Operationalizing Gentrification

Abstract

Few topics in urban sociology have garnered as much controversy as gentrification. Scholars disagree, sometimes vehemently so, on the definition, causes, and effects of this unique form of neighborhood change. Researchers would benefit from a better understanding of how the operationalization of common definitional components of the term impacts how many and which census tracts have “gentrified” or are "gentrifying.” Using data from the 1970, 1980, 1990, and 2000 long-form Censuses as well as the 2006-2010 American Community Survey, I ran separate multilevel longitudinal regressions based on five common indicators of gentrification. As expected, average household income, average housing unit value, the percentage of residents who graduated college and the percent who worked in professional occupations increased over time, while the share of residents living beneath the poverty line decreased. However, these patterns were not linear across time for all tracts and there was significant variation across tracts in the degree of these changes. A growing divergence across “gentrifiable” tracts in average household income, average housing unit value, and percentage of college graduates was observed from the beginning to the end of the study period.

Few topics in urban sociology have garnered as much controversy as gentrification. Scholars disagree, sometimes vehemently so, on the definition, causes, and effects of this unique form of neighborhood change. In fact, debate about gentrification’s definition was so fervent at one point that Damaris Rose called on scholars to embrace “definitional chaos” (Rose 1984), while others urged more consensus on central tenants (Zukin 1987). After decades of scholarship researchers have come to some measure of agreement about gentrification’s essential components: the influx of capital into previously poor or working-class neighborhoods associated with the arrival of new, higher socioeconomic status residents (Brown-Saracino 2010). But significant disagreement remains as to whether the displacement of long-term residents is a necessary byproduct of the process. While scholars can’t seem to agree on much when it comes to gentrification, there is a growing consensus that this phenomenon is becoming increasingly prevalent in US cities in recent years (Ellen and Ding 2016).
Ruth Glass first coined the term “gentrification” in 1964 when describing changes that she observed to the social structure and housing market in certain London neighborhoods (Brouillette 2009). Glass wrote: “One by one, many of the working class quarters have been invaded by the middle class… Once this process of ‘gentrification’ starts in a district it goes on rapidly until all or most of the working class occupiers are displaced and the whole social character of the district is changed” (Glass 1964). Glass’s term has been embraced by scholars from a variety of disciplines including sociology, anthropology, political science, planning, urban studies, geography, and African American studies, and researchers have been investigating the prevalence of this phenomenon in cities around the globe ever since (Brown-Saracino 2010).

Most influential scholarly definitions of the term gentrification describe it as the influx of capital into previously poor or working-class neighborhoods associated with the arrival of new, higher socioeconomic status residents (Brown-Saracino 2010). Components of such definitions can be divided into two categories: compositional (changes to the population of the neighborhood) and structural (changes to the built environment). Compositional components emphasize traits common to the “gentrifiers” who move into—and eventually take over—the neighborhood, whereas structural components describe the conditions of the built environment that attracted, or changed, in response to the gentrification process.

Gentrifiers are usually described as white (Freeman 2005), childless, well-educated and relatively affluent (Hwang 2016) young professionals (Ley 1996), although not all fit this description (Taylor 2002). They are often attracted to a neighborhood due to its proximity to central business districts and cultural amenities, such as museums and music venues (Brown-Saracino 2010). Low levels of homeownership and residential stability, as well as a high percentage of elderly residents, are often present in an area just before it undergoes gentrification.
(Hwang 2016). On the production-side, an aging built-environment, the prevalence of low-cost housing, and high vacancy rates are often associated with the stage prior to gentrification (*ibid*).

**Significance**

Despite ongoing disagreement between scholars regarding gentrification’s definition, coming to a resolution regarding how best to operationalize the term is more than just an intellectual exercise—it has potential real-world implications as well. The areas where journalists document changes and where scholars choose to study, as well as what they measure, all follow from how gentrification is defined and operationalized. Governments and nonprofits may respond to such reports when deciding where to allocate resources, such as the construction of new affordable housing (Ley 1986). It also has the power to shape how we make sense of the places we live and visit, and our relationships with the people who reside there (Brown-Saracino 2010).

