

# How Did the Housing Bust Affect the White-Black Homeownership Gap?

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## Abstract

This study documents the changes in the distribution of the white-black homeownership gap over the housing bust period of 2005 through 2011. Our analysis shows that the housing bust did not affect the homeownership gap uniformly. In fact, we find that the gap decreased for households that were the least likely to own and remained unchanged for households that were most likely to own, and that medium likely to own black households were especially vulnerable to the crisis. Contrary to the popular press's focus on the role of predatory lending among minority households, we find that the contribution of racial differences to the residual gap (which potentially captures any discriminatory practices) was modest. Overall, the changes in the total racial gap over the sample period are substantively explained by changes in wage income, interest dividend and rental income, and marital status, with the extent of their respective influences varying over the homeownership distribution. Our empirical approach reveals distributional information on the determinants of the changes in the homeownership gap at the household level. Such insights have valuable policy implications that would otherwise be concealed in analyses that look only at the conditional mean.

*Keywords:* Homeownership, Race, Housing Bust, Decomposition

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## 1. Introduction

Buoyed by low interest rates and demographic-induced demand from the baby-boomer generation, the late-1990s and early 2000s was a period of expanded homeownership in the United States. However, the American Dream did not reach all segments of the American households during the housing boom: while homeownership rose from 64% in 1994 to 69% in 2004, the white-black homeownership gap remained large at around 28 percentage points. The subsequent housing bust that followed unraveled the boom-period homeownership gains with elevated foreclosure and delinquency rates that were, disconcertingly, concentrated in minority and low-income neighborhoods. This has reignited concerns that the housing bust has precipitated wide disparities in the racial economic well-being since home equity is a major component of household wealth, and homeownership serves as a avenue for upward mobility for lower-income minority households. Moreover, homeownership is related to the consumption of housing services and potentially has far-reaching positive outcomes on children and communities.<sup>1</sup>

How did the housing bust exacerbate the white-black homeownership gap? In other words, was the exacerbation uniform across the homeownership distribution of the two ethnic groups? Within an ethnic group, which segments of the population were the most adversely affected? What are the determinants of homeownership loss and do these determinants vary across the races and their respective significance? This paper attempts to answer these questions by looking at the distribution of the racial homeownership

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<sup>1</sup>Traditionally, increasing homeownership has been an important policy goal as homeownership has been documented to improve economic and social well-being through expanded opportunities to accumulate wealth, greater control over one's living environment, increased incentives for households to engage and invest in local social capital, and better outcomes for children.

gap and decomposing the distribution into observable determinants and unobservable factors.

Because the probability of homeownership is unobservable and can only be estimated using the observable binary choice of owning or not owning a home, the decomposition methods applicable to the homeownership binary decision is more intricate and less straightforward than say, decomposing a continuous variable such as wage or house value. The approach used in this paper is the method introduced in Fesselmeier et al. (2011) and stands in contrast to the practice of analyzing racial homeownership differences across the distribution of some independent variables such as income or age or of analyzing the problem at the aggregate level. Rather, the goal here is to estimate the conditional homeownership probability distribution and to decompose the differences in the homeownership gap across the its distribution. There are two advantages to this approach. First, the technique used here overcomes a main deficiency of conventional approaches that rely on parametric assumptions about the underlying distribution. The main difficulty of a parametric approach is that welfare evaluations that rely on the shape of the underlying distribution will then be determined to a great extent by these *ad hoc* parametric assumptions. The method used in this paper is flexible enough to allow for heterogeneity across different ethnic groups. Second, it has a distinct advantage over an alternative technique which was proposed by Carillo-Yezer (2009) in that it does away with the need to constrain one's sample to the level of segregated neighborhoods, thus mitigating the risk of sample selection bias.

Uncovering distributional information that would otherwise be masked by analyses at the means or medians is particularly useful for welfare inequality analyses. Identifying the determinants of the distribution of the homeownership gap serves as stylized evidence for locating segments of the markets which policies had failed to reach. This is particularly pertinent to

the homeownership gap, underlying which hosts a well documented body of structural factors that had asymmetric effects along racial lines. These factors include income or job segregation, income inequality, predatory lending, and redlining practices.

Using this method, we semiparametrically estimate the household-level white-black homeownership gap in 2005 and in 2011 across the distribution of homeownership rates and decompose and quantify the magnitude of the determinants that were responsible for the change in the racial gap. To the extent that recent decomposition studies have shown that racial differences in socio-economic factors determine homeownership rates differently, depending on the particular segment of the household distribution that is in question,<sup>2</sup> analyses at the conditional mean, undertaken in many studies, are potentially misleading and could mask distributional information at the tails.

We find that the black homeownership distribution differed from the white homeownership distribution in significant ways. There were more black households at the cusp of homeownership, and these households were the hardest hit by the crisis. Moreover, our analysis shows that the housing bust affected the distribution differently. The median of the racial gap widened dramatically but the gap decreased considerably for households that were least likely to own and remained unchanged for black and white households that were most likely to own.

The relative importance of socio-economic factors in explaining the racial gap also changed during the sample period. Following the tradition of past empirical studies, we decompose the gap into an observable socio-economic

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<sup>2</sup>Using household-level data in a semiparametric specification, Fesselmeier et al. (2011) find that observable socio-economic determinants explain a major portion of the total racial gap for households likely to own but did a poor job in explaining the racial gap for low likelihood to own households. Carrillo and Yezer (2009) find similar results using census block group-level data on segregated neighborhoods.

factors component, typically referred to as the *characteristics gap*, and an unobservable residual component or the *residual gap*. Socio-economic factors include observed differences in income and wealth as well as differences in household demographics such as marital status, age, and educational attainment. In the housing literature, the residual gap is typically thought to be an amalgamation of the effects of racial differences in discrimination, access to credit, and credit history.

Contrary to the popular press's focus on the role of predatory lending among minority households, we find that the contribution of racial differences to the residual gap (which potentially captures any discriminatory practices) is small for most of the homeownership distribution. Overall, the changes in the total racial gap over the sample period are substantively explained by the changes in the characteristics gap. The major determinants explaining the changes in the characteristics gap are changes in household wage income, interest dividend or rental income, and marital status, with the extent of their respective influence varying over the homeownership distribution. We find a proportion of marginal minority homeowners who seemed particularly vulnerable to the housing boom and bust. These were the medium likely-to-own households where the increase in the racial gap was greatest.

The organization of the paper is as follows. The next section discusses the relevant literature. Section 3 describes our methodology, and section 4 the data. Section 5 contains our decomposition results, and the last section concludes.

## **2. Related Literature**

Interest in the wide disparities in the racial homeownership rates has been especially heightened recently with concerns that the minority and low-income segments of the population, which tend to concentrate in subprime neighborhoods, were disproportionately affected by the economic crisis that

was precipitated by the housing bust. This section reviews the literature on the white-black homeownership gap and focuses on the work that has been done in examining the determinants and their influence on the homeownership gap. We also look at the potential sources of differential racial effects these determinants could have on the homeownership gap as a result of the housing bust.

The literature on the determinants of the homeownership gap can be broadly classified into two categories. The first finds that most of the homeownership gap can be explained by racial differences in observable household characteristics, such as income, wealth, marital status, education and the age of the household head and duration of residence. These household attributes typically influence the consumption and investment demand for housing. For example, high transaction costs associated with buying a house makes ownership especially costly for households who are highly mobile and have a short expected duration of residence, and maintenance costs can become burdensome for households who are wealth and income constrained.<sup>3</sup> Another strand of literature focuses on discrimination that exists in the process of homeownership whereby minorities are treated differently by realtors and financial institutions (see, for example, Kain and Quigley (1972); Yinger (1995) and Munnell et al. (1996)).

