

Real Estate Platforms, the Housing Search Process, and Racial Residential Stratification

Elizabeth Korver-Glenn¹ · Hannah Lee² · Kyle Crowder²

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Abstract

Recent theoretical arguments suggest that, in addition to ongoing, overt racial housing discrimination and unequal access to resources, multiple subtle housing search processes are racially stratified and contribute to persistent racial segregation. Yet, little prior research has examined these processes. The present paper helps to fill this gap by investigating the racialized differences in the subtle ways that individuals use online housing search tools and identify real estate agents to assist them through the housing search process. To do so, we rely on novel survey data collected by Redfin from 2647 housing consumers using multiple online platforms to search for housing in markets across the United States and examine racialized differences in the likelihood of homebuyers attempting various types of activities using online housing search tools, successfully using the online search tools, and methods of identifying real estate agents with whom to work. While the nature of the data preclude definitive conclusions, our findings point to significant racialized differences in attempting, and successfully completing, online activities across three different 'types' of online tool engagement—early search, neighborhood search, and housing unit—as well as in identifying real estate agents. After reviewing our results, we discuss the implications of these findings for persistent racial residential stratification, and directions for future research.

 $\textbf{Keywords} \ \ \text{Housing search process} \cdot \text{Social structural sorting perspective} \cdot \text{Racial residential stratification} \cdot \text{Real estate} \\ \text{platforms}$

Introduction

The housing search process has long been recognized as one of the key mechanisms of racial residential stratification (Krysan & Crowder, 2017). Some work in this vein has suggested that racialized differences in internet usage and information accessed on online real estate platforms during the housing search may contribute to these stratifying effects (Asplund et al., 2020; Boeing et al., 2021; Krysan, 2008), while other work points to the potential of these platforms for reducing inefficiency and inequality (Doctorow, 2020; McLaughlin & Young, 2018; Redfin, 2018; Steil & Jordan, 2018). The mixed empirical evidence on the topic likely reflects a dearth of relevant data; most studies focus on a

narrow aspect of the housing search process, often in one or a small number of cities.

In this paper, we use a novel dataset to descriptively expand on this past work in multiple ways. First, we examine whether there are racialized patterns in how housing consumers across multiple markets use real estate platforms for activities at multiple stages of the housing search process. Second, we examine whether and the extent to which housing consumers' identification of real estate agents with whom to work is racialized, including through the use of such online platforms. We do so in light of recent theoretical advances that suggest that racial and economic segregation emerge and are reinforced through the accumulation of a vast set of subtle and more obvious differences in how people search for housing, and are assisted or exploited through housing search and exchange processes (Harvey et al., 2020;

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¹ Throughout this paper, we use "racialized" (e.g., "racialized differences" instead of "racial differences") to draw attention to race as a social construct and to denaturalize racial classifications and the processes undergirding racial stratification.



Elizabeth Korver-Glenn kelizabeth@wustl.edu

Washington University in St. Louis, 1 Brookings Drive, St. Louis, MO 63130, USA

University of Washington, Seattle, WA, USA

Korver-Glenn, 2018a; Krysan & Crowder, 2017). These racialized housing search processes are thought to reflect and exacerbate the continued effects of racist policies and practices and often-invisible racialized economic processes (Besbris, 2020; Imbroscio, 2021; Korver-Glenn, 2021; Krysan & Crowder, 2017).

We make these contributions by utilizing novel survey data, originally commissioned by Redfin (one of the largest real estate brokerage companies in the United States) to assess user patterns across multiple online platforms. The survey, collected in November-December 2018, asked 2647 housing consumers across the United States about their use of real estate platforms, how they identified real estate agents with whom to work, and their experiences in the housing market, among other questions. We use these data to investigate possible racialized differences in the likelihood of attempting various types of activities using these online tools, successfully using the online search tools, and methods of identifying real estate agents with whom to work. As discussed below, the nature of the data—particularly that they are drawn from a sample that may not be representative of the homebuyer population—preclude more definitive conclusions. Nevertheless, our findings are suggestive of significant racialized differences in aspects of the search process that have rarely been examined in past research: attempting, and successfully completing, online activities across three different 'types' of real estate platform engagement—early search, neighborhood search, and housing unit—as well as in identifying real estate agents among respondents included in the sample. In what follows, we contextualize our study within the existing body of related literature, describe our data, its limitations, and our method of analysis; present our findings; and describe the implications of our findings for future research on persistent racial residential stratification.

Background

Segregation and the Housing Search Process

Racial residential stratification, or segregation, is the core of systemic racial inequality in the United States (Bell, 2020; Reskin, 2012; Shapiro, 2017; Stoll & Covington, 2012). Though segregation itself does not cause racial disparities, it is a tool that elite and ordinary White actors and institutions use to preserve, hoard, or enhance opportunities for White residents while devaluing, extracting, or withholding opportunities from residents of color—a relational process that generates or exacerbates racial inequities in wealth, educational, criminal justice, and health (Bell, 2020; Dantzler, 2021; Howell, 2019; Korver-Glenn et al., 2023; Taylor, 2019). Understanding how racial residential segregation persists is thus key to interrupting its efficacy as a tool White

actors and institutions use to separate, concentrate, subordinate, and dominate communities of color (Bell, 2020).

The social structural sorting perspective (SSSP) theorizes the persistence of racial residential stratification by positing that the housing search process entails multiple stages, each of which allows a variety of racialized mechanisms to perpetuate racial segregation (Krysan & Crowder, 2017). From the pre-search stage, which consists of the development of neighborhood perceptions and knowledge of the housing market through lived experiences and interactions in social networks, to homeseekers' final decisions about where to live, the housing search process involves many decisions that ultimately shape residential outcomes. Each of these decisions can be informed by individuals' neighborhood perceptions, prejudices, or preferences; interventions of housing market professionals; perceptions of potential discrimination; and economic resources. Moreover, neighborhood perceptions, interactions with housing market professionals, and economic resources are not distributed randomly across homeseekers. Rather, they are entwined with historic and contemporary housing market racism; the existing, unequal social and spatial structure of property values and segregation; and racial ideologies and motivations; among other dynamics (Howell & Korver-Glenn, 2021, 2022; Korver-Glenn, 2021; Krysan & Crowder, 2017; Pattillo, 2007, 2013; Taylor, 2019). In short, the SSSP, as a process-based theory of segregation, highlights that racial residential stratification emerges from the accumulation of many subtle racialized processes. It encourages researchers to empirically examine how the housing search process itself is segregated, which in the contemporary housing market includes the use of online real estate platforms (Krysan, 2008) and efforts to find a real estate agent to help guide the search process (Besbris, 2020; Korver-Glenn, 2018a, 2021).

Online real estate platforms, owned and operated by private companies and local real estate boards, now dominate residential real estate (Boeing et al., 2021; Fields & Rogers, 2021; Shaw, 2020). Digital platforms such as Zillow, Trulia, Redfin, and local real estate boards' online multiple listing services (MLS) provide housing consumers with tools to discover information about the home-buying process; local home values and market dynamics; and local real estate agents, neighborhoods, and schools; among many other possibilities. Although some have described these platforms as having the potential to mitigate racial disparities in the search process (Doctorow, 2020; McLaughlin & Young, 2018; Redfin, 2018), these platforms are embedded within a racialized digital context in which internet users have unequal access to the internet and experience racial profiling, technological redlining, and other forms of digitally mediated racism (Cottom, 2020; Daniels, 2013; Noble, 2018). Because they are located within a racialized digital space, these online housing search tools may not be the equalizing



forces they are often presumed to be. Instead, they may perpetuate racial stratification in the housing search process.

Though there has been very little research on how differently racialized groups identify and use these now-ubiquitous online real estate platforms, the logic of the SSSP framework suggests there may be racialized differences in how individual housing consumers try to use online housing search tools, as well as whether they are *successful* in their attempts to do so. These gaps between trying and succeeding may stem from racial inequities in internet access; indirect racial discrimination mediated through online housing platform algorithms (e.g., Asplund et al., 2020); or encounters with Whiteness or White digital space—for example, through a racially coded description of a neighborhood of color or site algorithms suggesting only local White real estate agents to work with—that prompt consumers of color to leave the site. They may also stem from direct racial discrimination; for instance, when users of color attempt to contact a local real estate agent through one of these online platforms and the agent does not reply to their inquiry because of the racist stereotypes agents activate when interacting with people of color (e.g., Korver-Glenn, 2021). Overall, however, there has been a dearth of research examining whether and the extent to which homeseekers' attempts to use real estate platforms during the housing search process—and their success in using these platforms—is racialized.

In addition to the relative dearth of information about how housing consumers use real estate platforms, relatively little is known about how members of different racial groups identify real estate agents with whom to work. This is an important gap to fill given evidence that real estate agents facilitate the majority of all home-sale transactions in the United States (Besbris, 2016; National Association of Realtors, 2020; Shi & Tapia, 2016) and play key roles in shaping home buyers' and sellers' access to housing market resources and actual homes and neighborhoods (Besbris, 2016, 2020). As the 'gatekeeping' intermediaries of the housing market, real estate agents not only help home buyers view units and home sellers market their homes, but also connect homeseekers to other market professionals, including mortgage lenders and home inspectors, and actively influence processes with significant implications for buyers' and sellers' housing outcomes (Benites-Gambirazio, 2020; Besbris, 2016, 2020; Besbris & Korver-Glenn, 2023).

Some limited research suggests that homeseekers in Detroit and Houston tend to rely on their social networks to identify real estate agents and vice versa, such that homeseekers and real estate agents are often racially matched (Korver-Glenn, 2018b; Krysan, 2008), resulting in unequal neighborhood exposure and home access across homeseekers and real estate agents of different races. By contrast, research in Boston suggests that homeseekers rely more on calling agents about advertised for-sale homes than on

finding agents through their social networks (Newburger, 1995). However, as with previous research on housing consumers' use of real estate platforms, relatively little is known about how housing consumers identify real estate agents with whom to work or whether there are racialized differences in the identification process.

