ANNEX 9: METHODOLOGY FOR MULTINOMIAL LOGIT ESTIMATIONS AND SIMULATIONS

ANNEX 9: METHODOLOGY FOR MULTINOMIAL LOGIT ESTIMATION AND SIMULATIONS

This annex describes the four-choice multivariate logit procedure (discussed in chapter 5) for predicting the likelihood of white- and minority-favored treatment after controlling for observed factors other than race or ethnicity that may create treatment differences between testers.[1]

Multinomial Logit Estimation

The simple gross measures of adverse treatment are defined as in previous chapters. Specifically, favorable treatment is estimated as

White-favored = $Pr[T_i=1]$

Minority-favored = $Pr[T_i=2]$

where T_i represents the treatment outcome for test i, and the probability is measured as the weighted frequency of tests in a national sample.

The econometric model of real estate agent behavior is a four-choice multinomial logit, and the probability of each outcome is expressed as:

$$Pr[T_i=j \, / \, X_i] = exp(\exists_j \, X_i) \, / \, (\, exp(\exists_1 \, X_i) + exp(\exists_2 \, X_i) + exp(\exists_3 \, X_i) + exp(\exists_4 \, X_i) \,)$$

where X_i are the observed characteristics of test i and $\exists_j$ is the relationship between the characteristics and the likelihood of outcome j. Note that the likelihood of an outcome must be estimated relative to another outcomes, and so the coefficients on outcome 4 (neither treated favorably) are initialized to zero.

At this point, it is useful to contrast this model with the fixed-effects logit model discussed in Annex 9. Both models are designed to control for the fact that the two testers are part of a common test, but these controls are accomplished in quite different ways. The multinomial logit model allows the likelihood of each event to vary on all observable test characteristics. For example, if the testers encounter the same agent, the likelihood of both testers or neither tester being treated favorably may increase relative to the white-favored or minority-favored outcomes. The fixed-effects logit assumes that the visits of the two testers are completely independent from the perspective of the individual real estate agent and are only linked through the testing process, which is equivalent to assuming that $\exists_3$ equals the sum of $\exists_1$ and $\exists_2$. Based on this

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[1] Specifically, the four choice model can be used to examine how differences between testers and their visits decrease the likelihood of both testers being favored relative to either white favored or minority favored outcomes.

assumption, the common effect of the test on treatment can be eliminated by differencing the outcomes of the two testers and only considering tests where there are differences in treatment.[2] The advantage of the second approach is that it controls for both observable and unobservable characteristics of the test, making it ideal for testing how discrimination varies across tests because it eliminates potential biases caused by omitted test characteristics. On the other hand, the independence assumption in the fixed-effects approach rules out the possibility that an agent may decide whether to show a unit based on who else has seen the unit already, which may be an important consideration. Moreover, the estimated model arising from the fixed-effects logit cannot be used to predict sample probabilities without very strong assumptions.

The vector of test characteristics in the multinomial logit model includes the test-specific information that is common across the two testers (Z_i), such as assigned family income or the attributes of the neighborhood in which the advertised unit is located; as well as tester characteristics or circumstances that arise during an individual tester's visit (W_i or B_i), such as the tester's actual education level or the timing of the individual tester's visits. The vector X_i may be rewritten as

$$Xi = [Z_i , W_i , B_i]$$

We implemented a simulation strategy where we estimated the four-choice model using these observed test characteristics, then used the estimated coefficients to predict the likelihood of outcome T_i, and finally calculated the weighted average of probabilities over the sample:

White-favored = $Pr[T_i{=}2 / Z_i , W_i , B_i]$

Minority-favored = $Pr[T_i{=}3 / Z_i , W_i , B_i]$

Since we only have one observation per test, the multinomial logit specification exploits all information provided by the observed outcomes, and the weighted predicted probabilities using X_i will exactly match the weighted frequencies. Next, the predicted probabilities were calculated for alternative values of Z_i, W_i, and B_i .to estimate the effects of test and tester characteristics. The testers' individual attributes or visit circumstances were assigned to the same value for both testers within a test ($\overline{W}_i$) where this value was usually based on the average of the observed white and minority values. Unit and neighborhood characteristics were assigned in order to avoid segments of the market in which we expect that the real estate agent might intentionally or systematically favor minority clients ($\overline{Z}_i$).

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[2] Specifically, under the assumption that the outcomes for individual tester visits are described as a simple logit with two possibilities, favored (1) or disfavored (0), a model of the difference between the white and minority outcomes can be estimated as a simple logit with two possibilities, white favored (1) and minority favored (-1), as a function of the difference between the characteristics associated with the white and minority visits.

