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The Effect of Income Inequality on Gentrification in US Urban Counties*

T M Tonmoy Islam[a]

[a]*Department of Economics, Elon University, USA*

Abstract: Urban areas in the US have been experiencing a rise in gentrification in recent years. Gentrification can revitalize a city center and increase tax revenues for the local government at the expense of displacing the poor from their homes, moving them further out from the city center. A large body of literature have extensively studied the causes and consequences of urban gentrification; however, most focused in the gentrification of downtown areas. Little is known about the relationship between rising income inequality and the rate of gentrification in the metropolitan areas of the US. Using county- and census tract-level data, I look at whether the rise in income inequality from the 1980s is associated with the rise in the rate of gentrification in US urban counties. I find that there is a positive association between the share of total income going to the richer segment of the population, and the subsequent rise in the rate of gentrification of an urban county. The rise in the share of total income received by the bottom quintile of income distribution does not correlate with gentrification rates.

Keywords: urban counties, gentrification, income inequality

JEL Codes: R1, D3

1. INTRODUCTION

Like many other cities around the world, US cities are also witnessing a rise in the rate of gentrification in recent years. The downtowns of many large- and medium-sized cities have been transformed from low-income neighborhoods to high-income neighborhoods with amenities desired by the rich. Initially, this transformation was thought of revitalizing the city center and increase tax revenues for the local government (Beauregard (1985); Hackworth and Smith (2001)). However, such revitalization has come at the expense of the displacement of the poor from their homes, moving them further out from the city center (Guerrieri et al. (2013)). Consequently, the role of income inequality in influencing the process of gentrification has come into question. In this paper, I contribute to the literature by investigating if a rise in income inequality of urban counties (which are part of a metropolitan area) has contributed to the increase in their gentrification rates.

*Islam is an Associate Professor of Economics at Elon University, Elon, NC 27244. E-mail: tislam@elon.edu

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Many factors have been proposed that contributed to the gentrification of downtown areas. Factors such as increasing proportion of college graduates and high-skilled workers preferring to live in inner city neighborhoods, lowering of crime rates in central cities, a desire to live near entertainment activities, and favorable government policies have been proposed to have influenced gentrification (Glaeser and Gottlieb (2006);Couture and Handbury (2017);Zuk et al. (2018);Ellen et al. (2019); Lee et al. (2019); Su (2022); Couture and Handbury (2023);). Literature has also pointed out societal factors like delay in marriages, higher chance of social interaction, and the fall in crime rates have encouraged college-educated people to move to inner cities (Glaeser and Gottlieb (2006);Couture and Handbury (2017)).

A simple example can show how the factors mentioned above could gentrify not only the downtown, but also the areas surrounding downtown. Cities provide several amenities that are highly desired like wide variety of restaurants, parks, museums, theaters, and other entertainment activities. When crime rates in cities fell, it could have encouraged richer individuals, young college graduates, and high-skilled workers to move to downtown areas to enjoy those amenities. This phenomenon could lead to the gentrification of the city center. However, at the same time, income inequality was rising in the US (Piketty (2014);Tcherneva (2015);). As gentrification led to an increase in housing prices of downtown areas, it could make them more desirable for the richer population to reside or invest. With their higher disposable income and wealth, the richer population could buy properties from the middle class in the city center. Consequently, the downtown area can get re-gentrified, where the middle-class may be pushed out by the richer population. Some middle-class families pushed out of downtown may move to the areas surrounding downtown, which could push up property prices in those areas. Thus, it can be inferred that gentrification of the downtown area may not be limited in downtown areas only, it could spread to the surrounding regions. Studying the effect of income inequality at the metropolitan area, rather than the city center, would give us a better understanding of how income inequality affects the whole city.

In this paper, I contribute to the literature by investigating if a rise in income inequality of urban counties (which are part of a metropolitan area) has contributed to the increase in their gentrification rates. While there is evidence of gentrification in rural areas (Nelson et al. (2010);Lichter et al. (2021)) I focus primarily on counties in the metropolitan statistical areas of the US. Specifically, I study if there is any meaningful association between the rise in the share of total income going to the richest segment of society, and the subsequent change in the rate of gentrification of metropolitan areas in the following years. While there are a few papers have studied the relationship between inequality and gentrification (Couture and Handbury (2023), they mainly focused on gentrification of downtown areas, and not the whole metropolitan areas. My contribution to the literature is that I look at county-level gentrification index to see how it is associated with inequality.

I collect decadal county-level data of urban counties, along with their census tract data from the website of the National Historical Geographic Information System (NHGIS). I use the definition set forth by Ellen and O'Regan (2011) to determine if a census tract has gentrified over a decade and then aggregate it to a county level. Using this gentrification variable as my dependent variable, I run a series of OLS fixed effects regressions, where the main variable of interest is the percent of total county income going to the top 20 percent

and 5 percent of earners respectively. The results show that rising inequaltiy is positively associated with the rise in the rate of gentrification in a county. This result is robust to different specifications of the model.

