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The Many Misspellings of Albuquerque: A Comment on 'Sorting or Steering: The Effects of Housing Discrimination on Neighborhood Choice'*

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Abstract

This comment revisits the analysis in Christensen and Timmins (2022). We identify two critical errors used in the original analysis, one with the data and the other with coding. When either error is corrected several major results in the paper change, either in statistical significance or in effect size. The data error is a result of including fixed effects for the string variable 'city'. The raw variable is case sensitive and has many spelling mistakes. The coding error involves assigning a value of zero for the variable "of color" to both individuals identified as 'white' and as 'other' in the raw data. The level of clustering in the paper is also arguably too fine. Many of the results are not robust to clustering at the city level, as opposed to the subject pair level. In total, we affirm the authors' overarching claim of substantial and nuanced housing discrimination against racial minorities generally, and African Americans in particular; however, the effect sizes and significance are generally (although not always) smaller than the original authors findings. Additionally, there are several instances where the effects of discrimination on African Americans are no longer statistically significant but the effect of discrimination on Hispanics becomes significant.

Christensen and Timmins (2022) analyze the Housing Discrimination Study conducted by Housing and Urban Development (HUD). Based on the revealed preference framework, they test three hypotheses concerning the existence and severity of housing discrimination to buyers of minority race in the United States: (i) racial minority buyers are provided with limited housing choices; (ii) racial minority buyers are steered into minority communities; (iii) racial minority buyers (especially for mothers) are at a disadvantage in human capital accumulation due to being steered into lower quality neighbourhoods. Tests on all three

*We discovered these errors during the Ottawa Replication Games organized by the Institute for Replication. Thanks to Abel Brodeur for valuable feedback.

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hypotheses are conducted via fixed-effect regressions using data from the United States. Specifically, the datasets used in the original empirical analysis are experimental data from the 2012 Housing Discrimination Study (HDS) and micro-level data on neighbourhood attributes in 28 U.S. cities.

In this comment we show that the analysis contains two critical errors. The first is a result of the raw data not being sufficiently cleaned. All of the regressions contain fixed effects for the city of the recommended house. The city name is stored as a string that was manually input by humans, and the strings were not cleaned before creating the fixed effects. Unfortunately, due to spelling errors and case-sensitivity, this results in many cities being possibly represented each by multiple fixed effects; for example, Albuquerque, New Mexico has been input as Albuquerque, albuquerque, ALBUQUERQUE, and Albququerque (among others), with each being treated as a separate city fixed effect. Cleaning this variable before creating the fixed effects significantly changes both the estimated effect size and statistical significance of many of the results. See section 1.1 for more details.

The second error is that the binary variable of primary interest is miscoded. It appears that this variable, 'Racial Minority', is meant to be set to zero for white identified individuals, and set to one for everyone else. While this variable is correctly coded for 'white', 'african american', 'hispanic', and 'asian' individuals it is not correctly classified for the 'other' individuals. The 'other' individuals are coded as zero. Correcting this error can change both the effect size and statistical significance in many of the regressions. See section 1.2 for more details.

The 2012 HDS was conducted in 28 metropolitan areas by the Urban Institute, in conjunction with the U.S. Department of Housing and Urban Development. The study used a matched-pair block randomized design to simulate the actual housing search process. Matched pairs of recruited volunteers ("testers") receive identical assigned characteristics and only differ in their self-identified race. This attribute assignment mechanism ensures both testers in any matched pairs are equally qualified for purchasing or renting a given housing unit. Paired testers are matched to an advertised listing and randomly assigned to a real estate agent. Interactions between the pair of equally qualified testers and the real estate agent generates data on the location and attributes of both advertised and recommended listings. This experimental data captures any differential treatments in the home search process that occurred to buyers of minority race.

Micro-level data on neighbourhood attributes include school quality, crime counts, poverty rate, job occupation, share of single-parent households, home ownership rate and measures of local pollution exposures. Sources of data including Stanford Educational Opportunity Project (SEOP), American Community Survey (ACS) and U.S. Environmental Protection Agency (EPA). Information on school quality and local crime counts are scraped from private rating services and major online real estate platforms. Both the public-use experiment data and the micro-level neighbourhood attributes data are included in the replication package.

The main empirical specification used in the original study is:

$$A_{i,k,f} = \psi_1 \text{race}_i + \psi_2 \text{trial}_f + \tilde{A}_{i,k,f}^{\top} \psi_3 + W_{i,k,f}^{\top} \psi_4 + \nu_{i,k,f} \tag{1}$$

where $A_{i,k,f}$ denotes specific attributes of house k shown to tester i in trial f. This includes both the advertised houses and houses recommended by real estate agents. The variable of

interest, race_i, is an indicator variable representing the self-identified race of tester i. The original study concerns three representative minority race categories, African American, Hispanic and Asian. trial_f is a set of trial-specific fixed effects included in the regression. $\tilde{A}_{i,k,f}$ denotes the set of house attributes brought to the real estate agent in the first appointment by the tester, thus representing buyer's latent preferences. Lastly, $W_{i,k,f}$ is a vector of control variables relevant to the tester, the housing market and to the listing search itself.