The first three simulations eliminated factors that may create differences between white and minority treatment that are unrelated to race or ethnicity. The resulting probabilities of adverse treatment may be written as:

White-favored = $Pr[T_i=2 / Z_i, \overline{W}_i, \overline{W}_i]$

Minority-favored = $Pr[T_i=3 / Z_i, \overline{W}_i, \overline{W}_i]$

If the conditional probability of white- and minority-favored treatment are substantially lower than the observed frequencies in the sample, the findings indicate that random differences between testers in terms of their attributes or the circumstances encountered lead to the high levels of observed white and minority adverse treatment. Such evidence would suggest increased reliance on the net measure of adverse treatment. On the other hand, the last two simulations, in which the probabilities may be written as

White-favored = $Pr[T_i=2 / \overline{Z}_i, \overline{W}_i, \overline{W}_i]$

Minority-favored = $Pr[T_i=3 / \overline{Z}_i, \overline{W}_i, \overline{W}_i]$

are intended to rule out neighborhood environments in which minority testers might be systematically favored. If these simulations result in a substantial reduction in the probability of adverse treatment against whites while leaving adverse treatment against minorities relatively unchanged, the evidence would suggest increased reliance on the gross measure of adverse treatment.

Observed Test Characteristics

The vector of test characteristics include standard assignment variables and observable attributes on which testers were matched:

- Tester gender
- Marital status
- Presence of children in the household
- Number of bedrooms required
- Asset to income ratio (sales only)
- Debt payments to income ratio (sales only)

as well as variables that result from the selection of the advertised unit:

- Target price (rental only)
- Family income (sales only – assignment based on listing price of unit)
- Percent African-American in tract
- Percent Hispanic in tract

- Percent poverty in tract
- Percent owner-occupied in tract (sales only)

The first set of variables is standard across all metropolitan areas. The second set of variables, however, reflects substantial variation across metropolitan areas in both the cost of housing and the spatial distribution of different demographic groups. This raises the possibility that the influence of unit and neighborhood attributes might vary across metropolitan areas as well as within each site. Therefore, we identified the modal value for each of the unit and neighborhood variables listed above in each metropolitan area based on the sample of advertised units. In addition, we defined a range around the mode within which at least 60 percent of the advertised units fell. Then two variables were created to specify how far each unit's price or neighborhood composition was above or below the mode. This type of specification is typically referred to as a spline.

The vector of visit-specific characteristics includes actual tester attributes based on the employment application, such as:

- Previous experience as a tester
- Age of tester
- Family income
- High school graduate
- College graduate
- Whether tester resides in owner-occupied housing (sales only)

Both the white and minority tester's values on these variables are included in the specification along with the interaction between the white and minority tester's values. The effect of tester differences on test outcomes can be eliminated in the simulated measures of adverse treatment by setting white and minority tester characteristics to the same value. This simulation both eliminates a potentially important source of random differences between tester outcomes and also eliminates the possibility that net differences in treatment arise because minority testers on average have lower quality real-life characteristics than white testers.

The visit-specific characteristics also include

- The timing and order of the individual visits
- Name of the agent encountered

Rental visits always occurred in close proximity, and it is believed that order of visits may be very important for rental tests because sometimes there is only one apartment to rent. Therefore, a series of binary variables were created to represent whether the white tester visited the agency first and if so whether the tests occurred within four hours of each other, longer than four hours apart on the same day, or on different days (never more than one day apart). A

similar set of binary variables was created to control for whether the minority tester visited first. Sales visits never occurred on the same day and often were conducted many days apart. As a result, the specification included the number of days between the minority and the majority tester's visits and the day the advertisement appeared in the newspaper, the square of these two variables, and the interaction between the minority and the majority variables. The squared terms are included to allow for the possibility that the importance of delaying the visit by one day changes as the visits fall further from the date of the advertisement, and the interaction term is included in case the time between the two testers visits influence test outcomes. Finally, a binary variable was created to reflect whether the two testers saw the same agent during their visit based on a manual inspection of the names of the agents encountered by the two testers.[3] In the simulations, these variables can be set as if the visits occurred at the same time and were conducted with the same real estate agent.

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[3] This variable might help explain the substantial increase in gross white and minority adverse treatment in the sales sample. The share of sales tests in which both partners met the same agent fell from 58.6 to 27.0 percent between the 1989 and the 2000 studies.

ANNEX 10: METHODOLOGY FOR FIXED-EFFECTS LOGIT ESTIMATION

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This annex describes the fixed-effects logit procedure used to perform statistical tests for the existence of discrimination.   The primary goal of this analysis is to examine the robustness of the statistical results presented in chapter 3 after controlling for differences between testers' visits to the real estate agency and between the testers themselves.