The rest of the paper is structured in the following way: the Literature Review examines the existing research on gentrification and inequality, the Model section introduces the reduced form regression, the Data section explains where the data was collected from, and how it was complied. The Results section explains the main findings of the paper, and the Robustness section studies the sensitivity of the main results. The Conclusion section then concludes the paper.

2. LITERATURE REVIEW

The term 'gentrification' was first defined by sociologist Ruth Glass in the 1960s (Finio (2022)). Glass (1964) found that wealthy households moving to a neighborhood changed it from predominantly rent-occupied to predominantly owner-occupied. Subsequently, this change in the composition of the neighborhood increased housing costs, which moved low-income residents away from that neighborhood (Glass (1964)). Studying London, Glass (1964) said that gentrification is inevitable in a city, and a multitude of factors can affect it. Since then, different researchers have provided various methods of measuring gentrification, namely Freeman (2005),Walks and Maaranen (2008),McKinnish et al. (2010), and Ellen and O'Regan (2011).

In the beginning, gentrification was viewed favorably as a means of improving the conditions of decaying and low-income neighborhoods in cities (Lees et al. (2013)). Also, states were interested in developing decaying neighborhoods to generate higher tax revenue (Beauregard (1985); Hackworth and Smith (2001); Zuk et al. (2018)). Other benefits from gentrification included increasing land values, reducing vacancy rates, and growth spillovers (Atkinson (2004); McKinnish et al. (2010)) provide some evidence that gentrifying black neighborhoods increased the likelihood of middle-class black households moving to those areas. Thus, some researchers believed that gentrification brings in more benefit, and neighborhood decay is more detrimental for the economy (Vigdor (2010)).

However, initial studies on gentrification show that this development of decaying neighborhoods came at the expense of displacing the poor moving out to other parts (Zukin (1987)). Later studies have indicated that gentrification can reduce affordable housing and displace business and cultural activities that were valued by the poor living in cities (Hyra (2017)). It is also more likely to have pushed out people who have low credit scores (Ding et al. (2016)). Conversely, Asquith et al. (2023) have shown that building new rental housing in low-income neighborhoods can reduce the existing rent of surrounding apartment complexes by as much as six percent.

Gentrification also is said to have reduced the protection of the working class (Hackworth and Smith (2001)), which led to their flight from city centers to the periphery of cities, or to suburban areas. Ding et al (2016) found evidence that that those displaced due to gentrification are most likely to move to other low-income neighborhoods. Gentrifying neighborhoods may also experience job losses, especially low- and medium-income jobs. However, those

who lost their jobs due to gentrification may get higher pay jobs in neighborhoods further away (Meltzer and Ghorbani (2017)).

There are many reasons put forth why US cities experienced rising gentrification beginning in the 1990s. Guerrieri et al. (2013) showed theoretically and empirically why gentrification could occur in a city They (2013) assume that a person may like to live around people who are richer, and this preference leads to segregation of neighborhoods by income. If there is a demand shock in a city, then richer migrants who move to the city may move to the poorer neighborhoods that are adjacent to the richer neighborhoods. Finally, these richer migrants will bid up the price of housing in the poorer neighborhood, forcing the poor to leave the city (Guerrieri et al. (2013)). Other research has provided some indication that households who are renters, college graduates high-skilled workers, childless, or minorities, also may move to poorer or inner city neighborhoods (Couture and Handbury (2017); Ellen et al. (2013);Su (2022)). There was also a rise in high-skilled, dual-earner households, who preferred low-leisure, and these families were more inclined to move to cities (Edlund et al. (2022)) which could further lead to a rise in gentrification.

Although urban development helped bring about gentrification, another strand of literature argues that the falling levels of violent crime in the central city helped to bring in higher-income and college-educated individuals to live in the central city (Glaeser and Gottlieb (2006); Ellen et al. (2019)). This desire to live close to amenities offered by cities was documented in papers like Couture and Handbury (2017) and Lee et al. (2019). Other factors like growth in top income, delay in marriages, and higher chance of social interaction are said to have increased people moving to inner cities (Glaeser and Gottlieb (2006);Couture and Handbury (2017)).

The model developed in Couture et al. (2024) indicates that rising income inequality could have influenced gentrification of downtown areas. There is strong evidence that the United States witnessed a rise in income inequality from the 1980s. The percent of total income going to the top 1 or 10 percent of earners fell in the 1950s and 1960s, before rising again in the 1970s and onwards (Piketty (2014); Tcherneva (2015)). Other research, such as Islam (2016) provides some indication that most of the recent economic growth of the US was driven by the richest earners of the population. The following Table 1 illustrates the share of pre-tax income going to different segments of the population [1]

The Table shows that from 1970 till 1980, the share of total income going to the top 10 percent of the income group was steady at about 33 percent. But, from 1990 till 2019, their share rose from 38.8 percent to 45.7 percent. On the other hand, the proportion of income going to the bottom 50 percent fell from 16.9 percent to 13.6 percent over the same period.