Yet operationalizing gentrification provides an ongoing challenge for researchers. Case studies provide one approach to measuring the prevalence of gentrification, as well as its causes, effects, and everyday character. But such data collection efforts are time-consuming, resource-intensive, and inherently limited in their scope. These costs constrain research.

Qualitative measures have the potential to allow researchers to cast a wider net and identify instances of gentrification in a timelier manner. But given that there is no single agreed upon definition of the term, there is also no academic consensus regarding what, if any, combination of compositional (demographic, socioeconomic) or structural (new construction, improvements to the built-environment) measures indicate the presence of gentrification in a given area. Given that there is no single agreed upon definition of gentrification, there is also no academic consensus regarding what, if any, combination of compositional (demographic,
socioeconomic) or structural (changes to the built environment) measures indicate the presence of gentrification in a given area. That said, the following changes are consistent with most mainstream definitions: an increase in the median household value; an increase in the median household income; a decrease in the percentage of residents living below the poverty line; an increase in the percent of residents who graduated from a four-year college; and an increase in the percent of workers in professional occupations.

**The Hammel and Wyly “Gold Standard” Operationalization**

Geographers Daniel Hammel and Elvin Wyly conducted an influential, large-scale neighborhood field survey in 23 major US cities¹ from 1994 to 2001. They coded each census tract in the 23 cities as either gentrifying (358), not gentrifying (1,729), or not gentrifiable (2,953) (Wyly and Hammel 2004). Wyly and Hammel defined a census tract as “gentrifiable” if it was below the citywide median income level at the baseline year². A tract was considered “gentrifying” if it had a minimum of one improved structure on a majority of blocks and at least one block with at least one-third of its structures improved. They considered all other tracts to be “ungentrified.” According to census data, the tracts Wyly and Hammel identified as gentrifying with this approach experienced increases in median household income, declines in their poverty rates, and stalled declines in their white populations (Wyly and Hammel 1999).

There are a variety of benefits and drawbacks to any operationalization of gentrification. The most obvious limitation to Wyly and Hammel’s approach is that researchers who adopt their

---

¹ Specifically (in alphabetical order): Atlanta, Baltimore, Boston, Chicago, Cincinnati, Dallas, Denver, Detroit, Fort Worth, Indianapolis, Kansas City, Milwaukee, Minneapolis-St. Paul, New Orleans, Oakland, Philadelphia, Phoenix, St. Louis, San Diego, San Francisco, San Jose, Seattle and Washington, DC.

² 1960 for cities in the Northeast and Midwest and 1970 for cities in the South and West, reflecting regional differences in metropolitan-area migratory patterns.
operationalization are limited to performing their analyses in the 23 cities they studied\(^3\).

Whereas a benefit of Wyly and Hammel’s study is that they consider new construction and renovation of the built environment, another downside is that their data for structural improvement and mortgage lending trends are not widely available or easily gathered for replication\(^4\). Furthermore, the instances of gentrification that Wyly and Hammel identified mostly captured gentrification that had taken place in the late 1970s and 1980s but not that which occurred during the 1990s or 2000s (Hwang 2016).

However, given the widespread use of Wyly and Hammel’s operationalization of the term in the gentrification literature, the inclusion or exclusion of those tracts Wyly and Hammel identified as having gentrified in the output for a given operationalization is of interest in gauging a definition’s utility. Therefore, I start by limiting the scope of my study to the 23 cities Wyly and Hammel investigated, with the goal of later expanding my study to the top 50 cities\(^5\).

**Research Questions**

I seek to determine to what extent tracts that may have gentrified have varied over time across several common gentrification indicators. A better understanding of how tracts vary and covary on the definitional components of gentrification will enable researchers to determine the potential frequency of the phenomenon as well as evaluate the advantages and drawbacks of different definitions of the term. Gentrification scholars may be surprised to learn of the relative frequency (or infrequency) of change over time to certain gentrification indicators. For example, it may be the case that most tracts have experienced a decrease in the percentage of residents

---

\(^3\) And those 23 cities exclude such major urban centers as New York, Los Angeles, Houston, Miami, etc.

\(^4\) Such information is not included in Census or ACS data, for example.

\(^5\) Whether gentrification should be considered a specifically urban phenomenon or rural areas can also undergo this process is another point of contention in the literature.
living below the poverty line over time and, thus, this definitional component is not a particularly useful measure of gentrification.

