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ORIGINAL ARTICLE

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Chinese exclusion? Agent response in the market for owner-occupied housing

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Abstract

We design and implement a correspondence experiment to test for differences in real estate agent response to Chinese clients. In the full sample, real estate agents are no more likely to respond to white clients than Chinese clients. Subsample results show statistically significant differential treatment of Chinese clients in rural areas and in some states. White real estate agents favor white clients (7.90% higher response rate), and Chinese real estate agents favor Chinese clients by a wide margin (151.11% higher response rate).

KEYWORDS
field experiment, racial discrimination, real estate agent

1 | INTRODUCTION

Chinese immigrants to the United States represent the third largest group by country of origin, at just under 3 million people or 6.7% of the foreign-born population,[1] after Mexico and India (U.S. Census Bureau, American Community Survey, 2021). In addition to being a large current source of immigration relative to other countries, the size of the Chinese population in the United States has increased by 341% since 1990.[2] The history of Chinese people in the United States is long and varied, but marred by prejudice (Hilger, 2016) and institutional discrimination (Hilger, 2016;

[1] Includes immigrants (Chinese alone or in any combination) from mainland China, Hong Kong, and Taiwan.

[2] The population from mainland China, Hong Kong, and Taiwan was 921,070 in 1990 and increased to 3142,928 by 2021.

Zinzius, 2005). Despite facing historic prejudice and institutional discrimination, Chinese people in the United States generally achieve a higher socio-economic status than white Americans on most measurable outcomes (Sakamoto et al., 2009). In housing and mortgage markets, Chinese mortgage applicants are slightly more likely to be denied than white applicants (7% vs. 9%), but they purchase properties that are vastly more expensive than whites ($359,529 vs. $740,583) (Consumer Financial Protection Bureau [CFPB], 2021).

There is an expanding literature on the effects of mainland Chinese buyers in housing markets, showing that they pay a price premium over local buyers (Fan et al., 2023), inflate local house prices (Pavlov & Somerville, 2018), displace local low-income residents (Li et al., 2024), and cause white-flight (Boustan, 2024). Recently enacted legislation in several US states restricts real estate purchases by citizens of China.[3] With mostly favorable group-average socio-economic characteristics but a history of prejudice and institutional discrimination against them, Chinese people represent a unique minority group to study differential treatment in the housing market. There have been few studies of Chinese people in the US housing market, and those that exist do not usually parse Chinese people from other Asian subgroups.[4]

Previous research documents substantial discrimination by real estate agents in the housing search process against Black and Hispanic home seekers (Yinger, 1986; Ross & Turner, 2005; Turner et al., 2013; Hanson & Hawley, 2023). Christensen and Timmins (2023) demonstrated that discrimination in the housing search process has substantial welfare impacts on Black and Hispanic home seekers, highlighting the need to explore potential housing search discrimination against other groups. There is only a sparse and older literature that studies discrimination of Asians and almost no study of Chinese people in particular.

This article tests for differential treatment between Chinese and white clients in the housing market using a sample of real estate agents from 11 US states.[5] Our tests are based on a correspondence field experiment using e-mail communication, where we measure response/non-response to an initial inquiry for assistance with housing market needs. The experiment also tests for differences in gender, side of the market (buyer/seller), and a measure of assimilation into American culture. In addition to response/non-response, we also test for differences in the content of e-mails among agents that reply to our inquiries. We signal client race and gender through the client's name using three categories based on given name and surname: Chinese given name/Chinese surname (Chinese clients), white given name/Chinese surname (assimilated Chinese clients), and white given name/white surname (white clients). This is the first article to focus on the Chinese population seeking assistance with a housing transaction using a correspondence experiment in the United States and the first experimental study of housing discrimination against people of Asian descent since Turner et al. (2013).

In the full sample results, we find real estate agents do not differentially respond to Chinese clients compared to white clients. We also find no differences in agent response by client gender, but we do find that agents respond more often to clients asking for help selling a home than to

[3] Florida recently passed a law that prohibits Chinese citizens from owning land in restricted areas. Brown and Spellman (2023) documented 22 states that prohibit or restrict foreign ownership of private or public agricultural land.

[4] The Asian race group defined by the U.S. Census includes Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Native Hawaiian, and other Pacific Islanders. Chinese people represent the largest Asian proportion among those reporting their race to be Asian.

[5] The states in our sample are Alabama, Georgia, Maryland, North Carolina, North Dakota, Ohio, Texas, Virginia, West Virginia, Wisconsin, and Wyoming. The sample of states is based on the availability of real estate agent licensing data that includes an e-mail address, name, and city-level location.

clients buying a home (sellers have a 20.91% higher response rate). Subsample results show that the full sample results are masking important differences in differential treatment. Although we find no difference in response to white and Chinese clients in urban areas, the response to white clients in rural areas is 43% higher than that of Chinese clients and 19.93% higher than that of assimilated Chinese clients. We also find that at the state-level, differential treatment exists in three of our 11 sample states.[6] We find that white real estate agents favor white clients (7.90% higher response rate), and Chinese real estate agents favor Chinese clients by a wide margin (151.11% higher response rate). We also find that differential treatment is sensitive to the underlying racial demographics in the search area. Among agents that respond to the inquiry, we find some evidence of additional differential treatment—white clients are sent longer responses as measured by the number of characters and word count.

2 | BACKGROUND

2.1 | Observable group differences by race

Sakamoto et al. (2009) summarized the socio-economic status of Asian Americans across several Asian subgroups, including Chinese, using data from the 2005–2006 American Community Survey (ACS). This summary shows that Chinese people and Asians more generally have achieved a higher level of socio-economic status than whites across a range of measures. We update the Sakamoto et al. research in Table 1 using the 2021 ACS to show measures of socio-economic status for whites, all Asians, and for subgroups of Asians, including Chinese.

Table 1 corroborates what Sakaomoto et al. (2009) found in the older ACS data. Asians as a group (64%) are much more likely to be foreign-born than whites (4.6%), and the ratio of foreign-born among Chinese (66.4%) is similar to the larger Asian group. Of those that are foreign-born, 37.3% of whites are not US citizens, whereas 38.5% of Asians and 40.2% of Chinese do not have US citizenship. Both the larger group of Asians (56.4%) and the Chinese subgroup (58.6%) are vastly more likely to have earned a college degree than whites (38.3%). White families are less likely to live in poverty (6.3%) than both Asians (7.5%) and Chinese (9.7%), but the median income of white families is much lower ($74,932) than both Asians ($100,572) and Chinese ($93,007). On a per-capita basis, incomes are much closer than the median measure, but whites ($44,199) still have lower per-capita income than Asians ($47,542) and Chinese ($52,265). By nearly every measure, Asians, and in particular Chinese people, have similar or higher measures of socio-economic status than the white majority.

For measures of housing market outcomes, the statistical differences among whites, Asians, and the Chinese subgroup of Asians are not as one-sided. Whites have a higher home-ownership rate (72.6%) than Asians (62.7%), but the gap is closer with Chinese (66.2%). On the other hand, Asians ($528,400) and especially Chinese ($664,700) live in more valuable homes than white homeowners ($281,200) do.[7] In the mortgage market, the CFPB maintains data by race of the borrower and

[6] We find that white clients are favored in North Carolina (24.19% higher response rate), Ohio (39.57% higher response rate), and Wyoming (311.64% higher response rate). No other state-level tests show statistically significant differences among clients with different races.

[7] These differences are not conditional on other factors. Chinese borrowers are also more likely to live in neighborhoods with a higher percentage of minorities (9% vs. 41%) and in a metropolitan area (88% vs. 98%) than white borrowers (CFPB, 2021).

TABLE 1 Descriptive statistics for Asian American ethnic groups in the United States, 2021.

	Total population	Foreign-born (%)	Foreign-born—naturalized US citizen (%)	Foreign-born—not a US citizen (%)	Median age (years)	BA degree or more [age 25+] (%)	Poverty rate for families (%)	Median household income—2021 inflation adjusted ($)	Individual per capita income ($)	Owner-occupied housing units (%)	Owner-occupied median value
White alone	202,981,791	4.6	62.7	37.3	42.9	38.3	6.30	74,932	44,199	72.6	281,200
Asian alone	19,157,288	64.0	61.5	38.5	38.4	56.4	7.50	100,572	47,542	62.7	528,400
Asian American—single race											
Chinese (Chinese and Taiwanese)	4,360,466	66.43	59.81	40.19	40.1	58.6	9.7	93,007	52,265	66.2	664,700
Asian Indian alone	4,402,223	69.33	49.95	50.05	35.6	76.8	4.1	141,906	62,522	61.4	551,900
Bangladeshi alone	245,131	71.11	59.82	40.18	34.2	50.7	14.0	67,187	27,023	48.5	428,100
Cambodian alone	272,408	54.91	76.55	23.45	37.4	18.8	12.8	73,819	27,588	58.9	376,700
Filipino alone	2,960,811	63.19	74.03	25.97	43.4	50.5	4.4	101,157	41,139	63.6	467,700
Hmong alone	345,338	33.87	84.76	15.24	26.7	24.5	12.7	80,702	22,884	55.5	276,800
Indonesian alone	85,957	76.75	50.65	49.35	43.4	52.1	9.3	87,377	40,844	58.8	518,300
Japanese alone	742,549	42.31	31.58	68.42	52.9	54.6	4.5	87,789	53,829	66.3	638,100
Korean alone	1,445,315	68.72	67.96	32.04	43.0	60.7	7.9	82,946	49,676	54.3	551,000
Laotian alone	181,458	56.61	77.62	22.38	41.3	17.4	9.6	75,241	30,581	68.3	272,300
Pakistani alone	555,917	63.17	67.71	32.29	32.9	60.7	10.7	100,730	41,355	58.4	457,100
Sri Lankan alone	72,271	77.51	56.73	43.27	39.3	57.2	6.5	96,790	48,678	60.5	471,100
Thai alone	180,364	72.20	65.43	34.57	44.7	49.2	9.2	78,616	41,458	65.3	366,400
Vietnamese alone	1,896,690	64.81	76.21	23.79	40.6	33.9	10.4	77,884	34,380	69.3	400,600
Burmese alone	233,347	76.00	54.11	45.89	29.1	21.8	19.1	60,376	22,251	58.3	228,600
Nepalese alone	217,150	78.66	43.69	56.31	32.2	47.9	10.1	78,375	30,604	53.3	344,400

Source: 2021 American Community Survey 1-Year Estimates, Table S0201, https://api.census.gov/data/2021/acs/acs1/spp.

offers summary statistics by Asian subgroup. Using data from 2020 mortgage applications, the CFPB found that Chinese mortgage applicants are slightly more likely to be denied than white applicants (7% vs. 9%) and pay slightly higher average loan costs than whites ($5256 vs. $5577). However, CFPB (2021) also found that Chinese mortgagors pay lower interest rates than whites (3.23% vs. 3.13%) and have higher credit scores (752 vs. 776). Similar to the ACS data on home value, the CFPB (2021) showed that Chinese mortgagors purchase properties that are vastly more expensive than whites ($359,529 vs. $740,583).

