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ABSTRACT

This paper examines the white–black house value gap across the entire value distribution. Instead of using standard conditional mean analysis and decomposition methods (via OLS regression), we estimate and decompose the changes in the white–black house value gap from 1997 to 2005 using quantile regression. We find that the racial gap in 1997 and 2005 is mostly explained by differences in housing characteristics of white- and black-owned houses but that the variation in the racial gap is explained by racial differences in implicit prices of housing characteristics. Our results show that analysis at the conditional mean masks variations at the tails of the distribution.

1. Introduction

This paper examines the white–black house value gap. Instead of using standard conditional mean analysis and decomposition methods (via OLS regression), we estimate and decompose the changes in the white–black house value gap from 1997 to 2005 using quantile regression. Our paper continues the narrative on the racial gap in house values along the lines of Collins and Margo (2003) and Long and Caudill (1992), which examine long-term trends (from 1940 to 1990) and short-term differences (from 1970 to 1980), respectively. Both these papers suffer from the limitation of looking at the racial gap at the mean. Because the racial gap in the tails could be very different from that at the mean, the main objective of our paper is to extend these previous studies by providing a more comprehensive examination of racial home values differences across the entire value distributions of black-owned and white-owned houses.

Studying racial differences in house values is important because housing equity is a major component of household wealth.[1,2] The dual nature of housing both as a durable consumption good and an investment good implies that house values provide not only a measure of the amount of well-being derived from the consumption of housing services but rising house values could also potentially impact household consumption patterns. Greenspan and Kennedy (2005) finds that homeowners, on aggregate, extracted a sizeable portion of their home equity through cash-out refinancings in 2002 and 2003. While the theoretical underpinnings behind the wealth effect are debatable, several empirical studies, employing both aggregate and micro data, support the wealth effect hypothesis.[3] An investigation of racial differences in house values is thus instrumental in understanding policy implications directing at reducing racial inequality.

Similar to previous studies, we decompose the racial gap in house values into two parts — a *characteristics gap (CG)* and a *residual gap* (RG). The characteristics gap reflects the racial differences in the amount of housing services consumed, such as the number of rooms in a unit, while the residual gap reflects the racial differences in the valuation of housing services or attributes, which could arise because there might be quality differences that are not captured by the observable housing characteristics and these unobserved quality differences correlate with race. For example, a large RG could stem from the fact that blacks and whites are living in highly segregated neighborhoods with persistent quality differences even though the houses have similar observable characteristics. Overall, we find that white–black differences in house values are explained by differences in the amount of housing services each racial group consumes — in general,

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[1] Home equity comprises over one-half of the wealth of the typical US household Belsky and Prakken (2004) and is the most important form of wealth held by young black households (Blau and Graham, 1990).

[2] Theoretically, it is the racial difference in home equity that will give a more accurate representation of racial economic well-being derived from housing. Unfortunately, home equity is unobservable in most datasets, including the data we use here. It seems that empirically, house value is a noisy but consistent measure of home equity. Bostic et al. (2009) finds little difference in using a measure of home equity versus home value when measuring wealth effects.

[3] See for example, Muellbauer and Murphy (1990), Case et al. (2011), Campbell and Cocco (2007), and Bostic et al. (2009).

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whites consume more housing services. That is, the CG explains a major portion of the total racial gap. However, the variation in the racial difference across the house value spectrum comes from the variation in the RG. We find that, for both 1997 and 2005, decomposition at the conditional mean masks this variation in the racial gap and the RG. Moreover, the racial gap at the conditional mean remains relatively unchanged for the two years, both in terms of magnitude and in terms of its composition. This is not true when looking at the entire distribution. White and black households did not alter their housing consumption dramatically, as reflected in a change in the CG that is flat and close to zero. In contrast, there was a decline in the racial gap and the RG for the lower percentiles and an increase in the racial gap and the RG for house values beyond the 40th percentile. These results differ from the finding of Collins and Margo (2003), which documents a convergence between black and white-owned home values. We attribute the difference in our results to two plausible causes: that the Oaxaca–Blinder approach which Collins and Margo uses masked the distributional features that we find, and that we are using a more recent sample.[4]

This paper is organized as follows. Section 2 discusses previous studies. In Section 3, we describe our methodology. Section 4 describes the data we use and we discuss our results in Section 5. Section 6 concludes the paper.

2. Related studies

There is a long-standing interest in racial differences in economic well-being. The voluminous studies that look at employment income inequality in labor market studies only paint a partial picture. Economists began to seriously look at wealth differences to obtain a more comprehensive account. Birnham and Weston (1974) is one of the earlier studies on the portfolios of white and black households. It finds that at the same level of income and wealth, blacks have larger holdings of consumer durables, especially housing, than do whites.

Similarly, Blau and Graham (1990) studies the racial differences in magnitude and scope of the wealth of young households and finds that while blacks hold less assets than whites, portfolios of black households significantly tilt toward cars and houses. Blau and Graham decompose the racial differences using the Oaxaca–Blinder method of decomposition and find that income and other observable demographics could only explain about a quarter of the total wealth gap, leaving a large portion of the gap unexplained. While Blau and Graham only focuses on young households, Long and Caudill (1992), also employing the Oaxaca–Blinder method, extends the analysis by looking at national data for 1970, 1980 and 1986. Long and Caudill finds that, at the conditional mean, household and housing services characteristics could explain up to 59% of the total racial gap in house values. More recently, Collins and Margo (2003), using a longer time frame (from 1940 through 1990), investigates the time trend of the racial gap. Collins and Margo finds racial convergence in house values. The convergence finding is important since it points toward equality in value of homes between the races. Interestingly, however, this convergence is short-lived, reaching a plateau in the 1970s. From then on, the unexplained or the residual portion of the racial gap grew.

The literature on racial differences in house values is rather sparse. Past studies are primarily interested in the importance of appreciation rates in explaining the racial gap in homeownership. Long and Caudill (1992) find that white- and black-owned homes show very similar appreciation rates between 1970 and 1980. Coate and Vanderhoff (1993) find the same result for the period of 1974–1983. Instead of looking at national data, Kim (2000) focuses on neighborhoods. Using data from the Milwaukee, Wisconsin, Kim finds that neighborhoods that are predominantly white have substantially higher appreciation rates than those neighborhoods that are dominated by racial minorities. These studies all look at the racial difference at the mean. As we show later, black-owned and white-owned homes show vastly different appreciation rates across the percentiles over our 1997–2005 sample period.

3. Methodology

In this paper, we use the decomposition method that was first proposed by Machado and Mata (2005) and later extended by Albrecht et al. (2009) to include the semiparametric sample selection correction approach of Buchinsky (1998).[5] The Machado and Mata decomposition method can be thought of as a generalization of the Oaxaca–Blinder decomposition (Oaxca, 1973; Blinder, 1973) in that the Oaxaca–Blinder method decomposes the average difference of two groups into a component that is due to differences in observable characteristics and a component that is due to differences in returns while the Machado and Mata method decomposes the differences between the two groups at each percentile.