Fixed Effects Logit Estimation

This approach assumes that the testers' visits are independent from the perspective of the real estate agency and similar tester treatment is only observed because the testers approach the same agency and follow the exact same protocols. The probability (Pr) that an agent will take a particular, discrete action can be characterized as follows:

$$\Pr(A_{av} = 1 | W, \delta, X, \beta, \alpha) = F(\delta W_{av} + \beta' X_{av} + \alpha_a).$$

In this equation, *a* stands for a test, *v* stands for a visit by a tester, and there are two visits (one by a minority tester and one by a white tester) for each test.[1]   In this setting, A_{av} equals one if the broker takes the action and zero otherwise; W_{av} equals one if the tester is a white and zero otherwise; X is a vector of explanatory variables such as the tester's age and the income assigned for the purposes of the test; α_a is a fixed effect associated with the test; and δ and β are coefficients to be estimated. Finally, *F* is a function that relates the (linear) expression in parentheses with the probability that the action is taken. The analysis in this report assumes that this is the well-known logit function.[2]

In this model, δ is a measure of discrimination. It measures systematic favorable treatment of white testers or, equivalently, systematic unfavorable treatment of minority testers. Because it describes the treatment of minority testers relative to the treatment of their teammates, this coefficient corresponds to a net measure of discrimination. A test for the significance of δ is therefore a test of the null hypothesis that there is no (net) discrimination. In addition, the fixed effect represents unobserved factors that are shared by teammates and influence an agent's behavior, such as the personality of the agent or the policies of the agency. A methodology that does not account for this effect could make incorrect inferences about the

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[1] The vertical line and following symbols indicate that this expression should be read the probability that an action is taken "given values for the explanatory variables and underlying parameters."

[2] With a logit function, the left side of the equation can be written as the natural logarithm of the odds that the agent will take the action (defined as the probability divided by one minus the probability) and the right side is the linear form in parentheses after "*F*."

existence of discrimination, such as concluding that there is no discrimination even when discrimination exists (Yinger 1986).

Because the fixed effect is not observed, it cannot be estimated in this equation. However, Chamberlain (1980) shows that one can difference this equation, thereby eliminating the fixed effect. Estimating this differenced version of the model accounts for the fixed effects and provides an accurate test for the hypothesis that discrimination exists. Let a "1" indicate a visit by a minority tester and a "2" indicate a visit by the white tester. Then the Chamberlain fixed-effects logit can be written as follows:

$$\Pr(A_{a2} - A_{a1} = 1 | A_{a1} + A_{a2} = 1; \ \delta, (X_2 - X_1), \beta) = F(\delta + \beta'(X_{a2} - X_{a1})).$$

In this model, the dependent variable is now the difference in the treatment of test teammates, and the analysis applies only to the set of tests in which teammates are treated differently. In other words, a fixed-effects logit is conducted using only a sub-sample of the tests. If teammates are not treated differently very often for a particular type of behavior, therefore, the sample size for that type of behavior is very small and it is difficult to determine whether discrimination varies across tests.

The explanatory variables are now differences between test teammates. For example, if the age of the tester is one of the X variables, then the difference in the age of the testers now appears in the equation. Note that δ is now the constant term of the regression; however, δ has exactly the same interpretation it had before and is therefore still a net measure of discrimination.

The next step in the analysis is to recognize that discrimination can vary; that is, δ may not be the same under all circumstances. In more technical terms, the impact of W on the probability that A_{av} equals one may depend on the X's. In this case, our original equation becomes

$$\Pr(A_{av} = 1 | W, \delta^*, X, \beta, \gamma, \alpha) = F(\delta^* X_{av} + \gamma' W_{av} Z_{a2} + \alpha_a),$$

where Z is the subvector of the X's that might be associated with discriminatory behavior and the coefficient of W, now δ^*, no longer embodies the full effect of discrimination. Note that only the white values of the Zs appear because the model already accounts for differences in the Zs (and other elements of the Xs) across teammates.

When a differencing procedure is applied to the explanatory variables in this model, the Z's remain. To be specific, the Chamberlain procedure leads to the following equation:

$$\Pr(A_{a2} - A_{a1} = 1 | A_{a1} + A_{a2} = 1; \ \delta^*, (X_2 - X_1), \beta, X_a, \gamma) = F(\delta^* + \gamma' Z_{a2} + \beta'(X_{a2} - X_{a1})).$$