2.2 | Previous experimental research on discrimination against Chinese and Asians

The first experimental tests of discrimination in the housing market against people of Asian descent in the United States were conducted in 2000 and 2001 as part of the first two phases of the Department of Housing and Urban Development's Housing Discrimination Study (HDS) (Turner & Ross, 2003).[8] This study featured in-person paired testing, or audits, where one client from a minority group and one white client interact with a real estate professional, posing on the buyer side of a transaction. The HDS study randomly samples advertisements of housing units, and testers visit offices to inquire about those homes; both rental and for-sale listings are sampled, and the design of the study assigns relevant characteristics to the tester, such as income, assets, debt level, and family background. Asian testers for the HDS were recruited to represent Chinese, Japanese, Korean, Filipino, Vietnamese, and other Southeast Asians, Native Hawaiian, and other Pacific Islanders, and Asian Indians. The HDS study covered 11 metropolitan areas, primarily chosen to represent where Asians live.[9] Chinese testers were represented in 174 of the 598 phase two HDS audits and an additional 291 tests in Los Angeles that used both Korean and Chinese testers.

Turner and Ross (2003) found mixed results when using the data from in-person audits to test for discrimination against Asians and Chinese clients. The top line findings from Turner and Ross suggest that the magnitude of overall discriminatory actions against Asian rental home seekers is an incidence of 21.5%, the same level found for Black and Hispanics, but the difference in treatment between white and Asian testers is not statistically distinguishable from zero. The top-line findings from Turner and Ross for Asian homebuyers suggest discrimination happens 20.4% of the time (statistically significant), taking place in the categories of inspections, financing assistance, agent encouragement, and housing availability. Additionally, Turner and Ross reported that for Chinese rental home seekers in Los Angeles, there is overall discrimination of 4.1pp, and that this largely comes in the form of white clients being asked more often to complete an application and overall being more encouraged.[10] For clients seeking to purchase a home, Turner and Ross found overall favorable treatment of white clients relative to Chinese clients by 10pp, with the largest

[8] The Los Angeles and Minneapolis test locations conducted tests with Asian clients in 2000, whereas other areas were part of the second phase of the HDS in 2001.

[9] The 2000 HDS was sampled from the following metropolitan areas: Anaheim-Santa Ana, CA; Chicago, IL; Honolulu, HI; Los Angeles, CA; Minneapolis, MN; New York, NY; Oakland, CA; San Diego, CA; San Jose, CA; and Washington, D.C. At the time, these metropolitan areas contained about 77% of the Asian population in the United States.

[10] Turner and Ross (2003) found that in several categories, Chinese clients are treated more favorably than white clients, but these differences are not statistically meaningful. These include housing availability and the cost of renting.

differences occurring in the incidence of discussing a down payment, suggesting to the client that they are qualified, and overall encouragement in the process.[11]

Turner et al. (2013) provided updated estimates of discrimination against Asian home seekers using the 2012 HDS. Turner et al. (2013) conducted audits in 28 metropolitan areas to study discrimination, and 23 of these employed Asian testers.[12] Turner et al. (2013) did use Chinese testers to study discrimination but did not provide tests for subgroups within the broad category of Asian. Turner et al. (2013) found that Asian clients are told about 9.8% fewer rental units and shown 6.8% fewer rental units on average. For Asian home purchasers, they are told about 15.5% fewer homes, and shown 18.8% fewer homes on average than white clients. These differences represent about the same level of differential treatment as African Americans, but a smaller level than is found for Hispanic clients.

More recently, Christensen and Timmins (2022) used data from the 2012 HDS to study how discriminatory steering of clients by agents can distort the location choice of minority households. Christensen and Timmins (2022) found evidence that African American clients are steered away from white neighborhoods, and this is not true of Hispanic or Asian clients, except in the case when the neighborhood is a high-income white neighborhood where Asian clients are steered away. Christensen and Timmins (2022) also found evidence of steering Asian home-seekers that is related to school quality, and the level of local pollution in a local area.

Tests for differential treatment against Chinese go beyond real estate markets. For example, Oreopoulos (2011) used a correspondence experiment in the labor market to study discrimination against skilled immigrants in Canada, using a large sample of jobseekers with an array of ethnic names, including Chinese[13] and foreign credentials. Oreopoulos (2011) found evidence that Chinese job seekers are discriminated against, with an overall 26% lower callback rate than English-named jobseekers. This discrimination occurs regardless of the inclusion of foreign credentials on the resume but is smaller in some specifications when the Chinese jobseeker uses an English first name.

Our work fits into the previous literature both as an update and an extension. We focus on Chinese clients in the owner-occupied housing market, but we test both the buyer and seller sides. The focus on Chinese clients is new, with only a small part of the 2000 HDS study in one metropolitan area to serve as a comparison. We focus on Chinese clients because they are the third-largest and, for many decades, fastest growing Asian subgroup in the United States. Real estate buyers, especially from mainland China, have been the subject of interest in both the popular press and academic study. Focusing on Chinese clients specifically is more practical in an experimental setting because of the diversity along many dimensions across subgroups that make up the census definition of the Asian race (including socio-economic status as shown in Table 1, but also in culture, language, naming conventions, and history in the United States). Considering subgroup diversity in an experimental setting, it seems questionable to pool across these different groups to

[11] Turner and Ross do not provide a breakout of Chinese clients in other cities in their sample but do report differential treatment for Southeast Asian clients in Minneapolis.

[12] The Asian test areas in the 2012 HDS include: New York, Chicago, Los Angeles, Washington D.C., Philadelphia, Atlanta, Houston, Riverside-San Bernardino, Dallas-Fort Worth, San Diego, Newark, Tampa-St. Petersburg, Kansas City, Cleveland, Baltimore, Orange County, CA, Fort Worth-Arlington, San Antonio, Albuquerque, San Jose, Boston, Seattle, and Middlesex-Somerset-Hunterdon, NJ.

[13] The Chinese names in Oreopoulos (2011) are (for males) Dong Liu, Lei Li, Tao Wang Yong Zhang, and (for females) Fan Wang, Min Liu, Na Li, and Xiuying Zhang. Oreopoulos (2011) also used English first names with the same set of Chinese surnames.

examine discrimination; indeed, the only research (Oreopoulos, 2011) that examines Asian subgroups does not generally pool results. Our work also serves as an update to a literature that is limited in scope, with the most recent study over 10 years old.

3 | EXPERIMENT DESIGN AND IMPLEMENTATION

We tested for differential treatment by real estate agents between Chinese and white clients using a correspondence experiment. We contact real estate agents through e-mail and monitor if they respond to our initial inquiry, testing for differential response based on client characteristics. We discuss the particulars of experiment design and implementation below.

3.1 | Study area and subject pool

To study potential differential treatment by real estate agents, we first need to build a sample of agents that contains enough information to contact about using their services as part of a normal home sale or purchase transaction. We do this using state license and registration data, typically gathered by state departments of Professional Services, Safety, Licensure, or, in some cases, a state Real Estate Commission, or Verification Board. Regardless of the title, these agencies serve as the outlet where real estate agents apply for licensing in a state. We search all 50 states for such an agency and then determine if the state (1) collects enough data on real estate agents to be useful in a correspondence experiment and (2) will release the data for research (or other) purposes. To meet criteria (1), the state must release data with at least the following fields: agent first name, agent e-mail address, and physical location of operation at the municipal level.

After searching all 50 US states and determining the availability and viability of agent databases, we found 11 useful databases in the following states: Alabama, Georgia, Maryland, North Carolina, North Dakota, Ohio, Texas, Virginia, West Virginia, Wisconsin, and Wyoming. We combine states and eliminate repeat agent entries and entries missing the required data for the experiment; this yields a usable subject pool of 412,705 real estate agents. Based on experience with e-mail verification software, the design of the experiment, response rates in previous correspondence experiments, statistical power tests,[14] and building in a margin of error, we randomly selected 23,000 real estate agents for our sample. After e-mail verification, randomization, and minor errors in implementation, 20,051 real estate agents make up the experimental sample.

A notable design choice of our sample that differs from the HDS designs is that we do not attempt to limit our sample by where the current population of Asian or Chinese people live. Although this choice is understandable for the HDS design that is based on in-person interaction and relies on recruiting actors to participate in the study, we determined that a broader geographic footprint offers a fuller picture of how Chinese people are treated in the housing market. With a broader geographic sample, our experiment will allow us to determine if there is differential access for Chinese people to areas where there is not currently a large Chinese population. In practice, this creates some overlap between our geographic sample and the 2012 HDS sample, as our experiment covers six of the same metropolitan areas (Atlanta, GA; Dallas-Fort Worth,

[14] Our power calculations are based on previous experiments, but these experiments use white, Black, and Hispanic clients. Because we do not a priori know the response rate to Chinese clients and there are other differences between this experiment and previous work, we built in a margin of error in the size of the subject pool.

TABLE 2 Demographic summary statistics of study area.

	United States	States in study area	Census places in experiment	Census places, weighted by subject pool
Total population	331,449,281	90,260,803	50,812,584	50,812,584
Percent urban	80.00	75.41	96.21	99.92
Percent white	61.60	60.55	53.64	55.34
Percent Chinese	1.32	0.62	0.80	0.85
Percent Asian	12.40	4.46	5.35	5.79
Percent other	26.00	34.99	41.01	38.88

Note: Demographic data are from 2020 Census. Percentage of white and Asian is calculated as a number identifying only that group divided by total population. Percent Other calculated as 1-%only white-%only Asian.

TX; Fort-Worth-Arlington, TX; Houston, TX; San Antonio, TX; and Washington, D.C.). The only overlap our sample has with the 2000 HDS is the Washington, D.C. metropolitan area. The most obvious difference between our sample geography and the HDS studies is that we do not have a real estate agent list from California, where the only other Chinese-focused experimental tests were conducted as part of the 2000 HDS.[15]

Most states do not release any demographic information about the real estate agents on their list,[16] but Tables 2 and 3 display the information we do have about the demographics of the states and agents in the sample, respectively. The states in our sample represent about 27% of the US population and have a similar percentage of white residents, although they have far fewer Asian residents and about half of the Chinese population, with more of other minority groups than the United States as a whole. Using the municipality (census place) identified by individual agents in the data, the places in our data are less white and more Asian and Chinese than their state aggregates, with more of other minority groups. Weighting the municipality by the number of agents operating in the areas that are part of the experiment, column 4 of Table 2 shows that the sample ends up looking slightly more like the United States in terms of the percentage of Chinese and Asian population, although it has fewer white residents and more residents of other race groups.

