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Kiat Ying SEAH

Eric FESSELMEYER

Singapore Management University, [efesselmeyer@smu.edu.sg](mailto:efesselmeyer@smu.edu.sg)

Kien LE

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# Estimating and decomposing changes in the White–Black homeownership gap from 2005 to 2011

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**Kiat Ying Seah**

Institute of Real Estate Studies, National University of Singapore, Singapore

**Eric Fesselmeyer**

Institute of Real Estate Studies, National University of Singapore, Singapore

**Kien Le**

Qatar University, Qatar

**Abstract**

This study evaluates the effects of the recent US housing bust on the White–Black homeownership gap by estimating and decomposing the changes in the distribution of the gap between 2005 and 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 the most likely to own, and that Black households with around a 50% probability of homeownership were especially vulnerable to the crisis. We also find that the contribution of the residual gap was modest. Changes in the White–Black homeownership gap over the sample period are mainly attributed to changes in household income, whether the household earned dividend, interest or 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**

Decomposition, homeownership, housing bust, race

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**Introduction**

The late 1990s through the mid 2000s was a period of expanded homeownership in the USA. According to the US Census, the

**Corresponding author:**Eric Fesselmeyer, National University of Singapore, AS2  
#06-02, 1 Arts Link, Singapore 117570, Singapore.

Email: ecsef@nus.edu.sg

homeownership rate rose from 64% in 1994 to a historical peak of 69% in 2004.<sup>1</sup> At the same time, the USA experienced a notable boom in house prices. The housing price index of the Federal Housing Finance Agency (FHFA) shows that real house prices increased by more than 55% between the mid 1990s and the end of 2006. However, the American Dream did not reach all strata of society during the housing boom: the White–Black homeownership gap<sup>2</sup> remained large at around 24% in 2004.<sup>3</sup> The subsequent housing bust in 2006 unravelled the boom-period homeownership gains with elevated foreclosure and delinquency rates that were, disconcertingly, concentrated in minority and low-income neighborhoods (Bayer et al., 2013). By 2014, the US Census reports a homeownership rate of 64.5% and a 26 percentage point difference between White and Black homeownership rates. This has reignited concerns that the housing bust has precipitated wide disparities in households' economic wellbeing along racial lines since home equity is a major component of household wealth,<sup>4</sup> and homeownership is often perceived as an avenue for upward mobility.<sup>5</sup> Moreover, homeownership is related to the consumption of housing services and potentially has far-reaching positive outcomes on children and communities.<sup>6</sup>

This paper evaluates the changes in the determinants of the White–Black homeownership gap from before and after the housing bust of 2006. Specifically, we look at the White–Black homeownership gaps in 2005 and in 2011 and compare the changes in the determinants of these gaps in these two time periods.

Because a household's 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 are more intricate and less straightforward than, say, decomposing

the distribution of a continuous variable such as wage or house value (Fesselmeier et al., 2013). The approach used in this paper is the method introduced in Fesselmeier et al. (2011) which allows one to estimate the conditional homeownership probability distribution semi-parametrically and decompose the differences in the homeownership gap across its distribution. One advantage of this approach is that it overcomes parametric assumptions on the underlying distribution that conventional approaches rely on and that result in welfare evaluations that are determined to a great extent by these assumptions.

Using this method, we find that the Black homeownership distribution differed from the White homeownership distribution in significant ways. There were proportionately more Black households that had around a 50% likelihood 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 homeownership gap at the median 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.

We decompose the homeownership gap into an observable socio-economic 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 discrimination, racial differences in access to credit, credit history<sup>7</sup> and unobservable household characteristics.

We find that the contribution of the residual gap is small for most of the homeownership distribution. Overall, the changes in

the White–Black homeownership gap over the sample period are substantively explained by changes in the characteristics gap. The major determinants explaining the changes in the characteristics gap are changes in household income, whether the household earned dividend, interest or rental income,<sup>8</sup> and marital status, with the extent of their respective influence varying over the homeownership distribution. Further, we find that Black households with a medium probability of homeownership seemed particularly vulnerable to the housing bust as this segment of households are associated with the greatest increase in the homeownership gap.

### Related literature

The literature on the determinants of the White–Black 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 wealthy and income constrained.<sup>9</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; Munnell et al., 1996; Yinger, 1995; and, more recently, US Department of Housing and Urban Development (US HUD), 2013).

