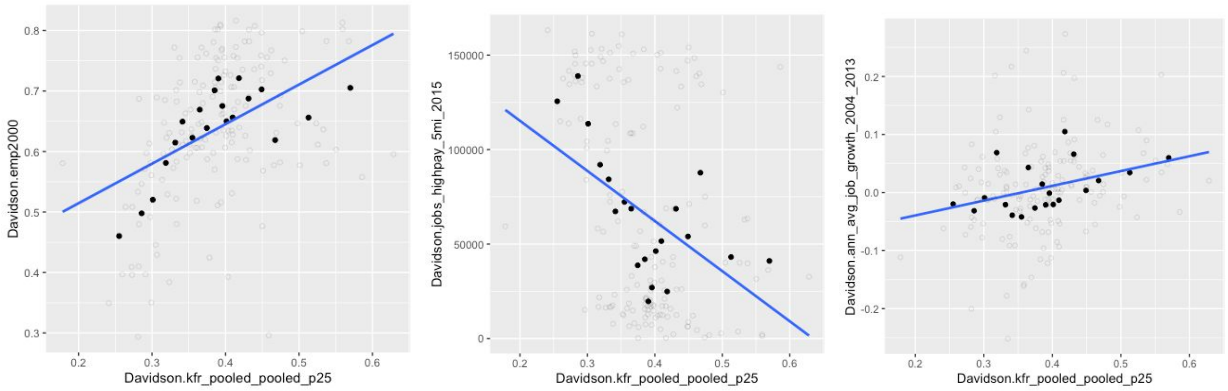


Figure 12: Binscatter Plot of Upward Mobility and Employment Rate in Davidson County
Figure 13: Binscatter Plot of Upward Mobility and the Number of High Paying Jobs in Davidson
Figure 14: Binscatter Plot of Upward Mobility and the Average Annual Job Growth in Davidson



Despite the seemingly direct effect that job growth could have on generational upward mobility levels, analysis of data from the Opportunity Atlas shows that there is a low correlative effect between upward mobility and several factors related to job growth. This disproof is evident in the scatter and binscatter plots (Figures 9-14) of average upward mobility plotted against three different variables relating to job growth, emp2000 (Employment Rate in 2000), jobs_highpay_5mi_2015, Number of High-Paying (>USD 40,000 annually) jobs within 5 miles in 2015, and ann_avg_job_growth_2004_2013 (Average Annual Job Growth Rate 2004-2013). Visually and empirically, these nonlinear plots show the relatively low correlation between average upward mobility and job growth. Further correlational analysis from Figure 6 also disproves this hypothesis. The magnitudes of the correlation coefficients between average upward mobility and the Number of Primary Jobs within 5 miles in 2015, the Number of High-Paying (>USD 40,000 annually) jobs within 5 miles in 2015, the Job Density (in square miles) in 2013, the Employment Rate in 2000, and the Average Annual Job Growth Rate 2004-2013 are 0.328439026, 0.322688567, 0.003794438, 0.404831358, and 0.180938477

respectively. These correlation coefficients are relatively low (compared to that of racial composition), proving that a region's job growth is not very indicative of its average upward mobility levels.

Other geographic and social factors may provide valuable insights into which neighborhoods provide children the best opportunities of upward mobility. From Figure 6, the correlation coefficients between upward mobility and the Average School District Level Standardized Test Scores in 3rd grade in 2013 and the Fraction of Residents with a College Degree or More in 2010 are 0.381638302 and 0.612759638, respectively. Looking at these correlation coefficients between upward mobility and factors related to education, we can conclude that levels of education play an important role in determining upward mobility. Comparing upward mobility and incarceration rates around Nashville (correlation coefficient = -0.572583124), we can conclude that incarceration rates also play an important role in determining upward mobility. But unlike other booming urban cities, several of Nashville's geographical features such as commuting time and population density are not indicative factors of upward mobility in Nashville (correlation coefficients between upward mobility and these factors are: "Average Commute Time of Working Adults in 2000" = 0.104027711, "Share of Working Adults with Commute Time of 15 minutes or less in 2010" = -0.142488121, "Population Density (per square mile) in 2010" = -0.258390638).