One final step is needed for the purposes of this analysis. In the above equation, the average level of discrimination is estimated by $\delta^* + \gamma'\overline{Z}$, where $\overline{Z}$ is the vector of mean values for the Zs for the white testers. This is an awkward way to estimate average discrimination, however, and a preferable method is to adjust the model so that this average is given, as in the simpler models, by the intercept. To accomplish this step, the variables in Z must be redefined as deviations from their mean values. If the HDS sample were nationally representative, the sample means could be used in this procedure. In fact, however, weighted means must be used to account for the HDS sampling plan. Thus, each Z variable (but not the control variables for teammate differences, which still do not affect the average difference in treatment) is expressed as a deviation from its weighted sample mean for white testers, and the intercept can be interpreted as an estimate of average discrimination.[3] The final estimating equation is as follows, where a w superscript indicates a variable or parameter estimate affected by weighting.

$$\Pr(A_{a2} - A_{a1} = 1 | A_{a1} + A_{a2} = 1;\ \delta^w, (X_2 - X_1), \beta, (X - \overline{X}^w), \gamma) = F(\delta^w + \gamma'(Z_{a2} - \overline{Z}^w) + \beta'(X_{a2} - X_{a1})).$$

With this formulation, $\delta^w = \delta^* + \gamma'\overline{Z}^w$ is an unbiased estimate of discrimination for the nation as a whole, and a test for the statistical significance of this coefficient can be interpreted as a test of the hypothesis that discrimination exists. Moreover, each γ coefficient indicates whether discrimination varies significantly with one of the Z variables. In other words, these coefficients indicate whether there is significant variation in discriminatory behavior. As explained earlier, this approach to variation in discriminatory behavior holds all other variables constant.

The fixed-effects logit procedure differs from the multivariate methods presented in Annex 8 precisely because it accounts for the test-level fixed effects. As noted earlier, the great advantage of this procedure is that it provides a particularly accurate and precise test of the hypothesis that discrimination exists, when discrimination is defined by a net measure. Because the fixed effects are not actually estimated, however, this approach cannot estimate the net incidence of discrimination without additional assumptions (see Ondrich et al., 1998). This procedure therefore cannot replace the multivariate method for estimating the net incidence of discrimination that was presented earlier in this report. Instead, it supplements this method by providing a precise test of the hypothesis that discrimination exists (by the net measure) and by determining whether net discrimination varies systematically with any observable variables, holding other variables constant.

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[3] Weighted sample means are always calculated for the entire sample of tests, not the sub-sample used for any particular fixed-effects regression.

Difference Variables

The fixed effects logit allows the analyst to control for differences between teammates and their visits to the real estate agency. This analysis controls for differences in the standard, unmatched factors that are clearly observed by the real estate agent. Namely,

- Difference in teammates' ages
- Difference in order (1 = white first, -1 = minority first)
- Difference in whether visit to housing agent took place in afternoon

The analysis also controls for factors that are not directly observed by the real estate agent, but may influence outcomes because they are correlated with tester appearance or behavior during the tester's visit. These include:

- Difference in whether tester is currently employed
- Difference in whether tester is currently a homeowner
- Difference in whether tester has experience conducting tests
- Difference in highest level of education completed by tester
- Difference in whether tester is looking for housing at the present time
- Difference in whether tester lives in the metropolitan area
- Difference in tester's gross annual income
- Difference in whether tester was born in the United States

These tester attributes were drawn from the employment applications of the individual testers.

ANNEX 11: FIXED-EFFECTS LOGIT RESULTS

Annex 11-1: Fixed-Effects Logit Results, Black/White Rental Tests, Housing Availability and Inspections

	Similar Units Available		Number of Units Recommended		Advertised Unit Inspected		Number of Units Inspected	
	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value
Intercept	0.6970	0.0061	0.4479	0.0025	1.0608	< .0001	0.7371	< .0001
Difference Variables								
AUDAGE	-0.0121	0.3370	0.0019	0.7875	-0.0313	0.0260	-0.0167	0.0721
NORDER	-0.2706	0.4675	-0.3509	0.0975	-0.5892	0.0764	-0.5677	0.0233
AFTNOON	-0.0008	0.9976	0.2775	0.0771	-0.1306	0.5885	0.0363	0.8458
CUREMP	-0.1149	0.7368	-0.0429	0.8399	0.1469	0.6698	0.0162	0.9485
NBUS	0.1091	0.8229	0.1503	0.5873	-0.2974	0.5308	0.2615	0.4047
White Tester Characteristics								
WAUDFEM	0.0679	0.8275	0.2547	0.1616	0.1592	0.5839	0.1167	0.5927
Agent and Agency Characteristics								
WAGBLK	0.1121	0.8100	0.1228	0.6835	-0.7549	0.0808	-0.2562	0.4253
WAGHIS	0.5675	0.3474	1.3988	0.0012	1.0036	0.1859	0.6885	0.1416
WAGAGE	0.2081	0.2126	0.2963	0.0038	0.5176	0.0021	0.3965	0.0008
NUMPEOP	-0.2277	0.2539	0.0768	0.5478	0.4145	0.0690	0.4669	0.0034
SIM	-0.3888	0.1942	-0.1518	0.4422	-0.7187	0.0129	-0.2190	0.3145
Neighborhood Characteristics								
POV	0.0251	0.2029	-0.0009	0.9349	0.0222	0.1400	0.0269	0.0390
PBLK	-0.0070	0.3260	-0.0021	0.6412	-0.0018	0.7602	-0.0088	0.0814
White Tester's Non-Test Characteristics								
WCUREMP	-0.8150	0.0776	-0.0663	0.8148	-0.6810	0.1545	0.1031	0.7608
WNBUS	-0.3144	0.7157	-1.1200	0.0440	-0.2922	0.7161	-1.1975	0.0521