Based on Eq.1, the original study tested the first hypothesis using two match-specific measures as the dependent variable in their respective regressions. The first measure used is the total number of recommended listings by the real estate agent, $\text{show}_{i,k,f}$. The regression specification is:

$$\text{show}_{i,k,f} = \psi_1 \text{race}_i + \psi_2 \text{trial}_f + \tilde{A}_{i,k,f}^{\top} \psi_3 + W_{i,k,f}^{\top} \psi_4 + \nu_{i,k,f} \tag{2}$$

And the second measure used is the availability of advertised homes (communicated by the real estate agents), $\text{home\_av}_{i,k,f}$. In this case, the regression specification is:

$$\text{home\_av}_{i,k,f} = \psi_1 \text{race}_i + \psi_2 \text{trial}_f + \tilde{A}_{i,k,f}^{\top} \psi_3 + W_{i,k,f}^{\top} \psi_4 + \nu_{i,k,f} \tag{3}$$

Note that in the original study, the race variable, race_i, can either be a racial minority identifier (i.e. any minority race) or a race-specific identifier (i.e. a specific race). In the provided dataset, they are labelled as ofcolor_i and APRACE_i, respectively. Two additional variables are included in $W_{i,k,f}^{\top}$: the natural logarithm of advertised listing prices and the neighbourhood racial composition of advertised house.

Similarly, the original study tested the second hypothesis using the specification:

$$\text{white\_share\_by\_inc}_{i,k,f} = \psi_1 \text{race}_i + \psi_2 \text{trial}_f + \tilde{A}_{i,k,f}^{\top} \psi_3 + W_{i,k,f}^{\top} \psi_4 + \nu_{i,k,f} \tag{4}$$

The dependent variable is the share of White households of three different income levels (high, medium, and low). The vector of controls used in this test included two additional controls: the natural logarithm of advertised listing prices and the share of White households in the neighbourhood of advertised house.

Lastly, the specification used to test the third hypothesis is:

$$\text{community\_attributes}_{i,k,f} = \psi_1 \text{race}_i + \psi_2 \text{trial}_f + \tilde{A}_{i,k,f}^{\top} \psi_3 + W_{i,k,f}^{\top} \psi_4 + \nu_{i,k,f} \tag{5}$$

Notice that the notation of dependent variable $\text{neighbourhood\_attributes}_{i,k,f}$ represents a class of neighbourhood attributes, including but not limited to: measures of school quality, community safety, poverty rate and household types, etc. The additional control variables used here are: the natural logarithm of advertised listing prices, neighbourhood racial composition of advertised house and related outcome of the advertised listing. Observations used in testing this hypothesis are generated by testers who were assigned the role of a mother.

We reproduced the original estimation results in Section 2 of this comment. These results match the main regression specifications presented in Table 5, 7 and 10 of the original paper, respectively. We should note that the original study was analyzed in `R`. For additional robustness, and due to our backgrounds, we performed this replication using `Stata`. The replication codes we used can be found at https://www.journals.uchicago.edu/doi/suppl/10.1086/720140.

1 Issues in the Original Study

1.1 City Names

During the replication process, it became obvious that the data within the 2012 HDS were manually recording responses from the rental offices they contacted, including the addresses of the houses that they requested to view. As with all manually input data, there is an inherent risk of user error and inconsistency, which can take many forms. Table 5 provides examples of these issues in the state of New Mexico, which include different capitalizations, spelling errors, spacing errors, and mistaken fields (specifically, a tester input the zip code instead of the city). While some of these errors required more labour-intensive manual correction, most of the errors are relatively minor and simple to address, however we did not find any attempt by the original authors to address these issues.

We also conducted a comprehensive review of errors in city-name matching in the 2012 HDS Census recommendations to potential buyers. Without cleaning the strings, there are 1757 unique cities across 23,323 records. However, upon comparison with a database of city names from USPS which was merged by zip code, 6667 records had a typed city name that did not match with USPS records.[1] Our cleaning process was able to match all but 210 of these remaining records, and reduced the number of unique city names to 1074. Overall, our algorithm reduced the number of unique cities by 38.8%.

Furthermore, the most important tools for reducing the number of city names was standardizing casing and removing all punctuation and spacing, which removed 439 of the 683 unique cities that we identified as incorrectly entered.