We follow Hanson and Hawley (2023) and apply an algorithm from Ambrose et al. (2021) to impute demographic information about real estate agents based on their name and location. Using the Ambrose et al. method, we assign race/ethnicity to real estate agents based on the group that has the highest probability of a match and report those summary statistics in Table 3. The algorithm suggests that 78% of real estate agents in the sample are white, whereas about 4.4% of the sample is Asian; other race/ethnicity groups make up the remaining 17.6% of the real estate agent subject pool. The algorithm does not allow us to estimate the percentage of Asians that might be

[15] Although we do not have a California licensing list, a small number of agents (30) licensed in other states list a California address for operations in our sample. Using the measure of address of operation, we have real estate agents in our sample from every state except Alaska, New Hampshire, Rhode Island, and Vermont.

[16] Only Wisconsin includes a field for the real estate agents reported races. In the full Wisconsin dataset of 9157 real estate agents, 100 (1.09%) report their race/ethnicity as Asian or Pacific Islander. A total of 5944 (64.91%) agents in the Wisconsin sample report white (non-Hispanic origin) as their race/ethnicity; a total of 2523 (27.55%) of the sample is categorized as unknown.

TABLE 3 Characteristics of real estate agent sample.

N	20,051
Observations matched to census place	19,410
% RE salespersons	81.85
% RE principal broker	17.56
% Gmail address	48.24
% Yahoo address	12.26
% Female	57.24
% Texas	42.12
% Georgia	15.76
% North Carolina	12.80
% Virginia	11.28
% White agents	77.93
% Asian agents	4.44
% Other agents	17.63

Note: The real estate agent sample comes from state-level licensing agencies. Census place match is based on the address a real estate agent provides. After Gmail and Yahoo, the next largest e-mail providers are Hotmail (3.9%) and AOL (3.2%); no other provider covers more than 1.9% of the sample. After Virginia, the next largest agent population comes from Ohio (8.87%); no other state makes up more than 3.25% of the sample. Agent race/ethnicity and gender is not a field in the original data. Agent race/ethnicity is imputed using an algorithm from Ambrose et al. (2021) using the agent's first name, last name, and zip code from the address field. Agent gender is imputed by Zero Bounce using the first name associated with each e-mail account and matching an algorithm.

Chinese; we use other methods to try and discern this as discussed below. The e-mail verification software we use provides an imputation of agent gender based on first name and assigns female to 57.4% of our sample.

We match most (96.8%) of the agents in our sample to a census place using the city provided in the database, which we use to match area demographic information in Table 3. About 42% of the agents in our sample come from Texas, whereas Georgia (15.75%), North Carolina (12.8%), and Virginia (11.28%) are the next most common locations. Beyond location and demographics, our agents are categorized as either salespeople (81.85%) or brokers (17.56%), and by the e-mail provider they use. Gmail is the modal provider, with 48.24% of real estate agents using that platform. The next highest used e-mail provider is Yahoo, accounting for 12.26% of the sample.

3.2 | Experiment design

The design of the experiment closely follows Hanson and Hawley (2023), using e-mail correspondence to contact real estate agents and measuring the response across multiple client characteristics. The experiment randomly assigns client characteristics to a large sample of real estate agent e-mails for correspondence. The primary characteristics for clients are side of market (buyer/seller), gender (male/female), and race (white/Chinese). This design allows a comparison between differential treatment of a client that is typical in markets, namely, that agents prefer to work with a home-seller instead of a buyer, all else equal,[17] with differential treatment of

[17] Hanson and Hawley (2023) found that real estate agents are more likely to respond to home-selling clients, as opposed to home-buying clients. The response rate to potential home-selling clients is 23.81% higher than that to home-buying clients in an experiment testing real estate agent responsiveness to an initial inquiry for assistance.

TABLE 4 Client names representing race and gender.

White clients	
Female	**Male**
Amy Nelson	Brendan Ryan
Angie Miller	Cody Murphy
Emily McCarthy	Gunner Nelson
Leslie Martin	Jake McCarthy
Melany Murphy	Luke Miller
Meredith Young	Mayer Anderson
Molly Ryan	Seth Martin
Chinese clients	
Female	**Male**
Fang Liu	Bo Yang
Jing Li	Hao Chen
Li Huang	Jun Wu
Lingling Chen	Lei Li
Na Zhao	Peng Wang
Xue Wu	Tao Zhou
Yan Zhang	Wei Zhang
Assimilated Chinese clients	
Female	**Male**
Amy Zhao	Brendan Li
Angie Liu	Cody Wang
Emily Wu	Gunner Chen
Leslie Chen	Jake Zhang
Melany Li	Luke Yang
Meredith Huang	Mayer Zhou
Molly Zhang	Seth Wu

Note: White given names from Gaddis (2019). White surnames from Word and Perkins (1996) and Word et al. (2000). Chinese given and surnames from the Chinese Ministry of Public Safety (translation: Xinping Li).

a client based on protected class (race and gender). The use of correspondence rather than in-person audits, as in the HDS studies, makes a large sample size feasible with a limited research budget.

We use the name of the client to signal gender and race to the real estate agent, and the text of the correspondence and subject of the e-mail to signal the side of the market in which the client intends to participate. We split the sample evenly across three categories of client race based on the given name and surname. The experimental categories for race are white given name/white surname (white client), white given name/Chinese surname (assimilated Chinese client), and Chinese given name/Chinese surname (Chinese client). Table 4 shows the client names used in the experiment, categorized by gender and race. For white client names, we use a subset of the names from Hanson and Hawley (2023). The source for white given names is Gaddis (2019) and is based on the name being relatively unique to the gender/race; white surnames are from Word and Perkins (1996) and Word et al. (2000). Chinese client names come from the Chinese Ministry

of Public Safety based on the popularity of names in the 1980s and 1990s. We employ a native Mandarin speaker to translate Chinese characters into English.[18] For the assimilated Chinese clients, we randomly assign a match between white given names and Chinese surnames within gender from each list.

The Chinese client names are written in pinyin, a romanized spelling of Chinese characters. This deviation from the underlying Chinese characters introduces interpretability issues for the gender of Chinese client names. Because the Chinese language uses many homonyms, the use of pinyin masks the true gender translation of each name. This can cause confusion about the gender of a name in some cases.[19] Further, the romanization of Cantonese and the fact that Taiwanese use a slightly different Romanization of their names lead to various spellings of the same Chinese character.[20] An astute subject may notice these differences; for example, Fan et al. (2023) used these differences in spelling to identify from where investors in Hong Kong housing originate in China. Our choice of spelling signals that the clients in the experiment are likely from Mainland China. Although the experiment design was intended to use pinyin spelling differences to signal gender among Chinese clients, due to the potential for confusion among real estate agents, our reported gender-based tests only reflect white and assimilated Chinese names.

We design the experiment across three categories for race to differentiate between Chinese that may have a different level of cultural assimilation in America, as this may interact with differential treatment by agents. This structure is similar to Hanson and Santas (2014), who studied how assimilation may alter discrimination against Hispanic clients in the rental housing market.[21] Although Chinese have at least a 200-year history of immigration to the United States,[22] the flow of immigrants from China has undergone major fluctuation in both the total number and regional source, potentially creating a group with heterogeneous levels of assimilation. Zinzius (2005) detailed Chinese immigration history to the United States, showing a local peak in the 1880s, followed by many decades of smaller inflow due to legislative restrictions, until a boom starting in the 1970s and increasing rates of inflow through the 2000s.[23]

[18] Chinese names are a series of characters; the English spelling is a phonetic representation of characters. Custom in China is to pronounce a surname first and a given name second. We follow the English language custom of writing the given name first and the surname second in correspondence.

[19] For example, the pinyin "Li" can be translated into many characters, some of which are popular female names and others are popular male names.

[20] To illustrate these differences, the surname Zhang is written as Cheung in the Cantonese Romanization and as Chang when using the Wade-Giles Romanization, which is popular with Taiwanese immigrants.

[21] Hanson and Santas (2014) used the structure of last names, grammar, and writing in correspondence to indicate cultural assimilation.

[22] Zinzius (2005) reported that the U.S. Office of Immigration noted the first immigrant from China in 1820. A wave of Chinese immigration to the United States occurred because of the gold rush in northern California in the 1850s, mostly from the Canton region. Emigration from China was legalized starting in 1868 (Zinzius, 2005).

[23] The source of Chinese immigration to the United States varies across the two-century history from regions within mainland China, Hong Kong, and Taiwan. The primary source of Chinese immigration is tied to political and economic events in China and the United States, as well as legislation in the United States at the federal, state, and local levels. Most early legislation during this period worked to restrict Chinese entry into the United States. See Zinzius (2005) for a list of legislation pertaining to Chinese immigration, along with a discussion of immigrant flows from China.

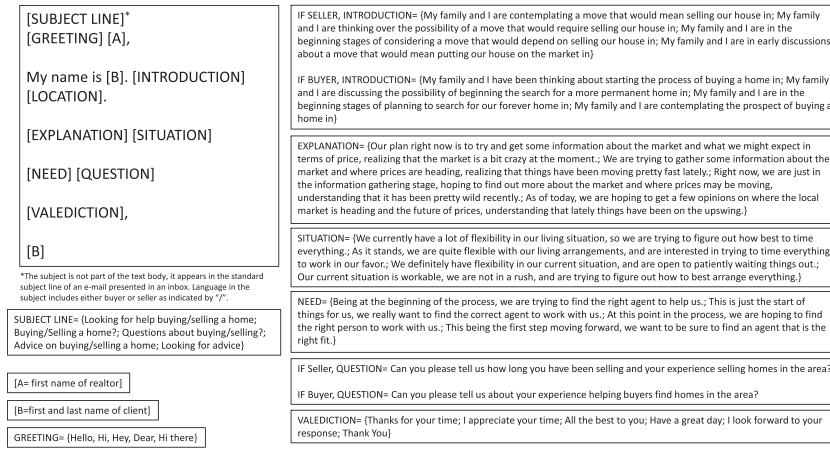

FIGURE 1 Construction of e-mail and randomized text options for inquiries.

3.3 | Content of inquiry

We create the content of e-mail correspondence to real estate agents using a standard structure and then randomize pieces of text to create inquiries. Figure 1 outlines the construction of e-mail inquiries and shows the options for the various parts of the inquiry. The overall construction of the correspondence is in the upper-left box of Figure 1, with the other boxes depicting the options for each piece. The realtor's name and location come from state licensing data and are randomly assigned to match a particular client's first and last name. Buyer/Seller status is randomly assigned, and all pieces of text unique to either a buyer or seller are randomly assigned within that status.