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-2: Fixed-Effects Logit Results, Black/White Rental Tests, Terms and Conditions

	Rent Incentives Offered		Application Fee Required	
	Coefficient	p-Value	Coefficient	p-Value
Intercept	0.2937	0.3297	-0.5571	0.0363
Difference Variables				
AUDAGE	0.0084	0.6423	0.0292	0.0542
NORDER	0.3267	0.4709	-0.3251	0.3725
AFTNOON	-0.4008	0.2560	-0.0926	0.7369
CUREMP	-0.0140	0.9764	-0.6560	0.0442
CURTENR			0.6548	0.0835
EXPERNC	0.7216	0.0357	-0.3477	0.3710
HIGHEDU			0.1944	0.0037
HOMEHNT	-0.5484	0.2187	0.6514	0.0374
MALIVE			-1.4949	0.0227
PEGAI	-0.2642	0.0748	0.2840	0.0092
NBUS	-0.2413	0.6407	-0.3723	0.3537
White Tester Characteristics				
WAUDFEM	-0.6210	0.1129		
WINCOME			0.0001	0.0708
Agent and Agency Characteristics				
WAGHIS			1.6602	0.0313
WAGAGE	0.4127	0.0429		
NUMPEOP	0.9270	0.0015		
White Tester's Non-Test Characteristics				
WCUREMP	1.2507	0.0594		
WCURTENR			-1.5900	0.0025
WEXPERNC			1.1329	0.0241
WHOMEHNT	-1.7623	0.0490		
WMALIVE			1.7702	0.0230
WPEGAI	0.3462	0.0358		
Timing Variables				
TESTNOV			-1.3148	0.0640
TESTDEC			-2.5869	0.0228

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

**Annex 11-3: Fixed-Effects Logit Results,
Black/White Rental Tests, Agent Encouragement**

	Tester Asked to Complete Application	
	Coefficient	p-Value
Intercept	0.4661	0.0161
Difference Variables		
AUDAGE	0.0149	0.1460
NORDER	-0.7560	0.0057
AFTNOON	0.2266	0.2647
CUREMP	0.6587	0.0182
CURTENR	0.3824	0.0929
HOMEHNT	0.1823	0.5021
PEGAI	-0.1978	0.0048
NBUS	0.9398	0.0124
Agent and Agency Characteristics		
WAGFEM	-0.1117	0.6840
Teammate Differences in Agent and Agency Characteristics		
AGFEM	0.4694	0.1090
White Tester's Non-Test Characteristics		
WCUREMP	-0.6464	0.0709
WHOMEHNT	-1.8705	0.0025
WNBUS	-2.0060	0.0032
Timing Variables		
TESTJUN	-0.7878	0.0134

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-4: Fixed-Effects Logit Results, Hispanic/Non-Hispanic White Rental Tests, Housing Availability and Inspections

	Similar Units Available		Number of Units Recommended		Advertised Unit Inspected		Number of Units Inspected	
	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value
Intercept	1.6423	0.0002	0.3869	0.0343	0.9807	0.0085	0.4127	0.0621
Difference Variables								
AUDAGE	0.0321	0.1867	0.0004	0.9704	0.0305	0.1745	0.0111	0.3797
NORDER	-1.2685	0.0235	-0.1543	0.5835	-1.2573	0.0149	-0.0325	0.9243
AFTNOON	0.1797	0.6463	0.2194	0.2767	0.7322	0.0586	0.0271	0.9138
EXPERNC	-0.4052	0.4820	-0.0836	0.7689	0.3227	0.5673	0.0217	0.9495
HIGHEDU	0.0104	0.9337	0.0274	0.6588	0.0326	0.7923	-0.0314	0.6962
NBUS	0.7037	0.1978	-0.3543	0.2230	0.4949	0.3941	-0.0299	0.9342
Agent and Agency Characteristics								
WAGHIS	-0.2314	0.7378	-0.6659	0.0460	0.6918	0.2558	-0.1510	0.7038
WAGAGE	0.5468	0.0429	0.0645	0.6175	0.4495	0.0580	0.1482	0.3562
WAGFEM	-0.2524	0.5878	0.1198	0.5956	1.0550	0.0142	0.2650	0.3373
Neighborhood Characteristics								
PHSP	0.0006	0.9717	0.0083	0.2566	-0.0210	0.0587	-0.0125	0.1305
White Tester's Non-Test Characteristics								
WEXPERNC	0.0069	0.9929	-0.7555	0.0627	-0.2413	0.7660	-0.8075	0.0989
WHIGHEDU	0.2864	0.0504	0.0673	0.3638	0.1240	0.4026	0.0006	0.9951
WNBUS	1.1768	0.2390	0.7497	0.1103	0.7591	0.3494	0.8027	0.1528

