The market for real estate brokerage services in low- and high-income neighborhoods: A 6 city study

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Abstract: We examine the market structure for real estate brokerage services across six large metropolitan areas, to see whether low-income neighborhoods or neighborhoods where house prices are low are as well served by real estate professionals as higher income or higher price neighborhoods. We collect more than 300,000 real estate listings and compute the Herfindahl-Hirschman Index (HHI) for each zip code neighborhood in each MSA. When we divide neighborhoods based on income, house value, and race, we find no evidence that access is worse in disadvantaged areas; that is, the market structure for brokerage services is at least as competitive in less advantaged neighborhoods. We also analyze market leaders in the six cities and find that some firms specialize in particular market segments, however.

Keywords: HHI, real estate brokerage competition, Herfindahl-Hirschman Index, redlining

The data and programs used in this study can be obtained from the authors. Contact Aaron Yelowitz at aaron@uky.edu for this information.

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Introduction

Residents of low-income or minority neighborhoods pay higher prices and have fewer choices for a variety of products and services. Underserved sectors include supermarkets, banks, and large drug stores,[1] credit cards,[2] gasoline retailing,[3] and insurance.[4] Allegations of "retail redlining" have led to lawsuits against companies such as General Motors, Wal-Mart, and Burger King.[5] While differences in the performance of housing markets in low-income or minority neighborhoods have been extensively studied, most of the attention has been focused on possible redlining practices by mortgage lenders.[6] Little attention has been paid to real estate middlemen—brokers and agents—in assessing the performance of urban real estate markets.[7]

This is surprising, given that housing market outcomes vary greatly. Home ownership rates differ among various economic and demographic groups. Two dimensions that have probably attracted the most attention are income and race. Very low-income households have home ownership rates that are

[1] Alwitt and Donley (1997) use Chicago as a case study and find that poorer zip codes have fewer and smaller outlets than nonpoor zip codes for supermarkets, banks, and large drug stores.
[2] Cohen-Cole (2011) finds that, after controlling for place-specific factors, qualitatively large differences exist in the amount of credit offered to similarly qualified applicants living in black vs. white areas.
[3] Myers, Close, Fox, Meyer, and Niemi (2011) analyze gasoline retailing and find that prices are higher in poorer areas, partially because of low competition and inelastic demand.
[4] Ong and Stoll (2007) find that variations in auto insurance costs occur because of both risk and redlining factors, and that black and poor neighborhoods are adversely affected. Regan (2007) focuses on insurance availability and finds positive correlation between the proportion of minority homeowners in a state and the share of more restrictive dwelling fire policies.
[5] See Myers, Close, Fox, Meyer, and Niemi (2011) for an extensive discussion of retail redlining.
[6] In the context of the Fair Housing Act, redlining is "the practice of denying a creditworthy applicant a loan for housing in a certain neighborhood even though the applicant may otherwise be eligible for the loan." Redlining based on racial composition is illegal, while redlining based on economic factors is legal. See http://www.federalreserve.gov/boarddocs/supmanual/cch/fair_lend_fhact.pdf .
[7] Myers (2004) studies racial housing price differentials and controls for neighborhood effects. She suggests that one possible source of racial housing price differentials is supplier price discrimination by real estate brokers and agents.

37 percentage points lower than the rate for high-income households, while home ownership rates for minority households lag behind those of white households by 24 percentage points.[8] There is some evidence that house prices paid also differ across groups. In a study of four cities, Bayer, Casey, Ferreira, and McMillan (2012) found that black and Hispanic homebuyers paid a premium of three percent—a difference not explained by variation in buyer income, wealth, or access to credit.

The type and degree of services demanded by buyers and sellers differ for low vs. high-priced houses. Real estate markets tend to be thicker in lower price ranges. Product heterogeneity tends to be greater in higher price ranges. There is also broad agreement that real estate markets are local and not national in geographic scope. Real estate brokers and agents thus compete in local markets. In large metropolitan areas most agents and many brokers tend to specialize even more, and compete in sub-markets/neighborhoods within the larger metropolitan market area. This outcome is not surprising, since sellers and buyers value the localized knowledge that agents and brokers bring to the transaction.

Given all these aspects of housing markets, the question that naturally arises is whether residents of low-income neighborhoods are as well-served by real estate agents and brokers as residents of high-income neighborhoods. Especially in light of Hsieh and Moretti's (2003) finding that when the average price of land in a city increases the fraction of real estate brokers relative to population increases and the productivity of a typical real estate agent falls, one can imagine that even in areas that are geographically proximate, different neighborhoods have different clienteles and are ripe for specialization, which may result in poorer neighborhoods being differentially served by real estate brokers and agents.

For this reason, we investigate whether sub-markets within broader metropolitan markets face different levels of competitiveness among real estate brokers. This research builds upon our earlier work

[8] Bunce and Reeder (2007, p. 1).

that analyzes market concentration in small, medium, and large real estate markets.[9] We have gathered data for six large metropolitan statistical areas: Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington, D.C. These cities were chosen for their geographic diversity, income diversity, and very different average house prices. Demographic information on income, house values, population, racial composition, and home ownership were obtained at the zip code level from the 2000 Census. These data were merged with information we gathered in 2011 from the National Association of Realtors' Realtor.com website on listings by broker for each zip code neighborhood.

Our final sample consists of 1,321 zip codes in these six cities which can be merged with Census Factfinder data and where there were at least 50 MLS listings. We compute Herfindahl-Hirschman Indices for each MSA and then for each zip code within the six MSA's. [10] After presenting zip-code-level summary statistics for each MSA, we analyze HHI's at the zip code level. We regress zip-code-level HHI on racial composition, median house price, median household income, and a measure of the heterogeneity of the housing stock in the neighborhood. We find that sub-markets are less concentrated in neighborhoods with heterogeneity in the housing stock and greater percent nonwhite, but more concentrated in neighborhoods with higher average prices. To see whether real estate brokers tend to specialize by neighborhood, we also identify the real estate brokers with the largest market shares in low-income, low-house-price, and high-minority neighborhoods and compare with high-income, high-house-price, and low-minority neighborhoods. We find that in many cases the market leaders differ substantially by neighborhood.

Income and Racial Gaps in Home Ownership

[9] Beck, Scott, and Yelowitz (2012).

[10] The Herfindahl-Hirschman Index (HHI) is calculated by summing the squared market shares (expressed as a percentage) of all firms on the supply side of a market. A monopoly market thus has an HHI of 10,000, while a market of atomistic firms has an HHI that approaches zero.

Considerable effort has gone into understanding the determinants of home ownership rates by income, racial, and ethnic status.[11] Haurin, Herbert, and Rosenthal (2007) assessed the extent of differences in home ownership rates among different socioeconomic groups, and reviewed existing research on possible explanations for these differences. They first discussed factors that affect the formation of households, and then turned to the propensity for homeownership.

In addition to factors that influence household demand for home ownership, Haurin, Herbert, and Rosenthal evaluated three types of supply constraints that may restrict different households' access to single-family housing: (1) the supply of mortgage credit may affect low-income and minority households differently; (2) there may be racial discrimination in mortgage markets; and (3) the type of housing stock may vary across different neighborhoods.

Racial or ethnic discrimination that affects access to homeownership can occur at several different levels. Munnell, Tootell, Browne, and NcEneaney (1996) supplemented data generated as a result of the Home Mortgage Disclosure Act with data collected by the Federal Reserve Bank of Boston from lending institutions on financial, employment, and property characteristics to see whether race plays a role in the lending decision. They found significant disparities between minority and white rejection rates, even after controlling for other factors. Yinger (1991) used data from the 1989 HUD Housing Discrimination Study that conducted fair housing audits. He found statistically significant differences in the treatment of blacks and whites and in the treatment of Hispanics and Anglos by sales and rental agents. Ondrich, Stricker, and Yinger (1998) used a similar approach to investigate the treatment of whites, blacks, and Hispanics by real estate brokers. They too found evidence of discrimination.

These and many other studies have examined person-based discrimination. A related issue is whether different types of neighborhoods are treated differently by various parties involved in the

[11] *Cityscape* recently devoted two special issues that focused on recent research on low-income and minority homeownership (Bunce and Reeder, 2007 and Reeder, 2008).

supply of housing. Berkovec, Canner, Gabriel, and Hannan (1994) used individual loan records from HUD along with census tract data to study default risk characteristics and performance of FHA-insured mortgages. They found that loans in high-income and high-house-price census tracts are less likely to default. They found no strong relationship between racial characteristics of a neighborhood and likelihood of default. Tootell (1996) addressed the issue of redlining directly by studying the racial composition of the neighborhood while controlling for the race of the applicant. He found that the racial composition of the neighborhood where a property is located is not significantly related to the lending decision. More recently, Ghent, Hernández-Murillo, and Owyang (2012) examine subprime loan pricing during 2005, and find evidence of redlining and adverse pricing for blacks and Hispanics.

Conceptual Framework

Yet to be analyzed is whether the supply of real estate professionals and market structure of real estate brokerage differs by neighborhood characteristics.[12] In a non-discriminatory competitive market characterized by free entry, we would expect real estate middlemen to pursue profitable opportunities wherever they occur. In equilibrium, agents and brokers would list and sell properties and be compensated for their services at prices that yielded the same return in low-income neighborhoods as high-income neighborhoods, and in zip codes where house prices are low as in zip codes where prices are high. Only the profit opportunities, and not the racial and ethnic characteristics of a neighborhood, would affect agents' and brokers' supply decisions.