We briefly describe the Machado–Mata method here. For a more complete account, see Machado and Mata (2005), and Albrecht et al. (2009) for a proof of the consistency of the method with and without a correction for sample selection.

3.1. Quantile regression

The primary input of the Machado–Mata method is quantile regression. Quantile regression provides a complete description of the conditional distribution under analysis; in contrast, least squares regression estimates only the conditional mean.[6] This is accomplished by allowing marginal effects to differ across quantiles so that, for example, we can determine that an additional bedroom in a white-owned house has a large effect on house value in the lower tail but a small effect in the upper tail.

Let V^r denote the log of the value of a house owned by race, r, where $r \in \{w, b\}$. V^r is determined by the hedonic model:

$$V^r = x\beta^r + e, \tag{1}$$

where x is a vector of housing characteristics. Then, if $\text{Quant}_\theta(e|x) = 0$, the θ^{th} quantile is characterized by the linear function

$$\text{Quant}_\theta(V^r|x) = x\beta^r_\theta, \tag{2}$$

where we note that the coefficients β^r_θ are indexed by the quantile.

Like Collins and Margo (2003), we worry about sample selection since we observe only households that purchased a house. In the presence of sample selection, the conditional quantile of the error may not be equal to zero. As such, quantile regression suffers from the omitted variable bias described in Heckman (1979). In order to obtain consistent estimates of the hedonic model, we follow Buchinsky (1998) and include a semi-parametric correction term, $h(\gamma^r z)$, that is analogous to the inverse Mills ratio:

$$\text{Quant}_\theta(V^r|x) = x\beta^r_\theta + h(\gamma^r z). \tag{3}$$

Here, z is a vector of observable demographics that determine home ownership.

[4] Collins and Margo examine racial differences from 1940 through 1990. We should also point out that it is difficult to directly compare results among empirical studies on racial gaps because of the difference in included explanatory variables.

[5] The Machado and Mata decomposition was first used in the housing literature by Mcmillen (2008). See Carrillo and Yezer (2009), Nicodemo and Raya (2012), and Fesselmeyer et al. (2012) for other examples of decompositions at the distribution level. To the best of our knowledge, our current study is the first paper in the housing literature that uses the Machado and Mata method with a sample selection correction.

[6] See Koenker and Hallock (2001) for a user-friendly introduction to quantile regression and a bibliography of applied studies. There have been a number of applications in the housing literature. See Zietz et al. (2008) for one example.

Table 1
Black–white house value ratios.

	1997	2005
All U.S.	0.74	0.73
Central city of MSA	0.72	0.64
In MSA, not in central city, urban	0.84	0.80
In MSA, not in central city, rural	0.75	0.74
Outside MSA, urban	0.69	0.73
Outside MSA, rural	0.69	0.71
Northeast	0.75	0.77
Central city of MSA	0.73	0.72
In MSA, not in central city, urban	0.88	0.87
Midwest	0.73	0.75
Central city of MSA	0.78	0.78
In MSA, not in central city, urban	0.77	0.73
South	0.76	0.74
Central city of MSA	0.72	0.65
In MSA, not in central city, urban	0.89	0.83
In MSA, not in central city, rural	0.79	0.81
Outside MSA, urban	0.71	0.68
Outside MSA, rural	0.69	0.70
West	0.96	1.14
Central city of MSA	0.93	1.02
In MSA, not in central city, urban	0.98	1.11

3.2. Marginal densities and decompositions

The second part of the Machado–Mata method involves estimating the quantiles of (unconditional) marginal densities and a counterfactual marginal density using the (conditional) quantile regressions described in the previous section. In our case, the marginal densities are the density of log house values of white homeowners and the density of log house values of black homeowners. The counterfactual marginal density is the density of log house values that would have prevailed if the characteristics of black-owned homes were valued at the same rate as those of whites.

The basic idea underlying the estimation of the unconditional quantiles is as follows. If M random values of θ are drawn from a uniform distribution, UNIF[0, 1], the corresponding M estimates of the conditional quantiles at x, $\left\{x\hat{\beta}^r_{\theta_m}\right\}_{m=1}^{M}$, constitute a random sample from race r's conditional distribution of V^r given x. To generate a sample from the marginal density, one has to also "integrate out" x; that is, to evaluate each $x\hat{\beta}^r_{\theta_m}$ for an x that is randomly drawn from the distribution of observed characteristics. In practice, each x is bootstrapped from the data. The sample from the counterfactual density is generated in the same manner except that the coefficients used are those computed with the white data; i.e., the counterfactual sample of black home values is $\left\{x_m\hat{\beta}^w_{\theta_m}\right\}_{m=1}^{M}$, where x_m are from the black homeowners' data. Once the samples from the marginal densities and counterfactual marginal density are generated sample quantiles are easily computed.

The step-by-step approach is as follows. To generate a random sample from the marginal density of house values of race r:

1. Estimate γ^r and $h(\cdot)$ semi-parametrically
2. Draw θ from a standard uniform distribution
3. Compute $\hat{\beta}^r_\theta$
4. Draw the observed characteristics x^{r*} from race r's data (where an asterisk denotes a bootstrapped value)
5. Compute the log house value $V^{r*} = x^{r*}\hat{\beta}^r_\theta$
6. Repeat steps 2 to 5 M times

To generate a counterfactual random sample of black-owned houses with characteristics valued with white returns, replace steps 4 and 5 with

4. Draw the observed black characteristics x^{b*} from the black data set
5. Compute the counterfactual log house value $V^{b*} = x^{b*}\hat{\beta}^w_\theta$

We use these density estimates to decompose the difference between white and black log house values into a characteristics gap and a residual gap. The decomposition of the white–black house values at each quantile θ is

$$\begin{aligned}\text{Quant}_\theta(V^w) - \text{Quant}_\theta\left(V^b\right) = {} & \text{Quant}_\theta(V^{w*}) - \text{Quant}_\theta\left(V^{b*};\hat{\beta}^w\right) \\ & + \text{Quant}_\theta\left(V^{b*};\hat{\beta}^w\right) - \text{Quant}_\theta\left(V^{b*}\right),\end{aligned} \tag{4}$$

where $\text{Quant}_\theta(V^{r*})$ is the θth quantile of the marginal density of race r and $\text{Quant}_\theta\left(V^{b*};\hat{\beta}^w\right)$ is the θth quantile of the counterfactual marginal density. The left-hand side of this equation is the total log house value gap at quantile θ. The first term on the right-hand side is the characteristics gap — the part of the total gap attributable to differences in house characteristics of white-owned and black-owned houses. The second term on the right-hand side is the residual gap — the part of the total gap attributable to differences in the way housing characteristics are priced and unobservable correlates.