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-5: Fixed-Effects Logit Results, Hispanic/Non-Hispanic White Rental Tests, Housing Costs

	Rent Incentives Offered		Application Fee Required	
	Coefficient	p-Value	Coefficient	p-Value
Intercept	-1.0649	0.0578	-0.5353	0.1153
Difference Variables				
AUDAGE	0.0133	0.6335	-0.0108	0.5664
NORDER	1.8901	0.0057	-0.4805	0.3842
AFTNOON	-0.6060	0.1698	0.4914	0.1684
CUREMP	1.0393	0.0165		
CURTENR	0.0252	0.9661		
EXPERNC	1.0226	0.1837	-0.4557	0.4095
HIGHEDU	-0.0730	0.6013	0.1796	0.1859
HOMEHNT			-0.7771	0.0699
PEGAI	0.2095	0.2932	-0.7201	0.0012
NBUS	-1.1545	0.1554		
White Tester Characteristics				
WCHILD			1.3321	0.0064
WMARRIED			-1.9507	0.0002
WAUDFEM			-1.0078	0.0365
Agent and Agency Characteristics				
WAGHIS	-1.2525	0.0696		
WAGAGE			-0.6984	0.0066
WAGFEM	-0.0627	0.9193	-0.4188	0.3362
Teammate Differences in Agent and Agency Characteristics				
AGFEM	1.1862	0.0394		
Neighborhood Characteristics				
POWN			0.0026	0.7873
White Tester's Non-Test Characteristics				
WCURTENR	-0.4549	0.6204		
WEXPERNC	-2.3685	0.0351	0.9937	0.1959
WHIGHEDU	0.0850	0.6338	-0.4534	0.0080
WPEGAI			0.6121	0.0173
WNBUS	3.0725	0.0135		

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

**Annex 11-6: Fixed Effects Logit Results,
Hispanic/Non-Hispanic White Rental Tests,
Agent Encouragement**

	Arrangements For Future Contacts	
	Coefficient	p-Value
Intercept	-0.8297	0.0050
Difference Variables		
AUDAGE	0.0343	0.1031
NORDER	0.7666	0.0677
AFTNOON	-0.5885	0.0485
HIGHEDU	0.4519	<.0001
PEGAI	0.4746	0.0011
White Tester Characteristics		
WAGE	-0.0456	0.0161
Neighborhood Characteristics		
PBLK	-0.0633	0.0699

Note: Estimated with fixed-effect logit. Regressions
also include dummy variables to indicate missing data.

Annex 11-7: Fixed-Effects Logit Results, Black/White Sales Tests, Housing Availability and Inspections

	Similar Units Available		Similar Units Available		Number Inspected	
	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value
Intercept	0.3277	0.0428	0.3764	0.0148	0.4024	0.0003
Difference Variables						
AUDAGE	0.00950	0.3363	0.00201	0.8434	0.00163	0.8165
NORDER	-0.1434	0.5314	0.0955	0.6545	-0.00411	0.9782
AFTNOON	-0.3996	0.0231	-0.4911	0.0048	-0.5240	<.0001
EXERNC	-0.0300	0.9146	0.2009	0.4627	0.6444	0.0012
HIGHEDU	0.1783	0.0239	0.0747	0.3030	0.0003	0.9959
White Tester Characteristics						
WAUDFEM	-0.4157	0.0679	-0.6306	0.0055	-0.2515	0.1065
Agent and Agency Characteristics						
WAGBLK	-0.8617	0.0722	-0.7299	0.1085	-0.3981	0.2056
WAGHIS	0.1977	0.7208	0.0869	0.8873	0.4312	0.3682
WAGAGE	0.2865	0.0468	0.1056	0.4490	0.0763	0.4263
WAGFEM	0.1195	0.5897	0.1935	0.3733	0.3785	0.0130
Neighborhood Characteristics						
MVAL	-3.01E-6	0.0114	-3.39E-6	0.0060	-1.21E-6	0.1556
PBLK	-0.00698	0.2660	-0.0176	0.0067	-0.0125	0.0081
White Tester's Non-Test Characteristics						
WEXPERNC	0.3098	0.3590	-0.2451	0.4640	-0.5962	0.0153
WHIGHEDU	-0.1035	0.2643	-0.0103	0.9100	0.0338	0.5823

