

# Racial Wealth Gaps and Housing Segregation: Evidence from Down Payment Assistance

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October 26th, 2015

## Abstract

Racial segregation between black and white households is a common characteristic of housing markets in the United States, but its causes are not well established empirically. We examine the possibility that some portion of segregation is driven by lower average wealth for black households. When purchasing a home, wealth directly affects home value because borrowers must meet down payment requirements for a mortgage. These requirements may keep black households from buying homes in more expensive and predominantly white neighborhoods. We use data from a down payment assistance grant in four cities between 2008 and 2013 to estimate how wealth shocks affect the home purchase decisions of black and white home buyers. If wealth gaps cause segregation, black households should use additional wealth to purchase homes in census tracts with a higher fraction of white residents. Our results indicate that in most cases, black households do not use the grant to buy homes in whiter neighborhoods than households that do not receive down payment assistance. An exception is during the years immediately following the Great Recession, when households may have been constrained by more restrictive down payment requirements. Down payment assistance may be a potential policy tool to reduce racial segregation in these situations.

**Keywords:** Segregation, Wealth, Inequality

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# 1 Introduction

Several studies link U.S. housing segregation with various negative social outcomes for minorities, such as lower educational attainment and employment rates (Kain 1968, Cutler and Glaeser 1997, Weinburg 2000, Stoll 2006, Ananat 2011, Boustan 2013). One potential reason segregation persists is that racial differences in socioeconomic characteristics affect buying power and lead to residential sorting. While the majority of research finds that socioeconomic differences explain only a small portion of the segregation of African American households, these studies often omit or do not include accurate measures of wealth (Gabriel and Rosenthal 1989, Harsman and Quigley 1995, Freeman 2000, Bayer et al. 2004, Gabriel and Painter 2008).<sup>1</sup> This paper examines the role that racial wealth gaps play in housing segregation by estimating how wealth shocks affect the home purchase decisions of black and white households.

The average white household has substantially more wealth than the average black household in the United States.<sup>2</sup> Insufficient wealth has been established as a barrier to homeownership (Linneman and Wachter 1989, Zorn 1989, Haurin, et al. 1997, Barakova et al. 2003, Haurin et al. 2007) and research finds that wealth gaps are one reason homeownership rates are lower for minority households (Gyourko et al. 1999, Charles and Hurst 2002, Gabriel and Painter 2003, Painter et al. 2003, Gabriel and Rosenthal 2005, Herbert and Tsen 2005, Herbert et al. 2005, Hilber and Liu 2008). Less is known about the relationship between wealth and racial segregation. Crowder et al. (2006) is the only study to our knowledge that focuses specifically on the role of wealth in housing

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<sup>1</sup>Bayer et al. (2014) find evidence of a mechanism in which decreasing economic inequality actually increases segregation, as more middle-class black neighborhoods become available.

<sup>2</sup>The 2010 Census reports the median net worth for non-Hispanic white households was over \$110,000, compared to approximately \$5,000 for black households (US Census, <http://www.census.gov/people/wealth/>).

segregation. Following households through the Panel Survey of Income Dynamics, they find no evidence that accumulating additional wealth increases the probability that a minority homeowner moves to a census tract with a higher fraction of non-Hispanic white residents.

We examine the role that wealth plays in segregation using information on a down payment assistance grant from the Federal Home Loan Bank of Cincinnati's Welcome Home Program (WHP) between 2008 and 2013. The WHP provides annual down payment assistance grants up to \$5,000 to low and moderate income homebuyers in Ohio, Kentucky and Tennessee. The grant allows borrowers to increase their down payment and potentially qualify to purchase a more expensive home. Households that qualify to purchase their desired home value prior to receiving the grant will likely use the assistance to lower their housing costs and purchase other goods. If grant recipients were previously unable to purchase their desired home because of insufficient wealth, they may use down payment assistance to increase their loan size and purchase a more expensive home. The positive correlation between home values and the fraction of white residents in a neighborhood suggests that black homebuyers may be able to use the grant to purchase more expensive homes in whiter neighborhoods.

Data from the WHP down payment assistance grant provides a unique opportunity to reexamine the role that wealth plays in racial segregation. Where previous research uses survey data, down payment assistance represents a plausible wealth shock. Our empirical analysis compares WHP grant recipients to similar households that do not receive assistance in the Home Mortgage Disclosure Act database. We use the merged dataset to estimate the effect of the WHP grant on loan size and racial composition in the census tract where the home is purchased. Specifically, we compare the effect of the grant on black grant recipients to the effect on white grant recipients. If black households are more likely to use the grant to purchase homes in whiter neighborhoods, it suggests

that black borrowers are more wealth constrained than white borrowers.

Our results are generally consistent with previous studies that find an insignificant relationship between wealth and segregation. This is evidence that the segregation of black households is primarily caused by a combination of discrimination and household preferences. However, we find evidence that black households use the grant to move to whiter census tracts during 2008 and 2009, the years near the end of the economic recession. These results may suggest that wealth gaps exacerbate segregation when lending standards or down payment requirements are more restrictive. Down payment assistance may be an effective policy tool to reduce segregation under these conditions.

## **2 Background**

### **2.1 Theories of Racial Segregation**

Common metrics indicate that racial segregation has decreased since the 1970s but it is still a predominant feature of many U.S. cities (Cutler et al. 1999). While the causes of persistent segregation are not well established, three general theories potentially explain why it exists. One theory postulates that racial discrimination restricts minority households from buying or renting homes in predominantly white neighborhoods. While this type of explicit discrimination is no longer legal, there is evidence that discrimination in the housing market still exists. Research shows that real estate agents may treat households differently based on race (Yinger 1998, Turner et al. 2002), black and Hispanic homebuyers pay more than white homebuyers for similar homes (Bayer et al. 2014) and mortgage rejection rates are higher for black households (Munnell et al. 1996, Turner et

al. 1999). Based on a review of research on housing discrimination, Ross (2008) argues that despite its prevalence, discrimination is not able to fully explain the persistence of U.S. housing segregation.