[12] In one part of the study by Ondrich, Ross and Yinger (2003), the authors used paired-audit-study data (the Housing Discrimination Study) to examine whether real estate agents representing home buyers practice redlining, defined as withholding from all customers houses located in integrated neighborhoods. They found evidence to support this hypothesis in suburbs, but not central cities. Galster and Godfrey (2005) also used these data to provide evidence of racial steering of home buyers. Zhao, Ondrich and Yinger (2006) found that the scope of discrimination and the probability that it will be encountered by a buyer diminished sharply between 1989 and 2000. It is important to note that performing a paired audit study – which inherently involves deception on the part of the auditors – is far easier and more feasible with home buyers rather than home sellers.

Geographically proximate neighborhoods can differ markedly in per capita income and ethnic and racial composition. Average home prices can also differ significantly by neighborhood. The prevailing method of compensating real estate agents and brokers involved in a housing transaction is that the seller pays a fixed percentage commission on the selling price of the home. This structure limits how real estate agents and brokers are compensated for their services. Payment for services rendered may be more closely connected to the selling price of the product than to the costs incurred in facilitating the transaction.

On both the buying and selling side of a real estate transaction, there are fixed and variable components of cost.[13] It is also the case that to a large degree costs are endogenous, i.e. agents and brokers themselves determine the level of effort and expense involved in listing and selling a particular house. The nature of costs combined with the fixed percentage commission structure means that the profitability of any transaction is likely to increase with the selling price of the house.[14] It is entirely plausible that real estate brokers and agents may be less likely to enter and serve neighborhoods where home prices are relatively low.

Given the relatively low home ownership rates among low-income and minority households, a natural question to ask is whether neighborhoods with higher proportions of low-income or minority households, where home prices may be relatively lower, are underserved by real estate middlemen. If brokers avoid neighborhoods, then a lack of competition among agents and brokers may lead to higher commissions and reduced services for residents of such neighborhoods.[15] Competitiveness in real estate brokerage has been a concern of the Antitrust Division of the U.S. Department of Justice and the Federal

[13] See the discussion in White (2006, pp. 7-8).

[14] Hsieh and Moretti (2003) analyze the market for real estate in different cities, and find that the supply of real estate agents is highly responsive to the average price of housing, which they attribute in no small part to the fixed commission rate structure. Although this conventional wisdom about commission rates may be correct, there is very little direct evidence on full commission rates. One notable exception is Woodward (2008).

[15] One limitation of our study is that we are unable to determine whether the market segmentation we observe is the result of deliberate choices by individual large brokerages not to serve certain neighborhoods, which is the essence of redlining. Rather, we are able to examine availability of brokerage services at the market level.

Trade Commission for a long time. The two agencies issued a joint report on competitiveness in the real estate industry in 2007. They cited anecdotal evidence of high concentration levels in local real estate markets as cause for concern.[16]

The general concern about competition in real estate brokerage alongside the differential rates of home ownership by income and race suggest an analysis of concentration levels by neighborhood. The structural question that we analyze is whether low-income, low-price, or high-minority neighborhoods face access issues by real estate brokers, i.e. do brokers avoid low-income and low-house-price neighborhoods because it is less profitable to do business there? If so, the lack of competition may lead to less market activity and relatively higher prices for real estate services. Similarly, do brokers as an industry discriminate against and avoid minority-dominated neighborhoods, possibly leading to lower levels of service and higher commissions for real estate services?

To answer these questions we chose six large MSA's, Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington, D.C. We gathered data that allow us to analyze the number and market shares of real estate brokers serving each zip-code neighborhood. We combined these data with Census data on income, house values, and racial composition, so that we can determine whether the supply of real estate brokerage services differs by income, house price, or racial composition in a neighborhood.

Data

We collected data from www.Realtor.com in April, 2011 for all zip codes in the Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington D.C. metropolitan statistical areas. This web site is

[16] Motivated by that and other studies that analyzed one or a handful of markets, we collected data in 2007 and 2009 on the number of brokers and market shares for 90 small, medium, and large real estate markets around the country and computed HHI's. In medium and large-sized markets we found no evidence of market concentration levels that might create problems for competition. In some of the small markets in our sample, we found HHI's in the range that would invite antitrust scrutiny under the FTC/DOJ Horizontal Merger Guidelines if two larger firms proposed to merge. We were also able to analyze the size distribution of firms in sub-markets within a larger metropolitan area, Louisville, KY, but were unable to look at sub-markets stratified by income, house prices, or racial composition.

maintained by the National Association of Realtors and allows users to search real estate listings throughout the country by city or zip code. It provides a nationally consistent source of data on local real estate markets. According to a report prepared by the GAO (2005, p. 18), approximately 95 percent of all homes listed on MLS's around the country are contained on www.Realtor.com. Since the brokerage firm listing the house is reported, we are able to record all the listings in each city at a point in time and thereby analyze local market structure. In Appendix I, we provide a comprehensive analysis of the extent to which the NAR data appear to summarize the full housing market, since other options like For Sale By Owner (FSBO) or listing exclusively on the local MLS (but not www.Realtor.com) are ignored in the subsequent analysis. The short answer is that the NAR data appear to summarize the vast majority of market activity, and this is the case not only for each of the six cities but for individual neighborhoods as well.[17]

We gathered information on all single-family homes, townhomes, and condominiums within each zip code, including the dwelling's address, city, lot size, bedrooms, bathrooms, listing broker, and unique URL link. Using a web scraping program, we attempted to collect information from 2,984 zip codes within these six MSA's; within those zip codes our program collected over 300,000 listings. Some zip codes did not contain any listings, most often because they were P.O. Boxes or unique zip codes (for example, related to a government facility). Overall, 1,884 zip codes had at least one real estate listing. The amount of real estate activity in each MSA differed substantially. For example, Atlanta had 265 real estate listings per zip code, more than three times higher than Boston's average of 85.[18]

We compiled a list of firms in each market from the core data set of 314,232 real estate listings. This was a non-trivial task, because real estate listings by the same office often have slightly different

[17] In related research we have taken steps to verify the validity of the Realtor.com data against other sources (see Beck, Scott, and Yelowitz, 2012). We compared Realtor.com data to MLS data used by the FTC/USDOJ in their 2007 Report and also found a very close connection. For example, our analysis found Des Moines, IA as a highly concentrated medium-sized market in 2007, consistent with discussion in the FTC/USDOJ report. It should be noted that we do not observe transactions, only listings.

[18] See Appendix Exhibit 1 for a complete description and breakdown of the construction of our sample.

names. Consider, for example, Keller Williams franchisees in Atlanta. According to the Keller Williams website, there are 32 offices in the Atlanta area.[19] One of the larger franchisee offices is "Keller Williams Realty Atlanta Partners". Various listings in Atlanta substitute the word "Ptnrs" or "Part" or "Part." or "Ptnr" for the word "Partners". Other listings substitute the word "Atl" or "Atl." for the word "Atlanta". Some other listings substitute "Rlty" or "Re" for the word "Realty". And a few listings use the abbreviations "KW" or "Keller Wms" for "Keller Williams". Overall, across the six MSA's, there were 18,825 unique names for offices or firms, although clearly from this example, a particular real estate brokerage firm can have multiple unique names in the data.

To create the HHI for each MSA and for each zip code, we had to perform the particularly time-intensive task of editing the firm names in defensible ways. Our first approach was to make extremely minor changes to office names, and then to treat each office as a unique firm. These minor changes included changing all lower case letters to upper case, removing extra spaces, dashes, periods, commas, slashes, explanation points, and converting obvious abbreviations (e.g. "C 21" to "CENTURY 21"). After these minor changes were made, there were a total of 16,264 firms across the six MSA's, varying from 1,767 in Boston to 5,855 in Los Angeles. To the extent that some of the individual offices identified by this process are parts of larger multi-location brokerage firms, then this "minor change" approach *understates* the HHI in the locality. Our second approach was to make "major edits", the most important of which is grouping all listings with a given franchise name and treating them as part of the same firm. For example, this approach would group the 32 Keller Williams offices in Atlanta into one firm.[20] As a consequence, this method likely *overstates* market concentration. The "major edit" approach leads to 14,922 firms across all areas, varying from 1,618 in Boston to 5,296 in Los Angeles. In this way, we are able to provide lower and upper bounds on the size distribution of firms in each given market.

[19] http://www.kw.com/kw/OfficeSearchSubmit.action?startRow=1&rows=50&city=Atlanta&stateProvId=GA&zip=

[20] As is indicated in their Uniform Franchise Offering Circulars, most real estate franchisors structure their franchise contracts so as to give legal autonomy to each franchisee, which would suggest that our first approach gives a better measure of the number of independent producers in a market than our second approach.

From the initial 1,884 zip codes with real estate listings in the MSAs, we created various geographies besides the MSA. In one specification, we restrict zip codes to those that are officially in the central city according to the U.S. Postal Service.[21] These political jurisdictions yield many fewer zip codes, as illustrated in Appendix Exhibit 1. In another specification, we rely on agent-reported city names, even if the city name is inconsistent with the official name in the zip code. This again yields many fewer zip codes.

