Gentrification and Economically Disadvantaged Students: An Examination of High School Test Scores in Seattle, Washington

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Abstract

Motivated by a changing economic landscape in Seattle, Washington, we examine associations between gentrification and high school standardized test scores there. Leveraging American Community Survey Data (ACS) from the US census from 2010 – 2019, we adapt a metric from the urban studies literature and implement it in order to assess over 130 census tracts. Further, we quantify the number of highschool aged children determined to be in gentrified tracts and aggregate the counts into the 10 Seattle public high school attendance zones. We find 14 gentrified tracts that are contained in eight of the ten attendance zones. We observed decreases in test scores over our study period, with the largest decreases occurring for economically disadvantaged students. We did not find an association between the test score changes and gentrification, leaving open the cause of the decrease for economically disadvantaged students an open question.

Introduction

The revolutionary educational reformer Horace Mann, known as the “father of American education”, famously stated that “Education, then, beyond all other divides of human origin, is a great equalizer of conditions of men—the balance wheel of the social machinery” (Growe 2003). Equal access to quality public education is not only a moral and social necessity, but an economic one as well. As class strata widen, and income inequality continues to be entrenched in American cities, the quality of public education suffers, contributing to a cycle of educational-economic immobility (Hochschild 2003). Seattle is a clear example of this phenomenon, as the city is coping with the modern dynamics of gentrification.

Gentrification is characterized by college-educated households moving into historically disinvested, low-income neighborhoods (Harding 2000). At the macro level, gentrification negatively impacts existing, typically low-income, residents by altering the

social ecology of their neighborhoods (Diem et al. 2019). These impacts include reductions in neighborhood satisfaction, disruption of support systems, racial resentment, and displacement of existing residents (Bolt and van Kempen 2013). Naturally, the effects of this disruption of the fabric of a neighborhood community extends to school districts, and the local students (Pearman 2019). As affluent, often white, families come to urban public school districts, there are several adverse implications for the low-income student population (Billingham 2019).

As part of our research, we seek to quantify the effects that gentrification has on the academic outcomes of low-income high school students in the Seattle public school system. Although a proudly progressive city, Seattle has a long history of gentrification (Harding 2000). Between 1960 and 1990, there was an influx of middle and upper income families that displaced low-income residents across the city. At the same time, Seattle enacted urban redevelopment policies that served public and private interests and exacerbated existing segregation in the city (Harding 2000). In the 2000s, an aggressive state-wide growth management plan combined with the technology sector boom further polarized the upper and lower classes, which worsened cross-neighborhood income inequality (Judge 2007).

For background, Seattle is home to 106 public schools that educate over 50,000 students (SPS 2021). The city is divided into school attendance areas, or districts, in which students K-12 are assigned based on home address (Seattle GeoData 2023). The majority of students follow a "track", moving from their local elementary school, to local middle school, up to high school. Thus, unmitigated income inequality across neighborhoods is mirrored in the school district demographics, meaning that public school districts are divided along poverty lines (Freidus 2020; Hagins 2022). In 1989, Seattle rolled out a controlled school choice policy, which introduced cross-district bussing, in an attempt to address school segregation. Although the legality of bussing in the city faced controversy, culminating in a landmark Supreme Court case in 2009, school choice—the choice to attend a public school out of a student's residential district—is still the hallmark of Seattle public school organization (Thro and Russo 2009). Although city officials see school choice as an equalizer, research has shown that this is often not the case (Posey-Maddox, Kimelberg, and Cucchiara 2014). Students that engage in school choice are more likely to be gentrifying middle-class students opting out of their local underserved public school, instead of low-income students attending a better-served public school in a wealthier district (Diem et al. 2019). One reason for this is the barrier of mobility: low-income families have lower rates of car ownership, making attending school in another district more difficult (Howland 2000).

The root of school choice policy aside, the academic achievement of students that are forced out of their local school suffers, especially when the displacement occurs at an early age (Ingersoll, Scamman, and Eckerling 1989). Displacement can happen for several

reasons, but rising housing prices as a result of gentrification is the most pertinent. As unaffordable rents force low-income families out of their neighborhoods in pursuit of more affordable housing, students move into unfamiliar schools or school districts (Ingersoll, Scamman, and Eckerling 1989). Increased tax dollar funding can come to public schools as white-middle class families move into urban areas. However, low-income and minority students still disproportionately lack access to quality public or charter schools as financial policy reform is aimed at pleasing incoming gentrifiers (Wilson 2015). This means that district leaders pivot school resources to incentivize middle- to high-income families to enroll in local public schools. District management claims that bringing new wealth into school districts in this way is beneficial, but research tells a different story – minority and low income students are often kept from the benefits of this new wealth influx (Diem et al. 2019; Bolt and van Kempen 2013; Reardon 2016). This is in part because the methods used to boost school resources, such as fundraising, event planning, and marketing, may worsen race and class tensions among parents and marginalize low-income parents (Posey-Maddox, Kimelberg, and Cucchiara 2014). These contentious decision-making processes can exclude the interests of low-income families, which can have sinister implications for those students.