Many also believed that the persistence of the White–Black homeownership gap could be attributed to the levels of segregation in American cities. Minority households are concentrated in central cities, which typically have homeownership rates 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 (Calem et al., 2004; Scheessele, 2002). Racial concentration of subprime lending was further compounded by predatory lending and redlining practices (Bradford, 2002; Temkin et al., 2002).

From a policy standpoint, it is crucial to determine the size of the White–Black homeownership gap and how the Great Recession has impacted it. One approach is to decompose the homeownership gap into a component that is attributable to observable racial differences in household characteristics and a residual component. The main insight of the decomposition approach is that systematic differences in household characteristics across racial groups can have differential impacts on homeownership decisions. The residual component captures unmeasured household-level factors, such as differences in tastes for homeownership and credit history, and the effects of discrimination, which includes differential credit access and predatory lending practices.

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 White–Black homeownership gap at the conditional mean (Collins and Margo, 2001; Long and Caudill, 1992; Silberman et al., 1982). While elucidative, the Oaxaca–Blinder approach could potentially mask important distributional impacts. Carrillo and Yezer (2009) explore the distribution of the homeownership gap by using the Machado and Mata (2005) method applied to aggregate homeownership rates. Fesselmeier et al. (2011) take a semi-parametric approach to decompose the homeownership gap using household-level data. The semi-parametric approach is especially amenable to richer household-level data and is capable of addressing heterogeneity across the different racial groups.

## Methodology

Our approach to decomposing the cross-sectional distribution of household-level homeownership probabilities of the two races and our exposition follows Fesselmeier et al. (2011). Additionally, in this paper, we measure temporal changes in the decomposition and their contributing factors.

The starting point of our approach is 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  $y^*$ :

$$y^* = X\beta + \varepsilon, \quad \varepsilon \sim F \quad (1)$$

where  $\beta$  is a vector of parameters and  $X$  contains observed household characteristics. The random term  $\varepsilon$  captures unobserved factors. A binary choice model can be written as:

$$y = \begin{cases} 1 & \text{if } y^* \geq 0 \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

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

$$Pr(y = 1|X) = \int_{-\infty}^{\infty} 1(\varepsilon \leq X\beta) dF^r = F^r(X\beta) \quad (3)$$

where  $1(\cdot)$  is an indicator function.

Note that the CDF  $F^r(\cdot)$  is explicitly allowed to differ across the two racial groups to avoid possible misspecification that could cause the 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>10</sup> The problem with such approaches is the implicit assumption that  $F^r(\cdot)$  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, as explained below, we estimate different CDFs for Black and White households by using the Klein and Spady (1993) semi-parametric binary choice model that is capable of estimating conditional homeownership probability functions that are consistent with the data.

## Decomposition

To analyse how the homeownership gap and its contributing factors changed from 2005 to 2011 we proceed in two steps. We first decompose each cross-section for year  $t$  and measure the contributing factors. We then take differences in the decompositions and the contributing factors across years.

The inputs to the decomposition are the homeownership probabilities predicted by the estimated conditional probability function. For each racial group in year  $t$ , we compute the  $\alpha$ -th percentile  $\xi^r(\alpha)$  from the the sample moment:

$$\frac{1}{N_r} \sum_i 1(\hat{F}^r(X_i^r \beta^r) \leq \xi^r(\alpha)) = \alpha, \quad (4)$$

where  $N_r$  is the number of observations of group  $r \in \{b, w\}$ , with  $b$  denoting Black households and  $w$  White households. (We temporarily suppress the time subscript  $t$  to simplify the notation.) 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:

$$\Delta_\alpha = [\xi^b(\alpha; X^w \beta^b) - \xi^b(\alpha)] + [\xi^w(\alpha) - \xi^b(\alpha; X^w \beta^b)], \quad (5)$$

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 (3) is evaluated using the attributes of White households. In other words, the counterfactual distribution describes what the distribution of Black homeownership would look like if Black households were to take on the same observed characteristics as their White counterparts.

The first term on the right-hand side of (5) 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 contribution of unobservable factors to the homeownership gap. Intuitively, we can think of the characteristics gap as capturing the difference in behaviour 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 and the effect of any unobservables. As such, if the characteristics gap is big in a given year, then differences in characteristics for that particular year are significant in explaining the homeownership gap, and, correspondingly, the residual gap is less important.