The MSA sample of zip codes forms the starting point for much of our analysis on disparities in market structure by income, house value, or race. From the initial sample of 1,884 zip codes, we restrict the sample to the 1,361 zip codes with at least 50 or more real estate listings. By doing so, we believe that our computation of HHI will not be mechanically influenced by small sample sizes (for example, the HHI must be 10,000 if there is only one listing in a zip code, and cannot be lower than 5,000 if there are two listings). We then append data from "Census Factfinder," drawing on the 2000 Census.[22] Overall, approximately 97 percent of zip codes – or 1,321 of 1,361 – had information tabulated from the decennial Census. We chose three critical characteristics at the zip code level – median value of single-family owner-occupied homes, median family income, and percent white – from the Factfinder tool.

Empirical Results

Our goal in this paper is to divide large markets (MSA's) into neighborhoods (zip codes) where we can obtain demographic information on income, house values, population, and home ownership for 2000, merged with concentration levels from 2011, and use these data to investigate whether the market structure for real estate brokerage services is fundamentally different in low-income, low-house-price, or high-minority neighborhoods. Exhibit 1 contains HHI's computed for each of the six cities at the

[21] See http://zip4.usps.com/zip4/citytown.jsp, where the central cities are Atlanta, Boston, Chicago, Dallas, Los Angeles and Washington.
[22] See http://factfinder2.census.gov/. The zip-code data is derived from the Census Summary Tape Files.

MSA level, the city level where the listing real estate agent inputs the city, and at the city level as defined by the USPS zip code. We include HHI's where all offices are considered separately, and where all offices of each franchisor are treated as part of one firm. At the MSA level, HHI's range from 36 to 341 when all offices are considered separately and from 302 to 678 when all offices of a franchisor are combined. HHI's are slightly higher when calculated at the city level, but not appreciably. All are clearly in the range considered unconcentrated by the USDOJ and the FTC when evaluating horizontal mergers.[23]

This point is reinforced when we examine market shares of the top four brokerages in each MSA. Exhibit 2a contains this information when all offices are considered separately, and Exhibit 2b does the same when all offices of a franchisor are combined. At the MSA level, even the largest real estate broker has less than a five-percent market share in Atlanta, Boston, Dallas, and Los Angeles when each office is considered as an independent firm. In Chicago, the largest broker has 7.8 percent of the market, and in Washington, D.C. the largest broker has 16.2 percent market share. When we treat all offices of a franchisor as one firm, a slightly different picture emerges. The larger franchisors in each MSA now have market shares in the teens, although none have as much as twenty percent of the market for real estate listings in the entire MSA.

These results confirm our earlier research that indicated a lack of concentration in markets for real estate brokerage in larger urban areas.[24] Now we turn our attention to smaller sub-markets within the larger MSA's. Exhibit 3 contains summary statistics at the zip code level for each of the six MSA's in our sample. Average population per zip code area varies from 20,300 in Boston to 38,009 in Los Angeles. Boston had the fewest housing units per zip code, 8,097, and Los Angeles had the most, 13,024. Median income ranged from $58,400 in Atlanta to $77,200 in Washington, D.C. Considerable variation exists

[23] Markets are classified according to HHI into three types under the 2010 Horizontal Merger Guidelines: unconcentrated (HHI<1500), moderately concentrated (1500<HHI<2500), and highly concentrated (HHI>2500). See http://www.justice.gov/atr/public/guidelines/hmg-2010.html

[24] Beck, Scott, and Yelowitz (2012), Tables 2a and 2b.

across cities in median house value, with housing being the cheapest in Dallas (median = $124,900) and most expensive in Los Angeles (median = $286,700). The percent of the population classified as white varies from 58.1 percent in Los Angeles to 87.1 percent in Boston. Finally, the level of housing market activity varies considerably as well. In Boston there were only 113 MLS listings per zip code, which is less than one-third the level in Atlanta where there were 380 MLS listings per zip code.

Exhibit 3 also contains HHI's computed at the zip code level and averaged over the entire urban area for each of the six MSA's. Again we compute HHI's when all franchise offices are considered separately and when all offices of a franchisor are combined. Considering all franchise offices separately yields average HHI's that range from 355 in Los Angeles to 815 in Washington, D.C. Combining all offices of each franchisor and treating them as one firm yields average HHI's that range from 642 in Los Angeles to 1151 in Chicago. None of the six MSA's on average has market structures at the zip code level that even fall into the moderately concentrated level according to the 2010 Horizontal Merger Guidelines. These average HHI's also fall in the middle of the range of HHI's that we observed when we analyzed small markets (fewer than 1000 listings) in our 2012 study.[25]

We are now ready to address the main topic of this paper—are low-income, low-house-price, or high-minority neighborhoods differentially served by the real estate brokerage industry? We have ranked zip codes in each of the six MSA's by median income quartile, by median house value, and by percent of the population classified as white. Exhibit 4 contains the 25th, 50th, and 75th percentile cutoffs for median income, median house value, and fraction white in each of the six MSA's. Unsurprisingly, there is considerable variation across cities. For example, for the 172 zip codes in Atlanta, a quarter have fewer than 57.5 percent of the population white, and moving from the 25th to the 75th percentile of zip code neighborhoods results in a 30 percentage point increase in fraction white. A similar change in Boston results in a much smaller (13 percentage points) change. Moving from the 25th to the 75th

[25] Beck, Scott, and Yelowitz (2012), Table 2c.

percentile in median house value in Atlanta results in a $58k change in price, while a similar movement in Los Angeles results in a $168k change in price.

Now we examine the relationship between market concentration as measured by the HHI for real estate brokers and median income, median house price, and fraction white more rigorously. We regress HHI in each zip code neighborhood on quartile categorical variables and a city identifier. Atlanta is the excluded MSA. These results are contained in columns A, B, and C of Exhibit 5. As can be seen, market concentration increases with median income, median house price, and fraction white, and there are significant differences in concentration across MSA's.

Median income, median house price, and fraction white are obviously correlated, so we next regress zip code level HHI on all three along with a city identifier. These results are contained in column D of Exhibit 5. House price and fraction white have significant effects on the degree of market concentration in local real estate brokerage markets. Zip codes in the highest quartile of house prices are significantly more concentrated than zip codes in the lower three quartiles. Zip codes in the lowest quartile of fraction white are significantly less concentrated than zip codes in the higher three quartiles. Residents of neighborhoods with relatively lower house prices and with relatively more minorities face markets for real estate brokerage services that are less, not more, concentrated. They are served by more firms with smaller market shares.

To further enrich our analysis of the market structure of real estate brokerage, we consider the effect of local market heterogeneity on the size distribution of firms. If the housing stock in a neighborhood is relatively homogeneous, then brokerage firms may be able to take advantage of scale economies, leading to fewer and larger firms. If the housing stock in a neighborhood is heterogeneous, then brokerage firms may specialize and occupy one of the many niches in market space, leading to more and smaller firms. HHI is thus expected to be smaller the more heterogeneous the housing stock in a neighborhood.

To measure heterogeneity in the housing stock in a zip-code neighborhood we calculate the standard deviation of list prices of houses advertised for sale on Realtor.com. Greater variation in list prices suggests greater variation in square footage, lot sizes, quality of construction, and various other characteristics and amenities associated with each house in the neighborhood. We include the standard deviation of list price in our HHI regression model, and these results are contained in column E. We also include mean list price in the regression.

Greater heterogeneity in the housing stock, as measured by the standard deviation of list prices, is associated with less concentration on the supply side of real estate brokerage markets. In neighborhoods where there is greater variety among houses, there tend to be more brokers with smaller market shares than in neighborhoods where the housing stock is more homogeneous. This relationship is statistically significant and robust to different specifications of the measure of heterogeneity.[26] Another interesting result of this regression is that the fraction white is still statistically significant. The estimated HHI is considerably smaller in the lowest quartile of fraction-white neighborhoods than in the three upper quartiles. High-minority neighborhoods are apparently served by more brokers with smaller market shares than relatively whiter neighborhoods, which perhaps suggests some specialization of real estate brokers by race.

To further explore the supply of brokerage services in different neighborhoods, we identify the market leaders and their market shares in the bottom and top quartiles of income, house price, and fraction white in each of the six MSA's. These results are contained in Exhibit 6, which lists the market shares of the top eight brokers in the lowest and highest income, house-price, and fraction-white quartiles.

[26] Column F regresses HHI on the ratio of the 90th percentile list price to the 10th percentile list price in the zip code, along with median list price and the full set of other variables. As can be seen, the results are relatively unchanged from Column E.

Market leaders in the bottom and top quartiles of income, house price, and fraction white are generally the same brokers. Some differences, however, do appear. For example, in Atlanta, Harry Norman Realtors was the third largest broker with a 10.0 percent market share in the top quartile of zip codes ranked by house price, but was the seventh largest broker in the lowest house-price quartile with only a 1.9 percent market share. Metro Brokers was a market leader in the lowest quartile of zip codes ranked by house price with a market share of 5.7 percent, but they do not appear among the top eight brokers in the highest house-price quartile.