This rising inequality in the late twentieth century may have influenced investment in city centers. Couture et al. (2024) propose that demand for high quality amenities increase in city centers with rising income inequality. This, according to their (2024) model, can lead to higher investment in those neighborhoods, which can eventually increase home prices. Consequently, the poor now either must pay a higher price to live in those neighborhoods,

[1]Data obtained from the World Inequality Database. https://wid.world/share/#0/countrytimeseries/sptinc_p0p50_992_j;sptinc_p99p100_992_j;sptinc_p90p100_z/US/2015/eu/k/p/yearly/s/false/8.267999999999999/60/curve/false/1928/2022. Retrieved July 31, 2024

Table 1: Share of Total Pre-tax Income Going to Different Segments of the Population

Share of Pre-Tax Income	To Top 1% of Population	To Top 10% of Population	To Bottom 50% of Population
1970	10.70%	33.60%	21.10%
1980	10.40%	33.80%	20.10%
1990	16.90%	38.80%	16.90%
2000	17.30%	42.70%	15.10%
2010	17.90%	43.80%	13.90%
2019	19.00%	45.70%	13.60%

Notes: Source: The World Inequality Database. Retrieved July 31, 2024.

or they move further from the city center (Couture et al. (2024)). Baum-Snow and Hartley (2020) also posit that the rise in employment opportunities in suburban areas also helped move minorities from inner cities to the suburbs.

Other research have indicated that rising income inequality may not have been beneficial for the poor in cities. While income inequality was both 'good' and 'bad' for cities, after 2000, higher income inequality in US cities is said to have led to less job growth (Partridge and Weinstein (2013)). Along with that, papers such as Su (2022), Diamond (2016) and Couture and Handbury (2023) provide evidence that once higher-skilled workers began to live in neighborhoods close to the city center (which happened in the US since the 1990s, according to Su (2022)), it could lead to an increase in the local amenities. Baum-Snow and Hartley (2020) alternately find that it is the white college-educated moving to downtown areas and demanding amenities they desire that may have led to the pushing out of minorities (who did not value those amenities as highly) from downtown to suburban areas. Other studies have indicated that a gentrifying neighborhood could increase income inequality in the neighboring areas (Meligrana and Skaburskis (2005); Christafore and Leguizamon (2012)), which could push the poor further out.

Taking all these together, it can be inferred that the rising income of the rich may have increased their investment in properties and amenities in US city centers. Those investments could have spillover effects, leading to the gentrification of the surrounding areas. Further re-gentrification of downtown and its surrounding areas could happen, which in turn could gentrify other parts of the city and the suburbs. Thus, studying the role of income inequality on gentrification rate of the whole metropolitan area could provide the full impact of income inequality on a city, and not just the downtown areas.

3. THE MODEL

In the years following World War II till the 1970s, income growth of the bottom 90th percentile exceeded that of the top 10th percentile in the US (Tcherneva (2015)). However, this trend reversed in the 1980s (Tcherneva (2015)). Such a rise in income inequality could have large effects on various socio-economic indicators. Following the model in Couture et al. (2024), I theorize that the additional income in the hands of the rich led to property

investments and revitalization of inner-city neighborhoods, which were previously termed as decaying (Wallace (1991)). Such revitalization of the inner-city could have pushed out the poor leading to gentrification. Therefore, a rise in income inequality could be associated with a rise in gentrification rates in urban areas.

To study this theory, I study the following model in this paper:

$$Gen_{i,t} = \alpha_i + \beta Dist_{i,t-10} + \gamma X_{i,t} + \eta_t + \epsilon_{i,t} \tag{1}$$

The dependent variable is the rate of gentrification between time t and time *t-10* of county *i*. The main regressor $Dist_{i,t-10}$ is a measure of the income inequality of county i in time *t-10*. Thus, this model is looking at how the income inequality of a county in a given time period can affect the rate of gentrification in the subsequent decade. I use different variables as proxies for $Dist_{i,t-10}$, such as (i) the share of total income going to the top 20 percent of income distribution ($Share_{Top20}$), (ii) the share of total income going to the top 5 percent of income distribution ($Share_{Top5}$), (iii) the difference between income shares going to the top income earners and bottom quintile of income distribution, namely $Share_{Top20}$ - $Share_{Bottom20}$, and $Share_{Top5}$ - $Share_{Bottom20}$, (iv) the ratio between income shares going to the top income earners and bottom quintile of income distribution given by these two equations: $Share_{Top20}$ / $Share_{Bottom20}$, and $Share_{Top5}$ / $Share_{Bottom20}$,[2] and (v) the share of population living in gentrified regions of a county. The variable X includes some of the different socioeconomic factors that can affect gentrification of a region such as median income and percentage of college graduates in the region, α_i is the county-specific fixed effect, η_t is the time effect, and $\epsilon_{i,t}$ is the error term. I focus on counties that are defined as part of the metropolitan statistical area (MSAs) of the US anytime during 1980-2020. This allows me to include a large set of counties in my analysis.

