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Neighbourhood Diversity, Metropolitan Segregation and Gentrification: What Are the Links in the US?

Lance Freeman

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Abstract

An important yet little understood aspect of gentrification is the extent to which it affects spatial relations between various social groups. This study employs two measures of gentrification to discern how it is related to neighbourhood-level diversity and metropolitan-level segregation in the US by race and class respectively. It is found that gentrification does not decrease neighbourhood-level diversity. The evidence on whether gentrification precedes increased levels of neighbourhood-level diversity is more mixed. Depending on the outcome and the metric of gentrification used, there are some instances where gentrification appears to lead to increased diversity. However, there are other instances where gentrifying neighbourhoods start out more diverse than other neighbourhoods and remain that way over the study period. The relationship between metropolitan-level segregation and gentrification is more tenuous, with some of the evidence suggesting that gentrification reduces income segregation and weaker less robust evidence suggesting gentrification increases racial segregation.

1. Introduction

An important yet little understood aspect of gentrification is the extent to which it affects spatial relations between various social groups. By definition, gentrification introduces gentrifiers into relatively low-income neighbourhoods and would therefore be thought to be associated with some increase in socioeconomic diversity there. Given the association of gentrification with displacement,

however, one might assume this increase in socioeconomic diversity to be fleeting. That is, once gentrification commences, the original low-income residents will be displaced in short order. The rich literature on conflict and sometimes collaboration within gentrifying neighbourhoods, however, belies the notion that gentrification means automatic displacement (Freeman, 2006; Patillo, 2007; Smith, 1996; Williams, 1988). This strand of research has documented how

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gentrifiers and long-term residents contest the neighbourhood's identity and the setting of norms over extended periods of time.

For both urban scholars and policy-makers, socioeconomic diversity within neighbourhoods is a topic of considerable concern. The class composition of a neighbourhood is thought to be an important determinant of one's life-chances (Goering and Feins, 2003). The concentration of the poor within certain neighbourhoods, in particular, is thought to have deleterious consequences for those residents. Achieving neighbourhood racial integration is viewed not only as necessary for racial justice but as a way of lessening racial barriers. Through interracial residential contact, the races would come to know each other beyond stereotypes and this would lessen racial animosity (Allport, 1954; DeMarco and Galster, 1993).

More widely, segregation by race is thought to contribute to a spatial mismatch whereby employment opportunities are spatially inaccessible to minorities, especially Blacks (Kain, 1992; Holzer, 1991). High levels of segregation by class also make it more likely that political boundaries will coincide with class-specific enclaves. This serves to reinforce political inequality by separating the 'haves' and 'have nots' into separate political jurisdictions (Massey, 1996).

Given the potential consequences, understanding gentrification's impact on neighbourhood diversity and spatial segregation is likely to be of considerable interest to both planners and policy-makers alike. The results of this research will be useful for those who attempt to anticipate neighbourhood trajectories in their efforts to plan for these neighbourhoods.

This extremely brief discussion suggests that neighbourhood diversity and segregation are topics of interest to social scientists and all those who have an interest in building and maintaining more livable communities.

1.1 How Might Gentrification Impact Spatial Relations between Social Groups?

A straightforward definition of gentrification is offered by *The Encyclopedia of Housing*, defining gentrification as

the process by which central urban neighbourhoods that have undergone disinvestments and economic decline experience a reversal, reinvestment, and the in-migration of a relatively well-off, middle- and upper middle-class population (Smith 1998, p. 198)

Beyond this definition, however, are connotations that are decidedly more sinister. Wyly and Hammel (2005, p. 3) put it most succinctly, stating that "gentrification is fundamentally about the reconstruction of the inner-city to serve middle class interests". For Slater (2006), gentrification refers to the disruption of social ties and loss of affordable housing that accompanies the middle class colonising of working-class neighbourhoods. For these authors, gentrification is more than just economic and demographic change. Its meaning is inherently pejorative. There is no consensus, however, that the process described in the first paragraph of this sub-section is inherently negative. Indeed, to circumvent the negative connotations associated with gentrification, some have proposed alternative terms like 'reurbanisation' (Buzar *et al.*, 2007; Lambert and Boddy, 2002) to identify the process described in the beginning of this sub-section.

As will be shown later, empirical evidence documenting how gentrification is related to neighbourhood diversity and segregation is sorely lacking. Consequently, the more neutral definition offered at the beginning of this sub-section will serve as a starting-point to assessing the relationships between gentrification, neighbourhood diversity and segregation.

If we take this definition, one could imagine several scenarios under which gentrification could impact spatial relations between

social groups. At the neighbourhood level, the arrival of gentrifiers leads to some immediate increase in neighbourhood diversity as more affluent households come to share space with the long-term low-income residents. Over time, the neighbourhood could become less diverse if the affluent households come to replace all of the low-income households. The net result in the long term would be no change in diversity as the neighbourhood simply traded one form of neighbourhood homogeneity—relatively poor—for another—relatively affluent. Under an alternative scenario, the low-income population, while perhaps decreasing after the arrival of gentrifiers, stabilises or decreases at a very slow pace. The long-term result here would be an increase in socioeconomic diversity. One could also imagine a relatively diverse neighbourhood becoming less so with the onset of gentrification. If gentrifiers were drawn to relatively low-income neighbourhoods that were already diverse, one might expect this diversity to decrease with the onset of gentrification. Anecdotally, one can think of US neighbourhoods such as Manhattan's Upper West Side that appear to be becoming less diverse over time. If gentrification resulted in only the affluent residing in the neighbourhood, this might decrease levels of socioeconomic diversity.

We might also expect racial diversity to increase as a result of gentrification. Given the over-representation of minorities amongst the urban poor and likewise the over-representation of Whites amongst gentrifiers, it would not be surprising for gentrification to entail White gentrifiers moving into predominantly Black and Latino inner-city neighbourhoods.

At the macro level, gentrification activity in select neighbourhoods could influence the overall spatial distribution of groups. If gentrification reduces the number of neighbourhoods with affordable housing, the poor could become concentrated in fewer neighbourhoods and thus be more segregated.

Alternatively, by introducing affluent, or at least middle-class, residents to additional neighbourhoods, gentrification could be associated with less segregation.

The extent to which any of these scenarios is true is an empirical question—one that, as the following discussion illustrates, remains unanswered.

1.2 What Do We Know about Gentrification and Socioeconomic Diversity?

Recent research suggests that, in the US, residential turnover in gentrifying neighbourhoods may not be any greater than that found in other neighbourhoods (Freeman, 2005; Freeman and Braconi, 2004; McKinnish *et al.*, 2008; Vigdor, 2002). These findings suggest a period of time when both gentrifiers and long-term low-income residents co-exist. If this is true, we might expect gentrifying neighbourhoods to exhibit above-average levels of socioeconomic diversity. Certainly, class diversity could increase because, as mentioned previously, gentrification is the introduction of households of higher socioeconomic status.

Little research has been done, however, to explore systematically how gentrification impacts neighbourhood diversity or segregation. Walks and Maaranen (2008) examined the relationship between gentrification, neighbourhood income distribution and ethnic diversity in Canada's three largest cities. Walks and Maaranen focused on the extent to which the income distribution was polarised or dominated by income groups at the extremes and the extent to which income was distributed among different income strata. Ethnic diversity was defined by both the absolute and relative proportion of different ethnic groups and the extent to which all of these groups are present in a given neighbourhood. Relative to other neighbourhoods, gentrifying neighbourhoods increased less in terms of ethnic diversity. Gentrifying neighbourhoods began the study period more

polarised by income and remained so over the course of the study period. Income inequality was also greater in gentrifying neighbourhoods throughout the course of the study period. It is not surprising that income inequality and polarisation would increase with the onset of gentrification. The introduction of higher-income individuals to a neighbourhood would be expected to increase income inequality and polarisation, unless the remaining low-income residents saw their incomes increase to approach the levels of the higher-income in-migrants. Finally, Walks and Maaranen found that the longer a neighbourhood had been gentrifying, the more pronounced these trends had become. Walks and Maaranen conclude that

If allowed to run its course, gentrification is likely to *reduce* neighbourhood levels of social mix and ethnic diversity (Walks and Maaranen, 2008, p. 320).