After estimating the homeownership gap, the residual gap, and the characteristics gap for 2005 and for 2011, we compute the differences in each of these gaps to measure how each one changed from 2005 to 2011. For example, to measure how the homeownership gap at the  $\alpha$ -th percentile changed from 2005 to 2011, we compute:

$$\Delta_{\alpha, 2011-2005} = \Delta_{\alpha, 2011} - \Delta_{\alpha, 2005}. \quad (6)$$

Since each homeownership gap has two components, a characteristics gap (CG) and a residual gap (RG), we can further write the change in the homeownership gap as:

$$\begin{aligned} \Delta_{\alpha, 2011-2005} &= CG_{\alpha, 2011} + RG_{\alpha, 2011} \\ &\quad - CG_{\alpha, 2005} - RG_{\alpha, 2005} \\ &= (CG_{\alpha, 2011} - CG_{\alpha, 2005}) \\ &\quad + (RG_{\alpha, 2011} - RG_{\alpha, 2005}) \end{aligned} \quad (7)$$

To better understand what the change in the characteristics gap and the change in the residual gap measures, consider that during the bust, some households lost their jobs, lost income, got divorced or postponed education. That is, observable characteristics in 2011 differ from those in 2005. But this difference is not what the *change* in the characteristics gap captures. Rather, our

counterfactual analysis asks, would the homeownership gap be narrower if Black households were to inherit the observable characteristics of their White counterparts in the respective years, 2005 and 2011. Suppose for the sake of simplicity that the total gap is the same in 2005 and 2011. An increase in the characteristics gap between 2005 and 2011 therefore represents an increase in the importance of characteristics in explaining the total gap relative to the unobservable factors. In this manner, our analysis provides an indication of the relative importance of changes in the characteristics gap *vis-a-vis* the relative importance in the changes in the residual gap in explaining the changes in the homeownership gap.

### Estimation of the household homeownership model

We estimate the homeownership model using the semi-parametric estimator of Klein and Spady (1993). In parametric binary models, estimation is typically carried out by optimising the log-likelihood function with a pre-specified probability of homeownership,  $F(X_i\beta)$ :

$$\max_{\beta} \sum_i y_i \log(F(X_i\beta)) + (1 - y_i) \log(1 - F(X_i\beta)). \quad (8)$$

Klein and Spady (1993) propose an estimator of  $\beta$  that maximises the log-likelihood function in (8) but with a non-parametric estimate  $\hat{F}(X_i\beta)$  in place of a parametric  $F(X_i\beta)$ , commonly a normal CDF or a logistic CDF.

Noting that  $E(y_i|X_i\beta) = F(X_i\beta)$ , Klein and Spady (1993) suggested estimating  $F(X_i\beta)$  using non-parametric regression. Intuitively speaking, a non-parametric regression computes a weighted average of  $y$  with the greatest weights given to observations with similar values of  $X$ , resulting in a

smoothed, localised estimate of the conditional expectation of  $y$  for that  $X$ . Formally, we estimate race  $r$ 's homeownership probability  $F^r(X\beta)$  as:

$$\hat{F}^r(X\beta^r) = \frac{\sum_{j=1}^{N^r} y_j K\left(\frac{X_j\beta^r - X\beta^r}{h}\right)}{\sum_{j=1}^{N^r} K\left(\frac{X_j\beta^r - X\beta^r}{h}\right)}. \quad (9)$$

The function  $K(\cdot)$  is a 'kernel' function, typically the normal density like we use, that determines the weights given to different observations based on the distance between the values of the regressors. The kernel assigns smaller weights to observations with values of  $X_j$  farther away from  $X$  so that these observations do not have much influence over the weighted average of  $y$  at  $X$ .

Plugging  $\hat{F}^r(X_i\beta^r)$  into (8) and maximising over  $\beta^r$  produces consistent estimators of race  $r$ 's homeownership model.

### Data

We use public data from the 2005 and 2011 American Community Survey (ACS) which is a nationwide, annual survey administered by the US Bureau of Census that samples residents of over 3 million housing units.<sup>11</sup> The ACS includes questions on demography (such as marital status, race, education, employment and occupation) and questions on housing (such as 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).