The gentrification index, as explained below are in rates, so I am using the lagged values of the regressors to explain the subsequent rate of gentrification of a county. There can be an issue of whether it is appropriate to use lagged regressors to determine the relationship between the dependent variable and the regressor. Bellemare et al. (2017) demonstrated using Monte Carlo simulations that lagged regressors do not eliminate endogeneity and can bias the coefficients. While they (2017) caution against using lagged regressors, they nonetheless say that it may be appropriate to use them if there is no reverse causality and if the relationship only occurs in lags, and not contemporaneously. Since gentrification is a slow-moving variable, requiring (1) the poor to move out of the neighborhood while the rich move in, (2) construction and renovation of homes, (3) construction of store and/or office spaces, and (4) the operation of different amenities to attract the rich, I theorize that the relationship between inequality and gentrification is not contemporaneous. Higher inequality may take some time to translate into factors that influences gentrification [3]. Similarly, I

[2]I did not include Gini Coefficient which is popular measure of inequality because the interpretation of the coefficient on the Gini is difficult to comprehend. This is because a one point change in Gini is a large change in inequality. On the other hand, looking at proportion of income going to top 5 percent or top 20 percent has an easier interpretation, and Piketty (2014) used proportions like these to understand inequality dynamics

[3]Furthermore, I ran regressions where the contemporaneous gentrification level was regressed using contemporaneous inequality level as the regressor, but the coefficient was significant.

believe that there is no reverse causality, that is, inequality is not affected by gentrification. This is because recent research has indicated that the rising inequality levels in the US are mainly associated with a falling productivity of workers (Ernst et al. (2024)). Thus, inequality is influenced by macroeconomic factors, and not the changes in neighborhood dynamics.

There is no one well-established method of measuring gentrification of a region. There are different methods, which mainly rely on finding the proportion of areas within a region experiencing a large positive shocks; for example, factors like household/family income, characteristics of housing built, educational attainment, housing prices, proportion of tenants living in the community, social status of residents, and proportion of artists in the community have been used independently or as part of a composite index to measure gentrification (among many, see Freeman (2005); Ellen and O'Regan (2011); McKinnish et al. (2010); Finio (2022); Walks and Maaranen (2008)). In this paper, I use the method created by Ellen and O'Regan (2011) to measure the gentrification rate of a county. In their (2011) paper, they define an area to be gentrified in the following way:

(i) First, they find out which areas in a region have an average income in the bottom 40th percentile of the region. Lets call this set of areas S.

(ii) They then calculate the ratio (R), which equals to the average household income in each area in set S divided by the region's average household income. This ratio R is calculated for years t and *t+10* for each of the areas in S;

(iii) If R_{t+10} - $R_t > 0.05$ for an areas in S, then that area is said to have gentrified.

I use the data from the census tract level to construct the gentrification index at the county level. A census tract is a semi-permanent sub-division of a county that has a population between 1200 to 8000 individuals [4]. For example, when measuring the gentrification index following Ellen and O'Regan (2011), I first identify the 'poor census tracts,' defined as the ones whose average household income fall in the bottom 40 percent of the income distribution of a county in a given year t. For those poor census tracts, I then calculate the 'ratio' of the average household income to that of the county average household income for years t and *t+10*. Finally, from those poor census tracts, I identify the ones that experienced an increase in the ratio by more than five percentage points over a decade. These are the gentrifying tracts in a county. The rate of gentrification is the proportion of gentrifying tracts in a county [5] For example, when measuring the gentrification index following Ellen and O'Regan

[4]Source: Glossary. The Census Bureau. https://www.census.gov/programs-surveys/geography/about/glossary.html#par_textimage_13. Last revised: February 10, 2022

[5]One of the reasons I used census tracts as the unit to measure gentrification, as opposed to other geographic units such as zip code is because, according to the definition, the census tracts are relatively permanent. However, it is not uncommon for a census tract to split or merge over time. To ensure that the boundaries of census tracts are not changing over time I use a geographic crosswalk to merge census tracks so that the borders remain consistent over time. In other words, I use the same census tract boundaries of 1980 for the years 1990, 2000, 2010 and 2020. This is possible because when a census tract splits, the numbers remain consistent, for example, if a hypothetical census tract number 1111 of 1980 is split into two smaller census tracts in the next decade (1990), the subsequent census tracts are numbered 1111.01 and 1111.02. Now if 1111.01 is further split into two in the next decade (2000), then the new census tracts are numbered as 1111.03 and 1111.04. Thus, using the census tract id, one can combine them to their original boundary (that of 1111) so that their boundaries are consistent with that of the initial year. For more information,

(2011), I first identify the 'poor census tracts,' defined as the ones whose average household income fall in the bottom 40 percent of the income distribution of a county in a given year *t*. For those poor census tracts, I then calculate the 'ratio' of the average household income to that of the county average household income for years *t* and *t+10*. Finally, from those poor census tracts, I identify the ones that experienced an increase in the ratio by more than five percentage points over a decade. These are the gentrifying tracts in a county. The rate of gentrification is the proportion of gentrifying tracts in a county.