In the US context, very little has been done, however, to explore how gentrification is related to neighbourhood diversity or segregation. Wyly and Hammel (2004) examined the relationship between mortgage applications and gentrification utilising Home Mortgage Disclosure (HMDA) data. They found that non-Whites were more likely to be denied a loan if they applied in a gentrified area compared with elsewhere. They also found that borrowers in gentrifying areas were

disproportionately high-income, single White males ... [whereas] ... African American (black), Hispanic, and Asian or Pacific Islander borrowers are substantially less likely to 'wind up' in core gentrified areas (Wyly and Hammel, 2004, p. 1227).

These results suggest that gentrification might lead to less neighbourhood diversity, but they fail to tell us how the demographics of gentrifying neighbourhoods actually change in terms of diversity. For example, although those seeking mortgages to purchase homes

in gentrifying neighbourhoods were disproportionately White, it is unclear if similar patterns would be found among renters.

Using a measure of gentrification developed by Hammel and Wyly (1996), Bostic and Martin (2003) explored the possibility that Black homeowners served as gentrifiers in many US neighbourhoods. They found that in the 1970s increases in Black homeownership were indeed related to the likelihood of a neighbourhood undergoing gentrification. This pattern was not evident, however, in the 1980s—a finding they attribute to policies that made it easier for Blacks to purchase homes outside poor inner-city neighbourhoods. These are the very neighbourhoods that were susceptible to gentrification in the 1970s. Bostic and Martin speculate that the easing of discriminatory barriers in the 1980s led Black homeowners to purchase homes away from poorer inner-city neighbourhoods that had the potential to undergo gentrification. This study suggests that Whites are not the only racial/ethnic group that can contribute to gentrification. Yet this study only examines the role of Black homeowners as possible causal agents of gentrification. Bostic and Martin do not shed light on how overall racial or class-based demographics change as a result of gentrification.

Most of the other research on gentrification that is related to the question of either segregation or neighbourhood-level diversity has either examined migration dynamics into and out of gentrifying neighbourhoods (Atkinson, 2000; Crowder and South, 2005; Spain *et al.*, 1980) or aggregate-level demographic changes in specific neighbourhoods (Fidel, 1992; Slater, 2004; Wagner, 1995).

Studies such as these, that have explored migration dynamics into and out of gentrifying neighbourhoods, are better suited for helping us to understand the *process* of neighbourhood change in gentrifying neighbourhoods. They elucidate the identity of the migrants into and out of these neighbourhoods.

However, they fail to tell us the end-result, demographically speaking, of these migratory patterns. Moreover, these studies do not identify comparison neighbourhoods that would allow us to discern how diversity and segregation differ between gentrifying and other comparable neighbourhoods. Finally, studies examining migration dynamics into housing units or neighbourhoods typically fail to identify whether the housing units or neighbourhoods themselves are part of gentrifying areas. Therefore, their findings can only be suggestive of patterns consistent with gentrification.

Studies that have focused on demographic changes in specific neighbourhoods do give us a sense of how a neighbourhood may be changing, demographically speaking, as a result of gentrification. Nevertheless, these studies suffer from several shortcomings if our aim is to understand how gentrification impacts segregation and neighbourhood-level diversity. First, operating at the scale of a single neighbourhood, it is impossible to draw any conclusions about how gentrification impacts segregation at the city or metropolitan level. Secondly, research utilising a case study approach typically fails to include a counterfactual neighbourhood. Thus, it is difficult to isolate gentrification as the causal agent behind any demographic changes observed. Thirdly, the case studies fail to employ a summary metric of diversity that could be used to make comparisons across time or space. Thus, the changes identified in the case studies do not tell us the magnitude of the changes in diversity observed. For example, Slater's (2004) finding that the White population increased in Park Slope does not tell us how diverse the neighbourhood is now or provide a summary statistic that would allow for easy comparison with other neighbourhoods. This is particularly true of studies that use changes in median income as one measure of gentrification. In this case, the summary statistic, median income,

completely masks the level of diversity in the neighbourhood.

Despite Walks and Maaranen's (2008) efforts, several questions regarding neighbourhood diversity and segregation remain unanswered. Walks and Maaranen focus on the distribution of income within gentrifying neighbourhoods, not the extent to which different income strata are present in a neighbourhood. Yet we are interested in how gentrification affects diversity, which conceptually is more closely linked to the presence of differing income classes in a neighbourhood, not the income distribution among them. Secondly, their study was limited to Canada's three largest cities, raising the question of how applicable their findings would be elsewhere. Furthermore, their study does not address the question of gentrification's impact on macro-level segregation. As discussed in the previous section, there is reason to suspect that gentrification could affect segregation patterns at the level of a metropolitan area.

More than a decade after Spain (1992) highlighted the need for research that explored how gentrification is related to residential segregation, the answers to these questions remain unknown. This paper seeks to address this gap in the literature by examining how gentrification is related to neighbourhood socioeconomic diversity and segregation at the metropolitan level. The research presented here will further our understanding of the links between gentrification, neighbourhood diversity and segregation in the US by employing a summary statistic to measure neighbourhood diversity, including a set of comparison neighbourhoods, and measuring the relationship between gentrification and segregation at the metropolitan scale.

2. Methodology

2.1 Analytical Approach

In thinking about how gentrification might be related to the spatial organisation of

different social groups, we conceptualise spatial differentiation on two levels. At the neighbourhood level, we examine diversity, or the extent to which different groups are all present in a given neighbourhood and in what proportion. The second way we think about the spatial organisation of different social groups is at the more macro level of the US metropolitan area. Here, we are interested in segregation, or the extent to which different social groups are spread evenly throughout the metropolis.

To assess how gentrification is related to neighbourhood socioeconomic diversity in the US, we will utilise two comparisons. First, we will analyse trends in neighbourhood socioeconomic diversity over time. We will measure socioeconomic diversity at the beginning of the decade and contrast that with socioeconomic diversity levels one decade later. Where data are available, we will assess changes in socioeconomic diversity in subsequent decades. By looking at changes in diversity over the course of a decade, we will gain a sense of how gentrification is associated with trends in diversity. By analysing diversity in subsequent decades, we will gain a long-term view of how gentrification is related to diversity.

Our second approach is to compare socioeconomic diversity in gentrifying neighbourhoods with socioeconomic diversity elsewhere. We will make comparisons with all other neighbourhoods, central-city neighbourhoods and neighbourhoods similar to gentrifying neighbourhoods prior to their undergoing gentrification. Comparing diversity across different types of neighbourhood will help us to distinguish those trends in neighbourhood diversity that are specific to gentrifying neighbourhoods and those trends that are affecting all urban neighbourhoods.

Finally, we consider how gentrification is associated with aggregate levels of segregation in the US. Gentrification may or may not influence diversity patterns at the neighbourhood

level. Equally important, however, is how gentrification is related to metropolitan-wide segregation. If gentrification pushes the poor from a relatively mixed neighbourhood to an exclusively poor one, it will impact diversity both in the gentrifying neighbourhood and in the larger metropolitan area. Metropolitan areas were chosen as the aggregate level to examine because they come closest to approximating a housing market.