We include in our sample only households that are headed by non-Hispanic Whites and non-Hispanic Blacks/African Americans who live in metropolitan areas (MSAs).<sup>12</sup> 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. 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 overweighted or underweighted in the sample.

Appendix A contains 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. Owing to very small standard errors, the difference in these homeownership gaps is significant at the 5% level. The averages of the explanatory variables are consistent with the findings of other studies of the economic differences of Black and White households (for example, Altonji and Doraszelski, 2005). Average household 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.

## Results

### *Klein–Spady estimates*

Estimates of  $\beta$  and their standard errors can be found in Appendix B. All estimates have very small standard errors which is not surprising given the size of our sample. We find that having a higher income, having a larger household, being married with a spouse present, being older, earning non-wage income and having higher levels of education increase the likelihood of homeownership

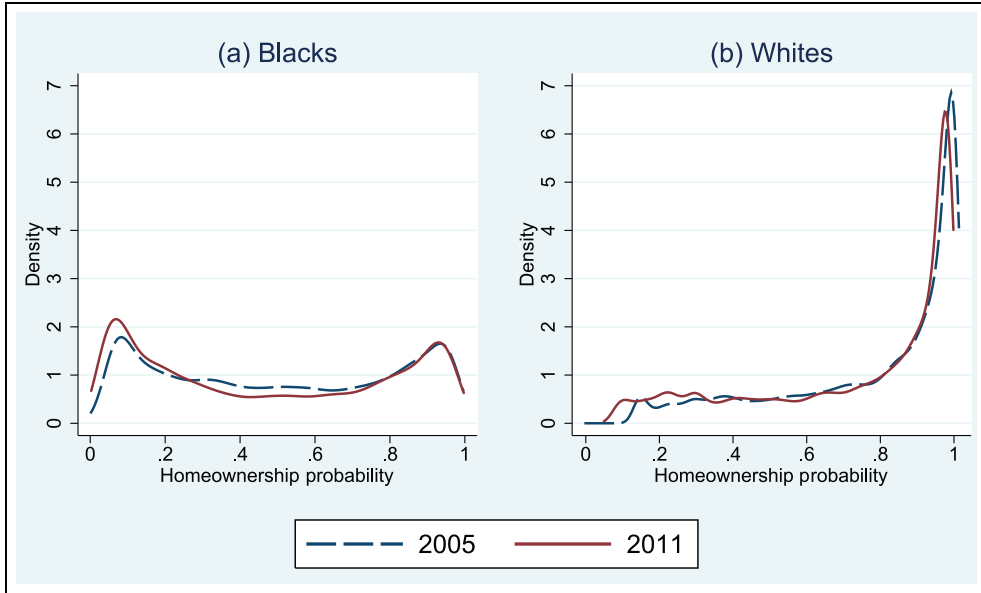
for both races. Homeownership decreases with higher house prices for both races.<sup>13</sup>

### *Household homeownership distribution*

Figure 1 provides snapshots of the two races' predicted household homeownership probabilities. Panel (a) contains kernel density estimates of the predicted homeownership probabilities of Black households in 2005 and 2011; panel (b) 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 mass 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 proportion of medium homeownership probabilities were unaffected between 2005 and 2011; the increase in the density at the low homeownership probabilities came from a decrease in the density at the high ownership 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 of Blacks at the low homeownership probabilities coincided with a decrease in the density at the medium homeownership probabilities. In other words, if we consider





**Figure 1.** Estimated homeownership probability densities.

the households with medium likelihood-to-own probabilities to be households that are at the margin of becoming homeowners, the housing bust tipped the distribution so that the probability that a Black household was at the homeownership margin decreased from 2005 to 2011. On the other hand, the housing bust did not affect the Black households that had a high homeownership propensity.

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 densities of Black households if endowed with White household characteristics. The counterfactuals in both years are very different from the Black densities and very similar to the White densities also shown in Figure 2, 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 homeownership gap, with the residual component explaining only a modest amount. We will explore the determinants of these changes in a later subsection.