Another challenge is the matter of degree and establishing bright lines by which we can confidently conclude that a tract has gentrified. For instance, given that United States population has become better educated over time, most tracts may have experienced an increase over time in the percentage of residents who have graduate from a four-year college. To indicate that an area has gentrified, therefore, the share of a tract’s population that has graduated from college arguably should have increased significantly over time, over and above the population-wide trend. Therefore, running a series of multilevel models with time as the independent variable and a gentrification definitional component as the dependent variable will aid in identifying the appropriate percentage by which a tract should have increased on that measure to determine that is has “gentrified.”

Thus, I examine how tracts that may have gentrified varied by decade from 1970 to 2010 on the following common measures of gentrification:

1. The median household income level;
2. The percentage of residents living below the poverty line;
3. The percent of residents who have graduated from a four-year college;
4. The percent of residents employed in a professional or executive occupation;
5. The average value of housing units.

Methods

Sample

I utilize United States Census data given its universal accessibility, reliability, and comprehensiveness. In order to measure change across time at the census tract level in common
indicators of gentrification, I utilized data from the Neighborhood Change Database (NCDB). Census tract boundaries are updated over time to reflect changes in human settlement patterns, and the NCDB tracts are harmonized to 2010 Census boundaries. I limited my initial study to tracts in the 23 cities studied by Hammel and Wyly.

The NCDB does not include a city name indicator, and so to ensure that I only included tracts embedded within the city limits of the 23 cities under investigation, I imported a “crosswalk file” from the Population Research Institute (PRI) at the Pennsylvania State University that matched metro-area and municipality names to census tract identifiers. I retained only those tracts which contained a municipality name that was consistent with one of the principal cities under investigation. Despite my best efforts, I cannot be certain that a complete and accurate list of all census tracts within the 23 cities under investigation made it into my sample. Firstly, census tracts boundaries sometimes traverse more than one municipal unit. It is unclear if any tracts include portions of the principal city and a bordering suburb and, if so, which municipality name—the principal city or the bordering suburb—was populated in the municipality filed for that tract (only one municipality name was included per tract)6. Secondly, the municipality name field was missing for several tracts (n =161). Thirdly, while the municipality matched that of the principal city (e.g., “Chicago city”) in most cases, this was not true for all cities, such as Indianapolis. Indianapolis’s boundaries extend over multiple counties and the municipality names for tracts in the Indianapolis metro area match those of the counties

6 I did not want to include tracts in cities’ surrounding suburbs and exurbs as Wyly and Hammel limited their study to tracts within the principal city. Also, whether gentrification is strictly an urban phenomenon or can occur in suburban or rural areas is a point of contention in the literature.
(e.g., Center township, Washington township)\textsuperscript{7}. Fourthly, like tract boundaries, municipality boundaries may have changed over the study period (1970-2010).

My sample began with a total of 6,231 tracts which contained data from the 1970, 1980, 1990 and 2000 censuses and the 2006-2010 American Community Survey (ACS)\textsuperscript{8}. I dropped all tracts from my analytic sample that were missing household income data ($n = 162$) or home value data ($n = 539$), had a population of less than 500\textsuperscript{9} ($n = 633$), or for which the tract’s group quarters population was equal to 50\% or more of its total population\textsuperscript{10} ($n = 30$) at any timepoint. After removing those observations from my dataset, I was left with a total of 4,867 tracts, comparable to Wyly and Hammel’s sample of 5,040 tracts.

Gentrification is associated with increases in a tract’s median household income and housing unit value, but these values are expected to increase over time in all (or at least most) tracts due to inflation. Thus, I recalculated those variables measured in dollars so that values from past decades were equivalent to 2010 dollars. This enables me to make comparisons in these variables across time without confusing, say, an increase in a tract’s average home value due to inflation with an increase in the desirability of the neighborhood and its housing stock.

To match the Hammel and Wyly criteria as closely as possible, I coded tracts that had a median household income in 1970 that was less than the citywide median as “gentrifiable” and all others as “not gentrifiable”. Wyly and Hammel defined a census tract “gentrifiable” if it was below the citywide median income level in 1960 for cities in the Northeast and Midwest and

\textsuperscript{7} I am particularly uncertain that I identified a complete and accurate list of tracts for Kansas City, which contained a suspiciously small number of tracts ($n = 66$) with the principal city name (“Kansas City city”).

