The Bargaining and Contagion Effects of Investors in Single Family Residential Properties: The Case of Denver Colorado[1]

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Abstract: We study the bargaining power of investors and the impact of investor-owned single family homes on nearby property values. By controlling for whether investors participate in a transaction as a buyer or seller, we find that investors tend to have more bargaining power than owner-occupiers — they purchase at lower prices and sell at higher prices, all else equal. Using a repeat sales methodology we find that increasing ownership by investors in a neighborhood has a small positive effect on nearby property values. Incidentally, we find that investors tend to demand smaller, older and lower quality homes in more densely developed neighborhoods than the market averages. We identify two types of investors: professional investors (e.g., corporations and partnerships) and individual investors. We find differences in the behavior of these two types of investors. For example, individual investors tend to invest in homes similar in terms of characteristics to those purchased by owner occupiers. The tendency to buy smaller, lower quality homes is primarily attributable to professional investors. We also find that professional investors have more bargaining power than individual investors.

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I. Introduction

The housing crisis of 2008-2011 focused attention on the role of investors in the housing markets. Historically, owner-occupiers have accounted for approximately 80% of the U.S. single family (1-4 units) housing stock. The remainder of the housing stock comprises second homes and properties owned by investors and rented for profit. Since World War II, housing policy has generally favored owner occupancy. The reasons for this preference include the belief that homeownership encourages savings (equity buildup) and has other positive externalities—including greater stability, more community involvement and better school performance by children of homeowners.[2] Basically, the argument boils down to homeowners having a greater stake in the neighborhood including its schools, public institutions and local property values. At the same time, investors and renters have frequently been viewed negatively. For example, single-family unit renters have sometimes been viewed as being more mobile and having less incentive to maintain their residences. Investors have often been described as being more likely to default since they have fewer emotional ties to the property and lower default costs (e.g., investors do not face the moving costs that defaulting owner-occupiers face). During the period from 1992-2008,, both President Clinton's and President Bush's administrations, and Congress supported programs to foster homeownership among lower income households and minorities.[3] In response, homeownership at the national level rose rapidly and peaked in 2006 at 69.0 %.

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[2] See for example, Coulson and Li, 2013 for further discussion.

[3] In 1994, President Clinton instructed HUD to develop programs designed to "… dramatically increase homeownership in our nation over the next six years. …" (See http://www.pragueinstitute.org/housing_us.htm). In 2002, President George W. Bush set a goal of 5.5 million new minority homeowners by 2010 (for details see http://www.whitehouse.gov/news/releases/2002/06/20020617.html), while Congress recently passed the

The sharp decline in national housing prices and the rapid increase in foreclosures following 2008 led to a reevaluation of the long-held national policy preference for homeownership. As unemployment rose, house prices fell and foreclosures added to the flow of properties for sale, some observers feared a long period of market disequilibrium created by an imbalance between the supply of houses for sale (artificially increased by the flow of foreclosures) and a shortage of buyers resulting in part from high unemployment, tighter underwriting conditions and the general reassessment of the estimated risks and rewards of homeownership. However, as sales and prices fell, a new type of investor began to enter the market. Large professional investors such as BlackRock were attracted to the market by the sharply depressed prices and the limited competition from local homeowners.[4] It is normal in housing markets for house prices to fall below replacement cost when there is too much supply relative to demand. In such circumstances, these new professional investors were interested in buying in bulk, converting units to rental to generate a cash flow stream and waiting for an upturn in the markets and values.

At the same time, Federal housing policy began to shift, placing more emphasis on the rental alternative and somewhat less emphasis on fostering homeownership.[5] The failures of

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"American Dream Downpayment Act" which provides $5,000 in down payment and closing-cost assistance to low-income and first-time homebuyers.

[4] For example, see New York Times article: (June 27,2014):"Investors Who Bought Foreclosed Homes in Bulk Look to Sell"

[5] A joint Report to Congress (February 2011) by the Treasury Department and the Department of Housing and Urban Development entitled "Reforming America's Housing Finance Market" states the Obama Administration's position. "Our plan champions the belief that Americans should have choices in housing that make sense for them and for their families. This means rental options near good schools and good jobs. It means access to credit for those Americans who want to own their own home, which has helped millions of middle class families build wealth and achieve the American Dream. And it means a helping hand for lower-income Americans, who are burdened by the strain of high housing costs."

Fannie Mae and Freddie Mac raised the question of how big a role the Federal government should play in financing homeownership. There was less appetite to backstop lending to riskier borrowers in the name of fostering homeownership. The conservator of the two government-sponsored enterprises (GSEs) has tended to focus on helping underwater homeowners and limiting new lending to traditional conservative loans.[6] With the demise of private subprime lending in the aftermath of the financial crisis, the Federal Housing Administration's role in housing finance increased sharply, but that increased role in the marketplace has only served to fuel the belief that the government should limit its financing risks. As part of the Dodd Frank Reform Act, the Consumer Financial Protection Bureau (CFPB) was created. In 2012, the CFPB promulgated new rules for financial institutions originating new mortgages and the backstopping of new mortgage backed securities. In combination, these developments have made it harder for households to finance the purchase of a home and lowered demand relative to the levels prior to 2008.