### *Decomposition results*

Figures 3 and 4 contain the decomposition results.<sup>14</sup> Figure 3 shows the homeownership gap and its components in 2005 and 2011 computed using equation (5). Figure 4 illustrates the changes in the homeownership gap and in the components of the gap from 2005 to 2011.<sup>15</sup>

Figure 3 shows that for both years, the shape of the homeownership 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 most severe for the middle likelihood-to-own Black households. For the most part, compared with the characteristics

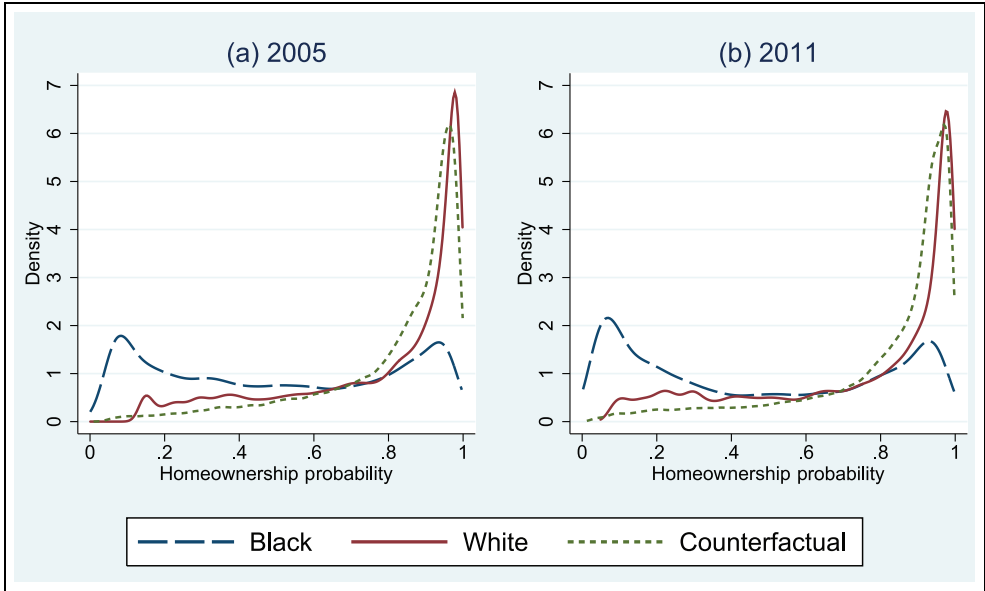


Figure 2. Homeownership probability densities with counterfactuals.

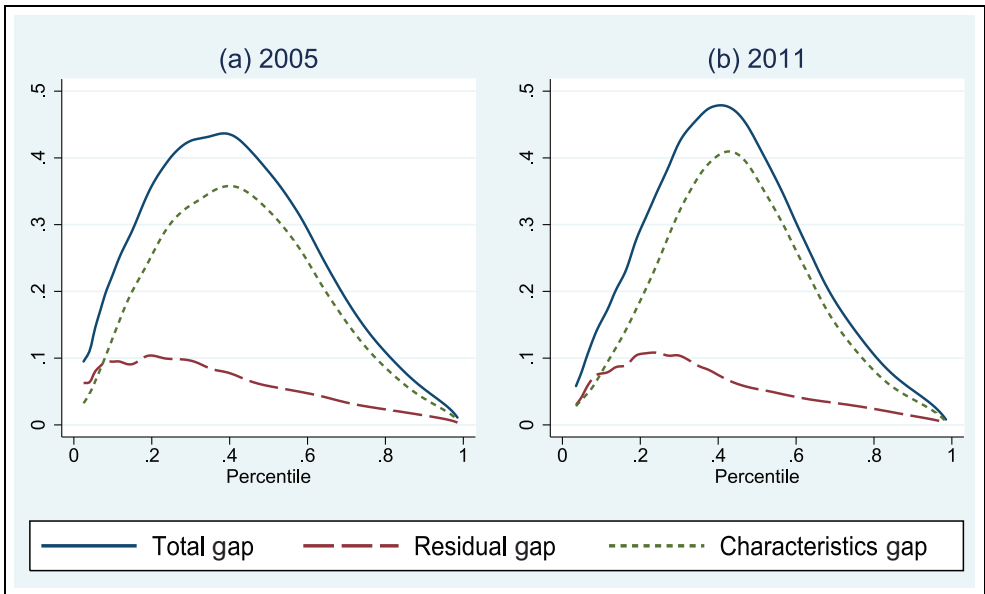
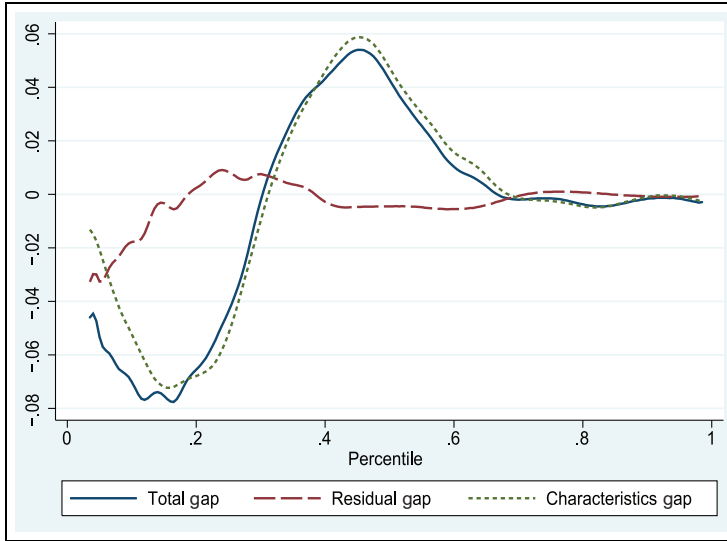