\textsuperscript{8} The 2010 Census was the first since 1940 to not contain a longform sample due to the launch of the ACS in 2005. The NCDB includes the 2006-2010 ACS which contains a comparable set of variables to the 1970-2000 Censuses.

\textsuperscript{9} A tract must be sufficiently populated at the beginning and end of the period in order to provide an accurate estimation of whether it “gentrified.” The development of unsettled or sparsely settled areas is not consistent with the concept of gentrification.

\textsuperscript{10} Tracts with large group quarters populations contain institutions such as colleges, military bases, prisons or nursing homes. Such areas are not commonly thought of as “gentrifiable.”
1970 for cities in the South and West, reflecting regional differences in metropolitan-area migratory patterns. However, NCDB census data was only available as far back as 1970, which is why I adopted that timepoint for my analysis. I deleted those tracts that I coded as “not gentrifiable” \( (n = 2,441^{11}) \) from my sample, leaving a total of 2,426 tracts remaining.

Gentrification is a specific type of neighborhood upward trajectory—while an increase in a tract’s median household income may not in and of itself necessarily signal that a tract has gentrified, to have gentrified a neighborhood must have increased in this measure. Therefore, I created a custom variable measuring whether a given tract’s median household income had increased between its inflation-adjusted 1970 value and 2010. Tracts with positive values on this measure experienced an increase in median household income between 1970 and 2010, indicating that they possibly may have gentrified. Tracts with negative values, however, experienced downward socioeconomic mobility over the study period and thus could not have possibly gentrified \( (n = 1,102) \), so I dropped them from my sample.

Similarly, a gentrified tract should have changed on the other measures under investigation in the expected direction. That is, a tract must have experienced increases in the percentage of its residents who are college graduates and who hold a professional occupation, as well as an increase in its inflation-adjusted average housing unit value and a decrease in its percent of residents living below the poverty line. Tracts that didn’t change from 1970 to 2010 in a way that is consistent with such expectations were dropped from the sample. This included 835 tracts for which the percentage of residents living below the poverty rate increased, an additional 17 tracts where the percentage of residents who work professional occupations decreased, and one tract where the percent of workers with professional occupations declined.

\[^{11}\text{By comparison, Wyly and Hammel determined that 2,953 tracts were “not gentrifiable.”}\]
No tracts were removed due to a decrease in the inflation-adjusted average housing unit value. I am left with a final analytic sample of 471 tracts that may have possibly gentrified (9.7% of my initial sample of 4,867), a figure comparable to the 358 tracts which Wyly and Hammel positively identified as having gentrified.

**Variables**

To implement the exclusion criteria outlined above, I created several custom variables from the NCDB data. In order to measure the percentage of a tract’s residents who graduated from college, I divided the total number of college graduates residing in a given tract by the total number of residents aged 25 or older in the tract. To determine the percentage of residents occupied in professional or executive positions, I added the total number of persons employed in technical and occupations with the number employed as executives, managers and administrators. I then divided this sum by total number of civilian employed persons aged 16 or greater residing in the tract. The tract’s average housing unit value was determined by dividing its inflation-adjusted aggregate housing units value variable by its number of owner-occupied housing units. The percentage of residents living beneath the poverty line and the average household income were included among the NCDB variables. As previously mentioned, I adjusted the 1970, 1980, 1990, and 2000 average household income values for inflation.

Table 1 lists the total number of census tracts that were included in the final analytic sample.