To begin addressing some of the limitations of prior research and extend work on the subtle racialized processes that contribute to persistent racial residential stratification, we draw from a unique national survey to descriptively explore the following research questions:

- 1. Are there racialized differences in the extent to which homebuyers try to use real estate platforms (e.g., to learn about neighborhoods)?
- 2. Are there racialized differences in the extent to which homebuyers succeed in their attempts to use real estate platforms for specific purposes (e.g., to learn about neighborhoods)?
- 3. Are there racialized differences in how homebuyers identify real estate agents?

Data and Methods

Data

Our data come from a voluntary online survey commissioned by Redfin, a national real estate brokerage that relies heavily on its online platform to allow potential homebuyers to investigate homes for sale. The survey, which was conducted by Qualtrics in November and December 2018, was completed by 2647 individuals from the general population who "indicated they had bought or sold a home in the past year, tried to buy or sell a home in the past year, or plan to do so this year" (Ellis, 2019). Respondents did not have to go to Redfin's website or use the Redfin platform to be sampled. Respondents were from all 50 U.S. states and Washington, D.C. and used a variety of online real estate platforms—including Zillow, Trulia, Realtor.com, and Redfin—to buy or sell homes.

Because Qualtrics has not shared information about the number of individuals invited to complete the survey or how these individuals were contacted, it is not possible to assess response rates or potential sources of response bias reflected in the data. For this reason, inferences to a broader population must be made with caution. However, because so little is known about how individuals engage with increasingly

² Redfin shared these data with the first author. This manuscript does not represent the views or opinions of Redfin.



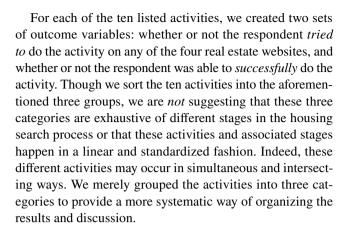
popular online platforms, these data do provide a unique opportunity to assess racialization in a part of the housing process completely obscured in most data. At the very least, they provide the opportunity to identify potential sources of stratification on which future research should focus.

From the 2647 individuals who completed the survey, we removed a total of 601 respondents for the following reasons. Given our focus on homebuyers, we removed 217 respondents who indicated they were exclusively homesellers. We also removed respondents who failed to answer a majority or all of the questions (n=6) and who preferred not to indicate their race (n=23). Finally, we removed respondents who had missing information on all of our explanatory variables (n=355). Our effective sample includes 2046 consumers, who were either exclusively homebuyers or both homebuyers and homesellers. Of these consumers, 1465 characterized their race as White, 179 reported their race as Black, 165 chose the Latinx category, 123 reported that they were Asian, and 114 reported a different race or multiple races.

Measures

We focus on three sets of outcome variables. The first two outcome variables come from a set of questions that ask: "Which of the following activities have you tried to do in the past 2 weeks on [real estate website]?" and "Which of the following activities that you tried to do in the past 2 weeks were you able to successfully do with [real estate website]?" Respondents were asked both of these questions for four real estate websites: Redfin, Zillow, Trulia, and Realtor.com. Respondents could select up to ten activities or a "None of the above" option. For this paper, we categorized the ten activities into three different stages of the housing search process: (1) the early search stage, which consists of three activities: get financially prepared, figure out what I want in a home, and learn about the buying and selling process; (2) the neighborhood search stage, which includes the following two activities: learning about the market and learning about a neighborhood; and (3) the housing unit stage, which includes five activities: find homes on the market, plan to tour a home with an agent, keep track of homes interested in, compare homes interested in, and plan to attend an open house.

Since the survey did not ask additional questions about these ten activities, it is beyond the scope of this paper to understand what, for example, "getting financially prepared" or "learning about the market" entail, or what it means to try to perform and succeed in these activities. Respondents may vary in their interpretations of these survey questions and associated activities. Regardless, the data offer a unique opportunity to understand how individuals use real estate platforms that previous data have not had the capacity to address.



The third outcome variable is whether or not the respondent found their real estate agent via social network, professional network, an online search, or an offline search. This variable was constructed from two questions: "How did you find the agent you used to help you with the homebuying process? Please check all that apply," which was shown to respondents who indicated they were homebuyers, and "How did you find your listing agent? Please check all that apply," which was shown to those who identified as homesellers. While our effective sample includes only homebuyers we included the latter question because there were individuals in our sample who identified as both buyers and sellers. Since the list of options respondents could select was not completely identical across the two questions, there were a total of 13 different ways across the two questions that respondents could indicate they found their agent, as well as "I don't remember" and "Other" options. Again, for organizational purposes, we grouped those options into the aforementioned four sets. Finding a real estate agent via social network includes the following options: the agent is a friend or family member, the agent was recommended by a friend or family member, or the agent was found via social media. Identifying a real estate agent through a professional network includes: meeting them at an open house, using an agent worked with in the past, the agent reaching out about selling the home, and recommended/introduced by the agent that was used to buy the home. An online search for a real estate agent includes the responses: getting a recommendation from a real estate website, getting a recommendation from a reviews website, and finding the agent through a search engine. Finally, strategies to find the agent through an offline search include: noticing the agent on yard signs around the neighborhood; noticing from a mailer, billboard, or flyer; and finding them via TV or radio advertisement.

Our focal explanatory variable is respondent self-reported race/ethnicity, which we conceptualize as a signal indicating respondents' variable locations within the U.S. racial hierarchy. Put another way, we conceptualize respondents' racial identity as a proxy for how they experience racialization in the housing market. Such racialization shapes



residential stratification processes. We differentiate between five ethnoracial groups: Asian, Black, Latinx, Other/Multiracial, and White. Respondent's gender is measured as three dummy variables: female, other gender, and male (reference). Age is measured as a dummy variable with "1" for respondents aged less than 35 years old and "0" for respondents who are 35 years and older. The region of residence is measured as four dummy variables: northcentral, northeast, south, and west (reference). Four dummy variables are included to represent the respondent's income: \$50,000-\$75,000; \$75,000-\$100,000; \$100,000-\$150,000; and \$150,000+ (reference). We include a dummy variable for each of the following four real estate websites with "1" indicating that they used the site in the past 2 weeks of taking the survey: Zillow, Redfin, Realtor.com, and Trulia. The frequency of visiting a real estate website when buying or selling a home is captured as a dummy variable with "1" indicating the respondent used the website daily or nearly daily. The respondents' role in the real estate process is indicated by a dummy variable taking a value of "1" for those who were exclusively homebuyers and "0" for those who were both buying and selling a home.

Analytic Strategy

We estimate logistic regression models for two of the outcome variables: tried to do an online activity and identified a real estate agent. For these two outcome variables, we first estimate a bivariate model with only the respondent's self-reported race/ethnicity and no covariates to assess overall racialized differences in the outcomes. We next add respondents' sociodemographic characteristics to the model, and then we incorporate controls for the use of online tools. In the figures, we illustrate the results for the bivariate model with no covariates, which we call "Raw Differences," and the full model with controls for both the respondents' sociodemographic characteristics and use of online tools, which we call "Differences with all controls."

Because the third outcome variable, which measures whether the respondent successfully did an online activity, is dependent on whether the respondent initially attempted to do the online activity, we account for non-random selection in attempting to perform the activity. That is, part of the racialized difference in the likelihood of success may reflect differential and non-random selection into attempting the activity in the first place. To address this issue of sample selection, we estimate 2-stage Heckman's (1976) standard sample selection models, also known as Tobit-2 models, for this set of outcome variables, in which the likelihood of success in an activity is predicted as a function of the latent probability of attempting the activity. The covariates used to predict the selection equation of the model (i.e., the likelihood of attempting and selecting into the specific activity)

include the respondent's race/ethnicity, gender, age, region of residence, income, and whether or not they were exclusively a homebuyer. For the outcome equation of the Heckman model (i.e., the likelihood of successfully completing the activity), we include the following covariates: respondent's race/ethnicity; respondent's income; four dummy variables indicating whether the respondent used Zillow, Redfin, Realtor.com, or Trulia; and whether the respondent used the website daily or nearly daily.

To illustrate the results, we present graphs showing the predicted probabilities of each of the outcome variables by the race/ethnicity of the respondent. The predicted probabilities were estimated with all other covariates held at their means. For the Heckman selection models, the predicted probabilities of successfully completing an activity are based on conditional expectations of being selected (i.e., of having attempted the activity). These graphs help to provide a clearer illustration of the racialized differences in the attempted use and successful use of online tools. Tables showing the coefficients from the logistic regression models and the Heckman models are located in the Appendix.³

Results

Characteristics of Platform Users

As described above, emergent theoretical arguments suggest that racial segregation is perpetuated by the accumulation of racialized differences in subtle aspects of the housing search process. Accordingly, we present results of analyses for three main stages of the search process: the *early search* stage in which searchers investigate the possibility of purchasing a home and prepare for the process; the *neighborhood search* stage through which searchers investigate the market and neighborhood options; and the *housing unit* stage, or the process through which individuals find specific housing units. Within each of these general stages we focus on racialized differences in the attempt to carry out several specific activities, as well as stratification in the conditional likelihood of reporting success in each of these activities.

We start our investigation of stratification in these processes by examining the basic characteristics of the sample of homebuyers on online platforms. These descriptive statistics are summarized in Table 1. Consistent with past research on racialized differences in the use of online search

³ In the models presented in the Appendix, we use Whites as the reference category to illuminate whether and how their racial status is preserved compared to Asian, Black, Latinx, and Other/Multiracial people in the housing search and broader residential segregation processes.