Many also believed that the persistence of the racial gap could be attributed to the levels of segregation in American cities. Minority households are concentrated in central cities, which typically have homeownership rates

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<sup>3</sup>Wachter and Megbolugbe (1992) find that endowment differences explain a considerable portion of the racial gap. Linneman and Wachter (1989) and Duca and Rosenthal (1993) find that downpayment and credit constraints are more important than income in homeownership decisions. Minority households also receive less intergenerational transfers and bequeathed estate than white households and this could potentially impact downpayment constraints (Gale and Scholz (1994)).

that are much lower than those in suburbia. Following the housing bust, interest in the impact of geographic concentration of low-income and minority households on homeownership decisions has reignited. Many have argued that residential segregation creates a spatial niche for unscrupulous marketing of risky subprime loans to households who are especially vulnerable to adverse economic shocks. These households were pushed into homeownership and the subsequent bursting of the housing market precipitated an unprecedented rise in foreclosures that were spatially and racially denominated. During the housing boom, evidence suggests that many minority households were “steered” to own homes using loans that exposed these households to high levels of risks (Scheessele (2002) and Calem et al. (2004)). Ethnic concentration of subprime lending is further compounded by predatory lending and redlining practices.<sup>4</sup>

To the extent that homeowners using subprime loans are more likely to default, the literature on systematic predatory lending has been met with some skepticism. Most of these studies compare the unconditional incidence of subprime and subsequent foreclosure rates between low-income minority and high-income white neighborhoods. The main criticism of these studies is that the evidence on systematic predatory lending is at best, indirect and is potentially biased due to the omission of household-level characteristics. Specifically, subprime borrowers may have characteristics, such as poor credit histories or high loan-to-value and debt-to-income ratios, that could result in higher default rates than prime borrowers.<sup>5</sup>

To some extent, the exact cause and the channel by which the geographi-

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<sup>4</sup>See for example, Bradford (2002) and Temkin et al. (2002).

<sup>5</sup>An exception is the study by Bayer et al. (2013). The authors find that, controlling for credit scores, black and Hispanic homeowners are more likely to be delinquent and default in the downturn, regardless of the likelihood of obtaining a subprime loan or local housing and labor market shocks.

cal growth of subprime lending could result in increased foreclosure rates and racially-denominated homeownership loss is still an unanswered question. Nonetheless, from a policy standpoint, it is crucial to determine the *magnitude* of the homeownership gap and how the Great Recession has impacted it. A naturally appealing approach is to decompose the homeownership gap into a component that is attributable to observable racial differences in household characteristics and a residual component that soaks up the effect of unobservable factors. The main insight of the decomposition approach is that systematic differences in household characteristics across ethnic groups can have differential impacts on homeownership decisions. While technically, the residual component captures unmeasured individual-level factors, such as differences in tastes for homeownership, and credit history, the literature tends to interpret the residual component as a measurement of the effects of discrimination, which includes differential credit access, and potentially captures the effects of predatory lending practices.<sup>6</sup> Although decomposition studies are agnostic with regards to the channels through which the observable household attributes contribute to the homeownership gap, it nonetheless serves as an informative summary, to researchers and policy makers alike, of what we know (in terms of racial differences in observable characteristics) versus what we do not know of the homeownership gap, and of the relative importance of each of these components.

Traditionally, decomposition studies use the Oaxaca-Blinder approach to estimate the gap at the conditional mean.<sup>7</sup> While elucidative, the Oaxaca-

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<sup>6</sup>If one has the fortuity of acquiring borrower-property level information such as loan details and credit history, some of the residual component would be explained by these variables.

<sup>7</sup>Some studies that use the Oaxaca-Blinder approach to estimate the homeownership gap are Silberman and Ihlanfeldt (1982), Long and Caudill (1992), and Collins and Margo (2001).



Blinder approach could potentially mask important distributional impacts. Carrillo and Yezer (2009) explores the distribution of the homeownership gap by using the Machado and Mata (2005) method. However, since the Machado-Mata approach is only applicable to a continuous dependent variable whereas homeownership is a binary variable, Carrillo and Yezer (2009) has to focus on average aggregate ownership rates at the census block group level and constrain their sample to include only highly segregated neighborhoods wherein the proportion of white households is either close to zero or close to 100%. It is unclear whether the Carrillo-Yezer results are applicable to less segregated neighborhoods. To overcome the sample selection problem in Carrillo and Yezer (2009), Fesselmeier et al. (2011) take a semiparametric approach to decompose the homeownership gap using household-level data. The semiparametric approach is especially amenable to the richer household-level data and is capable of addressing heterogeneity across the different ethnic groups while avoiding the curse of dimensionality that afflicts most nonparametric specifications.

### 3. Methodology

Our approach to decomposing the distribution of household-level homeownership probabilities of the two races follows Fesselmeier et al. (2011). We start with the standard approach that treats the unobserved utility of owning a home as a random variable and estimates the probability of homeownership conditional on an observed set of covariates  $X$ . Let the utility of homeownership be the latent variable  $y^*$ :

$$y^* = X\beta + \epsilon, \quad \epsilon \sim F_\epsilon \tag{1}$$

where  $\beta$  is a vector of parameters and  $X$  contains the standard observed household characteristics that existing studies have found to be important. These include variables such as household income, age, and the number of

persons in the household. The random term  $\epsilon$  captures unobserved factors that affect ownership such as discrimination against blacks in the mortgage market. A binary choice model can be written as

$$y = \begin{cases} 1 & \text{if } y^* \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Then, for any given  $X$ , the conditional probability of homeownership is:

$$Pr(y = 1|X) = \int_{-\infty}^{\infty} \mathbb{I}(\epsilon \leq X\beta) dF_{\epsilon} = F_{\epsilon}(X\beta) \quad (2)$$

Our decomposition is derived from the predicted homeownership probabilities of this conditional probability function. For each racial group in year  $t$ , we compute the  $\alpha$ -th percentile  $\xi^r(\alpha)$  from the the sample moment

$$\frac{1}{N_r} \sum_i \mathbb{I}(\widehat{F}_{\epsilon}^r(X_i^r \beta^r) \leq \xi^r(\alpha)) = \alpha,$$

where  $N_r$  is the number of observations of group  $r \in \{b, w\}$ , with  $b$  denoting black households and  $w$  white households.<sup>8</sup> The *total* homeownership gap in year  $t$  at the  $\alpha$ -th percentile,  $\Delta_{\alpha}$ , is  $\Delta_{\alpha} = \xi^w(\alpha) - \xi^b(\alpha)$ . The decomposition of the homeownership gap in year  $t$  at the  $\alpha$ -th percentile is then

$$\Delta_{\alpha} = [\xi^b(\alpha; X^w \beta^b) - \xi^b(\alpha)] + [\xi^w(\alpha) - \xi^b(\alpha; X^w \beta^b)], \quad (3)$$

where  $\xi^b(\alpha; X^w \beta^b)$  is the  $\alpha$ -th percentile of the black counterfactual; it is the  $\alpha$ -th percentile when the black homeownership equation (2) is evaluated using the attributes of white households.

The first term on the right-hand side of (3) represents the *characteristics gap* or the contribution of the racial difference in covariates to the overall gap in homeownership. The second term is the *residual gap* which is the

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<sup>8</sup>We suppress the time subscript  $t$  to simplify the notation.

contribution of unobservable factors to the homeownership gap. Intuitively, we can think of the characteristics gap as capturing the difference in behavior between the two races if their homeownership decisions were determined by observable characteristics alone, and the residual gap as capturing the racial difference in the manner by which these characteristics determine the respective propensity to own.