---

12 The market value of rental units is not incorporated into this measure. The aggregate amount of rent paid and the number of housing units occupied by renters for a given tract are captured in separate measures. I considered tracking changes in inflation-adjusted median rents over time as an increase in rents is commonly associated with gentrification. However, I decided against doing so due to a high degree of missingness on the aggregate rent variable for 1970.
Table 1: Final analytic sample, Census tracts by city and region

<table>
<thead>
<tr>
<th>Region</th>
<th>Northeast</th>
<th>Midwest</th>
<th>South</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>Boston (20)</td>
<td>Chicago (31)</td>
<td>Atlanta (9)</td>
<td>Denver (8)</td>
</tr>
<tr>
<td>(# of tracts)</td>
<td>Philadelphia (22)</td>
<td>Cincinnati (9)</td>
<td>Baltimore (6)</td>
<td>Phoenix (16)</td>
</tr>
<tr>
<td></td>
<td>Detroit (1)</td>
<td>Indianapolis (14)</td>
<td>Dallas-Fort Worth (44)</td>
<td>San Diego (59)</td>
</tr>
<tr>
<td></td>
<td>Kansas City (6)</td>
<td>Milwaukee (4)</td>
<td>New Orleans (18)</td>
<td>San Francisco (65)</td>
</tr>
<tr>
<td></td>
<td>Minneapolis-St. Paul (17)</td>
<td>St. Louis (9)</td>
<td>Washington, DC (24)</td>
<td>Seattle (63)</td>
</tr>
</tbody>
</table>

*Source: Neighborhood Change Database (NCDB)*

**Graphs**

To better visualize how the census tracts in my sample varied on these outcome measures over time, I estimated two-way line graphs in STATA where I specified the outcome (e.g., the percentage of the tract living below the poverty line) as the Y variable and the time measure, decade, as the X variable. Those graphs are presented here for reference and interpretation.

![Graph](image)

The first graph seemingly indicates that the general trend is that of an increase in the average household income level over time. However, in most tracts this value has remained relatively flat, signaling that gains in household income have failed to outpace inflation.

Furthermore, in several tracts the average household income level appears to have decreased between 2000 (decade 4) and the 2006-2010 period (decade 5). This is not entirely surprising
given the strong performance of the United States economy during the late 1990’s and that the 2006-2010 period captures the Great Recession of 2008 and its immediate aftermath.

This graph, indicating changes to the poverty rate over time, illustrates that most tracts in the sample contain relatively low levels of poverty and that poverty rates declined in these tracts over time overall. This is not surprising given that I dropped a large number ($n = 855$) of tracts from my sample for which the percent of residents below the poverty rate increased between 1970 and 2010, deeming them as having “not gentrified.” However, there are several exceptions to this trend that stick out. These outliers demonstrate that changes to the poverty rate over time were not necessarily linear: in several cases the percentage of residents living below the poverty line increased over the course of one or more decades before falling during subsequent decades.
The graph at the bottom of the previous page shows changes to the average housing unit value over time. An overall upward trend is evident, as is a growing dispersion in home values over time. For several outlier tracts at the top of the distribution it appears that the average housing value measure peaked in 2000 before falling slightly for 2006-2010. This is consistent with the bursting of the housing bubble during the Great Recession of 2008, which was triggered by the Subprime Mortgage Crisis and caused millions to lose their homes and their jobs. However, it appears that, despite this, most tracts continued to enjoy increases in this measure between 2000 and 2006-2010.
This graph, representing changes over time in the percentage of tract residents who graduated from a four-year college, also indicates a trend of overall increases in this measure. As the population of the United States has become better educated over time, so have the tracts in my sample. However, increases in this measure are not evenly distributed across tracts, as indicated by the growing dispersion in this outcome over time.

![Graph showing trend in percentage of tract residents who graduated from a four-year college over time.]

By contrast, the increase in the proportion of tract residents employed in professional or managerial occupations appears more uniform. Unlike for average household income, average housing value, or percent of residents who graduated from college, tract measures on this variable are not becoming notably more dispersed over time. Changes to the United States labor market over the 40-year period, such as the offshoring of industrialized production and the rise of the “knowledge economy,” are reflected in the increase in this measure.

**Models**

I ran separate multilevel longitudinal regressions to determine how the tracts’ average household income, average housing unit value, percent of residents living below the poverty line, percent of residents who are college graduates and percent of residents who work in professional occupation varied over time. I nested census tracts within cities and cities within regions in
order to account for the nonindependence of the observations and assess for city and regional effects. To do so, I used the `mixed` command in STATA. For example, I ran the following code for the average household income model:

```stata
mixed tshhinc decade || REGION: || Metro:
```

where `tshhinc` is the custom variable for the tract’s average household income. I then ran the same command for my other four variables of interest. All five of my outcome variables are continuous.