2.2 Measuring Socioeconomic Diversity and Segregation

We focus on spatial differentiation across class and racial lines. Class is important because to a certain extent it is the change in the class composition of a neighbourhood that defines gentrification. Moreover, among many policy-makers and scholars, sentiment has been in favour of increasing socioeconomic diversity in urban neighbourhoods. To measure class, we use educational attainment and income. Households are classified by the highest level of educational attainment of the householder, high school drop-out, high school graduate, some college and college graduate. Following the example of Massey and Eggers (1990, 1993), we divide household income into four categories: poor, working class, middle class and affluent. For 1970, 1980, 1990 and 2000, we define poor as those earning below the poverty line for a family of four. Working-class families are then defined as those with income above the poverty line, but less than twice the poverty line. Middle class is defined as income greater than twice the poverty line, but less than three times the poverty line. Affluent is defined as income greater than three times the poverty line. We then chose the income categories in the census that came closest to matching these categories.

We address racial diversity because race has been the defining characteristic of US neighbourhoods. We use five racial/ethnic groups—Asians, Blacks, Latinos, Whites and others—in our analysis.

Recall that our conceptualisation of neighbourhood diversity is the extent to which different groups are present in a neighbourhood. This leads to the choice of an index that will give higher values when all groups are present in equal proportions and lower values when one group is dominant. To be consistent, it would also be useful if our neighbourhood measure could be used to inform the construction of our macro-level measure of segregation. The entropy index is such an index that satisfies these criteria. To measure tract-level racial diversity we use

$$H_n = \sum_{r=1}^n p_{r^*t} \log \left(\frac{1}{p_{r^*t}} \right) \quad (1)$$

where, the proportion of families in tract t in race/ethnic group r , is designated by p_{r^*t} . In our case, the maximum race entropy is $\log 5$ or 1.61. The maximum level of diversity occurs when all groups have equal representation in the population and in the tract. In the four-group case, each group would have 25 per cent representation in the tract. The minimum value for entropy, 0, is achieved when only one group is represented in a tract.

The tract-level entropy can also be used to measure diversity for education and income. As defined here, education and income, however, are ordinal-level measures. There is an inherent ordering to the categories used. Thus, the diversity in a tract with only college graduates and high school drop-outs should be viewed differently from a tract with only high school graduates and those with some college. To account for this, we use an ordinal measure of diversity—the index of ordinal variation (Kvålseth, 1995) defined as

$$H_o = \frac{1}{k-1} \sum_{k=1}^{k-1} 4c_k(1-c_k) \quad (2)$$

where, k is the number of groups and c_k is the cumulative proportion of the total population at that level of k or lower.

This index measures the average deviation of each level when there is no variation (where the cumulative proportion each equals zero or one) (Reardon *et al.*, 2006). The index of ordinal variation reaches its maximum value of 1 when the population is split evenly between the highest- and lowest-ranked categories in a tract. The index reaches its minimum when the population is divided among all of the categories. To use the example of education, a tract with its population weighted towards high school drop-outs and college graduates will score higher and be considered more diverse than one where high school graduates and those with some college predominate.

Our analytical approach differs from that of Walks and Maarenen (2008) in that they only focus on income as a measure of class and their concern was with the distribution of income within a given neighbourhood, not the extent to which different income classes are present in the neighbourhood.

The second facet of spatial differentiation that may be related to gentrification that we consider is segregation. As described earlier, we envisage gentrification possibly affecting the way different social groups are distributed across neighbourhoods. For example, the poor might be confined to fewer neighbourhoods while middle- and upper-class residents might come to reside in more neighbourhoods as a result of gentrification. The dimension of segregation that comes closest to this conceptualisation is evenness (Massey and Denton, 1988). The dissimilarity index is the most well-known measure of evenness. For the purposes of our research, however, the dissimilarity index has a significant drawback. The dissimilarity index measures evenness between two groups. However, for both class and race, the dimensions of diversity of interest here, we have more than two groups. Using the dissimilarity index would require calculating an index for every pairwise combination. This is both tedious and analytically clumsy.

With the diversification of American cities away from a Black–White dichotomy, researchers are increasingly making use of the information theory index, a measure suitable for measuring evenness among more than two groups (Fischer, 2003; Iceland, 2004). Accordingly, to measure segregation at the metropolitan level, we use the information theory index. This measures the extent to which the average tract-level entropies (H_t) deviate from the maximum entropy for the entire metropolitan area (Theil, 1972, p. 66). If each tract mirrored the metropolitan area as a whole in its distribution of racial groups, the maximum entropy would be achieved. The information theory index is the weighted average of the proportional difference between the tract-level entropies and the city-level entropy. It is calculated as

$$H_{index} = \sum_{t=1}^n \frac{w_t (H_m - H_t)}{WH_m} \quad (3)$$

where, H_t is the tract-level entropy; H_m is the metropolitan-area-level entropy; w_t is the tract-level population; and W is the metropolitan area's population.

The information theory index ranges from 0 to 1. A score of 0 would mean that the racial composition of every tract mirrored that of the entire metropolitan area. A score of 1 would mean that only one group was present in each tract. The information theory index is calculated similarly for both nominal and ordinal entropy indexes.

To summarise briefly, for race, our nominal variable of interest, we measure tract-level diversity using Theil's entropy index. To measure diversity for our education and income ordinal variables, we use the index of ordinal variation. The information theory index is used to measure segregation for education, income and race at the metropolitan level.

2.3 Measuring Gentrification

In addition to the definition of gentrification described earlier in this paper, other definitions

have been offered. As part of their effort to map gentrification across US cities, Hammel and Wyly defined gentrification as

the replacement of low-income, inner-city working class residents by middle- or upper-class households, either through the market for existing housing or demolition to make way for new upscale housing construction (Hammel and Wyly, 1996, p. 250).

The US Department of Housing and Urban Development defined gentrification as

the process by which a neighbourhood occupied by lower-income households undergoes revitalisation or reinvestment through the arrival of upper-income households (US Department of Housing and Urban Development, 1979, p. 4).

Although not identical, these three definitions are consistent in including certain dimensions. All three definitions see gentrification as, first, occurring in central-city neighbourhoods that were, secondly, inhabited by low-income residents. Thirdly, these definitions also see gentrification as taking place in neighbourhoods that have experienced disinvestment. Fourthly, an influx of gentrifiers or residents of higher socioeconomic status and, finally, investment capital are also features of all three of the cited definitions.

Notably missing from this definition is the displacement of the original low-income residents, which Kennedy and Leonard (2001) argue should be part of the definition of gentrification. It certainly seems plausible that a low-income neighbourhood could experience an influx of gentry and investment capital without displacement occurring. This could be possible if the low-income residents were protected by rent regulation or housing subsidies and/or gentrifiers were occupying new developments in a relatively underpopulated area. Based on the definitions given earlier, it appears that many would characterise this type of neighbourhood change as gentrification. Accordingly, we seek to

measure gentrification using the five facets gleaned from the three definitions.

Freeman (2005) developed a metric that attempts to capture the five dimensions listed earlier. Using this metric, gentrification is measured as a census tract that is: located in the central city; had median household income below the 40th per centile of the metropolitan area at the beginning of the intercensal period; has a percentage of housing built over the past 20 years that is below the 40th per centile for the metropolitan area; has a percentage increase in educational attainment that is greater than that of the metropolitan area; and whose real housing prices increased during the decade. Freeman also uses these criteria to identify tracts with the potential to undergo gentrification, but which subsequently did not. He identified these tracts as those that: were located in the central city; and, had median household incomes below the 40th per centile of the metropolitan area at the beginning of the intercensal period. These we will call non-gentrifying tracts. They are useful for comparison purposes because they began in circumstances similar to those undergoing gentrification.

This operationalisation of gentrification developed by Freeman (2005) is convenient because it can be readily applied to the census data we are using. Gentrification is a notoriously difficult concept to measure, however, with census data. We thus decided also to use the work of Wyly and Hammel (2005) to identify gentrifying neighbourhoods. Wyly and Hammel identified gentrifying neighbourhoods through a combination of archival research, field work and census data analyses in 23 cities based on the definition developed by Hammel and Wyly (1996). The full list of cities canvassed by Wyly and Hammel and more detailed information about their methods can be found in Hammel and Wyly (1996).