Table 2 shows the incremental nature of this procedure in matching records and eliminating erroneous city names. The complete DO file we used to match the city names is available github.com/mattdwebb/HUDreplication, along with all our other replication materials.

An additional issue with the replication being done in `Stata` instead of `R` is that the number of observations sometimes differ. Within `Stata` the `reghdfe` package will treat a missing string variable as missing and omit that observation from the estimation sample. However, in `R` the `felm` package treats a missing string as a category of the string variable and includes those observations in the estimation sample. There are several records (approximately 30) in the dataset at hand that are missing a city name. We think that dropping the observations with a missing city name is a more conservative approach. In general, the coefficients and standard error are not changed meaningfully by including these records.

1.2 Race Categories

The paper treats the race variable inconsistently. From the replication package, the cleaned dataset contains a factor variable named APRACE_i, representing a tester's self-identified race. This factor variable has five unique values, coded as 1 to 5. After cross-referencing with other race-related indicator variables, we found that value "1" represents "White", "2" represents "African American", "3" represents "Hispanic", "4" represents "Asian" and "5" represents"Other Races". The original study uses this variable to construct another dummy

[1] We retrieved this database from `https://www.unitedstateszipcodes.org/zip-code-database/` at no cost.

variable, Racial Minority$_i$, based on the following rule: set ofcolor$_i$ equals 1 if APRACE$_i$ is valued between 2 to 4. In this case, all observations with APRACE$_i$ as 5 (i.e. "other" races) will have their ofcolor$_i$ assigned as zero, implying that they are treated as "not of color" in regressions with ofcolor$_i$ as one of the independent variables.

Race is usually handled using a set of indicator variables. Curiously, the paper reports the coefficents for the "African American", "Hispanic", and "Asian" categories, but not for the "Other Races" categories. The reported coefficients match the estimates from the model in which all four categorical variables are included, suggesting that 'White" is the intended omitted or reference category. There is thus an odd discrepancy between the reference category for the "Racial Minority" variable, which usually includes both "White" and "Other Races", and for the indicator variables, which is only "White". We suggest race categories are best handled consistently. It appears as though the authors intended to include the "Other Races" category as these coefficients are estimated but not reported in their regressions. Moreover, they didn't actively categorize the "Other Races" category to not being a racial minority. As a result, we drop observations with APRACE$_i = 5$. This gives a cleaner interpretation of both the "Racial Minority" and race indicator coefficients. This change sometimes alters the magnitude and statistical significance of the coefficient.

2 Updated Main Results

2.1 Table 5: Differences in Recommendations and Availability of Advertised Properties

Overall we find that adopting our corrected methodology for city fixed effects and the racial reference category provides no more evidence of difference in number of recommendations or home availability for minority groups than the original methodology. However point estimates and standard errors can vary significantly.

We first reproduce the original estimation results in Stata and present them in Column 1 of Panel A and B in Table 3 of this comment. These point estimates and their cluster-robust standard errors match the original results from Table 5 of the original paper.

To investigate the impact of inconsistent city names, we use the updated city name variable (discussed in Section 1.1) to replace the old variable and re-estimate Eq.2 and 3. Results are presented in Column 2 of Panel A and B in Table 3.

Comparing Column 2 to Column 1 in both panels, we notice that both the point estimates and their cluster-robust standard errors change appreciably. The effect sizes for the number of recommendations become more negative across all racial groups, while differences in home availability change heterogeneously across groups. To investigate the impact of mis-labelled race category, we exclude all observations of "other race" from the sample and re-estimated both equations with the old city name variable. These results are presented in Column 3 of both panels. Compare Column 3 to Column 1 in both panels, we find that changes in point estimates are quite significant but changes in standard errors are negligible.

In order to investigate the joint impact of city name and race categories, we re-estimate both equations using updated city names and exclude all "other race" observations from the sample. Results are presented in Column 4 of both panels. Compare Column 4 to Column 1

in both panels, we notice that many point estimates changed in absolute values, while some standard errors vary noticeably as well.

Lastly, we replace the city name fixed effects with zip codes fixed effects and re-estimate these two models as a robustness check. Results are presented in Column 5 of both panels. We notice that the estimated coefficients changed dramatically in absolute values and their standard errors also become bigger when compared to results in Column 4. All point estimates in Column 2-5 still remain statistically insignificant as in the original case.

These changes in point estimates and their standard errors imply that the results of the analysis are sensitive to both the updated city names and correct race category. While broad conclusions do not change, these findings suggest it is necessary to record city names in a consistent way and exclude unrelated observations when constructing the dataset to obtain accurate estimates.