After estimating the total racial gap, the residual gap, and the characteristics gap for 1997 and for 2005, we then compute the differences in each of these gaps to measure how each one changed over the sample period.

4. Data

We use the national sample from the 1997 and 2005 American Housing Survey (AHS). The AHS is the largest national housing survey in the United States. It follows housing units through time, adding newly constructed units each year. Housing units in the sample are surveyed every two years by the US Census Bureau for the years between the censuses but has much more data than the census does. The survey includes questions on unit characteristic, repairs, monthly housing costs and other financial characteristics, neighborhood quality, and the demographics of the occupants.[7]

We include in our sample only housing units that are owned by black or white households valued between $5000 and the top coded values in AHS.[8] We exclude mobile homes, public housing, units with farming income, and units with lots greater than 10 acres. Finally, we add renters, including those in multifamily units, to estimate selection into ownership.[9] Our final sample consists of 17,394 white households and 1623 black households in 1997 and 19,676 white households and 1901 black households in 2005. In total, there are over 40,000 observations.

Table 1 presents the average value of black-owned houses relative to white-owned houses for the entire U.S. and for each region over 1997 and 2005.[10] Nationally, the black–white ratio of average house values has declined slightly. The ratio has decreased in the metropolitan areas

[7] A comment on house value is in order. House value is self-reported by the household. Consequentially, one might worry that an inability of homeowners to accurately appraise their unit may cause our estimates to be inconsistent. Therefore, it is important to address not only the question of how accurately self-appraisals are but whether any error is correlated with the variables typically found in hedonic regressions. There have been several studies on the topic over the years; most show that there is no significant bias in owner valuations. (See Kiel and Zabel (1999) for a review of the literature.) For example, Kish and Lansing (1954), Kain and Quigley (1972), Robins and West (1977), and Follain and Malpezzi (1981) find that owners' valuations are biased by less than 5% on average. Two more recent studies use the AHS. Goodman and Ittner (1992) find that owners in the AHS overestimate the value of their homes on average by 6% and Kiel and Zabel (1999) finds that owners overvalue their homes by 5.1%. However, both papers finds that the owners' errors are largely uncorrelated with housing, owner, and market characteristics.

[8] The top-coded value was $350,000 in 1997 and $850,000 in 2005. Top coded values make up approximately 3% of the AHS.

[9] We include a standard set of demographic variables in the selection equation: log income of the household, sex, age, education, and marital status of the household head, and household size. Summary statistics of the selection equation variables are contained in Appendix A. Results of the first stage semiparametric estimates are presented in Appendix B.

[10] Some areas are omitted due to a small number of black observations.

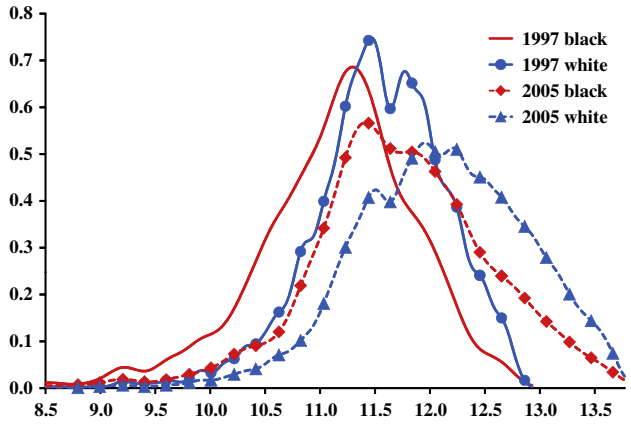

Fig. 1. Kernel estimates of log house value densities.

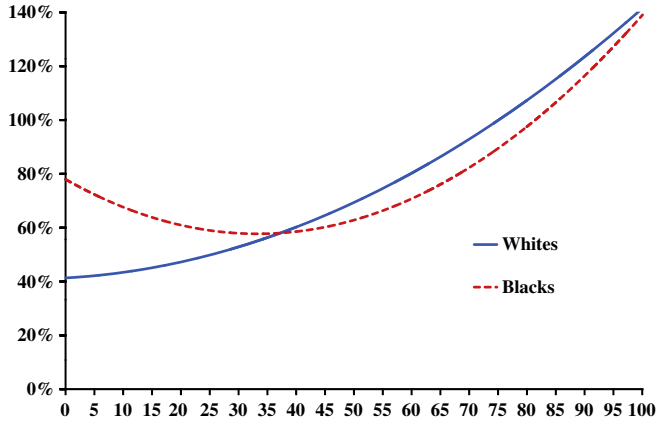

Fig. 2. Appreciation rates of house values by race by percentile.

and has increased outside them. The largest improvement in the black–white ratio comes from the West region. The black–white ratio was close to unity at 0.96 in 1997 and grew to 1.14 in 2005. The worst decline in the ratio comes from the South. The black–white ratio for urban houses that are located within a metropolitan area but outside of the central city declined from 0.89 in 1997 to 0.83 in 2005. Our numbers are not too different from the 1990's numbers reported in Collins and Margo (2003).

Appendix C contains summary statistics of the variables in the model by race for both years of the sample. On average, white households own houses that are more expensive than do black households. In 1997, the average value of white-owned houses was $117,283 and the average value of black-owned houses was $84,349. In 2005, the average value of white-owned houses was $223,895 while the average value of black-owned houses was $160,555. Housing improved in terms of many of the characteristics. The number of bathrooms and bedrooms and the incidence of central air conditioning, fireplaces, working dishwashers and garbage disposal all increased on average across years. Additionally, while the distribution of sampled white households across the metro status categories remained relatively constant over the time period, black ownership decreased in the "central city of an MSA" category and increased in the "outside the central city but still within the urban area of an MSA" category.

5. Results

5.1. Log house value densities

House values have increased substantially between 1997 and 2005. Over this period, the average house value increased for both white and black homeowners by approximately 90% (in levels). This average value does not capture certain distributional features. Figs. 1 and 2 give a more complete description of house values across the racial groups over time and highlight the contrast between looking at house values at the means versus looking at house value distributions.

The kernel estimates of the distribution of log house values for both 1997 and 2005 is depicted in Fig. 1. The rightward shift of the curves highlights the increase in house values over the sample period. House values also became more dispersed. The coefficient of variation for blacks increased from 0.65 to 0.84 while for whites it increased from 0.55 to 0.73, approximately a 30% increase for each group.

Fig. 2 shows the appreciation rates for both races (in levels).[11] White households tend to have appreciation rates that increase with the values of the homes, whereas black households do not exhibit such a monotonic trend. It is also interesting to note that black households in the 35th or lower percentiles have appreciation rates that are up to 40 percentage points higher than their white counterparts whereas at higher percentiles, the appreciation rates are similar for both races.[12] Our results stand in stark contrast to previous studies which reported that black- and white-owned homes have similar house price appreciation rates (Long and Caudill, 1992; Coate and Vanderhoff, 1993).