I chose the Ellen and O'Regan (2011) gentrification index because it relies on one factor, income, to determine gentrification. Their (2011) method also uses relative measures when determining the rate of gentrification, and so they consider the changes in prices and incomes in a city when determining its gentrification rate. The definition is also flexible, ensuring that gentrification in a city can be an ongoing process. For example, in a city, besides the poor neighborhoods, the working-class neighborhoods could also gentrify. This (2011) measure helps us identify whether poor and working-class neighborhoods have gentrified. It also allows for the regentrification of neighborhoods. Other factors, like share of tenants in a neighborhood or proportion of working age population with a bachelor's degree could be used to indicate if a neighborhood gentrified. However, these proportions have an upper limit (maximum of 1), so these variables cannot allow for regentrification after a certain point.

4. DATA

I obtained the census-tract and county level data from the website of the National Historical Geographic Information System (NHGIS) maintained by the University of Minnesota. NHGIS maintains a repository of different socio-economic datasets and has a simple interface to download data across different time periods. The data used in this paper has been originally collected by the Census Bureau, and NHGIS website acts as a data repository for that data. I downloaded data from 1990, 2000, 2010 and 2019. I did not use 2020 data because of the COVID-19 pandemic, which affected the county-level incomes.

I focus on counties that are part of the metropolitan statistical areas any time between 1980 and 2010. This gives me 1250 counties that are part of an urban area between the years 1980 – 2019. Table 2 provides the summary statistics of the downloaded data.

The Ellen and O'Regan (2011) method of measuring gentrification shows that 34 percent of the census tracts in urban areas have gentrified in the years 1990 to 2020. This is a large amount of urban land area, implying that a considerable amount of displacement of the poor occurred in urban counties. The table also shows the large differences in income shares going to different population groups. The share of total income going to the top 20 percent and 5 percent of the income distribution has a mean of 44 percent and 20 percent respectively, while that of the bottom 20 percent is only 3.85 percent. The real median income of urban counties is about 65,000 dollars.

As controls, I added county-level variables like unemployment rate, share of college graduates, median income, and the share of whites and blacks/African Americans. The economic variables were added to control for the economic conditions that could lead to gentrification.

please see: https://www2.census.gov/geo/pdfs/reference/GARM/Ch10GARM.pdf.

Table 2: Summary Statistics

Variable	Mean	Std. Dev.
Gentrified Measure Ellen and O'Regan (2011)	0.341	0.183
Share of Total Income going to top 5% of Earners	20.02	2.688
Share of Total Income going to top 20% of Earners	44.36	3.163
Share of Total Income going to 60-80% of Earners	23.55	0.911
Share of Total Income going to 40-60% of Earners	15.62	1.036
Share of Total Income going to 20-40% of Earners	9.612	1.029
Share of Total Income going to bottom 20% of Earners	3.854	0.685
Share of White Population	0.755	0.185
Share of Black/African American Population	0.107	0.135
Unemployment Rate	0.076	0.949
Share of College Graduates	0.247	0.105
Median Income (real)	64,836.9	16,879
Per Capita Income (real)	28,562.62	6,666.92
Number of counties	1,250	
Number of observations	3,131	

Notes: Data collected from the website of National Historical Geographic Information System (NHGIS) (website: http://www.nhgis.org). NHGIS compiles and collects data from different national censuses, including that of the United States. These data were originally collected by the US Census Bureau, and the NHGIS provides a portal to download the data across different time periods.

So, a poorer inner-city neighborhood with high unemployment rate may be more likely to gentrify than a richer neighborhood with low unemployment rate. Share of college graduates is used as a control since some papers, like Baum-Snow and Hartley (2020) have used it as a factor that affects gentrification. I also added the share of racial groups as regressors because although race is not used as an indicator in the index of gentrification, there is evidence that richer whites displace minorities in gentrifying neighborhoods (Finio (2022)). Thus, I added share of racial groups as it could be associated with gentrification. The urban counties have about 25 percent of the population with a college degree or higher, and have a real per capita income of about 28,500 dollars. The urban counties are about 75 percent white, and have an average unemployment rate of 7.6 percent.

5. RESULTS

Table 3 shows the main regression results. The dependent variable the measure of gentrification defined by Ellen and O'Regan (2011), as explained above. The main variable of interest in column (1) is the share of total income going to the top 20 percent of earners in the county ($Share_{Top20}$). Column (1) shows that a one percentage point increase in ($Share_{Top20}$) is significantly associated with an increase in the gentrification rate by 0.017*100 =1.7 percentage points in the subsequent decade. This indicates that there is a sizable association between rising income inequality and gentrification. Adding a squared term in column (2) renders the effect to be insignificant.