2.2 Table 7: Discriminatory Steering by Income

Table 4 shows the reproduction of a subset of the results in the original paper's Table 7. This set of results examines the extent to which different minorities were steered away from white neighborhoods differentiated by income category. The original findings suggest that their early findings of steering away from white neighborhoods is driven by diversion from high income white neighborhoods. For this reason we focus on these estimates for this replication. Column 1 of Table 4 shows that our `Stata` based replication matches their `R` estimates.

We then correct the two issues described above. For the binary race variable we find that correcting the city names drastically changes the estimate. The point estimate changes from -0.0265 to -0.0143, and the statistical significance changes from the 1% level to the 5% level. Changing just the definition of the 'of color' reduces the coefficient to -0.0234 but the statistical significance is unchanged. Changing both the variable definition and the city names results in an even larger shrinking of the coefficient to -0.0103 which is no longer statistically significant at conventional levels.

For the categorical race variable, a similar pattern emerges. Both African Americans and Asians were found to have fairly large negative coefficients at -0.0361 and -0.0258 respectively, which are statistically significant. However, correcting the city names shrinks these coefficients to -0.0119 and -0.00578, and makes them no longer statistically significant. Adopting fixed effects by zip code instead of city name similarly shrinks the absolute effect size of African Americans to -0.00310 and the estimate loses statistical significance, but has less effect on other estimates.

2.3 Table 10: Discriminatory Steering by Family Roles (Mothers)

Table 5 and 6 show the reproduction of results for four outcome variables from Table 10 in the paper. We report the results for Elementary school test scores, Elementary school rankings, the share of households with a high-skilled worker and single-parent households in neighbourhoods recommended to minority testers that were assigned the role of 'mother'. Column (1) presents the results of the direct replication of the regressions run in the paper. Here, the coefficients, signs and significance of the key variables of interest are maintained. There are slight differences between the standard errors between Table 10 and column (1)

in our paper, due to the differences in standard errors between the `felm` command in `R` and the `reghdfe` command in `Stata`.

In column (2), we adjust for race categories only. The signs of the coefficients are maintained in our replication but the magnitudes are different. For Elementary school test scores, Racial Minority is significant at 5% levels only, and African American is insignificant in our replication. For elementary school rankings, all variables become insignificant. For High Skill, racial minority is significant at 1% level and Hispanic is now only significant at 5% level. The sample size drops for all four outcomes, as we are drop observations from the 'other races' category from our analysis.

In column (3), we adjust for city names only. Here, we notice that the magnitudes of the coefficients are different from what is reported in the paper. For elementary school test scores, African American is significant at 1% level. The signs are maintained. For elementary school rankings, we also notice a change in the magnitude of coefficients. Hispanic is no longer significant, and Asian is significant at 10% level. For High skill, Racial Minority and African American become insignificant. Finally for single parent household, African American and Hispanic become significant at 1% and 5% levels respectively.

In Column (4), we adjust for both City Names and Race categories. For Elementary school test scores, Racial Minority and African American are no longer significant and Hispanic is only significant at 5% level. For elementary school rankings, Racial Minority is now significant at 10% level and African American and Asian are significant at 5% level. Hispanic becomes insignificant. For high skill, African American is significant at 10% level and Racial Minority is insignificant. For single parent households, Racial Minority is insignificant. African American, Asian and Hispanic become significant at 1%, 5% and 10% levels respectively.

In Column (5) we replace city fixed effects with zip code fixed effects, and see a large impact on estimates. For elementary school test scores, the signs for the coefficients of Racial Minority and Asian invert, and Racial Minority loses statistical significance while the Asian coefficient gains it at the 5% level. All estimates lose statistical significance in the Elementary school rankings models, while the estimate for the High Skill neighbourhood outcome shrinks by about one half for the African American subgroup and loses statistical significance. Coefficients for the share of single-parent households in recommended neighbourhoods gains significance across African American, Hispanic and Asian subgroups. As a result we can conclude that estimates of discriminatory steering for women with children is highly sensitive to how geographical fixed effects are specified.

In summary, we find that adopting our preferred methodology both for city fixed effects and the reference category for race variables shrinks the effect size across the outcomes of elementary school scores, rankings and high skill workers and causes estimates to lose statistical significance in several cases. The estimates for differences in the proportion of single-parent households became statistically significant at the 5% level across individual race categories.

3 Discussion on the appropriate level of clustering

The correct level of clustering used in the paper is up for debate. The authors use control, or the experimental pairs in the paper. However, in the online appendix it appears as though they previously used market clustering for 'consistency with sampling design.' This is reasonable if one views the sample as a small set of markets that were sampled from a large possible set of markets. One might also be concerned that individual participants within a market are exposed to the same agents, or houses, which might cause the scores to be arbitrarily correlated within a market.