Another theory focuses on household preferences. Under this theory, segregation is driven by the desire to live near others of the same race. In his seminal paper, Schelling (1971) proposes a model showing that racial segregation will result if only one type of household has even a mild preference to live in a homogenous neighborhood. There is some evidence that black households have a preference to live near households of the same race (Thernstrom and Thernstrom 1997, Krysan and Farley 2002, Ihlanfeldt and Scafidi 2002, Waldfogel 2008), but most research concludes that the preferences of black households play only a minor role in housing segregation.

More evidence exists that white households have a strong preference to avoid neighborhoods where the majority of the population is black (Emerson et al. 2001), which could play an important role in housing segregation. Although white households cannot legally exclude black households from their neighborhoods, they have been shown to leave areas that experience in-migration of minority households. Using data on mass migration of African Americans to northern cities during the mid-20th century, Boustan (2010) estimates 2.7 white people left a city in response to the arrival of each black migrant. Card et al. (2008) provides additional evidence that white households leave neighborhoods experiencing an influx of black households, particularly when the fraction of black residents passes some threshold or “tipping” point.

A third theory is the basis for our analysis, which states that segregation results from differences in socioeconomic characteristics. If minority households have fewer financial resources than white households, they may choose to live in neighborhoods that are more affordable. This segregation may appear to be caused by discrimination or preferences, but actually result from racial differences in buying power.

Previous research uses survey data and hedonic regression analysis to examine this theory. Results indicate that while socioeconomic differences may contribute to the segregation of the Asian and Hispanic populations, there is less evidence that it contributes to the segregation of black households (Gabriel and Rosenthal 1989, Harsman and Quigley 1995, Freeman 2000, Bayer et al. 2004, Gabriel and Painter 2008). Our study examines this theory from a different perspective, focusing on how wealth shocks alter the location of home purchase for households of different races. In addition to offering insights to the relationship between wealth and segregation, our study provides information on the potential benefits of down payment assistance, which is a common policy used to promote homeownership.

## **2.2 Down Payment Assistance and the Welcome Home Program**

Potential homebuyers may seek assistance to supplement their down payment from family, lenders or community sources. Freeman and Harden (2015) use information from a sample of low-income homebuyers in the Community Advantage Panel Study to show that access to different sources of down payment assistance varies by race. Black homebuyers are the least likely to receive down payment assistance from family, but are most likely to supplement their down payment using a community grant or a second mortgage.

Charles and Hurst (2002) provide additional evidence of racial differences in access using the 1991 to 1996 Panel Survey of Income Dynamics. In that survey, only 10 percent of black homebuyers receive financial assistance for their down payment, compared to 46 percent of white buyers. Ninety percent of those assisted white households receive some portion of that funding from family. Charles and Hurst conclude that lower levels of parental wealth significantly limit black households from

applying for loans. The lower rates of application explain a large portion of the homeownership gap between black and white households. Herbert and Tsen (2005) support this conclusion, showing that cash grants have a positive impact on the probability that low-income and minority households become homeowners.

Other research examines how homebuyers respond to receiving down payment assistance, specifically from family sources. Using a survey of homebuyers from 1988 to 1993, Englehardt and Mayer (1998) find that homebuyers who receive intergenerational transfers allocate the money between savings and down payment. Of the funds allocated toward down payment, about three-fourths is used to increase equity in the home, holding home price constant. The other one-fourth is used to buy a more expensive home. Other research finds similar results (Guiso and Jappelli 2002, Luea 2008).

The focus of our study is a community source of down payment assistance called the Welcome Home Program (WHP), which is operated by the Federal Home Loan Bank of Cincinnati (FHLB). The WHP is a product of the FHLB's Affordable Housing Program, created to help member institutions meet the requirements set forth in the Community Reinvestment Act of 1977. These requirements include providing ample credit opportunities to low and moderate income borrowers and promoting homeownership. Programs aimed at reaching these goals are funded by a portion of FHLB profits, which are set aside at the end of each fiscal year.

The WHP provides down payment assistance grants up to \$5,000 to eligible homebuyers. The grant can be used for down payment or other non-repair housing related costs. Beginning in January of each year, FHLB member banks can reserve the WHP funds on behalf of a borrower on a first come first serve basis. All of the funds are usually reserved by March of each year. Member banks can reserve funds for qualified homebuyers with a reservation request including a uniform residential-

loan application, third-party documentation of all income sources for all individuals residing in the home and, in some cases, an appraisal. The maximum amount of WHP funds that an individual bank can reserve is \$200,000.

Potential homebuyers must meet various requirements to be eligible for down payment assistance. First, total household income must be equal to or less than 80 percent of the income limits set forth by the state housing authority's mortgage revenue bond program. Each household must have also been able to qualify for a loan without down payment assistance and be able to supply a minimum of \$500 of their own funds toward down payment and closing costs on the home. The WHP does not allow co-borrowers who will not occupy the home and any funds received by the buyer at closing reduce the WHP funds dollar for dollar.<sup>3</sup>

### **3 Theoretical and Empirical Model**

In previous research (Lang and Hurst 2014), we examine if the WHP down payment assistance program alters the size and type of loan a household chooses. Using three years of data from Ohio, Kentucky and Tennessee, we find evidence that some borrowers use the grant to reduce loan size and switch from a Federal Housing Agency (FHA) to a conventional loan type. Because conventional loans charge fewer fees but require a larger down payment, the results suggest that lower housing costs are more valuable to the average grant recipient than purchasing a more expensive home. Because our current study focuses on households with less wealth, we limit the sample to borrowers that use FHA loans. Federal Housing Agency loans only require 3.5 percent down payment, so they are an attractive option for homebuyers without a large amount of wealth.

