

Gentrification and Opportunity Zones: A Study of 100 Most Populous Cities with D.C. as a Case Study

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Abstract

This article explores the role of gentrification in the selection of Opportunity Zone (OZ) census tracts, as well as the potential impact of OZ on gentrification in the 100 most populous urban areas in the United States and in Washington, D.C. It analyzes the role of gentrification in the selection of OZ census tracts in 100 core-based statistical areas (CBSAs). A CBSA is a geographic area defined in terms of counties, which consists of an urban area of at least 10,000 population and its surrounding socially and economically integrated areas. Next, we test whether gentrification has differential impacts on economic activity in OZ and non-OZ neighborhoods in the 100 most populous metropolitan areas. If so, we then use the District of Columbia (D.C.) as a case study to analyze the impact of gentrification on migration in D.C. and predict the impact of economic activity in OZ-eligible neighborhoods. We construct an education-based gentrification measure to analyze the relationship between OZs and gentrification in CBSAs. Our descriptive analysis of the 100 most populous urban areas in the United States (100 CBSAs) indicates that, although it appears that gentrified census tracts were not favored to receive OZ designation, the statistical relationships between gentrification and business and residential vacancy rates are stronger in OZ-designated tracts. In D.C., we find that gentrification has been spreading to more neighborhoods in OZ eligible neighborhoods. Using administrative data from the D.C. government, we find that in-migration rates of higher income residents are significantly higher compared to their out-migration rates.

We examine OZ eligible census tracts to understand the expected destination of new investment, measured as the number of permits, and find that census tracts with positive net migration and lower business vacancy rates are likely to receive increased financing.

Introduction

Opportunity Zones can potentially cause or speed up gentrification in many urban areas of the United States.¹ Through this program, the federal government creates tax incentives for investments in new businesses and commercial projects in the census tracts that received Opportunity Zone (OZ) designation. Eligibility criteria for OZ designation was broadly set by the federal government during the creation of the program, and state governors and local politicians were given the authority to select which census tracts to designate as Opportunity Zones from the range of census tracts that met OZ designation criteria. For instance, in Washington, D.C., out of 97 low-income communities and 19 contiguous census tracts, 25 of them received OZ designation.²

The rules and regulations of the Opportunity Zone program are flexible (Marcin, 2020), and, consequently, state governors and local political leaders could influence the selection process. The OZ program's main objective has been to attract more economic development to distressed neighborhoods, but due to the broad and flexible rules, more than one-half (about 57 percent) of all census tracts nationwide meet the eligibility criteria for OZ designation (Gelfond and Looney, 2018). Therefore, the gentrifying lower-income census tracts that meet the eligibility criteria could receive Opportunity Zone designation through lobbying efforts by developers and their supporters in local governments. These census tracts are expected to receive more private investments than those located in non-gentrifying tracts. Gentrification, the replacement of low-income and less-educated population groups with those of higher socio-economic status, has been associated with higher returns for investments in businesses and real estate (Brummet and Reed, 2020).

Place-based policies such as OZ are generally evaluated with respect to their effects on property and labor markets. While the OZ program is still new, there is already research examining its impact on residential and commercial property values (Alm, Dronyk-Trosper, and Larkin, 2021; Chen, Glaeser, and Wessel, 2020; Sage, Langen, and van de Minne, 2021), as well as employment and earnings (Arefeva et al., 2021; Atkins et al., 2021; Freedman, Khanna, and Neumark, 2021). This article considers the role of gentrification and how the in-migration and out-migration of higher income residents and lower income incumbent residents, respectively, can potentially attract more investments in some OZ census tracts. Specifically, this article attempts to explore the role of gentrification in the selection of OZ census tracts using business and residential vacancy rates (as indicators of the level of economic activity) in the 100 most populous urban areas in the United States and D.C. as a case study. Core-based statistical area (CBSA) is a collective term for metropolitan and micropolitan statistical areas. These geographic areas are defined in terms of whole counties (or county equivalents) and consists of an urban core of at least 10,000 population and its surrounding socially and economically integrated areas.³ Finally, we use Home Mortgage Disclosure Act (HMDA) data to study how gentrification affects the trend among potential homebuyers by racial group.

¹ <https://www.brookings.edu/blog/up-front/2018/02/26/will-opportunity-zones-help-distressed-residents-or-be-a-tax-cut-for-gentrification/>.

² See <https://dmped.dc.gov/page/how-dc-designated-our-opportunity-zones> for information on OZ designation in D.C.

³ https://www.census.gov/glossary/#term_CoreBasedStatisticalAreasCBSAs

Following Card, Mas, and Rothstein (2008) and Brummet and Reed (2020), we first construct a gentrification measure for all central city census tracts in the 100 most populous urban areas in the United States. Then, we develop an empirical model to study the role of gentrification in OZ designation. Identifying census tracts as gentrifying and non-gentrifying has not been free of problems (Ding, Hwang, and Divringi, 2016; Otabor, Kurban, and Schmutz, 2020). Without having access to finer geographic-level data on the in-migration rate of the higher income population and the out-migration rate of the lower income population, it is not possible to accurately measure the displacement impacts of gentrification (Hwang, 2015). A recent study (Otabor, Kurban, and Schmutz, 2020) used address-level income and real property tax data from the D.C. government to study within-city migration. Similarly, we use D.C. administrative data to analyze the relationship between gentrification and migration patterns of the 116 census tracts that met OZ eligibility criteria. If gentrification played a role in receiving OZ designation, these census tracts would be expected to receive a higher share of subsidized investments.

Information on business and residential vacancy rates allows us to compare census tracts in terms of their economic potential to attract new businesses and residents. Lower business vacancy rates indicate that neighborhoods are attracting more new businesses. These new investments could be partially driven by gentrification as businesses respond to the increasing demand for new goods and services set in motion by the inflow of higher income residents. Our descriptive analysis of the 100 most populous urban areas in the United States (100 CBSAs) indicates that, although it appears that gentrified census tracts were not favored to receive OZ designation, the statistical relationships between gentrification and business and residential vacancy rates are stronger in OZ designated tracts. In D.C., we found that gentrification has been spreading to more neighborhoods in OZ-eligible tracts, and this process is mostly driven by an influx of higher income residents and an outflow of lower income residents. The in-migration rates of higher income residents are significantly higher compared to their out-migration rates, which caused displacement of the lower income residents. Having access to administrative data from the D.C. government allows us to directly measure the year-to-year pace of gentrification in OZ-designated census tracts. The empirical model of this study can be extended to other metropolitan areas once data are available.

Literature Review

Place-based development policies use tax incentives to spur economic growth. Such policies have been implemented at the federal level, as well as within and across states. The OZ program is still in its infancy, and the long-term impact of the program is still unfolding. Several recent studies have sought to capture early signals of the type of effect this designation is anticipated to have on various outcomes of interest.

One area that has garnered much attention is the property market. Chen, Glaeser, and Wessel (2020) estimated the effect of OZ designation on housing prices using data from the Federal Housing Finance Agency (FHFA) and the Urban Institute. The authors first use a simple difference-in-differences approach, then a propensity-score weighted version of the difference-in-differences approach to compare OZ designated tracts with eligible, non-designated tracts. Their third approach compares OZ designated tracts with bordering areas. All three approaches point

to a small and statistically insignificant effect of OZ designation on residential property prices. While they emphasize the preliminary nature of their findings given the recency of the policy implementation, they do not find evidence of expectation among homebuyers of neighborhood upgrading. They conclude by questioning the effectiveness of capital subsidies versus “investments in human capital and neighborhood amenities” as the way forward for eligible tracts.

Sage, Langen, and van de Minne (2021) examined the effect of OZ designation on property values, using a difference-in-differences framework to compare OZ designated census tracts with eligible (but not designated) tracts. They posited that higher property values should be the result of a successful OZ program. On the contrary, the authors found that in general, OZ designation did not impact prices. They found, however, an increase in prices for properties with high redevelopment or renovation requirements and for vacant land. From these findings, the authors concluded that “tax benefits are priced in, but investors anticipate limited future economic growth of OZ census tracts.”

Alm, Dronyk-Trosper, and Larkin (2021) focused on Florida data for the period 2016 to 2020 to estimate the impact of OZ designation on both residential and business real estate prices. They employed different ordinary least squares (OLS) methods and fuzzy regression discontinuity, all of which suggest a negligible impact on both of their measures of economic development. They found that the effect on non-vacant residential property values is positive, whereas the impact on commercial and vacant property is unclear.

The designation process for OZ status has also sparked interest due to the broad discretion state governors have in selecting tracts for designation among the OZ eligible tracts. The cause for concern is enabled by the lack of meaningful oversight on the governors in their decisionmaking. Eldar and Garber (2021) evaluated the extent to which favoritism was exercised in OZ designation, using two different proxies for favoritism. They found a 5 percent greater likelihood of selection for tracts in counties which exhibited strong support for the governor in the last election. This study further found a 6.4 to 13.3 percent larger probability of OZ designation associated with campaign contributions by investors. Their findings suggest that the OZ designation process was in fact influenced by the governors’ desire (and ability, through the OZ program design) to reward supporters. Results from using a matching technique support the initial findings that favoritism played a material role in designation. In comparing the relative importance of favoritism as against economic distress in the governors’ OZ selection decisions, the authors argued that favoritism allowed 10 percent of the tracts to be selected, whereas these tracts would not have been selected otherwise. Additionally, about 20 percent of the OZ designations would have been assigned to other tracts which have higher rates of distress when assessed on the variables of income, poverty, and unemployment. Furthermore, their analysis suggests that favoritism toward investors was a stronger determining factor compared to rewarding voter support.

Frank, Hoopes, and Lester (2020) studied the role of political affiliation using a linear probability model with state-fixed effects as a baseline model, adding indicator variables to estimate the partial effects of the variables of interest. They found a 7.6 percent greater likelihood of designation if the census tract’s state representative has the same political party affiliation as the governor. They also studied various state-level information channels used by governors in their selection process. They

found that the channel used is a strong determinant of the increased likelihood of designation, which ranges from 0.0 percent to 25.6 percent, depending on the channel.

This article contributes to the early literature studying the economic effects of OZs. It differs from other studies in that it evaluates the extent that gentrification, which has links to property prices and has been seen to be affected by public policies, played a role in the decisionmaking process for OZ designation. The intuition behind this inquiry stems from the fact that gentrifying tracts tend to have a stronger potential for economic growth and thus could be expected to deliver better economic returns relative to comparable non-gentrifying tracts. As such, from the standpoint of policymakers, it may appear more pragmatic to select a gentrifying census tract as opposed to a tract in greater economic distress that may not attract investors precisely due to the level of its distress.

This article also contributes to the literature on gentrification. Gentrification literature has seen a renewed interest in, and a broadening of, factors deemed causal in the process of gentrification (Hwang and Lin, 2016). One such factor is the effect of public policy. To what extent has public policy sparked, intensified, or mitigated the gentrification process? Another strand of the gentrification literature examines the racial aspects and effects of gentrification, whereby those moving in tend to be primarily white and those moving out tend to be minority, with a focus on African-Americans. While the gentrification literature is over 50 years old, there is still no consensus on a definition. Broadly, the idea revolves around neighborhood change from working class to middle class, associated with an influx of migrants of a higher socio-economic class. Variables used to capture this change include changes in income, rent, home value, or education profile. This article draws from the gentrification measure used by Brummet and Reed (2020).

Brummet and Reed (2020) used longitudinal microdata to study the impact of gentrification on the well-being of original residents. Based on work by Baum-Snow and Hartley (2019) and Couture and Handbury (2019), they operationally defined gentrification as “an increase in college-educated individuals’ demand for housing in initially low-income, central city neighborhoods.” They demonstrated that this measure of gentrification performs as well as other commonly used measures such as change in income, rent, and house value. Brummet and Reed (2020) pointed to the following benefits of the education variable: (1) easier separation of cause and effect, given the relative stability of college attainment after age 25; (2) prior use of this variable in studying tipping (Böhlmark and Willén, 2020; Card, Mas, and Rothstein, 2008); (3) early detection possibility, given that changes in education may be a precursor to changes in rent and income; and (4) the recent “return to the city” has been driven by college educated individuals (Baum-Snow and Hartley, 2019; Couture and Handbury, 2019; Edlund, Machado, and Sviatschi, 2019; Su, 2019).