Table 1 Descriptive statistics for survey sample

	White Mean/SD	Black Mean/SD	Latinx Mean/SD	Asian Mean/SD	Other/multira- cial Mean/SD
Tried to	'	,			
Find homes on the market	0.29/0.45	0.21/0.41	0.26/0.44	0.21/0.41	0.27/0.45
Get financially prepared	0.08/0.28	0.09/0.29	0.08/0.27	0.11/0.31	0.11/0.32
Plan to tour home with agent	0.03/0.18	0.04/0.19	0.02/0.13	0.02/0.15	0.01/0.09
Learn about a neighborhood	0.15/0.36	0.11/0.32	0.17/0.38	0.18/0.38	0.21/0.41
Learn about the market	0.12/0.33	0.07/0.25	0.15/0.36	0.13/0.34	0.11/0.32
Keep track of homes interested in	0.19/0.39	0.13/0.34	0.16/0.37	0.14/0.35	0.19/0.4
Figure out what I want in a home	0.2/0.4	0.14/0.35	0.2/0.4	0.18/0.38	0.23/0.42
Compare homes interested in	0.19/0.39	0.12/0.33	0.21/0.41	0.17/0.38	0.24/0.43
Plan to attend an open house	0.05/0.21	0.05/0.22	0.05/0.22	0.07/0.25	0.02/0.13
Learn about buying/selling process	0.06/0.24	0.06/0.24	0.06/0.24	0.07/0.25	0.11/0.31
Successfully able to					
Find homes on the market	0.23/0.42	0.14/0.35	0.2/0.4	0.15/0.36	0.21/0.41
Get financially prepared	0.03/0.16	0.04/0.19	0.03/0.17	0.05/0.22	0.04/0.21
Plan to tour home with agent	0.02/0.13	0.01/0.11	0.02/0.13	0.02/0.15	0/0
Learn about a neighborhood	0.09/0.28	0.03/0.18	0.1/0.3	0.14/0.35	0.14/0.35
Learn about the market	0.07/0.26	0.03/0.18	0.08/0.27	0.09/0.29	0.05/0.22
Keep track of homes interested in	0.14/0.34	0.09/0.29	0.13/0.33	0.11/0.31	0.17/0.37
Figure out what I want in a home	0.14/0.34	0.08/0.27	0.12/0.33	0.1/0.3	0.11/0.31
Compare homes interested in	0.15/0.36	0.08/0.27	0.18/0.38	0.15/0.35	0.16/0.37
Plan to attend an open house	0.02/0.13	0.03/0.18	0.02/0.13	0.03/0.18	0.02/0.13
Learn about buying/selling process	0.03/0.16	0.02/0.13	0.03/0.17	0.03/0.18	0.01/0.09
Identify real estate agent					
Social network	0.27/0.44	0.22/0.41	0.22/0.42	0.21/0.41	0.21/0.41
Online	0.14/0.35	0.11/0.32	0.11/0.31	0.17/0.38	0.12/0.33
Offline	0.06/0.25	0.05/0.22	0.05/0.23	0.01/0.09	0.08/0.27
Professional network	0.05/0.22	0.04/0.21	0.07/0.26	0.03/0.18	0.03/0.16
Covariates					
Male (ref)	0.52/0.5	0.47/0.5	0.45/0.5	0.38/0.49	0.33/0.47
Female	0.48/0.5	0.52/0.5	0.55/0.5	0.62/0.49	0.67/0.47
Other gender	0/0.03	0.01/0.07	0/0	0/0	0/0
Age of respondent < 35 years	0.39/0.49	0.43/0.5	0.57/0.5	0.45/0.5	0.62/0.49
Age of respondent > 35 years (ref)	0.61/0.49	0.57/0.5	0.43/0.5	0.55/0.5	0.38/0.49
Northcentral	0.28/0.45	0.22/0.42	0.12/0.33	0.15/0.36	0.16/0.37
Northeast	0.23/0.42	0.14/0.35	0.13/0.34	0.15/0.36	0.14/0.35
South	0.27/0.44	0.48/0.5	0.33/0.47	0.24/0.43	0.3/0.46
West (ref)	0.21/0.41	0.16/0.36	0.42/0.49	0.45/0.5	0.4/0.49
Income: 50 k to 75 k	0.28/0.45	0.39/0.49	0.37/0.48	0.23/0.42	0.31/0.46
Income: 75 k to 100 k	0.24/0.43	0.28/0.45	0.25/0.44	0.31/0.46	0.32/0.47
Income: 100 k to 150 k	0.26/0.44	0.17/0.38	0.24/0.43	0.30/0.46	0.24/0.43
Income: 150 k + (ref)	0.22/0.41	0.16/0.36	0.13/0.34	0.16/0.37	0.13/0.34
Buyer only	0.58/0.49	0.66/0.48	0.65/0.48	0.67/0.47	0.72/0.45
Buyer and seller (ref)	0.42/0.49	0.34/0.48	0.35/0.48	0.33/0.47	0.28/0.45
Used Zillow	0.77/0.42	0.81/0.39	0.85/0.36	0.8/0.4	0.77/0.42
Used Redfin	0.21/0.41	0.2/0.4	0.21/0.41	0.28/0.45	0.2/0.4
Used Realtor	0.55/0.5	0.5/0.5	0.52/0.5	0.54/0.5	0.54/0.5
Used Trulia	0.38/0.48	0.47/0.5	0.47/0.5	0.46/0.5	0.46/0.5
Number of websites used	1.9/0.94	1.98/1.01	2.04/0.98	2.09/1.04	1.97/1.01
Used website daily	0.4/0.49	0.44/0.5	0.36/0.48	0.38/0.49	0.31/0.46
N N	1465	179	165	123	114



tools, White homebuyers are overrepresented in the data, representing about 72% (1465 of 2046) of the homeseekers on these platforms, well above their concentration (60%) in the U.S. population a whole (U.S Census, 2021). In contrast, Black (n = 179) and Latinx (n = 165) homebuyers make up 8.7% and 8% of the sample, respectively, and Asian homebuyers (n = 123) just 6% of the sample—all well below the representation of these groups in the U.S. population as a whole. Of course, these differences may be driven by a number of factors, including differences in the likelihood of being in the position to purchase a home, as well as differences in the likelihood of using online resources to search. Nevertheless, these disparities suggest that the use of online sites—resources that have grown in popularity and, theoretically, could have an equalizing effect on the purchase process—are embedded in broader patterns of racialized stratification.

Also of potential importance are racialized differences in the sociodemographic characteristics of the respondents in the sample. These differences are fairly modest, but point to some potential variations in the selectivity of those using the platforms. For example, relative to White respondents, lower proportions of respondents in the Black, Latinx, Asian, and Other/Multiracial categories are older than age 35—a fact that may reflect age variations in the experience of language-or resource-related barriers to internet use among these groups (Ono & Zavodny, 2008).

Differences in income among homebuyers in the data are also modest but potentially important. Though White respondents using these online resources are fairly evenly distributed across the income categories, Black, Latinx, and Other/Multiracial respondents are slightly more concentrated in the lowest (\$50–\$75 k) and second-lowest (\$75–100 k) income categories. Asian respondents are most concentrated in the middle two income categories. Finally, locational variations between groups are small, although Black respondents, like the U.S. Black population as a whole, are slightly more concentrated in the South than are other groups.

Overall, the descriptive statistics in Table 1 are consistent with research indicating uneven utilization of online homesearch resources. However, they also suggest that there are modest differences in sociodemographic characteristics of online housing platform users across racial groups—differences that may shape the housing search process in ways that are important to consider as we seek to understand the role of racialization.

Early Search Stage

More important for our purposes, however, are the differences in the intensity of use of online resources indicated in Table 1. There is little variation between groups in the

number of different housing-related websites used; all groups report using approximately two websites during their search. There are also modest differences in the frequency of use of online tools, though Black respondents are marginally more likely than other racial groups to use online resources on a daily basis.

Figure 1 summarizes racialized differences in activities related to the early stage of the search process in which the homebuyer lays the groundwork for entering the market. This includes establishing criteria for the impending search, efforts to get financially prepared for a purchase, and learning about the buying and selling process. The left side of Fig. 1 displays differences in the proportion of group members attempting a particular activity while the right side displays differences in the proportion successfully completing the activity among those attempting the activity.

Our analysis points to only modest racialized differences in the attempted and successful use of online search tools for these early search stage activities. The most pronounced racialized differences in these early-stage processes were in the use of online resources to "figure out what I want in a home." Specifically, about 14% of Black respondents, but about 20% of White respondents, reported that they used the online platforms to establish these search parameters, a difference that is statistically significant and remains so even after controlling for other sociodemographic and online engagement factors. This suggests that Black homebuyers may be more likely than members of other racialized groups, or at least Whites, to establish housing preferences prior to engaging with online tools. Although our data do not contain information on alternative sources Black homebuyers may use as they determine what they want in a home, this finding is generally consistent with past research showing a stronger reliance on social networks and other informal sources of information for homeseekers of color (Krysan et al., 2018). The percentage of other racial groups using the online service for the purpose of investigating home priorities is similar to that of White respondents.

Among those attempting to use online platforms to "figure out what I want in a home," variation in success rates is modest. Conditional on attempting this activity, between 48 and 68% of all groups report that they were successful in using online platforms to set their search criteria. White respondents reported success at the highest rate, but their contrast with most other groups is statistically non-significant. Only the contrast between White homebuyers and those from the "Other/Multiracial" category is statistically significant after controlling for sociodemographic characteristics, platform use patterns, and the latent probability of attempting to use the platform to figure out the housing search parameters.