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<sup>3</sup>Additional program information can be found at the Federal Home Loan Bank of Cincinnati's web page: <https://web.fhlbcin.com/Pages/fhlbcin.aspx>

The theoretical framework that outlines how down payment assistance could alter decisions in the home purchase process is based on models from a long line of research on mortgage borrowing constraints (Ambrose et al. 2002, Brueckner 1994, Goodman and Nichols 1997, Haurin et al. 2006, Hendershott et al. 1997, Linneman and Wachter 1989, Pennington-Cross and Nichols 2000).<sup>4</sup> We build upon this work and characterize a utility function for a homebuyer who is using an FHA loan to purchase a home. Borrowers choose home value and non-housing consumption to maximize their utility, described by

$$U(V, NH | \alpha, \delta, \gamma, LTV, X). \quad (1)$$

This decision is subject to four constraints:

$$D \leq \gamma * Y \quad (1a)$$

$$Y = \alpha(X) * (V - D) + NH \quad (1b)$$

$$V - D \leq \delta(X) * (1 - \gamma) * Y \quad (1c)$$

$$V \leq \frac{D}{(1 - LTV(X))} \quad (1d)$$

The variable  $V$  represents the price of the purchased home,  $NH$  is non-housing consumption and  $Y$  is the net present value of available income and wealth. The constraint (1a) shows that the available financial resources are divided into two components: the present value of flow of expected income and current wealth stock, or savings. The portion of wealth that is in savings can be used toward a down payment  $D$  is equal to  $\gamma Y$ , where  $\gamma < 1$ .

The constraint (1b) represents the allocation of income and wealth among lifetime housing costs, a down payment and non-housing consumption. The term  $(V - D)$  represents loan size and  $\alpha(X)$

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<sup>4</sup>Because we cannot measure how assistance alters timing of purchase, it is not included in the theoretical model. Similarly, we do not examine households that are not purchasing a home.

is the present value price of borrowing one dollar, which incorporates the interest rate, property tax rate, mortgage premiums, insurance rates and maintenance. The price is also a function of borrower characteristics, which is represented by  $X$ . Household wealth that is not used for either down payment or housing costs is dedicated to non-housing consumption.

Constraint (1c) characterizes the required debt-to-income ratio, also known as the income constraint (Hendershott et al. 1997). Lenders require that monthly mortgage payments are less than a defined fraction of a borrower's monthly income. This requirement establishes the maximum affordable loan size and housing price that can be purchased, subject to the interest rate. The maximum home price is calculated by multiplying the expected income stream by  $\delta(X)$ , which represents the debt-to-income requirement for a borrower with characteristics  $X$ .

The final constraint (1d) represents the maximum home value a borrower can purchase based on the ratio of down payment to home price, also known as the wealth constraint. The variable  $LTV(X)$  represents the maximum allowable loan-to-value ratio for a borrower with characteristics  $X$ . If a loan has more lenient loan-to-value requirements, the borrower with down payment  $D$  can purchase a more expensive home. Similarly, increasing the down payment increases the maximum price of the home that can be purchased.

When borrowers receive down payment assistance, it represents an increase in wealth. There are three ways borrowers can allocate this additional wealth to the goods that provide utility. First, they could use assistance to loosen the wealth constraint (1d) and purchase a more expensive home. If borrowers allocate an additional \$5,000 toward down payment, it increases the maximum allowable home price by that \$5,000 divided by  $(1 - LTV(X))$ . For example, if the loan-to-value ratio requirement is 90 percent, then the maximum home price increases by \$50,000. However, it is unlikely a borrower would use the grant to purchase a substantially more expensive home. A

borrower's income constraint (1c) is not affected by down payment assistance and a larger loan increases the lifetime cost of owning the home through higher monthly mortgage payments.

Borrowers can alternatively use the down payment assistance to decrease their loan size, holding home price constant. If grant recipients do not decrease the amount of their own wealth they allocate to the down payment, loan size and lifetime housing costs decrease. Borrowers can use the savings to purchase additional non-housing consumption throughout the lifetime of the loan.

The third and final possibility is that borrowers use the assistance to replace their own funds in the down payment. In this case, the grant does not necessarily alter the size of the down payment, loan size or home price. Lifetime housing costs do not change but more wealth is in stock and available for non-housing consumption. Households might prefer this option if they value having additional savings available for unexpected income shocks.

Borrowers will allocate down payment assistance to the choices that yield the highest utility on the margin. In the case of a previously unconstrained household, the grant will likely be divided among the three possibilities. However, it is possible that a borrower at a corner solution for one of its choice variables will allocate more of the grant to that use. This is the foundation of the hypothesis that we examine in our analysis.

If racial differences in wealth cause housing segregation, it suggests that the average black household cannot choose its optimal home value because it is constrained by lack of wealth. If the household values a more expensive home that was not available before receiving assistance, the household will use down payment assistance to loosen the wealth constraint and buy a more expensive home. Considering the relationship between racial composition and home prices, a more expensive home may be located in a neighborhood with a higher percentage of white residents.

In contrast, the average white household holds more wealth and is more likely to have access to

down payment assistance from family members. Because of this, white households may be able to achieve their optimal home value without down payment assistance from a community organization. If this is the case, using the WHP grant to buy a more expensive home may not yield the highest marginal utility. The average white household may be more likely to use down payment assistance to increase non-housing consumption.

Based on this reasoning, we create an empirical specification to examine if black and white households respond differently to receiving down payment assistance. This specification is constructed to find if black households use the grant more often than white households to initiate larger loans and buy homes in more integrated neighborhoods. If they do, it may be evidence that the racial wealth gap contributes to racial segregation.