Given the options in Figure 1, an example of a typical inquiry to a real estate agent in our experiment is the following:

> Hi there [Agent Name],
>
> My name is Yan Zhang. My family and I are in the beginning stages of planning to search for our forever home in [City].
>
> Right now, we are just in the information gathering stage, hoping to find out more about the market and where prices may be moving, understanding that it has been pretty wild recently. We currently have a lot of flexibility in our living situation, so we are trying to figure out how best to time everything.
>
> This being the first step moving forward, we want to be sure to find an agent that is the right fit. Can you please tell us about your experience helping buyers find homes in the area?
>
> Thanks for your time,
>
> Yan Zhang

3.4 | Experiment implementation

The experiment takes place over 7 weeks between mid-May and mid-June 2022. This is a time of transition in the national market for housing, as the average 30-year fixed rate mortgage rose from 3% in January 2022 to over 5% in May, reaching 5.8% by the end of the experiment. Turnover in the market slowed, with the ratio of new houses for sale to new houses sold (months of supply) reaching 10.1 in July 2022 after a climb from pandemic level lows of 3.3 in August 2020. At the same time, median sales prices were hitting an all-time high in the third quarter of 2022, rising steadily from a low in the second quarter of 2020.[24]

We send inquiries to real estate agents on all weekdays, Monday to Friday, with a near uniform distribution of inquiries going out across those days. Approximately 19% of inquiries are sent on each of Monday, Tuesday, and Wednesday, with 21% sent on Thursdays and 23% sent on Fridays. Our process for sending inquiries to real estate agents is to use a batch e-mail sending software that links to a unique e-mail account for all clients listed in Table 4. Each client sends two batches of 10 e-mails per day that are sent out from the research team using different computer terminals with different internet protocol addresses.

The client e-mail accounts are based on a private internet domain purchased and maintained by the research team. We use this domain to create e-mail addresses of the form: Firstname.Lastname@domain.com. We initially ran a pilot test using three different private domain choices to see if the choice of domain influenced response. The pilot test uses a first and last name that is common among white females. The pilot study, run in April 2022, shows that one of the three domain options had a statistically meaningful higher response rate than the other two. The domain that we use in this study had a 25% response rate in the pilot study, whereas the other domain names had a 20% and 13.33% response rates, respectively. The pilot response rate for the domain we use in this study is nearly identical to the average response rate (25.57%) in Hanson and Hawley (2023) that uses a public e-mail domain.

Each client's individual e-mail account is set up to show both the e-mail address and client name, uniquely identifying them to real estate agents. We maintain each account for 14 days after the experiment before importing, sorting, and matching all replies from that account back to the original inquiries. The match between response and initial inquiry is largely completed using a merge with the real estate agent's e-mail address. In cases where a response comes from an alternate e-mail address (such as a second account owned by the agent or a colleague responding on the agent's behalf), we match back using the agent's name, location, and, in many cases, the original inquiry that appears in the text of the reply.

3.5 | Balance tests

The design of the experiment randomizes all client characteristics: race, gender, and buy/sell status across the sample of real estate agents. As a check on how well the randomization worked, Table 5 offers balance tests for the primary experimental categories across several observable real estate agent characteristics. The balance tests mostly reveal that the randomization process successfully maintained no statistically distinguishable correlation between the experimental client categories and observable characteristics of real estate agents. Statistical tests cannot reject zero

[24] All national housing market summary data from the FRED economic database at the St. Louis Federal Reserve.

TABLE 5 Balance tests for observable, non-randomized characteristics of real estate agents.

Client type	Percent of sample (%)	Pct. Pt. difference	*p*-Value	Client type	Percent of sample (%)	Pct. Pt. difference	*p*-Value
Panel A: Proportion sending to salesperson				Panel B: Proportion sending to Gmail account			
Seller	82.75	−0.84pp	0.1190	Seller	47.89	0.71pp	0.3178
Buyer	81.91			Buyer	48.60		
White	82.67	−0.25pp	0.7094	White	47.73	0.65pp	0.4528
Chinese	82.42			Chinese	48.38		
White	82.67	−0.77pp	0.2471	White	47.73	0.88pp	0.3109
Assimilated Chinese	81.90			Assimilated Chinese	48.61		
Female	82.18	0.30pp	0.5677	Female	47.99	0.50pp	0.4753
Male	82.48			Male	48.49		
Panel C: Proportion sending to Yahoo account				Panel D: Proportion of Non-white agents			
Seller	12.42	−0.32pp	0.4859	Seller	20.67	0.98pp	0.0908
Buyer	12.10			Buyer	21.65		
White	12.63	−0.56pp	0.3288	White	21.97	−2.04pp	0.0037
Chinese	12.07			Chinese	19.93		
White	12.63	−0.53pp	0.3527	White	21.97	−0.41pp	0.5623
Assimilated Chinese	12.10			Assimilated Chinese	21.56		
Female	12.43	−0.33pp	0.4758	Female	21.13	0.05pp	0.9203
Male	12.10			Male	21.18		
Panel E: Agent gender is female				Panel F: Proportion Texas			
Seller	50.76	0.98pp	0.1628	Seller	42.34	−0.45pp	0.5141
Buyer	51.74			Buyer	41.89		
White	51.20	0.33pp	0.7086	White	42.41	−0.38pp	0.6609
Chinese	51.53			Chinese	42.03		
White	51.20	−0.18pp	0.8284	White	42.41	−0.50pp	0.5602
Assimilated Chinese	51.02			Assimilated Chinese	41.91		
Female	51.76	−1.02pp	0.1475	Female	42.09	0.05pp	0.9478
Male	50.74			Male	42.14		
Panel G: Proportion North Carolina				Panel H: Proportion Ohio			
Seller	12.35	0.90pp	0.0566	Seller	9.06	−0.39pp	0.3343
Buyer	13.25			Buyer	8.67		
White	12.70	0.37pp	0.5203	White	8.80	0.05pp	0.9121
Chinese	13.07			Chinese	8.85		
White	12.70	−0.07pp	0.9093	White	8.80	0.16pp	0.7441
Assimilated Chinese	12.63			Assimilated Chinese	8.96		
Female	12.66	0.29pp	0.5417	Female	8.66	0.42pp	0.2978
Male	12.95			Male	9.08		

Note: We use a difference in proportions test statistic, the *z*-test statistic, to calculate the *p*-values. All *p*-values are based on a two-tail test, unless otherwise noted. White, Chinese, and assimilated Chinese names are defined in Table 4.

TABLE 6 Real estate agent response differences by race, gender, and side of market.

Client type	Number of e-mails	Response rate (%)	Pct. Pt. difference	Pct. difference	*z*	*p*-Value
All clients	20,051	15.74				
Seller	10,077	17.23	2.98pp	20.91%	5.7933	0.0000
Buyer	9974	14.25				
White	6685	16.19	0.78pp	5.06%	1.2309	0.2184
Chinese	6678	15.41				
White	6685	16.19	0.55pp	3.52%	0.8623	0.3885
Assimilated Chinese	6688	15.64				
Female	6681	16.39	0.95pp	6.15%	−0.2102	0.1318
Male	6692	15.44				

Note: Authors' calculations from experimental data. Response rate is any return e-mail correspondence divided by the number of e-mails sent to that group. We use a difference in proportions *z*-test statistic, shown in footnote 26 of the text, to calculate the *p*-values. All *p*-values are based on two-tailed tests. We formally test the response difference between Chinese and assimilated Chinese clients and cannot reject the null that the extremely small magnitude difference is equal to zero (p-value = 0.7122). The test for male and female differences only includes assimilated Chinese and white names.

difference in the proportion of agents with a given characteristic between groups in all cases except for one with another characteristic close to traditional significance levels.

The randomization process disproportionally assigned buying clients to agents located in North Carolina by a slight margin that is close to statistically significant at the 5% level. Although 12.35% of sellers send inquiries to North Carolina agents, 13.25% of buyers do, with the test for equivalence rejecting zero difference close to the 5% level ($p = 0.0566$). The most notable failure in the randomization process is in the proportion of clients sending to non-white real estate agents by race group of the client. White clients send 21.97% of e-mails to non-white agents, whereas Chinese clients send 19.93%. This 2.04pp difference is statistically different from zero at less than the 1% level ($p = 0.0037$). We revisit how these two balance failures might change our results in the robustness section of the article after we discuss the primary results of the experiment.

4 | RESULTS

4.1 | Primary results

For the full 20,051 sample of real estate agents, we received a response from 3157 inquiries, for an overall response rate of 15.74%. Table 6 shows how the real estate agent response rate differs by the major categories in the experiment and shows difference in proportions tests for each major category. All statistical tests shown in the results tables are from standard two-sample difference in proportions tests and reflect two-tailed[25] tests unless otherwise indicated.[26] Rows 2 and 3 of

[25] We use the two-tailed test because there is not a clear prediction in direction for the combination of statistical and animus discrimination between Chinese in white clients. Group average characteristic differences between Chinese and white clients may make Chinese clients more desirable in a real estate transaction. However, Chinese clients are a minority group operating in a white-majority industry with a history of being discriminated against. For these reasons, statistical and animus discrimination may be working in opposite directions.

[26] All significance tests are two-sample difference in proportions tests using an asymptotically normally distributed test statistic calculated as $z = \frac{\widehat{p_1}-\widehat{p_2}}{\sqrt{\widehat{p_p}\widehat{q_p}(1/n_1+1/n_2)}}$, where, $\widehat{p_p} = \frac{x_1+x_2}{n_1+n_2}$, and $\widehat{q_p} = 1 - \widehat{p_p}$

Table 6 show the response rate broken down between clients inquiring for help selling a home and clients asking for help buying a home. The randomization in the assignment of the side of market causes a small degree of difference between the number of inquiries generated from sellers (10,077) and buyers (9974). Real estate agents are more likely to respond to clients seeking assistance with selling a home (17.23%) than they are to clients seeking assistance buying a home (14.25%). The seller response rate is nearly three percentage points, or 20.91%, higher than the baseline buyer response rate. The difference in agent response between buying and selling clients is statistically significant, with a *p*-value on the difference in proportions test of 0.0000.

Table 6 also shows response rate differences between white and Chinese or assimilated Chinese clients. White names are favored over both types of Chinese clients by real estate agents, but the difference is small and not statistically distinguishable from zero. In both cases, white names are favored by less than 1 percentage point, which is a 5% or less difference from the Chinese client baseline. These results indicate that, in the aggregate, real estate agents do not differentiate between white and Chinese clients, and there appears to be no relative differential treatment for assimilation of given name. By comparison, Hanson and Hawley (2023) found an 8.48% difference in real estate agent response rates between whites and African American clients and a 32.18% difference between white and Hispanic clients using a sample of real estate agents in Ohio.

Lastly, Table 6 shows the difference in real estate agent response rates for male and female clients. Females are favored by 0.95 percentage points over males, a result that is not statistically distinguishable from zero. The gender result is particularly interesting, because Hanson and Hawley (2023) found that real estate agents have a statistically significant 13.57% higher response rate than females in Ohio. The gender result shown in Table 6 is based on using only white and assimilated Chinese names to avoid the unclear gender signal from the pinyin translation of Chinese characters.