For example, class interests can impact schools through an increase of in-school police presence. Gentrifiers tend to favor more police in schools, which is a practice that is well-documented to be traumatic for low-income children - specifically those who are Black and Latinx, which adversely affects school performance (Beck 2020). Gentrification can also shift institutional composition in school districts through the teaching and administrative body. Having authority figures in schools that are representative of the neighborhood demographic and culture has been shown to be beneficial for the academic outcomes of students (Nyland 2023). Yet gentrification pushes out teachers and administrators that make low-income and minority students feel seen and represented (Cole 1986). Not only does this have adverse effects on those students at the micro-level, but could also influence education financial policy. There is causal evidence that shows that greater minority representation on school boards translates into greater investment in minority students (Fischer 2020). We include this in our research as recent literature has failed to investigate whether gentrification-induced changes have shifted school board representation and, consequently, financial policy.

Methods

We obtained data from the American Community Survey (Bureau 2022), Seattle Public Schools (SPS 2021), and US Department of Education (Department of Education

2023). Data from the 5-year ACS census on median household income forms the basis of our gentrification definition.

Certain basic measures such as house prices, housing supply, and median income are frequently used as inputs to gentrification metrics. Under our specification, gentrification is not possible in all areas. An urban area is considered “disinvested” if the median income of its population and housing prices in the area at the beginning of the research period are 40th percentile or lower. Further, a disinvested neighborhood is considered gentrified if it has witnessed an increase of investment and an inflow of affluent gentry by the end of the research period. To operationalize these guidelines, we modeled out criteria of gentrification benchmarks used by Pearman and Freeman in highly cited papers on the topic of urban gentrification (Pearman and Swain 2017; Freeman 2005). Additionally, using census tracts provides a small enough unit with enough data to give a standard unit of area to apply the disinvestment and gentrification criteria. The criteria for a disinvested urban tract are:

1. The tract's median household income was in the bottom 40th percentile of the city's median income at the start of the study period.
2. The tract’s average single-family home sale price was in the bottom 40th percentile of the city’s average single-family home sale price at the start of the study period.

If a tract falls under these two criteria, then it can be considered gentrified if it:

1. The increase of tract’s of college educated residents was in the top third of all tracts in the city at the end of the study period.
2. The tract's inflation adjusted average single-family home sale price increased by the end of the study period.

A tract that meets both disinvestment criteria and both gentrification criteria is considered gentrified. We use the gentrification classification for tracts to determine the number of high-schoolers who are in a gentrified tract in each Seattle school attendance area.

Data Acquisition

The American Community Survey (ACS) publishes data yearly and every 5 years. Drawing from this dataset, we used the following census variables:

- B19013 - Median Household Income In The Past 12 Months
- B07009_004E, B07009_005E, B07009_006E - Geographical Mobility in the Past Year by Educational Attainment For Current Residence in the United States
- B14001_007E - School Enrollment By Level Of School For The High School Population 3 Years And Over

- B25077_001E - Median Value (Dollars)

Our outcome variable of interest is standardized test scores from Washington State Assessments in Mathematics (Department of Education 2023). While similar State Assessments are also conducted for Reading / Language Arts, prior research has shown that Mathematics assessments tend to be more objective. These data are published by the US Department of Education for 12 Seattle public schools on a yearly basis. The variables we use are the number of students that completed the assessment and were assigned a proficiency level (NUM_VALID) and the percentage of students that scored at or above proficient (PCT_PROF) for both the entire student population and economically disadvantaged students at the school.

Data Manipulation

The first goal we tackled was figuring out how to aggregate the data for the gentrification metrics. For median household income, median value of owner occupied housing units, and increase of residents with a college education or higher, we added them to a dataframe with tracts as the rows. The tracts we used were the subset of tracts that fall within the Seattle Public School District.

For the ACS data that measured the increase of residents with college education or higher, the increase in residents in this category was broken down into three levels: Some college or associate degree, Bachelor's degree, and Graduate or professional degree. We took the sum of these residents per tract as the data for this metric.

We used this data to determine whether a tract had an median home value and median household income in the bottom 40th percentile for the first five year block of our study period, 2010–2014. We also evaluated whether each tract had an increase in median home value from the first to second half of our study period, and whether the increase in college educated or higher level residents was in the top third of the city. Each of these four criteria were assigned binary values. These values were multiplied to determine whether a tract was gentrified or not.

Using the determination of whether a tract was gentrified or not, we used the ACS data to determine the number of high school students gentrified per tract. To determine the number of students gentrified by school attendance zone, we added the weighted amount of high school students in gentrified tracts together, which were weighted by the percent of the tract which fell within the school zone. This allowed us to determine what percentage

of the high school students in a school area were impacted by gentrification within our study period.

To determine student population per school we needed to overlay census released tracts with the published school zones. We were able to accomplish this by making two distinct shape maps: one of all 131 tracts and another of the 10 school boundaries. From there, we used intersecting methods to combine the two. Since some tracts were spilling into other school zones, we determined the percentage within each respective zone to use in our final calculations. Using these percentages and the tract population as a whole, we were able to easily calculate the number of students per tract in a given school area.

Our data for our dependent variable (high school test scores on the standard math assessment) were drawn from Department of Education data published for schools across the country on a school-by-year basis. This means that we had to make five year estimates for the percent of students proficient on the exam, which we did by taking the average of 2009–2014 and 2015–2019 to calculate our start and end periods for our study respectively. We filtered each file from 2009 to 2019 by location (Seattle) and found that data was available for 9 public schools in Seattle. We then selected our variables of interest - the percentage of students that scored proficient or higher for all students and economically disadvantaged students at each school (e.g ECD_PCTPROF_1011, ALL_PCTPROF_1516, etc.). In this time frame, the 2012-13 test score data was missing, so we were unable to use this data.