In addition to the effects on new and incumbent residents, there is interest in the effect on the changing neighborhoods. Gentrification is associated with higher incomes, and thus, greater levels of disposable income. While higher levels of disposable income can be thought of as generally positive for businesses, Meltzer’s (2016) exploration of the effect of gentrification on small businesses found mixed results. On the one hand, she did not find higher levels of displacement in gentrifying neighborhoods, as compared with their non-gentrifying counterparts. Conditional on a business leaving, however, the length of vacancy is longer for gentrifying as compared with non-

gentrifying neighborhoods. She noted that “cities with less vibrant neighborhood retail markets could be more vulnerable to gentrification-induced displacement.”

Our study aligns with Neumark and Simpson’s (2015) suggestion⁴ for extending the evidence base with respect to place-based policy. In this article, we also seek to predict the investment flow across OZ tracts and understand whether gentrifying tracts are predicted to capture more of the business investment, thus giving initial insight into potential redistribution effects due to inclusion of gentrifying tracts.

The Opportunity Zone Selection Process

Overall, 42,078 of the 73,070 census tracts in the United States were eligible for OZ status, of which 8,687 received the OZ designation (Urban Institute). The Internal Revenue Service (IRS) lists two categories of tracts eligible for OZ designation, namely Low-Income Communities (LICs),⁵ and eligible non-LIC contiguous tracts.⁶ In selecting tracts for OZ designation, states prioritized LIC tracts.⁷ This is evidenced by 97.2 percent of OZ-designated tracts being LICs compared to 69.9 percent of eligible non-designated tracts being LICs. Although OZ-designated tracts had a much higher share of LICs compared to the share of LICs in eligible non-OZ-designated tracts, analysis shows that many of the tracts selected for designation did not need the additional subsidy to attract new investment. That is, there were other LIC tracts more in need of the designation than those selected (Gelfond and Looney, 2018). Thus, while the OZ program aims to spur economic activity in distressed areas, the impact of OZ designation may be affected by poor geographic targeting.

Under the definition of LIC, 97 census tracts within D.C. were eligible to be designated as OZs. Based on the conditions for tracts contiguous with LICs to be designated as OZs, 19 additional census tracts were potentially eligible.⁸ In total, 116 census tracts in D.C. were potentially OZ eligible. Of these, 25 tracts were designated as OZ, which corresponds to the maximum number of tracts that D.C. could nominate.⁹ Summary data made available by the Urban Institute¹⁰ compares D.C.’s OZ-designated tracts with the eligible, non-designated tracts and all tracts within D.C.

⁴ Neumark and Simpson (2015) reviewed the literature on place-based policies and made recommendations for going forward.

⁵ Broadly, an LIC either has a poverty rate of at least 20 percent, or the median family income is less than or equal to 80 percent of the statewide or metropolitan area median family income. The definition of LIC used for OZ determination is codified in §45D(e) of the IRS Code. See [26 USC 45D: New markets tax credit \(house.gov\)](#).

⁶ Non-LIC tracts are eligible for OZ designation if they are contiguous with (if they share a common border with) an OZ designated tract, and the median family income of the contiguous tract is not greater than 125 percent of the median family income of the OZ designated tract. Both these conditions must be met for the contiguous tract to be eligible for OZ designation. See also [Microsoft Word - rp-18-16.docx \(irs.gov\)](#). Note that the IRS does not require the contiguous tract to be in the same state as the OZ-designated tract.

⁷ Both LICs and eligible contiguous tracts are eligible to receive OZ designation. Only those eligible tracts which are nominated by a state, the District of Columbia, or a U.S. territory, and which are subsequently certified “by the Secretary of the U.S. Treasury via his delegation of authority to the Internal Revenue Service (IRS),” receive the designation of Qualified Opportunity Zone (QOZ or OZ), however.

⁸ <https://www.cdfifund.gov/sites/cdfi/files/documents/ozone-information-resource.2.27.18-locked2.xlsx>

⁹ The OZ regulation instructs states to designate either 25 percent of all LICs census tracts or 25 census tracts if the state has fewer than 100 LICs.

¹⁰ See Theodos, Meixell, and Hedman (2018), which provides a link to state-level tract characteristics by Opportunity Zone designation status at https://www.urban.org/sites/default/files/urban_statesozs_update.xlsx.

Across the economic, housing, demographic, education, and socioeconomic change characteristics compared, there exists an expected pattern with designated OZs having the lowest values on characteristics associated with positive neighborhood characteristics (such as median household income and median home value), followed by non-designated eligible tracts, and then all tracts within D.C. Conversely, designated OZ tracts had the highest values on characteristics associated with negative neighborhood characteristics (such as poverty rate and unemployment rate).

OZ designation incentivizes new investments to the selected census tracts with reductions in federal capital gains tax. OZ designation could potentially have positive social and economic impacts on low-income and undercapitalized census tracts. At the same time, heterogeneity among residents of these areas suggests differential effects on them. The flow of investment toward OZs can positively influence neighborhood amenities, which may increase rents and housing prices, and thus, gentrification. On the other hand, given the choice between gentrifying and non-gentrifying OZ tracts, a gentrifying OZ may present a more attractive option for the investor given the comparison between the expected rate of return on investments. Indeed, in a Brookings blog post, Looney (2018) posed the question “Will Opportunity Zones help distressed residents or be a tax cut for gentrification?”¹¹

In addition to federal capital gain tax incentives, the D.C. government also provides capital gain tax benefits for qualified investments. To receive D.C. OZ capital gain tax incentives, a proposed project needs to meet one of four criteria:¹² (1) it invests in one of the projects selected by D.C.; (2) it receives support from an Advisory Neighborhood Commissioner (ANC) that represents one of the OZ neighborhoods; (3) it falls into one of the projects in the District Portfolio Project; and (4) it receives a 75 or higher score from the Urban Institute’s Community Impact Assessment Tool. Through these local incentives, the D.C. government tries to direct additional OZ investments to support its economic policy priorities.

Data and Methods

Gentrification, originally conceptualized by Glass (1964) as the replacement of the working class by the middle class, has been measured using increases in education levels, household incomes, rents, and housing prices. Following Card, Mas, and Rothstein (2008) and Brummet and Reed (2020), we use the change in the percentage of college graduates in a census tract between two time periods as our measure of gentrification. Specifically, the gentrification measure is calculated as the change from time t to $t+1$ in the number of individuals aged 25 or older with a bachelor’s degree or higher living in census tract j in city c , divided by the total population aged 25 or older living in tract j and city c in year t :

¹¹ Adam Looney, “Will Opportunity Zones Help Distressed Residents or Be a Tax Cut for Gentrification?” Up Front (blog), Brookings Institution, February 26, 2018, <https://www.brookings.edu/blog/up-front/2018/02/26/will-opportunity-zones-help-distressed-residents-or-be-a-tax-cut-for-gentrification/>.

¹² <https://dmped.dc.gov/page/opportunity-zones-washington-dc>.

$$gent_{jc} \equiv \frac{bachelors25_{jc,t+1} - bachelors25_{jc,t}}{total25_{jc,t}} \quad (1)$$

The more recent wave of gentrification has been characterized by the flow of young college graduates to lower income neighborhoods. As such, this measure detects earlier stages of neighborhood changes and improvements in neighborhood amenities (Brummet and Reed, 2020).

The education and population variables used to calculate the gentrification measure are from the American Community Survey (ACS) 5-year estimates. Additional characteristics of the census tracts used in the analysis of the 100 most populous CBSAs are also from this source. For the case study on D.C., income, home value, and migration characteristics are sourced from the D.C. government’s individual income tax and real property tax administrative records. The other D.C. data points are retrieved from the ACS.

Gentrifying and gentrified neighborhoods attract higher-income residents, and therefore are associated with higher levels of median household income. Because of the increased purchasing power or disposable income, the neighborhoods at the various stages of gentrification are more attractive to many businesses than non-gentrifying ones. We use residential and business vacancy data from the U.S. Postal Service (USPS) as a proxy for business attractiveness. This measure is used to predict where the new OZ investments will flow. Vacancy data for businesses and residents are collected by USPS and aggregated by the U.S. Department of Housing and Urban Development (HUD) to provide quarterly information on census tract-level vacancies for various time intervals, with durations varying from 3 to 36 months or longer (HUD, 2016).¹³ This data will be referred to as USPS-HUD throughout this article. Additionally, based on the notion that household investment is a precursor to nonresidential business fixed investment (Fisher, 2007), we use building permit data as a proxy in predicting the flow of new business investments in our D.C. analysis. Specifically, we use the change in construction permits over the period 2011 to 2015. Permit data are retrieved from the D.C. government’s open data website.¹⁴

Additionally, we use mortgage loan data from the Home Mortgage Disclosure Act (HMDA) for the period 2007–19. These data provide the number and value of loans originated and is disaggregated to examine the distribution of home buyers by race.

Our contribution is three-fold. First, we explore the role of gentrification in OZ-designated census tracts. Second, we use USPS-HUD vacancy data to predict the flow of new business investments across OZ census tracts. Additionally, following Brummet and Reed (2020), we use longitudinal microdata from the D.C. government, specifically the individual income and real property data, to explore neighborhood change in D.C. between 2011 and 2015. Annual in- and out-migration and demographic data for all D.C. residents allow us to observe gentrification, in-migration of higher income residents, and displacement of the lower income population throughout the city.

¹³ The USPS identifies a vacant address as one to which mail has not been delivered for more than 3 months (GAO, 2011). In HUD-USPS data, long-term vacant and inhabitable addresses are labeled as “no stat”. They may reflect either the units under construction or those demolished or abandoned. To avoid measurement errors, we exclude “no stat” addresses from our vacancy counts.

¹⁴ <https://opendata.dc.gov/search?q=building%20permits>

The following three exhibits provide categorized summary data on the relationship between gentrification and Opportunity Zone status for the CBSAs, and for D.C. Exhibit 1 shows the unweighted¹⁵ mean gentrification score, as well as its frequency and percent of the distribution, for census tracts within the 100 CBSAs, categorized based on their status as eligible, non-designated census tracts or as OZ designated census tracts. Overall, the mean gentrification score¹⁶ of the 100 CBSAs is 1.83. On average, OZ-designated census tracts have a lower mean gentrification score compared to their eligible, non-designated counterparts (1.49 compared to 1.91). These OZ census tracts account for 3,693 (18.95 percent) of the total census tracts studied.

Using the average gentrification score (1.83) as a proxy for the average national gentrification score, three categories are identified within the gentrification measure. Exhibit 2 shows the percentage breakdown into these categories for each of the two Opportunity Zone statuses. The stagnant or negative trend is made up of census tracts with a negative or zero gentrification score. The below-average trend comprises census tracts with a positive gentrification score below the national average. Because the gentrification scores of the stagnant or negative trend, and the below-average trend are less than the national average, we classify these tracts as non-gentrifying. Tracts that make up the above-average trend are classified as gentrifying because they consist of tracts with a gentrification higher than the national average. Compared to non-designated census tracts, OZs had a higher percentage of tracts classified as stagnant or negative trend (48.01 percent compared to 42.86 percent). Compared to non-designated census tracts, however, OZs had a lower percentage of tracts classified as below-average trend (25.94 percent compared to 27.92 percent) as well as a lower percentage classified as above-average trend (26.05 percent compared to 29.22 percent).

Exhibit 1

CBSA Gentrification by Opportunity Zone Status

Opportunity Zone Status	Mean	Frequency	Percent
Eligible, Non-Designated	1.91 (10.14)	15,794	81.05
Designated Opportunity Zone	1.49 (4.31)	3,693	18.95
Total	1.83	19,487	100

CBSA = core-based statistical area.

