

Calculating a gentrification metric across UWIN sites

Mason Fidino

The metric I think we should use

So, I had to go back to the drawing board a few times in order to generate a gentrification metric that could be applied to the 20 different UWIN cities in this study. Initially, we were going to hitch our wagon to the metrics provided in Freeman (2009). However, after collecting all the necessary census data and calculating these metrics it became apparent that the Freeman (2009) paper quantified city-level segregation, not gentrification. Instead, Freeman's 2009 paper actually used a gentrification metric they proposed in a 2005 paper of theirs to identify gentrifying areas. The general 'rules' tied to this metric are that a census tract must (Freeman 2005):

1. Be located in the inner city.
2. Have a median income less than the 40th percentile of the metropolitan area at the beginning of the intercentennial.
3. Has a percentage of housing built over the past 20 years that is below the 40th per centile for the metropolitan area.
4. Has a percentage increase in educational attainment that is greater than that of the metropolitan area.
5. Housing prices increased during the decade.

Unfortunately, when using these rules most UWIN sites within cities were not located in 'gentrifying' areas. As a result, this metric made gentrification so rare that it would be impossible to make comparisons in gentrifying vs non-gentrifying areas.

Because of this, I scoured through the literature again to find some other metrics that we could use to identify gentrifying areas within a city. From this, it became apparent rather quickly that there is a lot of disagreement on what 'rules' should be used to identify gentrification. This is good news, in some regards, as it gives us a little bit of wiggle room. After some searching, I decided to give a slightly modified version of the gentrification metric used by Chapple et al. (2017). This metric uses a two-step process to identify gentrifying areas. First, for an area to be gentrifying, it must be vulnerable to gentrification at the start of the study (in this case that is 2010). For a census tract to be vulnerable to gentrification it must:

1. Have at least 500 residents in year 1.
2. Have at least two of these three qualities.
 - a. The median income of residents in the census tract must be lower than the city's average income.
 - b. The proportion of college-educated residents in the census-tract must be lower than the proportion of college-educated residents across the city.
 - c. The proportion of nonwhite residents in the census tract must be greater than the proportion of nonwhite residents across the city.

Of 952 UWIN sites across 20 cities, 361 (37.9%) were considered vulnerable to gentrification (see more below).

Following this, a census tract was considered gentrifying if at the end of the study (in this case that is 2019) if the census tract:

1. Was vulnerable to gentrification in 2010.
2. Had at least two of these three qualities.

- a. The change in the proportion of college educated residents was greater than average change across the city.
- b. The change in the proportion of non-hispanic white residents was greater than the average change across the city.
- c. The change in median income was greater than the average change across the city, after correcting for inflation.

Of the 361 sites that were vulnerable to gentrification, 295 of them were considered gentrifying.

The data

The objective of this analysis is to determine how historical patterns of gentrification are associated to patterns of urban biodiversity. As such, we needed to compile census data from multiple years. To do so, I used the `tidycensus` package in R to query census data from the year 2000, 2010, 2015, and 2019. The 2000 data came from the 10-year decennial census whereas the remaining data come from the 5-year American Community Survey (ACS). The 10 year gap between 2000 and 2010 was because the 2005 5-year ACS data was not available. The 5-year ACS data was used because the 1-year ACS data did not contain estimates for smaller towns.

Across all of these years I compiled data on race, income, number of housing units educational attainment (Table 1) for all census tracts that fell within counties that were sampled. For a given city that is sampled, we are making the assumption that the metropoliation area is “the counties that are sampled.”

Step 1. Figuring out which areas are vulnerable to gentrification

Step 1.1 Household income in 2000 less than reginonal median.

To calculate this I took the median income at the 40th percentile for each census tract that fell within a county that was sampled in a given UWIN city. Following this, I determined which census tracts were less then that specific value. I then intersected the site coordinates on those census tracts to determine if that specific site fell within a census tract that had a median income less than the 40th percentile of the studies area in 2000. Unlike other metrics we calculated here, we don’t need to compare census tracts across time. Instead, all I did was calculated the 40th income percentile in 2000 and used that as the cutoff for the 2019 census tract levels.

Here is a table that shows how many sites are above (FALSE) and below (TRUE) the 40th percentile of median income. Some cities look to have a pretty even split, which is nice, while other cities (e.g. Salt Lake City, `scut` has many sites above the median income value).

Table 1: The number of sites below the median income in 2000 for each city.

	FALSE	TRUE
ahga	18	10
autx	14	18
boma	14	9
chil	55	56
deco	13	26
inin	26	19
ioio	28	9
jams	26	20
lrar	17	10
mawi	12	10
naca	37	34
phaz	42	45

	FALSE	TRUE
poor	18	5
rony	6	14
scut	129	17
sewa	19	14
slmo	28	10
tawa	17	25
uril	18	17
wide	12	17

Step 1.2. Educational attainment less than regional median

Here is a table that shows how many sites are above (TRUE) and below (FALSE) the average change in in educational attainment.

Table 2: The number of sites below the median educational attainment 50th percentile of educational attainment (i.e., college degree) between 2000 and 2019.