Because WHP down payment assistance is not randomly allocated, we estimate an interaction term to control for the unobserved characteristics that may be associated with grant receipt but do not differ between black and white households. Under the assumption that black and white households that receive the grant are similar in unobservable characteristics, our strategy identifies how the grant differentially affects the decisions of black versus white households.

We examine two outcome variables in our empirical analysis. First is the size of the loan initiated by the borrower. Second is the fraction of white residents in the census tract of home purchase. Our baseline specification is

$$Loansize_{imt} = \beta_0 + \beta_1 * WHP_{imt} + \beta_2 * Black_{imt} + \beta_3 (WHP_{imt} * Black_{imt}) + X_{imt} * \beta_4 + \lambda_m + \tau_t + \epsilon_{imt}.$$

The variable  $Loansize_{imt}$  represents the size of the mortgage initiated by household  $i$ , that purchases a home in metropolitan area  $m$  in year  $t$ .<sup>5</sup> The independent variable  $WHP_{imt}$  equals

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<sup>5</sup>In previous work, we utilized census tract characteristics instead of MSA fixed effects. In the cur-

one if household  $i$  receives down payment assistance through the Welcome Home Program. The coefficient  $\beta_1$  represents how the grant alters loan size for white homebuyers.

The second variable,  $Black_{it}$ , equals one if the individual who initiates the loan indicates his or her race is black and equals zero if the homebuyer is white. The coefficient  $\beta_2$  represents the average loan size difference between black and white borrowers who do not receive the grant. The coefficient on the interaction term of  $WHP_{it}$  and  $Black_{it}$  represents the differential effect of the grant on black homebuyers, relative to white homebuyers. We measure loan size in thousands of dollars so if  $\beta_3$  equals three, the difference in loan size between assisted and unassisted black homebuyers is \$3,000 larger than the difference between assisted and unassisted white homebuyers. A positive and significant coefficient indicates that black households are more likely than white homebuyers to use the grant to initiate larger loans.

The term  $X_{it}$  is a matrix that includes borrower characteristics reported by the Home Mortgage Disclosure Act (HMDA) database,  $\lambda_m$  are MSA fixed effects and  $\tau_t$  are time fixed effects. Although it is not shown in the specification, the variables in  $X_{it}$  and the fixed effects are interacted with the  $Black_{it}$  binary variable to allow for baseline differences between black and white borrowers.

In addition to loan size, we also estimate a second specification that examines how the grant affects a household's access to racially integrated neighborhoods. The right-hand side of the second specification is the same as the regression above. The only difference is that the dependent variable is the fraction of the population that is white in the census tract where the home is purchased by household  $i$ . The coefficient of interest is still  $\beta_3$ , which measures the differential effect of the grant between white and black households.

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rent specification, we examine how the grant may affect the location of home purchase within the MSA. Therefore we expand the comparison group beyond the households within a single census tract.

There are some caveats to this empirical strategy related to the types of households that choose to apply for and receive down payment assistance. Only borrowers whose annual income is below a county-specific threshold are eligible for the grant. We control for income as reported by HMDA, but we also omit ineligible households from the analysis.

Tenure expectations could also play a role in applying for the grant. Recipients that move within five years of purchasing their home are required to repay a portion of the grant. The required repayment decreases as tenure in the home increases. Because of this, homebuyers that expect to live in a home for only a short time are less likely to apply for assistance. As home values were not increasing rapidly during the period of study, there is less concern that there is a large subset of borrowers engaging in short-term home investments.

Given the available data, it is difficult to control for other factors that affect whether or not a household applies for down payment assistance. Focusing on the interaction term is helpful in eliminating some portion of selection bias in our estimates, but it relies on the assumption of equivalent selection bias between black and white households. We also control for the observable characteristics of the borrowers in the dataset, which are described in the next section.

## **4 Data and Results**

We utilize information on homebuyers who receive down payment assistance grants from the Welcome Home Program (WHP), operated by the Federal Home Loan Bank of Cincinnati (FHLB). The grant is available to people who are purchasing homes through FHLB bank members in Ohio, Kentucky and Tennessee. Between 2008 and 2013, black households make up a meaningful portion of grant recipients in only four of the cities in the coverage area. Because our research centers on

how the grant alters neighborhood access for minorities, we focus on the four metropolitan statistical areas (MSAs) with the largest number of black grant recipients. Those are Cincinnati, OH, Cleveland, OH, Memphis, TN and Nashville, TN. We only include information from the counties of the MSA that fall within either Ohio or Tennessee because income eligibility requirements differ along state lines. In those counties, the FHLB distributed 1,416 down payment assistance grants to borrowers using FHA loans who report being black or non-Hispanic white.<sup>6</sup>

The WHP dataset includes the income, loan size, ethnicity, race, sex and location of purchase for each of the grant recipients. Using the information provided by the FHLB, we match homebuyers from the WHP data to data from the Home Mortgage Disclosure Act (HMDA) website. The HMDA data include every loan that was initiated at a bank that met the HMDA reporting standards and report information on the size, type and location of the loan. The HMDA database also reports the income, ethnicity, race, and sex of the loan applicant and the presence of a co-applicant.

We merge the data from the FHLB to the HMDA data using loan size, location, borrower ethnicity, race, and sex. There is a suitable match for 1,117 of the possible 1,416 grant recipients, corresponding to a 90 percent match rate. We do not include grant recipient observations for which a match cannot be found.