Source: Authors' calculation from American Community Survey and Internal Revenue Service data

¹⁵ Each census tract is given the same weight. Oversampling is not an issue.

¹⁶ Because our gentrification measure is based on the change in percentage of a tract's population which is 25 and older with a college degree, the category titles refer to the direction of the change.

Exhibit 2

CBSA Opportunity Zone Status by Gentrification Category

Gentrification Measure Category	Opportunity Zone Status		
	Eligible, Non-Designated (%)	Designated OZ (%)	Total (%)
Stagnant or Negative Trend	42.86	48.01	43.84
Below-Average Trend	27.92	25.94	27.54
Above-Average Trend	29.22	26.05	28.62
Total	100.00	100.00	100.00

CBSA = core-based statistical area. OZ = Opportunity Zone.

Notes: Average is calculated for the 100 most populous CBSAs. Stagnant or Negative Trend refers to those losing college educated population; Below-Average Trend refers to those increasing college educated population at a rate below the 100 CBSA trend; Above-Average Trend refers to those increasing college educated population above the trend such as to be classified as gentrifying.

Source: Authors' calculation from American Community Survey and Internal Revenue Service data

Exhibit 3 replicates exhibit 2, but for Washington, D.C., using the city's mean gentrification score (1.95). Similar to the CBSAs, OZ tracts in D.C. have a lower percentage of tracts that are gentrifying compared to eligible, non-designated tracts (27 percent compared to 45.88 percent). Also, like exhibit 2, compared to non-designated census tracts, OZs had a higher percentage of tracts classified as stagnant or negative trend (35 percent compared to 31.87 percent). D.C., however, has a higher percentage of OZ designated tracts with a positive gentrification score but are classified as non-gentrifying (38 percent compared to 22.25 percent).

Exhibit 3

D.C. Opportunity Zone Status by Gentrification Category

Gentrification Measure Category	Opportunity Zone Status		
	Eligible, Non-Designated (%)	Designated OZ (%)	Total (%)
Stagnant or Negative Trend	31.87	35.00	32.54
Below-Average Trend	22.25	38.00	25.65
Above-Average Trend	45.88	27.00	41.81
Total	100.00	100.00	100.00

D.C. = District of Columbia. OZ = Opportunity Zone.

Notes: Average is calculated for D.C. Stagnant or Negative Trend refers to those losing college educated population; Below-Average Trend refers to those increasing college educated population at a rate below the D.C. trend; Above-Average Trend refers to those increasing college educated population above the trend such as to be classified as gentrifying.

Source: Authors' calculation from American Community Survey and Internal Revenue Service data

Model Specification

Although exhibits 1–3 show that gentrification itself may have not played a role in OZ designation, the change in neighborhood demographics can affect the pace and types of investments that flow to the census tracts. Two census tracts with the same gentrification rate could have different rates of in-migration of higher income residents and out-migration of lower income

residents. Gentrification usually starts with the in-migration of young college graduates, and the displacement of lower income residents intensifies when higher income college graduates move in. We first attempt to test whether gentrification has differential impacts on vacancy rates in OZ and non-OZ neighborhoods within the CBSAs. We then use D.C. as a case study to analyze the impact of gentrification on migration and predict the impact of business vacancy rate on economic activity in OZ-eligible neighborhoods.

Our primary regression specification is a fixed-effects ordinary least squares model. Equation (2) represents the specification for the 100 most populous CBSAs, and equation (3) represents the specification for D.C.:

$$\Delta Y_i = \beta_0 + \beta_1 \text{gent} + \mu + \varepsilon \quad (2)$$

$$Z_i = \beta_0 + \beta_1 \text{busvac} + \beta_2 \text{resvac} + \beta X + \gamma + \varepsilon \quad (3)$$

In equation (2) ΔY is our outcome variable representing the rate of change. Depending on the regression, this represents the change in either the residential vacancy rate or the business vacancy rate in census tract I ; gent is the education-based measure of gentrification as calculated in equation (1).¹⁷ For the regressions on the 100 most populous CBSAs, the change is over the period 2010 to 2016, and CBSA fixed effects are included, denoted by μ . For the regressions on D.C., in equation (3) we employ a panel design, with our dependent variable as the number of permits for the years 2011 through 2015, denoted as Z_i . We include year fixed effects, denoted by γ . In equation (3) busvac and resvac represent business vacancy rate and residential vacancy rate, respectively.

For the D.C. regressions, X represents a vector of socioeconomic factors for which we control. The following section first presents summary statistics and regression results for the 100 most populous CBSAs, followed by summary statistics and regression results for D.C., in which we include more control variables.

Summary Statistics and Results

100 Most Populous CBSAs in the U.S.

Exhibit 4 presents census tract level summary statistics for the 100 most populous CBSAs in the United States. On average, about 10 percent of the census tracts in these CBSAs were granted the OZ designation (exhibit 4). Our gentrification measure shows that, on average, the share of the population over age 25 holding a bachelor's degree or higher in the census tracts within these CBSAs increased approximately 2 percent between 2010 and 2016.

We focus not only on the OZ census tracts, but we include the OZ eligible census tracts because they have been a focal point of the gentrification debate. The regression specification used for the CBSAs is estimated separately on four types of census tracts: 1) designated OZ tracts; 2) non-designated but OZ-eligible tracts; 3) OZ-eligible (all eligible tracts, whether LIC or eligible non-LIC but contiguous tracts); and 4) non-eligible tracts. Results for the four models for which the dependent variable is the change in residential vacancy rate are shown in exhibit 5. Model 1 shows

¹⁷ Calculation of the gentrification measure noted earlier in this article.

the effect of gentrification on the change in residential vacancy rates for OZ census tracts. A one-unit increase in the gentrification measure is associated with a -0.05-unit change in the residential vacancy rate. This result is significant at the 1-percent level. Model 2 shows a significant positive but small effect on residential vacancy rates for non-OZ tracts.

The coefficient of 0.01 is significant at the 1-percent level. Model 3 shows a negative and significant effect on residential vacancy rates for eligible tracts (-0.01), which is significant at the 1-percent level. We also see that the effect is smaller compared to Model 1. That is, gentrification has a larger effect on residential vacancy rates in OZs than eligible census tracts. Model 4 also shows a positive effect (0.02), which is significant at the 0.1-percent level.

Exhibit 4

Summary Statistics of Census Tracts in the 100 Most Populous CBSAs

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	37,615	61,576.94	30,250.42	5,000.00	249,194.00
Median Home Value (2010), \$	36,568	287,008.80	191,838.10	11,000.00	1,000,000.00
Median Gross Rent (2010), \$	38,067	534.07	469.26	0	8,017
Population below 100% of the Poverty Level (2010), %	37,698	14.09	12.91	0.00	100.00
Median Household Income (2016), \$	37,571	65,878.09	33,101.39	3,250.00	249,597.00
Median Home Value (2016), \$	36,857	289,710.50	230,363.80	10,200.00	2,000,000.00
Median Gross Rent (2016), \$	36,851	1,169.32	467.68	114.00	3,500.00
Population below 100% of the Poverty Level (2016), %	37,717	15.55	13.06	0.00	100.00
Opportunity Zone Rate	35,333	0.10	0.30	0	1
Gentrification Rate	37,938	0.02	0.22	- 1.84	39.90
Residential Vacancy Rate (2010)	28,115	0.04	0.05	0.00	1.00
Business Vacancy Rate (2010)	28,086	0.09	0.08	0.00	0.80
Residential Vacancy Rate (2016)	37,845	0.03	0.05	0.00	1.00
Business Vacancy Rate (2016)	37,829	0.08	0.08	0.00	1.00

CBSAs = core-based statistical areas.

Source: American Community Survey American Community Survey (ACS) 2010 and ACS 2016-5-year average

Exhibit 5

Regression Results for Residential Vacancy Rate

VARIABLES	(1) OZ	(2) Non-OZ	(3) Eligible	(4) Non-Eligible
Gentrification	-0.0480*** (0.0153)	0.00617*** (0.00233)	-0.0123*** (0.00462)	0.0177*** (0.00212)
Constant	-0.0113 (0.00969)	-0.00674*** (0.00214)	-0.00565 (0.00368)	-0.00836*** (0.00205)
Observations	2,935	25,127	15,074	12,988
R-squared	0.147	0.082	0.118	0.066
CBSA FE	YES	YES	YES	YES

* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$.

CBSA = core-based statistical area. FE = fixed effects. OZ = Opportunity Zone.

Note: Standard errors in parentheses.

Source: Authors' calculation from American Community Survey and U.S. Postal Service-U.S. Department of Housing and Urban Development data

These results suggest that increases in the gentrification measure decrease the residential vacancy rate for OZ and eligible census tracts but increase the residential vacancy rate among ineligible tracts. When considering the universe of tracts which are non-OZ (to include both non-eligible tracts, as well as eligible tracts which did not receive the OZ designation), the effect of gentrification was positive and significant as in the case of the non-eligible tracts; however the size of the effect was an order of magnitude smaller.

Considering models for which business vacancy rate is the dependent variable, exhibit 6 shows results for the same group of populations. Like the negative and significant effect of gentrification on the residential vacancy rate for the OZ population, the effect on the business vacancy rate is negative and significant, and in this case, of a larger magnitude than the effect on the residential vacancy rate.

Model 1 shows that a one-unit increase in the gentrification measure is associated with a -0.08 unit change in the business vacancy rate. This result is significant at the 1-percent level. In contrast, the effect of gentrification on the non-OZ population (Model 2) is practically zero (-0.0002). For the eligible population (Model 3), the effect of gentrification on the business vacancy rate is similar in magnitude to the effect on the residential vacancy rate. Model 4, which covers the non-eligible population, is also 0.

Exhibit 6

Regression Results for Business Vacancy Rate

VARIABLES	(1) OZ	(2) Non-OZ	(3) Eligible	(4) Non-Eligible
Gentrification	-0.0772*** (0.0265)	-0.000195 (0.00150)	-0.0140* (0.00790)	5.27e-05 (0.00148)
Constant	0.0522*** (0.0168)	0.00506 (0.00537)	0.0299*** (0.00748)	-0.00975 (0.00691)
Observations	2,932	25,094	15,061	12,965
R-squared	0.095	0.049	0.066	0.047
CBSA FE	YES	YES	YES	YES

*p<0.1. **p<0.05. ***p<0.01.

CBSA = core-based statistical area. FE = fixed effects. OZ = Opportunity Zone.

Note: Standard errors in parentheses

Source: Authors' calculation from American Community Survey and U.S. Postal Service-U.S. Department of Housing and Urban Development data

Overall, exhibits 5 and 6 suggest a significant correlation between gentrification and attractiveness of OZ-designated census tracts to potential residents and businesses. Federal subsidies toward new investments in OZ tracts are expected to accelerate this process. The economic benefits of the OZ subsidies could be captured by the new affluent residents who could replace the incumbent lower income residents.

Because of the differential impact of gentrification on vacancy rate in OZs, we use D.C. as a case study to further analyze migration and gentrification and to predict how investments from place-based incentives such as OZ can affect economic activity.

D.C. Case Study

Administrative income tax data from the D.C. government allow us to measure gentrification more directly by simultaneously accounting for the in-migration of high-income adults and the out-migration of lower income incumbent residents.

Exhibit 7 presents summary statistics for the census tracts within D.C. In D.C., about 14 percent (25 out of 179) of census tracts have OZ designation. This contrasts with 10 percent of census tracts having OZ designation in the 100 most populous CBSAs. The gentrification rate for D.C. is nevertheless double the rate for the 100 most populous CBSAs (0.04 compared to 0.02). Appendix exhibits A-5 through A-8 show similar summary statistics for census tracts within D.C. for each of the following categories: OZ-eligible, OZ non-eligible, OZ-designated, and OZ-non-designated. OZ-designated tracts and OZ-eligible tracts tend to rank as expected given the eligibility criteria. For example, OZ-designated tracts have the lowest median home value and median rent among the four categories for both 2010 and 2016, followed by OZ-eligible tracts.