There are a great deal of clusters when clustering at the control or trial level, 2,150 specifically. However, with market level clustering there are only 29. Moreover, these clusters are unbalanced. While it would be ideal to bootstrap of jackknife to improve the reliability of the inferences we don't do so, as even the conventional clustering at the market level changes the statistical significance in many cases.

We redo some of the tables in the comment with the alternative level of clustering. Table 7 considers market clustering instead of trial clustering in Table 3. Given that the paper finds very little statistical differences in the number of recommendations or home availability it is not surprising that the market clustering results are also statistically insignificant for the most part.

Table 8 is the market clustering version of Table 4. With market clustering the statistical significance of the "Racial Minority" coefficient changes for the original data. With trial clustering this is significant at the 1% level, but with market clustering it is significant at the 5% level. After correcting the city names, this coefficient is significant at the 5% level with trial clustering but only the 10% level with market clustering. When city names and of color are corrected the coefficient is not significant regardless of clustering. For the categorical race variables the level of clustering does not matter as much, with Asian and African American both being significant with the original city names, and not significant with the corrected names.

Table 9 similarly is the market clustering version of Table 5. In this table many of the standard errors are actually slightly smaller than with the finer level of clustering. However, for our preferred specification, with the corrected other race issue and city names some of the standard errors are larger. Specifically the coefficient on "Racial Minority" is significant at the 10% level when clustering by trial, but not when clustering by market for both Elementary School Scores and Elementary School rankings.

Likewise, Table 10 is the market clustering version of Table 6. Similar to 5, most of the standard errors are slightly smaller with a finer level of clustering for the high skill coefficient. For our preferred specification, the coefficient for "Racial Minority" becomes insignificant when we cluster at market level, compared to trial level for single-parent households. For High skill, Racial Minority becomes insignificant.

In general it appears as the level of clustering requires some careful consideration for this study. However, many of the results from the original paper are no longer significant after the data cleaning and coding errors are corrected, so the level of clustering is not of first order importance in this comment.

4 Conclusion

In "Sorting or Steering: The Effects of Housing Discrimination on Neighborhood Choice" the authors argue that the 2012 HUD study demonstrates substantial and nuanced housing discrimination against racial minorities generally, and African Americans in particular. Our comment reaffirms these statements, but points out that the scale and scope change dramatically. We note that the results for both racial minorities in general and African Americans in particular are generally less substantial and significant than the original authors findings, although there are cases where our findings are more substantial and significant in both categories (for example, in Table 6B and Table 10B). Furthermore, there are several instances where the effects of discrimination on African Americans are no longer statistically significant but the effect of discrimination on Hispanics becomes significant (Table 4 and Table 5A).

References

Christensen, Peter, and Christopher Timmins. 2022. "Sorting or Steering: The Effects of Housing Discrimination on Neighborhood Choice." *Journal of Political Economy*, 130(8): 2110–2163.

Table 1: City Names for New Mexico

City	**Freq.**	**City**	**Freq.**
87111	1	LOS LUNAS	12
ALBUQUERQUE	10	LOs Lunas	1
ALbuquerque	10	Los LUnas	1
Akbuquerque	1	Los Lunas	67
Albquerque	4	Los lunas	2
Albququerque	4	los Lunas	1
Albuqerque	2	los lunas	4
Albuquerque	998	los Ranchos	1
Albuquewrque	4	Peralta	1
Alnuquerque	4	peralta	4
Alubuqeurque	4	Placitas	3
albuquerque	131	RIO RANCHO	16
albuqueruque	3	Rio Rancho	257
Belen	26	RioRancho	1
belen	8	rio Rancho	1
Bosque Farms	3	rio rancho	10
CEDAR CREST	4	SANDIA PARK	8
Cedar Crest	10	Sandia Park	21
Corrales	14	sandia park	1
EDGEWOOD	24	TIJERAS	27
Edgewood	4	Tijeras	58
edgewood	1	tijeras	3

Notes: Tabulation of city name strings for the State of New Mexico. Notice the common pattern of three entries for a correctly spelled city which follows the pattern of CITY, City, city.

Table 2: Number of Erronenous Cities Eliminated in Each Step

	Step	Unique Cities	Cities Eliminated In Previous Step	Additional Matches	Total Matched	Unmatched Cities
1	Matched from the beginning	1757		16656	16656	6667
2	Fully upper case and remove all punctuation	1318	439	2374	19030	4293
3	Match all acceptable cities & counties (upper case)	1318	0	2203	21233	2090
4	clean up missing matches	1318	0	1055	22288	1035
5	Split typed city name and match on first 4 splits	1275	43	237	22525	798
6	Fuzzy matching based on sounding	1151	124	359	22884	439
7	Finding the modal string for each string group	1119	32	102	22986	337
8	Fuzzy matching based on all cities & counties	1107	12	49	23035	288
9	Manual changes	1074	33	78	23113	210
10	Keep rest	1074	0	210	23323	0
	Total Number of Observations					23323

Notes: This table summarizes the incremental nature of the matching algorithm. Initially the 23,323 are coded as corresponding to 1,757 cities. After all the steps of the algorithm there are 1,074 cities.