Since we have been working with 5-year ACS data from 2009–2014 and 2015–2019 as our start and end blocks of time to determine gentrification, we had to take the averages of the percent proficient for all and ECD students for each of these two time frames. The data per year per school for either all students or ECD students were given in three forms. First, the data was given as a percentage range of less than ten percent, which we just took the midpoint of to determine a single year's proficiency. Second, some data was given as a very large range. For example, LT50 means less than 50 percent, GT50 means greater than 50 percent and so on. FInallily, some of the data was given as PS, which is protected student, and scores were not given as they would violate student privacy. To condense our data into 5-year blocks, we took the averages of the midpoint data inside of each time frame for all students and ECD students separately. It was faster to do these averages by hand because of the large range and PS data. We then subtracted the second block from the first block to get the change in percent proficient from the start to the end of the study. This is our outcome variables which we named ECD_PCTPROF_1520-0914 and ALL_PCTPROF_1520-0914, which were the change in percent proficient for economically disadvantaged students from 2009–2014 to

2015–2019 and the change in percent proficient for all students from 2009–2014 to 2015–2019 respectively. Finally, all of this data was merged into a single dataframe.

Using this final aggregation of data, we plotted the change in test scores for ECD students and all students for each high school over the percent of students gentrified in the corresponding high school attendance area. We also plotted the difference in the test score changes between all students and ECD students over the 10 year study period with the same explanatory variable.

Analysis of Results

After creating our master data frame, we plotted the change in percent of high school students scoring proficient on the from the start to the end of the study period against the percent of the high schoolers in the given district that were affected by gentrification. We made three different versions of this plot. For all three, the x-axis of our plot was the percentage of students who were affected by gentrification in a given school zone. The y-axes all pertain to the percent of students scoring proficient scores on the Washington State Assessments in Mathematics. One of the y-axis is the change in percent of ECD students scoring proficient, the next is the change in percent of all students scoring proficient, and finally we plotted the difference between all and ECD for the change in the percentage of proficient scores against the percentage of students residing in a gentrified census tract. We did not run any statistical analysis on these plots as there was no apparent pattern.

Additionally, we created maps of Seattle, Washington that show the median household incomes at the start of the study period, the median home value of owner-occupied units at the start and end of the study period, and the inflow of college educated residents by tract at the end of the study period. The data were used to create maps depicting the gentrified tracts in seattle, the number of students residing in each gentrified tract, and the percentage of students per school zone who resided in a gentrified tract.

Results

Through our analysis of Census Bureaus' American Community Survey (ACS) data in conjunction with the gentrification metric modeled off of Pearman and Freeman, we determined that 14 of Seattle, Washington's 131 census tracts are considered gentrified from 2010-2019 - accounting for 10.6% of the tracts within the city. To determine if a tract

was gentrified, we first had to determine if a tract was disinvested in the 2010-2014 time period - meaning it must have a sufficiently low median household income and home value. We found that 39 census tracts were disinvested at the start of our study period. Therefore, 35.9% of disinvested tracts were later gentrified - which means they must have had a relatively high inflow of college residents and an increase in median home value.

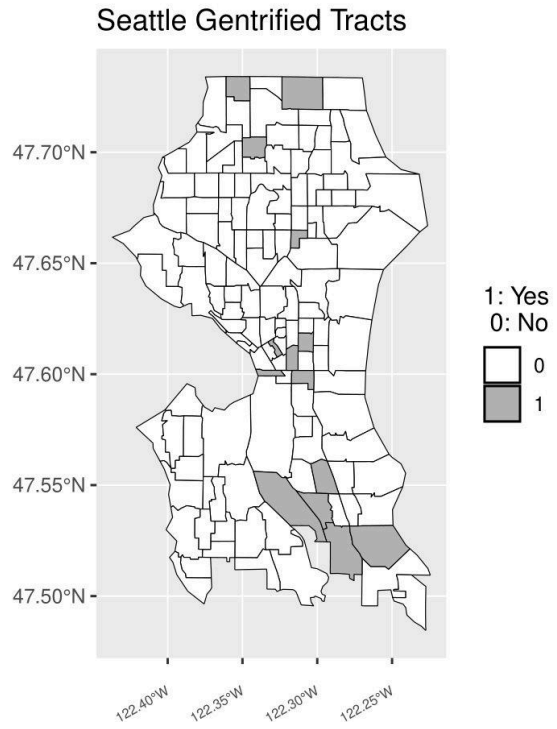

Figure 1. *This geographical map of Seattle Washington shows the tracts within city bounds that are considered gentrified during the study period 2010–2019. The 14 census tracts considered gentrified (gray shading) sit in three rough clusters, the center north, the western middle, and the Southeastern portions of the city, with one more census tract sitting in the middle of the northern half of Seattle. Determination of gentrification is based on the metric developed by Pearman and Freeman (Pearman 2019; Freeman 2005). This determination is made over a 10 year period. For a tract to be considered gentrified, it must have sufficiently low median household income and home value at the start of the study period, and an increased home value and an inflow of college educated residents by the end of the study period. We obtain data for these quantities from the US Census Bureaus' American Community Survey (ACS) 5-Year estimates for 2010–2014 and 2015–2019. See Methods Section for details*