5.2. Regression results

Appendices D through G contain quantile regressions estimates for the 25th, 50th, and 75th quantiles for whites and blacks in 1997 and in 2005. We have also included OLS estimates for comparison in order to illustrate how the marginal effects at different quantiles of the distribution differ from the ones at the conditional mean. First, we note that almost all of the estimates are statistically significant.[13] The quantile estimates and the OLS estimates have the same signs, and the signs match our *a priori* expectations. For example, detached housing is worth relatively more, housing outside metropolitan areas is cheaper than housing in central cities in metropolitan areas, housing in the West region is more expensive than housing in the Northeast region and housing in midwestern and southern cities is cheaper. The quantile estimates and the OLS estimates differ in magnitudes. One example is the effect of age on house value. For whites in 1997, the OLS estimate for a unit built between 1990 and 1997 is 0.31, indicating that a house built during this period is valued on average 36% higher than a house built before the benchmark year of 1920 (see Appendix D).[14] The percentage effect is 60% at the 25th quantile, 39% at the 50th quantile and 20% at the 75th quantile for a house built within the same period. Another example is the coefficient for a house located in a rural area outside an MSA for the black regression in 2005 (see Appendix G). The OLS estimate indicates that such a house is valued on average 16% less than a house located in the central city of an MSA. At the 25th quantile such a house is valued 4% less, at the 50th quantile it is valued 6% less, and at the 75th quantile it is valued 19% less.

5.3. Decompositions

The decomposition results for 1997 and 2005 are presented in Figs. 3 and 4.[15] In 1997 the total racial difference (as depicted by the "Total

[11] Appreciation rates are calculated at each percentile as: 100 × (house value in 2005 − house value in 1997) / (house value in 1997).

[12] A polynomial approximation was used to smooth the data in Fig. 2.

[13] One notable exception is the sample selection coefficient estimates in the black regressions. This is likely due to the relatively smaller number of black households in the sample.

[14] The percentage effect of a dummy variable on a log dependent variable is $100 \cdot [exp(\beta) - 1]$. That is, an estimate of $\beta = 0.31$ translates to an effect of 36%.

[15] Appendix H contains 95% confidence intervals of the decomposition estimates.

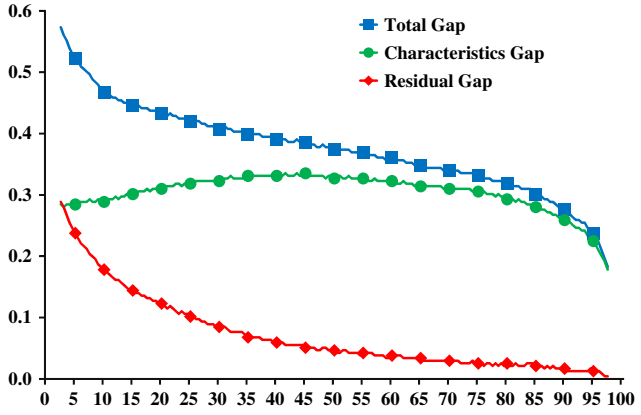

Fig. 3. 1997 Decomposition.

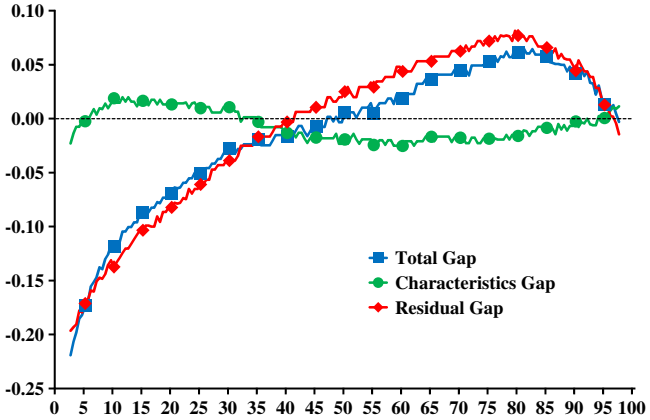

Fig. 5. 2005–1997 Change in gaps by percentile.

Gap" graph) in log house values is large at the lower percentiles and decreases monotonically. In 2005, the total racial difference is smaller than its 1997 counterpart in the lower percentiles but larger in the higher percentiles. For both years the total difference is dominated by the CG; that is, the differences in log house values of white- and black-owned houses are explained by the differences in the amount of housing services each racial group consumed. In general, whites consumed more housing services. The graphs show that the shape of the total gap graphs mirrors that of the RG for both years. In other words, the variation in the racial difference across the log house value distribution comes from the variation in the RG. For both years, the RG is larger for lower-valued housing and narrows at the upper tail of the value distribution. This indicates that white homeowners are paying higher implicit prices than black homeowners for the same bundle of housing services for lower-valued homes. There are several possible scenarios explaining this phenomenon at the lower percentiles. For one, black households could possibly face discrimination in the housing market and are steered away from more expensive white neighborhoods by realtors (see Yinger (1976)). It is also possible that black homeowners select their homes in predominantly black neighborhoods for cultural and personal reasons or that black homeowners are limited by location choice because they work in highly urbanized industries while their white counterparts are able to suburbanize with their jobs. If black neighborhoods have relatively higher negative externalities (such as higher crime rates, greater noise and air pollution, and lower quality schools), black-owned housing attributes will have lower implicit prices than those of white-owned houses. Conversely, the observation that the RG is lower at the higher percentiles suggests that black homeowners of higher-value homes face less discrimination are as likely to find jobs in suburbia as white homeowners or are more amenable to living in integrated or predominantly white neighborhoods.

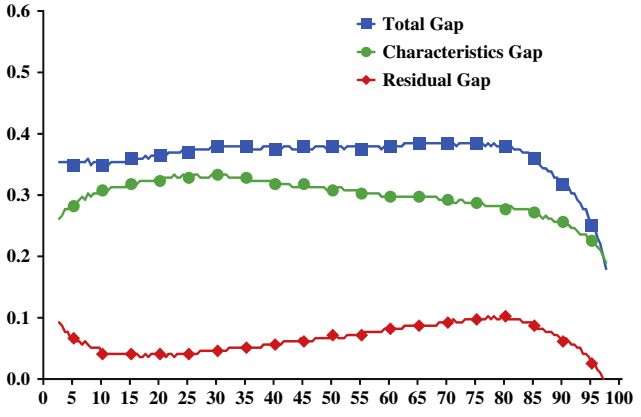

Fig. 4. 2005 Decomposition.