Note that we have explicitly allowed the CDF  $F_{\epsilon}^r(\cdot)$  to differ across the two racial groups to avoid possible misspecification that could cause our estimates to be inconsistent. Early racial gap studies tend to treat the CDF for each group as known (either as a normal or a logistic distribution) and use race dummies to capture race-associated differences in homeownership probabilities. Later studies continue to treat the CDF as known (either normal or logistic) but allow the coefficients of each racial group to differ.<sup>9</sup> The problem with such approaches is the implicit assumption that  $F_{\epsilon}^r(\cdot)$  is the same for the two racial groups. Such an assumption is usually not based on any *a priori* knowledge nor any economic theory. In our study, we are able to estimate different CDFs for black and white households by using the Klein and Spady (1993) semiparametric single index binary choice model which avoids the ‘curse of dimensionality’ one would encounter in nonparametric regression but is capable of estimating conditional homeownership probability functions that are consistent with the data.<sup>10</sup>

After estimating the total racial gap, the residual gap, and the characteristics gap for 2005 and for 2011, we then compute the differences in each of these gaps to measure how each one changed over the sample period at each percentile.

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<sup>9</sup>See Herbert et al. (2005) for an extensive survey of this literature.

<sup>10</sup>The Klein-Spady approach is ‘semiparametric’ because it achieves model identification by assuming that the CDF depends on the vector  $X$  through a single linear combination  $X\beta$  but does not impose any other distributional assumptions.

### 3.1. Estimation

#### 3.1.1. Home Ownership Model

We estimate the homeownership model using the semiparametric estimator of Klein and Spady (1993). In parametric binary models, estimation is typically carried out by optimizing the log-likelihood function with a pre-specified  $F_\epsilon$ :

$$\max_{\beta} \sum_i y_i \log(F_\epsilon(X_i\beta)) + (1 - y_i) \log(1 - F_\epsilon(X_i\beta)). \quad (4)$$

Klein and Spady (1993) propose an estimator of  $\beta$  that maximizes the log-likelihood function in (4) but with a nonparametric estimate  $\hat{F}_\epsilon(\cdot)$  in place of  $F_\epsilon(\cdot)$ .<sup>11</sup> Specifically, define  $\hat{P}_{own}^r = N_r^{-1} \sum y_i^r$  as the sample proportion of homeowners in a particular racial group. Then for any real value  $\nu$ ,

$$\hat{F}_\epsilon^r(\nu) = \frac{\hat{P}_{own}^r \hat{q}^r(\nu|y=1)}{\hat{P}_{own}^r \hat{q}^r(\nu|y=1) + (1 - \hat{P}_{own}^r) \hat{q}^r(\nu|y=0)}, \quad (5)$$

where  $\hat{q}(\cdot|y)$  is a kernel estimate of  $q(\cdot|y)$ , the conditional density of  $X|\beta$ . The kernel estimates for either racial group are

$$\hat{q}^r(\nu|y=1) = \frac{\sum y_i^r K[(\nu - X_i^r \beta^r)/h_r]}{N_r \hat{P}_{own}^r h_r} \quad (6)$$

and

$$\hat{q}^r(\nu|y=0) = \frac{\sum (1 - y_i^r) K[(\nu - X_i^r \beta^r)/h_r]}{N_r (1 - \hat{P}_{own}^r) h_r}, \quad (7)$$

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<sup>11</sup>In single index binary choice models, the function  $F_\epsilon^r$  includes a location and level shift and so the vector  $X$  does not include a constant. In other words, the intercept component of  $\beta$  is subsumed in the function  $F_\epsilon^r$  and is not identified; we need to impose the normalization that  $\beta' \beta = 1$ . Identification of  $\beta$  and  $F_\epsilon^r$  also requires that  $X$  contains at least one continuously distributed variable which has a non-zero coefficient.

where  $K$  is the kernel function<sup>12</sup> and  $h_r$  the bandwidth, which varies with the racial group and satisfies the rate  $N_r^{-1/6} < h_r < N_r^{-1/8}$ .<sup>13</sup> Klein and Spady do not give any practical guidelines about how to select the bandwidth. In this paper, we use Silverman (1986)'s rule of thumb.

### 3.1.2. Counterfactual probabilities and decomposition

To compute the decomposition, we first estimate the counterfactual homeownership probabilities of blacks. Recall that the counterfactual of blacks is the probability of ownership if the black homeownership distribution was evaluated for white characteristics. These counterfactual probabilities are calculated from (5) using the black kernels,  $\hat{q}^b(\nu|y=1)$  and  $\hat{q}^b(\nu|y=0)$  of (6) and (7), and evaluating  $\nu$  at  $\nu = X_i^w \beta^b$ . The bandwidth for the counterfactual is  $h_b$ . The counterfactual percentiles are then computed, and the decomposition is carried out using equation (3).<sup>14</sup>

## 4. Data

We use data from the 2005 and 2011 American Community Survey (ACS) which is a nationwide, annual survey that samples residents of over 3 million housing units. The ACS essentially collects the same information as the U.S. Census. It includes questions on demography (such as marital status, race, education, employment, and occupation) and questions on housing (such as

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<sup>12</sup>In this study, we use the normal density function as the kernel function. The variation in density estimates is often negligible compared to the variation with bandwidth choice. See, for example, Cameron and Trivedi (2005), pp. 300 for comparisons.

<sup>13</sup>Klein and Spady (1993) showed that their estimator is consistent and achieves the asymptotic efficiency bound of Cosslett (1987).

<sup>14</sup>The decomposition can be done using the coefficients and distribution from either the white or black estimates. For example, Long and Caudill (1992) use the coefficients from the black regression whereas Collins and Margo (2001) use the coefficients from the white regression.

tenure choice, property value, housing type, and cost of utilities). To control for differences in housing costs across cities, we supplement the ACS data with the housing price index constructed by Carrillo et al. (2012).<sup>15</sup>

We include in our sample only households that are headed by non-hispanic blacks or non-hispanic whites that live in metropolitan areas. We drop observations of households with more than one family, households whose head is in school, and households that live in a mobile home, trailer, boat, tent, or van. In the final sample, we are left with 531,303 white households and 71,654 black households in 2005 and 527,556 white households and 85,616 black households in 2011.<sup>16</sup> We include household-level sample weights in our Klein-Spady estimation as well as in our decomposition. The main purpose of these weights is to allow the researcher to compute statistics that are representative of the full population since some household characteristics are over-weighted or under-weighted in the sample.<sup>17</sup>

Appendices A and B contain descriptive statistics of the variables we include in the model. The white homeownership rate was 74.2% in 2005 and 71.9% in 2011 whereas for blacks it was 46.3% in 2005 and 44.3% in 2011. These numbers translate into an average homeownership gap of 28.0 percentage points between the races in 2005 and 27.6 percentage points in 2011. The averages of the explanatory variables are consistent with our beliefs about the economic differences of black and white households. Average household

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<sup>15</sup>The index and documentation can be found at <http://eoolsen.weebly.com/price-indices.html>.

<sup>16</sup>The advantage of using the ACS over other data sets such as the American Housing Survey is its large size. This is particularly important in our study because a semiparametric model such as the one we estimate requires more data than fully parameterized models.

<sup>17</sup>Details of these weights are discussed on the IPUMS website and in the Census Bureau's handbook, "A Compass for understanding and using the American Community Survey Data," February, 2009.

income is higher for white households. White heads are more likely to be college-educated, more likely to be male, and are more likely to be married. We also note that black households are much more concentrated in the south than white households.