Exhibit 7

Summary Statistics of Census Tracts in D.C.

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	175	63,425.41	35,154.07	15,119.00	213,889.00
Median Home Value (2010), \$	167	433,329.90	182,856.50	143,400.00	924,000.00
Median Gross Rent (2010), \$	178	769.24	515.56	0	3,204
Population below 100% of the Poverty Level (2010), %	176	19.41	13.99	1.30	91.20
Median Household Income (2016), \$	175	78,623.75	43,276.66	14,692.00	235,517.00
Median Home Value (2016), \$	173	506,302.90	266,187.40	88,600.00	1,498,300.00
Median Gross Rent (2016), \$	173	1,402.02	489.09	395.00	2,557.00
Population below 100% of the Poverty Level (2016), %	178	18.88	13.67	0.00	66.30
Opportunity Zone Rate	178	0.14	0.35	0	1
Gentrification Rate	178	0.04	0.09	- 0.06	1.14
Residential Vacancy Rate (2010)	162	0.04	0.03	0.00	0.17
Business Vacancy Rate (2010)	162	0.08	0.06	0.00	0.29
Residential Vacancy Rate (2016)	178	0.03	0.03	0.00	0.11
Business Vacancy Rate (2016)	178	0.06	0.05	0.00	0.24

D.C. = District of Columbia.

Sources: American Community Survey (ACS) 2010; ACS 2016

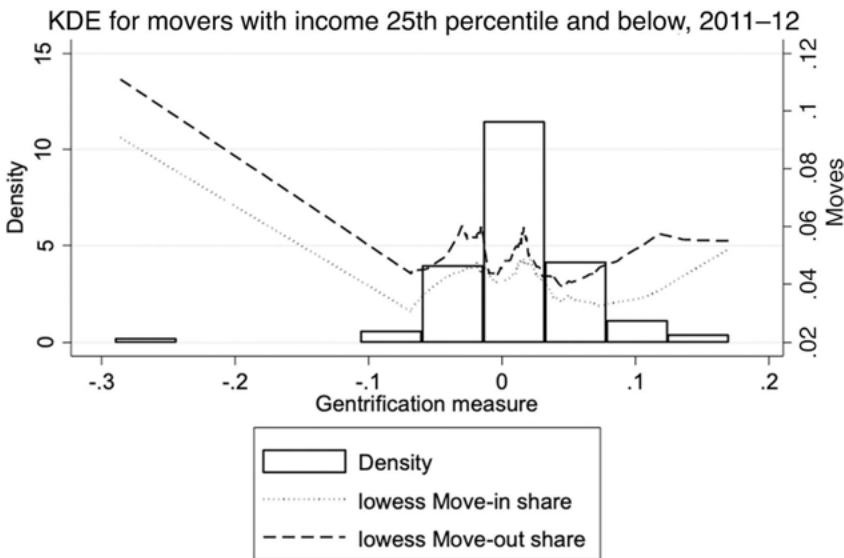
Access to individual income tax and residential property tax data from the D.C. government allows us to provide answers to the displacement effects of gentrification on lower income populations. Due to data limitations, previous studies have relied on limited samples from the U.S. Census Bureau and the IRS. We use kernel density estimates (KDE)¹⁸ to analyze the relationship between migration into and out of OZ-eligible census tracts and gentrification. In the context of possible displacement by the inflow of higher income residents and outflow of lower income residents, we focus on the section of the distribution at or below the 25th percentile of income distribution and at or above the 75th percentile of income distribution. Exhibits 8a–8d and 9a–9d show kernel regression estimates of the relationship between in-migration of higher income groups, out-migration of lower income groups, and our measure of gentrification. They show the year-over-year changes in gentrification and in-and-out migration in D.C. census tracts, for the period 2011 to 2015, for the income group below the 25th percentile and above 75th percentile in OZ-eligible neighborhoods. In the case of those below 25th percentile (exhibits 8a–8d), both the number and the share of census tracts experiencing growth in their college graduate population show an increase between 2011 and 2015, which suggests that gentrification affected more neighborhoods during this period. As shown in the graphs in exhibit 8, the out-migration rate for the lower

¹⁸ Kernel density estimation is a type of nonparametric probability density estimation that fits a model (the relationship between observations of a random variable and their probability density) to the specified distribution (usually with indefinite parameters) of the data. Generally, it is like a histogram in the sense that it allows for an understanding of how a relationship is different at different parts of a distribution. KDE, however, has the advantage of producing a smooth estimate, which is more precise.

income population is consistently above their in-migration rate. In terms of directionality in the relationship between out-migration and gentrification, exhibit 8a shows that, between 2011 and 2012, out-migration for the 25th percentile or lower income group rose with the increase in gentrification. Exhibit 8b shows an almost flat line between 2012 and 2013, followed by decreases in 2013–14 (exhibit 8c) and 2014–15 (exhibit 8d). The difference between the out-migration and the in-migration for the 25th percentile and lower income gets bigger where the gentrification measure is larger than zero. From year to year, as more college graduates moved in, more and more lower income incumbent residents were displaced.

Exhibit 8a

Kernel Density Estimates, 25th Percentile and Below Income Groups in D.C., 2011–12



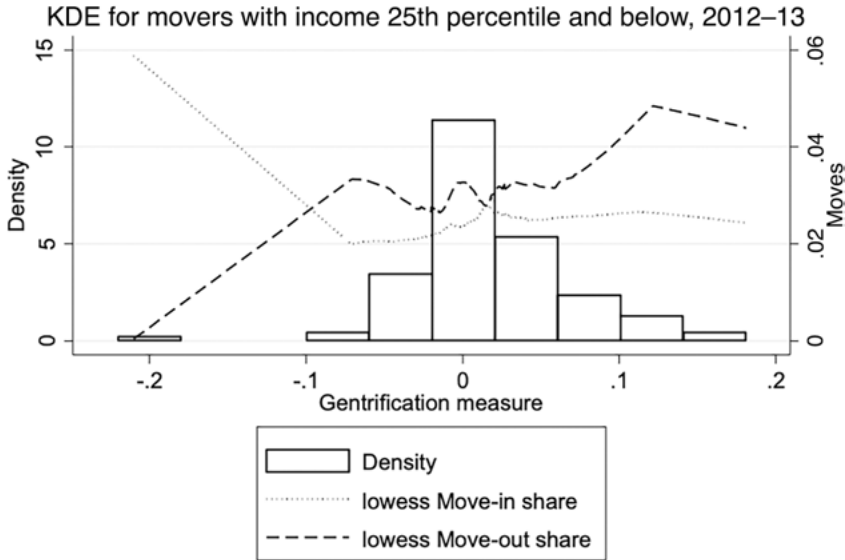
kernel = epanechnikov, bandwidth = 0.0060

D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Exhibit 8b

Kernel Density Estimates, 25th Percentile and Below Income Groups in D.C., 2012–13



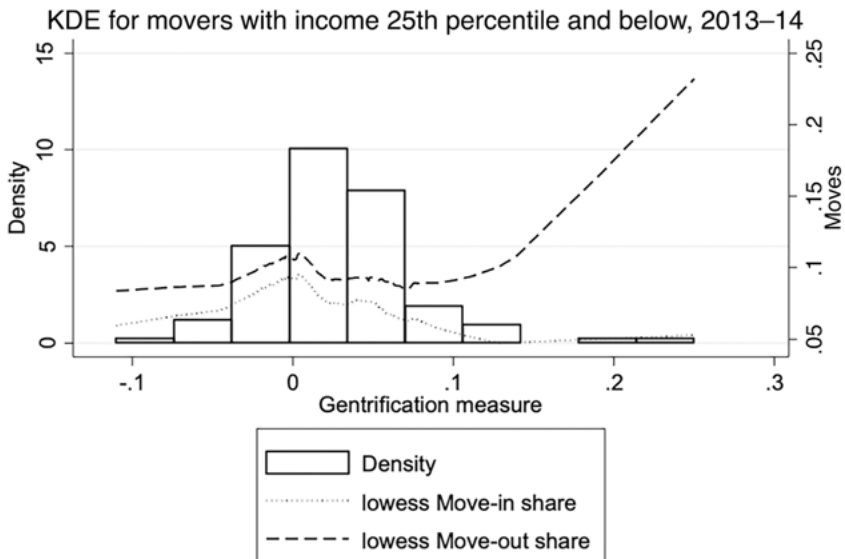
kernel = epanechnikov, bandwidth = 0.0040

D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Exhibit 8c

Kernel Density Estimates, 25th Percentile and Below Income Groups in D.C., 2013–14



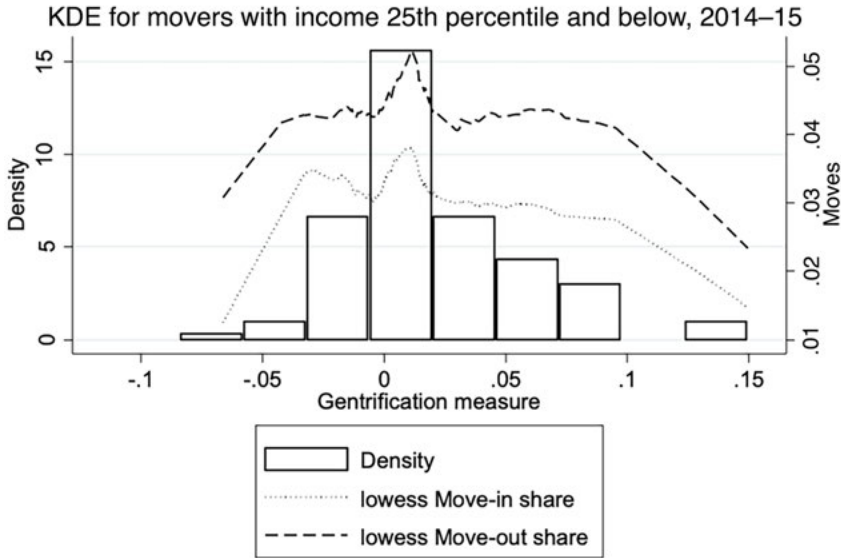
kernel = epanechnikov, bandwidth = 0.0040

D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Exhibit 8d

Kernel Density Estimates, 25th Percentile and Below Income Groups in D.C., 2014–15



kernel = epanechnikov, bandwidth = 0.0100

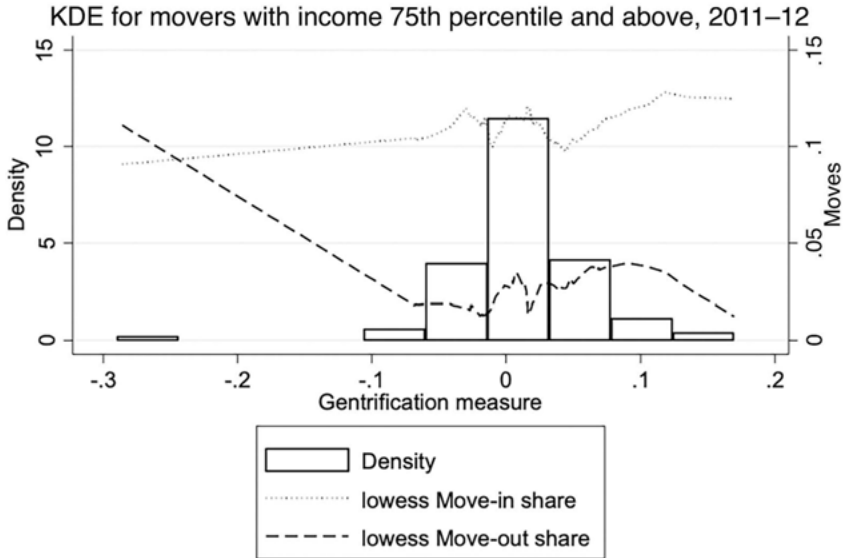
D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Exhibits 9a–9d display the inflow and outflow of higher income residents to and from the OZ-eligible neighborhoods in D.C. The rate of inflow is about three times larger than the rate of outflow. Exhibits 9a–9d point to two important results. First, in this period, gentrification spread to more lower income neighborhoods in D.C. Second, the rate of the inflow of higher income residents to these neighborhoods was significantly higher than their outflow rate, which suggests that the OZ designation will attract more investments and accelerate the gentrification process.