The most common reason that grant recipients cannot be matched to the HMDA data is that only certain types of banks are required to report to the HMDA. Depository and non-depository institutions are required to report mortgage loan data if they hold assets above a certain threshold. That threshold was \$37 million in 2008 and \$43 million in 2013. If a WHP grant recipient purchased the loan from an institution that did not meet the asset threshold, it will not be reported in the

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<sup>6</sup>The potential matches also include observations with unreported race or loan type, although matching these observations was unlikely. Data for 2007 was available but it is omitted because only 20 grant recipients used FHA loans across all four metropolitan areas.

HMDA data. In other cases, errors in the entry of the loan applicant information by FHLB or any of the institutions that reported to HMDA could also prevent a successful match.

The matched data include whether or not a borrower receives down payment assistance, as well as the characteristics reported in the HMDA for each loan in our sample. We merge this loan information to data from the Census about racial composition and median home value of the tract of home purchase. While we do not report regressions where median home value is the dependent variable, we use this information to show that areas with higher fractions of white residents tend to have higher property values.

The loans initiated in years 2008 and 2009 are linked to data from the 2000 Decennial Census. The loans initiated in years 2010 and 2011 are linked to the 2005-2009 American Community Survey (ACS). Loans in 2012 and 2013 are linked to data from the 2007-2011 ACS because 2012 was the first year in which HMDA coded loans in the 2010 Census Geography. All dollar values are converted to real values using 2008 as the base year.

Table 1  
Down Payment Assistance Grants for FHA Borrowers by MSA and Year

Year	Cincinnati		Cleveland		Nashville		Memphis		Total
	Black	White	Black	White	Black	White	Black	White	
2008	11	38	1	10	1	1	1	0	63
2009	21	114	2	23	8	28	2	12	210
2010	21	157	17	15	12	54	3	13	292
2011	13	114	8	12	7	34	2	7	197
2012	7	66	7	13	11	37	0	0	141
2013	16	95	14	9	11	58	5	6	214
Total	89	584	49	82	50	212	13	38	1,117

Table 1 reports the number of down payment assistance grant recipients by MSA, race and year. Banks in Cincinnati allocated the largest number of grants to both races, with 584 to white borrowers and 89 to black borrowers. Memphis allocated the lowest number of loans, with only 13 black borrowers receiving a down payment assistance grant.

The number of grants allocated in all MSAs is much larger after 2008. This is primarily due to grant recipients being more likely to use an FHA loan, instead of a conventional loan, after the housing crash in 2007. A similar trend toward FHA loans exists for borrowers that did not receive down payment assistance. With the exception of Memphis, the reported MSAs have a relatively high number of white homebuyers, which mirrors the difference in the number of white and black grant recipients.

Table 2 reports the descriptive statistics for the data. Relative to white borrowers, black borrowers buy homes in census tracts with lower fractions of white residents and lower median home values in all four MSAs. Black borrowers also report lower incomes than white borrowers and are more likely to be female and have no co-applicant.

Compared to other borrowers, grant recipients of both races are more likely to be female, have a lower income and apply for a loan without a co-applicant. White grant recipients buy homes in tracts with lower median home values but similar fractions of white residents as white borrowers who did not receive assistance.

In most cases, the difference between loans initiated by black grant recipients and other black borrowers is similar to the difference between assisted and unassisted white borrowers. The exception is the Memphis MSA, where relative to other black borrowers, black grant recipients buy homes in census tracts with higher fractions of white residents and higher median home values. Black grant recipients in Memphis buy homes where the fraction of white residents is 58 percent, compared to 42 percent for other black borrowers.

Table 2  
Descriptive Statistics for FHA loans from 2008 to 2013

	Cincinnati	Cleveland	Nashville	Memphis
<b>Black Borrowers</b>				
Non-Grant Recipients				
Tract Percent White	59	52	63	42
Tract Median Value	110	100	127	120
Loan Amount (000s)	95	82	119	96
Applicant Income (000s)	38	35	38	35
Female	0.61	0.63	0.61	0.64
Co-applicant	0.15	0.08	0.12	0.06
Observations	2,408	3,825	3,571	4,593
Grant Recipients				
Tract Percent White	60	46	58	58
Tract Median Value	105	92	124	135
Loan Amount (000s)	82	64	108	102
Applicant Income (000s)	33	30	33	33
Female	0.66	0.86	0.64	0.77
Co-applicant	0.06	0.04	0.10	0.00
Observations	89	49	50	13
<b>White Borrowers</b>				
Non-Grant Recipients				
Tract Percent White	88	90	81	77
Tract Median Value	129	131	142	144
Loan Amount (000s)	103	98	129	115
Applicant Income (000s)	39	37	40	38
Female	0.43	0.42	0.43	0.42
Co-applicant	0.22	0.18	0.24	0.19
Observations	15,647	15,907	20,275	4,711
Grant Recipients				
Tract Percent White	88	87	80	80
Tract Median Value	124	121	138	130
Loan Amount (000s)	91	81	113	98
Applicant Income (000s)	34	32	33	34
Female	0.48	0.50	0.47	0.34
Co-applicant	0.12	0.06	0.16	0.16
Observations	583	82	212	38
<b>Total Observations</b>	<b>18,727</b>	<b>19,863</b>	<b>24,208</b>	<b>9,355</b>

Interestingly, the fraction of white residents in the census tract of home purchase is lower for all borrowers in Memphis, regardless of race and whether or not the household received down payment assistance. The 2010 dissimilarity index, which is a measure of segregation, between the black

and white populations in Memphis is lower than the index in Cincinnati and Cleveland. White households purchasing homes in tracts with relatively fewer white residents is consistent with lower levels of segregation.<sup>7</sup> However, a lower dissimilarity index is inconsistent with black households purchasing homes in tracts with fewer white residents. It is not clear if the small sample size in Memphis represents the true nature of the housing market or if the finding is unique to the time period of study.