Due to the unreliable circumstances that may arise in collecting massive amounts of data, there are several limitations to this Opportunity Atlas data that could potentially make this

investigation inconclusive. First, some regions were lacking sufficient data about certain subgroups due to the small number of participants that fell under certain subgroups. For example, less than 5% of the Nashville area is Asian and Hispanic, so it is difficult to collect sufficient data to conclude what factors would affect upward mobility for Asians and Hispanics. Second, this investigation relied on correlational analysis, not causal analysis, to determine what factors are good indicators of upward mobility levels. Correlational analysis can help me reach conclusions about which factors are related to increasing upward mobility but it does not fully explain how or why this effect is correlated, whereas causal analysis identifies which factors are responsible for levels of upward mobility. Therefore, causal analysis can help pinpoint which policies would be most effective in directly increasing upward mobility in different neighborhoods. Another limitation of the Opportunity Atlas data is that it is relatively outdated. For example, most of Nashville's job growth has arisen in the past five years, whereas the data regarding Nashville's job growth in the Opportunity Atlas was collected over ten years ago. Therefore, the conclusion that Nashville's current job growth has a low correlative effect on its present average upward mobility may or may not be valid given this limitation in the data from the Opportunity Atlas.

In conclusion, Nashville has many diverse characteristics that continue to shape its present and future economy. Despite its recent surge in job growth, Nashville's income equality still suffers as a result of its long history of racial segregation. Because of the enduring socioeconomic impacts that racial injustice causes, Nashville has many challenges to face in implementing policies that are most effective in boosting levels of upward mobility. While job

growth rates and racial differences seem to define a neighborhood's upward mobility potential most directly, a thorough analysis of census data from the Opportunity Atlas demonstrates which of these core factors are actually correlated to varying upward mobility levels across different neighborhoods. In calculating the correlation coefficients between the average upward mobility and many other factors, it is evident that the racial differences account for the largest disparities in upward mobility levels across different neighborhoods in Nashville. Considering what factors actually affect upward mobility the most, Nashville should pursue socioeconomic policies that improve these specific factors in order to maximize levels of upward mobility and reduce poverty in underprivileged neighborhoods. Policies that target these specific problems would potentially help Nashville alleviate income inequality across the entire region.

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Appendix: Correlation Coefficients between Upward Mobility and Other Variables

Variable Name	Description	Correlation Coefficient
hhinc_mean2000	Mean Household Income 2000	0.706848409
mean_commutetime2000	Average Commute Time of Working Adults in 2000	0.104027711
frac_coll_plus2010	Fraction of Residents with a College Degree or More in 2010	0.612759638
foreign_share2010	Share of Population Born Outside the U.S.	-0.105947637
med_hhinc2016	Median Household Income in 2016	0.683976315
popdensity2010	Population Density (per square mile) in 2010	-0.258390638
poor_share2010	Poverty Rate 2010	-0.629945307
gsmn_math_g3_2013	Average School District Level Standardized Test Scores in 3rd grade in 2013	0.381638302
rent_twobed2015	Average Rent for Two-Bedroom Apartment in 2015	0.419076414
singleparent_share2010	Share of Single-Headed Households with Children 2010	-0.635625553
traveltime15_2010	Share of Working Adults with Commute Time of 15 minutes or less in 2010	-0.142488121
emp2000	Employment Rate 2000	0.404831358
mail_return_rate2010	Census Form Rate Return Rate 2010	0.530371851
ln_wage_growth_hs_grad	Log wage growth for HS Grad., 2005-2014	-0.102590153
jobs_total_5mi_2015	Number of Primary Jobs within 5	-0.328439026

	miles in 2015	
jobs_highpay_5mi_2015	Number of High-Paying (>USD 40,000 annually) jobs within 5 miles in 2015	-0.322688567
nonwhite_share2010	Share of People who are not white 2010	-0.618685770
ann_avg_job_growth_2004_2013	Average Annual Job Growth Rate 2004-2013	0.180938477
job_density_2013	Job Density (in square miles) in 2013	-0.003794438
jail_pooled_pooled_p25	Fraction incarcerated on April 1st, 2010	-0.572583124
kfr_pooled_pooled_p25	Mean percentile rank in the national distribution of household income in 2014-2015	