	FALSE	TRUE
ahga	20	8
autx	16	16
boma	16	9
chil	62	49
deco	15	24
inin	29	16
ioio	15	22
jams	32	14
lrar	15	12
mawi	16	6
naca	37	36
phaz	45	44
poor	14	9
rony	8	15
scut	136	10
sewa	20	13
slmo	35	3
tawa	27	15
uril	12	23
wide	18	11

Step 1.3: The census tract must have at least 500 people.

Step 1.4: The proportion of non-white people in a census tract is greater than the city median.

Table 3: The number of sites over with more non-white people than the city average.

	FALSE	TRUE
ahga	14	14

	FALSE	TRUE
autx	16	16
boma	12	15
chil	58	53
deco	18	21
inin	26	19
ioio	19	18
jams	32	14
lrar	19	10
mawi	7	15
naca	39	36
phaz	40	52
poor	12	11
rony	10	13
scut	131	15
sewa	19	14
slmo	27	11
tawa	25	17
uril	21	14
wide	7	22

Step 1.5: Combining the vulnerability metrics.

The site MUST have > 500 people and at least two of the other qualities to be considered vulnerable to gentrification.

Table 4: The number of sites that reside in census tracts we identified as vulnerable to gentrification.

	0	1
ahga	22	6
autx	17	15
boma	18	9
chil	55	56
deco	15	24
inin	27	18
ioio	28	9
jams	31	15
lrar	20	9
mawi	13	9
naca	41	34
phaz	44	48
poor	15	8
rony	9	14
scut	131	15
sewa	21	12
slmo	30	8
tawa	24	18
uril	18	17
wide	12	17

Step 2. Determine if a vulnerable location has undergone gentrification.

For a site to be considered gentrifying it must:

1. Have been vulnerable to gentrification in 2010.
2. Have at least two of the following qualities:
 - a. An increase in the proportion of college educated people that is greater than the city average.
 - b. An increase in the proportion of white people greater than the city average.
 - c. An increase in median household income greater than the city average (absolute value).

We already have the first part calculated, so we just need to do the rest.

Step 2.1. Has a percentage increase in educational attainment that is greater than that of the metropolitan area.

Here is a table that shows how many sites are above (TRUE) and below (FALSE) the average change in educational attainment.

Table 5: The number of sites where the increase in educational attainment (i.e., a college degree) between 2010 and 2019 was greater than the city average.

	FALSE	TRUE
ahga	15	13
autx	15	17
boma	16	9
chil	61	52
deco	16	23
inin	15	30
ioio	15	22
jams	21	25
lrar	19	8
mawi	14	8
naca	41	33
phaz	53	34
poor	15	8
rony	9	14
scut	118	28
sewa	15	18
slmo	15	23
tawa	27	15
uril	26	9
wide	18	11

Step 2.2: The proportion of white people living in a census tract is greater than the city average.

Table 6: The number of sites where the change in the proportion of white people was greater than the city average.

	FALSE	TRUE
ahga	21	7
autx	12	20
boma	12	13
chil	70	43
deco	18	21
inin	18	27
ioio	20	17
jams	30	16
lrar	18	9
mawi	7	15
naca	34	40
phaz	33	54
poor	16	7
rony	17	6
scut	68	78
sewa	9	24
slmo	9	29
tawa	21	21
uril	3	32
wide	17	12

Step 2.3: The change in median income was greater than the city average between 2010 and 2019.

Calculating this is similar to educational attainment within a given census tract. However, we also need to account for inflation in these calculations. I went to the [U.S. Bureau of Labor Statistics website] (https://www.bls.gov/data/inflation_calculator.htm) and used their inflation calculator to determine how much the price of \$1 has changed between January 2010 and January 2019 (it is \$1.17). Thus, I multiplied the dollar values of median housing prices in 2000 by 1.17 before comparing changes in housing prices.

Here is a table that shows how many sites reside in census tracts that have increased in price (TRUE) over time and those that have not (FALSE)

Table 7: The number of sites that reside in census tracts whose housing prices have increased between 2000 and 2019.

	FALSE	TRUE
ahga	17	10
autx	12	18
boma	14	9
chil	57	55
deco	13	26
inin	21	24
ioio	10	27
jams	28	18
lrar	14	13
mawi	11	10
naca	41	30
phaz	46	39

	FALSE	TRUE
poor	13	10
rony	13	7
scut	56	90
sewa	20	13
slmo	13	25
tawa	13	29
uril	14	21
wide	19	9

Step 2.4: Combining the gentrification metrics.

Table 8: The number of sites that reside in census tracts we identified as vulnerable to gentrification.

	0	1
ahga	26	2
autx	21	11
boma	23	4
chil	87	24
deco	24	15
inin	34	11
ioio	34	3
jams	40	6
lrar	25	4
mawi	18	4
naca	55	20
phaz	58	34
poor	21	2
rony	21	2
scut	140	6
sewa	25	8
slmo	32	6
tawa	32	10
uril	28	7
wide	22	7