Column (3) uses a different regressor, namely the share of total income going to the

Table 3: Main Regression Results

Variable	(1)	(2)	(3)	(4)
Lag of Share of total	0.017**	-0.004		
income to top 20% of Earners	(0.003)	(0.036)		
Lag of Share of total		0.000		
income to top 20% of		(0.000)		
Earners squared				
Lag of Share of total			0.017**	0.0320
income to top 5% of Earners			(0.0034)	(0.0217)
Lag of Share of total				-0.0004
income to top 5% of				(0.0005)
Earners Squared				
Observations	3,131	3,131	3,131	3,131
R-squared	0.0439	0.0440	0.0481	0.0485
Number of fips	1,250	1,250	1,250	1,250

Notes: Robust standard errors in parenthesis. The dependent variable is the gentrification index determined by the methods outlined in Ellen and O'Regan (2011). The regression controlled for year effects, county-level fixed effects, and a constant. ** indicate significance at the 5 percent level, * at the 10 percent level.

top 5 percent of earners ($Share_{Top5}$) as the main variable of interest. Here too, the coefficient is positive and significant at 0.017, which indicates that increasing ($Share_{Top5}$) by one percentage point is associated with an increase in the gentrification rate by 1.7 percentage points. Adding a squared term (column (4)) has the same interpretation as that in column (2) gentrification.

5.1. Further Regressions

Table 4 adds some more county-level variables as regressors – like percentage of different racial groups, the natural log of median income, the unemployment rate and the percentage of college graduates. As mentioned in the Data section, these variables either have been used as indicators to gentrification, or has been associated with gentrification, so I have added them as controls. Adding additional regressors did not change the sign and significance of the coefficients. The coefficient on ($Share_{Top20}$) is positive and significant at 0.018, indicating that it is positively associated to the rate of gentrification of the subsequent decade. Similar to Table 3, increasing ($Share_{Top5}$) by 1 percentage point is also positively correlated with gentrification. Adding a square term removes the significance of the main variable of interest. As further tests, I ran regressions where all the regressors were lagged values. The coefficients and their significance of the main variables of interest remained similar to that seen in Table 4, so I did not report them in the paper.

Taken together, Tables 3 and 4 show that the increase in gentrification in a city parallels the rising levels of income inequality in a city. The rise in inequality beginning in the 1980s mean that the richest and the educated segments of society began to receive an increasing

Table 4: Main Regression Results with Additional County-level Regressors Added

Variables	(1)	(2)	(3)	(4)
Lag of Share of total	0.018**	-0.004		
income to top 20% of Earners	(0.003)	(0.036)		
Lag of Share of total		0.000		
income to top 20% of		(0.000)		
Earners squared				
Lag of Share of total			0.017**	0.031
income to top 5% of Earners			(0.003)	(0.017)
Lag of Share of total				0.000
income to top 5% of				(0.000)
Earners Squared				
Lag of ln(Median Income)	YES	YES	YES	YES
Lag of Pct of Different Racial Groups	YES	YES	YES	YES
Lag of Prop. Of College Graduates	YES	YES	YES	YES
Lag of Unemployment Rate	YES	YES	YES	YES
Year Effect	YES	YES	YES	YES
Observations	3,131	3,131	3,131	3,131
R-squared	0.0473	0.0474	0.0516	0.0518
Number of fips	1,250	1,250	1,250	1,250

Notes: Robust standard errors in parenthesis. The dependent variable is the gentrification index determined by the methods outlined in Ellen and O'Regan (2011). The regression controlled for year effects, county-level fixed effects, and a constant. ** indicate significance at the 5 percent level, * at the 10 percent level.

Table 5: Using a Different Regressor as a Proxy for Income Dispersion

Variables	(1)	(2)	(3)	(4)
Lag of Diff.	0.015**	-0.012	0.015**	0.018*
	(0.003)	(0.023)	(0.002)	(0.011)
Lag of Diff. squared		0.000		0.000
		(0.000)		(0.000)
Observations	3,131	3,131	3,131	3,131
R-squared	0.042	0.043	0.047	0.048
Number of fips	1,250	1,250	1,250	1,250

Notes: Robust standard errors in parenthesis. The dependent variable is the gentrification index determined by the methods outlined in Ellen and O'Regan (2011). The regression also controlled for the lag of the natural log of county median income, lag of the pct of different racial groups in the county, lag of the proportion of college graduates in the county, lag of county-level unemployment rate, county-level fixed effects, year effects, and a constant. ** indicate significance at the 5 percent level, * at the 10 percent level. The variable *diff* = $Share_{Top20}$ - $Share_{Bottom20}$ in columns (1) and (2) of Table 5, and *diff* = $Share_{Top5}$ - $Share_{Bottom20}$, in columns (3) and (4).

share of total income. During that time, young college-educated and skilled workers began to move to the city centers. These factors, coupled with the additional wealth accumulated by the rich provided them an opportunity of lucrative investments in city centers. Cities then responded by supplying more luxurious housing and service, driving up housing prices. The rich then may have begun to move to the cities. Consequently, more neighborhoods adjacent to the gentrified neighborhoods may start to gentrify, as seen in Guerrieri et al. (2013), and even the middle, and upper-middle class may be pushed out of the city center if more higher-priced amenities are built to attract even richer residents to the city.