The overall response rate in this experiment is noticeably lower than the most comparable real estate agent field experiment, Hanson and Hawley (2023), which has an overall response rate of 25.57%. Subject pool, experiment design, and other non-experiment factors are all responsible for the response rate differences between this study and the previous literature.[27] The primary subject pool difference between this study and Hanson and Hawley (2023) is the geographic variation. Hanson and Hawley (2023) used a subject pool of only Ohio real estate agents; here we use a sample drawn from several states, many of which have lower overall response rates than Ohio (as shown in Table 10). Although we use e-mail verification software to ensure that e-mail addresses in our subject pool are active, we cannot control for differences across states in maintaining a list of agents that are currently active in the market—lists are provided "as is" and represent all licensed agents in a state.

On the design side, the current experiment uses a private domain to send inquiries to real estate agents, whereas Hanson and Hawley (2023) used a public domain. Using a private domain is not unique to this work, as Neumark et al. (2019) used private e-mail domains to run a correspondence study of labor market discrimination. The use of a private domain may contribute to a lower

$\widehat{p_1}$ and $\widehat{p_2}$ are the response rates for the different groups in question across various aspects of the experiment, for example, buyers and sellers. x_1 and x_2 are the number of responses for each group, and n_1 and n_2 are the number of subjects in each experimental group.

[27] Factors affecting the overall response rate difference between this study and other studies using correspondence with real estate agents include the e-mail domain of subjects and clients, the location of subjects being more urban or rural, the quality of agent e-mails on state registries, and changes in the housing market. For example, during the Hanson and Hawley (2023) study, the average interest rate on a 30-year mortgage was 2.8%, but for the period of the current study, it is 5.7%.

response rate if agents are less likely to respond to e-mails originating from unfamiliar domains. In addition, the experiment here uses different control group (white) names and tests differential treatment for a different minority group, contributing to overall response differences.

We can separate the effect of subject pool differences from other aspects of the experiment, including design differences, by examining response for the overlapping elements of the current study and Hanson and Hawley (2023). Using the overlap in names[28] and trimming the sample to only Ohio real estate agents, we can separate the effect of subject pool differences from other factors that differ between the experiments. Using a more geographically diverse subject pool accounts for approximately 25% of the overall response rate difference, whereas the other aspects account for the remaining 75%.[29]

The overall level of response is most important for determining the subject pool size necessary to detect a difference between control and treatment. The subject pool size for this experiment considered that the response rate would be lower than previous studies of real estate agent discrimination due to changes in design, subject pool, timing of the real estate cycle, and composition of treatment/control groups.

4.2 | Subsample results

Table 7 separates the primary results into subsamples of sellers, buyers, females, and males and shows tests for race group differences within them. The subsample results largely echo the full sample results; there is only a small magnitude difference between white and Chinese clients that is not statistically different from zero for most subgroups, with two notable exceptions.

We cannot reject the null hypothesis of zero difference for any of the subsample categories, although the sign of the difference shows that white clients are preferred in all subsample cases. The difference between white and Chinese clients is largest for the home seller category, where white clients have a 1.16 percentage point higher response rate than Chinese clients and a 0.97 percentage point higher response rate than assimilated Chinese clients. These differences are smaller for home-buying clients and, again, not statistically different from zero, but favor white clients.

Among female names, using only white and assimilated Chinese clients to test, we again find small differences that are not statistically different from zero but that favor white clients by 0.64 percentage points. Among male clients, testing between white and assimilated Chinese, we cannot reject the null hypothesis of zero difference despite a 0.45 percentage point higher response rate for white clients.

[28] The names that overlap between Hanson and Hawley (2023) and this experiment are Angie Miller, Brendan Ryan, Cody Murphy, Emily McCarthy, Gunner Nelson, Jake McCarthy, Leslie Martin, Luke Miller, Mayer Anderson, Melany Murphy, Meredith Young, Molly Ryan, and Seth Martin.

[29] Parsing the response rate from Hanson and Hawley (2023) for the client names that overlap with this study results in a response rate of 28.11% for that experiment. Using the same list of names only for the current experiment results in a response rate of 15.93% for the full sample and 18.9% for subject pool originating in Ohio. The adjusted total response rate difference between the experiments is thus 28.11% − 15.93% = 12.18%, and the geography-constant response rate difference is 28.11% − 18.9% = 9.21%. This implies that other factors account for 9.21%/12.18% = 75.6% of the response rate difference, while expanding the geographic footprint of the experiment accounts for (12.18% − 9.21%)/12.18% = 25.4%.

TABLE 7 Real estate agent response differences for race by side of market and gender.

	Client type	Number of e-mails	Response rate (%)	Pct. Pt. difference	Pct. difference	*z*	*p*-Value
Home seller	White	3338	17.94	1.16pp	6.91%	1.2625	0.2068
	Chinese	3397	16.78				
	White	3338	17.94	0.97pp	5.72%	1.0540	0.2919
	Assimilated Chinese	3342	16.97				
Home buyer	White	3347	14.43	0.44pp	3.15%	0.5143	0.6070
	Chinese	3281	13.99				
	White	3347	14.43	0.11pp	0.77%	0.1344	0.8931
	Assimilated Chinese	3346	14.32				
Females	White	3339	16.71	0.64pp	3.98%	0.7103	0.4775
	Assimilated Chinese	3342	16.07				
Males	White	3346	15.66	0.45pp	2.96%	0.5075	0.6118
	Assimilated Chinese	3346	15.21				

Note: Authors' calculations from experimental data. Response is any return e-mail correspondence. We use a difference in proportions test statistic, the *z*-test statistic, shown in footnote 26 of the text, to calculate the *p*-values. All *p*-values are based on a two-tail test.

4.3 | Response by real estate agent location and agent demographics

The experiment contains data from 11 different US states and over 20,000 unique real estate agents operating across a variety of different housing markets. In this section, we examine how heterogeneity across the geographic location of where agents originate, the local demographics of these areas, and real estate agents themselves affects our findings.

Tables 8 and 9 parse the primary experimental results based on the location of the client's search (and real estate agent's location) being either urban (Table 8) or rural (Table 9). Urban locations are defined as census places with a population of 5000 or more, whereas rural locations are census places with a population of less than 5000. The results for urban areas only show that sellers receive a higher response rate by a higher margin than the full sample, and that the male-female difference is nearly identical to the full sample results. The urban area results show even lower levels of response rate differences between white and Chinese clients. The difference between white and Chinese clients in the urban-only sample is 0.59% of the Chinese baseline (0.09 percentage points) and is not statistically distinguishable from zero, compared to 5% in the full sample. The difference between white and assimilated Chinese clients is also smaller in the urban-only sample (0.76%) than the full sample (3.52%), and again not statistically distinguishable from zero.

Table 9 presents results for the sample of clients searching and agents operating in rural areas. Results from rural areas suggest that real estate agents in these areas are more likely to respond to white (20.94%) than Chinese (14.65%) clients by 43% of the baseline Chinese response rate, or 6.3 percentage points. This result is statistically significant at the 1% level with a *p*-value of 0.0013. The experimental results in rural areas also show a much larger difference between white and assimilated Chinese clients than the full sample—white clients have a nearly 20% higher

TABLE 8 Real estate agent response differences by race, gender, and side of market, urban areas only.

Client type	Number of e-mails	Response rate (%)	Pct. Pt. difference	Pct. difference	*z*	*p*-Value
All clients	17,164	15.32				
Seller	8634	16.84	3.05pp	22.15%	5.5534	0.0000
Buyer	8530	13.79				
White	5750	15.39	0.09pp	0.59%	0.1343	0.8931
Chinese	5686	15.30				
White	5750	15.39	0.12pp	0.76%	0.1717	0.8637
Assimilated Chinese	5728	15.28				
Female	5727	15.96	1.25pp	8.49%	1.8569	0.0633
Male	5751	14.71				

Note: Authors' calculations from experimental data. Response rate is any return e-mail correspondence divided by the number of e-mails sent to that group. We use a difference in proportions *z*-test statistic, shown in footnote 26 of the text, to calculate the *p*-values. All *p*-values are based on two-tailed tests. The test for male and female differences only includes assimilated Chinese and white names. Urban is defined as a census place with a population greater than or equal to 5000.

TABLE 9 Real estate agent response differences by race, gender, and side of market, rural areas only.

Client type	Number of e-mails	Response rate (%)	Pct. Pt. difference	Pct. difference	*z*	*p*-Value
All clients	2246	17.59				
Seller	1123	18.52	1.87pp	11.23%	1.1639	0.2445
Buyer	1123	16.65				
White	721	20.94	6.30pp	43.00%	3.2088	0.0013
Chinese	792	14.65				
White	721	20.94	3.48pp	19.93%	1.6852	0.0920
Assimilated Chinese	733	17.46				
Female	720	19.31	0.23pp	1.21%	0.1123	0.9106
Male	734	19.07				

Note: Authors' calculations from experimental data. Response rate is any return e-mail correspondence divided by the number of e-mails sent to that group. We use a difference in proportions *z*-test statistic, shown in footnote 26 of the text, to calculate the *p*-values. All *p*-values are based on two-tailed tests. The test for male and female differences only includes assimilated Chinese and white names. Rural is defined as a census place with a population of less than 5000.

response rate (3.48 percentage points), and this difference is statistically meaningful at the 10% level. Although agents in rural areas are more likely to practice differential treatment based on client race, they are less likely to differentially respond based on client gender and side of market. The side of market results still show that sellers are preferred, but the magnitude of the difference is about half of the urban result and not statistically different from zero. The small premium for female clients is eliminated in rural areas at only 1.21% of the male baseline response rate, and this is not statistically different from zero.

Table 10 shows the overall response rate and the response rate by race group across the 11 different states that constitute the real estate agent subject pool. There are large differences in the overall real estate agent response rate across areas, ranging from a low of 12.53% in Georgia to a high of

TABLE 10 Response and response by race, by real estate agent location.

State location	Full sample			White clients	Chinese clients				Assimilated Chinese clients			
	N	Responses	Response rate (%)	Response rate (%)	Response rate (%)	PP Diff. (pp)	Pct. Diff (%)	*p*-Value	Response rate (%)	PP Diff. (pp)	Pct. Diff (%)	*p*-Value
Alabama	412	63	15.29	14.69	15.20	−0.51	−3.36	0.9061	15.97	−1.28	−8.02	0.7622
Georgia	3160	396	12.53	12.28	12.16	0.12	0.99	0.9318	13.11	−0.83	−6.33	0.5669
Maryland	652	146	22.39	25.00	21.83	3.17	14.52	0.4324	20.38	4.62	22.67	0.2566
North Carolina	2567	497	19.36	21.20	17.07	4.13	24.19	0.0291	19.88	1.32	6.64	0.5014
North Dakota	118	39	33.05	31.82	21.21	10.61	50.02	0.3011	43.90	−12.08	−27.52	0.2505
Ohio	1778	318	17.89	20.07	14.38	5.69	39.57	0.0097	19.20	0.87	4.53	0.7062
Texas	8445	1098	13.00	12.98	13.50	−0.52	−3.85	0.5635	12.52	0.46	3.67	0.6060
Virginia	2262	465	20.56	19.77	22.43	−2.66	−11.86	0.2024	19.46	0.31	1.59	0.8796
West Virginia	161	33	20.50	24.53	22.58	1.95	8.64	0.8060	13.04	11.49	88.11	0.1478
Wisconsin	389	81	20.82	19.08	20.14	−1.06	−5.26	0.8259	23.68	−4.60	−19.43	0.3797
Wyoming	107	21	19.63	34.29	8.33	25.96	311.64	0.0074	16.67	17.62	105.70	0.0880

Note: Authors' calculations from experimental data. Response is any return e-mail correspondence. We use a difference in proportions test statistic, the *z*-test statistic, shown in footnote 26 of the text, to calculate the *p*-values. All *p*-values are based on a two-tail test.