As seen in the figures below, the highest median household incomes of Seattle tracts based on the 2020–2014 ACS sit on the middle Eastern border of the map and the western edge of the 46.75º N latitude line. The tracts with the lowest median household incomes are most densely in the far north and south of the map, but the lowest income tract is in the center of the map along the 47.65º N latitude line. The location of tracts where median value of owner-occupied households was relatively high and low was similar to that of the median household income map's results. The main difference is that the tracts with the highest median household incomes are comparatively higher on the East side of the map along the 47.65º N latitude line than the East side on the same latitude, when in the 2010-2014 ACS they were relatively similar. More generally, the census tracts with the highest median home value (dark colors) are on the East side of the county along the 46.65º N latitude, with the census tracts with the lowest median home values (light

colors) sitting in the southern half and northern quarter of the county. It was the metrics from these two maps that determined if a tract was disinvested from 2010-2014.

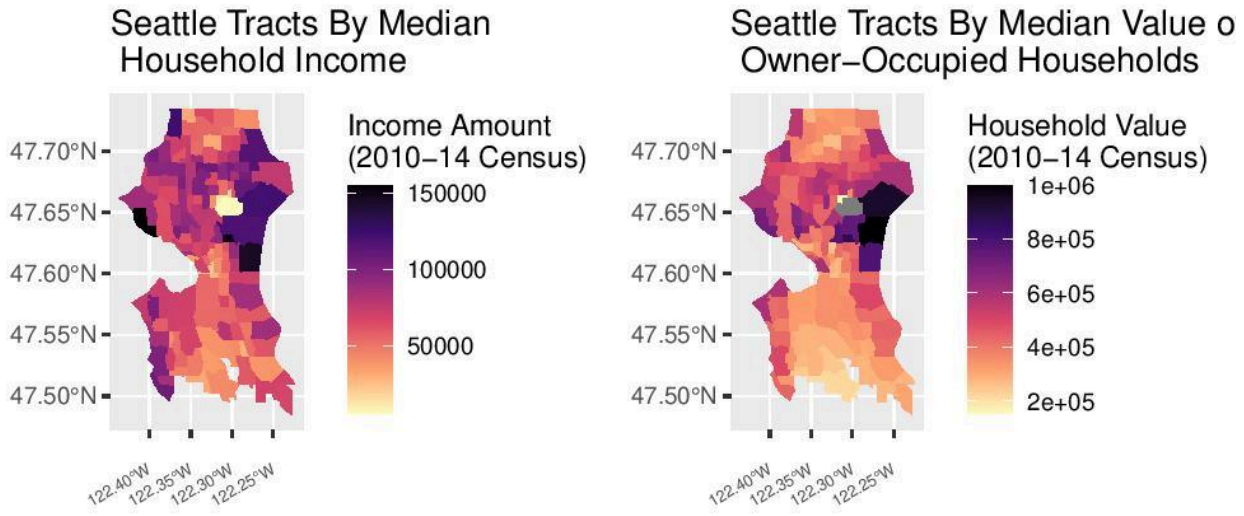

Figure 2. (Left) *This geographical map of Seattle, Washington shows the median household income of census tracts. The tracts with the highest median household incomes (dark colors) sit on the middle Eastern border of the map and the western edge of the 46.75º N latitude line. The tracts with the lowest median household incomes are most densely in the far north and south of the map, but the lowest income tract is in the center of the map along the 47.65º N latitude line. The determination of median household income was based on the Census Bureaus' American Community Survey (ACS) 5-Year estimates for the median household income on the census tract level from 2010-2014.* ***(Right)*** *This geographical map of Seattle, Washington shows the median value of owner-occupied households in census tracts during the five year period 2010-2014. The census tracts with the highest median home value (dark colors) are on the West side of the county along the 46.5º N latitude, with the census tracts with the lowest median home values (light colors) sitting in the southern half and northern quarter of the county. The determination of median household income was based on the Census Bureaus' American Community Survey (ACS) 5-Year estimates for the median value for owner occupied households on the census tract level from 2010-2014.*

For analysis of the second part of the gentrification metric, we can study the maps of Median household value and Influx of College educated residents. The household value map for the 2015-2019 ACS survey looks very similar to the 2010-2014 one. Generally, the North remained having higher values, with the highest continuing to be on the East side of the map along the 47.65º N latitude line. It is worth noting that the scale of the home value changed between the two ACS periods. In the 2010-2014 survey, the top of the scale was $1,000,000+ while in the 2015-2019 survey the top of the scale was $2,000,000+. While this doesn't change the makeup of values on the map, it does affect

the coloring a bit. The map detailing the inflow of college aged residents is interesting. There appears to be little to no pattern to explain, geographically, the tracts that experience higher inflow.