Several of the larger brokers in Boston appear to specialize in sub-markets. Coldwell Banker has a 25.2 percent market share in the highest house-price quartile, but only a 6.9 percent market share in the lowest house-price quartile. When zip codes are ranked by fraction white, Coldwell Banker has a 15.5 percent market share in the bottom quartile and a 7.4 percent market share in the top quartile. While Coldwell Banker seems to specialize in high-income, high-house-price, racially mixed neighborhoods in Boston, RE/MAX International seems to take the opposite approach. RE/MAX is the market leader in the lowest income and house-price quartile zip codes and in the highest fraction-white zip codes. Hammond Residential Real Estate pursues a similar strategy. They are among the top eight in the highest income and house-price and lowest fraction-white quartiles, but do not appear among the top eight in the lowest income and house-price and highest fraction-white quartiles.[27]

In Chicago market leader RE/MAX is relatively more specialized in high-income and high-fraction-white zip codes relative to low-income and low-fraction-white zip codes. RE/MAX has roughly the same market share, however, in zip codes ranked according to house price. Second-ranked Coldwell Banker also is relatively more specialized in high-income and high-fraction-white zip codes, but is even more specialized in high-house-price zip codes relative to low-house-price zip codes. Several independent brokers have significant market shares in particular market niches. @Properties is the

[27] Boston is the only one of the six MSA's where median house price and fraction white are negatively correlated.

fourth largest broker in low-income zip codes and the third largest broker in low-fraction-white neighborhoods. Baird and Warner is the third largest broker in zip codes ranked by income and by house price.

An interesting pattern emerges from closer scrutiny of individual broker market shares in Dallas. Market leader Keller-Williams and Ebby Halliday Realtors both specialize (relatively) in high-income and high-house-price neighborhoods. Century 21 ranks first and second in low-house-price and low-income neighborhoods, but is much lower ranked in high-house-price and high-income neighborhoods. When neighborhoods are ranked by fraction white, however, no specialization patterns are evident.

Los Angeles is characterized by the highest correlation between fraction white and house price and income among the six MSA's. Century 21 has the largest market share in low-income, low-house-price, and low-fraction-white zip codes, but is sixth, seventh, and sixth, respectively, in high-income, high-house-price, and high-fraction-white zip codes. Coldwell Banker exhibits the reverse of that pattern, with the leading market share in high-income, high-house-price, and high-fraction-white zip codes. RE/MAX is the third-ranked broker city-wide by overall market share. Its market presence, however, is evenly spread across zip codes as ranked by income, house price, and fraction white.

In Washington, D.C. the two overall market leaders are Long & Foster and RE/MAX. Long & Foster seems to specialize in high-income and high-house-price zip codes, while RE/MAX shows no such tendency. Weichert Real Estate Associates is fourth-ranked overall in the D.C. market. It has roughly double the market representation in high-income, high-house-price, and high-fraction-white zip codes as in low-income, low-house-price, and low-fraction-white zip codes. Third-ranked Keller-Williams is spread evenly over the MSA when zip codes are sorted by income, house price, and fraction white.

In summary, the analysis of Exhibit 6 certainly suggests that firms specialize in different parts of the housing market; nonetheless, there is no evidence to suggest that this specialization leads to differential availability of brokerage services. It may be that the services offered by brokers serving low-

income, low-house-price, or low-fraction-white neighborhoods falls short of those offered by brokers in other neighborhoods, but such differences would arise naturally if different clients demand different types and levels of services.

Summary and Conclusions

Real estate brokers often specialize in local sub-markets within larger urban markets, especially since geographically proximate neighborhoods can differ nontrivially by income levels, house prices, racial composition, and other attributes. Real estate agents and brokers are typically compensated based upon the selling price of the home. The nature of agents' and brokers' costs is such that the profitability of any real estate transaction is likely to increase with the selling price of the house.

The question naturally arises whether low-income neighborhoods or neighborhoods where house prices are low are as well served by real estate professionals as higher income or higher price neighborhoods. If so, this might partially explain the income gap in home ownership. A related question is whether neighborhoods with high-minority populations are differentially served by brokers, which might partially explain the racial gap in home ownership. Poor service by real estate professionals might also affect property appreciation in minority neighborhoods, which in turn could have important implications for the wealth gap by race.[28]

To answer these questions we gather data for six large metropolitan areas: Atlanta, Boston, Chicago, Dallas, Los Angeles, and Washington, D.C. We collected information on income, house values, racial composition, and home ownership at the zip code level from the 2000 Census. We combined these data with information that we collected from Realtor.com in 2011 on real estate listings by broker

[28] Herbert and Belsky (2008, p. 30-31) argue that the literature on differential housing appreciation rates is thin and it is difficult to draw general conclusions. One study – Kim (2000) – did find lower appreciation rates for minorities in Milwaukee, WI, neighborhoods.

for each zip-code neighborhood, which we used to calculate HHI's and market shares for individual real estate brokers.

To understand the relationship between market concentration and income, house price, and fraction white, we regress HHI on median income, median house price, and fraction white in each zip code neighborhood. We also include in the regression analysis a measure of the heterogeneity in the housing stock in each zip code, the standard deviation in list prices, as well as mean list price. We find that in neighborhoods where there is greater variety among houses, there tend to be more brokers with smaller market shares than in neighborhoods where the housing stock is more homogeneous. Estimated HHI is considerably smaller in the lowest quartile of fraction-white neighborhoods than in the upper three quartiles. High-minority neighborhoods are apparently served by more brokers with smaller market shares than relatively whiter neighborhoods. Market concentration also increases with average list price, indicating that high-house-price neighborhoods tend to be served by fewer but larger real estate brokers.

Finally, we analyzed market shares of individual brokers in each MSA in the lowest and highest quartiles of zip code neighborhoods ranked by median income, median house price, and fraction white. The general pattern is that market leaders in one segment tend to be market leaders in other segments, however, there are numerous examples of brokers specializing in particular market segments.

It is important to note that our investigation of access to real estate brokerage across neighborhoods only scratches the surface of what is surely a more complicated picture. D'Rozario and Williams (2005) note that retail redlining can fall into eight categories, only one of which is refusing service to all customers in certain areas. We cannot observe the quality of brokerage services, and it is possible that smaller firms serving the minority/low-price/low-income neighborhoods provide lower quality service than some of the market leaders who do not have a presence there. We also do not analyze the commission rate structure across neighborhoods. Getting full commission rates (that is, of

both the listing and selling agent) is very difficult, because as Zumpano and Hooks (1988) point out, in 1980 the NAR adopted policies to prohibit publishing the total commission on MLS listings. Although Hsieh and Moretti (2003) present full commission rates for a number of cities, the commissions were drawn from the late 1970s, before the NAR policy was in effect. With the notable exception of Woodward (2008), no recent study has presented the distribution of full commission rates. Given the difficulties in measuring quality and commission rates, our data scraping method which allows us to learn about access to real estate brokerage is an appropriate first step. Future studies that measure either of these two dimensions will enhance the understanding of redlining in real estate brokerage.

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Exhibit 1

HHI's by different geographic levels and brokerage definitions

	Atlanta	Boston	Chicago	Dallas	Los Angeles	Washington DC
MSA Level						
HHI - All Offices Considered Separate	120	36	122	107	52	341
HHI - All Franchise Offices Combined	512	418	677	622	302	678
Sample Size	67,426	19,783	85,825	34,782	52,037	32,986
City Level (Realtor Defined)						
HHI - All Offices Considered Separate	233	142	249	184	46	562
HHI - All Franchise Offices Combined	633	393	414	460	340	773
Sample Size	13,441	2,269	18,531	6,494	5,363	2,878
City Level (USPS Zip Codes)						
HHI - All Offices Considered Separate	224	144	228	259	46	560
HHI - All Franchise Offices Combined	620	396	408	498	366	772
Sample Size	15,142	2,255	19,850	6,113	6,126	2,881

Notes: Sample size refers to the number of MLS listings used to compute the HHI. All data obtained from Realtor.com in April 2011. The zip codes used to define MSAs come from http://www.census.gov/population/www/metroareas/metroarea.html . MSAs include both the central city and other cities that are part of the same labor market. In the Atlanta MSA, the cities with the most listings were: Atlanta, Marietta, Lawrenceville, Decatur, Cumming, Alpharetta, Smyrna, Kennesaw, Douglasville, and Acworth. In the Boston MSA, the cities with the most listings were: Boston, Plymouth, Newton, Quincy, Cambridge, Brockton, Lowell, Rochester, Manchester, and Haverhill. In the Chicago MSA, the cities with the most listings were: Chicago, Aurora, Naperville, Elgin, Joliet, Plainfield, Palatine, Des Plaines, Evanston, and Arlington Heights. In the Dallas MSA, the cities with the most listings were: Dallas, Fort Worth, Arlington, Plano, Mckinney, Frisco, Garland, Irving, Carrollton, and Denton. In the Los Angeles MSA, the cities with the most listings were: Los Angeles, Long Beach, Lancaster, Irvine, Palmdale, Santa Ana, Anaheim, Huntington Beach, Whittier, and Orange. In the Washington DC MSA, the leading cities were: Washington, Alexandria, Silver Spring, Woodbridge, Fredericksburg, Arlington, Frederick, Hyattsville, Upper Marlboro and Bowie. The city-level definitions include only listings in the city proper, not adjoining areas.