Table 3: Differences in Recommendations and Availability of Advertised Properties

	Differences in Number of Recommendations (Panel A)				
	Original Data	Updated City Name Only	Correct Race Only	Updated City Name & Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.142	-0.264	-0.0151	-0.165	-0.312
	(0.228)	(0.181)	(0.223)	(0.177)	(0.208)
African American	-0.169	-0.352	-0.159	-0.341	-0.561**
	(0.311)	(0.240)	(0.311)	(0.241)	(0.273)
Hispanic	-0.130	-0.162	-0.0880	-0.152	-0.296
	(0.284)	(0.226)	(0.283)	(0.227)	(0.269)
Asian	0.0833	-0.105	0.110	-0.0786	-0.206
	(0.283)	(0.230)	(0.283)	(0.230)	(0.264)
ln(price), advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	6554	6555	6488	6489	6489
Adjusted R^2	-0.229	0.0317	-0.242	0.0243	-0.404
	Differences in Home Availability (Panel B)				
	Original Data	Updated City Name Only	Correct Race Only	Updated City Name & Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	0.00573	-0.00236	-0.000759	-0.00847	-0.00188
	(0.0210)	(0.0166)	(0.0213)	(0.0169)	(0.0171)
African American	-0.00875	-0.0212	-0.00902	-0.0219	-0.0287
	(0.0252)	(0.0205)	(0.0253)	(0.0206)	(0.0229)
Hispanic	-0.00769	0.00506	-0.00871	0.00444	0.0139
	(0.0296)	(0.0231)	(0.0298)	(0.0232)	(0.0226)
Asian	0.0178	-0.000256	0.0178	0.000558	0.0173
	(0.0260)	(0.0207)	(0.0262)	(0.0207)	(0.0220)
ln(price), advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	6561	6562	6494	6495	6495
Adjusted R^2	-0.174	0.101	-0.198	0.0869	-0.328

Cluster-robust standard errors in parentheses. Clustered at the trial level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Discriminatory Steering and Neighborhood Racial Composition: High Income

	Original Data	Updated City Name	Correct Race	Updated City Names and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.0265***	-0.0143**	-0.0234***	-0.0103	-0.0148**
	(0.00843)	(0.00713)	(0.00838)	(0.00731)	(0.00711)
African American	-0.0338***	-0.0128	-0.0335***	-0.0119	-0.00310
	(0.0109)	(0.00963)	(0.0109)	(0.00966)	(0.00980)
Hispanic	-0.0147	-0.0131	-0.0126	-0.0126	-0.0241**
	(0.0113)	(0.00934)	(0.0113)	(0.00944)	(0.00942)
Asian	-0.0246**	-0.00719	-0.0233**	-0.00578	-0.0201**
	(0.00994)	(0.00890)	(0.0100)	(0.00896)	(0.00876)
Share White, advertised home	No	No	No	No	No
ln(price), advertised home	No	No	No	No	No
Racial composition, advertised home	No	No	No	No	No
Poverty share advertised home	No	No	No	No	No
Observations	21442	21442	21213	21213	20783
Adjusted R^2	0.718	0.713	0.718	0.713	0.756

Standard errors in parentheses. Clustered at the trial level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Discriminatory Steering and Neighbourhood Effects (Mothers):

	School Quality and Neighbourhood Safety: Elementary School scores (Panel A)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.147***	-0.103**	-0.136**	-0.101*	-0.020
	(0.052)	(0.042)	(0.059)	(0.053)	(0.101)
African American	-0.223**	-0.006	-0.180***	-0.004	-0.269*
	(0.103)	(0.072)	(0.059)	(0.060)	(0.150)
Hispanic	-0.237***	-0.199***	-0.277***	-0.223**	-0.407***
	(0.079)	(0.069)	(0.103)	(0.091)	(0.133)
Asian	-0.054	-0.056	-0.007	-0.046	0.260**
	(0.136)	(0.125)	(0.088)	(0.074)	(0.111)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	3805	3689	3805	3689	3654
Adjusted R^2	0.763	0.765	0.756	0.759	0.785
	School Quality and Neighbourhood Safety: Elementary School Rankings (Panel B)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-3.089***	-0.329	-1.646***	-1.185*	-0.311
	(1.030)	(1.099)	(0.493)	(0.619)	(0.523)
African American	-3.026***	-1.837	-1.899***	-1.431**	-1.035
	(0.846)	(1.208)	(0.555)	(0.723)	(0.763)
Hispanic	-1.921*	-0.165	-0.871	-0.885	0.424
	(1.041)	(1.169)	(0.688)	(0.790)	(0.661)
Asian	-3.818***	-1.001	-1.077*	-1.205*	-0.690
	(0.978)	(1.504)	(0.610)	(0.690)	(0.619)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	4520	4398	4520	4398	4290
Adjusted R^2	0.701	0.704	0.689	0.692	0.769