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-8: Fixed-Effects Logit Results, Black/White Sales Tests, Financing Assistance

	Help with Finance Offered		Down payment Discussed	
	Coefficient	p-Value	Coefficient	p-Value
Intercept	0.2572	0.1402	0.5372	0.0043
Difference Variables				
AUDAGE	0.0029	0.8143	0.0033	0.7715
NORDER	-0.1865	0.4179	-0.4143	0.0868
AFTNOON	0.0812	0.6391	0.1763	0.3158
CUREMP	0.0117	0.9541	-0.0884	0.7747
CURTENR	0.2039	0.4251		
EXPERNC	-0.4698	0.1203		
HIGHEDU	-0.1657	0.0250		
HOMEHNT			-.02981	0.2095
MALIVE	-0.5964	0.1748	1.6783	0.0010
PEGAI			-0.1695	0.0157
NBUS			1.3315	0.0032
White Tester Characteristics				
WMARRIED			-0.2990	0.2974
Agent and Agency Characteristics				
WAGHIS	1.2871	0.0513	1.0835	0.1673
NUMPEOP			0.4575	0.0082
Teammate Differences in Agent and Agency Characteristics				
AGAGE	0.2789	0.0110	0.2950	0.0067
AGFEM			-0.3439	0.0950
AGNUM	0.5098	0.0007	0.8820	<.0001
Neighborhood Characteristics				
POV	-0.0396	0.0341		
White Tester's Non-Test Characteristics				
WCUREMP			0.6574	0.1035
WCURTENR	-0.9661	0.0058		
WEXPERNC	1.1272	0.0058		
WHIGHEDU	0.1597	0.0724		
WMALIVE	2.0018	0.0055		
WNBUS			-2.3932	0.0004
Timing Variables				
TESTAUG	-0.5685	0.0586		
TESTSEPT	-0.8537	0.0135		
TESTOCT	-0.9713	0.0056		

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-9: Fixed-Effects Logit Results, Black/White Sales Tests, Agent Encouragement

	Follow-Up		Qualified to Buy	
	Coefficient	p-Value	Coefficient	p-Value
Intercept	0.0618	0.7383	0.9887	<.0001
Difference Variables				
AUDAGE	-0.0017	0.8813	-0.0059	0.6375
NORDER	-0.1088	0.6457	-0.5623	0.0290
AFTNOON	0.3332	0.0796	0.3106	0.1429
CUREMP	0.2675	0.1789		
CURTENR	0.1716	0.4310	0.3278	0.2965
EXPERNC			0.4372	0.1019
HIGHEDU	0.0391	0.6216	-0.7469	0.0048
HOMEHNT	1.0100	0.0002		
PEGAI			-0.1043	0.1642
NBUS			0.8091	0.0107
White Tester Characteristics				
WCHILD	-0.7577	0.0025	-0.4354	0.1101
WINCOME			0.0001	0.2404
Agent and Agency Characteristics				
WAGBLK	0.8018	0.0575		
WAGAGE			-0.5345	0.0130
WAGFEM	-0.7167	0.0029		
Teammate Differences in Agent and Agency Characteristics				
AGAGE			0.5592	0.0008
AGNUM			0.6114	<.0001
Neighborhood Characteristics				
MVAL	0.0000	0.2153	1.835E-6	0.3112
PBLK			-0.0121	0.1209
White Tester's Non-Test Characteristics				
WCURTENR			-0.4882	0.1763
WHIGHEDU	0.1378	0.1684		

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-10: Fixed-Effects Logit Results, Hispanic/Non-Hispanic White Sales Tests, Housing Availability and Inspections