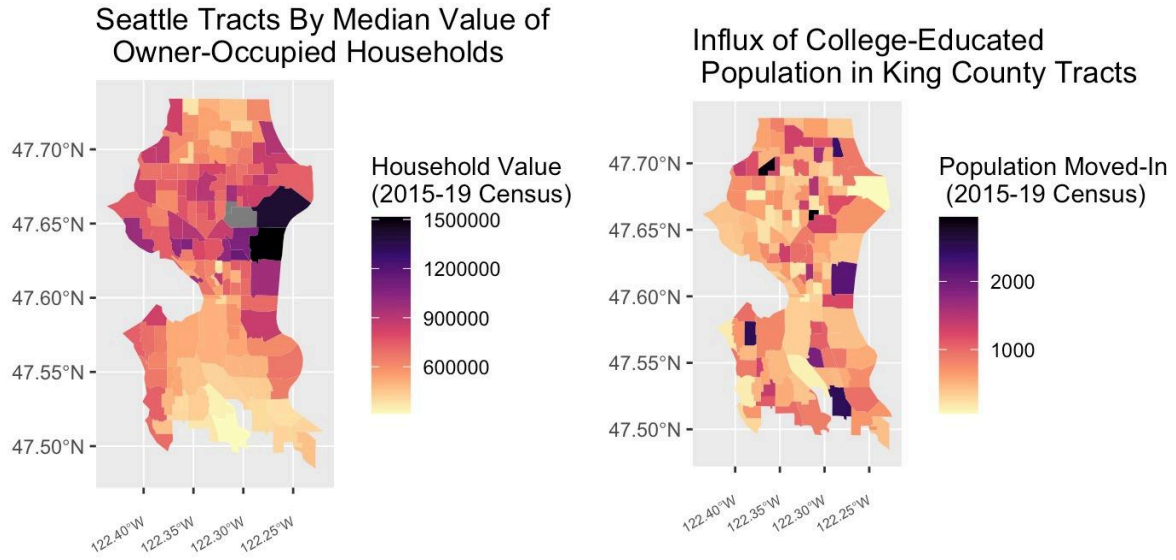

Figure 3. (Left) *This geographical map of Seattle, Washington shows the median value of owner-occupied households in census tracts during the five year period 2015-2019. The census tracts with the highest median home value (dark colors) are on the West side of the county along the 46.5° N latitude, with the census tracts with the lowest median home values (light colors) sitting in the southern half and northern quarter of the county. The determination of median household income was based on the Census Bureaus' American Community Survey (ACS) 5-Year estimates for the median value for owner occupied households on the census tract level from 2015-2019.* ***(Right)*** *This geographical map of Seattle, Washington shows the number of college educated residents that moved into given census tracts during the five year period 2015-2019. The census tracts with the highest number of college-educated residents moving in (dark colors) are scattered separately throughout the city boundaries with the census with the census tracts with lower numbers college-educated residentents moving-in (light colors) also relatively uniformly spread throughout the city. The determination of number of college-educated residents moving-into a given census tract was based on the Census Bureaus' American Community Survey (ACS) 5-Year estimates for Geographical Mobility in the Past Year by Educational Attainment For Current Residence in the United States on the census tract level from 2015-2019. This statistic contains multiple levels of education by geographic mobility, so for our statistic we took the sum of the Some college or associate degree, Bachelor's degree, and Graduate or professional degree as the number of people who were college educated. See Methods section for details.*

As seen in the figure below, the highest population of students living in a gentrified tract was along the northern border of Seattle. There were also a series of gentrified tracts in the southeast that each contained moderate amounts of student populations. Since these tracts all landed within the same attendance zone, that high school had the largest

population of gentrified students that fed into it. For context, the census tracts do not map exactly into attendance areas as shown in figure 4. There are 10 Seattle Public School Attendance Zones and 131 overlapping census tracts. Each attendance zone is relatively comparable in size, and each contains multiple census tracts, but the attendance zones do not necessarily share borders with the census tracts. In particular, on the inland Eastern side of the map, the census tracts tend to overlap only on their western portions. The rest of the census tracts are generally contained within the area defined by Attendance zones, just without the same borders. This means that the percent of a census tract in an attendance zone was used as a weight to determine how many students in that zone should be assigned to a specific attendance area. This resulted in figure 4 where the school zones in the Northwest, center, and Southeast have the highest percentage of students living in areas affected by gentrification - with between 9-12% affected. The two easternmost attendance zones had the lowest proportion of students living in census tracts affected by gentrification - accounting for between 0-3% of their high school student population.