Table 3 presents the results for regressions in which loan size is the dependent variable. Robust standard errors are reported in parentheses. Observations from all four MSAs are included in the first column of Table 3. Note that each of the covariates, including MSA and time fixed effects, is interacted with a binary variable that equals one if the race of the borrower is black. Results that do not include racial interactions are not meaningfully different from those that are reported.

The down payment assistance coefficient in the first column is -4.32, meaning that white grant recipients initiate loans that are just over \$4,000 less than the average white borrower that does not receive assistance. Black borrowers who do not receive assistance initiate loans that are \$20,000 larger than the average unassisted white borrower. Unreported regressions show that the average black borrower buys a home in a census tract where the median home value is nearly \$6,000 less than white borrowers, suggesting that the negative coefficient on loan size is due to black borrowers having fewer resources to dedicate to a down payment.<sup>8</sup>

The primary coefficient of interest is  $\beta_3$ , which estimates the effect of receiving assistance for black households relative to white households. In the full sample regression, this variable is small

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<sup>7</sup>A dissimilarity index ranking for 2010 by MSA is found at <http://www.psc.isr.umich.edu/dis/census/segregation2010.html>.

<sup>8</sup>If the natural log of median home value is included as an explanatory variable in regressions, the absolute value of the grant coefficients decrease but there are not meaningful changes in statistical significance or interpretation.

and positive, but statistically insignificant. This suggests that black borrowers do not behave any differently than white borrowers in terms of loan size when they receive down payment assistance.

Table 3  
Effect of Down Payment Assistance on Loan Size

	(1) All	(2) Cincinnati	(3) Cleveland	(4) Nashville	(5) Memphis
WHP Grant ( $\beta_1$ )	-4.32*** (0.87)	-3.61*** (1.07)	-8.63*** (2.91)	-4.50** (1.76)	-10.8** (5.40)
Black ( $\beta_2$ )	20.1*** (3.86)	-2.84 (8.44)	46.0*** (6.67)	19.6** (7.67)	-8.18 (9.75)
WHP Grant*Black ( $\beta_3$ )	0.21 (2.06)	-2.23 (2.52)	0.053 (5.45)	3.30 (4.16)	20.1** (7.95)
Ln(Applicant Income)	73.8*** (0.49)	68.3*** (0.86)	66.7*** (0.80)	83.1*** (0.90)	73.6*** (2.08)
Black*Ln(Applicant Income)	-7.04*** (1.05)	-0.12 (2.35)	-16.2*** (1.85)	-6.48*** (2.12)	-3.03 (2.69)
Female	-1.18*** (0.28)	-1.23** (0.50)	0.19 (0.50)	-1.99*** (0.51)	-1.99* (1.07)
Black*Female	1.14* (0.63)	-1.63 (1.50)	1.68 (1.15)	-0.43 (1.21)	3.35** (1.51)
Co-applicant	-5.38*** (0.39)	-6.41*** (0.68)	-4.00*** (0.70)	-6.49*** (0.68)	-2.51* (1.49)
Black*Co-applicant	4.20*** (1.12)	4.49** (2.18)	3.11 (2.14)	4.01** (2.00)	-0.072 (2.96)
Constant	-163*** (1.83)	-142*** (3.11)	-138*** (2.91)	-172*** (3.32)	-148*** (7.62)
Observations	72,055	18,728	19,864	24,108	9,355
R-squared	0.388	0.309	0.304	0.339	0.291

Significance levels \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors in parentheses.

All regressions include MSA and year fixed effects that are interacted with the black race binary variable.

The estimates for the control variables indicate that higher incomes, being male or borrowing without a co-applicant is associated with larger loans for white borrowers. The effect of each characteristic for black borrowers is the sum of the original coefficient and the interaction term. In each case, the sign of the effect for black borrowers is the same as white borrowers but the magnitude of the effect is smaller and sometimes insignificant. The coefficients on the interaction terms suggest racial differences in how borrower characteristics translate into outcomes in the mortgage market.

In columns two through five of Table 3, the sample is divided into the four metropolitan areas. The results in Cincinnati, Cleveland and Nashville reported in columns two through four are similar to the estimates from the full sample. In all three cities, white grant recipients initiate smaller loans than other white borrowers. While the absolute value of the effect on loan size in Cleveland is larger than the size of the \$5,000 grant, the confidence interval includes values greater than -5. It is also possible that grant recipients reduce loan size by more than the size of the grant by taking additional measures beyond obtaining down payment assistance. Also consistent with the results in the first column, black grant recipients in these three cities do not behave differently than white grant recipients, relative to borrowers that do not receive assistance.

The final column of Table 3 shows that Memphis is the only MSA in which black households appear to use the grant differently than white households. Whereas white recipients reduce their loan size by nearly \$11,000, the effect for black recipients is significantly less negative. The difference in loan size between black borrowers with and without assistance is the sum of  $\beta_1$  and  $\beta_3$ , which equals 9.3. An F-test with the null hypothesis of  $\beta_1 + \beta_3 = 0$  has a p-value of 0.11. This is not strong evidence that black grant recipients initiate larger loans than other black homebuyers. It only suggests that black households are less likely than white households to reduce the size of their mortgage when they receive down payment assistance.

The results from the next specification are reported in Table 4, where the dependent variable is the fraction of white residents in the census tract of home purchase. Like Table 3, the first column reports estimates from a regression using the entire sample. For homebuyers of both races, the estimates indicate that receiving down payment assistance is not associated with any difference in the fraction of white residents in the census tract where the home is purchased. Columns two through four report the estimates for the Cincinnati, Cleveland and Nashville subsamples. In all

three MSAs, the fraction of white residents is not significantly different between grant recipients and other homebuyers.