Exhibit 9a

Kernel Density Estimates, 75th Percentile and Above Income Groups in D.C., 2011–12

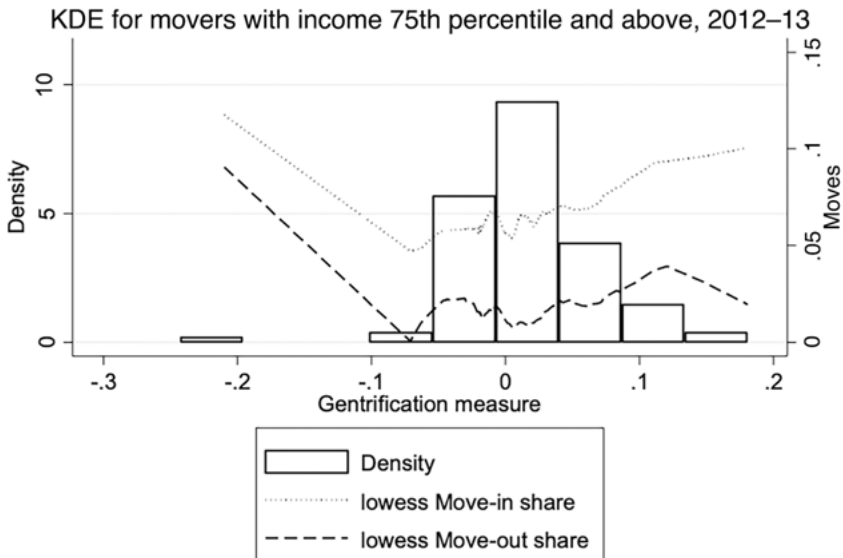


D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Exhibit 9b

Kernel Density Estimates, 75th Percentile and Above Income Groups in D.C., 2012–13

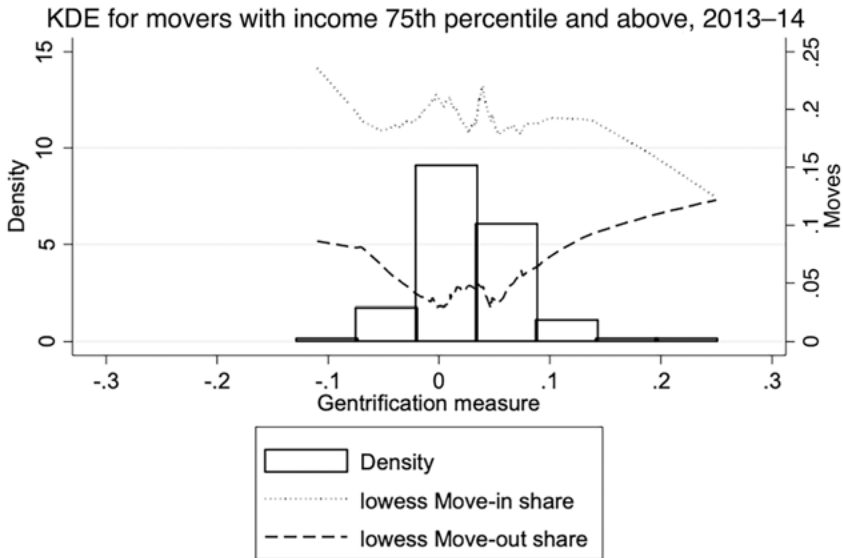


D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Exhibit 9c

Kernel Density Estimates, 75th Percentile and Above Income Groups in D.C., 2013–14



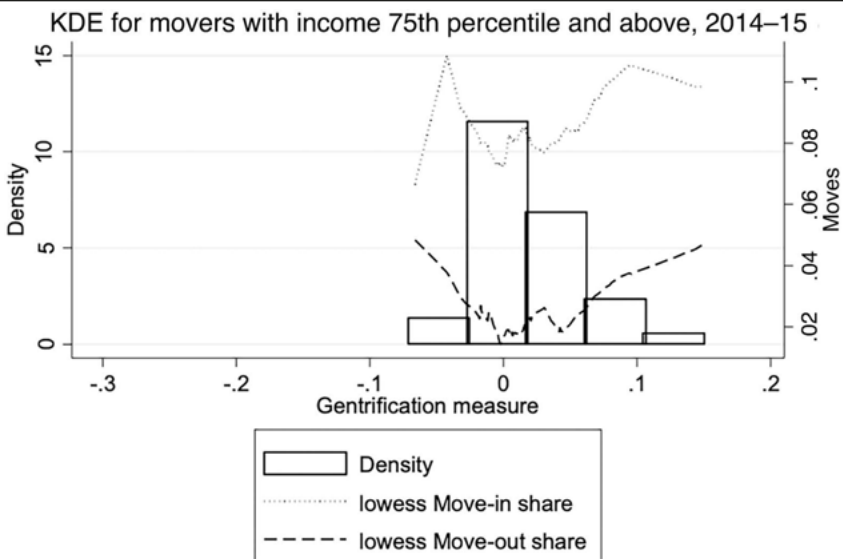
kernel = epanechnikov, bandwidth = 0.0060

D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Exhibit 9d

Kernel Density Estimates, 75th Percentile and Above Income Groups in D.C., 2014–15



kernel = epanechnikov, bandwidth = 0.0100

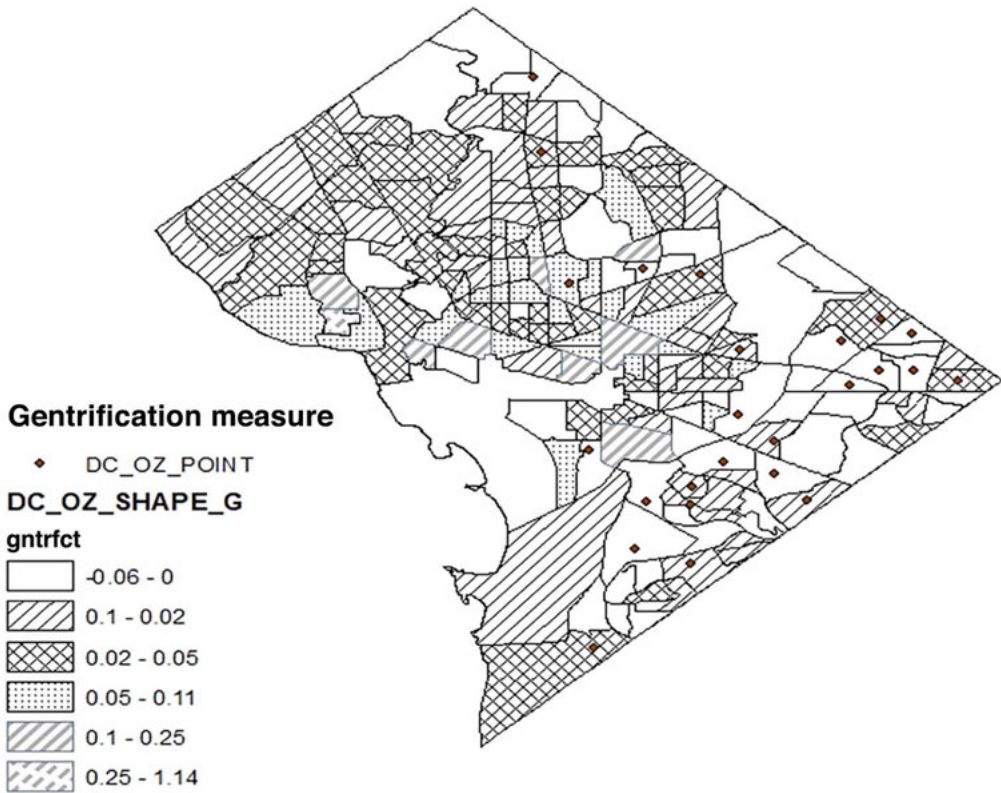
D.C. = District of Columbia. KDE = kernel density estimates.

Sources: D.C. administrative individual income tax data and author's calculation from American Community Survey data

Next, using spatial analysis, we examine the relationship between OZ location decisions and gentrification in D.C. Exhibit 10 shows D.C. census tracts on the gentrification scale, with lack of current gentrification indicated by a lack of pattern, and the various patterns showing different levels on the gentrification over the period studied. The points on the map indicate census tracts designated as OZ. Of the 25 OZ census tracts, 12 have a positive gentrification score, corresponding to 48 percent of OZ census tracts. Only 24 percent, however, or six OZ census tracts, can be classified as gentrifying (that is, with a gentrification score above the city average). Thus, conditional on being an OZ, a census tract is more likely to be non-gentrifying than to be gentrifying. An additional five census tracts are bordering two or more census tracts with a positive gentrification score. Thus, 68 percent of D.C. OZ census tracts have a positive gentrification score or are surrounded by these census tracts. Alternately, Appendix exhibits A-7 through A-10 show the year-to-year gentrification measure changes for the periods 2011–12 (exhibit A-7), 2012–13 (exhibit A-8), 2013–14 (exhibit A-9), and 2014–15 (exhibit A-10). These exhibits indicate which census tracts showed consistent annual increase in the gentrification measure over the entire period, as well as the level of this increase, which tracts had periods of increase and periods without, and which did not experience increase at any time (and may have experienced decrease). The aim of the OZ program is to generate economic activity in distressed areas and areas with difficulty attracting investment. From the literature, we know that gentrifying areas already provide a pull factor in terms of investment dollars, and as such, they do not generally require additional factors to spur economic activity. Whereas we do not have direct evidence on whether gentrification was an explicit factor in the decisionmaking process, we find that there is a positive relationship between gentrification and OZ designation.

Exhibit 10

Gentrification Scale and Designated Opportunity Zones in D.C.



*D.C. = District of Columbia. OZ = Opportunity Zone.
Source: Author's calculation from American Community Survey data*

After our spatial analysis of OZ location and gentrification, we then try to predict which OZ census tracts will receive higher investments using a fixed-effects ordinary least squares regression focusing on OZ-eligible tracts in our analysis. Exhibit 11 shows our preferred specification. The dependent variable is the number of construction permits, a proxy for new investments, from 2011 to 2015, with residential and business vacancy rates as the main independent variables of interest. We also control for neighborhood and individual characteristics.

The effect of the average business vacancy rate is negative, significant, and relatively stable across models at an approximate value of -0.6. The coefficient on average residential vacancy rate is negative but insignificant. The coefficient on net migration rate per 100 is positive and significant. In predicting which census tracts will be favored in the allocation of OZ investment, however, we expect new investments measured by the number of construction permits to flow to census tracts with lower business vacancy rates and a positive net migration.

Discussion

Our previous analysis of the core-based statistical areas (CBSAs) and D.C. shows that there is a correlation between gentrification and both residential and business vacancy. CBSAs are geographic areas defined in terms of whole counties (or county equivalents) and consists of an urban core of at least 10,000 population and its surrounding socially and economically integrated areas.¹⁹ We also find that the impact of gentrification on economic development, as measured by the vacancy rate is stronger in OZs. Making use of the available administrative D.C. data, we examine the relationship between migration patterns and gentrification. We find that even prior to the designation, displacement of lower income residents was already a feature of these census tracts.