**Results**

The model for the percentage of residents living below the poverty line generates a fixed effects intercept of 9.48% and a fixed effects slope of -0.73%. I interpret this as the average percent of residents living below the poverty rate in 1970 was 9.48% across all tracts, and that this value decreased by an average of 0.73 percentage points in each subsequent decade. The random effects residual is 0.16%, and the random effect parameter for region is <0.01% and for city is 0.07%. This indicates that the city and regional effects on this measure are quite modest.

My model for the share of residents who graduated from college has a fixed effects intercept of 14.0% and fixed effects slope of 8.6%. This means that the average share of residents across all tracts who graduated from college in 1970 was 14.0% and has increased by 8.6 percentage points per decade on average. The random effects residual is 2.7%, while the random effect parameter for region is 0.2% and for city is 0.9%. Thus, differences across cities moderate a significant portion of the effect of time on this measure.

The model of the percentage of residents with professional and managerial occupations has a fixed effects intercept of 29.1% and a fixed effects slope of 5.6%. Thus, the average share of residents who occupied these positions in 1970 was 29.1% and this value increased by 5.6
percentage points per decade on average. The random effects residual is 1.7% and the regional random effects parameter is 0.2% and city random effects parameter is 0.4%.

My model for the average household income has a fixed effect intercept of $58,369 and a fixed effect slope of $1,902. In other words, the inflation-adjusted average household income across all tracts was $58,369 in 1970 and that income increased by an average of $1,902 per decade in these tracts. The random effects residual is $2.85 billion, while the random effects parameter for region is $191 million and for city is $282 million. I am unable to make sense of these values as they defy reason given that they are of an entirely different scale than the rest of the household income measures.

Finally, the model for average home value has a fixed effects intercept of -$61,847 and a fixed effects slope of $105,734. The random effects residual is $2.86 trillion, the random effects parameter for region is $624 billion and for city is $464 billion. I am unable to make sense of these measures as it is impossible for the average household value to be negative, and the random effects values are not of the appropriate scale for the variable.

Conclusion

Gentrification scholars cannot agree upon a single definition of the term and, therefore, there is no universal set of criteria for identifying which census tracts have gentrified. Incorporating different definitional components of gentrification into an operationalization of the term will produce different sets of neighborhoods that have undergone this process. Having a better understanding of the patterns of variation over time for common definitional components of the term can help establish which would be the most useful to incorporate into one’s preferred definition and operationalization.
I examined change over a period of four decades in five common indicators of
gentrification among tracts that may have gentrified within 23 cities. I found that, as expected,
the average household income, the average housing unit value, the percentage of residents who
graduated college and the percent of workers in professional occupations has increased, and the
percent of residents living beneath the poverty line has decreased, over time. However, these
patterns were not necessarily linear for all tracts and there was significant variation in the scope
of these changes by tract. For example, a growing divergence between tracts in the average
household income, average housing unit value, and percentage of college graduates was
observed from the beginning to the end of the period.

The longitudinal and the nested nature of the data necessitated a multilevel model
approach. While I was able to interpret the findings of the poverty rate, college graduate, and
professional occupation models, the random effect residuals and regional and city random effects
parameters did not make sense for the household income or housing unit value models. This
suggests that I may have mis-specified these models in STATA or that underlying data
irregularities are skewing the findings. City and regional effects were modest for the poverty
rate measure but more significant for the college graduates share indicator.

In future versions of the paper I plan to track changes to the following additional
gentrification indicators: the racial composition of the tract (the percentage of residents who are
White, Black, Hispanic or Asian); the percent of residents who are foreign born; the percent of
residents who are children (<18); the percent of residents who are elderly (65+); the percent of
single and childless couple households; the percent of residents who are young adults (aged 21-
34); the average number of residents per household; the total number of housing units in the
tract; the percent of housing units that are vacant; the homeownership rate of the tract; the
average size (total number of rooms) of housing units in the tract; the percentage of residents in the tract who moved into their homes within the past 5 years; and the percentage of housing units that were constructed 30+ years ago. I chose to start with the five that I investigated here because they are the most reliable indicators of gentrification.
List of References