Exhibit 2a

Top Four Brokerages by MSA: HHI - All Offices Considered Separate

Atlanta		Boston		Chicago	
Firm Name	Market Share	Firm Name	Market Share	Firm Name	Market Share
Harry Norman Realtors	4.5%	Keller Williams Realty	2.5%	Coldwell Banker Residential	7.8%
Prudential Georgia Realty	4.3%	Re/Max Prestige	1.8%	Baird & Warner	3.7%
Better Homes & Gardens Real Estate Metro Brokers	4.1%	William Raveis Real Estate & Home Services	1.7%	@Properties	2.6%
Coldwell Banker Residential Br	4.1%	Century 21 Commonwealth	1.2%	Koenig & Strey Real Living	2.5%
Dallas		**Los Angeles**		**Washington DC**	
Firm Name	Market Share	Firm Name	Market Share	Firm Name	Market Share
Keller Williams Realty	4.9%	Prudential California Realty	4.8%	Long & Foster Real Estate Inc	16.2%
Ebby Halliday Realtors	4.7%	First Team Real Estate	3.0%	Weichert Realtors	4.5%
Coldwell Banker Residential	3.5%	Keller Williams Realty	1.8%	Coldwell Banker Residential Brokerage	3.1%
Coldwell Banker APEX	2.4%	Coldwell Banker	1.7%	Keller Williams Realty	3.1%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Exhibit 2b

Top Four Brokerages by MSA - HHI - All Franchise Offices Combined

Atlanta		Boston		Chicago	
Firm Name	Market Share	Firm Name	Market Share	Firm Name	Market Share
Keller-Williams	15.0%	Coldwell Banker	12.7%	Re/Max	18.8%
Re/Max	11.8%	Re/Max	10.9%	Coldwell Banker	13.5%
Coldwell Banker	7.0%	Century 21	7.4%	Century 21	8.0%
Prudential	5.5%	Keller-Williams	5.6%	Prudential	4.8%
Dallas		**Los Angeles**		**Washington DC**	
Firm Name	Market Share	Firm Name	Market Share	Firm Name	Market Share
Keller-Williams	16.1%	Coldwell Banker	8.4%	Long & Foster	17.2%
Re/Max	12.1%	Century 21	7.6%	Re/Max	15.9%
Coldwell Banker	8.5%	Re/Max	7.4%	Keller-Williams	6.7%
Ebby Halliday Realtors	8.0%	Prudential	7.3%	Weichert	4.6%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Exhibit 3

Zip Code Level Summary Statistics

	All MSAs	Atlanta MSA	Boston MSA	Chicago MSA	Dallas MSA	Los Angeles MSA	Washington DC MSA
Population	28216	25369	20300	28959	25395	38009	23077
	(18429)	(14334)	(12472)	(21962)	(15018)	(19525)	(13478)
Housing Units	10570	9853	8097	11023	10013	13024	9119
	(6496)	(5398)	(5113)	(8316)	(5996)	(5613)	(5456)
Median Income (in $1000s)	65.9	58.4	71.4	67.6	60.7	61.4	77.2
	(25.6)	(21.3)	(24.3)	(25.2)	(22.8)	(27.6)	(25.3)
Median House Value (in $1000s)	205.1	142.3	242.7	184.8	124.9	286.7	205.7
	(135.4)	(77.1)	(146.7)	(114.1)	(77.4)	(170.3)	(91.1)
Percent White (%)	70.4	67.6	87.1	76.1	75.2	58.1	66.0
	(24.4)	(26.3)	(14.8)	(25.3)	(18.0)	(21.8)	(25.3)
MLS Listings	207	380	113	258	175	160	154
	(156)	(225)	(66)	(162)	(111)	(88)	(86)
HHI All Franchise Offices Considered Separate	597	473	794	668	593	355	815
	(417)	(347)	(443)	(440)	(352)	(234)	(465)
HHI All Franchise Offices Combined	971	824	1138	1151	1062	642	1115
	(481)	(360)	(528)	(477)	(417)	(312)	(515)
Sample Size	1321	172	157	310	176	308	198

Notes: Zip codes restricted to those with 50+ MLS listings on Realtor.com and where the zip code could be merged to Census Factfinder data from 2000. MLS listings gathered between April 11-13, 2011. Standard deviations in parentheses. The HHI measures and listings are computed in 2011, while the population, housing, income, house value and race statistics are computed from the 2000 Census.

Exhibit 4

Descriptive Statistics (Unit of observation is Zip Code)

	Atlanta MSA	Boston MSA	Chicago MSA	Dallas MSA	Los Angeles MSA	Washington DC MSA
25th Percentile of Median Family Income	$45,394	$55,601	$53,631	$45,328	$41,175	$60,284
50th Percentile of Median Family Income	$54,829	$67,004	$64,631	$56,980	$55,994	$74,539
75th Percentile of Median Family Income	$69,463	$82,072	$76,594	$71,482	$75,940	$92,091
25th Percentile of Median House Value	$97,550	$162,400	$124,100	$77,600	$174,650	$143,200
50th Percentile of Median House Value	$117,050	$196,500	$162,250	$105,100	$233,900	$182,250
75th Percentile of Median House Value	$155,650	$262,400	$208,400	$152,650	$343,250	$234,300
25th Percentile of Fraction White	57.5%	83.8%	67.3%	66.9%	42.0%	52.9%
50th Percentile of Fraction White	76.5%	93.6%	86.2%	80.4%	59.6%	73.0%
75th Percentile of Fraction White	87.1%	96.9%	93.8%	88.8%	76.8%	84.5%
Mean List Price	$226,666	$474,792	$275,020	$271,962	$663,908	$449,861
Median List Price	$169,779	$384,918	$221,578	$199,802	$506,807	$383,212
Sample Size	172	157	310	176	308	198

Notes: Zip codes restricted to those with 50+ MLS listings on Realtor.com and where the zip code could be merged to Census Factfinder data from 2000. Quartiles are within MSA.

Exhibit 5

Regression Results on HHI (Unit of observation is Zip Code)

	A	B	C	D	E	F
2nd Income Quartile	85.5			-30.9	-30.2	-44
	(32.3)			(37.1)	(36.2)	(36.2)
3rd Income Quartile	151.6			-29.8	-29.6	-45.9
	(32.3)			(42.8)	(41.8)	(41.9)
4th Income Quartile	353.9			57.6	13.6	-19.6
	(32.3)			(49.9)	(49.1)	(49.4)
2nd House Price Quartile		31.6		-19.6	-39.9	-49.9
		(32.5)		(35.8)	(35)	(34.8)
3rd House Price Quartile		128.8		3.6	-32.5	-46.4
		(32.5)		(40)	(39.4)	(39.1)
4th House Price Quartile		311.2		137.3	15	-8
		(32.5)		(45.9)	(47.2)	(47.5)
2nd Race Quartile			221.3	208.4	205.4	199.7
			(31.6)	(34.1)	(33.3)	(33)
3rd Race Quartile			343.2	302.8	301.1	293.6
			(31.5)	(36)	(35.1)	(34.8)
4th Race Quartile			414.5	368.7	327.3	318.8
			(31.6)	(35.7)	(35.3)	(35)
Boston	314.8	314.6	315.4	315.5	231.9	167.4
	(45.8)	(46.2)	(44.8)	(43.8)	(44.4)	(46.6)
Chicago	327.3	327.2	327.3	327.6	307.1	279.4
	(39.5)	(39.8)	(38.6)	(37.8)	(37)	(37.7)
Dallas	238.1	238.1	238.1	238.1	224.9	206
	(44.5)	(44.8)	(43.5)	(42.6)	(41.6)	(41.8)
Los Angeles	-181.8	-181.8	-181.8	-181.8	-313.3	-397.2
	(39.5)	(39.8)	(38.6)	(37.8)	(40.6)	(44.7)
Washington DC	291.7	291.7	291.8	292	213.5	144.9
	(43.3)	(43.6)	(42.3)	(41.4)	(42.1)	(44.4)
SD of List Price (/1000)					-0.1033	
					(0.0380)	
Mean List Price (/1000)					0.3825	
					(0.0621)	
90/10 Ratio of List Price						-10.3
						(4.2)
Median List Price (/1000)						0.5556
						(0.0583)
Constant Term	676.5	706.3	579.5	574.7	578.9	649.2
	(37.3)	(37.6)	(36.5)	(38.6)	(37.6)	(47.5)

Notes: Standard errors are in parentheses. Zip codes restricted to those with 50+ MLS listings on Realtor.com and where the zip code could be merged to Census Factfinder data from 2000. Quartiles are within MSA. Sample size is 1321 zip codes in each regression.