Figure 3. White-Black homeownership gaps by year.

gap, the residual gap is small, indicating that unobservable factors explain relatively little of the homeownership 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



**Figure 4.** Changes in the White-Black homeownership gaps (2005 to 2011).

factors other than observable household characteristics are important determinants of the homeownership gap for households that are least likely to own a home.

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

A clearer picture emerges when we graph the 2005–2011 changes in the homeownership gap, the characteristics gap and the residual gap in Figure 4. The housing bust did not affect the homeownership gap uniformly across the distribution. In fact, the homeownership gap decreased for households below the 30th percentile, and then increased substantially for households between the 30th

percentile and the 65th percentile. The increase in the gap is greatest around the median.

Figure 4 offers a glimpse into the drivers behind the dynamics of the homeownership gap. Movements in the homeownership gap mirror 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 homeownership gap. The contribution of changes in the residual gap to changes in the homeownership gap is modest and only affected the distribution below the 20th percentile. This part of the distribution experienced declines in both the residual gap and the characteristics gap, resulting in a large decline in the homeownership gap.

Numerous studies (for example, Avery et al., 2006; Bayer et al., 2013; Bradford, 2002; Calem et al., 2004) draw attention to the roles that subprime and predatory lending played in the disproportionate homeownership loss among low-income and minority households during the Great

Recession.<sup>16</sup> Aggar et al. (2004) shows that low-income and minority households were offered easier access to credit during the housing boom but the availability of easy credit was, in most part, exploitative and opportunistic in nature, and that 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. In our present analysis, the effects of predatory lending, among other unobservable, racially denominated factors (such as differences in credit history, credit access and discrimination in the housing markets) that effected a change in the homeownership gap, are captured in the changes of the residual gap.

To put the results in the context of discriminatory practices in housing markets, suppose that Black households were systematically subjected to such practices in 2005 and White households were not. By virtue of the fact that these practices are unobserved (by the researcher), the residual gap in explaining the homeownership gap would be significant in 2005. Suppose that the residual gap was much greater than the characteristics gap for 2005, then our analysis would show that if Black households were to have the same socio-economic characteristics as their White counterparts, the hypothetical homeownership gap would not have narrowed. That is, a lot of the homeownership gap would not have been explained by observable characteristics. Much of the gap is therefore unexplained (and by default, in the residual gap). An increase in the residual gap from 2005 to 2011, would indicate that the unobservable factors delineated along the racial White–Black line have increased in importance in the determination the homeownership gap.

Was the change in the homeownership gap over the period from 2005 to 2011 due to the changes in characteristics or was it

due to the changes in unobservable factors? The modest contribution of the residual gap changes vis-a-vis the contribution of the changes in the characteristics gap in Figure 5 indicates that much of the homeownership gap changes is due to the changes in households' observable socio-economic factors.

The individual household covariates that explain much of the changes in the homeownership gap are shown in Figure 5. They include household income, whether the household received interest, dividend or rental income ('other income') and marital status.<sup>17</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 household 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 30th percentile is clearly related to Black and White households in this segment of the distribution having become more similar in terms of income and marital status.