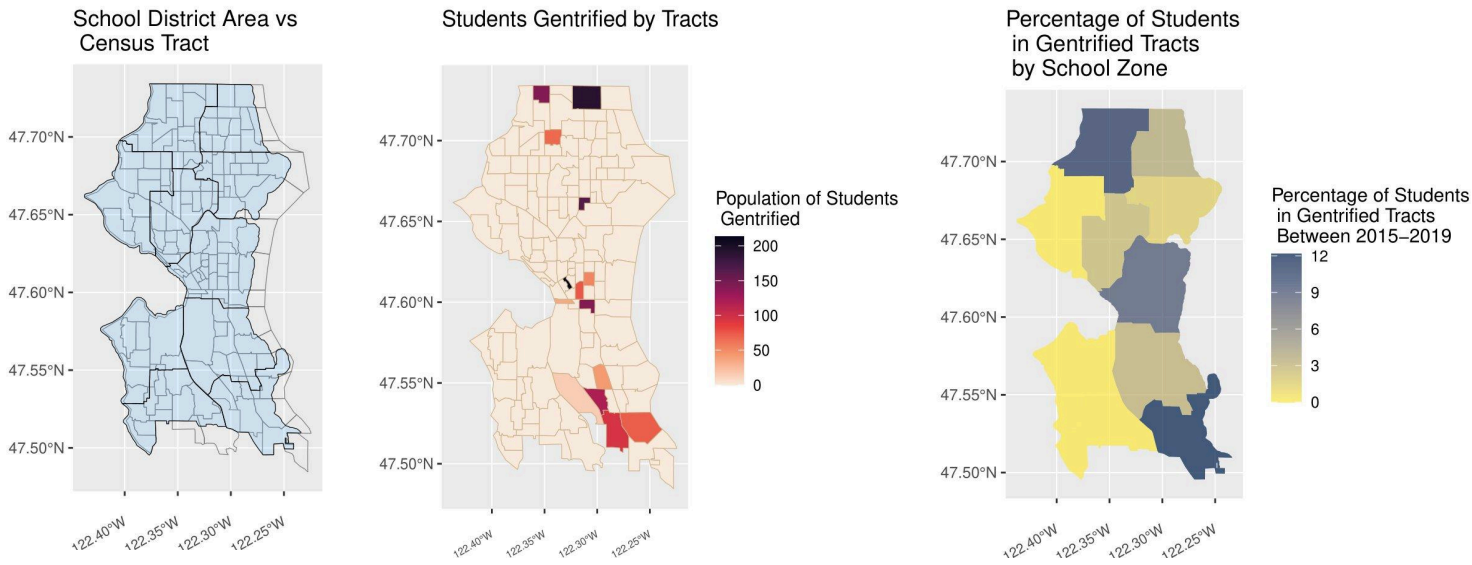

Figure 4. (Left) *This geographical map of Seattle, Washington shows the overlay of Seattle Public School Attendance Zones (dark lines and light blue fill) over census tracts (light gray lines) that overlap with or are contained within the Attendance Zones. There are 10 Seattle Public School Attendance Zones and 131 overlapping census tracts. Each Attendance zone is relatively comparable in size, and each contains a number of tracts, but the Attendance Zones do not necessarily share borders with the census tracts. In particular, on the inland Eastern side of the map, the census tracts tend to overlap only on their western portions. The rest of the census tracts are generally contained within the area defined by Attendance zones, just without the same borders. We obtained our data from Seattle GeoData and Census Bureaus' American Community Survey (ACS). See Methods Section for details.* ***(Middle)*** *This geographical map of Seattle,*

Washington shows the number of students residing in census tracts that are considered gentrified from 2010-2019. The gentrified census tracts with the highest number of students residing in them (dark colors) are in the northern part of the map. The gentrified census tracts with lower numbers of students residing in them (lighter colors) are in both the central and southern portions of the map. The census tracts that are not considered gentrified during our study period are cream colored. Determination of gentrification is based on the metric developed by Pearman and Freeman (Pearman 2019; Freeman 2005). This determination is made over a 10 year period. For a tract to be considered gentrified, it must have sufficiently low median household income and home value at the start of the study period, and an increased home value and an inflow of college educated residents by the end of the study period. We obtained our data from the American Community Survey (ACS). See Methods Section for details. ***(Right)*** *This geographical map of Seattle, Washington shows the percentage of students live in a census tract considered gentrified from 2010-2019 for a given Seattle Public School Attendance Area. The attendance areas with the highest proportion (dark blue) of students affected by gentrification are in the Northwest, center, and Southwest. The attendance zones with the lowest percentages of students residing in areas considered gentrified are on the western border of the map. Determination of gentrification is based on the metric developed by Pearman and Freeman - the same metric used in the middle map and the map in figure 1 (Pearman 2019; Freeman 2005). We obtained our data from Seattle GeoData and Census Bureaus' American Community Survey (ACS). See Methods Section for details.*

Our final analytical component was to compare our gentrification data with standardized test scores at these high schools. We compiled this into three separate graphs: One showing the change in test scores for economically disadvantaged (ECD) students over a 10 year period, one showing the change in test scores for all students over a 10 year period, and one showing the difference in test score changes between economically disadvantaged and total student body. We found no direct correlation between the percent of students affected by gentrification and changes in test scores. However, interestingly, for ECD students, every school's proficiency dropped between 5 and 35 percent from the 2010–2014 average to the 2015–2019 average. Furthermore, for all students, every school's proficiency dropped between 5 and 25 percent from the 2010–2014 average to the 2015–2019 average. In terms of the difference in scores, there is no clear correlation between the percent of students affected by gentrification and the difference between ECD and all student's change in percent of students attaining proficient scores. All but one school, Chief Sealth International High School, had a larger decrease in percent of ECD scoring proficient scores than all students scoring proficient scores.