Exhibit 11

Regression Results for Residential Permits

VARIABLES	(1) Permits	(2) Permits	(3) Permits	(4) Permits	(5) Permits	(6) Permits	(7) Permits	(8) Permits	(9) Permits	(10) Permits
Net migration rate per 100 pop										0.310* (0.161)
Assessment									-6.36e-06 (6.88e-06)	-6.42e-06 (6.86e-06)
Income								-0.000278 (0.000277)	-0.000256 (0.000296)	-0.000317 (0.000297)
Unemployment rate							0.205 (0.409)	0.163 (0.411)	0.245 (0.422)	0.262 (0.420)
Poverty rate						0.0943 (0.213)	0.0876 (0.214)	0.0809 (0.214)	0.0956 (0.232)	0.0721 (0.231)
Hispanic population					32.65 (45.81)	30.33 (46.16)	30.06 (46.21)	35.29 (46.50)	23.83 (48.66)	23.36 (48.46)
Non-Hispanic Black					-17.63 (35.28)	-20.19 (35.79)	-22.77 (36.20)	-18.80 (36.42)	-20.06 (39.03)	-18.72 (38.88)
Ave vacancy rate business		-0.665** (0.280)	-0.635** (0.289)	-0.635** (0.289)	-0.656** (0.291)	-0.658** (0.291)	-0.657** (0.292)	-0.666** (0.292)	-0.672** (0.298)	-0.649** (0.297)
Ave vacancy rate residential	-0.726 (0.741)		-0.332 (0.758)	-0.332 (0.758)	-0.366 (0.759)	-0.389 (0.762)	-0.395 (0.763)	-0.354 (0.764)	-0.334 (0.820)	-0.289 (0.817)
Constant	59.97*** (4.076)	61.94*** (2.873)	63.36*** (4.337)	63.36*** (4.337)	73.90*** (27.78)	73.57*** (27.82)	73.79*** (27.85)	80.62*** (28.67)	84.46*** (30.56)	86.19*** (30.44)
Observations	464	464	464	464	464	464	464	464	447	447
R-squared	0.125	0.137	0.137	0.137	0.142	0.142	0.143	0.145	0.151	0.160
Number of census tract	116	116	116	116	116	116	116	116	112	112
FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time Fixed Effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Standard errors in parenthesis

***p<0.01, **p<0.05, *p<0.1

FE = fixed effects.

Sources: District of Columbia administrative income tax data and U.S. Postal Service-U.S. Department of Housing and Urban Development data

¹⁹ https://www.census.gov/glossary/#term_CoreBasedStatisticalAreasCBSAs

Gentrification is an interesting phenomenon to study in the context of OZ, given that public policy is identified as a causal factor in the recent gentrification literature. Indeed, the investment from public policy can raise expectations regarding neighborhood change, with these expectations spurring a rise in property prices. Whereas early literature found small and often insignificant effects of OZ designation on property prices, the effect in areas which already have some level of expectation of neighborhood improvement (through early signs of gentrification) may react differently to OZ designation compared to other similar census tracts.

To complement the previous migration analysis based on individuals, we turn to loan origination data, which gives an indication of neighborhood dynamics from the property perspective. This data also provide insight into the racial breakdown of loan information. A strand of gentrification literature focuses on this racial component. Appendix exhibits A-1–A-5 show loan originations by dollar amount and number of loans estimated from Home Mortgage Disclosure Act data for four groups of census tracts in D.C., namely OZ-designated, OZ non-designated, OZ-eligible, and OZ non-eligible. Although HMDA loan origination data do not accurately reflect the total number of houses purchased in D.C. in the 2010–19 period, they can be useful in providing a picture of general trends. We also compare the number of loan originations to African-American and non-African-American potential home purchasers shown in appendix exhibits A-3 and A-5. Generally, appendix exhibits A-1 and A-2 show an increase in the loan amount and the number of loans generated to potential homebuyers in OZ-designated and OZ-eligible census tracts between 2010 and 2019 and a decrease in the loan amount and the number of loans in OZ non-designated and OZ non-eligible areas. This shows the potential increase in economic activity and migration to OZ-designated and OZ-eligible areas. We also find a slight increase in the number of loans originated to potential African-American home purchasers in OZ-designated and OZ-eligible census tracts. Additionally, the number of loans originated to potential African-American home purchasers have consistently decreased in OZ non-designated and OZ non-eligible census tracts. If OZ designation increases the rate of gentrification in OZ-designated census tracts, we may observe the displacement of African-American residents from these census tracts after more investments flow into them. The D.C. government tries to spread OZ investments toward the neighborhoods that it designates as policy priorities. It is unclear if the amount of OZ incentives provided by the D.C. government is sufficient to counterbalance the profit opportunities created by gentrification in OZ-designated census tracts.

Conclusion

The Opportunity Zones policy is in its early days, and the long-term effects of the program are yet to be determined. Still, in this article we explore the interaction between Opportunity Zones and gentrification, a process whose effects have been studied for over 50 years.

In the first section of this article, we looked at the interaction between Opportunity Zones and gentrification in CBSAs. We showed that as Opportunity Zones get further into the gentrification process, there is a positive net migration, and evidence of increased economic business activity through the decrease in residential and business vacancy rates. We then used D.C. as a case study, a city known to be experiencing gentrification, to analyze the relationship between

migration and gentrification and to predict the effects of an increase in investment due to policy on economic activity.

The focus of our analysis of migration patterns in D.C. was primarily on two income groups: movers with income below the 25th percentile (low-income movers) and movers with income above the 75th percentile (high-income movers) of the income distribution. We see that the further an Opportunity Zone eligible tract advances into gentrification, the more we observe out-migration among low-income movers. At the same time, we observe increases in in-migration of high-income movers. Furthermore, spatial analysis of gentrification and OZ designation location between 2012 and 2015 showed that D.C. is becoming more gentrified through time. Our analysis also indicates that approximately 68 percent of the OZ-designated census tracts were either gentrifying or adjacent to two or more gentrifying tracts.

In our analysis on D.C., we tried to predict the destination of new investments among OZ eligible census tracts, using construction permits as a proxy for new investments. We found that census tracts with positive net migration and lower business vacancy rates are likely to receive increased permit applications. Thus, based on our previous findings of the stronger negative relationship between gentrification and business vacancy rates in OZ-eligible and OZ-designated census tracts, gentrifying neighborhoods are expected to receive a greater share of new investments as measured by the number of permits. Given recent literature (Hwang and Lin, 2016) on the effect of investment and public policy as a contributor to gentrification, our findings suggests that the selection of gentrifying and gentrification-adjacent census tracts as designated OZs could attract more new financing. Therefore, we expect gentrifying designated OZs to disproportionately benefit from the new investments.

In the future, we expect further research on Opportunity Zones to provide a more precise estimate on the effect of OZ designation on the rate of gentrification once more data become available. Specifically, we expect to see data on actual investment and its effect on designated OZ census tracts. Additionally, it will be interesting to examine the impact of D.C.'s recently passed law²⁰ regarding receipt of OZ tax benefits at the District level²¹ on which projects get funded and the impact on gentrification in D.C.

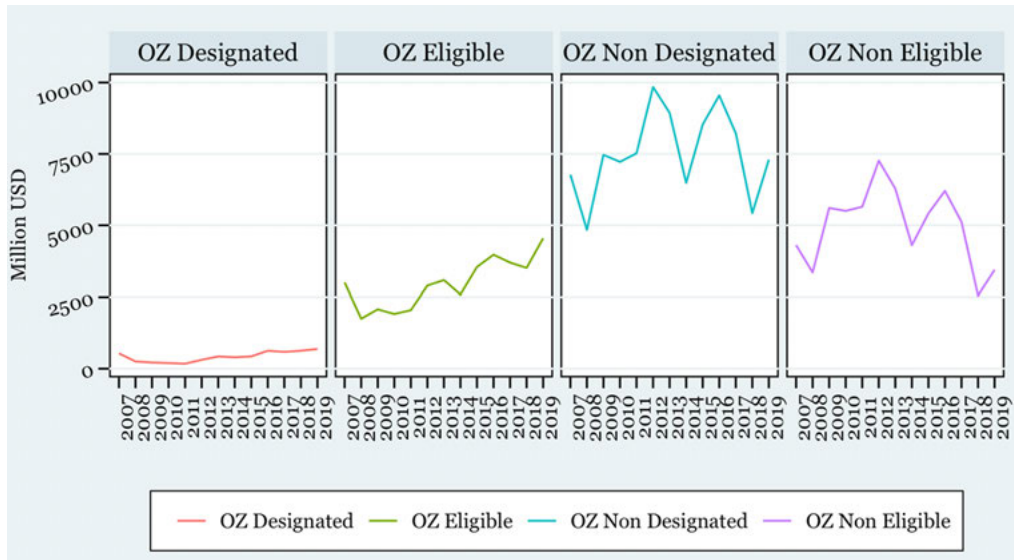
²⁰ D.C. Act 23-407 Section 2021

²¹ [D.C. Opportunity Zone Marketplace - District Qualified Opportunity Fund](#)

Appendix

Exhibit A-1

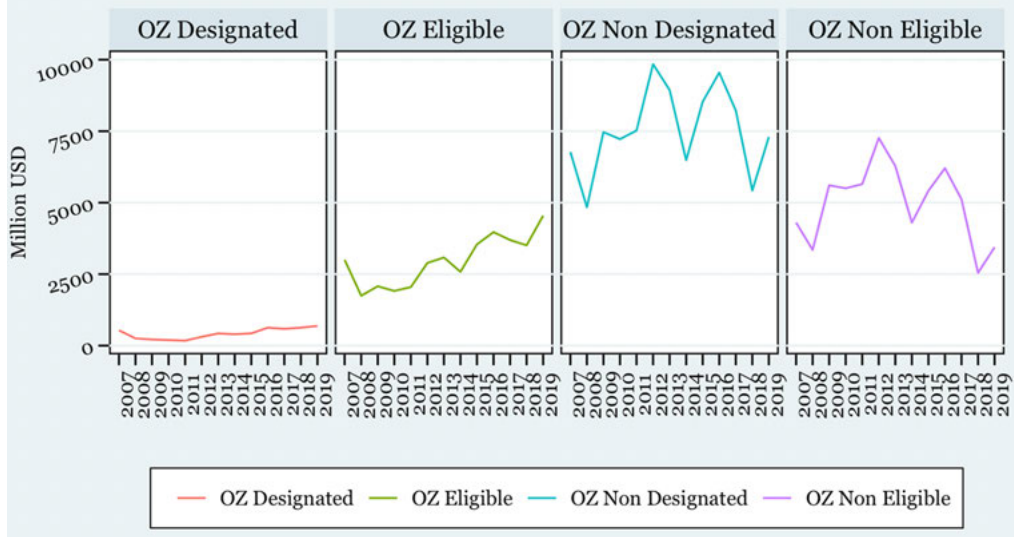
Total Amount of Loans Originated in D.C.



D.C. = District of Columbia. OZ = Opportunity Zone. USD = U.S. dollars.
 Sources: Consumer Finance Protection Bureau; Federal Financial Institution Examination Council

Exhibit A-2

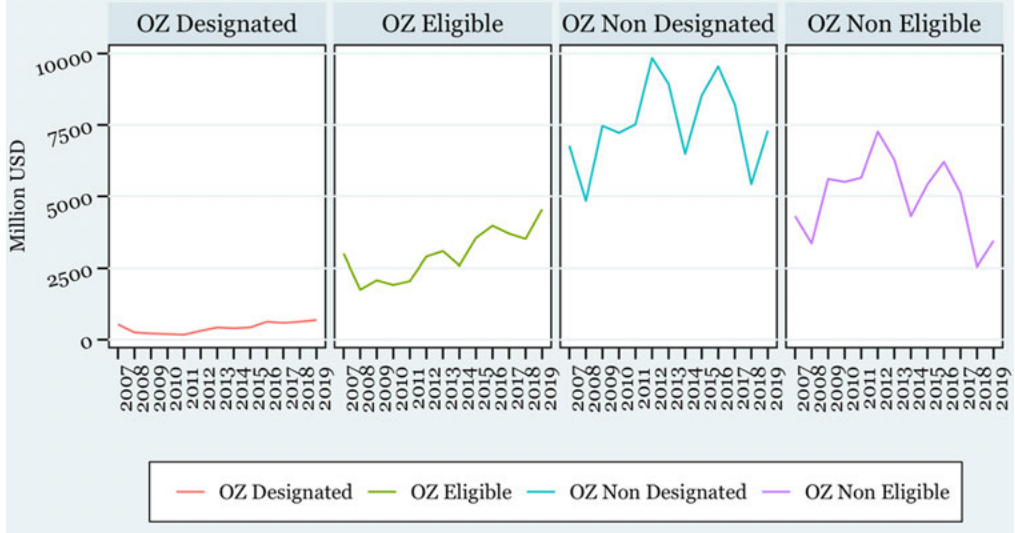
Total Number of Loans Originated in D.C.