33.05% in North Dakota. The median real estate agent response rate is 19.36% in North Carolina, and most states have a response rate within a few percentage points of the median. Maryland, Ohio, Virginia, West Virginia, Wisconsin, and Wyoming all have a response rate between 17.89% and 22.39%. Texas has the second lowest response rate at 13%, and Alabama has the third lowest at 15.29%.

Across states, there are noticeable differences in discrimination that are not apparent in the full sample results. Real estate agents in three states, North Carolina, Ohio, and Wyoming, are statistically more likely to respond to white clients than to clients with a Chinese name. The largest difference between white and Chinese clients comes in Wyoming, where white clients have a 25.96 percentage point higher response rate, or the white response rate is over 300% of the response rate to Chinese clients. Real estate agents in Ohio also demonstrate differential treatment toward white clients, with a response rate favoring white clients that is 5.69 percentage points, or 39.57% higher than Chinese clients. In North Carolina, white clients have a 4.13 percentage point, or 24.19%, higher response rate than Chinese clients. The most comparable study to ours, Hanson and Hawley (2023), finds that real estate agents in Ohio are more likely to respond to white clients than Hispanic or African American clients.

None of the state-level response rate differences between white clients and assimilated Chinese clients is statistically different from zero at the state level, although some of these differences are large in magnitude. White clients have a 105.70% higher response rate than assimilated Chinese clients in Wyoming, and assimilated Chinese clients have a 37.96% higher response rate than white clients in North Dakota. We cannot reject that even these seemingly large differences are different from zero due to small sample sizes in these states. In states where we draw more of the subject pool, differences are slight and typically favor white clients, although assimilated Chinese clients have a larger response rate in Alabama, Georgia, and Wisconsin.

The large sample of real estate agents in the experiment provides an opportunity to examine heterogeneity in response across agent characteristics. Another potential dimension where differences may arise is the race of real estate agents. Agents are a heterogeneous group along many dimensions, including national origin, and we attempt to categorize real estate agents in our sample on this basis to better match with the clients in our experiment. The algorithm we use to assign agent race is not able to differentiate within subcategories of the Asian race group, so we use last names that are highly concentrated by national origin as defined by Lauderdale and Kestenbaum (2000) and rely on a match between census and social security administration data. Lauderdale and Kestenbaum (2000) produced a list of the top 50 surnames based on the country of origin among Asians for each of the following countries: China, Japan, Korea, India, and Vietnam.[30]

We use each Asian subgroup surname list from Lauderdale and Kestenbaum to match the list of real estate agents in our sample and assign a country of origin given that the agent is assigned Asian status by the Ambrose et al. algorithm. The algorithm assigns Asians to 890 real estate agents in our sample; among those agents, the surname match classifies 160 as Chinese, 290 as either Japanese, Korean, Indian, or Vietnamese, with no match for 440 agents. In addition to the Lauderdale and Kestenbaum classification, we employed a panel of six individuals born in China and fluent in Mandarin and Cantonese to review the unclassified names and offer an opinion on whether they are a Chinese surname. If three or more members of the panel indicate that one of

[30] We do not use the Filipino surname classification from Lauderdale and Kestenbaum, as these names are highly correlated with Hispanic names in the United States. The top Filipino surnames in their study are Reyes, Santos, Garcia, Cruz, and Ramos.

TABLE 11 Difference in response tests by real estate agent race/ethnicity.

Client type	Response rate (%)	Pct. difference	*p*-Value	Client type	Response rate (%)	Pct. difference	*p*-Value
Panel A: White real estate agents ($n = 15{,}626$)				Panel E: Hispanic real estate agents ($n = 1875$)			
White	17.89	7.90%	0.0402	White	10.02	−4.84%	0.7286
Pooled Chinese	16.58			Pooled Chinese	10.53		
Panel B: Asian real estate agents ($n = 890$)				Panel F: Chinese real estate agents, Lauderdale and Kestenbaum classification ($n = 160$)			
White	7.10	−36.78%	0.0429	White	7.58	−45.19%	0.2178
Pooled Chinese	11.23			Pooled Chinese	13.83		
Panel C: Non-white real estate agents ($n = 4242$)				Panel G: Chinese real estate agents, including subjective classification ($n = 293$)			
White	10.14	−13.78%	0.1129	White	6.19	−60.22%	0.0162
Pooled Chinese	11.76			Pooled Chinese	15.56		
Panel D: Black real estate agents ($n = 1463$)				Panel H: Non-Chinese, Asian real estate agents ($n = 290$)			
White	12.72	−5.85%	0.6753	White	8.18	−13.35%	0.7150
Pooled Chinese	13.51			Pooled Chinese	9.44		

Note: Pooled Chinese names include all names where the surname is Chinese, regardless of first name origin. Authors' calculations from experimental data. Response is any return e-mail correspondence. We assume real estate agent race/ethnicity using an algorithm from Ambrose et al. (2021). Within agents classified as Asian by the algorithm, we use data from Lauderdale and Kestenbaum (2000) detailing the 50 most common Asian American last names by country of origin to identify agents likely to have ancestry from China, Japan, Korea, India, and Vietnam. Subjectively identified Chinese surnames rely on a panel of six individuals born in China that are fluent in Mandarin and/or Cantonese, where we include only surnames identified as Chinese by three or more panel members. Panel G includes agents that are identified by algorithm to be Asian but are defined by another national origin by the Lauderdale and Kestenbaum classification (excluding Filipino). We use a difference in proportions *z*-test statistic to calculate all *p*-values using a two-tailed test; see footnote 26. Results for agents whose country of ancestry is Korea, India, or Vietnam, respectively, show small magnitude differences between responses to white and Chinese clients that are not statistically different from zero.

the unclassified names is Chinese, we assign it as such in the data and examine the subcategory of those real estate agents.[31]

Table 11 shows results of the experiment, both for the algorithm-implied race of real estate agents and for the subgroup of country-of-origin-matched agents. All results in Table 11 pool the treatment group as both Chinese clients and assimilated Chinese clients. We pool all Chinese clients to increase the number of available observations within an agent type. The results of real estate agent response by race/country of origin offer a dramatically different view of behavior than the full sample results. Among white real estate agents, white clients have a statistically significant 7.9% higher response rate than Chinese clients. Among Asian real estate agents, white clients have a statistically significant 36.78% lower response rate than Chinese clients. The grouping of all

[31] Of the 336 Asian, unclassified surnames that cover 440 real estate agents, the panel identified 79 of them as Chinese. Of the 79, 38 were unanimously determined to be Chinese surnames. Seventeen of the surnames had the support of only 3 panelists, and the remaining 24 surnames had either 4 or 5 panel members' support.

non-white agents has a 13.78% lower response rate to white clients than Chinese clients, and this result has a *p*-value of 0.1129, close to statistical significance at the 10% level. We cannot reject a zero difference between white and Chinese clients for the other algorithm-assigned race/ethnicity categories of real estate agents (Black and Hispanic), although the sign of the difference favors Chinese clients for agents in these categories.

Within the group of algorithm-assigned Asian real estate agents, we find that Chinese real estate agents strongly favor Chinese clients—white clients have a 45.19% lower response rate than Chinese clients from this group. Due to the small sample size (160 agents), we cannot reject that this difference is statistically equal to zero, but we find a much lower level of discrimination against white clients among the non-Chinese, but classified (Japanese, Korean, Indian, and Vietnamese) group of Asian real estate agents (whites have a 13.35% lower response rate, not statistically different than zero). Adding the subjectively identified Chinese real estate agents to the Lauderdale and Kestenbaum classified surnames increases the number of Chinese-identified real estate agents to 293. With this classification of Chinese real estate agents, we find an even larger discrepancy between Chinese clients and white clients—whites have a 60.22% lower response rate than Chinese clients (the response rate to Chinese clients is 151% larger than the response rate to white clients), and this difference is statistically meaningful at conventional levels (*p*-value = 0.0162).

There are clear differences in treatment across subsamples of real estate agents, especially when there is a match between the agent and the potential client's race/ethnicity. Although some of these tests do not produce a statistically significant result due to low sample size, the magnitude of the difference suggests strong discrimination by Asian and Chinese real estate agents against white clients. We find a much lower level of discrimination against Chinese clients by white agents. It is also worth noting that we did not design the experiment to over-sample Asian or Chinese real estate agents. This design choice allows us to capture a market-level of differential treatment but prevents us from definitively rejecting a zero difference in some categories. Perhaps future work in this area will construct larger subject pools of minority agents to see how these relatively small sample results hold up.

4.4 | Interaction with local demographics

In addition to a real estate agent's own race/ethnicity, the local area where the agent operates may drive response to clients with different race/ethnicity backgrounds. To test how the local demographics of where agents operate relate to differential response in the experiment, we run regression-based tests that examine the interaction between client race/ethnicity and the percent of Asian residents in the area.[32] These regressions take the following form:

$$Y_i = \propto + \beta(\%M)_m + \gamma 1(c_i = M) + \delta(\%M_m \times 1(c_i = M)) + \varepsilon_i \quad (1)$$

[32] The American Community Survey also offers place-level data on subgroups within the Asian race demographic. We estimate a similar model using the percentage of Chinese people living in an area, as that is the best match for the clients in our experiment. These regressions produce results that are of the same sign but a smaller magnitude and not statistically distinguishable from zero than the results presented in this section. Notably, the results using the percentage of Chinese residents are based on smaller samples, in some places are missing data, and have large confidence intervals around the population-estimated averages. These results are available upon request.

where Y_i is a (0, 1) variable for response/non-response to a client (c_i), % M is a continuous measure of the percentage of minority group M (in this case, we examine the percentage of Asians) that lives in municipality m, and 1 represents the indicator function. This regression tests if the response to minority clients in the experiment varies by the percentage of that minority group living in a municipality. We also estimate specifications of the regression model that include dummy variables for the other major experimental categories of the experiment—buyer/seller status, and male/female client. Table 12 displays the regression results across a range of specifications that account for various aspects of the experiment.