There have been few other attempts systematically to measure gentrification in US cities aside from the efforts of Freeman (2005) and Hammel and Wyly (1996) as already

described. Lipton (1977) defined gentrifying neighbourhoods based on the following criteria: the census tract had to be within two miles of a city's central business district; the census tract had below-average family income or educational attainment at the beginning of the decade; over the course of the ensuing decade, the census tract's family income or educational attainment rose above the metropolitan average. Hammel and Wyly's (1996) measure would certainly seem to be superior to Lipton's in that they validated and refined their census-based identification scheme with archival research and field work. Freeman's measure comes closer than Lipton's to capturing the five aspects of gentrification listed earlier. Lipton's measure does not attempt to capture disinvestment or reinvestment, two hallmarks of gentrification according to the definitions outlined earlier. Moreover, limiting gentrification to neighbourhoods only within two miles of the central business district seems over-restrictive.

Using Freeman's (2005) and Hammel and Wyly's (1996) metrics of gentrification has the advantage of being consistent with definitions that have been offered in the literature as well as having been used in prior research. In addition, they would appear to be superior to other measures that have been developed to measure gentrification across US cities. By using the approach developed by Freeman (2005) and Wyly and Hammel (2005), we enhance the robustness of our analyses.

2.4 Data

Data for this study come from tract-level data from the 1970, 1980, 1990 and 2000 decennial censuses. We use the Neighborhood Change Database produced by Geolytics to link census tracts across the decades. Geolytics created consistent tract boundaries based on 2000 census boundaries for the earlier censuses. For our analyses involving race, we only go back to 1980 because of the different way race was classified prior to then. Table 1 provides some basic descriptive statistics for

Table 1. Neighborhood characteristics by gentrification status

| | <i>Non-gentrifying^a</i> (N = 4294) | <i>Gentrifying as defined by Freeman^b</i> (N = 2048) | <i>Gentrifying as defined by Wyly and Hammel</i> (N = 325) |
|----------------------|--|--|---|
| <i>1970</i> | | | |
| High school drop-out | 0.575 | 0.599 | 0.497 |
| High school graduate | 0.267 | 0.265 | 0.234 |
| Some college | 0.084 | 0.077 | 0.113 |
| College graduate | 0.074 | 0.059 | 0.155 |
| Poor | 0.202 | 0.208 | 0.212 |
| Working class | 0.291 | 0.294 | 0.288 |
| Middle class | 0.378 | 0.377 | 0.328 |
| Affluent | 0.129 | 0.120 | 0.172 |
| <i>1980</i> | | | |
| High school drop-out | 0.462 | 0.478 | 0.316 |
| High school graduate | 0.301 | 0.303 | 0.221 |
| Some college | 0.128 | 0.123 | 0.166 |
| College graduate | 0.108 | 0.096 | 0.296 |
| Poor | 0.245 | 0.250 | 0.226 |
| Working class | 0.280 | 0.277 | 0.248 |
| Middle class | 0.350 | 0.349 | 0.307 |
| Affluent | 0.125 | 0.124 | 0.218 |
| Percentage White | 0.550 | 0.570 | 0.613 |
| Percentage Black | 0.321 | 0.312 | 0.239 |
| Percentage Asian | 0.017 | 0.016 | 0.049 |
| Percentage Latino | 0.105 | 0.097 | 0.089 |
| <i>1990</i> | | | |
| High school drop-out | 0.382 | 0.387 | 0.196 |
| High school graduate | 0.280 | 0.286 | 0.156 |
| Some college | 0.159 | 0.166 | 0.181 |
| College graduate | 0.180 | 0.161 | 0.467 |
| Poor | 0.334 | 0.344 | 0.211 |
| Working class | 0.366 | 0.374 | 0.263 |
| Middle class | 0.252 | 0.241 | 0.296 |
| Affluent | 0.049 | 0.041 | 0.230 |
| Percentage White | 0.468 | 0.512 | 0.617 |
| Percentage Black | 0.355 | 0.339 | 0.229 |
| Percentage Asian | 0.030 | 0.024 | 0.058 |
| Percentage Latino | 0.138 | 0.116 | 0.090 |
| <i>2000</i> | | | |
| High school drop-out | 0.339 | 0.301 | 0.138 |
| High school graduate | 0.291 | 0.283 | 0.131 |
| Some college | 0.230 | 0.233 | 0.212 |
| College graduate | 0.140 | 0.183 | 0.519 |
| Poor | 0.396 | 0.369 | 0.268 |

(Continued)

(Table 1 Continued)

| | <i>Non-gentrifying^a</i> (N = 4294) | <i>Gentrifying as defined by Freeman^b</i> (N = 2048) | <i>Gentrifying as defined by Wyly and Hammel</i> (N = 325) |
|-------------------|--|--|---|
| Working class | 0.234 | 0.230 | 0.174 |
| Middle class | 0.279 | 0.295 | 0.306 |
| Affluent | 0.090 | 0.106 | 0.252 |
| Percentage White | 0.367 | 0.454 | 0.606 |
| Percentage Black | 0.372 | 0.340 | 0.196 |
| Percentage Asian | 0.034 | 0.028 | 0.068 |
| Percentage Latino | 0.194 | 0.147 | 0.099 |

^aIdentified as non-gentrifying for the 1990–2000 period.

^bIdentified as gentrifying for the 1990–2000 period.

the neighbourhoods of various categories. For purposes of brevity, we only present descriptive data for tracts that were identified as gentrifying between 1990 and 2000 using Freeman's measure and for tracts identified as gentrifying using Wyly and Hammel's measure.

The neighbourhoods identified as gentrifying and non-gentrifying during the 1990s by Freeman (2005) started out roughly comparable in 1970 and remained roughly comparable until 1990. After 1990, the gentrifying neighbourhoods became relatively more White, less poor and more highly educated—as would be expected of neighbourhoods in the beginning stages of gentrification. The neighbourhoods identified as gentrifying by Wyly and Hammel are more White and are generally of higher socioeconomic status than those identified by Freeman as gentrifying. In terms of socioeconomic status, this is true dating back at least to 1970 and, in terms of race/ethnicity, at least back to 1980. It is also noteworthy that the poverty rates did not decline substantially in the gentrifying neighbourhoods, regardless of the classification scheme. The poor are those most vulnerable to being displaced from gentrifying neighbourhoods. However, in the neighbourhoods defined as gentrifying here, there appears to have been an

in-movement of the more affluent without the wholesale displacement of the poor. In the following sections, we explore how socioeconomic diversity in these neighbourhoods has changed over time.

3. Results

We begin our discussion of the results by discussing neighbourhood-level diversity in gentrifying neighbourhoods as measured by the ordinal and nominal entropy scores. We present the average entropy scores for gentrifying, non-gentrifying and all other neighbourhoods using Freeman's classification. We also present average entropy scores for gentrifying neighbourhoods all other central-city neighbourhoods in those same cities, using Wyly and Hammel's classification scheme. Using Freeman's measure of gentrification, we have tracts that began gentrifying in 1970, 1980, and 1990 respectively. For each of these years, we also present diversity levels in subsequent decades. Thus, for tracts that began gentrifying in 1970, we present diversity measures in 1980, 1990 and 2000. For tracts that began gentrifying in 1980, we present diversity measures in 1990 and 2000. And for tracts that began gentrifying in 1990, we present diversity measures in 2000.