Interestingly, the RG in the 2005 decomposition, depicted in Fig. 4, shows a different pattern than its 1997 counterpart. The RG in 2005 shows a moderate and steady increase from around the 10th to the 80th percentile. Up to the 40th percentile, the magnitude of the 2005 RG is smaller than that of 1997. However, beyond the 40th percentile, the 2005 RG is larger than the RG in 1997. Recall that above the 40th percentile, we also see that while white-owned homes appreciated at a higher, and a more uniform rate, black-owned houses are appreciating at a rate that increases with the values of the houses, as conveyed by the convex curve in Fig. 2. The juxtaposition of a steadily increasing RG and convex appreciation rates indicates that even with increasing rates of appreciation, black-owned house values are still not catching up with white-owned houses. This suggests that a substantial number of black households still own houses that are of inferior quality.[16] These black-owned houses are therefore less valuable than white-owned houses and that the housing bubble did not mitigate the racial gap in home values above the 40th percentile. In fact, the residual gap has increased over the sample period and contributed to the increase in the total racial gap, especially for the higher percentiles.

A clearer picture of how the total racial gap has changed between 1997 and 2005 is provided in Fig. 5.[17] Here, we see that the total gap decreased for low valued houses up to around the median and increased in the higher percentiles. That is, over the sample period, the value of black-owned houses increased relatively faster than their white-owned counterparts while the opposite was true for higher valued houses. Any changes in housing consumption between white and black households had little effect on the change in the total gap since the change in the CG from 1997 to 2005 is close to zero for the entire house value distribution. In general, whites consumed more housing services than did blacks and this consumption pattern did not change over the sample period. The change in the RGs, however, reflects the change in the total gap in shape and magnitude. That is, for lower valued houses (up to around 40th percentile) the decrease in the total gap is explained by the reduction in racial differences in the implicit prices of housing characteristics whereas for higher-valued houses (from the 40th percentile onwards), the increase in the total gap is explained by the increase in the RG in 2005. In contrast to Collins and Margo (2003) which finds that the RG declined over the long-run (1940-1990), we

[16] A house that is located in a neighborhood with substantial disamenities will have lower implicit prices than a house that is located in neighborhood with desirable characteristics.

[17] To compute this change, we take the 1997 values and minus them from the 2005 values.

Table 2
Decomposition as a percent of the total gap.

Percentile	1997					2005				
	Total gap	Characteristics gap	Residual gap	Characteristics gap (%)	Residual gap (%)	Total gap	Characteristics gap	Residual gap	Characteristics gap (%)	Residual gap (%)
10th	0.47	0.29	0.18	61.8	38.2	0.35	0.31	0.04	88.2	11.8
20th	0.43	0.31	0.12	71.6	28.4	0.36	0.32	0.04	88.7	11.3
30th	0.41	0.32	0.08	79.2	20.8	0.38	0.33	0.05	87.8	12.2
40th	0.39	0.33	0.06	84.8	15.2	0.37	0.32	0.06	84.9	15.1
50th	0.37	0.33	0.05	87.5	12.5	0.38	0.31	0.07	81.1	18.9
60th	0.36	0.32	0.04	89.4	10.6	0.38	0.30	0.08	78.4	21.6
70th	0.34	0.31	0.03	91.3	8.7	0.38	0.29	0.09	76.0	24.0
80th	0.32	0.29	0.03	92.0	8.0	0.38	0.28	0.10	73.0	27.0
90th	0.28	0.26	0.02	93.8	6.2	0.32	0.26	0.06	80.6	19.4
Mean	0.35	0.28	0.07	80.0	20.0	0.34	0.29	0.05	85.3	14.7

find that the decline over 1997–2005 occurs only in the lower-percentile group. Taken together, our results suggest that the housing bubble might have mitigated the racial gap at the lower percentiles, but a substantial portion of the residual gap actually increased for the rest of the distribution.

To illustrate how the racial gap at the mean could mask distributional features, we now compare the differences in the quantile decomposition results with the Oaxaca–Blinder decomposition at the mean. Table 2 contains the contribution of the characteristics gap and residual gap to the total gap for both approaches. For both years, the total gap remains roughly the same in terms of its magnitude as well as its composition. At the mean, the residual gap explains only 15–20% of the total racial gap, less than a quarter of the characteristics gap which explains about 80–85%. However, the composition of the racial gap changes over time across the percentiles: while the CG is fairly constant in size across the distribution in 2005, the RG has decreased for the lower-percentile group but has increased for the higher-percentile group. Clearly, studying the respective contributions of the CG and the RG at the mean could understate or overstate the two components across their distributions and masks the changes that have occurred over time.

6. Conclusion

This paper estimates and decomposes the white–black house value gap for the entire distribution of house values in 1997 and in 2005. The main objective of our study is to show that examining a decomposition at the conditional mean values could mask important distributional features. Our results show that racial differences in house values across the entire house value spectrum are mostly explained by differences in the characteristics of white- and black-owned houses — white households consume more housing services than do black households. This consumption pattern does not change over time. Between 1997 and 2005, we find that black-owned houses increased in value faster than white-owned houses in the lower value percentiles while the opposite was true for higher valued houses. In this case, we conclude that these changes were not caused by differences in house characteristics but by differences in the appreciation rates of the implicit prices of housing characteristics.

Our results suggest that more meaningful information can be gleaned from examining the racial gap over the entire house value distribution than if one were to examine the racial gap at the conditional means. Collins and Margo (2003) finds that there was a decline in the residual gap over the long-run (between 1940–1990); our results show that the decline occurred only for the lower segment of the house value population and that the residual gap increased in the upper segment.

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Appendix A. Selection equation variables summary statistics.

	1997				2005			
	White		Black		White		Black	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Log of household income	10.41	1.08	9.93	1.17	10.66	1.10	10.17	1.22
Head is male	0.35	0.48	0.55	0.50	0.41	0.49	0.58	0.49
Age of head	49.70	17.26	47.63	16.50	50.63	17.29	47.90	16.22
Years of schooling of head	13.25	2.99	12.27	2.87	13.51	3.02	12.75	2.70
Years of schooling squared	184.57	81.06	158.71	69.69	191.65	82.87	169.88	69.97
Head is married	0.58	0.49	0.34	0.47	0.57	0.50	0.34	0.47
Household size					0.26	0.44		
1	0.25	0.43	0.28	0.45	0.26	0.44	0.31	0.46
2	0.35	0.48	0.27	0.44	0.35	0.48	0.27	0.44
3	0.16	0.37	0.19	0.39	0.16	0.36	0.17	0.38
4	0.15	0.36	0.14	0.35	0.15	0.35	0.14	0.35
5+	0.09	0.29	0.12	0.33	0.10	0.30	0.11	0.31
Observations	29,134		3,793		32,132		4,240	

Appendix B. Selection equation estimates.