Estimates of  $\beta$  and their standard errors can be found in Appendices C and D. All estimates have very small standard errors which is not surprising given the size of our sample. Consistent with previous studies, we find that having a higher income, having a larger household, being married with a spouse present, being older, earning more non-wage income, and having higher levels of education increase the likelihood of homeownership for both races. Homeownership decreases with higher house prices for both ethnicities. There are some differences between the races. For example, being an American citizen has a positive effect on white homeownership and a negative effect on black homeownership.<sup>18</sup>

## 5. Results

### 5.1. Homeownership Distribution

Figure 1 provides snapshots of the two races' predicted homeownership probabilities. Panel (a) contains kernel density estimates of the predicted homeownership probabilities of black households in 2005 and 2011; panel (b)

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<sup>18</sup>Like various studies before us, such as Rosenthal (1988), we have included the duration of residence as a covariate. While actual duration of residence is a noisy measure of anticipated duration – an important determinant of a household's user cost of homeownership, it is potentially endogenous. The main justification for its inclusion in the current study is that excluding it would cause omitted variable bias in two important covariates, namely, age of head of household and family size. We confirmed this by re-estimating our model without the duration variable. By including the duration of residence however, means that the variable will not have a causal interpretation. See Angrist (2001) for a discussion on the pros and cons of including an endogenous variable as a covariate.

contains the white counterparts. For the white densities, a large percentage of the area under the density is concentrated in the upper range, reflecting the very high probability of homeownership for many of the white households. On the other hand, the black densities are much more uniform with nontrivial masses at the lower range, indicating that a considerable number of black households had a very low probability of homeownership.

The housing bust affected both racial groups adversely in terms of their respective propensities to own. For both groups, the density at the lower end of the distribution increased in 2011 but the accompanying decreases occur at different parts of the distributions. For whites, the decrease in the density occurs at the highest homeownership probabilities with fewer very likely to own households in 2011, leaving the density from around 0.35 to 0.9 relatively unchanged. That is, the medium likelihood to own probabilities were unaffected between 2005 and 2011; the increase in the density at the low likelihood to own probabilities came from a decrease in the density at the high likelihood to own probabilities. For the black households, the decrease in the density occurs from around 0.30 to 0.80 while the density at the highest probabilities was relatively unchanged. The increase in the density at the low likelihood to own probabilities of blacks was due to a decrease in the density at the middle likelihood to own probabilities. In other words, if we consider the middle-percentile households to be households that are at the margin of becoming homeowners, the housing bust tipped the distribution so that more black households who were at the homeownership cusp in 2005 were less likely to be homeowners in 2011. On the other hand, the housing bust did not affect the black households that had a high homeownership propensity.

What would homeownership rates for the black households look like if blacks had the same socio-economic attributes as whites? The gains in black homeownership rates would be substantial. Figure 2 contains the estimated black counterfactual densities for 2005 and 2011, which would be the den-



sities of black households if endowed with white household characteristics. The counterfactuals in both years are very different than the black densities and very similar to the white densities as is shown in Figure 3, where the dotted lines represent the counterfactual densities. This strongly suggests that differences in black and white characteristics in both years explain a substantial portion of the total homeownership gap, with the residual component explaining only a modest amount. We will explore the determinants of these changes in a later subsection.

### 5.2. Decomposition Results

Figures 4 and 5 contains the decomposition results.<sup>19</sup> Figure 4 shows the total homeownership gap and its components in 2005 and 2011 computed using equation (3). Figure 5 illustrates the changes in the total gap and in the components of the gap from 2005 to 2011.<sup>20</sup>

Figure 4 shows that for both years, the shape of the total gap and the characteristics gap across the percentiles are similar: small at the lower percentiles, large at the middle percentiles, and small again at the upper percentiles. These patterns tell us that the gap is the most severe for the middle likelihood-to-own black households. For the most part, compared to the char-

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<sup>19</sup>Note that since the decompositions are computed by percentile these figures have homeownership probability percentiles on the  $X$ -axis rather than homeownership probabilities like in the density figures.

<sup>20</sup>Ideally, we would include confidence intervals around the estimates in Figures 4 and 5. Unfortunately it is not feasible due to the computational time needed to estimate our model. In contrast to decomposition methods based on linear regression models that can be estimated extremely quickly, the estimation of the Klein-Spady model with over 600,000 observations and a large number of variables is very time intensive, taking over 8 hours for each year of data. The usual recommended number of bootstraps is 500 making such an approach impossible. The small standard errors of the Klein-Spady model gives us confidence that the decomposition is also accurately estimated.

acteristics gap, the residual gap is small, indicating that unobservable factors explain relatively little of the racial gap, especially at the higher percentiles. However, for both years, the residual gap contributes somewhat to the gap at very low percentiles. This tells us that factors other than household characteristics are important determinants of the racial gap for households that are least likely to own a home. The residual gap is largest at around the 30<sup>th</sup> percentile.

How did the housing bust affect the distribution of the homeownership gap? It appears that the middle-percentile black households were the most affected by the crisis: the increase in the gap is most severe in this percentile group. When comparing the 2005 total gap distribution with the 2011 distribution, we see that the 2011 total gap has a more prominent peak around the 40<sup>th</sup> percentile while the 2005 total gap has a smaller, flatter peak located from around the 28<sup>th</sup> to the 42<sup>nd</sup> percentile.

A clearer picture emerges when we graph the 2005-2011 changes in the total racial gap, the characteristics gap, and the residual gap in Figure 5. The housing bust did not affect the total gap uniformly across the distribution. In fact, the total gap decreased for households below the 30<sup>th</sup> percentile, and then increased substantially for households between the 30<sup>th</sup> percentile and the 65<sup>th</sup> percentile. The increase in the gap is greatest around the median. Table 1 contains the homeownership gap and components by decile. For example, at the 40<sup>th</sup> percentile in 2005 white households are 43.5 percentage points more likely to be homeowners than black households; this number increased to 47.9 in 2011.

Figure 5 also offer a glimpse into the drivers behind the dynamics of the total gap. It is instructive at this juncture to reiterate what the components measure. Changes in the characteristics gap measure changes in racial differences in observable homeownership variables such as the relative change in income or age. Changes in the residual gap reflect shifts in the relationship

of how these variables determine homeownership. In particular, the residual gap captures factors that are not included in the homeownership equation, and any changes in these unobservable factors in 2005 and 2011 will be reflected through changes in the coefficients and shape of the homeownership equation. That is, technically, the change in the said relationship could come either from the sensitivity of each racial group to observable variables or it could come from changes in the underlying distribution of the variables. In the context of the housing market, the residual gap is typically understood to be an amalgamation of the effects of racial differences in credit access, credit history and discrimination. In Figure 5, the total gap mirrors the movements in the characteristics gap indicating that changes in observable household characteristics during the sample period are the predominant determinants driving the dynamics of the racial gap. The contribution of changes in the residual gap to changes in the total gap is modest and only affected the distribution below the 20<sup>th</sup> percentile. This part of the distribution experienced declines in both the residual gap and the characteristics gap, resulting in a large decline in the total homeownership gap.