	Advertised Units Available		Number Recommended		Advertised Unit Inspected	
	Coefficient	p-Value	Coefficient	p-Value	Coefficient	p-Value
Intercept	0.1619	0.5514	0.1395	0.2830	-0.0236	0.9223
Difference Variables						
AUDAGE	0.0325	0.0824	0.0025	0.7714	0.0469	0.0049
NORDER	-0.7059	0.0421	-0.0860	0.6096	-0.6004	0.0350
AFTNOON	-0.5577	0.0341	0.0363	0.7813	-0.6523	0.0018
EXERNC	-1.0663	0.0227	0.3626	0.0882	-0.5282	0.1501
CUREMP	-0.8887	0.0719	0.5989	0.0108	-0.6345	0.0955
MALIVE	-1.0933	0.1937	-0.4176	0.3520	0.5829	0.5399
White Tester Characteristics						
WAGAGE	-0.0195	0.2058	-0.0144	0.0843	-0.0138	0.3054
WCHILD	-0.1775	0.6244	-0.3178	0.0671	-0.3948	0.2048
Agent and Agency Characteristics						
WAGHIS	-0.2787	0.7423	0.2960	0.3887	0.5631	0.3183
WAGAGE	0.7949	0.0004	0.0563	0.6052	0.2769	0.1380
WAGFEM	0.5275	0.1291	-0.0117	0.9450	-0.2257	0.4280
Neighborhood Characteristics						
MVAL	-4.41E-7	0.8279	8.874E-8	0.9293	-4.57E-7	0.7528
PHIS	-0.0071	0.6014	0.0003	0.9595	-0.0133	0.1882
White Tester's Non-Test Characteristics						
WEXPERNC	2.0236	0.0013	-0.7578	0.0125	1.2692	0.0190
WCUREMP	0.7376	0.2628	-0.6852	0.0331	0.7465	0.1659
WMALIVE	1.5379	0.2282	1.7505	0.0081	0.2024	0.8671

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-11: Fixed-Effects Logit Results, Hispanic/Non-Hispanic White Sales Tests, Financing Assistance

	Help with Financing Offered		Lenders Recommended		Down Payment Discussed	
	Coefficient	p-Value	Coefficient	p-Value		
Intercept	1.2752	<.0001	0.2793	0.2084	0.4377	0.0477
Difference Variables						
AUDAGE	-0.0014	0.9364	0.0014	0.9283	0.0136	0.3115
NORDER	-0.6608	0.0650	0.1000	0.7337	0.1949	0.4769
AFTNOON	0.3190	0.2509	-0.0118	0.9597	0.0769	0.7346
CUREMP	0.9978	0.0013	0.1860	0.4262		
CURTENR	-1.1485	0.0161	-0.0156	0.9606	0.0491	0.8931
EXPERNC	0.9192	0.0643	0.4992	0.1890	0.8795	0.0383
HIGHEDU					0.1741	0.0735
HOMEHNT	-0.3548	0.4563			-0.9843	0.0286
MALIVE	1.1374	0.0649			-1.0474	0.1894
PEGAI	-0.4144	0.0125				
NBUS					-1.9096	0.0016
White Tester Characteristics						
WAGAGE	0.3622	0.0732	-0.0164	0.2762	0.3681	0.0389
Agent and Agency Characteristics						
WAGFEM			0.4418	0.2225		
NUMPEOP	-0.1542	0.4939	-0.2246	0.3269	0.2804	0.0886
Teammate Differences in Agent and Agency Characteristics						
AGNUM	0.4438	0.0367	0.5366	0.0044		
Neighborhood Characteristics						
PBLK			0.0186	0.4070		
White Tester's Non-Test Characteristics						
WCURTENR	-1.3867	0.0128	-0.9384	0.0288	-1.0073	0.0258
WEXPERNC	-2.1669	0.0018	-1.2644	0.0144	-1.3518	0.0156
WHIGHEDU					-0.1740	0.0882
WHOMEHNT	1.5781	0.0264			1.7141	0.0050
WMALIVE					2.4524	0.0407
WPEGAI	0.6120	0.0017				
WNBUS					1.6762	0.0343

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

Annex 11-12: Fixed-Effects Logit Results, Hispanic/Non-Hispanic White Sales Tests, Agent Encouragement

	Qualified to Buy	
	Coefficient	p-Value
Intercept	0.1734	0.4733
Difference Variables		
AUDAGE	0.0070	0.6477
NORDER	-0.2623	0.4031
AFTNOON	-0.1014	0.6590
CUREMP	0.7934	0.0043
CURTENR	0.2824	0.4316
EXPERNC	0.1881	0.5190
HIGHEDU	0.0359	0.7030
HOMEHNT	-0.4531	0.1621
PEGAI	0.3945	0.0040
White Tester Characteristics		
WAUDFEM	-0.9853	0.0049
Agent and Agency Characteristics		
NUMPEOP	0.5621	0.0084
SIM	1.0675	0.0598
Teammate Differences in Agent and Agency Characteristics		
AGNUM	0.7360	0.0002
SAMEAGNT	-0.5197	0.1472
White Tester's Non-Test Characteristics		
WCURTENR	-0.0221	0.9623
WHIGHEDU	-0.1677	0.1548

Note: Estimated with fixed-effect logit. Regressions also include dummy variables to indicate missing data.

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