## Conclusion

Little is known about the distribution of the homeownership gap and how much it and its contributing factors have changed following the bust. Our study helps fill this gap by analysing 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).

Understanding differences in White and Black homeownership rates and their causes



**Figure 5.** Variable contributions to the White-Black homeownership gaps (2005 to 2011).

is important to policy makers and researchers alike. Home equity is a major component of household wealth in the USA, and homeownership can be an avenue for upward mobility. 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 complement analyses of the economic wellbeing of different racial groups.

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### Notes

1. For an analysis of the causes of the boom as well as the subsequent bust see Gabriel and Rosenthal, 2015.
2. Throughout this paper, for ease of exposition, we use the term 'White-Black

homeownership gap' or simple 'homeownership gap' to refer to differences in homeownership rates between non-Hispanic Whites and non-Hispanic Blacks/African Americans.

3. See Housing Vacancies and Homeownership at <http://www.census.gov/housing/hvs/index.html>.
4. See, for example, page 47 of Bricker et al. (2012).
5. Hart Research Associates' 2015 survey 'How Housing Matters' found that many Americans believe that stable, affordable housing is necessary for achieving a middle-class lifestyle.
6. Traditionally, increasing homeownership has been an important policy goal as homeownership has been documented to improve economic and social wellbeing 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 (DiPasquale and Glaeser, 1999) and better outcomes for children (Aaronson, 2000).

7. See, for example, Herbert et al. (2005).
8. The American Community Survey defines such income as income from an estate or trust, interest, dividends, royalties and rents received by the household.
9. Wachter and Megbolugbe (1992) find that endowment differences explain a considerable portion of the homeownership 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).
10. See Herbert et al. (2005) for an extensive survey of this literature.
11. The main 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 semi-parametric model such as the one we estimate requires more data than fully parameterised models.
12. There are 283 MSAs in the sample.
13. Like various other studies such as Rosenthal (1988), we have included the duration of residence as a covariate. While actual duration of residence is a noisy measure of expected duration – an important determinant of a household's user cost of homeownership, it is potentially endogenous, and its effect will not have a causal interpretation. 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.
14. 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.
15. Ideally, we would include confidence intervals around the estimates in Figures 3 and 4. Unfortunately it is not feasible owing 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.
16. Readers who are interested in a broader account of the antecedents and causes leading to the financial crisis can refer to Immergluck (2009)'s account of the development of the US mortgage finance industry.
17. 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 homeownership gap.

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Appendix A

	2005				2011			
	White		Black		White		Black	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Ownership rate	0.74	0.44	0.46	0.50	0.72	0.45	0.44	0.50
Log of household income	10.73	1.33	10.04	1.77	10.79	1.46	10.07	1.98
Age of head								
< 30	0.09	0.29	0.14	0.34	0.08	0.27	0.11	0.31
30–40	0.18	0.38	0.21	0.41	0.16	0.36	0.19	0.39
40–50	0.23	0.42	0.24	0.43	0.20	0.40	0.23	0.42
50–60	0.20	0.40	0.19	0.39	0.22	0.41	0.22	0.41
60–70	0.13	0.34	0.12	0.32	0.17	0.37	0.14	0.35
70 +	0.17	0.37	0.11	0.31	0.17	0.38	0.11	0.31
Educational attainment								
Less than grade 12	0.09	0.29	0.16	0.37	0.08	0.27	0.13	0.34
Grade 12	0.34	0.47	0.42	0.49	0.32	0.47	0.38	0.49
1 or 2 years of college	0.21	0.41	0.23	0.42	0.23	0.42	0.27	0.44
4 years of college	0.21	0.41	0.12	0.32	0.22	0.42	0.13	0.34
5 + years of college	0.14	0.34	0.07	0.25	0.15	0.36	0.08	0.27
Marital status of head								
Married – spouse present	0.58	0.49	0.31	0.46	0.56	0.50	0.30	0.46
Married – spouse absent	0.29	0.46	0.39	0.49	0.30	0.46	0.38	0.49
Divorced or never married	0.13	0.34	0.30	0.46	0.13	0.34	0.32	0.47
Head is American citizen	0.90	0.30	0.90	0.30	0.89	0.32	0.88	0.32
Head is male	0.58	0.49	0.41	0.49	0.55	0.50	0.39	0.49
Household size								
1	0.31	0.46	0.34	0.47	0.31	0.46	0.37	0.48
2	0.32	0.47	0.26	0.44	0.33	0.47	0.26	0.44
3	0.15	0.35	0.17	0.38	0.15	0.35	0.16	0.37
4	0.14	0.34	0.12	0.33	0.13	0.33	0.11	0.32
5 +	0.08	0.28	0.10	0.30	0.09	0.28	0.09	0.29