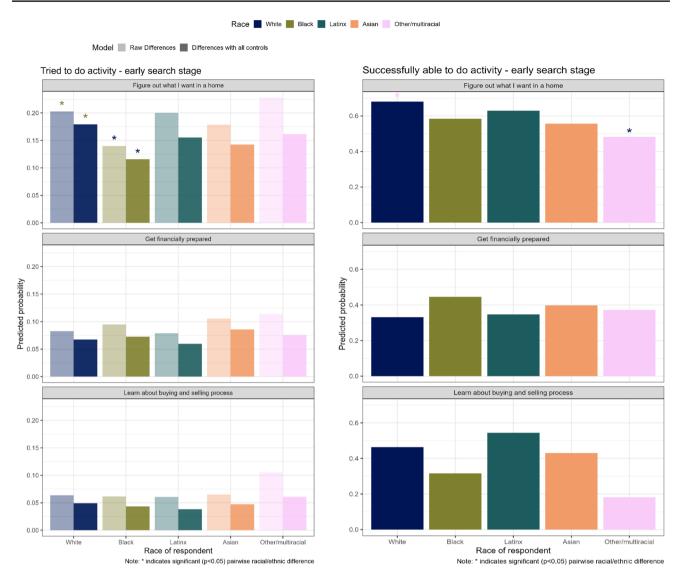


Fig. 1 Early-search stage racialized differences in trying/successfully using online search tools

Relatively few of the survey respondents report using these online resources to lay the financial groundwork for the purchase or to learn about the process of buying and selling. Fewer than 11% of each group reported the use of the online tools to learn about the buying and selling process, and only slightly more used the tools to get financially prepared. More important for our purposes is the fact that racialized differences in the use of online resources to prepare for the transaction process are very modest, and these differences are even more muted in our full models when we control for group differences in sociodemographic characteristics and frequency in the use of online tools in logistic regression models. Differences in reported rates of success in these activities among those who attempted them are also small and consistently statistically non-significant. The absence of strong racial disparities in this realm suggests that individuals from all groups who use these online tools do so in possession of the similar levels of information needed to start the process.

Neighborhood Search Stage

In contrast to the modest differences in *early search* stage search processes, our analyses point to substantial racialized variation in the ways that homebuyers use online tools in the *neighborhood search* stage. First, as shown in the upper left panel of Fig. 2, Black homebuyers are less likely than members of all other groups to report having tried to use online platforms to "learn about a neighborhood," although only the contrast between Black and Other-race/Multiracial individuals is statistically significant. About 11% of Black homebuyers report trying to investigate neighborhoods using



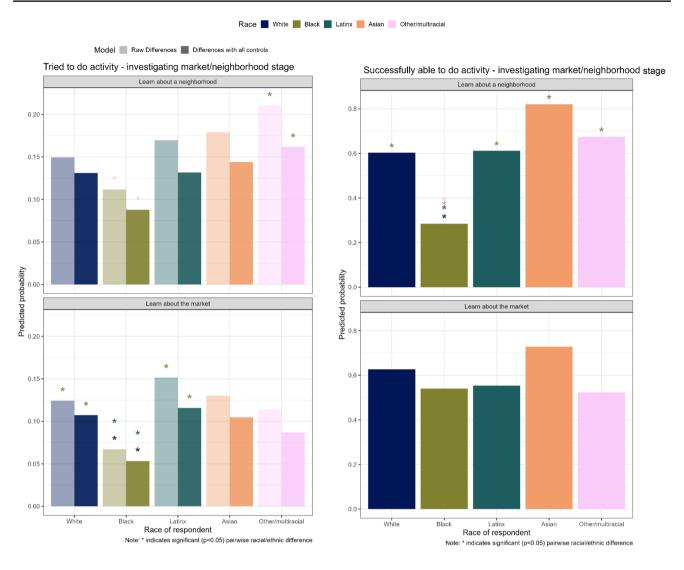


Fig. 2 Neighborhood search stage racialized differences in trying/successfully using online search tools

online platforms whereas just over 21% of Other/Multiracial respondents report doing so. This contrast is reduced slightly after controlling for group differences in sociode-mographic characteristics and online behavior, but remains statistically significant. White, Latinx, and Asian consumers in the sample are also more likely than Black consumers to have reported using online platforms to investigate neighborhoods, but none of these differences are statistically significant.

More extensive are group differences in levels of success in investigating neighborhoods using an online platform. As shown in the upper-right panel of Fig. 2, among those attempting to use online services to identify a neighborhood to target in the housing search, the rate of success is substantially and statistically significantly lower for Black respondents than for members of other groups: a little less

than 30% of Black respondents who attempted this activity reported success, compared to just over 60% for White and Latinx respondents, almost 70% for Other/Multiracial respondents, and over 80% for Asian respondents. Thus, not only are Black respondents least likely to attempt to identify a neighborhood destination using an online resource, they are least likely to report succeeding when they do try—a fact that likely leaves Black respondents more reliant on social networks, past residential experiences, and other social sources to find a neighborhood (Krysan et al., 2018).

Among those who attempt to use online platforms to learn about the market more generally, there are no significant group differences in the level of reported success in this activity (lower-right panel of Fig. 2). However, there are significant group differences in the likelihood of attempting this activity. As shown in the lower-left panel of Fig. 2, Black





Fig. 3 Housing unit stage racialized differences in trying/successfully using online search tools

respondents are less likely than members of all other groups to report that they used the online service to learn about the options available in the housing market. For example, about 12 percent of White respondents and 15% of Latinx respondents report using the online tools to learn about housing options in the market. By contrast, only about 6% of Black respondents report using the tools for this purpose. The contrasts between Black respondents and both White and Latinx respondents in this regard are statistically significant and persist even after controlling for group differences in sociodemographic and other characteristics.

Housing Unit Stage

As shown in Fig. 3, there are also important racialized differences in the way that homeseekers use online platforms

during what we call the *housing unit* stage. Although between a fifth and a quarter of homeseekers from each group report trying to use online resources to find homes on the market, Black respondents are least likely (20%) and Whites most likely (28%) to use the tools for this purpose. The result is a statistically significant difference between Black and White respondents that persists even after controlling for group differences in economic resources and other characteristics. The impact of this Black-White difference in the likelihood of using online tools to find units is magnified by a statistically significant Black disadvantage in the likelihood of *successfully* finding homes on the market when they attempt to do so.

Moreover, Black respondents are significantly less likely than all other groups except for Asians to try to use online resources to compare homes of interest and less likely than



White respondents to try to keep track of homes of interest. All of these differences are statistically significant with controls for sociodemographic characteristics and region, and point to potentially important racialized differences in the process of residential decision-making. Black homebuyers—even those attempting to use online resources—may be less reliant on these tools to make key decisions in the housing search process or may experience algorithmic barriers to information or access when they do use these tools. Asplund et al. (2020) found, for example, that White internet users "saw significantly more housing-related advertisements" (p. 33) than non-White users while African American users were more likely to see ads for predatory rent-to-own programs than any other group. Although our data do not provide information on underlying motivational factors, the racialized differences we observe may reflect algorithmic barriers experienced when attempting to use online tools, greater reliance on interpersonal connections to mitigate experiences of online or offline discrimination, or a combination of the two.

Other group differences in the use of online tools in the process of choosing a unit are modest, although among those attempting to do so, Latinx respondents appear to be more successful than either their Black or White counterparts in using online tools to set up tours with an agent (lower-right panel of Fig. 3). This difference points to stratification in the nature of interactions with important gatekeepers in the housing search process.

Identifying Real Estate Agents

In light of these differences, the final component of the analysis examines racialized differences in the strategies used by respondents to identify their real estate agent. As real estate agents serve as key gatekeepers in many aspects of the search process—for instance, in connecting buyers to mortgage bankers (Besbris, 2016, 2020)—and almost 90% of home buyers and sellers rely on real estate agents during the housing exchange process (National Association of Realtors, 2020), this aspect of the housing search process is likely to have a profound impact on residential outcomes. Overall, we find evidence that differences in strategies to find a real estate agent are quite modest, with two exceptions: Asian respondents are particularly unlikely to use offline searches to identify an agent—significantly less likely than both White respondents and those in the Other/Multiracial category-but are slightly more likely to use an online search, significantly more so than Black respondents after controlling for sociodemographic characteristics. Figure 4 presents this component of our analysis.

Perhaps the most important finding here is that for all groups, the most common strategy for finding a real estate agent is through engagement of social networks, with no

indication of statistically significant differences between groups. Around 20% of respondents from each group report that they found their agent using their social network—a much higher percentage than any other strategy. Given that members of racialized groups are likely to draw on distinct, racially circumscribed networks, this finding points to a key mechanism through which social networks shape residential outcomes (see also Korver-Glenn, 2018b; Krysan & Crowder, 2017; Krysan, 2008).

Discussion

Drawing on a novel survey with a rich set of individuallevel data on housing consumers' experiences in the housing market—especially their attempts to use real estate platform tools, whether such attempts were successful, and how they identified real estate agents—we use our descriptive findings to build on existing theory and recommend directions for future research.

First, our paper provides initial evidence that there are few racialized differences in homebuyers' attempted/successful use of real estate platforms in the *early-search* stage of the housing search process. This finding contradicts problematic assumptions about the role of racial disparities in motivation, capabilities, or confidence in shaping the use of online tools (see Agarwal et al., 2009; Jackson et al., 2001; Stanley, 2003). Overall, in our sample, homebuyers' attempts to use *early-search* tools (e.g., learn about the buying and selling process; get financially prepared; figure out what I want in a home)—and success at doing so—occur at remarkably similar rates across racial groups.

Second, our findings suggest that online platforms may contribute to stark racialized differences in the housing search process that emerge in the *neighborhood search* stage of the housing search process, when homebuyers attempt to learn about market and neighborhood options. Black homebuyers in particular seemed to experience significant disadvantages in using online housing tools at this stage. Black homebuyers were significantly less likely than Latinx or White homebuyers to try to learn about the market using online tools. Moreover, Black homebuyers were significantly less likely than Other/Multiracial respondents to attempt to learn about a neighborhood using online tools and, most pronounced, were significantly less likely than any other group (Asian, Latinx, Other/Multiracial, White) to *successfully* learn about a neighborhood using real estate platform tools.