D.C. = District of Columbia. OZ = Opportunity Zone. USD = U.S. dollars.
 Sources: Consumer Finance Protection Bureau; Federal Financial Institution Examination Council

Exhibit A-3

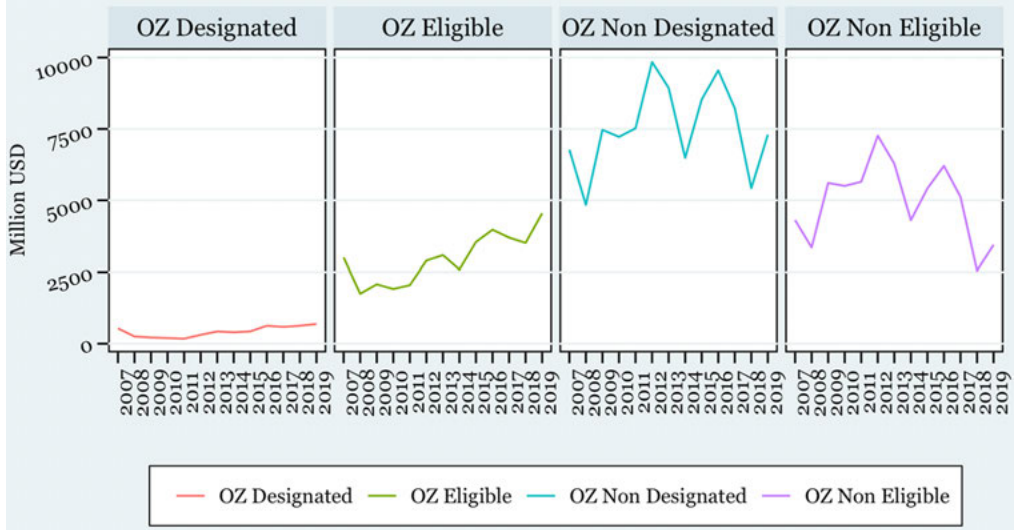
Number of Loans Originated to African-American Population in D.C.



D.C. = District of Columbia. OZ = Opportunity Zone. USD = U.S. dollars.
 Sources: Consumer Finance Protection Bureau; Federal Financial Institution Examination Council

Exhibit A-4

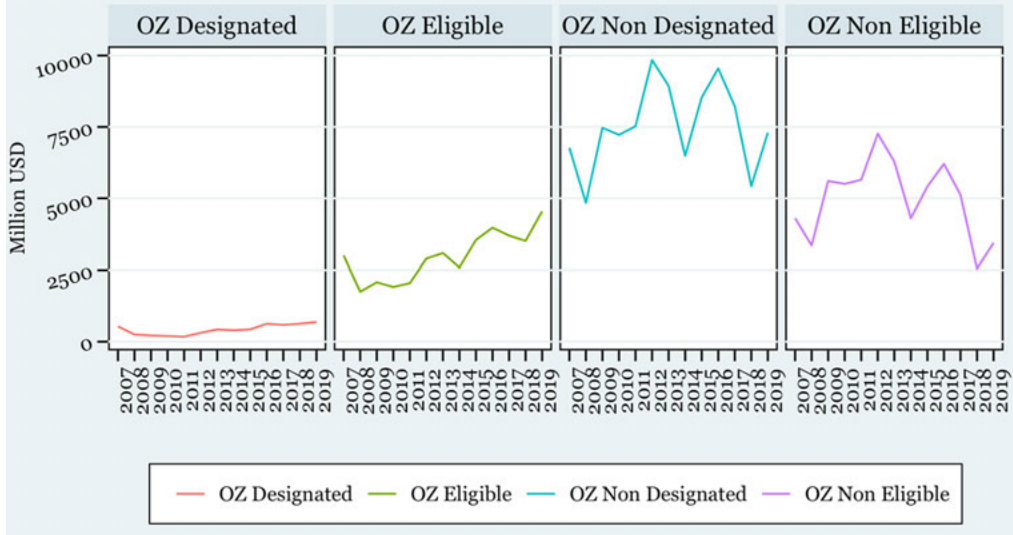
Total Amount of Loans Originated to African-American Population in D.C.



D.C. = District of Columbia. OZ = Opportunity Zone. USD = U.S. dollars.
 Sources: Consumer Finance Protection Bureau; Federal Financial Institution Examination Council

Exhibit A-5

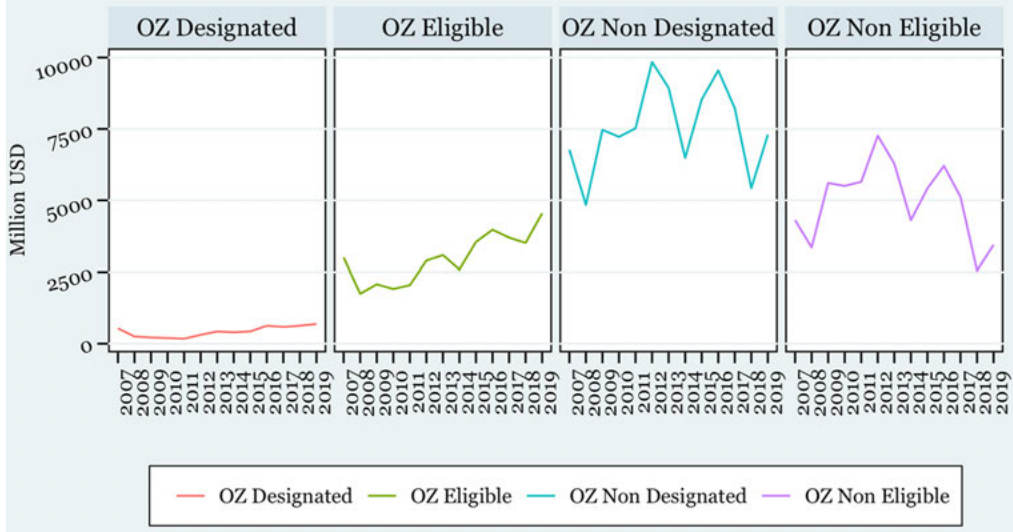
Number of Loans Originated to Non-African-American Population in D.C.



D.C. = District of Columbia. OZ = Opportunity Zone. USD = U.S. dollars.
 Sources: Consumer Finance Protection Bureau; Federal Financial Institution Examination Council

Exhibit A-6

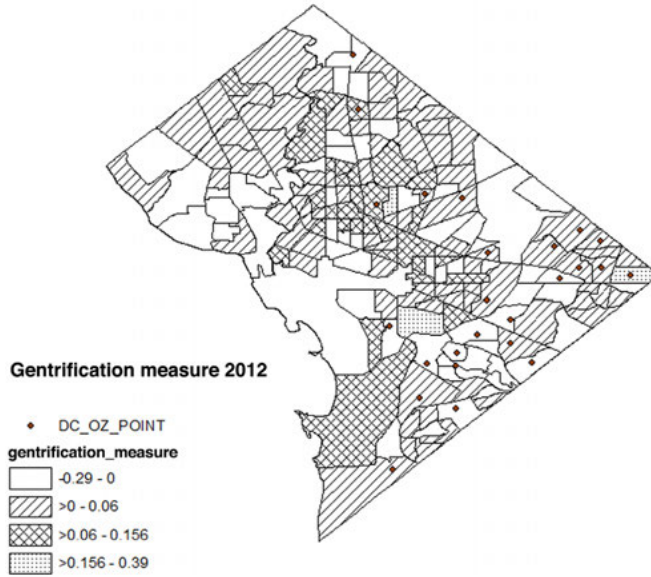
Total Amount of Loans Originated to Non-African-American Population in D.C.



D.C. = District of Columbia. OZ = Opportunity Zone. USD = U.S. dollars.
 Sources: Consumer Finance Protection Bureau; Federal Financial Institution Examination Council

Exhibit A-7

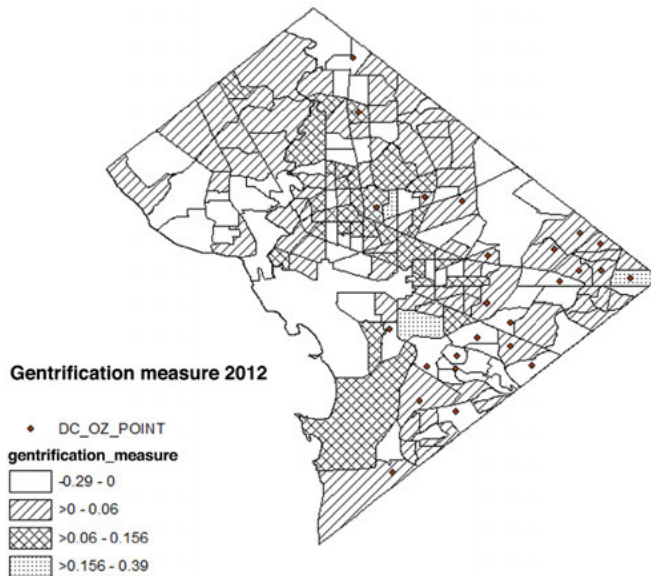
Gentrification Scale and Designated OZ in D.C., 2012



D.C. = District of Columbia. OZ = Opportunity Zone.
Source: Author's calculation from American Community Survey data

Exhibit A-8

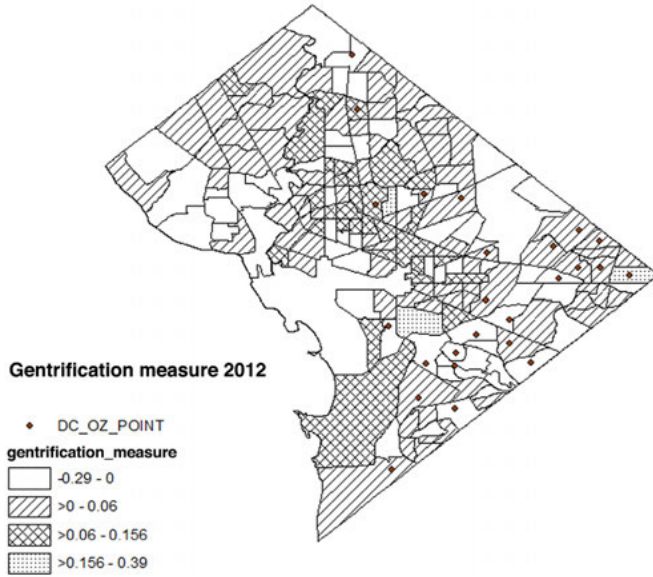
Gentrification Scale and Designated OZ in D.C., 2013



D.C. = District of Columbia. OZ = Opportunity Zone.
Source: Author's calculation from American Community Survey data

Exhibit A-9

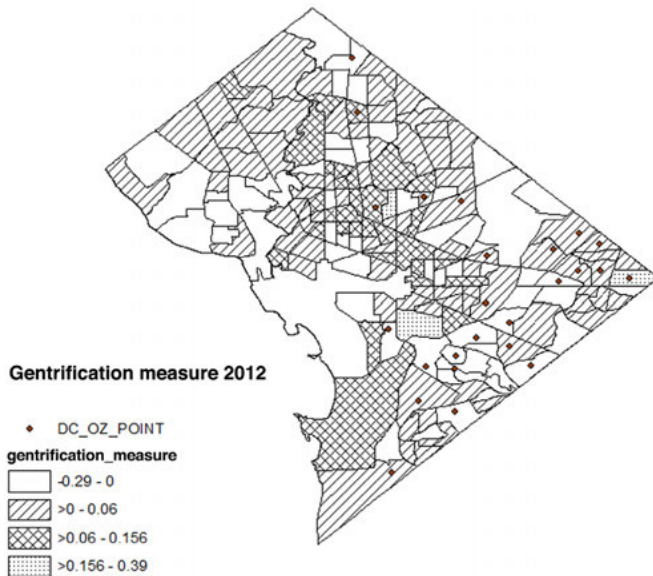
Gentrification Scale and Designated OZ in D.C., 2014