	1997				2005			
	White		Black		White		Black	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Constant	−26.17	0.67	−19.51	1.84	22.98	1.08	−25.02	1.66
Log of household income	1.00	.	1.00	.	1.00	.	1.00	.
Head is male	−0.67	0.09	−0.06	0.10	−0.20	0.10	0.04	0.22
Age of head	0.14	0.02	0.16	0.05	0.16	0.03	0.27	0.06
Years of schooling of head	1.11	0.08	−0.03	0.08	0.78	0.05	0.27	0.06
Years of schooling squared	−0.03	0.00	0.01	0.00	−0.02	0.00	0.00	0.00
Head is married	1.79	0.14	2.00	0.22	1.72	0.15	1.38	0.26
Household size (1 excluded)								
2	0.93	0.17	1.30	0.31	0.43	0.23	1.01	0.27
3	0.98	0.17	1.76	0.29	0.65	0.16	1.77	0.26
4	1.40	0.21	1.02	0.17	0.12	0.15	2.17	0.33
5+	1.21	0.20	1.84	0.28	1.38	0.24	1.47	0.34

Note: The coefficient of log household income is set to 1 for identification reasons.

Appendix C. Summary statistics.

	1997				2005			
	White		Black		White		Black	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Value of housing unit	117,283	64,307	84,349	54,925	223,895	163,758	160,555	134,935
Housing units, detached (%)	95	22	91	28	95	23	89	31
Bathrooms	1.59	0.66	1.43	0.62	1.75	0.71	1.59	0.67
Bedrooms	3.08	0.84	3.14	0.89	3.16	0.82	3.20	0.82
Central air conditioning (%)	58	49	50	50	71	45	68	47
Fireplace (%)	0.46	0.50	0.28	0.45	0.49	0.50	0.35	0.48
Floors	1.88	0.86	1.75	0.92	1.93	0.93	1.80	0.97
Garage or carport (%)	80	40	58	49	84	37	64	48
Laundry/utility/pantry rooms	0.59	0.52	0.54	0.52	0.41	0.55	0.31	0.50
Working dishwasher (%)	67	47	36	48	76	43	52	50
Working garbage disposal (%)	48	50	26	44	56	50	40	49
Heating fuel (%)								
Electricity	23	42	23	42	24	43	27	44
Gas	63	48	68	47	65	48	67	47
Fuel Oil	11	31	6	24	9	29	4	20
Wood	2	13	1	11	1	12	0	6
Other	1	10	1	12	1	7	1	8
Period built (%)								
1919 or earlier	8	27	7	26	6	24	5	22
1920s	5	21	6	23	4	19	5	21
1930s	5	22	8	28	4	20	7	26
1940s	8	27	12	33	6	24	9	28
1950s	16	36	17	38	13	34	13	34
1960s	15	36	17	38	13	34	15	36
1970–1974	8	28	10	30	7	26	9	28
1975–1979	10	31	7	25	11	31	8	28
1980–1984	6	23	4	20	5	23	4	20
1985–1989	8	27	5	21	7	26	5	23
1990s	12	32	7	25	14	35	10	30
2000–2005	9	29	9	29				
Neighborhood quality (%)								
Poor	2	12	4	20	1	11	2	16
Average	24	43	31	46	23	42	28	45
Good	74	44	65	48	76	43	69	46
Metro status (%)								
Central city of MSA	21	41	49	50	21	41	42	49
In MSA, not in cen. city — urban	38	48	27	44	37	48	32	47
In MSA, not in cen. city — rural	17	37	6	24	18	38	9	28
Outside MSA, urban	9	29	8	27	10	29	8	28
Outside MSA, rural	15	36	10	30	15	36	9	28
Region category (%)								
Northeast	20	40	12	32	18	39	11	32
Midwest	29	45	21	41	27	45	18	38
South	34	47	59	49	35	48	63	48
West	18	38	8	27	19	40	8	26
Observations	17,394		1,623		19,676		1,901	

Appendix D. Estimates of log house value regressions for whites in 1997.

	OLS		25% quantile		50% quantile		75% quantile	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Constant	10.82	0.08	10.48	0.01	10.83	0.01	11.30	0.01
Housing unit, detached	0.06	0.02	0.07	0.00	0.08	0.00	0.05	0.00
Bathrooms	0.13	0.01	0.12	0.00	0.15	0.00	0.15	0.00
Bedrooms	0.07	0.00	0.08	0.00	0.07	0.00	0.06	0.00
Central air conditioning	0.07	0.01	0.07	0.00	0.04	0.00	0.03	0.00
Fireplace	0.18	0.01	0.17	0.00	0.17	0.00	0.17	0.00
Floors	0.10	0.01	0.11	0.00	0.11	0.00	0.10	0.00
Garage or carport	0.07	0.01	0.07	0.00	0.06	0.00	0.07	0.00
Laundry/utility/ pantry rooms	0.03	0.01	0.03	0.00	0.03	0.00	0.02	0.00
Working dishwasher	0.15	0.01	0.15	0.00	0.14	0.00	0.14	0.00
Working garbage disposal	0.04	0.01	0.04	0.00	0.04	0.00	0.04	0.00
Heating fuel (benchmark = electricity)								
Gas	−0.03	0.01	−0.03	0.00	−0.02	0.00	−0.02	0.00
Fuel oil	0.11	0.01	0.14	0.00	0.14	0.00	0.08	0.00
Wood	0.06	0.03	0.05	0.00	0.02	0.00	0.06	0.00
Other	0.00	0.03	−0.04	0.00	0.03	0.00	0.04	0.00
Period built (benchmark = before 1920)								
1920s	0.07	0.02	0.09	0.00	0.05	0.00	0.06	0.00
1930s	0.05	0.02	0.06	0.00	0.04	0.00	0.03	0.00
1940s	0.11	0.02	0.15	0.00	0.11	0.00	0.07	0.00
1950s	0.16	0.02	0.27	0.00	0.16	0.00	0.08	0.00
1960s	0.17	0.02	0.30	0.00	0.17	0.00	0.06	0.00
1970–1974	0.17	0.02	0.31	0.00	0.16	0.00	0.04	0.00
1975–1979	0.15	0.02	0.31	0.00	0.15	0.00	0.01	0.00
1980–1984	0.18	0.02	0.32	0.00	0.18	0.00	0.08	0.00
1985–1989	0.25	0.02	0.40	0.00	0.27	0.00	0.11	0.00
1990–1997	0.31	0.02	0.47	0.00	0.33	0.00	0.18	0.00
Neighborhood quality (benchmark = poor)								
Average	0.17	0.03	0.18	0.00	0.16	0.00	0.11	0.00
Good	0.26	0.03	0.26	0.00	0.24	0.00	0.20	0.00
Metro status (benchmark = cen. city MSA)								
In MSA, not in cen. city — urban	0.10	0.01	0.10	0.00	0.12	0.00	0.13	0.00
In MSA, not in cen. city — rural	0.05	0.01	0.06	0.00	0.07	0.00	0.09	0.00
Outside MSA, urban	−0.19	0.01	−0.16	0.00	−0.15	0.00	−0.18	0.00
Outside MSA, rural	−0.11	0.01	−0.13	0.00	−0.08	0.00	−0.05	0.00
Region (benchmark = Northeast)								
Midwest	−0.13	0.01	−0.13	0.00	−0.12	0.00	−0.14	0.00
South	−0.18	0.01	−0.21	0.00	−0.19	0.00	−0.17	0.00
West	0.16	0.01	0.11	0.00	0.15	0.00	0.20	0.00
Inverse Mills ratio	−2.36	0.30	−2.72	0.13	−2.54	0.13	−2.51	0.14
Inverse Mills ratio squared	1.76	0.34	2.28	0.16	2.02	0.16	1.89	0.17

Appendix E. Estimates of log house value regressions for blacks in 1997.