Table 4  
Effect of Down Payment Assistance on Fraction of White Residents (x100) in Census Tract of Home Purchase

	(1) All	(2) Cincinnati	(3) Cleveland	(4) Nashville	(5) Memphis
WHP Grant ( $\beta_1$ )	0.36 (0.48)	0.34 (0.63)	-2.10 (1.53)	0.74 (0.94)	3.94* (2.29)
Black ( $\beta_2$ )	-81.7*** (2.99)	-60.1*** (6.93)	-76.2*** (6.45)	-54.9*** (5.36)	-112*** (5.94)
WHP Grant*Black ( $\beta_3$ )	2.31 (1.93)	3.34 (2.68)	0.73 (4.79)	-2.53 (3.77)	16.6*** (5.08)
Ln(Applicant Income)	4.67*** (0.23)	3.40*** (0.44)	4.74*** (0.38)	5.49*** (0.38)	7.11*** (1.01)
Black*Ln(Applicant Income)	14.1*** (0.79)	8.49*** (1.83)	10.1*** (1.72)	9.51*** (1.43)	21.7*** (1.60)
Female	-0.51*** (0.13)	-0.62** (0.26)	-0.34 (0.22)	-0.71*** (0.22)	0.024 (0.52)
Black*Female	-0.39 (0.50)	-3.38*** (1.18)	-1.01 (1.07)	-0.73 (0.86)	1.66* (0.98)
Co-applicant	0.86*** (0.15)	1.07*** (0.29)	0.54** (0.27)	1.14*** (0.26)	-0.12 (0.61)
Black*Co-applicant	0.68 (0.82)	3.37** (1.69)	1.77 (2.03)	-0.41 (1.28)	-0.10 (1.82)
Constant	72.9*** (0.86)	77.6*** (1.67)	73.0*** (1.45)	63.9*** (1.42)	53.4*** (3.80)
Observations	72,054	18,728	19,863	24,108	9,355
R-squared	0.395	0.255	0.425	0.154	0.432

Significance levels \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors in parentheses. All regressions include MSA and year fixed effects that are interacted with the black race binary variable.

In Memphis, however, receiving the grant is associated with white borrowers buying a home in a tract where the fraction of white residents is 3.94 percentage points higher than the tracts of other white borrowers. The coefficient is statistically significant at the ten percent level. The effect for black grant recipients is 16.6 percentage points larger and significant at the one percent level. Summing the two WHP coefficients, black grant recipients purchase homes in tracts where

the fraction of white residents is over 20 percentage points higher than other black borrowers in Memphis. These results are consistent with estimates in Table 3, which indicate that black grant recipients in Memphis do not reduce loan size as much as white borrowers who receive assistance. Relatively larger loans may be used to purchase homes in census tracts with higher fractions of white residents.

In both Tables 3 and 4, the coefficient on the black indicator variable in Memphis is the largest negative value among the four cities. In the case of loan size, the coefficient in Memphis is insignificant, while the coefficients in two of the three other cities are positive and significant. In Table 4, the absolute value of the coefficient on the black indicator variable in Memphis is nearly twice the size of the next largest coefficient in Cleveland. Of the MSAs in the sample, the fraction of black residents in Memphis is the highest. In fact, it is the only MSA where there are a similar number of mortgages initiated to white and black households.

It appears that the Memphis housing market is different than the other MSAs in the sample, although it is not clear how these differences are related to wealth constraints for black households. While the results in Memphis are statistically strong, there are only 13 black borrowers and 38 white borrowers who receive down payment assistance over the six years in the sample. There is no evidence that the results are driven by outliers, but the coefficients should be interpreted with caution because of the small sample size.

Table 5 reports regressions that stratify the data by year. Because the number of down payment assistance grants each year is relatively small, we pool the data into two-year increments. Panel A of Table 5 reports regressions in which the dependent variable is loan size. Column one includes loans initiated in 2008 and 2009. Unlike the regressions from the full sample in Table 3, white grant recipients during this time period do not use down payment assistance to significantly reduce loan

size. The coefficient for black grant recipients is positive but not statistically significant, suggesting that black borrowers do not use the grant differently than white borrowers.

Columns two and three of Table 5 report estimates for the years between 2010 and 2013. During these years, white grant recipients are more likely to initiate smaller loans than unassisted white borrowers. Black borrowers do not respond differently than white borrowers to receiving down payment assistance.

Table 5  
Effects of Down Payment Assistance

	(1) 2008 -2009	(2) 2010 - 2011	(3) 2012 - 2013
<hr/> <hr/> Panel A: Independent Variable: Loan Size (1000s) <hr/>			
WHP Grant ( $\beta_1$ )	-1.84 (1.88)	-3.67*** (1.29)	-6.50*** (1.51)
Black ( $\beta_2$ )	27.1*** (5.95)	16.9*** (6.08)	13.3* (7.33)
WHP Grant*Black ( $\beta_3$ )	4.11 (4.26)	-2.89 (3.08)	2.12 (3.59)
<hr/> <hr/> Panel B: Independent Variable: Percent of White Residents (x100) <hr/>			
WHP Grant ( $\beta_1$ )	1.88** (0.78)	0.82 (0.73)	-1.27 (0.97)
Black ( $\beta_2$ )	-90.7*** (5.60)	-80.8*** (4.52)	-63.8*** (5.10)
WHP Grant*Black ( $\beta_3$ )	7.45** (3.76)	0.37 (2.93)	0.58 (3.46)
Observations	26,738	23,993	21,324

Significance levels \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Robust standard errors in parentheses. All regressions include MSA and year fixed effects that are interacted with the black race binary variable.