Although we are unable to parse all of the reasons for these neighborhood search stage inequalities, the findings here—in sharp contrast to the findings for the early search stage— suggest that Black homebuyers in particular may experience indirect or direct discrimination in the





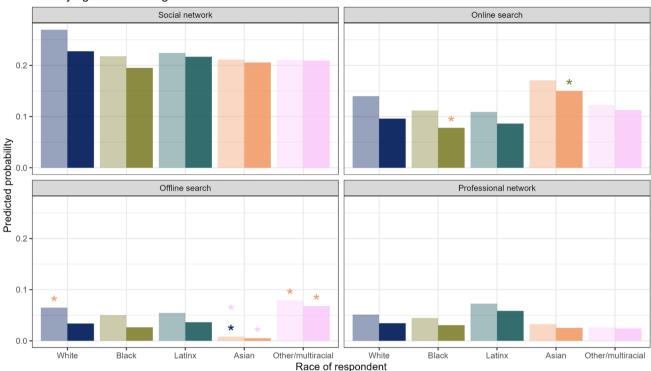


Fig. 4 Racialized differences in identifying real estate agents

Identifying real estate agent

neighborhood search stage of the housing search process when using online housing platforms. For instance, Black homebuyers may experience discrimination through racially biased algorithms that steer them away from certain neighborhoods, including those they were initially interested in, and toward others that they do not care about as much. Alternatively, they may receive less information about neighborhoods of interest (see also Asplund et al., 2020). They may also experience, or at least anticipate, discrimination in reaching out to real estate agents or other professionals who advertise their services on these online housing tools to inquire about neighborhoods, and may receive no reply or inaccurate information (e.g., Korver-Glenn, 2021).

This finding underscores the hyper-salience of the existing, racially unequal structure of neighborhoods for individuals' residential choice-sets and decision-making (Krysan & Crowder, 2017) and the anti-Blackness that constitutes the U.S. housing market (Dantzler, 2021; Taylor, 2019). That is, individuals' residential options, or the range of residential choices presented to them, and the decisions they make within these choice parameters, are inseparable from the existing landscape of racial residential segregation and the

racial knowledge that undergirds housing market processes in the United States (Taylor, 2019). It is no accident that Black homebuyers are particularly disadvantaged when they begin to seek out information about neighborhoods and the market using real estate platforms. Instead, the barriers Black homebuyers experience at this stage of their search are likely a function—whether indirect or direct—of the vested interest housing market organizations and actors have in maintaining the existing structure of racial residential segregation, which preserves racial status and economic value for Whites and White neighborhoods precisely because of their anti-Blackness (Connolly, 2014; Korver-Glenn, 2021; Taylor, 2019).

Note: * indicates significant (p<0.05) pairwise racial/ethnic difference

Third, Black homebuyers experience significant disadvantage in the *housing unit* stage of the housing search process when they attempt to use real estate platforms to find individual housing units. Black homebuyers were significantly less likely than Latinx, Other/Multiracial, and White homebuyers to try to compare homes they were interested in via these tools. They were significantly less likely than White homebuyers to attempt to find homes on the market and, among those who tried to do so, were less successful in



finding homes on the market. These differences may be related to algorithmic barriers Black homebuyers experience in seeking out information about the market and neighborhoods; if Black homebuyers have experienced such barriers in seeking out information on specific neighborhoods, they may be less likely to turn to online platforms to try to find specific homes because they anticipate discriminatory treatment. By contrast, at the housing unit stage, Latinx homebuyers were significantly more likely to successfully plan to tour a home with an agent than either Black or White homebuyers.

Our findings regarding consistent White and, at times, relative Latinx homebuyer success at completing attempted platform activities, as well as Black homebuyers' relative lack of success across the housing unit and neighborhood stages, echo prior work on anti-Blackness and housing discrimination using in-person audit methodologies. This research has found that Black homebuyers are consistently disadvantaged relative to White homebuyers when interacting with real estate agents, while Latinx and White homebuyers are treated more comparably (Galster & Godfrey, 2005; Turner et al., 2013). Other research has found that Latinx and Black homebuyers experience similar forms and levels of racism in housing market interactions and processes (Howell & Korver-Glenn, 2021, 2022; Korver-Glenn, 2021). To build on this large and at times conflicting body of work, future work should continue to explore how and to what effect Latinx people use real estate platforms.

Finally, our findings demonstrate that the most common method of identifying real estate agents among respondents in the sample was through one's social networks. This finding provides further support for previous research (limited in geographic scope) that suggests the housing search process is further racialized through the existing structure of racially segregated social networks in the United States, specifically through the racial matching between the housing market's gatekeepers—real estate agents—and housing consumers (Korver-Glenn, 2018b; Krysan, 2008). Racially segregated homeseeker-real estate agent networks likely contribute to racialized flows of information about neighborhoods and homes (Krysan & Crowder, 2017). They also ensure the persistence of all-White backstage spaces, in which overt and coded forms of housing market-related racism flourish (Korver-Glenn, 2021). In short, in line with emerging theoretical arguments, our findings suggest that reliance on social networks—which in these data was the most common means of identifying real estate agents with whom to work—is yet another mechanism through which racial residential stratification persists.

Conclusion

Our findings contribute to recent theorization of the myriad subtle and overt ways racialized housing search processes unfold by examining racialized differences in the use of housing market platforms to seek out information about the home-buying process, neighborhoods, and individual housing units, as well as in how homebuyers identify real estate agents with whom to work. Despite claims in some industry and public circles that internet technologies open access to information to more people and help correct racial inequities in the housing search process specifically, our findings suggest that, like other digital platforms, online housing market platforms may be part of, and contribute to, a racialized landscape of "platform capitalism" (Cottom, 2020, p. 442). Racialized differences in attempted and successful use of these online housing platforms may be key mechanisms related to the persistence of racial residential stratification.

Limitations

Although our research illuminates multiple understudied and underexplained mechanisms of segregation, it is limited in several ways that suggest directions for future research. First, our data do not allow us to examine housing market platform users' post-search residential outcomes. Though our findings have important potential implications for residential stratification, we are unable to directly link the extent to which housing market platform users try to use and are successful in using these platforms to on-the-ground segregation patterns. Future research should more fully elucidate the link between differentials in various aspects of the housing search process and post-search residential outcomes.

Second, while our findings suggest that racial discrimination may be occurring during the neighborhood and housing unit stages of the housing search process, the present paper does not directly examine housing consumers' perceptions or experiences of discrimination during the housing search process. Future research should further explore the links between (unequal) online housing search processes and the extent to which consumers perceive, and respond to, such discrimination at each stage.

Third, our data are limited in that they do not allow us to adjudicate how housing search platforms are contributing to unequal patterns in their (successful) use—for instance, whether discrimination is algorithmically driven, is due to market professionals' discriminatory use of these



⁴ It is important to note that these studies classified testers "who identified as Hispanic and black but likely were perceived to be black…as testers for the black/white tests, changing their name if necessary" (Turner et al., 2013, p. 5), thereby precluding analysis of Afro-Latinx homeseekers.

platforms on the 'other' side of consumers' requests and transactions, or both. Future research should examine this gap both quantitatively and qualitatively.

Finally, as noted earlier, since we have limited information about the specifics of the survey and the sample, such as the number of individuals invited to complete the survey or how these individuals were contacted, we consider the findings uncovered in this study as important groundwork for the collection of additional data about these housing search processes and the mechanisms underlying the racialized disparities. Moreover, the limited information about the survey and sample suggests that we are not able to identify specific biases impacting the sample. As such, a publicly available nationally representative survey of the use of online platforms among homebuyers and homesellers, and the effects on residential outcomes, would be of substantial value in assessing the subtle forces upholding segregation.

Despite these challenges, our research extends existing segregation theory and empirical work by drawing on a novel data source to highlight some ways in which homebuyers' use of housing market platforms are racially stratified across multiple stages of the housing search process. We show that inequality in the attempted and successful use of real estate platforms may emerge when consumers—especially Black homebuyers—attempt to learn information about neighborhoods and the market, as well as when they attempt to identify individual units. And, unlike the limited prior research on online search processes that

focuses primarily on Black-White differences, we document differences in search-tool use across Asian, Black, Latinx, Other/Multiracial, and White consumers, shedding additional light on varied racialized distinctions in the housing search process. For example, our results suggest that Asian respondents are significantly less likely than their White and Other/Multiracial counterparts to use offline search tools to identify real estate agents, illuminating important racialized differences that need to be untangled further in future research. Such investigations would provide an opportunity to better understand how consumers identify agents and the implications for residential segregation given the gatekeeping role of agents in the housing search process. Moreover, our findings suggest that across these racial groups, housing consumers identify real estate agents vis-à-vis their social networks at roughly the same rates, providing further evidence of an entrenched racialized search process since Americans' social networks are extremely racially segregated. Together, stratification in these subtle yet significant housing search processes reflects and contributes to the broader structure of racial residential segregation—the cornerstone of systemic racial inequality more broadly.

Appendix

See Tables 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.