	OLS		25% quantile		50% quantile		75% quantile	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Constant	10.52	0.29	9.80	0.21	10.59	0.10	11.50	0.08
Housing unit, detached	0.17	0.05	0.13	0.01	0.13	0.00	0.17	0.00
Bathrooms	0.08	0.03	0.10	0.00	0.10	0.00	0.10	0.00
Bedrooms	0.07	0.02	0.05	0.00	0.05	0.00	0.06	0.00
Central air conditioning	0.07	0.04	0.08	0.00	0.01	0.00	0.02	0.00
Fireplace	0.15	0.04	0.16	0.00	0.14	0.00	0.10	0.00
Floors	0.13	0.02	0.13	0.00	0.13	0.00	0.13	0.00
Garage or carport	0.07	0.03	0.06	0.00	0.06	0.00	0.01	0.00
Laundry/utility/ pantry rooms	0.03	0.03	0.06	0.00	0.02	0.00	0.00	0.00
Working dishwasher	0.09	0.04	0.18	0.00	0.11	0.00	0.03	0.00
Working garbage disposal	0.06	0.04	0.06	0.00	0.07	0.00	0.02	0.00
Heating fuel (benchmark = electricity)								
Gas	-0.06	0.04	-0.03	0.00	-0.06	0.00	-0.02	0.00
Fuel oil	0.05	0.07	0.06	0.01	0.08	0.01	0.07	0.00
Wood	0.18	0.14	0.12	0.04	0.15	0.02	0.13	0.01
Other	−0.17	0.12	−0.31	0.04	−0.25	0.02	0.01	0.01
Period built (benchmark = before 1920)								
1920s	0.10	0.08	0.10	0.02	0.16	0.01	−0.05	0.01
1930s	0.06	0.07	0.04	0.01	0.21	0.01	0.07	0.00
1940s	0.17	0.07	0.23	0.01	0.21	0.01	0.08	0.00
1950s	0.26	0.07	0.43	0.01	0.32	0.00	0.07	0.00
1960s	0.27	0.07	0.37	0.01	0.30	0.01	0.10	0.00
1970–1974	0.21	0.08	0.43	0.01	0.27	0.01	0.03	0.01
1975–1979	0.19	0.08	0.38	0.02	0.33	0.01	0.07	0.01
1980–1984	0.22	0.09	0.27	0.02	0.22	0.01	0.15	0.01
1985–1989	0.31	0.09	0.48	0.02	0.34	0.01	0.16	0.01
1990–1997	0.40	0.08	0.57	0.02	0.42	0.01	0.31	0.01
Neighborhood quality (benchmark = poor)								
Average	0.04	0.07	−0.01	0.01	0.16	0.01	0.04	0.00
Good	0.12	0.07	0.13	0.01	0.26	0.01	0.09	0.00
Metro status (benchmark = cen. city MSA)								
In MSA, not in cen. city — urban	0.21	0.04	0.19	0.00	0.23	0.00	0.25	0.00
In MSA, not in cen. city — rural	0.16	0.06	0.18	0.01	0.17	0.00	0.14	0.00
Outside MSA, urban	−0.18	0.06	−0.16	0.01	−0.12	0.00	−0.16	0.00
Outside MSA, rural	−0.07	0.06	−0.13	0.01	−0.04	0.00	−0.04	0.00
Region (benchmark = Northeast)								
Midwest	−0.22	0.06	−0.21	0.01	−0.20	0.00	−0.28	0.00
South	−0.14	0.05	−0.16	0.01	−0.15	0.00	−0.23	0.00
West	0.40	0.07	0.34	0.01	0.38	0.01	0.37	0.01
Inverse Mills ratio	−1.65	1.05	−0.29	2.76	−2.20	1.33	−3.01	1.14
Inverse Mills ratio squared	1.10	1.05	−0.15	2.77	1.63	1.36	2.44	1.16

Appendix F. Estimates of log house value regressions for whites in 2005.

	OLS		25% quantile		50% quantile		75% quantile	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Constant	11.61	0.10	10.90	0.01	11.73	0.01	12.39	0.02
Housing unit, detached	−0.03	0.02	−0.01	0.00	−0.06	0.00	−0.04	0.00
Bathrooms	0.17	0.01	0.16	0.00	0.19	0.00	0.20	0.00
Bedrooms	0.08	0.01	0.09	0.00	0.08	0.00	0.07	0.00
Central air conditioning	0.08	0.01	0.12	0.00	0.09	0.00	0.03	0.00
Fireplace	0.17	0.01	0.19	0.00	0.17	0.00	0.14	0.00
Floors	0.06	0.01	0.07	0.00	0.07	0.00	0.10	0.00
Garage or carport	0.06	0.01	0.07	0.00	0.07	0.00	0.06	0.00
Laundry/utility/ pantry rooms	0.02	0.01	0.03	0.00	0.02	0.00	0.02	0.00
Working dishwasher	0.19	0.01	0.20	0.00	0.17	0.00	0.16	0.00
Working garbage disposal	0.09	0.01	0.07	0.00	0.07	0.00	0.09	0.00
Heating fuel (benchmark = electricity)								
Gas	−0.04	0.01	−0.02	0.00	−0.04	0.00	−0.07	0.00
Fuel oil	0.15	0.02	0.21	0.00	0.20	0.00	0.07	0.00
Wood	−0.05	0.04	0.01	0.00	0.01	0.00	−0.07	0.00
Other	−0.04	0.05	−0.17	0.00	−0.05	0.00	−0.03	0.00
Period built (benchmark = before 1920)								
1920s	0.08	0.03	0.07	0.00	0.10	0.00	0.12	0.00
1930s	0.11	0.03	0.13	0.00	0.10	0.00	0.08	0.00
1940s	0.10	0.02	0.13	0.00	0.10	0.00	0.12	0.00
1950s	0.16	0.02	0.23	0.00	0.19	0.00	0.13	0.00
1960s	0.13	0.02	0.24	0.00	0.15	0.00	0.08	0.00
1970–1974	0.10	0.02	0.21	0.00	0.12	0.00	0.03	0.00
1975–1979	0.07	0.02	0.21	0.00	0.09	0.00	-0.02	0.00
1980–1984	0.08	0.03	0.23	0.00	0.11	0.00	-0.01	0.00
1985–1989	0.19	0.02	0.37	0.00	0.22	0.00	0.08	0.00
1990s	0.19	0.02	0.36	0.00	0.22	0.00	0.09	0.00
2000–2005	0.32	0.02	0.49	0.00	0.36	0.00	0.24	0.00
Neighborhood quality (benchmark = poor)								
Average	0.10	0.04	0.07	0.00	0.05	0.00	0.03	0.00
Good	0.20	0.04	0.17	0.00	0.15	0.00	0.13	0.00
Metro status (benchmark = cen. city MSA)								
In MSA, not in cen. city — urban	0.14	0.01	0.13	0.00	0.17	0.00	0.18	0.00
In MSA, not in cen. city – rural	−0.01	0.01	0.04	0.00	0.04	0.00	0.02	0.00
Outside MSA, urban	−0.30	0.02	−0.20	0.00	−0.23	0.00	−0.27	0.00
Outside MSA, rural	−0.26	0.01	−0.20	0.00	−0.19	0.00	−0.21	0.00
Region (benchmark = Northeast)								
Midwest	−0.27	0.01	−0.13	0.00	−0.32	0.00	−0.44	0.00
South	−0.30	0.02	−0.25	0.00	−0.36	0.00	−0.39	0.00
West	0.27	0.02	0.28	0.00	0.23	0.00	0.27	0.00
Inverse Mills ratio	−2.74	0.39	−2.47	0.22	−3.34	0.19	−3.74	0.29
Inverse Mills ratio squared	1.88	0.43	1.84	0.29	2.62	0.24	2.94	0.36