6. ROBUSTNESS TESTS

6.1. Different Measure of Income Inequality

Instead of using $Share_{Top20}$ to indicate income inequality, I use the difference between the percentage of income going to the top and bottom 20 percent of earners as the main variable of interest. Table 5 illustrates the results. I define the inequality variable *diff* = $Share_{Top20}$ - $Share_{Bottom20}$ in columns (1) and (2) of Table 5, and *diff* = $Share_{Top5}$ - $Share_{Bottom20}$, in columns (3) and (4). The results are similar to that seen in Tables 3 and 4. The magnitude of the diff. variable shows a positive association with the gentrification rate. Thus, columns (1) and (3) show that an increase in the variable diff. by one percentage point is associated with an increase in the gentrification rate by about 1.5 percentage points of the following years. Similar to above regressions, adding a squared term removes the significance of the main variable of interest.

I also try to use the ratio of share of total income going to the richest of earners to share of

Table 6: Using a Different Regressor as a Proxy for Income Dispersion

Variables	(1)	(2)	(3)	(4)
Lag of Ratio	0.010**	0.025**	0.023**	0.050**
	(0.003)	(0.007)	(0.005)	(0.012)
Lag of Ratio squared		0.000		-0.002**
		(0.000)		(0.001)
Observations	3,131	3,131	3,131	3,131
R-squared	0.039	0.041	0.043	0.047
Number of fips	1,250	1,250	1,250	1,250

Notes: Robust standard errors in parenthesis. The dependent variable is the gentrification index determined by the methods outlined in Ellen and O'Regan (2011). The regression also controlled for the lag of the natural log of county median income, lag of the pct of different racial groups in the county, lag of the proportion of college graduates in the county, lag of county-level unemployment rate, county-level fixed effects, year effects, and a constant. ** indicate significance at the 5 percent level, * at the 10 percent level. The variable $ratio = Share_{Top20} \,/\, Share_{Bottom20}$ in columns (1) and (2), while columns in (3) and (4), $ratio = Share_{Top5} \,/\, Share_{Bottom20}$.

total income going to bottom 20 percent. The results are illustrated in Table 6. Columns (1) and (2) of Table 6 uses $ratio = Share_{Top20} \,/\, Share_{Bottom20}$ as the variable measuring inequality, while Columns (3) and (4) uses $ratio = Share_{Top5} \,/\, Share_{Bottom20}$. The table shows a similar trend seen in Table 5. In columns (2) and (4), there is some evidence of a squared term being significant, but almost all the ratio data is in the upward segment of the curve, so we see that there is a positive association between inequality and the subsequent gentrification.

As a final test, I look at the proportion of population that lives in a gentrified neighborhood as the dependent variable. In other words, I use the same method as Ellen and O'Regan (2011) to identify the gentrified neighborhoods, but instead of finding the proportion of neighborhood that gentrified, I calculate at the percentage of people in the county that lives in those gentrified neighborhoods. The results are given Table 7. The coefficients in columns (1) and (3) are significant. This indicates that as $Share_{Top20}$ increases by 1 percentage points, it is associated with an increase in the population living in gentrified neighborhoods by 1.34 percentage points. Similarly, an increase in $Share_{Top5}$ by one percentage point is associated with an increase in the population living in gentrified neighborhoods by 1.2 percentage points.

6.2. Larger Urban Counties

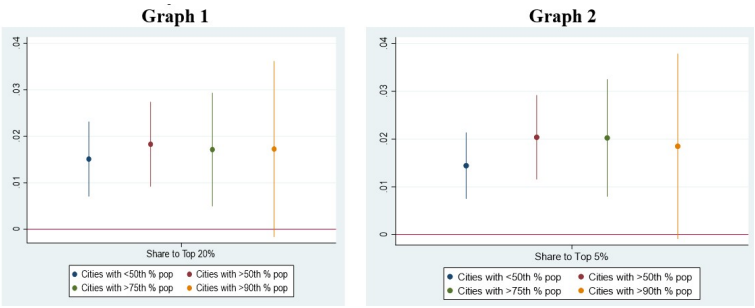
To see if gentrification is prevalent across all urban areas, or only in the largest urban areas, I divide the urban counties based on their urban population in 1980. Using the population data of the counties in my dataset, I calculate the median population, population of the 75th percentile, and population of the 90th percentile. I then divide the counties into the following groups: (1) counties with population less than the median, (2) counties with