There are numerous studies that draw attention to the roles subprime and predatory lending played in disproportionate homeownership loss among low-income and minority households during the economic crisis. Low income and minority households were offered expanded homeownership opportunities during the housing boom but the availability of easy credit was, in most part, exploitative and opportunistic in nature and the subsequent bust exposed the vulnerability of these homeowners as they were, among various reasons, fundamentally ill-equipped to handle the risks of homeownership at the outset. There were some skepticism against the systematic predatory lending literature since most of these studies offer indirect evidence - by comparing the incidence of subprime lending between white neighborhoods versus low-income and minority neighborhoods - and controls for household-

level risk characteristics, such as credit histories, is often less than ideal in these studies. How important and significant are racial differences in unobservable factors such as credit history, credit access and discrimination in housing markets in raising the homeownership loss among black households during the housing bust? The modest contribution of the residual gap changes *vis-a-vis* the contribution of the changes in the characteristics gap in Figure 5 corroborates the view that it is the households' socio-economic factors that matter. We explore these factors in detail in the next subsection.

### 5.3. Drivers of the changes in the Characteristics Gap

The individual household covariates that explain much of the changes in the total gap are shown in Figure 6. They include wage income, whether the household received interest, dividend, or rental income (“other income”), and marital status.<sup>21</sup> For each of these variables, there is a graph for the variable's contribution to the characteristics gap in 2005 and in 2011 and a graph of the change in the variable's contribution from 2005 to 2011. These graphs measure the *marginal* contribution of each variable, holding all other variables constant.

Changes in wage income, in other income, and in the marital status of the household head decreased the characteristics gap for the lower half of distribution. In other words, the decrease in the characteristics gap below the 30<sup>th</sup> percentile is clearly attributable to black and white households in this segment of the distribution having become more similar in terms of income and marital status.

Underlying the graphs in Figure 6 are temporal changes in household covariates in the different segments of the homeownership probability distri-

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<sup>21</sup>Although education is an important determinant of the characteristics gap for both years, there is little change in its effect across years. Consequently, education had little effect on the change in the total gap.

bution. We can gain some additional insight into these changes by comparing the unconditional changes in the variables in our sample data across the homeownership propensity distribution. To do so, we first group households into decile groups based on their homeownership probability for each race and year.<sup>22</sup> We then report a summary statistic for each group, either the mean or the median, depending on the nature of the variable in question. The results are in Figures 7 to 9.

### 5.3.1. *Effects of Income*

Figure 7 shows the percentage change in the median natural log of income from 2005 to 2011 for each homeownership probability decile by race. To the extent that income had a large, narrowing effect on the size of the characteristics gap, particularly below the median, one would expect the income growth of black households in the lower-percentile groups to fare similarly or better than their white counterparts. This is what we see in Figure 7. Below the 40<sup>th</sup> percentile, that is, in the first 4 decile groups, blacks not only had positive income growth in absolute terms but also fared as well or did better than whites. For example, the median black household in the least likely to own group (the first decile group) experienced an increase of 1.67% in log income while the median white household in this group experienced an increase of 1.37%.

Comparing the change in the number of households with other income, which includes interest, dividends, or rental income, Figure 8 shows that the percentage of households with other income decreased for all groups, from the least likely to own up to the most likely to own, except for one group: the least likely to own blacks. We see here as well that blacks fared better

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<sup>22</sup>That is, households below the 10<sup>th</sup> homeownership probability percentile form one group, all households above the 10<sup>th</sup> homeownership probability percentile and below the 20<sup>th</sup> homeownership probability percentile form a second group, etc.

than whites below the 30<sup>th</sup> percentile.

### *5.3.2. Effects of Marriage*

Changes in marital status affect the characteristics gap through marriage's positive effect on homeownership. For each race and decile group, we calculate the percentage of heads of households that were married with their spouse present for 2005 and 2011. Figure 9 shows the results. Both black and white households saw an increase in the marriage rate of the least likely to own households, and from the 30<sup>th</sup> percentile onwards, both groups saw a decline in marriage rates. Relatively speaking, below the 20<sup>th</sup> percentile (decile groups 1 and 2), whites experienced a greater increase in marriage rates than blacks did. Black households had a small increase in the marriage rate in the 3<sup>rd</sup> decile group compared to a decrease for white households. From the 30<sup>th</sup> percentile to the median (decile groups 4 and 5), the decline for black households was smaller than for the white households in the same decile groups.

## **6. Conclusion**

This study documents the changes in the distribution of the homeownership gap over the housing bust period of 2005 through 2011. We find that there were more black households than there were white households who were at the margin of homeownership at the middle percentiles. These households were the most adversely affected by the crisis as the increase in the racial gap was greatest among this segment of the population. Our analysis shows that the housing bust did not change the homeownership gap uniformly. In fact, the gap decreased for households that were the least likely to own, increased for households that were medium likely to own, and remained unchanged for households that were the most likely to own. Contrary to the popular press's focus on the role of predatory lending among minority households,

we find that the contribution of racial differences to the residual gap (which potentially captures any discriminatory practices) was modest. Overall, the changes in the total racial gap over the sample period were substantively explained by the changes in the characteristics gap. The major determinants explaining the changes in the characteristics gap were changes in household wage income, interest dividend and rental income, and marital status, with the extent of their respective influence varying over the homeownership distribution.<sup>23</sup>

Understanding the racial differences in homeownership rates and their causes is important. Home equity is a major component of household wealth in the United States and homeownership can be an avenue for upward mobility for lower-income minority households. Moreover, because homeownership is related to the consumption of housing services and potentially has far-reaching positive outcomes on children and communities, analyses of the racial differences in homeownership complements analyses of the economic well-being of different racial groups. In this paper, we uncover changes in the homeownership distribution using household-level data. Our analyses covers the housing boom and bust period to provide useful distributional information as well as a contextual background against studies that have looked at the channels through which differential homeownership gains and losses could have come about (for example, Bayer et al. (2013)). We believe

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<sup>23</sup>A caveat is in order: following the traditional route, we do not control for racial differences in household formation in this study. We believe that controlling for household formation is *conceptually* important, however, we defer the joint estimation of homeownership and household formation propensities to future research. In our opinion, the current empirical methodology in addressing this issue is wanting. For example, Haurin and Rosenthal (2007) used the bivariate probit to jointly estimate headship and homeownership probabilities. Their approach relies solely on parametric assumptions to identify the model as there are no readily available exclusion restrictions or instruments.

that this is important to policy makers and researchers alike, who may be interested in not just understanding the homeownership gap at the mean but also in identifying the segments of the population that were affected by the housing bust, how much they were affected, and the causes behind it.



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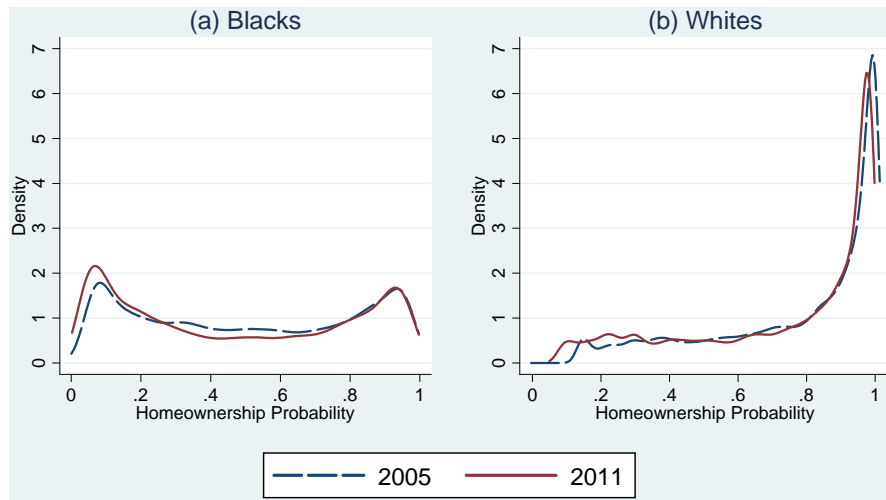