Column 1 of Table 12 replicates the main result of the full sample experiment. The data used to estimate the coefficient on Chinese client combines all clients with a Chinese surname into one group. The coefficient of −0.00661 means that there is a 0.661 percentage point difference favoring white clients. This coefficient is equal to the weighted average difference of the separate Chinese and assimilated Chinese results from Table 6. In percentage terms, this is a 4.08% (coefficient/constant) lower response rate for Chinese clients relative to the white clients. This result is small in magnitude and not statistically different from zero. Column 2 adds the other categories of the experiment (side of market, gender)[33] to the baseline. The baseline result of no discrimination against Chinese clients does not change appreciably, and the results for sellers and female clients also corroborate Table 6. Sellers have a 2.98pp advantage over buyers, and female clients do not have an advantage over males. The regression constant changes as the reference group changes when adding dummies for other client characteristics.

Column 3 of Table 12 adds the percentage of Asian residents living in the municipality to the estimates in column 2. The coefficient on % Asian means that going from a municipality with 0% Asian to 100% Asian increases the response rate in the experiment 3.18pp, or that the response rate increases by 0.03pp for every 1pp increase in the Asian population, although this result is not statistically significant. Controlling for the demographics of the neighborhood does not appreciably change any of the primary results between columns 2 and 3.

The primary regression results of interest are columns 4 and 5; these show results of specifications that include the interaction between a Chinese client and the percent of Asian residents in a municipality. These results allow us to test if Chinese clients (or white clients) are treated differently in areas where more Asians live. The results show that the local demographics play a major role in how real estate agents respond to the experiment. The coefficient estimate suggests that Chinese clients have a statistically significant 1.64pp lower response rate than white clients, or 9.39% lower response rate than the baseline white response rate when including neighborhood demographics and the interaction with client race. Chinese client treatment is dependent on the percentage of Asians living in the municipality. The sign on the interaction term is positive, indicating that as the percentage of Asians living in an area increases, the response gap between whites and Chinese clients closes. The magnitude suggests that for a 10-percentage point increase in the percent of Asians in a municipality, the response gap falls by a statistically significant 1.75 percentage points, more than eliminating the baseline level of differential treatment for municipalities with no Asian residents.[34] Column 5 results confirm the approximate magnitude and statistical

[33] Female gender in the regression model is defined as equal to one if the client has a name from the white female or assimilated Chinese female list. Chinese female names are part of the reference group.

[34] A 10-percentage point increase in the percent of Asians for the municipalities in our data is approximately the same as going from the 25th percentile (1.6% Asian) of the distribution to the 90th percentile (12.3% Asian) of the distribution, or about 1.6 standard deviations.

TABLE 12 Regression results with municipal demographics.

	(1) Baseline	(2) Baseline w/client characteristics	(3) Baseline w/client and municipality demographics	(4) Interaction between client and municipality demographics	(5) Interaction between client and municipality demographics w/client characteristics
Chinese client	−0.00661	−0.00465	−0.00399	−0.0164**	−0.0143*
	(0.00546)	(0.00563)	(0.00570)	(0.00745)	(0.00759)
Home-selling		0.0298***	0.0292***		0.0292***
		(0.00514)	(0.00520)		(0.00520)
Female client		0.00843	0.0100*		0.01004
		(0.00563)	(0.00570)		(0.00571)
% Asian			0.03175	−0.0841	−0.08419
			(0.04127)	(0.0699)	(0.06987)
Chinese Client*%Asian				0.175**	0.178**
				(0.0867)	(0.0866)
Constant	0.162***	0.143***	0.139***	0.165***	0.145***
	(0.00445)	(0.00585)	(0.00639)	(0.00607)	(0.00718)
Observations	20,051	20,051	19,410	19,410	19,410
R-squared	0.000	0.002	0.002	0.000	0.002

Note: Standard errors are in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Chinese client dummy variable is equal to one if the client has a Chinese surname. The female client dummy variable is equal to one if the client has a white or assimilated Chinese female name.

significance of the results in column 4, accounting for the other major categories of clients in the experiment.

4.5 | Agent response content

The experiment is designed to test differential treatment from an initial e-mail inquiry; however, the content of responses generates additional data that can be analyzed for differences between groups. Following Hanson et al. (2011), we test for differences in the content of responses sent by real estate agents. We test for differences in the length of e-mail replies—measured in both characters and word counts—as well as differences in the word choice of replies. To test for differences in word choice, we define several broad categories of terms and test for the difference in propensity for e-mails to include terms in each category. The broad categories are Negative, Positive, Contact, and Probing. Words in the Negative category include: busy, unavailable, unfortunate(ly), don't, can't, and conflict. Positive words include: happy, glad(ly), excited, interested, well, learn, and soon. The Contact category searches for words that suggest further contact and includes: call, text, phone, meet, Facebook, website, cell, and talk. Finally, the Probing category identifies e-mails that are seeking more information or clarification and includes exactly, value, budget, pre-approved, bank, lender, neighborhood, contract, referral, referred, why, mortgage, cash, and who.

Table 13 displays results for tests of differences in e-mail content across the primary groups in the experiment. These tests only include observations from real estate agents that replied to an experimental inquiry; all non-response discrimination is excluded from these tests, so these results represent a potentially new source of differential treatment by real estate agents. We find agents send statistically significant longer responses in both words and character counts to sellers than buyers; the magnitude is 141 characters and 19 words, or between 6.5% and 7.7% of the buyer baseline e-mail response. We also find that agents sent statistically significant longer correspondence to white clients than Chinese clients, favoring white clients by 125 characters, or 5.7% of the Chinese baseline, or 17 words (6.7 of the Chinese baseline). The difference between white and assimilated Chinese is even larger, with whites favored by 154 characters (8.3%) and 21 words (7.2%). We find no statistically significant differences in correspondence length between male and female clients.

Our tests for keyword differences in the content of response across experimental groups are less revealing. Of the four categories of keyword differences, only the Contact keyword group ever tests statistically different from zero. This difference occurs between white and Chinese clients, showing that real estate agents responding to e-mails are more 4.2pp more likely to use words that suggest further contact when replying to white clients. No other keyword tests are close to as large in magnitude, and none are statistically different from zero.

5 | ROBUSTNESS

In this section, we examine how aspects of the experimental design affect the results, highlighting the choice of client names and the characteristics of real estate agents, including the e-mail provider they use. The experiment uses several different names of clients to signal gender and race in the experiment. This design choice represents the reality of clients as heterogeneous members of a group and guards against exposing the experiment to real estate agents, but may

TABLE 13 Real estate agent response content differences by race, gender, and side of market.

	Length of reply		Response keyword search			
Client type	Number of characters	Number of words	Negative	Positive	Contact	Probing
Seller	1969	308	0.100	0.666	0.720	0.422
Buyer	1828	289	0.100	0.672	0.716	0.442
Difference	141	19	0.000	0.006	0.004	0.020
(*p*-Value)	0.0006	0.0005	0.9777	0.7086	0.7928	0.2630
White	1997	312	0.108	0.677	0.731	0.435
Chinese	1872	295	0.093	0.672	0.689	0.430
Difference	125	17	0.015	0.005	0.042	0.005
(*p*-Value)	0.0185	0.0199	0.2579	0.8065	0.0333	0.7894
White	1997	312	0.108	0.677	0.731	0.435
Assimilated Chinese	1843	291	0.098	0.660	0.735	0.430
Difference	154	21	0.010	0.017	0.004	0.005
(*p*-Value)	0.0010	0.0014	0.4642	0.4087	0.8296	0.8126
Female	1935	303	0.107	0.682	0.744	0.414
Male	1907	300	0.100	0.653	0.721	0.453
Difference	28	3	0.007	0.029	0.023	−0.039
(*p*-Value)	0.5559	0.5870	0.5491	0.1591	0.2288	0.0671

Note: Authors' calculations from experimental data. Non-response is not included in any test. For the length of reply, we use a standard *t*-test statistic. For keyword search, we use a difference in proportions *z*-test statistic, shown in footnote 26 of the text, to calculate the *p*-values. All *p*-values are based on two-tailed tests. The tests for male and female differences only include assimilated Chinese and white names. Negative words include: busy, unavailable, unfortunate(ly), don't, can't, and conflict. Positive words include: happy, glad(ly), excited, interested, well, learn, and soon. Contact words include: call, text, phone, meet, Facebook, website, cell, and talk. Probing words include: exactly, value, budget, pre-approved, bank, lender, neighborhood, contract, referral, referred, why, mortgage, cash, and who.

have implications for measured discrimination if agents react differently to client names within categories. We also examine how the characteristics of real estate agents and their locations that do not pass the balance tests in Table 5 affect the overall results.

5.1 | Client names

Figure 2 displays real estate agent response organized by client name in the experiment, indicating the implied gender and race, and the response rate spread between clients that inquire about help selling or buying a home. The client Amy Nelson (white, female) has the highest response rate in the experiment at 19.46%, whereas Na Zhao (Chinese, female) had the lowest response rate at 10.69%. Figure 2 demonstrates the dispersion in response rates across names, even when, in the aggregate, the response rate across groups is not large. Figure 2 shows a concentration of low response rates to clients with Chinese surnames at the bottom of the distribution, as clients with the lowest seven response rates all have Chinese surnames. At the other end of the distribution, three of the top five response rates are for clients with Chinese surnames, and four of the top five client response rates are for females.

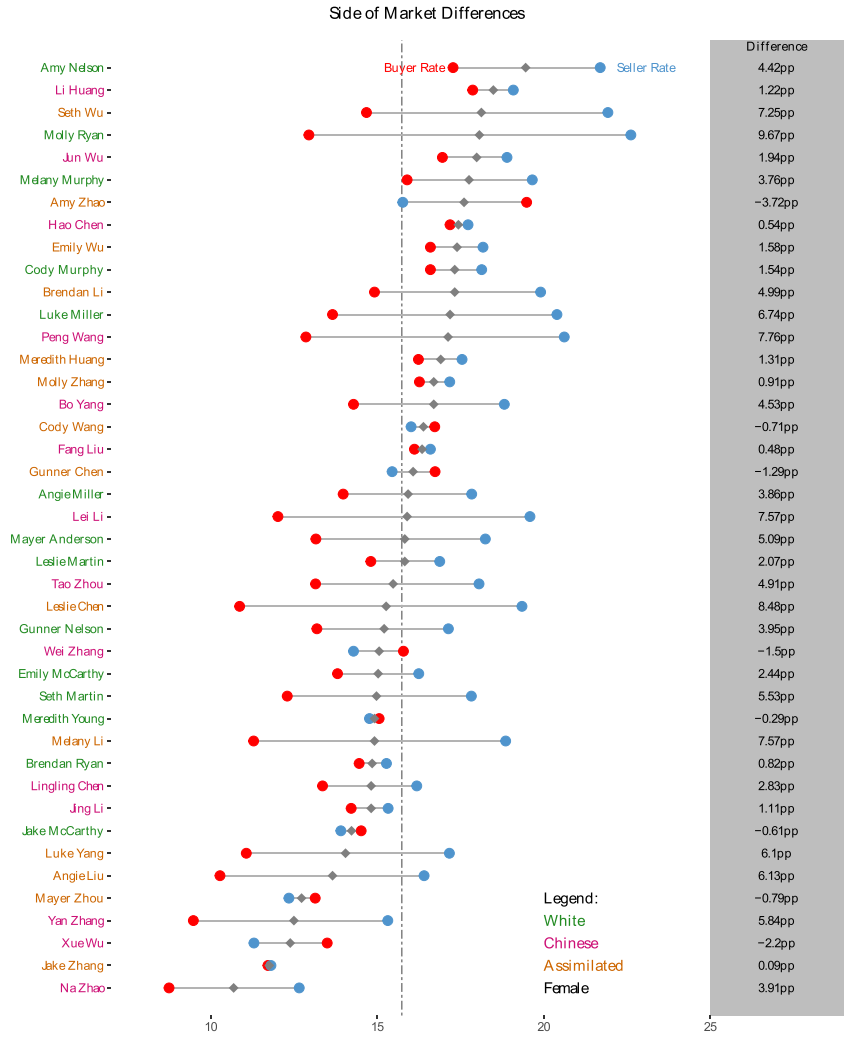

FIGURE 2 Response rate by client name. *Note*: Authors' calculations from experimental data. Vertical dashed line shows the overall response rate of 15.74%. [Color figure can be viewed at wileyonlinelibrary.com]