Table 7: Using a Different Method to Measure Rate of Gentrification

Variables	(1)	(2)	(3)	(4)
Lag of Share of total income to top 20% of Earners	0.012** (0.004)	-0.041 (0.044)		
Lag of Share of total income to top 20% of Earners squared		0.000 (0.000)		
Lag of Share of total income to top 5% of Earners			0.014** (0.004)	0.006 (0.024)
Lag of Share of total income to top 5% of Earners Squared				0.000 (0.000)
Observations	3,131	3,131	3,131	3,131
R-squared	0.047	0.047	0.052	0.052
Number of fips	1,250	1,250	1,250	1,250

Notes: Robust standard errors in parenthesis. The dependent variable is the proportion of population (out of all the people living in the county) living in gentrified neighborhood. The gentrified neighborhood is determined by the methods outlined in Ellen and O'Regan (2011). The regression also controlled for the lag of the natural log of county median income, lag of the pct of different racial groups in the county, lag of the proportion of college graduates in the county, lag of county-level unemployment rate, county-level fixed effects, year effects, and a constant. ** indicate significance at the 5 percent level, * at the 10 percent level.

Figure 1: Coefficient of Total Income going to Top 20% and Top 5% Respectively of Urban Counties in Different Centiles of Population



Notes: The graph shows the point estimates and the 95% confidence intervals of the coefficients, where the regressors are the share of total income going to the top 20% (Graph 1) and share of total income going to the top 5% (Graph 2). The dependent variable is the gentrification index calculated using methods outlined in Ellen and O'Regan (2011). The regression also controlled for the lag of the natural log of county median income, lag of the pct of different racial groups in the county, lag of the proportion of college graduates in the county, lag of county-level unemployment rate, county-level fixed effects, year effects, and a constant.

population greater than the median, (3) counties with population greater than the 75th percentile, and (4) counties with population greater than the 90th percentile. I then run separate regression on each of the four groups, where the main regressors are $Share_{Top20}$ and $Share_{Top5}$ respectively. The coefficient plots are shown in Figure 1.

The coefficients show that a positive association between inequality and gentrification is present in almost all urban counties in the US. I do find that the standard errors of cities with greater than 90th percentile of population have a wide range, but they are significant at 10 percent critical value. This implies that gentrification is now part of the urban fabric, and there is a strong association between gentrification and inequality in urban areas of different population densities.

6.3. Looking at Shares of Total Income going to Earners in Different Parts of the Income Distribution

As a placebo, I also test if share of total income going to different quintiles of the income distribution are associated with the rise in the rate of gentrification. Table 8 shows the result, where the dependent variable is the rate of gentrification, and the main variable of interest is the share of total income going to different quintiles of income distribution. As seen in the regressions, the coefficients are negative and significant, This is an interesting trend, as it shows that rising incomes of the bottom quintiles is negatively associated with gentrification. This further shows that it is the income growth of the richest segment of the population that is associated with the rise in gentrification of cities. As income growth of the richest earners is much higher than the poorest, so the increase in the incomes of the rich is associated with an increase in the gentrification of cities.

Table 8: Results using Different Quintiles of Income Distribution

Variables	(1)	(2)	(3)	(4)
Lag of Share of Total Income to lowest 20% of Earners	-0.0342** (0.0134)			
Lag of Share of Total Income to 20-40% of Earners		-0.0431** (0.0109)		
Lag of Share of Total Income to 40-60% of Earners			0.0487** (0.0107)	
Lag of Share of Total Income to 60-80% of Earners				-0.0379** (0.0102)
Observations	3,131	3,131	3,131	3,131
R-squared	0.035	0.041	0.046	0.044
Number of fips	1,250	1,250	1,250	1,250

Notes: Robust standard errors in parenthesis. The dependent variable is the proportion of population (out of all the people living in the county) living in gentrified neighborhood. The gentrified neighborhood is determined by the methods outlined in Ellen and O'Regan (2011). The regression also controlled for the lag of the natural log of county median income, lag of the pct of different racial groups in the county, lag of the proportion of college graduates in the county, lag of county-level unemployment rate, county-level fixed effects, year effects, and a constant. ** indicate significance at the 5 percent level, * at the 10 percent level.

7. CONCLUSION

In US cities, gentrification is becoming a matter of concern. While gentrification can increase economic activity in a city and increase tax revenues for the local government, it also drives out the poor and minorities from the city. Consequently, the implications of gentrification is now being studied widely.

In this paper, I study whether gentrification is associated with income inequality. Since the increase in the rate of gentrification and increase in inequality happened concurrently, I theorize that the rise in gentrification was driven in part by the rise in income inequality. I collect census-tract level data to construct the county-level gentrification index, following Ellen and O'Regan (2011). I also collect other county-level data from the website of NHGIS to be controls in the regression.

The analysis showed that there is a linear association between the share of total income going to the richest segment of society and the subsequent rate of gentrification of a county. This correlation is robust to changes in the specification of the model. This shows that gentrification has been rising and is continuing unabated, and it is associated with the rise in income inequality. Further research on the spatial relationship of gentrification between downtown and suburban counties would provide important information on how gentrification spreads from the inner city to the suburbs.

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