Figure 1: Estimated Homeownership Probability Densities

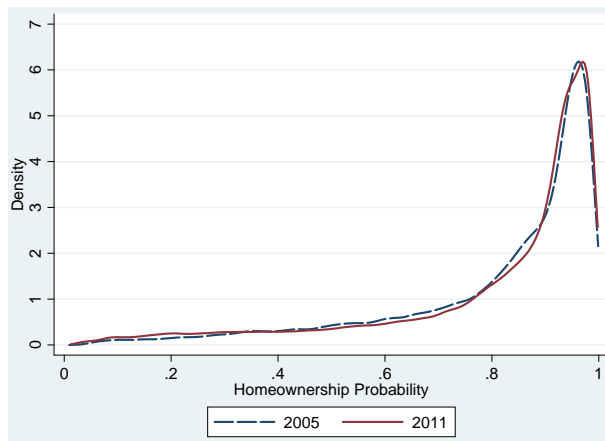


Figure 2: Counterfactual Homeownership Probability Densities

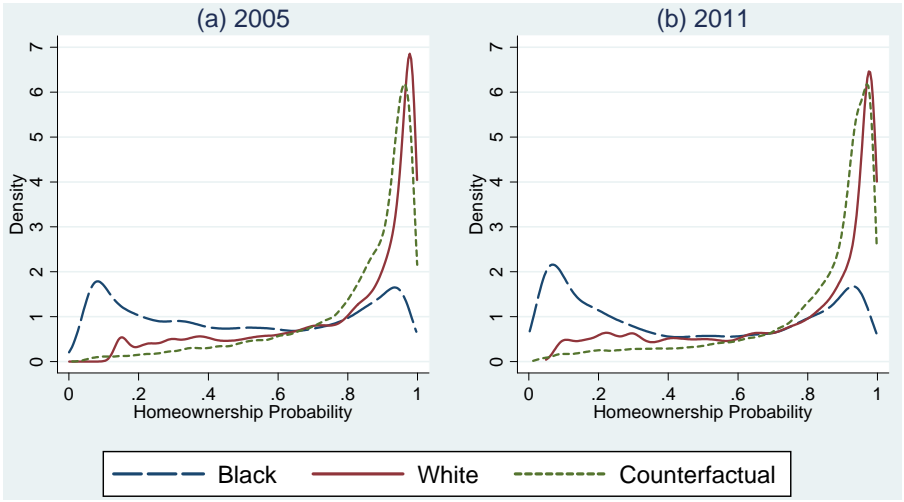


Figure 3: Homeownership Probability Densities with Counterfactuals

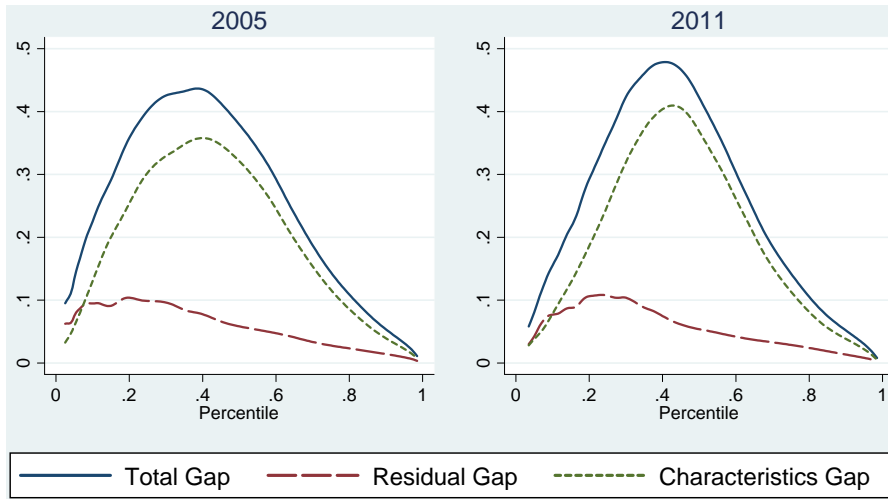


Figure 4: White-Black Homeownership Gaps by Year

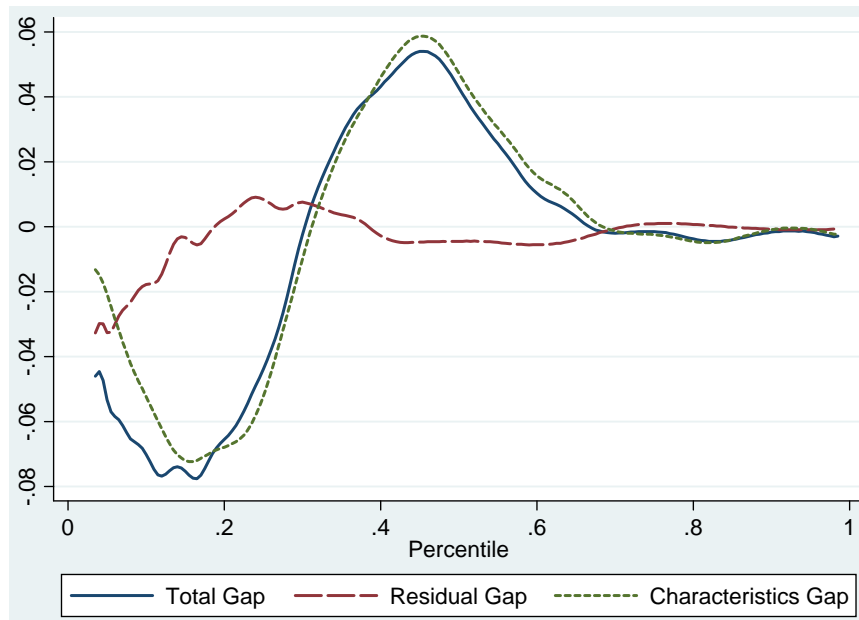


Figure 5: Changes in the White-Black Homeownership Gaps (2005 to 2011)



Figure 6: Variable Contributions to the White-Black Homeownership Gaps (2005 to 2011)



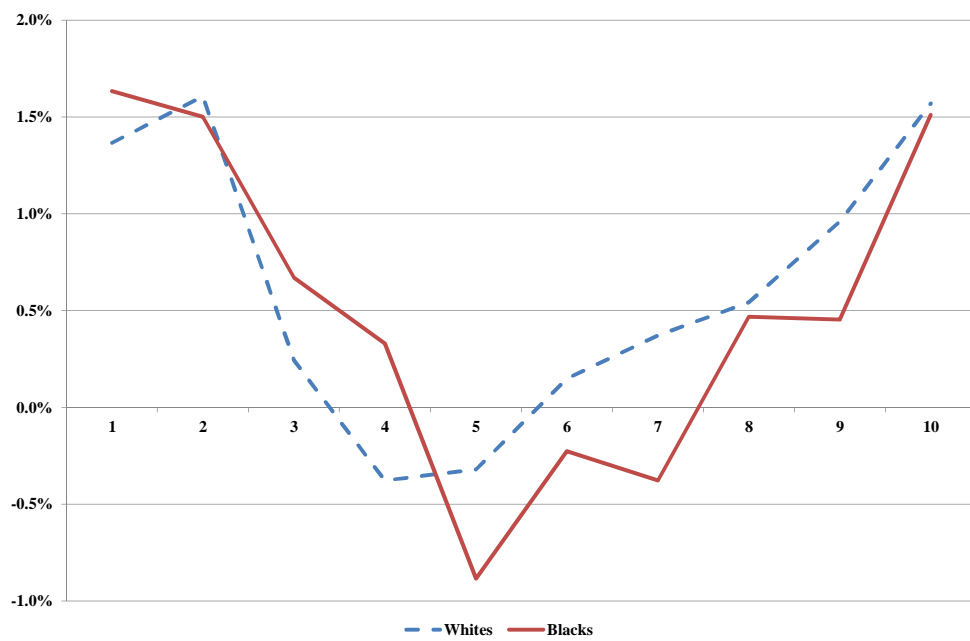


Figure 7: Percentage Changes in Median Log(income) by Homeownership Probability Deciles