Standard errors in parentheses. Clustered at the trial level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: School Quality and Neighbourhood Safety: Elementary School Test Scores (Panel A)

	American Community Survey: High Skill (Panel A)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.035**	-0.047***	-0.019	-0.026	-0.033**
	(0.015)	(0.018)	(0.016)	(0.016)	(0.017)
African American	-0.062***	-0.078***	-0.029	-0.042**	-0.029
	(0.022)	(0.023)	(0.021)	(0.021)	(0.023)
Hispanic	-0.053***	-0.046**	-0.052***	-0.047**	-0.058***
	(0.018)	(0.020)	(0.018)	(0.019)	(0.019)
Asian	-0.008	-0.011	0.020	0.021	0.007
	(0.022)	(0.022)	(0.019)	(0.020)	(0.022)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	7997	7827	7997	7827	7661
Adjusted R^2	0.661	0.665	0.651	0.654	0.710
	American Community Survey: Single Parent Household (Panel B)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	0.000	0.008	0.007	0.013	0.015
	(0.013)	(0.015)	(0.011)	(0.011)	(0.010)
African American	0.026	0.026	0.031**	0.034**	0.042***
	(0.018)	(0.018)	(0.014)	(0.014)	(0.013)
Hispanic	0.020	0.013	0.027**	0.028**	0.026**
	(0.015)	(0.016)	(0.012)	(0.013)	(0.012)
Asian	-0.016	-0.021	-0.025*	-0.030**	-0.030**
	(0.018)	(0.018)	(0.013)	(0.013)	(0.013)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	7997	7827	7997	7827	7661
Adjusted R^2	0.484	0.482	0.479	0.479	0.564

Standard errors in parentheses. Clustered at the trial level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Differences in Recommendations and Availability of Advertised Properties, Alternative Clustering

	Differences in Number of Recommendations (Panel A)				
	Original Data	Updated City Name Only	Correct Race Only	Updated City Name & Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.142	-0.264	-0.0151	-0.165	-0.312
	(0.231)	(0.185)	(0.220)	(0.184)	(0.189)
African American	-0.169	-0.352	-0.159	-0.341	-0.561**
	(0.275)	(0.222)	(0.275)	(0.224)	(0.224)
Hispanic	-0.130	-0.162	-0.0880	-0.152	-0.296
	(0.306)	(0.261)	(0.312)	(0.268)	(0.305)
Asian	0.0833	-0.105	0.110	-0.0786	-0.206
	(0.329)	(0.281)	(0.327)	(0.281)	(0.278)
ln(price), advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	6554	6555	6488	6489	6489
Adjusted R^2	-0.235	0.0283	-0.248	0.0207	-0.407
	Differences in Home Availability (Panel B)				
	Original Data	Updated City Name Only	Correct Race Only	Updated City Name & Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	0.00573	-0.00236	-0.000759	-0.00847	-0.00188
	(0.0162)	(0.0155)	(0.0168)	(0.0153)	(0.0162)
African American	-0.00875	-0.0212	-0.00902	-0.0219	-0.0287
	(0.0267)	(0.0211)	(0.0271)	(0.0216)	(0.0248)
Hispanic	-0.00769	0.00506	-0.00871	0.00444	0.0139
	(0.0229)	(0.0205)	(0.0237)	(0.0207)	(0.0204)
Asian	0.0178	-0.000256	0.0178	0.000558	0.0173
	(0.0255)	(0.0206)	(0.0258)	(0.0205)	(0.0237)
ln(price), advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	6561	6562	6494	6495	6495
Adjusted R^2	-0.180	0.0978	-0.204	0.0831	-0.331

Cluster-robust standard errors in parentheses. Clustered at the market level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Discriminatory Steering and Neighborhood Racial Composition: High Income