As noted earlier, Wyly and Hammel developed their measure of gentrification based on field work conducted in the 1990s. Their efforts, however, did not allow them to identify when gentrification began. Consequently, although we present diversity levels for 1970, 1980, 1990 and 2000 for Wyly and Hammel tracts that had undergone gentrification, we cannot be certain when the gentrification actually began. In our discussion, we generally compare the Hammel and Wyly gentrifying tracts with other central-city neighbourhoods in the same cities and the Freeman gentrifying tracts with non-gentrifying tracts as identified by Freeman. For comparison's sake, using Freeman's measure of gentrification, we also present diversity measures for all other neighbourhoods as well.

3.1 Education

Figure 1 illustrates tract-level diversity for education using our ordinal measure of entropy.

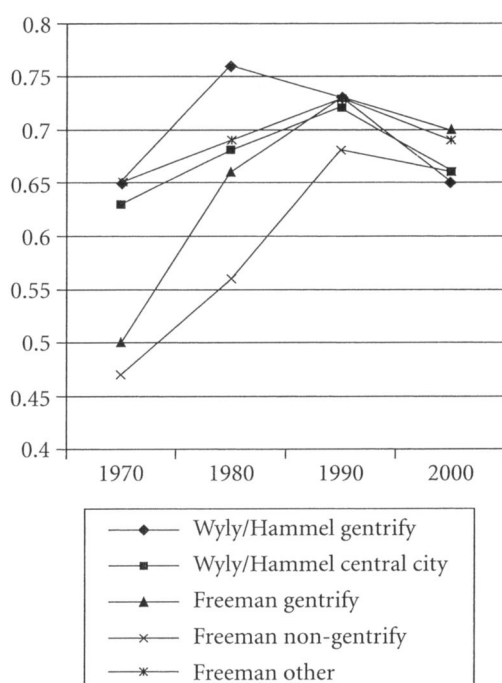


Figure 1. Tract-level entropy scores: education

Using the Wyly and Hammel measure, the gentrifying tracts began more diverse and remained so, until 2000 when they were slightly less diverse than other central-city neighbourhoods. These tracts became more diverse up to 1980 and then declined thereafter. Using Freeman's measure of gentrification, we observe that gentrifying tracts were always more diverse than the comparable non-gentrifying tracts. After increasing in diversity from 1970 both types of tracts declined in diversity thereafter.

Figures 2 and 3 present trends in diversity using Freeman's definition of gentrification for tracts where gentrification began in 1980 and 1990 respectively. The differences in diversity across the three types of neighbourhood are small for both sets of neighbourhoods. Generally speaking, the gentrifying neighbourhoods increased in diversity more than in comparable non-gentrifying neighbourhoods.

Taken together, the results presented in Figures 1, 2 and 3 suggest several general patterns. Gentrifying neighbourhoods typically began and remained more educationally diverse over the study period than non-gentrifying neighbourhoods as defined by Freeman or central-city neighbourhoods in the cities studied by Wyly and Hammel. Education diversity generally increased until the 1980s and then declined thereafter.

3.2 Income

Figures 4, 5, and 6 present the index of ordinal variation scores for income. Figure 4 illustrates that gentrifying tracts as identified by Wyly and Hammel began more diverse in 1970 and, while fluctuating in terms of diversity, remained more diverse than other central-city neighbourhoods. The neighbourhoods identified by Freeman as gentrifying during the 1970s began the decade more diverse and remained more diverse than non-gentrifying or other neighbourhoods. Between 1970 and 1990, there were only

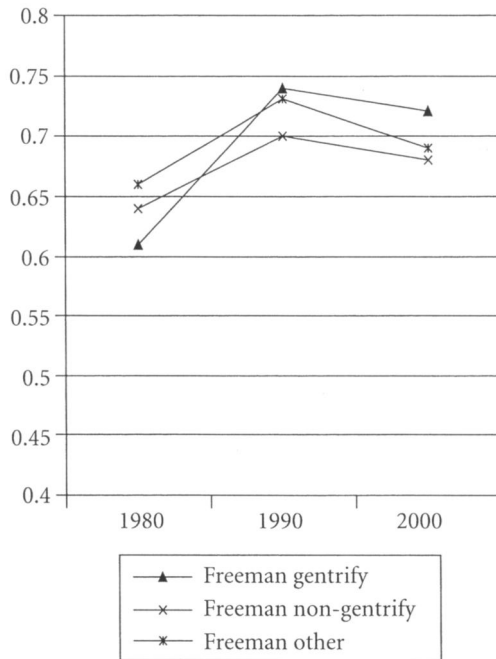


Figure 2. Tract-level entropy scores for education—gentrification began in 1980

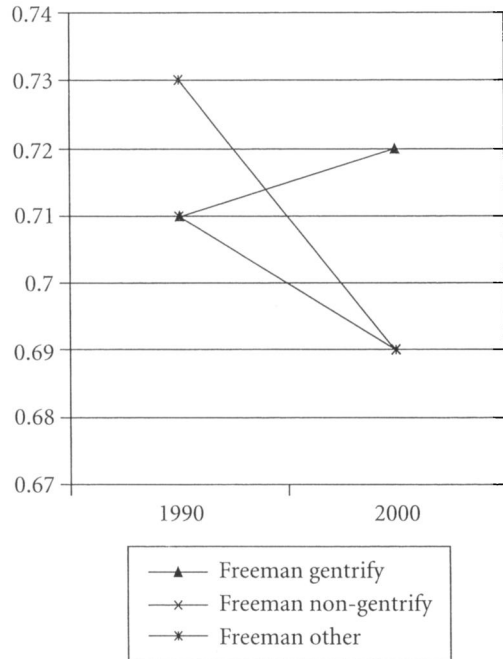


Figure 3. Tract-level entropy scores for education—gentrification began in 1990

modest changes in levels of income diversity. From 1990 to 2000, however, there was a larger increase in income diversity.

Figure 5 depicts trends in income diversity for tracts that began gentrifying in 1980 according to Freeman's measure. The overall pattern for all neighbourhoods mirrors that shown in Figure 4: income diversity declined modestly from 1980 to 1990 and then increased more substantially thereafter. The gentrifying tracts were always more diverse than the non-gentrifying ones; however, by 2000, other tracts had become the most diverse.

Finally, Figure 6 highlights changes in income diversity for those tracts that began gentrifying in 1990 according to Freeman's measure. Levels of diversity were virtually the same at the onset of the decade and, as was depicted in Figures 4 and 5, increased significantly among all types of tract over the decade. The gentrifying tracts increased somewhat more.

The entropy income measures, regardless of which classification scheme used generally showed modest changes in diversity between 1970 and 1990, but more substantial increases between 1990 and 2000. In contrast to the comparison neighbourhoods, the gentrifying neighbourhoods typically began more diverse and remained so over the study period.

3.3 Race

The final dimension of neighbourhood diversity we consider is race. Recall that we only extend the analysis back to 1980 because of changes in the way the Census Bureau classified race after 1970. We use a nominal measure of entropy because race, unlike education or income, is a nominal variable.