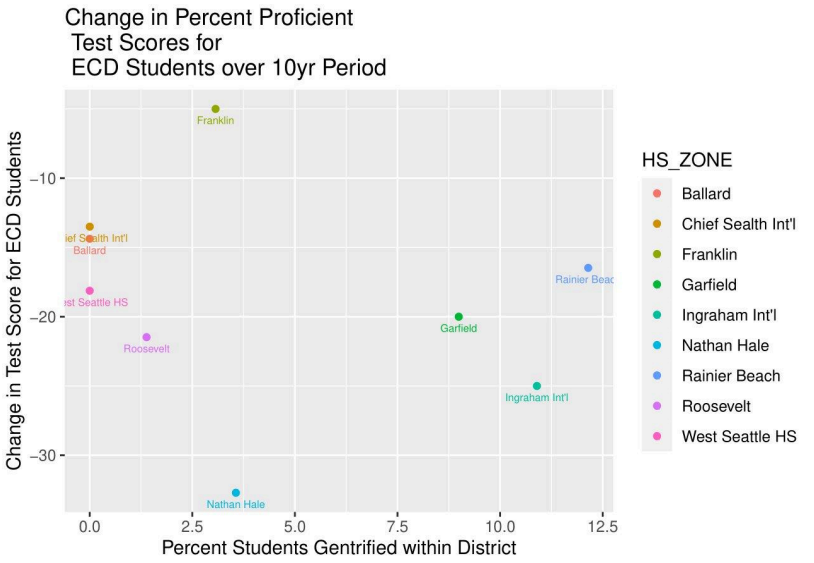

Figure 5. (Right) This is a scatter plot of the percent of economically disadvantaged students (ECD) in a seattle public school attendance zone who live in a gentrified census tract by the percentage change in percent proficient on the Washtington test. The change is the difference in scores between the average percent of ECD students scoring proficient from 2010–2014 to the average percent of ECD students scoring proficient from 2015–2019. The metrics for ECD and a score considered proficient are determined by the Department of Education. There is no apparent correlation between the percent of students affected by gentrification and the change in proficient scores for ECD students, although every school's proficiency dropped between 5 and 35 percent from the 2010–2014 average to the 2015–2019 average. The percentage of students who were affected by gentrification by school attendance zone was determined by taking the sum of the students residing in gentrified tracts that were within a given school zone, divided by the total students in an attendance zone. Tracts were considered gentrified if they met the criteria specified in the methods section that is modeled off the metric defined by Pearman and Freeman. We obtained our data from the Census Bureaus' American Community Survey (ACS) 5-year estimates, Seattle GeoData, and the Department of Education

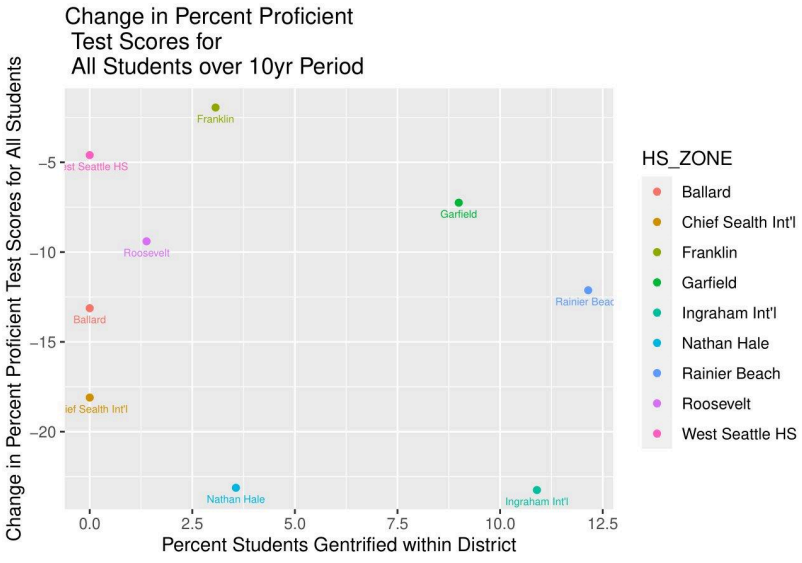

Figure 6. (Left) This is a scatter plot of the percent of all those in a Seattle public school attendance zone who live in a gentrified census tract by the percentage change in percent proficient on the Washington State Assessments in Mathematics. The change is the difference in scores between the average percent of all students scoring proficient from 2010-2014 to the average percent of all students scoring proficient from 2015-2019. The metric for a score considered proficient is determined by the Department of Education. There is no apparent correlation

between the percent of students affected by gentrification and the change in proficient scores for all students, although every school's proficiency dropped between 5 and 25 percent from the 2010–2014 average to the 2015–2019 average. The percentage of students who were affected by gentrification by school attendance zone was determined by taking the sum of the students residing in gentrified tracts that were within a given school zone, divided by the total students in an attendance zone. Tracts that were overlapping school attendance zone boundaries were accounted for by using an average weighted by percent area within the given attendance zone. Tracts were considered gentrified if they met the criteria specified in the methods section that is modeled off the metric defined by Pearman and Freeman. We obtained our data from the Census Bureaus' American Community Survey (ACS) 5-year estimates, Seattle GeoData, and the Department of Education.