(continued)



(Continued)

	2005		2011					
	White		Black					
	Mean	St. dev.	Mean	St. dev.				
Household earn self-employed income	0.12	0.33	0.06	0.24	0.11	0.31	0.05	0.23
Household has other income	0.33	0.47	0.08	0.27	0.27	0.44	0.06	0.24
Number of earners in household								
1	0.26	0.44	0.31	0.46	0.27	0.44	0.32	0.47
2	0.40	0.49	0.46	0.50	0.40	0.49	0.46	0.50
3 +	0.34	0.47	0.24	0.43	0.33	0.47	0.22	0.42
Household moved into residence								
2 years ago or less	0.21	0.40	0.26	0.44	0.17	0.37	0.23	0.42
2 to 4 years ago	0.19	0.39	0.21	0.41	0.17	0.37	0.22	0.41
5 to 9 years ago	0.19	0.39	0.19	0.39	0.20	0.40	0.19	0.39
10 to 19 years ago	0.19	0.40	0.15	0.36	0.22	0.42	0.18	0.38
20 to 29 years ago	0.10	0.30	0.08	0.27	0.11	0.31	0.08	0.26
30 years or more ago	0.12	0.33	0.10	0.31	0.13	0.34	0.11	0.31
Occupational income score	24.22	16.16	20.66	13.65	23.37	16.35	19.73	14.18
Housing price index	1.37	0.35	1.38	0.35	1.53	0.41	1.54	0.42
Number of observations	531,303		71,654		527,556		85,616	

**Appendix B**

	2005				2011			
	White		Black		White		Black	
	Estimate	Std err	Estimate	Std err	Estimate	Std err	Estimate	Std err
Log of household income	0.149	0.001	0.163	0.003	0.118	0.001	0.136	0.002
Age of head (<30 excluded)								
30–40	0.085	0.003	0.075	0.007	0.035	0.003	0.045	0.007
40–50	0.100	0.003	0.098	0.007	0.050	0.003	0.065	0.007
50–60	0.110	0.003	0.103	0.008	0.060	0.003	0.073	0.007
60–70	0.140	0.004	0.153	0.009	0.079	0.003	0.083	0.008
70 +	0.085	0.004	0.168	0.010	0.053	0.003	0.119	0.009
Educational attainment (Less than grade 12 excluded)								
Grade 12	0.067	0.003	0.046	0.006	0.060	0.002	0.038	0.005
1 or 2 years of college	0.091	0.003	0.086	0.006	0.084	0.003	0.071	0.005
4 years of college	0.112	0.003	0.144	0.008	0.110	0.003	0.124	0.006
5 + years of college	0.087	0.004	0.163	0.009	0.098	0.003	0.155	0.007
Marital status of head (Married – spouse present excluded)								
Married – spouse absent	–0.127	0.003	–0.099	0.006	–0.093	0.002	–0.077	0.005
Divorced or never married	–0.194	0.003	–0.153	0.007	–0.149	0.003	–0.137	0.005
Head is American citizen	0.055	0.003	–0.057	0.006	0.042	0.002	–0.031	0.005
Head is male	–0.014	0.002	–0.004	0.004	–0.011	0.001	–0.006	0.003
Household size (1 excluded)								
2	0.031	0.003	0.023	0.005	0.022	0.002	0.016	0.004
3	0.055	0.003	0.020	0.006	0.027	0.003	0.022	0.005
4	0.084	0.004	0.027	0.008	0.042	0.003	–0.001	0.006
5 +	0.066	0.004	0.022	0.008	0.026	0.003	0.008	0.007
Household earn self-employed income	0.030	0.003	0.049	0.009	0.025	0.002	0.035	0.007

(continued)