We formally test if any individual client name has a different response rate than their race/gender group and find four names that appear abnormal:[35] Li Huang (Chinese Female with 18.49% response rate vs. 13.6% other group member response rate), Na Zhao (Chinese Female with 10.69% response rate vs. 14.89% other group member response rate), Jake Zhang (assimilated Chinese male with 11.76% response rate vs. 15.78% other group member response rate), and Seth Wu (assimilated Chinese male with 18.13% response rate vs. 14.72% other group member response rate). Removing clients that test differently from their race/gender groups from testing does not appreciably change any of the primary results of the experiment. We still find that sellers are preferred to buyers by a nearly identical, statistically significant margin (20.70%), no statistically

[35] Formal tests appear in Table A1.

significant difference between male and female clients, and no statistically significant difference between white clients and clients with Chinese surnames (regardless of given name).[36]

5.2 | Agent characteristics

The balance tests of real estate agent characteristics in Table 5 show that the randomization process produces two characteristics of the full sample that are different between major categories of our experiment. First, buyers are more likely than sellers to send e-mail communication to real estate agents in North Carolina. Second, white clients are more likely than Chinese clients to send e-mail communication to non-white real estate agents.

Table 10 shows that real estate agents in North Carolina have an overall response rate that is substantially higher than the full sample (19.36% vs. 15.74%). We retest our primary results for buyers and sellers for North Carolina specifically, and then for the sample excluding North Carolina. Using only the North Carolina sample, we find a smaller seller advantage than the full sample results; sellers have a 2.1pp higher response rate that is not statistically different than zero at conventional levels ($p = 0.1631$). For the sample of real estate agents outside of North Carolina, we find that sellers have a 3.1pp advantage over buyers, statistically significant at conventional levels ($p = 0.0000$). Reweighting the results based on a neutral percentage of e-mails going to buyers and sellers and accounting for the difference in buyer/seller response between North Carolina and other areas shows that the primary results underestimate the degree of seller favoritism in the sample by 0.04 percentage points (2.98pp vs. 3.02pp reweighted).

The second element of the balance tests suggests that white clients are more likely than Chinese clients to send e-mail communication to non-white real estate agents, and Table 11 shows that non-white real estate agents are more likely to respond to Chinese clients. Using the results in Table 11 and reweighting by a neutral percentage of e-mails to non-white agents, we can determine how being unbalanced affects our results. The sample of non-white real estate agents has a 10.14% response rate to white clients and an 11.65% response rate to Chinese clients (difference is not statistically significant). The sample of white agents has a 17.89% response rate to white clients and a 16.58% response rate to Chinese clients, or 7.9% higher for white clients (statistically significant, $p = 0.0402$). Reweighting based on the differential response from non-white agents shows a small uptick in the difference between white and Chinese clients from 0.78% to 0.81%, a result that would not be statistically different from zero with the sample size of the experiment.

5.3 | Results by e-mail provider

The experiment makes use of state lists of licensed real estate agents and the e-mail addresses they provide. This means that our sample includes agent e-mail addresses across a range of providers. Each of these providers imposes different filters for messages from unknown recipients, and the use of different providers may be correlated with other factors that affect response in the experiment. For example, less popular providers are likely correlated with older agents, or perhaps those that are no longer active in the industry.

Although the balance tests show that the most popular e-mail providers in the data are spread evenly between groups, we do not know how the agent e-mail provider may interact with elements

[36] Formal retests with unusually performing clients removed are shown in Table A2.

of the experiment. To examine this further, we reassess our primary results using a single, common e-mail provider, Gmail, which is used by 48.24% of real estate agents in our sample. Gmail using real estate agents has a substantially higher response rate, 19.82%, than other agents in the sample at 11.95%, so this robustness check also sheds light on how the overall response rate of the experiment may impact measured discrimination.

The results of the robustness check show some interesting differences with the full sample results (Table S3). We find a larger difference between buyers and sellers in the Gmail-only sample—sellers are favored by 25.54% versus 20.91% in the full sample (15.14% in the non-Gmail sample). Measures of differential treatment between white and Chinese clients are slightly larger in the Gmail sample. White clients are favored by 6.37% over Chinese clients; the gap is only 5.06% in the full sample, but is not statistically significant in either case (the difference is 3.9% in the non-Gmail sample). White clients are favored over assimilated Chinese surname clients by 9.96% in the Gmail sample, and this result is statistically significant at the 10% level (p-value of 0.0572), a finding that is both larger in magnitude and closer to statistical significance than the full sample result. The non-Gmail sample shows that assimilated Chinese clients are favored over white clients, with a 4.8% higher response rate, but this difference is not statistically meaningful (p-value of 0.4639).

6 | DISCUSSION AND CONCLUSIONS

Contrary to the experience documented in previous research using correspondence experiments to study Hispanic and Black clients, we do not find overall discrimination against Chinese clients by real estate agents. This baseline finding is true for both assimilated (white given name/Chinese surname) and non-assimilated (Chinese given name/Chinese surname) clients compared to white clients. Despite the overall findings for race, we do find that real estate agents clearly respond differently to some clients; they are more likely to respond to home sellers than homebuyers by nearly 21%.

Although we cannot reject the null hypothesis of zero difference between white and Chinese clients in the full sample, there are subsample results that suggest a more nuanced picture of real estate agent behavior. Notably, we find statistically significant discrimination against Chinese clients in rural areas, where white clients have a 43% higher response rate. We also find evidence of discrimination in three states: North Carolina, Ohio, and Wyoming, and in all three cases, the level of unequal treatment is large. Additionally, we find evidence of unequal treatment in the subsamples that parse real estate agents by their own race—finding that white agents treat white clients more favorably, and that Asian, and especially Chinese agents, treat Chinese clients more favorably. Finally, we find evidence that differential treatment relates to the demographics of the search area, as we show Chinese clients' treatment improving with the percentage of Asians living in an area.

The evidence that real estate agents are more responsive to own-race clients could be explained not only by homophily but also by within-group benefits to completing a real estate transaction. For example, if an agent–client race match increases mutual trust, agents may be able to operate without signing exclusivity agreements or may not be asked to perform additional costly services for the client (a market analysis or home inspection, for example). Although the overall null finding suggests that differential treatment is not likely to be as large as it is for other groups, the interaction with agent and area demographics may work to slow the integration of Chinese immigrants and restrict choice for Chinese people in the American housing market.

Given that statistical differences favor Chinese clients in this setting and full sample results cannot reject the null hypothesis of no differential treatment, it is tempting to conclude animus toward Chinese clients must exist. Although we cannot rule out animus, and heterogeneity in subsample results clearly shows differential treatment favoring white clients in some areas and among white agents, we cannot rule out alternative explanations. Subsample results also show favorable treatment of Chinese clients among Asian and especially Chinese agents. It is possible that where white clients are favored, rather than animus, agents practice statistical discrimination based on other unmeasured dimensions, for example, a prejudice about clients' speed of transaction or required agent effort. Agents may also be responding to statistical differences that we have not observed in the average income, mortgage, and housing data, for example, modal experiences or the interaction between statistical differences and feelings of animus.

Previous studies, including Ewens et al. (2014), tested for differences between animus and statistical discrimination by varying the information included in correspondence with property owners. This type of test is viable as a way to determine the cause of discrimination in cases where interaction between the causes is unlikely and information can send a clear signal of client quality. In the current experiment, this would be similar to testing for differential treatment between white and Chinese clients across groups of buyers and sellers (Table 7 results). In our setting, we do not find evidence that differential treatment by race of client is different for the homebuyer and home seller groups, suggesting that statistical and animus causes of differential treatment cannot be clearly separated in our study.

There are many differences between our work and previous studies of differential treatment of Asian clients, so a direct comparison of our results to Turner and Ross (2003) and Turner et al. (2013) is mostly speculative. Importantly, both of the previous studies rely on HDS data, where in-person testers focused on metropolitan areas with the largest Asian populations. Both previous studies found substantial levels of discrimination against Asian clients, although only the 2003 study tested for differential treatment of Chinese clients, and these tests were only reported for Los Angeles. Thinking about the time path of differential treatment, in our most comparable sample to these studies, we find no evidence of differential treatment for Chinese clients in urban areas, and that treatment of Chinese clients becomes more favorable as the percentage of Asian residents in the area increases, although we find substantial differential treatment in rural areas. An optimist might conclude that our study therefore indicates a decline in differential treatment of Chinese clients in the housing market in the intervening 20 years. Other explanations are not limited to differences in the outcomes measured, testing methodology, heterogeneity in audit testers, agent sample, geographic representation (state, metropolitan, and neighborhood level), socio-economic changes, and increasing diversity among real estate agents.

This experiment represents a test of differential treatment by real estate agents in the initial information-gathering stage of the home purchase/sale process. There are opportunities for both agents and other actors to practice differential treatment at many other points in the home purchase/sale process that are not examined here. Previous studies have found discrimination by mortgage lenders (Hanson et al., 2016), in the number of homes shown to home seekers (Zhao, 2005), in the number of homes a client is told about, in denying appointments to meet in person, in learning about other available homes (Turner et al., 2013), in steering clients toward minority neighborhoods and areas with lower quality schools, higher crime, and more pollution (Christensen & Timmins, 2022), and in the language used to communicate with clients (Hanson et al., 2011). We present suggestive evidence that non-response is not the only channel of differential treatment, as we find that real estate agents responding to inquiries send longer correspondence to white clients and that this correspondence is more likely to contain language suggestive of

future contact. Testing for differential treatment in other aspects of the agent search process and among other protected classes of individuals seems an area ripe for future research.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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