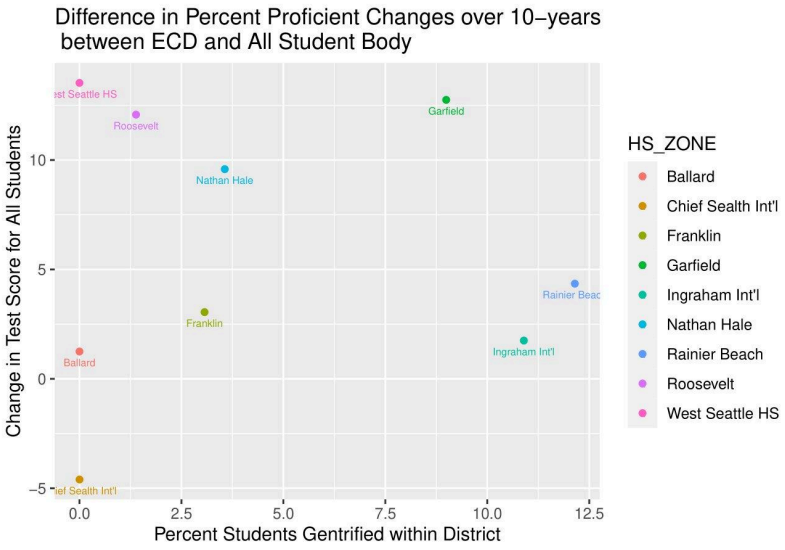

Figure 7. (Right) This is a scatter plot showing the difference in the change between the percent of ECD and all high school students scoring proficient on the Washington State Assessments in Mathematics by the percentage of students residing in a gentrified area per school attendance zone. The change for either ECD or all students is the difference in scores between the average percent of all students scoring proficient from 2010–2014 to the average percent of all students scoring proficient from 2015–2019. The difference between all students and ECD students is the ECD change minus the all change, meaning that positive numbers indicate larger drops in proficiency for ECD students. There is no clear correlation between the percent of students affected by gentrification and the difference between ECD and all student's change in percent of students attaining proficient scores. All but one school, Chief Sealth International High School, had a larger decrease in percent of ECD scoring proficient scores than all students scoring proficient scores. The percentage of students who were affected by gentrification by school attendance zone was determined by taking the sum of the students residing in gentrified tracts that were within a given school zone, divided by the total students in an attendance zone. Tracts were considered gentrified if they met the criteria specified in the methods section that is modeled off the metric defined by Pearman and Freeman. We obtained our data from the Census Bureaus' American Community Survey (ACS) 5-year estimates, Seattle GeoData, and the Department of Education

Discussion and Conclusion

Our research calculates a Seattle-specific gentrification metric at a census tract level. By applying Pearman's gentrification specification to 131 census tracts, we

determine which tracts are gentrified. This data is then aggregated to the school zone level based on the high school student population in each tract. We found that 14 census tracts accounting for 7.05% of Seattle's high school student population were gentrified, fairly similar to the national average.

Our gentrification metric was based off of a metric developed by Francis Pearman. First, we determined whether a tract was disinvested. A tract was considered to be disinvested if it a) was in the bottom 40 percentiles of the city's median income at the start of the study period and b) had an average single-family home sale price in the bottom 40 percentiles. If a tract was disinvested at the start of the study period, it was considered to be gentrified if a) the increase of college educated residents in the tract was in the top third of all tracts in the city and b) the inflation adjusted single-family home sale price increased by the end of the study period. We decided on this metric because the associated data was the most readily available for Seattle. While other metrics might have been more comprehensive, we were unable to implement these metrics due to data constraints.

Our dependent variable was data from the Washington state assessments in Mathematics. While there are extensive limitations with the use of standardized test scores, they are one of few measurable and objective means of academic assessment. While studies have shown that standardized test results can replicate existing racial and socioeconomic bias in the education system, mathematics tests have been shown to be relatively more objective that reading and language assessments. The standardized test data we found showcased the scores from 13 different schools in yearly increments. While this sounds great because we only have 10 school zones, in reality only 9 overlapped. We had test score data for Cleveland High School, Nova High School, and South Lake high school but no zone data for them. On the other side, we had zone data for Lincoln High School but no test score data. Having 9 data points in the end was probably the biggest drawback of our study. Due to the nature of the results, and the spread on the chart, the small number didn't allow us to fully understand or develop a correlation between gentrification and results.

The sporadic seeming results, in part, were due to another limitation in our test score spreadsheet. To maintain anonymity, when the number of students that took the test was below a certain threshold (the line seemed to differ from school to school and was not published), the exact percent proficient was not published. Instead they had the tags: GE50, LT50, LE20, or LE10. Here, GE stands for greater than or equal, LT is less than, LE is less than or equal to. Since we had no way to infer these values, we simply ignored them in our proficiency change over time calculations. Although only a handful of spots contained these tags, it is worth noting that some schools had semi-incomplete test data as a result.

Our findings revolving around which areas in Seattle gentrified are the most notable. During our preliminary research we could not find any data on city-wide gentrification values, so we seem to be the first to find and map it. These data points could most definitely be used for further studies. It could help influence urban planning policy as well as further research could be done on how other aspects of life change as a result of increased gentrification. In addition, our data on percent of students within each school zone gentrified could help with educational policy and more granular investigation of the specific areas within school districts that could benefit from added support and resources. Another perk of this study is that based on how we made our code, we can continuously map gentrification in future years. This could continue to be helpful as long as we remain the only ones to have put the time and effort into studying and finding results.

As we have noted repeatedly throughout this study, the lack of complete data presented major issues. The first area that future research should address are these data gaps. Additionally, researchers with access to time-series data concerning socioeconomic outcomes and changes at the tract-level could reinforce the findings of this study by implementing more comprehensive gentrification metrics.

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Acknowledgments

We are grateful for the advice and guidance provided by Larry Nyland, Sarah Diem, and Genevieve Siegel-Hawley.