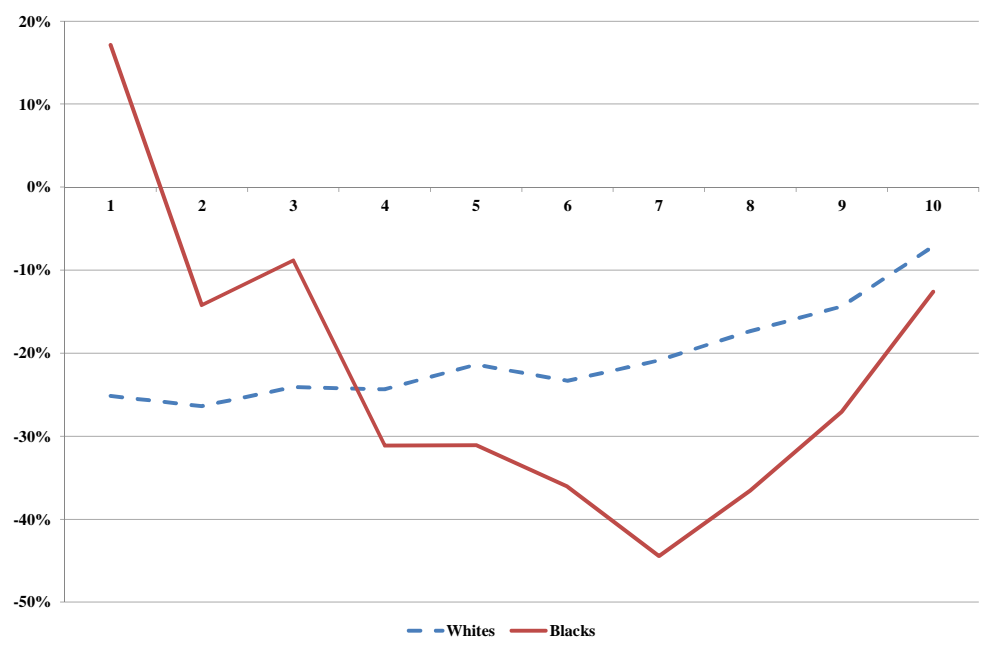


Figure 8: Percentage Change in the Number of Households with Other Income by Homeownership Probability Deciles

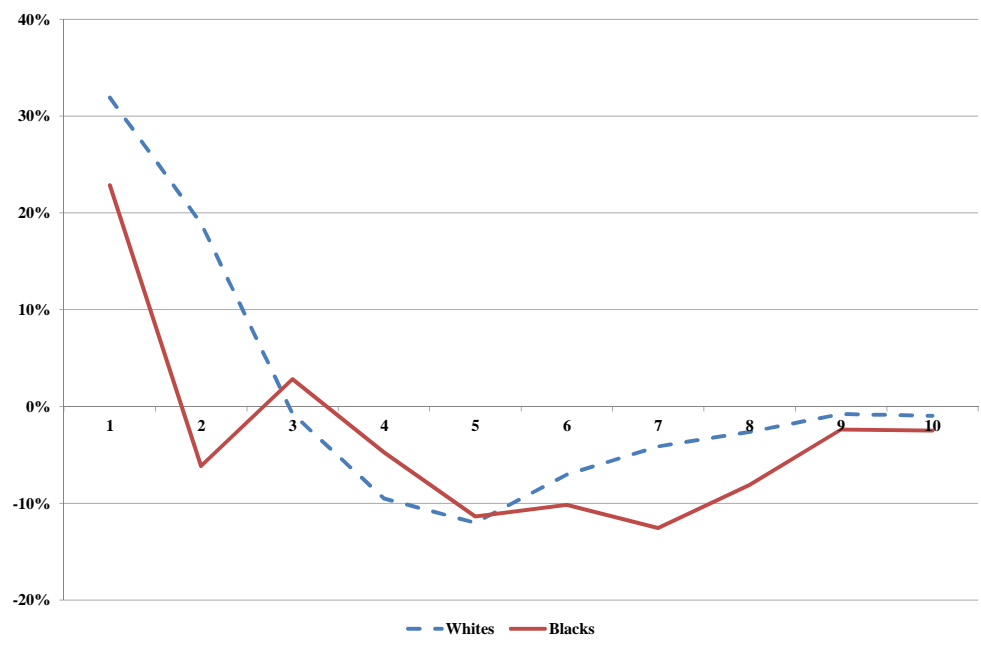


Figure 9: Percent Change in Marriage Rates by Homeownership Probability Deciles

Percentile	2005			2011			Changes from 2005 to 2011		
	Total Gap	Characteristics Gap	Residual Gap	Total Gap	Characteristics Gap	Residual Gap	Total Gap	Characteristics Gap	Residual Gap
10 <sup>th</sup>	0.225	0.131	0.095	0.155	0.078	0.077	-0.070	-0.052	-0.018
20 <sup>th</sup>	0.358	0.254	0.104	0.292	0.186	0.106	-0.065	-0.068	0.002
30 <sup>th</sup>	0.426	0.329	0.096	0.423	0.319	0.104	-0.002	-0.010	0.008
40 <sup>th</sup>	0.435	0.358	0.078	0.479	0.404	0.075	0.043	0.046	-0.003
50 <sup>th</sup>	0.379	0.321	0.058	0.422	0.368	0.054	0.043	0.047	-0.005
60 <sup>th</sup>	0.293	0.245	0.047	0.303	0.261	0.042	0.010	0.016	-0.005
70 <sup>th</sup>	0.187	0.154	0.034	0.185	0.153	0.033	-0.002	-0.001	-0.001
80 <sup>th</sup>	0.109	0.086	0.023	0.105	0.081	0.024	-0.004	-0.004	0.001
90 <sup>th</sup>	0.054	0.039	0.014	0.052	0.038	0.013	-0.002	-0.001	-0.001