Figures 7 and 8 illustrate trends in racial diversity across the different classifications of neighbourhoods. Figure 7 shows tracts that began gentrifying in 1980 using Freeman's definition and tracts identified as

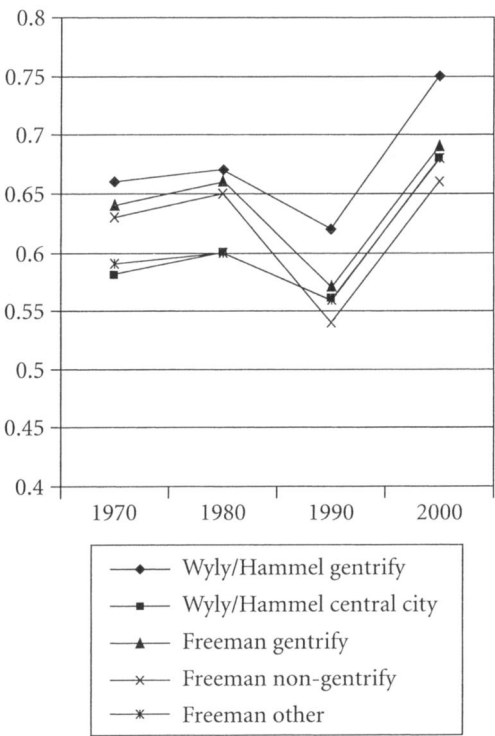


Figure 4. Tract-level entropy scores: income

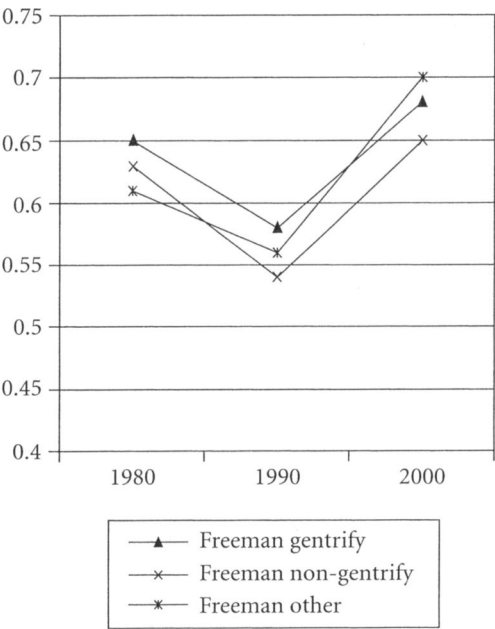


Figure 5. Tract-level entropy scores for income—gentrification began in 1980

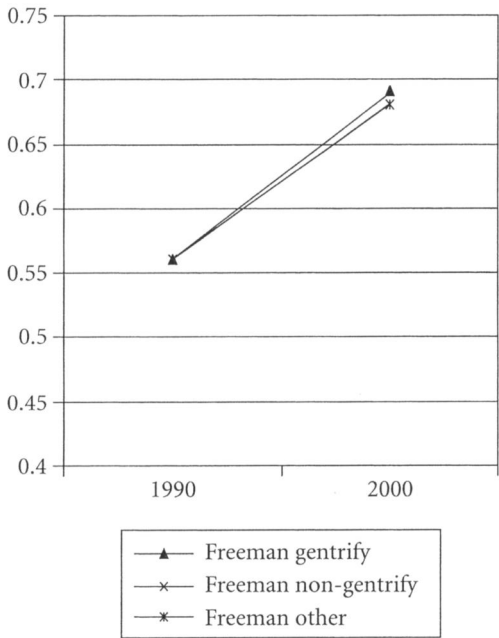


Figure 6. Tract-level entropy scores for income—gentrification began in 1990

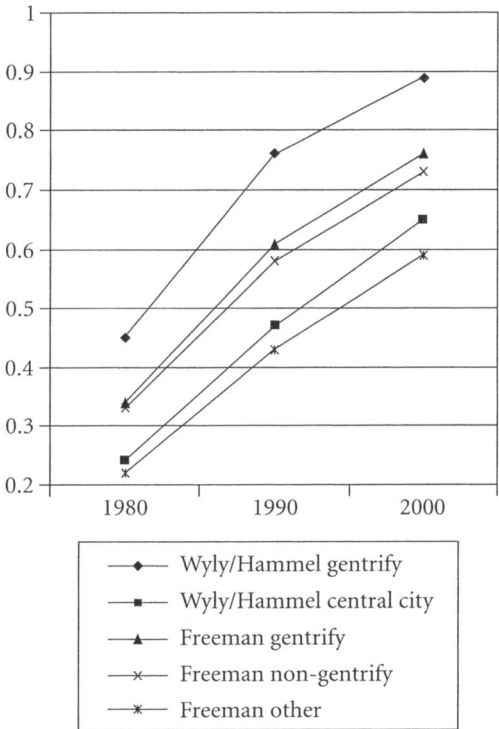


Figure 7. Tract-level entropy scores: race

gentrifying by Wyly and Hammel. Clearly, neighbourhood racial diversity increased during the study period substantially for all types of neighbourhood. This is not surprising given the increasing racial diversity of America. Wyly and Hammel's gentrifying neighbourhoods began being exceptionally diverse and remained exceptionally diverse up to 2000. Freeman's gentrifying tracts were more racially diverse than the tracts he classified as non-gentrifying or other neighbourhoods, but these gentrifying tracts were only modestly more diverse than the non-gentrifying tracts or the other tracts.

Figure 8 focuses on those tracts that were identified as beginning to gentrify in the 1990s according to Freeman's criteria. For these tracts, however, non-gentrifying tracts began more racially diverse and remained so over the course of the study period. Racial diversity increased among the three types of tract and the relative ranking of the tracts in terms of their racial diversity remained roughly the same—the gentrifying tracts were slightly less racially diverse than the non-gentrifying, but

more diverse than the other tracts over the study period.

Taken together, Figures 7 and 8 suggest the following with regard to neighbourhood racial diversity and gentrification. First, gentrifying neighbourhoods are typically more racially diverse than other types of neighbourhood, the only exception being neighbourhoods commencing gentrification in 1990 using Freeman's scheme. Secondly, the differences are substantial between the gentrifying neighbourhoods and central-city neighbourhoods as classified by Wyly and Hammel, but more modest between the gentrified, non-gentrified and other neighbourhoods as classified by Freeman. Thirdly, these differences, regardless of the classification scheme, remained stable over time. Finally, racial diversity increased in gentrifying neighbourhoods over the course of study period, as it did in all types of neighbourhood.

3.4 Neighbourhood Diversity: A Precursor to Gentrification?

The results presented thus far show that gentrifying neighbourhoods typically were more diverse at the start of the study period. This raises the possibility that neighbourhood diversity is actually a precursor of gentrification. This would be consistent with Ley's culture of consumption thesis whereby gentrifiers actively seek out social diversity of the type found in central cities (Allen, 1980; Ley, 1986). If this is true, we should find elevated levels of diversity in the decades prior to the commencement of gentrification.

To test the possibility that neighbourhood diversity precedes gentrification we examined diversity scores in the decades preceding gentrification. Because Wyly and Hammel did not identify the commencement of gentrification in the neighbourhoods they studied, their classification scheme was not included in this analysis.

For reasons of brevity we do not illustrate the results, which are available from the

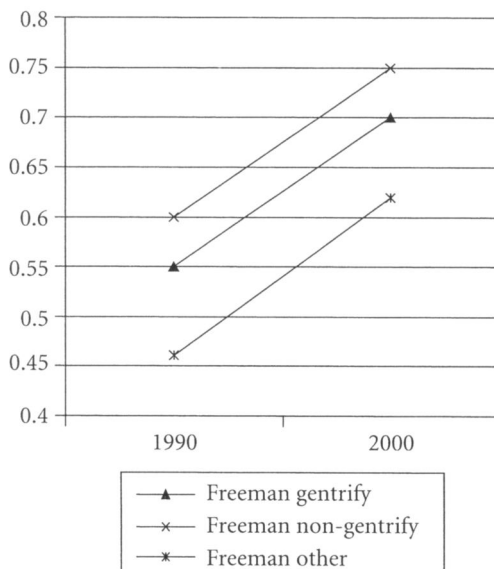


Figure 8. Tract-level entropy scores for race—gentrification began in 1990

author upon request. We found no evidence that higher levels of educational or racial diversity precede gentrification. For income diversity there was some evidence that could be construed as supporting the notion that diverse neighbourhoods are more likely to undergo the process of gentrification. The neighbourhoods that underwent gentrification in the 1990s were more diverse dating back to 1970.