Exhibit 6a – Market Leaders By MSA – Lowest Quartile vs. Highest Quartile – Atlanta MSA

Lowest Income Quartile		Highest Income Quartile	
Firm Name	Market Share	Firm Name	Market Share
Keller-Williams Realty Inc.	14.9%	Keller-Williams Realty Inc.	16.8%
RE/MAX International	10.3%	RE/MAX International	11.3%
Coldwell Banker Real Estate Corp.	5.7%	Harry Norman Realtors at CCOS	8.9%
Better Homes & Gardens Metro	5.3%	Coldwell Banker RE Corp.	8.7%
Solid Source Realty GA LLC	4.2%	Prudential Real Estate	7.5%
Prudential Real Estate	3.0%	Solid Source Realty GA LLC	3.1%
Harry Norman Realtors at CCOS	2.3%	Better Homes & Gardens Metro	2.7%
Century 21 Real Estate LLC	1.8%	Duffy Realty	2.5%
Lowest House-Price Quartile		**Highest House-Price Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Keller-Williams Realty Inc.	13.6%	Keller-Williams Realty Inc.	17.1%
RE/MAX International	11.6%	RE/MAX International	10.8%
Better Homes & Gardens Metro	5.7%	Harry Norman Realtors at CCOS	10.0%
Coldwell Banker Real Estate Corp.	4.7%	Coldwell Banker RE Corp.	9.4%
Solid Source Realty GA LLC	4.2%	Prudential Real Estate	7.2%
Prudential Real Estate	2.8%	Solid Source Realty GA LLC	3.1%
Harry Norman Realtors at CCOS	1.9%	Duffy Realty	2.5%
Southern REO Associates LLC	1.7%	Sotheby's International Realty	2.5%
Lowest Race (%White) Quartile		**Highest Race (%White) Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Keller-Williams Realty Inc.	15.2%	Keller-Williams Realty Inc.	15.0%
RE/MAX International	8.4%	RE/MAX International	12.6%
Solid Source Realty GA LLC	6.3%	Prudential Real Estate	7.2%
Better Homes & Gardens Metro	6.3%	Coldwell Banker RE Corp.	6.1%
Coldwell Banker Real Estate Corp.	4.7%	Harry Norman Realtors at CCOS	5.6%
Prudential Real Estate	2.9%	Better Homes & Gardens Metro	3.7%
Harry Norman Realtors at CCOS	2.4%	Solid Source Realty GA LLC	3.3%
Southern REO Associates LLC	1.8%	Duffy Realty	2.0%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Exhibit 6b – Market Leaders By MSA – Lowest Quartile vs. Highest Quartile – Boston MSA

Lowest Income Quartile		Highest Income Quartile	
Firm Name	Market Share	Firm Name	Market Share
RE/MAX International	10.7%	Coldwell Banker Real Estate Corp.	23.8%
Coldwell Banker Real Estate Corp.	9.3%	RE/MAX International	7.8%
Century 21 Real Estate LLC	7.4%	Century 21 Real Estate LLC	5.8%
Keller-Williams Realty Inc.	6.4%	Prudential Real Estate	5.8%
Prudential Real Estate	3.4%	Hammond Residential Real Estate	5.2%
Sotheby's International Realty	2.2%	Keller-Williams Realty Inc.	3.7%
BHG Masiello	1.7%	William Raveis RE & Home Services	3.6%
William Raveis RE & Home Services	1.7%	Sotheby's International Realty	3.3%
Lowest House-Price Quartile		**Highest House-Price Quartile**	
Firm Name	Market Share	Firm Name	Market Share
RE/MAX International	13.8%	Coldwell Banker Real Estate Corp.	25.2%
Keller-Williams Realty Inc.	7.0%	RE/MAX International	7.0%
Coldwell Banker Real Estate Corp.	6.9%	Hammond Residential Real Estate	6.3%
Century 21 Real Estate LLC	6.8%	Century 21 Real Estate LLC	5.3%
Prudential Real Estate	6.7%	Sotheby's International Realty	4.6%
Coco, Early & Associates			
The Olivares and Molina D's	4.0%	Prudential Real Estate	4.3%
BHG Masiello	3.1%	Keller-Williams Realty Inc.	4.3%
Bean Group	1.5%	William Raveis RE & Home Services	3.5%
Lowest Race (%White) Quartile		**Highest Race (%White) Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Coldwell Banker Real Estate Corp.	15.5%	RE/MAX International	10.7%
RE/MAX International	7.2%	Coldwell Banker Real Estate Corp.	7.4%
Century 21 Real Estate LLC	7.1%	Prudential Real Estate	6.3%
Keller-Williams Realty Inc.	5.2%	Keller-Williams Realty Inc.	6.2%
Hammond Residential Real Estate	4.4%	Century 21 Real Estate LLC	4.4%
		Coco, Early & Associates	
Sotheby's International Realty Affiliates Inc.	3.6%	The Olivares and Molina D's	3.8%
Prudential Real Estate	2.6%	BHG Masiello	3.5%
William Raveis Real Estate & Home Services	1.7%	The Gove Group Real Estate LLC	2.4%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Exhibit 6c – Market Leaders By MSA – Lowest Quartile vs. Highest Quartile – Chicago MSA

Lowest Income Quartile		Highest Income Quartile	
Firm Name	Market Share	Firm Name	Market Share
RE/MAX International	12.7%	RE/MAX International	18.8%
Coldwell Banker Real Estate Corp.	9.7%	Coldwell Banker Real Estate Corp.	17.1%
Century 21 Real Estate LLC	7.9%	Baird & Warner	7.5%
@PROPERTIES	5.0%	Prudential Real Estate	6.9%
Prudential Real Estate	3.5%	Koenig & Strey GMAC Real Estate	5.1%
Keller-Williams Realty Inc.	3.2%	Century 21 Real Estate LLC	4.7%
Baird & Warner	2.8%	Keller-Williams Realty Inc.	3.8%
McColly Real Estate Corporate	2.1%	@PROPERTIES	3.4%
Lowest House-Price Quartile		**Highest House-Price Quartile**	
Firm Name	Market Share	Firm Name	Market Share
RE/MAX International	15.6%	Coldwell Banker Real Estate Corp.	16.5%
Coldwell Banker Real Estate Corp.	9.7%	RE/MAX International	14.8%
Century 21 Real Estate LLC	9.4%	Baird & Warner	7.5%
McColly Real Estate Corporate	3.7%	Prudential Real Estate	7.4%
Keller-Williams Realty Inc.	2.6%	Koenig & Strey GMAC Real Estate	5.9%
Prudential Real Estate	2.4%	@PROPERTIES	5.8%
Baird & Warner	2.0%	Century 21 Real Estate LLC	4.8%
Realty Executives International	1.6%	Keller-Williams Realty Inc.	3.8%
Lowest Race (%White) Quartile		**Highest Race (%White) Quartile**	
Firm Name	Market Share	Firm Name	Market Share
RE/MAX International	12.2%	RE/MAX International	19.0%
Coldwell Banker Real Estate Corp.	11.1%	Coldwell Banker Real Estate Corp.	15.1%
@PROPERTIES	6.1%	Century 21 Real Estate LLC	12.3%
Century 21 Real Estate LLC	6.0%	Prudential Real Estate	4.4%
Prudential Real Estate	4.1%	McColly Real Estate Corporate	4.3%
Baird & Warner	4.0%	Baird & Warner	3.3%
Keller-Williams Realty Inc.	3.7%	Keller-Williams Realty Inc.	3.3%
Koenig & Strey GMAC Real Estate	2.4%	Realty Executives International	2.4%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Exhibit 6d – Market Leaders By MSA – Lowest Quartile vs. Highest Quartile – Dallas MSA

Lowest Income Quartile		Highest Income Quartile	
Firm Name	Market Share	Firm Name	Market Share
Keller-Williams Realty Inc.	11.5%	Keller-Williams Realty Inc.	20.3%
Century 21 Real Estate LLC	10.0%	RE/MAX International	13.7%
RE/MAX International	9.0%	Ebby Halliday Realtors	12.3%
Coldwell Banker Real Estate Corp.	6.8%	Coldwell Banker Real Estate Corp.	8.8%
Ebby Halliday Realtors	5.1%	Century 21 Real Estate LLC	3.3%
Williams Trew Real Estate Services	3.2%	Prudential Real Estate	2.2%
Virginia Cook Realtors	2.4%	Allie Beth Allman & Assoc.	2.1%
Allie Beth Allman & Assoc.	2.4%	Virginia Cook Realtors	1.9%
Lowest House-Price Quartile		**Highest House-Price Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Century 21 Real Estate LLC	14.3%	Keller-Williams Realty Inc.	18.1%
Keller-Williams Realty Inc.	11.5%	RE/MAX International	12.2%
RE/MAX International	10.5%	Ebby Halliday Realtors	12.0%
Coldwell Banker Real Estate Corp.	8.5%	Coldwell Banker Real Estate Corp.	8.2%
Ebby Halliday Realtors	3.5%	Allie Beth Allman & Assoc.	3.8%
Johnson Monroe Realtors	1.7%	Century 21 Real Estate LLC	3.2%
Prudential Real Estate	1.6%	Dave Perry Miller & Associates	2.7%
Williams Trew Real Estate Services	1.4%	Virginia Cook Realtors	2.5%
Lowest Race (%White) Quartile		**Highest Race (%White) Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Keller-Williams Realty Inc.	12.0%	Keller-Williams Realty Inc.	16.9%
RE/MAX International	10.6%	RE/MAX International	11.1%
Century 21 Real Estate LLC	8.9%	Coldwell Banker Real Estate Corp.	9.4%
Coldwell Banker Real Estate Corp.	7.1%	Century 21 Real Estate LLC	7.8%
Ebby Halliday Realtors	6.6%	Ebby Halliday Realtors	6.9%
Allie Beth Allman & Assoc.	2.8%	Prudential Real Estate	2.4%
Dave Perry Miller & Associates	2.6%	Allie Beth Allman & Assoc.	1.7%
Briggs Freeman Real Estate	2.1%	HomesUSA	1.5%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Exhibit 6e – Market Leaders By MSA – Lowest Quartile vs. Highest Quartile – Los Angeles MSA