	Original Data	Updated City Name	Correct Race	Updated City Names and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.0265**	-0.0143*	-0.0234**	-0.0103	-0.0148*
	(0.00973)	(0.00827)	(0.00859)	(0.00708)	(0.00760)
African American	-0.0338***	-0.0128	-0.0335***	-0.0119	-0.00310
	(0.0109)	(0.00963)	(0.0109)	(0.00966)	(0.00980)
Hispanic	-0.0147	-0.0131	-0.0126	-0.0126	-0.0241**
	(0.0113)	(0.00934)	(0.0113)	(0.00944)	(0.00942)
Asian	-0.0246**	-0.00719	-0.0233**	-0.00578	-0.0201**
	(0.00994)	(0.00890)	(0.0100)	(0.00896)	(0.00876)
Share white, advertised home	No	No	No	No	No
ln(price), advertised home	No	No	No	No	No
Racial composition, advertised home	No	No	No	No	No
Poverty share, advertised home	No	No	No	No	No
Observations	21442	21442	21213	21213	20783
Adjusted R^2	0.718	0.713	0.718	0.713	0.756

Standard errors in parentheses. Clustered at the market level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Discriminatory Steering and Neighborhood Effects (Mothers): Market Clustering

	School Quality and Neighbourhood Safety: Elementary School scores (Panel A)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.147***	-0.103***	-0.136*	-0.101	-0.026
	(0.045)	(0.031)	(0.066)	(0.069)	(0.116)
African American	-0.223***	-0.006	-0.180***	-0.004	-0.269
	(0.069)	(0.059)	(0.059)	(0.060)	(0.164)
Hispanic	-0.237***	-0.199***	-0.277***	-0.223**	-0.407***
	(0.054)	(0.033)	(0.077)	(0.079)	(0.097)
Asian	-0.054	-0.056	-0.007	-0.046	0.260*
	(0.096)	(0.060)	(0.095)	(0.078)	(0.141)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	3805	3689	3805	3689	3654
Adjusted R^2	0.763	0.765	0.756	0.759	0.785
	School Quality and Neighbourhood Safety: Elementary School Rankings (Panel B)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-3.089***	-0.329	-1.646***	-1.185*	-0.311
	(1.036)	(1.032)	(0.444)	(0.579)	(0.538)
African American	-3.026***	-1.837*	-1.899***	-1.431**	-1.035
	(0.984)	(1.005)	(0.469)	(0.698)	(0.852)
Hispanic	-1.921	-0.165	-0.871	-0.885	0.424
	(1.472)	(1.274)	(0.896)	(0.999)	(0.713)
Asian	-3.818***	-1.001	-1.077**	-1.205**	-0.690
	(0.822)	(1.208)	(0.398)	(0.516)	(0.540)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	3805	3689	3805	3689	3654
Adjusted R^2	0.763	0.765	0.756	0.759	0.785

Standard errors in parentheses. Clustered at the market level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: School Quality and Neighbourhood Safety: Elementary School Test Scores (Panel A)

	American Community Survey: High Skill (Panel A)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	-0.035**	-0.047**	-0.019	-0.026	-0.033*
	(0.014)	(0.018)	(0.015)	(0.016)	(0.018)
African American	-0.062***	-0.078***	-0.029	-0.042**	-0.029
	(0.019)	(0.019)	(0.018)	(0.017)	(0.021)
Hispanic	-0.053***	-0.046**	-0.052***	-0.047**	-0.058**
	(0.015)	(0.017)	(0.015)	(0.018)	(0.022)
Asian	-0.008	-0.011	0.020	0.021	0.007
	(0.018)	(0.018)	(0.016)	(0.016)	(0.019)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	7997	7827	7997	7827	7661
Adjusted R^2	0.661	0.664	0.650	0.654	0.710
	American Community Survey: Single Parent Household (Panel B)				
	Original Data	Correct Race Only	Updated City Name Only	Updated City Name and Correct Race	Zip Code FE
	(1)	(2)	(3)	(4)	(5)
Racial Minority	0.000	0.008	0.007	0.013	0.015
	(0.016)	(0.020)	(0.011)	(0.012)	(0.012)
African American	0.026	0.026	0.031***	0.034***	0.042***
	(0.016)	(0.019)	(0.010)	(0.011)	(0.012)
Hispanic	0.020	0.013	0.027**	0.028*	0.026*
	(0.018)	(0.021)	(0.012)	(0.015)	(0.014)
Asian	-0.016	-0.021	-0.025*	-0.030**	-0.030**
	(0.026)	(0.026)	(0.014)	(0.013)	(0.013)
ln(price) advertised home	Yes	Yes	Yes	Yes	Yes
Racial composition, advertised home	Yes	Yes	Yes	Yes	Yes
Outcome, advertised home	Yes	Yes	Yes	Yes	Yes
Observations	7997	7827	7997	7827	7661
Adjusted R^2	0.483	0.481	0.477	0.477	0.562

Standard errors in parentheses. Clustered at the market level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$