3.5 Neighborhood Diversity and Gentrification

Several patterns emerge from the data presented in Figures 1–8. In general, gentrifying neighbourhoods started more diverse than other neighbourhoods and remained so throughout the study period. The size of the differences in diversity between the gentrifying neighbourhoods and other neighbourhoods remained relatively stable over the course of the study period. The differences in diversity are greater between the Hammel and Wyly gentrifying neighbourhoods and their central-city counterparts than between the Freeman gentrifying and non-gentrifying neighbourhoods. This is probably due to the fact that the comparison neighbourhoods selected for Freeman's measure of gentrification were selected to be as similar as possible to the gentrifying neighbourhoods, save for the actual gentrification.

Returning to the original hypotheses, the evidence allows us to refute the contention that gentrification reduces neighbourhood diversity. The evidence is somewhat more mixed on the question of whether gentrification increases neighbourhood diversity. However, it does appear that gentrifying neighbourhoods are typically more diverse and that this surfeit of diversity persists over time.

It is possible that gentrification indirectly impacts segregation, however, by affecting how various groups are spread across a given metropolitan area. For example, if poorer

households were increasingly shut out of neighbourhoods that were gentrifying and funnelled towards the remaining poor neighbourhoods, the end-result would be a more segregated metropolis with the poor concentrated in fewer neighbourhoods. In the next section, we test for this possibility.

4. The Segregated Metropolis and Gentrification

As described earlier, we use the information theory index to discern whether segregation is associated with gentrification. Using Freeman's definition of gentrification, we examine whether the proportion of the population living in gentrified tracts is associated with changes in segregation as measured by the information theory index. Because Wyly and Hammel examined a very small number of cities and because their sample was not selected in a probabilistic fashion, we decided not to use their measure of gentrification activity in our regression analyses. We do, however, explore the relationship between the number of gentrifying tracts and segregation in the metropolitan areas studied by Wyly and Hammel using a simple scatter plot, as will be discussed later.

To test if gentrification is associated with changes in segregation we regress the proportion of the population living in gentrifying tracts on changes in information theory index scores for education, income and race respectively. Because Freeman's gentrification metric in effect measures changes in the number of gentrifying tracts, we are regressing changes in the number of gentrifying tracts on contemporaneous changes in the information theory index. For education and income, we have changes in information theory index scores between 1970 and 1980, 1980 and 1990, and 1990 and 2000. For race, we have changes in information theory index scores between 1980 and 1990, and 1990 and 2000. Therefore, the regression models for

changes in education and income segregation have three observations per metropolitan area, one for each decade of change. The regression model for changes in racial segregation has two observations per metropolitan area. Because each metropolitan area contributes more than one observation to the sample, there is the possibility of dependence among observations and understated standard errors. Standard errors that are too small could lead to erroneous conclusions of statistical significance. To avoid this problem, the regression models are estimated using the cluster option in STATA. This produces Huber–White robust standard errors.

As we are merely interested in discerning the relationship between segregation and gentrification, we make no explicit attempt fully to model residential segregation. Thus, we begin with simple bivariate models. Where significant relationships between gentrification and segregation are in evidence, we add controls to lessen the possibility of observing a spurious relationship. The multivariate models are estimated using fixed effects for the metropolitan areas. This allows us to hold constant all of the time-invariant traits of the various metropolitan areas. A fixed effects approach is the equivalent of adding a dummy variable for each metropolitan area.

A fixed effects approach seems especially appropriate because we are not attempting to specify all of the factors that might contribute to changes in our measures of segregation. The regression equation is expressed as follows:

$$\Delta segregation_{it-it+1} = \alpha + \beta gentrification_{it} + \beta control_{it} + \beta Metro_1 \dots \beta Metro_n$$

where, α is the intercept; β represents the regression coefficients for the proportion of the population living in gentrifying tracts in metropolitan area i in decade t ; the control variables for metropolitan area i in decade t ; and a series of dummy variables representing each metropolitan area, save one.

4.1 Regression Results

The second column of Table 2 shows that there was no significant relationship between the change in the proportion of the population living in gentrifying areas and changes in education segregation as measured by the information theory index. The third column of Table 3 illustrates the relationship between income segregation and gentrification. Here, we do observe a statistically significant relationship. The information theory index

Table 2. Proportion of tracts gentrifying regressed on changes in education, income and racial segregation

| | <i>Change in information theory index for education segregation (N = 701)</i> | <i>Change in information theory index for income segregation (N = 701)</i> | <i>Change in information theory index for racial segregation (N = 430)</i> |
|----------------------------------|---|--|--|
| Proportion of tracts gentrifying | −0.02 (0.01) | −0.28*** (0.090) | 1.526*** (0.180) |
| Constant | 0.000 (0.001) | 0.009 (0.009) | −0.260*** (0.018) |
| R ² | 0.01 | 0.01 | 0.41 |

Notes: Robust standard errors in parentheses. *** Significant at 1 per cent. Gentrification as measured by Freeman (2005).

Table 3. Proportion of tracts gentrifying regressed on changes in income and racial segregation and control variables

| | <i>Change in information theory index for income segregation (N = 532)</i> | <i>Change in information theory index for racial segregation (N = 430)</i> |
|--|--|--|
| Proportion of tracts gentrifying | -1.522*** (0.147) | 0.736*** (0.134) |
| Metropolitan income entropy [Metropolitan race entropy] | -0.460*** (0.146) | -0.087 (0.268) |
| Percentage poor [percentage Black] | -0.054 (0.105) | -0.258*** (0.035) |
| Population | -0.000*** (0.000) | -0.000 (0.000) |
| Constant | 0.666*** (0.110) | -0.023 (0.155) |
| R ² | 0.72 | 0.70 |

Notes: Robust standard errors in parentheses. *** Significant at 1 per cent. Control variables for racial segregation models are in brackets. Gentrification as measured by Freeman (2005).

declines as the proportion of the population living in a gentrifying tract increases. Finally, the fourth column of Table 2 illustrates how changes in gentrifying activity predict changes in the racial segregation. The relationship is positive and significant. Increases in the information theory index are associated with increases in the proportion of the population living in a gentrifying tract.

The bivariate models suggest that gentrification lessens income segregation while increasing racial segregation. Before considering the implications of these findings, we add a few statistical controls to lessen the possibility that these relationships are not spurious. We look for controls that might be expected to be related to gentrification activity and the respective type of segregation. For our multivariate models of income and racial segregation, we add the population size of the metropolitan area and the region of the country. Larger metropolises are generally more segregated and also might be expected to be the site of more gentrification activity as these places will attract a disproportionate

share of diverse individuals who might undertake gentrification. We control for the region of the country because prior research has associated region both with segregation and gentrification activity (Farley and Frey 1994).

For our model of income segregation, we add the income entropy score for the metropolitan area as a whole and the percentage of poor in the metropolitan area. The level of income diversity in a metropolitan area might influence the level of income segregation there. We add the poverty rate because it is the poor who are most likely to be isolated from other groups and, consequently, might have an outsized impact on segregation.

For our model of racial segregation, we add the race entropy score for the metropolitan area and the percentage Black for the metropolitan area. The level of racial diversity in a given area may relate to the level of segregation found there. In more diverse areas, there might be more opportunities for each group to self-segregate. We control for the proportion Black because this is the most segregated group in America. Consequently, metro areas

with a large Black presence are likely to be more segregated (Massey and Denton, 1993).

Table 3 shows the results of our multivariate models for income and racial segregation. The addition of statistical controls does little to dampen the relationships observed in Tables 2 and 3. Increases in the proportion of the population living in gentrifying tracts are still associated with decreased income segregation and increased racial segregation respectively

4.2 Segregation and Gentrification as Defined by Wyly and Hammel

As mentioned previously, the small number of cities surveyed by Wyly and Hammel precluded the use of regression to discern the relationship between gentrification as defined by Wyly and Hammel and segregation. We did, however, plot the number of tracts that have undergone gentrification as the independent variable against segregation as measured using the information theory index. For purposes of brevity, we only summarise our conclusions from this exercise (details of which are available from the author upon request).