Lowest Income Quartile		Highest Income Quartile	
Firm Name	Market Share	Firm Name	Market Share
Century 21 Real Estate LLC	10.3%	Coldwell Banker Real Estate Corp.	12.3%
Keller-Williams Realty Inc.	6.8%	Prudential Real Estate	9.8%
RE/MAX International	6.0%	RE/MAX International	8.1%
Prudential Real Estate	5.9%	Keller-Williams Realty Inc.	5.8%
Coldwell Banker Real Estate Corp.	5.1%	First Team Real Estate	5.7%
Pinacle Estate Properties Inc.	1.5%	Century 21 Real Estate LLC	3.9%
First Team Real Estate	1.1%	Sotheby's International Realty Affiliates Inc.	2.4%
Rodeo Realty Inc.	0.9%	Realty Executives International	1.6%
Lowest House-Price Quartile		**Highest House-Price Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Century 21 Real Estate LLC	11.8%	Coldwell Banker Real Estate Corp.	15.2%
Keller-Williams Realty Inc.	6.8%	Prudential Real Estate	10.3%
RE/MAX International	6.3%	Keller-Williams Realty Inc.	7.0%
Prudential Real Estate	5.7%	RE/MAX International	6.4%
Coldwell Banker Real Estate Corp.	5.0%	First Team Real Estate	4.3%
Pinacle Estate Properties Inc.	1.5%	Sotheby's International Realty Affiliates Inc.	3.6%
Realty Executives International	1.2%	Century 21 Real Estate LLC	2.7%
First Team Real Estate	1.1%	Rodeo Realty Inc.	2.3%
Lowest Race (%White) Quartile		**Highest Race (%White) Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Century 21 Real Estate LLC	12.0%	Coldwell Banker Real Estate Corp.	12.4%
RE/MAX International	6.7%	Prudential Real Estate	10.6%
Prudential Real Estate	5.7%	Keller-Williams Realty Inc.	6.9%
Coldwell Banker Real Estate Corp.	5.2%	RE/MAX International	6.6%
Keller-Williams Realty Inc.	4.9%	First Team Real Estate	5.1%
First Team Real Estate	1.5%	Century 21 Real Estate LLC	3.7%
Realty Executives International	0.9%	Sotheby's International Realty Affiliates Inc.	2.7%
ERA	0.8%	Rodeo Realty Inc.	2.5%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Exhibit 6f – Market Leaders By MSA – Lowest Quartile vs. Highest Quartile – Washington DC MSA

Lowest Income Quartile		Highest Income Quartile	
Firm Name	Market Share	Firm Name	Market Share
Long & Foster Real Estate Inc.	14.3%	Long & Foster Real Estate Inc.	24.4%
RE/MAX International	13.7%	RE/MAX International	14.6%
Keller-Williams Realty Inc.	6.5%	Keller-Williams Realty Inc.	6.7%
Century 21 Real Estate LLC	5.5%	Weichert Real Estate Affiliates Inc.	6.6%
Coldwell Banker Real Estate Corp.	4.6%	Coldwell Banker Real Estate Corp.	4.8%
Weichert Real Estate Affiliates Inc.	3.7%	Washington Fine Properties LLC	3.5%
Fairfax Realty Inc.	3.7%	McEnearney Associates Inc.	3.0%
Exit Realty Corp. International	2.7%	Century 21 Real Estate LLC	2.3%
Lowest House-Price Quartile		**Highest House-Price Quartile**	
Firm Name	Market Share	Firm Name	Market Share
RE/MAX International	14.6%	Long & Foster Real Estate Inc.	25.1%
Long & Foster Real Estate Inc.	12.8%	RE/MAX International	12.7%
Keller-Williams Realty Inc.	7.1%	Keller-Williams Realty Inc.	6.2%
Century 21 Real Estate LLC	6.4%	Weichert Real Estate Affiliates Inc.	6.2%
Coldwell Banker Real Estate Corp.	4.7%	Coldwell Banker Real Estate Corp.	5.7%
Weichert Real Estate Affiliates Inc.	3.6%	Washington Fine Properties LLC	4.1%
Fairfax Realty Inc.	3.5%	McEnearney Associates Inc.	3.6%
Exit Realty Corp. International	2.7%	Sotheby's International Realty Affiliates Inc.	3.1%
Lowest Race (%White) Quartile		**Highest Race (%White) Quartile**	
Firm Name	Market Share	Firm Name	Market Share
Long & Foster Real Estate Inc.	16.6%	RE/MAX International	18.8%
RE/MAX International	13.2%	Long & Foster Real Estate Inc.	15.8%
Keller-Williams Realty Inc.	6.4%	Keller-Williams Realty Inc.	6.2%
Fairfax Realty Inc.	5.0%	Weichert Real Estate Affiliates Inc.	6.0%
Coldwell Banker Real Estate Corp.	4.1%	Century 21 Real Estate LLC	5.7%
Exit Realty Corp. International	4.0%	Coldwell Banker Real Estate Corp.	4.2%
Weichert Real Estate Affiliates Inc.	3.6%	ERA	1.9%
Century 21 Real Estate LLC	3.6%	Real Estate Teams LLC	1.6%

Notes: Sample sizes are the same as for the MSA sample in Exhibit 1.

Appendix I: Do the NAR data provide a complete picture of the housing market?

One important concern is the extent to which scraping data from www.Realtor.com provides a full characterization of local housing market conditions. The two key concerns are that For Sale By Owner (FSBO) listings could serve as an important and cheaper alternative to listing with a broker and that some brokers may put their listings on a local MLS but not on the NAR's website.

We are aware of three recent studies that have analyzed FSBO activity. First, the National Association of Realtors (2011) has found that FSBO activity ranged from 9-14 percent over the past decade, with a dramatic reduction in FSBO activity during the latter half of the decade. For example, they report that FSBO activity in 2011 – the period when our sample was collected – was 10 percent. Their study also shows that in 37 percent of these FSBO transactions, the seller knew the buyer (NAR, 2011, Exhibit 6-26). Second, Woodward (2008, p. 107) analyzed HUD-1 statements from 2001 and found a higher percentage of homes sold by FSBO than did the NAR study, even for the same time period. 18.5 percent of the home transactions in her sample had no line items related to brokerage commissions, and it is unlikely that these brokerage fees would have been hidden in another line item.[29] She notes that this percentage compares with a rate of 13 percent for 2001 from the NAR, and attributes the difference to the composition of the sample. She uses FHA data that focus on less-valuable homes which are more likely to be sold by their owners without assistance from a real estate agent. The data used in her analysis drew approximately equal numbers of loans from each state, and the 18.5 percent figure is not weighted for differences in the underlying availability of homes in each state. Thus it is difficult to compare her figure with the NAR's. Finally, Hendel, Nevo, and Ortalo-Magné (2009) examine FSBO activity in Madison, Wisconsin. They find that the share of listings that are FSBO is roughly 21 percent.

Overall, none of these studies sheds much light on our sample. First, the overall FSBO percentages from the NAR are much higher in the earlier part of the decade, when the housing market was healthier. They are also national numbers and include both FSBO sales that are between related parties and those between unrelated parties. Since virtually all MLS transactions will be between unrelated parties, the NAR statistics will overstate the importance of FSBO activity on arm's length transactions. Second, the fact that Woodward's (2008) analysis also focuses on the early part of the decade and on a narrow segment of transactions (FHA loans, rather than conventional or jumbo loans) also calls into question the ability to extrapolate the findings to our sample. Finally, in a longer working paper that preceded the publication of Hendel, Nevo, and Ortalo-Magné (2009), the authors clearly acknowledge that their data come from a single city, and they do not know how representative their results are of other markets. They note that Madison, WI is unique in a number of respects (being a college town and a state capital), and that it is a mid-sized city, which is clearly different from the six large cities in our study.

To further analyze the importance of FSBOs, we have investigated the-for-sale-by-owner market extensively to see what percentage of residential real estate transactions do not involve a real estate professional and thus fall outside the coverage of our Realtor.com data. We discuss the steps

[29] Email correspondence with Dr. Woodward, August 29, 2012.

extensively below, and conclude that, at most, FSBO transactions account for slightly more than 10 percent of housing transactions.

First, it should be noted that NAR (2011) finds that only 10 percent of transactions were FSBO in 2011, but many of those were where the seller knew the buyer prior to purchase. Even so, national statistics could mask substantial variation across cities or across neighborhoods. Conceptually, it is much more difficult to collect FSBO data than NAR data. FSBO sales are far more likely to be between parties that know each other, and therefore less likely to show up in the public domain until the transaction is completed. Even for FSBO's that are arm's length transactions, the intensity of marketing varies. The NAR (2011, Exhibits 7-8 and 8-11) reports that 38 percent of FSBO's did not actively market their home at all, and only 33 percent of FSBO's put the listing on the internet (versus 92 percent of agent listings). Thus, many FSBO listings may not represent serious selling efforts.