Table 2 Odds ratios for logistic regression models of trying to do activity in early-search stage: figure out What I Want in a Home

Table 3 Odds ratios for logistic regression models of trying to do activity in early-search stage: get financially prepared

	E' . 1	, T , 1	· · · · · · · · · · · · · · · · · · ·		C + C - 11	1	
		nat I want in a ho			Get financiall		
	(1)	(2)	(3)		(1)	(2)	(3)
Black	0.638*	0.585*	0.598*	Black	1.166	1.115	1.086
	t = -1.993	t = -2.333	t = -2.209		t = 0.563	t = 0.393	t = 0.295
Latinx	0.983	0.861	0.841	Latinx	0.950	0.930	0.878
	t = -0.083	t = -0.705	t = -0.806		t = -0.169	t = -0.233	t = -0.415
Asian	0.857	0.746	0.761	Asian	1.313	1.314	1.298
	t = -0.634	t = -1.170	t = -1.075		t = 0.883	t = 0.866	t = 0.820
Other/multiracial	1.162	0.931	0.880	Other/multiracial	1.430	1.283	1.135
	t = 0.646	t = -0.296	t = -0.519		t = 1.155	t = 0.787	t = 0.394
Female		1.881***	1.653***	Female		1.683**	1.461*
		t = 5.105	t = 3.956			t = 2.971	t = 2.114
Other gender		0.00001	0.00004	Other gender		0.00003	0.0001
		t = -0.030	t = -0.027			t = -0.028	t = -0.025
Age of resp < 35 years		1.088	1.033	Age of resp $<$ 35 years		1.384*	1.304
		t = 0.719	t = 0.268			t = 1.986	t = 1.598
Northcentral		0.880	0.878	Northcentral		1.538	1.542
		t = -0.794	t = -0.790			t = 1.792	t = 1.780
Northeast		0.847	0.849	Northeast		1.787*	1.709*
		t = -0.931	t = -0.898			t = 2.265	t = 2.065
South		0.860	0.815	South		1.430	1.368
		t = -0.988	t = -1.311			t = 1.555	t = 1.344
Income 50 k-75 k		2.599***	1.882**	Income 50 k-75 k		3.069***	2.284*
		t = 4.592	t = 2.975			t = 3.451	t = 2.509
Income 75 k–100 k		2.565***	1.969**	Income 75 k-100 k		2.698**	2.154*
		t = 4.497	t = 3.176			t = 3.003	t = 2.299
Income 100 k-150 k		1.727*	1.505	Income 100 k-150 k		2.580**	2.273*
		t = 2.556	t = 1.877			t = 2.884	t = 2.479
Used Zillow			1.855***	Used Zillow			1.104
			t = 3.527				t = 0.447
Used Redfin			0.706*	Used Redfin			0.853
			t = -1.987				t = -0.664
Used Realtor			1.118	Used Realtor			1.090
			t = 0.933				t = 0.524
Used Trulia			0.971	Used Trulia			1.301
			t = -0.236				t = 1.570
Used website daily			0.547***	Used website daily			0.665*
			t = -4.529				t = -2.215
Buyer only			1.762***	Buyer only			2.365***
			t = 4.163				t = 4.091
Constant	0.254***	0.097***	0.068***	Constant	0.090***	0.017***	0.012***
	t = -21.071	t = -10.961	t = -9.516		t = -25.367	t = -11.674	t = -10.318
N	2046	2046	2046	N	2046	2046	2046
Log likelihood	- 1012.526	- 968.265	- 933.880	Log likelihood	- 601.262	- 578.369	- 562.955
AIC	2035.051	1964.530	1907.759	AIC	1212.524	1184.737	1165.909

p < .05; **p < .01; ***p < .001



p < .05; **p < .01; ***p < .001

Table 4 Odds ratios for logistic regression models of trying to do activity in early-search stage: learn about buying and selling process

Table 5 Odds ratios for logistic regression models of trying to do activity in neighborhood search stage: learn about a neighborhood

	Learn about b	uying and sellin	g process		Learn about a	neighborhood	
	(1)	(2)	(3)		(1)	(2)	(3)
Black	0.966	0.904	0.877	Black	0.716	0.661	0.638
	t = -0.105	t = -0.302	t = -0.387		t = -1.347	t = -1.638	t = -1.76
Latinx	0.952	0.808	0.769	Latinx	1.163	1.055	1.004
	t = -0.144	t = -0.609	t = -0.745		t = 0.686	t = 0.235	t = 0.019
Asian	1.026	0.975	0.965	Asian	1.239	1.118	1.115
	t = 0.068	t = -0.065	t = -0.091		t = 0.871	t = 0.442	t = 0.423
Other/multiracial	1.736	1.437	1.256	Other/multiracial	1.517	1.335	1.279
	t = 1.705	t = 1.095	t = 0.676		t = 1.729	t = 1.164	t = 0.971
Female		1.150	0.963	Female		1.597***	1.353*
		t = 0.726	t = -0.188			t = 3.458	t = 2.178
Other gender		0.00004	0.0002	Other gender		0.00001	0.0001
		t = -0.028	t = -0.023			t = -0.030	t = -0.026
Age of resp < 35 years		1.601*	1.526*	Age of resp < 35 years		0.800	0.752*
		t = 2.518	t = 2.219			t = -1.717	t = -2.14
Northcentral		1.023	0.986	Northcentral		0.759	0.780
		t = 0.089	t = -0.055			t = -1.538	t = -1.35
Northeast		1.011	0.906	Northeast		0.920	0.901
		t = 0.038	t = -0.342			t = -0.436	t = -0.53
South		0.864	0.790	South		0.821	0.786
		t = -0.596	t = -0.951			t = -1.193	t = -1.427
Income 50 k-75 k		5.178***	3.628**	Income 50 k-75 k		2.743***	2.047**
		t = 3.908	t = 3.039			t = 4.455	t = 3.102
Income 75 k-100 k		4.081***	3.083**	Income 75 k-100 k		2.418***	1.878**
		t = 3.298	t = 2.627			t = 3.850	t = 2.706
Income 100 k-150 k		3.013*	2.610*	Income 100 k-150 k		1.681*	1.487
		t = 2.547	t = 2.202			t = 2.229	t = 1.673
Used Zillow			1.267	Used Zillow			2.316***
			t = 0.891				t = 4.031
Used Redfin			0.543*	Used Redfin			0.665*
			t = -2.010				t = -2.148
Used Realtor			1.102	Used Realtor			0.946
			t = 0.519				t = -0.428
Used Trulia			1.677**	Used Trulia			1.523**
			t = 2.728				t = 3.156
Used website daily			0.573**	Used website daily			0.623**
			t = -2.577				t = -3.282
Buyer only			1.956**	Buyer only			1.460**
			t = 2.859				t = 2.582
Constant	0.068***	0.015***	0.012***	Constant	0.176***	0.087***	0.050***
	t = -25.118	t = -9.708	t = -8.593		t = -23.728	t = -10.645	t = -9.555
N	2046	2046	2046	N	2046	2046	2046
Log likelihood	- 493.406	- 473.464	- 457.663	Log likelihood	- 872.219	- 844.873	- 815.776
AIC	996.811	974.928	955.327	AIC	1754.438	1717.745	1671.553

p < .05; **p < .01; ***p < .001



p < .05; p < .01; p < .01; p < .001

Table 6 Odds ratios for logistic regression models of trying to do activity in neighborhood search stage: learn about the market

Table 7 Odds ratios for logistic regression models of trying to do activity in housing unit stage: find homes on the market

	Learn about th	ne market			Find homes of	n market	
	(1)	(2)	(3)		(1)	(2)	(3)
Black	0.507*	0.457*	0.468*	Black	0.648*	0.594**	0.587**
	t = -2.200	t = -2.504	t = -2.409		t = -2.241	t = -2.624	t = -2.644
Latinx	1.259	1.122	1.089	Latinx	0.877	0.813	0.785
	t = 0.996	t = 0.486	t = 0.355		t = -0.704	t = -1.078	t = -1.241
Asian	1.054	0.958	0.972	Asian	0.667	0.604*	0.609*
	t = 0.189	t = -0.150	t = -0.097		t = -1.775	t = -2.157	t = -2.092
Other/multiracial	0.907	0.817	0.792	Other/multiracial	0.929	0.815	0.776
	t = -0.319	t = -0.649	t = -0.741		t = -0.336	t = -0.910	t = -1.107
Female		1.014	0.881	Female		1.756***	1.534***
		t = 0.092	t = -0.852			t = 5.148	t = 3.805
Other gender		0.00001	0.0001	Other gender		0.00001	0.00002
		t = -0.029	t = -0.026			t = -0.032	t = -0.029
Age of resp $<$ 35 years		0.802	0.766	Age of resp $<$ 35 years		0.847	0.803*
		t = -1.543	t = -1.826			t = -1.564	t = -2.014
Northcentral		0.713	0.742	Northcentral		0.988	0.993
		t = -1.747	t = -1.507			t = -0.084	t = -0.049
Northeast		0.641*	0.675	Northeast		1.040	1.043
		t = -2.047	t = -1.786			t = 0.250	t = 0.258
South		0.853	0.827	South		0.948	0.904
		t = -0.896	t = -1.047			t = -0.387	t = -0.711
Income 50 k–75 k		2.315***	1.643*	Income 50 k-75 k		2.671***	1.993***
		t = 3.457	t = 2.007			t = 5.582	t = 3.815
Income 75 k–100 k		2.335***	1.729*	Income 75 k–100 k		2.295***	1.801**
1001 1501		t = 3.501	t = 2.225	1001 1501		t = 4.653	t = 3.221
Income 100 k–150 k		1.540	1.324	Income 100 k-150 k		1.834***	1.630**
H 17'H		t = 1.747	t = 1.117	1117:11		t = 3.426	t = 2.708
Used Zillow			2.985***	Used Zillow			1.549**
Hood Dodfin			t = 4.485 0.776	Head DadGa			t = 2.998 $0.630**$
Used Redfin				Used Redfin			
Hood Doolton			t = -1.243	Hood Doolton			t = -3.047 0.898
Used Realtor			1.106 t = 0.698	Used Realtor			t = -1.011
Used Trulia			l = 0.098 1.110	Used Trulia			t = -1.011 1.049
Oscu IIulia			t = 0.699	Osca Iruna			t = 0.432
Used website daily			0.494***	Used website daily			0.633***
osca website dairy			t = -4.270	Osed website daily			t = -3.950
Buyer only			1.477*	Buyer only			1.568***
zajei omj			t = 2.440	zajoi omj			t = 3.842
Constant	0.142***	0.106***	0.053***	Constant	0.402***	0.166***	0.155***
	t = -24.656	t = -9.395	t = -8.553	2011011111	t = -15.777	t = -10.003	t = -7.928
V	2046	2046	2046	N	2046	2046	2046
Log likelihood	- 751.972	- 737.323	- 707.930	Log likelihood	- 1193.790	- 1149.705	- 1115.951
AIC	1513.944	1502.646	1455.861	AIC	2397.581	2327.410	2271.901

p < .05; **p < .01; ***p < .001



p < .05; **p < .01; ***p < .001

Table 8 Odds ratios for logistic regression models of trying to do activity in housing unit stage: compare homes interested in

Table 9 Odds ratios for logistic regression models of trying to do activity in housing unit stage: keep track of homes interested in