The resulting graphs showed weak relationships, at best, between gentrification and segregation. The slopes of the fitted lines, which are the single lines that best fit the data, were very modest, highlighting the weakness of these relationships. To the extent that there was a relationship, the fitted line for income suggests that the relationship is negative. Segregation by income declined more in metropolises with more gentrifying neighbourhoods. The same pattern was evinced for race. For education the reverse is true. The metropolitan areas with the most gentrified neighbourhoods had more segregation by education.

Taken together, the regression analyses performed on the full sample of metropolitan areas using Freeman's gentrification measure and the visual inspection of the small number

of metropolitan areas studied by Wyly and Hammel suggest that the relationship between segregation and gentrification may only be robust with regard to income segregation. The regression analyses found both income and racial segregation to be significantly related to gentrification after controls were included. Income segregation was negatively related, while racial segregation was positively related to gentrification. The number of metropolises included in the analysis using Wyly and Hammel's measure of gentrification was too small to draw firm conclusions, but the pattern for income segregation was consistent with what was found using Freeman's measure—the greater the proportion of gentrifying tracts, the lower the level of income segregation. Therefore, we have some confidence that the negative relationship between income segregation and gentrification is indeed real.

In contrast, the direction of the relationship between racial segregation and gentrification found using Wyly and Hammel's gentrification metric was the opposite of that found using Freeman's gentrification metric. Given the much larger sample size of the analysis based on Freeman's gentrification metric, more weight should probably be attached to the finding using Freeman's metric. The contradictory results only underscore the lack of a robust relationship for racial segregation and gentrification.

5. Conclusion

Because spatial relations have important economic, political and social implications, the spatial separation of social groups continues to be a major concern for students of the city. Gentrification, a process whereby the more affluent invade relatively poor neighbourhoods, would seem to have the potential to impact dramatically upon the spatial separation of social groups. Some have feared that gentrification, by displacing

low-income minorities would lead to greater spatial separation and more homogeneous neighbourhoods. Those with a more sanguine view of gentrification have often put forth the notion that gentrification will lead to the deconcentration of poverty or greater social mixing (Rose, 2004).

Our evidence suggests that, at the neighbourhood level, gentrification does not decrease diversity in the US. There was no evidence of gentrifying neighbourhoods becoming relatively less diverse over the course of the study period. This general pattern was robust across the two types of gentrification measures considered, one developed by Freeman (2005) and another by Hammel and Wyly (1996). Moreover, this was the general pattern, with a few exceptions, for education, income and racial segregation. This clearly runs counter to the notion that gentrification makes neighbourhoods more homogeneous. Although some original residents are displaced or replaced, the resultant neighbourhoods generally are still more diverse than other similar non-gentrifying neighbourhoods or other neighbourhoods in general.

Our results are in some ways both consistent and inconsistent with those of Walks and Maaranen (2008). Like Walks and Maaranen, we find that the level of racial or ethnic diversity generally increased in gentrifying neighbourhoods. Our results differ, however, because in the three Canadian cities studied by Walks and Maaranen ethnic diversity increased at a slower rate in the gentrifying neighbourhoods. These differences may be due to the differences between the Canadian and US contexts. The US is more segregated due to the historically higher levels of racial antagonism found there. Thus, the racial mixing engendered by gentrification, with Whites moving into Black neighbourhoods is rare outside the context of gentrification. This reasoning is of course speculative and worthy of further study.

The evidence is somewhat murkier on the question of whether gentrifying neighbourhoods increase diversity. In some instances, the gentrifying neighbourhoods began the study period more diverse than comparable neighbourhoods. However, there were also examples where gentrifying neighbourhoods were less diverse at the beginning of the study period and became relatively more so during this time-frame. This last pattern would be consistent with the notion that gentrification begets diversity. Yet because this pattern was not evinced across all metrics or outcomes, it would be imprudent to make such a claim based on the available US evidence. However, we cannot rule out the possibility that the causal arrow between gentrification and diversity perhaps runs from the latter to the former—greater diversity may lead to gentrification.

Either interpretation—gentrification leading to more diversity or diverse neighbourhoods attracting gentrifiers—would indeed be consistent with some demand-side explanations of gentrification. These demand-side explanations posit that the diversity of inner-city neighbourhoods is an important attraction to members of the post-industrial middle class. These would-be gentrifiers value diversity and tolerance and seek out diverse neighbourhoods as a way of establishing their cosmopolitan identity (Caufield, 1994; Ley, 1996). That the evidence presented here for the US shows that gentrifying neighbourhoods are typically more diverse than other neighbourhoods suggests there is a positive link between gentrification and social and economic diversity. The evidence presented here is perhaps too tenuous to resolve the long-standing debate between demand- and supply-siders over the relative importance of each to causing gentrification. Nevertheless, this is yet another piece of evidence that provides some, albeit modest, support for supply-side explanations.

At the US metropolitan level, the evidence is more mixed. We did find that increases in gentrifying neighbourhoods were associated with greater racial segregation using Freeman's measure of gentrification. However, this finding must be tempered by the fact that increases in gentrifying neighbourhoods were modestly associated with *less* racial segregation using Wyly and Hammel's measure of gentrification—albeit on a smaller and less representative sample. On the other hand, income segregation at the metropolitan level declined with increases in segregation using Freeman's measure of segregation. This pattern was also evident, albeit weakly, when using Wyly and Hammel's measure.

For education, there was also a weak negative relationship when using Wyly and Hammel's metric and an insignificant relationship when using Freeman's metric. Thus, when considering how gentrification is related to spatial segregation at the US metropolitan level, the story is mixed—weak evidence of increased separation for race and some evidence of decreased separation by income. We interpret the findings on race cautiously because the analysis based on Wyly and Hammel's metric, while on a small representative sample, contradicted the finding using Freeman's metric.

The US evidence for the relationship between gentrification and neighbourhood-level diversity thus appears to be more robust than that for metropolitan-level segregation and gentrification. In some ways, this may not be surprising. While gentrification can surely impact a specific neighbourhood in terms of diversity, its impact on a larger metropolitan area may be muted. The proportion of a metropolitan area undergoing gentrification is in almost all instances a relatively small proportion of the overall metropolis. Using Wyly and Hammel's metric, this proportion never exceeded 10 per cent. Using Freeman's

measure of gentrification, only 6 per cent of a metropolis' tracts on average underwent gentrification during the decade starting in 1990. It may be the case that gentrification affects too small an area significantly to affect metropolitan-level spatial patterns, hence the somewhat inconsistent findings with regard to segregation and gentrification.

For those in the US who make neighbourhood plans or policy, the results presented here contain important information. Certainly, those who want to anticipate gentrification, as a means of dampening its negative effects, might cast a particularly keen eye on diverse neighbourhoods, whether by class or race. It is these neighbourhoods that seem to be somewhat more prone to undergo gentrification. The results also imply that gentrification will result in people from diverse groups and backgrounds sharing residential space, with all the potential and pitfalls that entails. Certainly, the conflict that can arise from people with differing backgrounds residing in the same neighbourhood as a result of gentrification has been pointed out before (Freeman, 2006; Smith, 1996; Patillo, 2007). The results presented here imply that diversity will be an enduring feature of neighbourhoods undergoing gentrification.

At the scale of the US metropolitan area, the results presented here are perhaps too tenuous to strongly recommend a course of action. More research is needed before one could confidently draw conclusions about how gentrification impacts segregation. Until such research is produced, however, it may be wise at least to be wary of the possible negative impact that gentrification may have on segregation. This study did produce mixed evidence on this and other researchers have linked racial segregation and gentrification (Wyly and Hammel, 2004). Given the often pernicious effects of racial segregation, such attention would indeed be warranted.

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