Unlike Realtor.com, there is not a sole aggregator of FSBO listings (although some – like www.FSBOMadison.com – do an excellent job for a local market). Because it is impossible to account for the number of FSBO yard signs in a given market or neighborhood, our analysis requires that a FSBO seller has taken the larger step of listing their home online. We rely on two well known websites – www.Zillow.com and www.ForSaleByOwner.com . According to Zillow's website, their real estate network (partnering with Yahoo) is the largest, with more than 25 million unique visitors each month. The ForSaleByOwner.com website advertises aggressively on Google, and currently ranks first in organic search for the term "FSBO".[30] At the time we accessed the Zillow data, the cost for a person to put their home on the FSBO listing was $1, and is currently free. Assuming a FSBO owner was aware of Zillow's price, it seems likely they would list their home there, in addition to any other methods they were using to market their home. The cost to list on ForSaleByOwner.com is much higher, while at the same time offering better targeting to buyers who are open to FSBOs. As of August, 2012, the price to list on this website is $80.95 per month, or a one-time fee of $184 until sold, or a higher price for upgraded packages that include videos and wider reach.[31]

In March 2012, we compared the number of listings on Realtor.com to each of these websites for the six large cities in our sample. The results are shown in Appendix Exhibit 2. The first five columns of data come from Zillow, the sixth column from Realtor.com, and the final column from ForSaleByOwner.com. Of the three websites, Zillow in some sense provides the fullest characterization of the housing market because it provides by city or zip code the number of agent listings, FSBO listings, and so forth. As the fifth column shows, the fraction of FSBO listings on Zillow is miniscule – under 2 percent in all cities. Although the count is usually higher with the alternative website ForSaleByOwner.com, the fraction of listings that are FSBO is perhaps 5 percent for a city as a whole.

Although the absolute level of FSBO activity is low for all six cities, it could be the case that such activity varies within city, which in turn could have a meaningful effect on our HHI measures. Thus, we examined the Zillow data by zip code, which directly addresses the concern that FSBO listings might vary from one neighborhood to another in a way that affects the HHI computations. We collected data for

[30] As of August 30, 2012.
[31] See http://www.forsalebyowner.com/listing/new/package .

723 zip codes in the 6 cities; of these, 203 zip codes had at least 50 observations on agent listings and/or FSBO listings. One such illustration is provided in Appendix Figure 1, which is a screenshot from the zip code 60614 in Chicago, IL. There were 785 For Sale by Agent listings and 7 FSBO listings in that zip code. For each of these 203 zip codes, we computed the percentage of listings that were FSBO listings (e.g, $\frac{FSBO}{(FSBO+AGENT)}$). On average, the fraction of listings that were FSBO was 1.25 percent. 99 percent of the zip codes had fewer than 4.3 percent of listings as FSBO. As a consequence, it appears that FSBOs play a fairly minor role in the housing market, and the incidence of FSBO listings does not vary tremendously across neighborhoods (at least in the large cities and time period we examine).

Finally, it is also a challenging task to compare Realtor.com data to local MLS data, since many local MLS's require membership to gain access. We were able to examine, however, the count of listings for some large zip codes in Dallas on Realtor.com and the MLS site TexasRealEstate.com. We found a tight correspondence between the listings on the two sites for nine large zip codes (correlation=0.88).

In summary, this analysis suggests that our approach of using data from Realtor.com is the best and most comprehensive approach to measuring market activity, and captures the overwhelming share of all listing activity in the market. Both the use of FSBOs and ignoring the NAR site are relatively small issues, and don't appear to vary dramatically by neighborhood.

Appendix Exhibit 1 – Data Extraction

	Atlanta-Sandy Springs-Marietta, GA	Boston-Cambridge-Quincy, MA-NH	Chicago-Naperville-Joliet, IL-IN-WI	Dallas-Fort Worth-Arlington, TX	Los Angeles-Long Beach-Santa Ana, CA	Washington-Arlington-Alexandria, DC-VA-MD-WV	Total
Initial Zip Codes Scraped	345	327	510	436	662	704	2984
Zip codes with at least 1 listing	254	234	419	279	375	323	1884
> Dwellings in these zip codes (including duplicates)	86663	20267	86461	34933	52619	33289	314232
> Listings per Zip Code (including duplicates)	341	87	206	125	140	103	
> Dwellings in these zip codes (no duplicates)	67426	19783	85825	34782	52037	32986	292839
% Unduplicated	78%	98%	99%	100%	99%	99%	93%
> Listings per Zip Code (no duplicates)	265	85	205	125	139	102	155
Zip codes within MSA	254	234	419	279	375	323	1884
Zip codes within official city according to USPS	50	26	62	46	63	25	272
Zip codes with agent-reported city name	71	27	61	50	87	22	318
Zip codes within MSA	254	234	419	279	375	323	1884
Zip codes within MSA (50 or more listings)	177	158	327	185	314	200	1361
Zip codes within MSA	172	157	310	176	308	198	1321

(50 or more listings, merged to Census Factfinder)							
> Firms in MSA (Unedited)	2465	2180	3529	2166	6736	1749	18825
> Firms in MSA (Minor Edits)	**2028**	**1767**	**3179**	**1935**	**5855**	**1500**	**16264**
> Firms in MSA (Major Edits)	**1775**	**1618**	**2964**	**1856**	**5296**	**1413**	**14922**

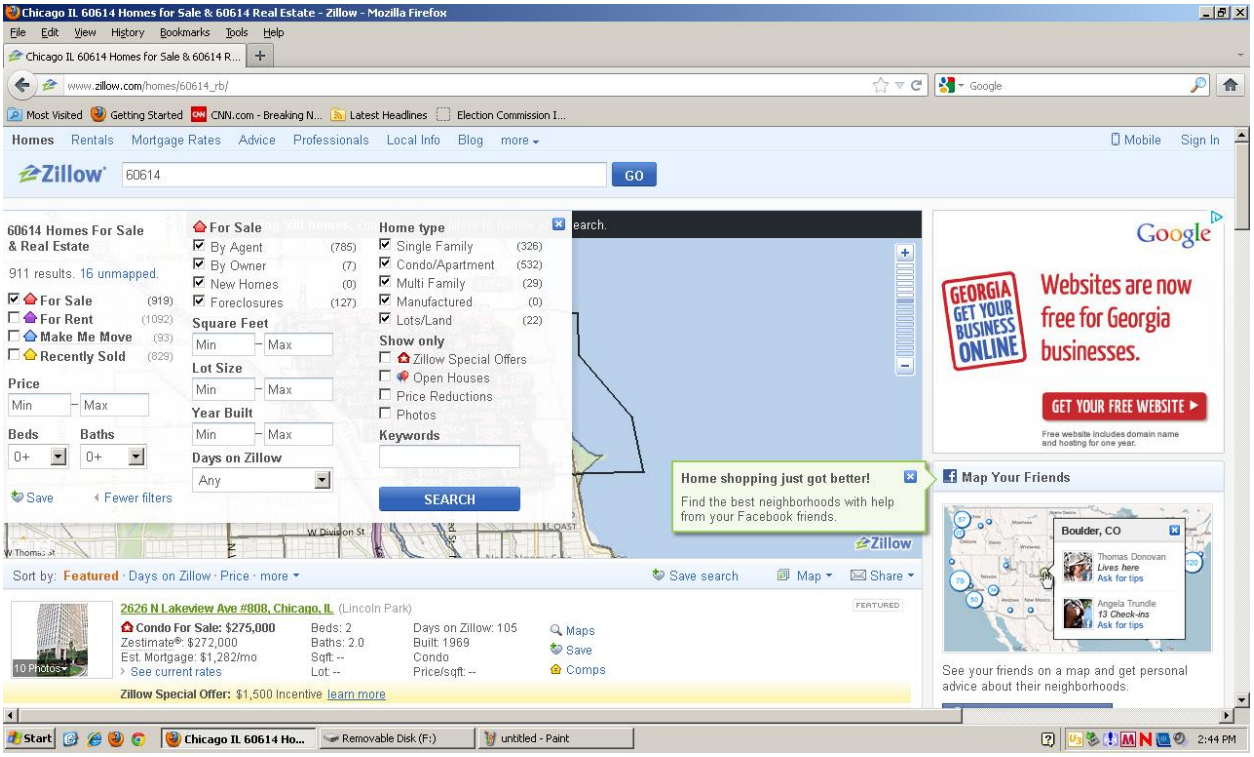
Notes: Source of USPS cities is http://zip4.usps.com/zip4/citytown.jsp . "Minor Edits" include: Changing lower case to upper case; removing extra spaces, dashes, periods, commas, slashes, explanation points, or ampersands; Converting RE MAX to REMAX, AND to &, C 21 to CENTURY 21, etc.; and treating each office as its own brokerage. "Major Edits" include grouping all franchisees as one firm.

Appendix Exhibit 2

City	Homes For Sale, By Type						
	By Agent	By Owner	New Homes	Foreclosures	$\frac{FSBO}{(FSBO + AGENT)}$	Realtor com	For Sale By Owner .com
Atlanta, GA	4632	80	24	823	1.70%	8757	209
Boston, MA	2106	27	2	311	1.27%	1577	66
Chicago, IL	13000	166	0	11,000	1.26%	16119	491
Dallas, TX	5559	73	57	417	1.30%	4622	162
Los Angeles, CA	10000	89	38	6746	0.88%	5286	37
Washington, DC	2270	32	14	297	1.39%	2149	140

Source: Zillow.com, Realtor.com and ForSaleByOwner.com, accessed 3/13/2012

Appendix Figure 1
Zillow Screenshot from Chicago, IL



Notes: Screenshot taken from www.zillow.com in March, 2012.