Table 1: Decomposition Results

## Appendix A. Summary Statistics (2005)

	White		Black	
	Mean	St. Dev.	Mean	St. Dev.
Ownership rate	0.74	0.44	0.46	0.50
Log of household income	10.73	1.33	10.04	1.77
Age of head				
< 30	0.09	0.29	0.14	0.34
30-40	0.18	0.38	0.21	0.41
40-50	0.23	0.42	0.24	0.43
50-60	0.20	0.40	0.19	0.39
60-70	0.13	0.34	0.12	0.32
70+	0.17	0.37	0.11	0.31
Educational attainment				
Less than grade 12	0.09	0.29	0.16	0.37
Grade 12	0.34	0.47	0.42	0.49
1 or 2 years of college	0.21	0.41	0.23	0.42
4 years of college	0.21	0.41	0.12	0.32
5+ years of college	0.14	0.34	0.07	0.25
Marital status of head				
Married - spouse present	0.58	0.49	0.31	0.46
Married - spouse absent	0.29	0.46	0.39	0.49
Divorced or never married	0.13	0.34	0.30	0.46
Head is American citizen	0.90	0.30	0.90	0.30
Head is male	0.58	0.49	0.41	0.49
Household size				
1	0.31	0.46	0.34	0.47
2	0.32	0.47	0.26	0.44
3	0.15	0.35	0.17	0.38
4	0.14	0.34	0.12	0.33
5+	0.08	0.28	0.10	0.30
Household earn self-employed income	0.12	0.33	0.06	0.24
Household has interest, dividend, or rental income	0.33	0.47	0.08	0.27
Number of earners in household				
1	0.26	0.44	0.31	0.46
2	0.40	0.49	0.46	0.50
3+	0.34	0.47	0.24	0.43
Household moved into residence				
2 years ago or less	0.21	0.40	0.26	0.44
2 to 4 years ago	0.19	0.39	0.21	0.41
5 to 9 years ago	0.19	0.39	0.19	0.39
10 to 19 years ago	0.19	0.40	0.15	0.36
20 to 29 years ago	0.10	0.30	0.08	0.27
30 years or more ago	0.12	0.33	0.10	0.31
Occupational income score	24.22	16.16	20.66	13.65
Housing price index	1.37	0.35	1.38	0.35
Number of observations	531,303		71,654	

## Appendix B. Summary Statistics (2011)

	White		Black	
	Mean	St. Dev.	Mean	St. Dev.
Ownership rate	0.72	0.45	0.44	0.50
Log of household income	10.79	1.46	10.07	1.98
Age of head				
< 30	0.08	0.27	0.11	0.31
30-40	0.16	0.36	0.19	0.39
40-50	0.20	0.40	0.23	0.42
50-60	0.22	0.41	0.22	0.41
60-70	0.17	0.37	0.14	0.35
70+	0.17	0.38	0.11	0.31
Educational attainment				
Less than grade 12	0.08	0.27	0.13	0.34
Grade 12	0.32	0.47	0.38	0.49
1 or 2 years of college	0.23	0.42	0.27	0.44
4 years of college	0.22	0.42	0.13	0.34
5+ years of college	0.15	0.36	0.08	0.27
Marital status of head				
Married - spouse present	0.56	0.50	0.30	0.46
Married - spouse absent	0.30	0.46	0.38	0.49
Divorced or never married	0.13	0.34	0.32	0.47
Head is American citizen	0.89	0.32	0.88	0.32
Head is male	0.55	0.50	0.39	0.49
Household size				
1	0.31	0.46	0.37	0.48
2	0.33	0.47	0.26	0.44
3	0.15	0.35	0.16	0.37
4	0.13	0.33	0.11	0.32
5+	0.09	0.28	0.09	0.29
Household earn self-employed income	0.11	0.31	0.05	0.23
Household has interest, dividend, or rental income	0.27	0.44	0.06	0.24
Number of earners in household				
1	0.27	0.44	0.32	0.47
2	0.40	0.49	0.46	0.50
3+	0.33	0.47	0.22	0.42
Household moved into residence				
2 years ago or less	0.17	0.37	0.23	0.42
2 to 4 years ago	0.17	0.37	0.22	0.41
5 to 9 years ago	0.20	0.40	0.19	0.39
10 to 19 years ago	0.22	0.42	0.18	0.38
20 to 29 years ago	0.11	0.31	0.08	0.26
30 years or more ago	0.13	0.34	0.11	0.31
Occupational income score	23.37	16.35	19.73	14.18
Housing price index	1.53	0.41	1.54	0.42
Number of observations	527,556		85,616	

## Appendix C. Klein-Spady Estimates (2005)

	White		Black	
	Estimate	StdErr	Estimate	StdErr
Log of household income	0.149	0.001	0.163	0.003
Age of head (<30 excluded)				
30-40	0.085	0.003	0.075	0.007
40-50	0.100	0.003	0.098	0.007
50-60	0.110	0.003	0.103	0.008
60-70	0.140	0.004	0.153	0.009
70+	0.085	0.004	0.168	0.010
Educational attainment (Less than grade 12 excluded)				
Grade 12	0.067	0.003	0.046	0.006
1 or 2 years of college	0.091	0.003	0.086	0.006
4 years of college	0.112	0.003	0.144	0.008
5+ years of college	0.087	0.004	0.163	0.009
Marital status of head (Married - spouse present excluded)				
Married - spouse absent	-0.127	0.003	-0.099	0.006
Divorced or never married	-0.194	0.003	-0.153	0.007
Head is American citizen	0.055	0.003	-0.057	0.006
Head is male	-0.014	0.002	-0.004	0.004
Household size (1 excluded)				
2	0.031	0.003	0.023	0.005
3	0.055	0.003	0.020	0.006
4	0.084	0.004	0.027	0.008
5+	0.066	0.004	0.022	0.008
Household earn self-employed income	0.030	0.003	0.049	0.009
Household has interest, dividend, or rental income	0.104	0.002	0.139	0.008
Number of earners in household (1 excluded)				
2	-0.053	0.003	-0.032	0.006
3+	-0.049	0.003	-0.028	0.008
Household moved into residence (1 or 2 years ago excluded)				
2 to 4 years ago	0.140	0.002	0.112	0.005
5 to 9 years ago	0.235	0.002	0.220	0.005
10 to 19 years ago	0.330	0.002	0.321	0.005
20 to 29 years ago	0.440	0.003	0.424	0.006
30 years or more ago	0.622	0.003	0.613	0.006
Occupational income score	0.002	0.000	0.002	0.000
Housing price index	-0.189	0.002	-0.242	0.006

## Appendix D. Klein-Spady Estimates (2011)

	White		Black	
	Estimate	StdErr	Estimate	StdErr
Log of household income	0.118	0.001	0.136	0.002
Age of head (<30 excluded)				
30-40	0.035	0.003	0.045	0.007
40-50	0.050	0.003	0.065	0.007
50-60	0.060	0.003	0.073	0.007
60-70	0.079	0.003	0.083	0.008
70+	0.053	0.003	0.119	0.009
Educational attainment (Less than grade 12 excluded)				
Grade 12	0.060	0.002	0.038	0.005
1 or 2 years of college	0.084	0.003	0.071	0.005
4 years of college	0.110	0.003	0.124	0.006
5+ years of college	0.098	0.003	0.155	0.007
Marital status of head (Married - spouse present excluded)				
Married - spouse absent	-0.093	0.002	-0.077	0.005
Divorced or never married	-0.149	0.003	-0.137	0.005
Head is American citizen	0.042	0.002	-0.031	0.005
Head is male	-0.011	0.001	-0.006	0.003
Household size (1 excluded)				
2	0.022	0.002	0.016	0.004
3	0.027	0.003	0.022	0.005
4	0.042	0.003	-0.001	0.006
5+	0.026	0.003	0.008	0.007
Household earn self-employed income	0.025	0.002	0.035	0.007
Household has interest, dividend, or rental income	0.085	0.002	0.133	0.007
Number of earners in household (1 excluded)				
2	-0.035	0.002	-0.022	0.004
3+	-0.029	0.003	-0.025	0.006
Household moved into residence (1 or 2 years ago excluded)				
2 to 4 years ago	0.161	0.002	0.135	0.004
5 to 9 years ago	0.310	0.002	0.289	0.004
10 to 19 years ago	0.397	0.002	0.395	0.004
20 to 29 years ago	0.482	0.002	0.474	0.005
30 years or more ago	0.600	0.002	0.589	0.004
Occupational income score	0.001	0.000	0.002	0.000
Housing price index	-0.141	0.002	-0.165	0.004