Appendix G. Estimates of log house value regressions for blacks in 2005.

	OLS		25% quantile		50% quantile		75% quantile	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Constant	10.93	0.29	10.22	0.18	11.20	0.06	12.00	0.08
Housing unit, detached	0.11	0.05	−0.10	0.00	0.06	0.00	0.00	0.00
Bathrooms	0.13	0.03	0.15	0.00	0.12	0.00	0.10	0.00
Bedrooms	0.09	0.02	0.10	0.00	0.09	0.00	0.11	0.00
Central air conditioning	0.11	0.04	0.22	0.00	0.10	0.00	−0.04	0.00
Fireplace	0.09	0.03	0.12	0.00	0.08	0.00	0.07	0.00
Floors	0.13	0.02	0.10	0.00	0.12	0.00	0.15	0.00
Garage or carport	0.05	0.03	0.10	0.00	0.04	0.00	0.03	0.00
Laundry/utility/ pantry rooms	0.05	0.03	0.07	0.00	0.06	0.00	0.04	0.00
Working dishwasher	0.20	0.04	0.22	0.00	0.17	0.00	0.15	0.00
Working garbage disposal	0.06	0.04	0.05	0.00	0.09	0.00	0.07	0.00
Heating fuel (benchmark = electricity)								
Gas	−0.05	0.03	−0.02	0.00	−0.05	0.00	−0.02	0.00
Fuel oil	0.15	0.07	0.27	0.01	0.18	0.00	0.11	0.01
Wood	−0.18	0.23	−0.12	0.06	−0.13	0.03	−0.13	0.03
Other	−0.09	0.14	−0.09	0.05	−0.30	0.02	−0.16	0.02
Period built (benchmark = before 1920)								
1920s	0.01	0.08	0.07	0.01	-0.03	0.01	0.02	0.01
1930s	0.06	0.08	0.09	0.01	0.03	0.00	0.09	0.01
1940s	0.11	0.07	0.20	0.01	0.03	0.00	0.14	0.01
1950s	0.16	0.07	0.26	0.01	0.15	0.00	0.22	0.01
1960s	0.18	0.07	0.26	0.01	0.15	0.00	0.24	0.01
1970–1974	0.18	0.08	0.27	0.01	0.08	0.00	0.21	0.01
1975–1979	0.17	0.08	0.34	0.01	0.13	0.00	0.18	0.01
1980–1984	0.15	0.09	0.18	0.02	0.13	0.01	0.20	0.01
1985–1989	0.22	0.09	0.29	0.02	0.19	0.01	0.22	0.01
1990s	0.23	0.08	0.39	0.01	0.18	0.01	0.26	0.01
2000–2005	0.36	0.08	0.49	0.01	0.31	0.01	0.44	0.01
Neighborhood quality (benchmark = poor)								
Average	−0.04	0.09	0.03	0.02	−0.02	0.01	−0.20	0.01
Good	0.10	0.09	0.14	0.01	0.09	0.01	−0.05	0.01
Metro status (benchmark = cen. city MSA)								
In MSA, not in cen. city — urban	0.19	0.03	0.15	0.00	0.24	0.00	0.21	0.00
In MSA, not in cen. city — rural	0.05	0.05	0.02	0.01	0.10	0.00	0.15	0.00
Outside MSA, urban	−0.24	0.06	−0.09	0.01	−0.13	0.00	−0.20	0.00
Outside MSA, rural	−0.17	0.06	−0.04	0.01	−0.06	0.00	−0.21	0.00
Region (benchmark = Northeast)								
Midwest	−0.29	0.05	−0.03	0.01	−0.23	0.00	−0.49	0.00
South	−0.31	0.05	−0.12	0.01	−0.27	0.00	−0.47	0.00
West	0.59	0.07	0.66	0.01	0.67	0.00	0.55	0.00
Inverse Mills ratio	−1.01	1.03	−0.68	2.17	−1.72	0.80	−2.12	0.94
Inverse Mills ratio squared	0.28	1.05	0.07	2.25	0.94	0.83	1.26	0.94

Appendix H. 95% Confidence intervals of the decomposition estimates.

Percentile	Total gap		Characteristics gap		Residual gap	
	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
1997						
10th	0.41	0.52	0.27	0.31	0.13	0.23
20th	0.38	0.47	0.29	0.33	0.08	0.16
30th	0.36	0.45	0.30	0.34	0.05	0.12
40th	0.35	0.42	0.31	0.35	0.03	0.10
50th	0.34	0.41	0.31	0.35	0.02	0.07
60th	0.33	0.39	0.30	0.34	0.01	0.06
70th	0.31	0.37	0.29	0.33	0.00	0.06
80th	0.28	0.35	0.27	0.31	0.00	0.06
90th	0.24	0.32	0.23	0.28	-0.02	0.06
2005						
10th	0.31	0.40	0.28	0.34	0.01	0.08
20th	0.33	0.41	0.30	0.35	0.01	0.07
30th	0.34	0.42	0.31	0.36	0.02	0.07
40th	0.35	0.42	0.30	0.35	0.04	0.08
50th	0.35	0.43	0.29	0.34	0.05	0.10
60th	0.36	0.43	0.28	0.33	0.06	0.12
70th	0.36	0.43	0.27	0.32	0.07	0.13
80th	0.35	0.43	0.26	0.31	0.08	0.14
90th	0.29	0.38	0.23	0.29	0.04	0.11

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