	Compare hon	nes interested in			Keep track of	homes interested	d in
	(1)	(2)	(3)		(1)	(2)	(3)
Black	0.590*	0.547*	0.550*	Black	0.616*	0.572*	0.564*
	t = -2.222	t = -2.506	t = -2.460		t = -2.081	t = -2.354	t = -2.39
Latinx	1.134	1.032	1.004	Latinx	0.781	0.731	0.709
	t = 0.625	t = 0.151	t = 0.018		t = -1.104	t = -1.369	t = -1.49
Asian	0.867	0.784	0.792	Asian	0.670	0.608	0.621
	t = -0.572	t = -0.959	t = -0.906		t = -1.487	t = -1.816	t = -1.72
Other/multiracial	1.308	1.137	1.085	Other/multiracial	0.999	0.857	0.841
	t = 1.166	t = 0.544	t = 0.340		t = -0.005	t = -0.611	t = -0.67
Female		1.527***	1.330*	Female		1.905***	1.643***
		t = 3.427	t = 2.253			t = 5.048	t = 3.812
Other gender		0.00001	0.00003	Other gender		0.00001	0.00003
		t = -0.030	t = -0.028			t = -0.030	t = -0.023
Age of resp < 35 years		0.941	0.893	Age of resp < 35 years		1.006	0.940
		t = -0.508	t = -0.925			t = 0.053	t = -0.504
Northcentral		0.861	0.864	Northcentral		1.108	1.135
		t = -0.909	t = -0.875			t = 0.617	t = 0.751
Northeast		0.916	0.923	Northeast		0.929	0.939
		t = -0.496	t = -0.441			t = -0.395	t = -0.33
South		0.923	0.879	South		1.040	1.012
		t = -0.523	t = -0.825			t = 0.244	t = 0.073
Income 50 k-75 k		2.267***	1.649*	Income 50 k-75 k		1.701**	1.294
		t = 4.051	t = 2.422			t = 2.658	t = 1.258
Income 75 k-100 k		2.140***	1.645*	Income 75 k-100 k		1.724**	1.376
		t = 3.732	t = 2.396			t = 2.699	t = 1.553
Income 100 k-150 k		1.683*	1.469	Income 100 k-150 k		1.398	1.247
		t = 2.546	t = 1.849			t = 1.654	t = 1.072
Used Zillow			1.719**	Used Zillow			1.848***
			t = 3.149				t = 3.421
Used Redfin			0.690*	Used Redfin			0.641*
			t = -2.128				t = -2.489
Used Realtor			1.015	Used Realtor			0.937
			t = 0.128				t = -0.532
Used Trulia			1.020	Used Trulia			1.056
			t = 0.159				t = 0.436
Used website daily			0.577***	Used website daily			0.781
			t = -4.112				t = -1.883
Buyer only			1.679***	Buyer only			1.566**
			t = 3.825				t = 3.287
Constant	0.237***	0.118***	0.093***	Constant	0.239***	0.111***	0.080***
	t = -21.675	t = -10.443	t = -8.726		t = -21.601	t = -10.684	t = -9.149
N	2046	2046	2046	N	2046	2046	2046
Log likelihood	- 986.738	- 962.977	- 932.999	Log likelihood	- 964.867	- 937.413	- 915.630
AIC	1983.476	1953.955	1905.999	AIC	1939.734	1902.827	1871.260

p < .05; **p < .01; ***p < .001



p < .05; **p < .01; ***p < .001

Table 10 Odds ratios for logistic regression models of trying to do activity in housing unit stage: plan to attend an open house

Table 11 Odds ratios for logistic regression models of trying to do activity in housing unit stage: plan to tour a home with an agent

	Plan to attend	open house			Plan to tour ho	ome with agent	
	(1)	(2)	(3)		(1)	(2)	(3)
Black	1.071	1.240	1.158	Black	1.152	1.215	1.189
	t = 0.189	t = 0.583	t = 0.394		t = 0.343	t = 0.466	t = 0.411
Latinx	1.031	1.109	1.066	Latinx	0.524	0.515	0.499
	t = 0.080	t = 0.263	t = 0.163		t = -1.077	t = -1.092	t = -1.141
Asian	1.407	1.312	1.254	Asian	0.708	0.688	0.638
	t = 0.886	t = 0.688	t = 0.571		t = -0.575	t = -0.614	t = -0.736
Other/multiracial	0.361	0.365	0.350	Other/multiracial	0.250	0.233	0.212
	t = -1.406	t = -1.379	t = -1.434		t = -1.365	t = -1.430	t = -1.515
Female		1.347	1.194	Female		0.958	0.940
		t = 1.324	t = 0.770			t = -0.159	t = -0.224
Other gender		0.00001	0.00002	Other gender		0.00002	0.00002
		t = -0.019	t = -0.017	C		t = -0.018	t = -0.017
Age of resp < 35 years		0.784	0.726	Age of resp < 35 years		1.455	1.419
		t = -1.083	t = -1.415			t = 1.412	t = 1.306
Northcentral		0.941	0.970	Northcentral		0.991	1.014
		t = -0.205	t = -0.102			t = -0.023	t = 0.034
Northeast		1.339	1.292	Northeast		1.807	1.819
		t = 0.994	t = 0.859			t = 1.569	t = 1.564
South		0.593	0.578	South		1.094	1.111
		t = -1.665	t = -1.730			t = 0.240	t = 0.277
Income 50 k-75 k		1.064	0.911	Income 50 k-75 k		1.040	0.979
		t = 0.174	t = -0.255			t = 0.087	t = -0.046
Income 75 k–100 k		1.545	1.378	Income 75 k-100 k		1.926	1.885
		t = 1.277	t = 0.929			t = 1.587	t = 1.506
Income 100 k- 150 k		1.565	1.498	Income 100 k-150 k		1.594	1.560
		t = 1.372	t = 1.227			t = 1.136	t = 1.075
Used Zillow			1.399	Used Zillow			1.061
			t = 1.112				t = 0.177
Used Redfin			0.839	Used Redfin			1.603
			t = -0.626				t = 1.530
Used Realtor			1.185	Used Realtor			1.546
			t = 0.773				t = 1.596
Used Trulia			1.367	Used Trulia			1.163
			t = 1.418				t = 0.557
Used website daily			1.166	Used website daily			0.886
,			t = 0.688	,			t = -0.437
Buyer only			1.639*	Buyer only			1.698
, ,			t = 2.044	, ,			t = 1.787
Constant	0.049***	0.038***	0.020***	Constant	0.035***	0.018***	0.009***
	t = -24.385	t = -9.540	t = -8.405		t = -23.231	t = -8.969	t = -8.059
N	2046	2046	2046	N	2046	2046	2046
Log likelihood	- 385.539	- 379.256	- 374.213	Log likelihood	- 282.398	- 277.423	- 272.834
AIC	781.079	786.512	788.426	AIC	574.796	582.846	585.668

p < .05; p < .01; p < .01; p < .001



p < .05; p < .01; p < .01; p < .001

Table 12 Odds ratios for logistic regression models of identifying real estate agent: social network

Table 13 Odds ratios for logistic regression models of identifying real estate agent: online search

	Social networ	k			Online search		
	(1)	(2)	(3)		(1)	(2)	(3)
Black	0.755	0.845	0.823	Black	0.773	0.834	0.799
	t = -1.479	t = -0.847	t = -0.936		t = -1.034	t = -0.701	t = -0.825
Latinx	0.783	0.901	0.939	Latinx	0.753	0.889	0.889
	t = -1.250	t = -0.507	t = -0.295		t = -1.090	t = -0.433	t = -0.411
Asian	0.726	0.841	0.878	Asian	1.265	1.559	1.665
	t = -1.400	t = -0.730	t = -0.528		t = 0.937	t = 1.682	t = 1.860
Other/multiracial	0.722	0.847	0.899	Other/multiracial	0.860	1.095	1.192
	t = -1.371	t = -0.672	t = -0.409		t = -0.509	t = 0.296	t = 0.548
Female		0.612***	0.764*	Female		0.464***	0.572***
		t = -4.345	t = -2.221			t = -5.167	t = -3.507
Other gender		2.450	0.953	Other gender		0.00000	0.00000
		t = 0.605	t = -0.034			t = -0.034	t = -0.034
Age of resp < 35 years		1.519***	1.666***	Age of resp $<$ 35 years		1.127	1.136
		t = 3.713	t = 4.263			t = 0.835	t = 0.837
Northcentral		1.325	1.271	Northcentral		1.053	1.009
AT A .		t = 1.811	t = 1.459	37 . d		t = 0.255	t = 0.040
Northeast		1.466*	1.391	Northeast		1.172	1.071
Cauth		t = 2.408	t = 1.939	Courth		t = 0.788 1.442	t = 0.319
South		1.199	1.263 t = 1.456	South			1.555*
Income 50 k-75 k		t = 1.191 $0.332***$	t = 1.436 $0.524***$	Income 50 k-75 k		t = 1.924 $0.311***$	t = 2.200 $0.523**$
income 30 k-/3 k		t = -6.884	t = -3.739	income 30 k-/3 k			t = -2.948
Income 75 k–100 k		t = -0.864 $0.335***$	t = -3.739 $0.469***$	Income 75 k-100 k		t = -5.749 $0.376***$	t = -2.946 $0.544**$
meome /3 k=100 k		t = -6.789	t = -4.400	IIICOIIIC /3 K-100 K		t = -5.009	t = -2.902
Income 100 k-150 k		0.565***	0.676*	Income 100 k-150 k		0.439***	t = -2.902 $0.530***$
meome 100 k 150 k		t = -3.929	t = -2.531	meome 100 k 150 k		t = -4.597	t = -3.363
Used Zillow		1- 3.727	0.574***	Used Zillow		1- 4.377	0.701*
Coca Zinow			t = -4.165	esca Zinow			t = -2.159
Used Redfin			1.350*	Used Redfin			1.726***
			t = 2.260				t = 3.536
Used Realtor			0.946	Used Realtor			1.384*
			t = -0.490				t = 2.204
Used Trulia			1.085	Used Trulia			1.415*
			t = 0.696				t = 2.364
Used website daily			2.294***	Used website daily			2.260***
·			t = 7.170	•			t = 5.492
Buyer only			0.406***	Buyer only			0.401***
			t = -7.723				t = -6.075
Constant	0.369***	0.609**	0.652*	Constant	0.163***	0.361***	0.210***
	t = -16.926	t = -3.173	t = -1.974		t = -24.112	t = -5.425	t = -5.856
N	2046	2046	2046	N	2046	2046	2046
Log likelihood	- 1157.689	- 1093.949	- 1010.026	Log likelihood	- 811.302	- 760.641	- 691.764
AIC	2325.377	2215.899	2060.053	AIC	1632.603	1549.283	1423.529

p < .05; p < .01; p < .01; p < .001



p < .05; p < .01; p < .001

Table 14 Odds ratios for logistic regression models of identifying real estate agent: offline search