Panel B of Table 5 reports stratified regressions where the dependent variable is the fraction of white residents in the census tract where the home is purchased. The estimates in the first column indicates that during 2008 and 2009, white grant recipients buy homes in census tracts where the fraction of white residents is 1.88 percentage points higher than the census tracts of other white

borrowers. The effect is significant at the five percent level. The coefficient on the interaction term indicates that the effect for black grant recipients is 7.45 percentage points higher than the effect for white recipients and is also statistically significant.<sup>9</sup> The average difference in the fraction of white residents for black and white households that did not receive the grant is approximately 32 percentage points during this time period. This estimate suggests that giving every borrower, regardless of race, the same \$5,000 down payment assistance grant would reduce that difference by 20 percent.

The effects on tract-level racial composition are not statistically significant for borrowers of any race between the years 2010 and 2013. Interestingly, the value of the coefficients on the black binary variable in Panel B are less negative over time, which may suggest that access to integrated neighborhoods improved over the sample period. If this is the case, the estimated effect of the grant may be driven by the changes in the ability of all black borrowers to buy homes in tracts with higher fractions of white residents.

## 5 Discussion

Racial housing segregation between black and white residents is a common characteristic of housing markets in the US, although little is known about why it persists. We examine the possibility that some portion of segregation is driven by racial differences in wealth. If black households have limited access to wealth, it reduces their ability to provide down payments and qualify for larger loans to purchase homes in more expensive and predominantly white areas. To investigate this possibility, we use data from a down payment assistance grant to estimate if wealth shocks differentially affect

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<sup>9</sup>Estimates in Table 5 are not meaningfully altered in value or statistical significance when the Memphis MSA observations are omitted from the sample.

black and white homebuyers.

In general, estimates provide little evidence of a strong relationship between wealth gaps and racial segregation. In a sample that includes four cities and six years, black and white borrowers react similarly to receiving down payment assistance. There are two situations in which the grant seems to affect homebuyers differently by race, which may provide an avenue for future research.

The first exception is in the Memphis, TN metropolitan area. Compared to white borrowers who receive down payment assistance, black grant recipients in Memphis are less likely to initiate smaller loans than unassisted borrowers and more likely to buy homes in census tracts with higher fractions of white residents. The relative effect of the grant for black recipients is four times larger than the effect for white recipients.

Compared to the other metropolitan areas in the sample, Memphis has the highest fraction of black residents. Based on our regression estimates, low-income black homebuyers in Memphis also tend to buy in more segregated neighborhoods than in the other cities. This level of segregation seems contradictory to the fact that the dissimilarity index in Memphis is less than the indices found in Cleveland and Cincinnati. Because no other obvious differences exist for Memphis, it is difficult to determine why the estimates in Memphis do not align with the rest of the sample. Due to the small sample size, it is not possible to conclude that wealth gaps matter in Memphis, but it does suggest that future research should consider geographical differences in the causes of segregation.

Our estimates also suggest that down payment assistance reduced racial segregation by as much as 20 percent during 2008 and 2009, the years immediately following the financial crisis. During this time, access to credit was constrained and regression results suggest that the average black borrower purchased a home in a more segregated neighborhood. However, black borrowers who receive down payment assistance during these years purchase homes in significantly more integrated census tracts.

White grant recipients also appear to use the grant to buy homes in tracts with higher fractions of white residents, although the effect is about 75 percent lower than the effect for black recipients. From 2010 to 2013, the grant is not associated with significant differences in census tract racial composition for borrowers of either race.

The estimates from the recessionary period suggest that there are certain situations in which wealth may play a role in segregation. During the financial crisis, as lending standards became more stringent, many borrowers may have been constrained by lack of wealth. Receiving down payment assistance in this situation could allow a household to purchase their desired home value and gain access to more integrated neighborhoods. Our results are consistent with the average borrower becoming less wealth constrained after the end of the financial crisis.

In related research, Ouazad and Rancière (2013) connect racial segregation to credit access during the housing boom of the early 2000s. They find that racial segregation increased with expansion of credit to low-income and minority populations. The authors argue that the effect occurs because while decreased lending standards increase credit access to low-income and minority households, it also allows white households to move to more racially homogenous neighborhoods. Our results are consistent with both races losing access to predominantly white neighborhoods during the financial crisis, but we find that down payment assistance seems to mitigate those effects. The mitigating effects are larger for black households, which could lead to reductions in segregation.

In spite of the results found during the financial crisis, our estimates are consistent with previous work that finds little relationship between wealth gaps and racial segregation. In most cases, black and white households react in similar ways to receiving down payment assistance. These estimates suggest that further investigation into the relationship between wealth and segregation

should consider baseline housing market characteristics or focus on situations where the decisions of borrowers are more likely to be constrained. Racial wealth gaps may play a more important role in racial segregation than previously believed, but only under certain conditions.

## 6 Conclusion

This paper examines the potential relationship between racial differences in wealth and housing segregation. Where previous work uses survey data on household wealth, we utilize a down payment assistance grant to simulate a wealth shock. If wealth gaps are a primary cause of segregation, black borrowers should use the additional wealth to buy homes in more integrated neighborhoods more often than white borrowers. We estimate the effects of down payment assistance on loan size and the racial composition of the census tract where the home is purchased. We estimate and compare the effects of black and white borrowers who receive assistance.

Consistent with prior research, there is little evidence that wealth gaps cause housing segregation in the majority of cases. However, there are two situations where down payment assistance appears to differentially alter the outcomes of black and white homebuyers. The first is in Memphis, TN and the second is during 2008 and 2009, the years immediately following the financial crisis. These cases suggest that wealth gaps may play a more important role in black and white segregation under certain circumstances.

Our results contribute to a literature on racial segregation, but also provide insights into the effects of down payment assistance in general. In recent years, state and federal programs have been created to help low-income and first-time homebuyers accumulate enough wealth for a down payment. The results in the current study support prior research that finds the majority of household

use down payment assistance to reduce housing costs. Additional research is needed to understand the long-run effects of participating in down payment assistance programs.

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