D.C. = District of Columbia. OZ = Opportunity Zone.
Source: Author's calculation from American Community Survey data

Exhibit A-10

Gentrification Scale and Designated OZ in D.C., 2015



D.C. = District of Columbia. OZ = Opportunity Zone.
Source: Author's calculation from American Community Survey data

Exhibit A-11

Summary Statistics of OZ Eligible Census Tracts in 100 Most Populous CBSAs

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	17,996	42,147.09	15,743.46	5,000.00	158,580.00
Median Home Value (2010), \$	17,550	229,642.80	162,399.00	11,000.00	988,300.00
Median Gross Rent (2010), \$	17,896	880.68	267.55	116.00	2,000.00
Population below 100% of the Poverty Level (2010), %	18,067	3,933.98	1,816.07	0	24,494
Median Household Income (2016), Dollars	17,986	44,062.26	16,654.52	3,250.00	181,406.00
Median Home Value (2016), \$	17,403	215,970.70	170,925.30	10,200.00	1,796,900.00
Median Gross Rent (2016), \$	17,958	994.06	315.54	114.00	3,391.00
Population below 100% of the Poverty Level (2016), %	18,067	4,113.47	2,027.78	0	33,081
Gentrification Rate	18,018	0.02	0.10	-0.26	6.17
Residential Vacancy Rate (2010)	14,203	0.05	0.06	0.00	0.86
Business Vacancy Rate (2010)	14,196	0.11	0.08	0.00	0.75
Residential Vacancy Rate (2016)	18,050	0.04	0.06	0.00	0.94
Business Vacancy Rate (2016)	18,039	0.10	0.09	0.00	1.00

CBSAs = core-based statistical areas. OZ = Opportunity Zone.
Sources: American Community Survey (ACS) 2010; ACS 2016

Exhibit A-12

Summary Statistics of OZ Non-Eligible Census Tracts in 100 Most Populous CBSAs

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	16,914	82,555.89	28,816.01	6,125.00	249,194.00
Median Home Value (2010), \$	16,336	361,463.50	201,537.10	18,600.00	1,000,000.00
Median Gross Rent (2010), \$	15,063	1,131.04	358.63	183.00	2,000.00
Population below 100% of the Poverty Level (2010), %	17,266	4,378.36	2,032.43	0	25,000
Median Household Income (2016), \$	16,883	89,535.76	30,980.80	11,736.00	249,597.00
Median Home Value (2016), \$	16,760	380,066.90	260,333.30	29,400.00	2,000,000.00
Median Gross Rent (2016), \$	16,244	1,392.67	519.35	235.00	3,500.00
Population below 100% of the Poverty Level (2016), %	17,266	4,658.01	2,385.83	0	60,942
Gentrification Rate	17,192	0.02	0.32	-1.84	39.90
Residential Vacancy Rate (2010)	12,339	0.02	0.02	0.00	1.00
Business Vacancy Rate (2010)	12,323	0.08	0.07	0.00	0.80
Residential Vacancy Rate (2016)	17,083	0.01	0.02	0.00	1.00
Business Vacancy Rate (2016)	17,086	0.07	0.07	0.00	0.73

CBSAs = core-based statistical areas. OZ = Opportunity Zone.
Sources: American Community Survey (ACS) 2010; ACS 2016

Exhibit A-13

Summary Statistics of OZ Designated Census Tracts in 100 Most Populous CBSAs

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	3,409	33,885.68	13,569.78	6,336.00	117,750.00
Median Home Value (2010), \$	3,282	207,244.90	154,177.60	12,600.00	944,400.00
Median Gross Rent (2010), \$	3,396	799.39	244.65	116.00	1,981.00
Population below 100% of the Poverty Level (2010), %	3,422	3,692.83	1,864.64	0	24,494
Median Household Income (2016), Dollars	3,408	35,036.56	14,052.84	4,621.00	130,592.00
Median Home Value (2016), \$	3,216	191,499.80	160,449.80	10,400.00	1,321,400.00
Median Gross Rent (2016), \$	3,406	901.51	292.08	203.00	2,983.00
Population below 100% of the Poverty Level (2016), %	3,422	3,866.72	2,055.80	0	28,186
Gentrification Rate	3,406	0.02	0.04	-0.12	1.01
Residential Vacancy Rate (2010)	2,746	0.07	0.07	0.00	0.57
Business Vacancy Rate (2010)	2,746	0.12	0.08	0.00	0.62
Residential Vacancy Rate (2016)	3,417	0.05	0.07	0.00	0.69
Business Vacancy Rate (2016)	3,419	0.11	0.09	0.00	0.86

*CBSAs = core-based statistical areas. OZ = Opportunity Zone.
Sources: American Community Survey (ACS) 2010; ACS 2016*

Exhibit A-14

Summary Statistics of OZ Non-Designated Census Tracts in 100 Most Populous CBSAs

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	31,501	64,738.04	30,438.96	5,000.00	249,194.00
Median Home Value (2010), \$	30,604	302,408.80	195,402.80	11,000.00	1,000,000.00
Median Gross Rent (2010), \$	29,563	1,017.58	338.26	159.00	2,000.00
Population below 100% of the Poverty Level (2010), %	31,911	4,200.28	1,938.86	0	25,000
Median Household Income (2016), \$	31,461	69,442.53	33,300.67	3,250.00	249,597.00
Median Home Value (2016), \$	30,947	307,383.50	237,954.30	10,200.00	2,000,000.00
Median Gross Rent (2016), \$	30,796	1,214.55	474.49	114.00	3,500.00
Population below 100% of the Poverty Level (2016), %	31,911	4,434.56	2,237.29	0	60,942
Gentrification Rate	31,804	0.02	0.24	-1.84	39.90
Residential Vacancy Rate (2010)	23,796	0.03	0.04	0.00	1.00
Business Vacancy Rate (2010)	23,773	0.09	0.08	0.00	0.80
Residential Vacancy Rate (2016)	31,716	0.02	0.04	0.00	1.00
Business Vacancy Rate (2016)	31,706	0.08	0.08	0.00	1.00

*CBSAs = core-based statistical areas. OZ = Opportunity Zone.
Sources: American Community Survey (ACS) 2010; ACS 2016*

Exhibit A-15

Summary Statistics of OZ Eligible Census Tracts in D.C.

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	113	47,323.70	24,561.66	15,119.00	158,580.00
Median Home Value (2010), \$	109	358,219.30	143,959.40	143,400.00	836,900.00
Median Gross Rent (2010), \$	115	731.28	417.54	0	2,294
Population below 100% of the Poverty Level (2010), %	115	3,029.12	1,178.53	0	7,089
Median Household Income (2016), \$	113	57,897.67	32,103.94	14,692.00	181,406.00
Median Home Value (2016), \$	111	406,646.00	222,695.60	88,600.00	1,425,000.00
Median Gross Rent (2016), \$	112	1,185.38	418.92	395.00	2,557.00
Population below 100% of the Poverty Level (2016), %	115	3,463.57	1,309.43	83	7,665
Gentrification Rate	115	0.04	0.11	-0.06	1.14
Residential Vacancy Rate (2010)	107	0.05	0.04	0.003	0.17
Business Vacancy Rate (2010)	107	0.08	0.06	0.00	0.29
Residential Vacancy Rate (2016)	115	0.03	0.03	0.00	0.11
Business Vacancy Rate (2016)	115	0.06	0.06	0.00	0.24

CBSAs = core-based statistical areas. OZ = Opportunity Zone.

Sources: American Community Survey (ACS) 2010; ACS 2016

Exhibit A-16

Summary Statistics of OZ Non-Eligible Census Tracts in D.C.

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	62	92,772.08	32,585.55	43,476.00	213,889.00
Median Home Value (2010), \$	58	574,486.20	164,457.90	273,400.00	924,000.00
Median Gross Rent (2010), \$	63	838.52	656.30	0	3,204
Population below 100% of the Poverty Level (2010), %	63	3,197.14	1,334.68	0	7,012
Median Household Income (2016), \$	62	116,398.70	34,696.05	54,780.00	235,517.00
Median Home Value (2016), \$	62	684,721.00	244,810.80	297,400.00	1,498,300.00
Median Gross Rent (2016), \$	61	1,799.77	335.59	1,055.00	2,494.00
Population below 100% of the Poverty Level (2016), %	63	3,574.83	1,428.16	65	7,366
Gentrification Rate	63	0.04	0.04	-0.05	0.20
Residential Vacancy Rate (2010)	55	0.02	0.02	0.00	0.07
Business Vacancy Rate (2010)	55	0.08	0.06	0.00	0.25
Residential Vacancy Rate (2016)	63	0.01	0.01	0.00	0.04
Business Vacancy Rate (2016)	63	0.05	0.05	0.00	0.22

CBSAs = core-based statistical areas. OZ = Opportunity Zone.

Sources: American Community Survey (ACS) 2010; ACS 2016

Exhibit A-17

Summary Statistics of OZ Designated Census Tracts in D.C.

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	24	33,305.71	9,271.65	19,238.00	56,736.00
Median Home Value (2010), \$	24	276,358.30	63,105.25	143,400.00	408,400.00
Median Gross Rent (2010), \$	25	765.60	296.62	0	1,422
Population below 100% of the Poverty Level (2010), %	25	2,966.44	1,031.27	34	4,771
Median Household Income (2016), \$	24	38,291.38	15,074.93	14,692.00	87,535.00
Median Home Value (2016), \$	23	301,269.60	98,106.65	220,500.00	590,100.00
Median Gross Rent (2016), \$	24	918.29	200.64	440.00	1,317.00
Population below 100% of the Poverty Level (2016), %	25	3,302.04	1,139.88	211	5,660
Gentrification Rate	25	0.01	0.02	-0.01	0.07
Residential Vacancy Rate (2010)	22	0.06	0.03	0.005	0.12
Business Vacancy Rate (2010)	22	0.11	0.06	0.02	0.29
Residential Vacancy Rate (2016)	25	0.05	0.03	0.00	0.11
Business Vacancy Rate (2016)	25	0.09	0.05	0.00	0.17

*CBSAs = core-based statistical areas. OZ = Opportunity Zone.
Sources: American Community Survey (ACS) 2010; ACS 2016*

Exhibit A-18

Summary Statistics of OZ Non-Designated Census Tracts in D.C.

	N	Mean	St. Dev.	Min	Max
Median Household Income (2010), \$	151	68,212.65	35,385.53	15,119.00	213,889.00
Median Home Value (2010), \$	143	459,674.80	183,246.50	173,700.00	924,000.00
Median Gross Rent (2010), \$	153	769.83	543.72	0	3,204
Population below 100% of the Poverty Level (2010), %	153	3,108.55	1,266.92	0	7,089
Median Household Income (2016), \$	151	85,034.20	42,849.07	17,303.00	235,517.00
Median Home Value (2016), \$	150	537,741.30	269,977.50	88,600.00	1,498,300.00
Median Gross Rent (2016), \$	149	1,479.93	477.17	395.00	2,557.00
Population below 100% of the Poverty Level (2016), %	153	3,535.78	1,381.43	65	7,665
Gentrification Rate	153	0.04	0.10	-0.06	1.14
Residential Vacancy Rate (2010)	140	0.04	0.03	0.00	0.17
Business Vacancy Rate (2010)	140	0.08	0.06	0.00	0.26
Residential Vacancy Rate (2016)	153	0.02	0.02	0.00	0.11
Business Vacancy Rate (2016)	153	0.06	0.05	0.00	0.24

*CBSAs = core-based statistical areas. OZ = Opportunity Zone.
Sources: American Community Survey (ACS) 2010; ACS 2016*

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