Table 15 Odds ratios for logistic regression models of identifying real estate agent: professional network

	Offline search				Professional n	etwork	
	(1)	(2)	(3)		(1)	(2)	(3)
Black	0.763	0.871	0.778	Black	0.867	0.951	0.884
	t = -0.754	t = -0.370	t = -0.643		t = -0.375	t = -0.129	t = -0.30
Latinx	0.832	1.081	1.081	Latinx	1.454	1.746	1.745
	t = -0.513	t = 0.209	t = 0.198		t = 1.160	t = 1.657	t = 1.590
Asian	0.118*	0.147	0.144	Asian	0.623	0.748	0.729
	t = -2.115	t = -1.885	t = -1.898		t = -0.907	t = -0.549	t = -0.58
Other/multiracial	1.236	1.794	2.089	Other/multiracial	0.501	0.640	0.693
	t = 0.584	t = 1.528	t = 1.856		t = -1.158	t = -0.736	t = -0.59
Female		0.326***	0.412***	Female		0.430***	0.531**
		t = -4.727	t = -3.551			t = -3.600	t = -2.59
Other gender		10.362	7.583	Other gender		0.00001	0.00000
		t = 1.521	t = 1.377			t = -0.020	t = -0.020
Age of resp $<$ 35 years		1.137	1.045	Age of resp < 35 years		1.129	1.069
		t = 0.607	t = 0.198			t = 0.552	t = 0.293
Northcentral		1.172	1.191	Northcentral		1.562	1.763
		t = 0.544	t = 0.566			t = 1.525	t = 1.857
Northeast		1.117	1.048	Northeast		0.890	0.971
		t = 0.382	t = 0.149			t = -0.354	t = -0.08
South		1.314	1.518	South		1.150	1.346
		t = 0.964	t = 1.403			t = 0.466	t = 0.958
Income 50 k–75 k		0.317***	0.584	Income 50 k-75 k		0.487*	0.788
		t = -3.839	t = -1.670			t = -2.268	t = -0.70
Income 75 k–100 k		0.284***	0.406**	Income 75 k-100 k		0.644	0.871
		t = -4.116	t = -2.798			t = -1.480	t = -0.44
Income 100 k-150 k		0.569*	0.727	Income 100 k-150 k		0.646	0.757
		t = -2.364	t = -1.277			t = -1.556	t = -0.96
Used Zillow			0.750	Used Zillow			1.300
			t = -1.252				t = 0.981
Used Redfin			2.059***	Used Redfin			2.428***
			t = 3.451				t = 3.922
Used Realtor			1.671*	Used Realtor			1.541
			t = 2.348				t = 1.882
Used Trulia			1.636*	Used Trulia			1.240
			t = 2.334				t = 0.957
Used website daily			2.408***	Used website daily			1.533
			t = 3.965				t = 1.880
Buyer only			0.461***	Buyer only			0.457***
			t = -3.461				t = -3.38
Constant	0.069***	0.156***	0.055***	Constant	0.054***	0.089***	0.031***
	t = -25.154	t = -6.955	t = -7.457		t = -24.629	t = -8.139	t = -8.20
N	2046	2046	2046	N	2046	2046	2046
Log likelihood	- 459.649	- 422.922	- 382.652	Log likelihood	- 403.154	– 388.799	- 362.699
AIC	929.299	873.844	805.305	AIC	816.307	805.599	765.398

p < .05; **p < .01; ***p < .001



p < .05; **p < .01; ***p < .001

Table 16 Results from Heckman sample selection models for successfully completing each activity

		1			•					
	Find homes on market	Get financially prepared	Plan to tour home Learn about a with agent neighborhood	Learn about a neighborhood	Learn about the market	Keep track of homes interested in	Figure out what I want in a home	Compare homes interested in	Plan to attend an open house	Learn about the buying and selling process
	(1)	(2)	(3)	(4)	(5)	(9)	(7)	(8)	(6)	(10)
Black	- 0.176*	0.118	- 0.204	- 0.312**	- 0.009	- 0.059	- 0.093	- 0.084	0.274	- 0.199
	t = -2.381	t = 0.932	t = -0.877	t = -2.631	t = -0.054	t = -0.564	t = -0.875	t = -0.809	t = 1.682	t = -1.213
Latinx	- 0.058	0.005	*929.0	0.008	- 0.084	0.074	- 0.050	0.040	- 0.008	0.073
	t = -0.881	t = 0.037	t = 2.002	t = 0.086	t = -0.773	t = 0.788	t = -0.562	t = 0.514	t = -0.046	t = 0.450
Asian	- 0.110	0.087	0.399	0.216	0.108	0.013	-0.122	0.097	0.026	- 0.047
	t = -1.259	t = 0.591	t = 1.189	t = 1.958	t = 0.818	t = 0.109	t = -1.136	t = 0.989	t = 0.140	t = -0.247
Other/multiracial	1 - 0.054	0.054	- 0.031	890.0	- 0.077	0.156	- 0.198*	-0.147	0.691*	-0.234
	t = -0.712	t = 0.376	t = -0.052	t = 0.624	t = -0.538	t = 1.568	t = -1.992	t = -1.664	t = 2.031	t = -1.467
Income 50 k-75 k 0.123	k 0.123	0.349*	0.555*	- 0.120	- 0.292*	- 0.041	- 0.064	0.043	0.213	0.292
	t = 1.604	t = 2.109	t = 2.418	t = -0.987	t = -2.154	t = -0.464	t = -0.615	t = 0.468	t = 1.391	t = 1.164
Income 75 k–100 k	0.134	0.383*	0.185	- 0.112	- 0.279*	- 0.046	- 0.069	0.079	0.001	0.145
	t = 1.809	t = 2.301	t = 0.749	t = -0.926	t = -2.013	t = -0.514	t = -0.660	t = 0.857	t = 0.005	t = 0.610
Income 100 k–150 k	0.087	0.342*	0.211	- 0.175	- 0.094	- 0.068	- 0.047	0.076	- 0.146	0.015
	t = 1.263	t = 2.094	t = 0.887	t = -1.586	t = -0.763	t = -0.797	t = -0.474	t = 0.878	t = -0.976	t = 0.067
Used Zillow	0.059	-0.054	0.161	- 0.098	- 0.189	0.067	- 0.064	0.008	- 0.602***	0.032
	t = 1.188	t = -0.546	t = 0.933	t = -1.046	t = -1.698	t = 0.938	t = -0.831	t = 0.131	t = -4.955	t = 0.265
Used Redfin	- 0.048	0.114	0.192	- 0.068	- 0.087	- 0.028	0.036	- 0.047	0.009	0.318*
	t = -0.897	t = 1.003	t = 1.298	t = -0.800	t = -0.947	t = -0.395	t = 0.474	t = -0.701	t = 0.081	t = 2.067
Used Realtor	- 0.008	0.104	0.162	0.036	0.038	0.043	- 0.009	-0.013	0.281**	0.0002
	t = -0.234	t = 1.384	t = 1.318	t = 0.647	t = 0.607	t = 0.930	t = -0.176	t = -0.295	t = 3.129	t = 0.003
Used Trulia	-0.015	0.065	- 0.018	0.094	0.031	0.018	- 0.007	0.065	- 0.078	0.083
	t = -0.430	t = 0.893	t = -0.152	t = 1.697	t = 0.489	t = 0.380	t = -0.144	t = 1.468	t = -0.865	t = 1.033
Used website daily	0.035	- 0.033	- 0.048	0.084	0.044	0.025	0.013	0.053	0.018	0.125
	t = 0.902	t = -0.406	t = -0.391	t = 1.329	t = 0.600	t = 0.479	t = 0.229	t = 1.050	t = 0.189	t = 1.289
Constant	0.491**	- 0.346	1.895	0.761*	1.318**	0.473	0.801**	0.950***	1.697*	- 0.490
	t = 2.770	t = -0.875	t = 1.654	t = 2.072	t = 2.684	t = 1.931	t = 3.278	t = 3.579	t = 2.488	t = -0.780
N	2,046	2,046	2,046	2,046	2,046	2,046	2,046	2,046	2,046	2,046
Rho	0.375	0.361	-0.952	- 0.065	-0.451	0.311	- 0.040	-0.432	-0.792	909.0
Inverse mills rati	Inverse mills ratio 0.157 (0.113)	0.178 (0.173)	- 0.864 (0.505)	- 0.031 (0.196)	- 0.236 (0.254)	0.142 (0.142)	- 0.019 (0.134)	- 0.193 (0.153)	- 0.462 (0.314)	0.335 (0.254)

Coefficients are from the outcome equation of the Heckman sample selection model that is predicting successfully doing an activity as a function of the latent probability of attempting the activity. Variables included in the selection equation of the model (i.e., attempting each activity): respondent's race/ethnicity, respondent's gender, respondent's age, region of residence, income level, and whether or not the respondent was a buyer only or a buyer and seller.

 *p < .05; $^{**}p$ < .01; $^{***}p$ < .001



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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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