Potential housing investors have seen these shifts as an opportunity or at least a leveling of the playing field. Investors have traditionally operated at a disadvantage in the housing market because they do not benefit from several of the tax advantages that have been given to individual homeowners. For example, owner-occupiers do not have to recognize the implicit rental income associated with living in the home, while investors must treat rental income as taxable income. Also, owner occupiers are essentially exempt from capital gains taxes on any gains. (See Poterba and Sinai, 2008, for further discussion) While the owner occupier tax

[6] In the last few years, there has been limited resumption of programs with smaller downpayments and less restrictive underwriting. However, the share of the market attributable to riskier loans remains well below the levels of the early 2000s.

advantages remained in effect through 2017[7], post 2008 some of the financing advantages have been reduced. Investors have responded, at least in select markets. Investors have been able to help lenders sell large blocks of Real Estate Owned (REO) through purchases at auctions or in bulk purchases.

As noted above, there remains a stigma associated with investor owned (rental) properties. After the financial crisis, researchers began to investigate the role played by investors. For example, a study published by the Federal Reserve Bank of Boston (Greenberg, Essene and Lee, 2009) showed that small multifamily investors were not more likely to default, in part, because they used less risky financing options. Fisher and Lambie-Hanson (2012) explore the differences between investors and owner-occupiers in Chelsea MA- an urban area with a mixture of single-family homes and multifamily properties. The authors distinguish between owner-occupiers, local investors and out-of-town investors. They focus on three behaviors: holding period, dollars invested after purchase and foreclosure risk. They find that overall, investors have shorter holding periods, invest more after purchase and experience about the same foreclosure risk when compared to owner-occupiers. However, they find that local investors have the shortest holding periods, the largest investment after purchase and a greater risk of foreclosure than either other group.

Allen *et al.* (2018) examine how investors impact housing prices. In their research, investors are "defined as grantees that purchased 2 or more single- family dwellings or

[7] In late 2017, the tax code was revised in ways that could reduce the tax benefits of homeownership for some taxpayers. In particular, the standard deduction was increased and a cap was placed on state and local tax deductions. As a result, it is expected that fewer homeowners will find it advantageous to itemize deductions and make use of the mortgage interest deduction. Our date terminates in 2016 before the revised tax proposal was promulgated and so the 2017 tax changes should not influence our results.

purchased 1 single-family dwelling as an LLC, LP, etc. during the sample period…" They find that the larger the investor – where size is measured by the number of purchases in a specified time frame - the greater the purchase discount for the investor. They report that large investors obtain a discount close to fourteen percent, while small investors obtain a discount of roughly eight percent. Allen *et al*. (2018) also report that an increase in the percentage of homes purchased by investors is associated with higher house prices in the census tract. Allen *et al*. (2018) focus solely on the nature of the buyer (i.e., investor vs. owner-occupier) and do not control for the type of seller. As discussed below, because our data identifies both buyer and seller, we are better able to control for the fact that investors tend to buy lower quality homes (the "demand" effect) and minimize the omitted variable bias associated with estimating purchase discounts. [8]

The present paper provides new information about the role of investors in the housing markets. First we explore the buying and selling behavior of investors. In particular, we investigate whether investors tend to be better "bargainers" in negotiating transaction prices. We apply the methodology of Harding, Rosenthal and Sirmans (2003) to estimate the bargaining effect and the associated demand effect. We find that, after controlling for the major house characteristics (house size, lot size, number of bathrooms and bedrooms and age), investors tend to pay less as buyers and sell for more. Like Fisher and Lambie-Hanson (2012), we explore possible differences in behavior by type of investor. In our data, we distinguish

[8] As an example of the importance of controlling for the seller consider two cases: In one, an investor buyer negotiates with an owner occupier and in the second, negotiates with another investor. Assuming that investors are more experienced in negotiating real estate transactions as both buyer and seller, an investor should prefer to negotiate with an owner occupier than another investor and we would expect to see little "discount" in the second case as bargaining effects cancel out. Thus, failure to control for the nature of the seller may lead to biased estimates of the negotiated "discount".

between investors that operate as corporations or partnerships ("professional investors") and individual investors. We find that investors (especially professional investors) are better bargainers than owner occupiers. This finding is subject to different interpretations or explanations. First, it could simply reflect the fact that investors are more experienced and skilled at evaluating homes and negotiating real estate transactions. Alternatively, it could mean that investors take advantage of distressed homeowners facing foreclosure and/or pressure to move and therefore buy for prices below market value. The result could also mean that investors provide liquidity at times when there are few other buyers and that the lower negotiated price reflects the forward-looking risk of the local market. Finally, it could mean that investors are better at market timing—buying when prices are low and selling when prices are high. Most likely, the true explanation involves some combination of these effects.

Next, we study whether having nearby investor-owned properties has a negative effect on local house prices by modifying the approach developed by Harding, Rosenblatt and Yao (2009) to study the contagion effect of foreclosed properties on nearby non-distressed property values. Specifically, we study whether home values in neighborhoods with a sharp increase in investor ownership are adversely affected by the increased presence of nearby investor owned properties. The method entails controlling for observed and unobserved property characteristics by using a repeat sales specification, where the traditional dummy variables on the right hand side are augmented by controls for the change in the number of nearby distressed properties and nearby investor–owned properties. Our results confirm previous

reports (See Frame, 2010 for a review of related literature[9]) that find a negative contagion effect for distressed properties but, significantly, we also show a small positive effect from having nearby properties that are investor-owned. As discussed above, this finding is counter to the conventional wisdom and consistent with the results of Allen *et al*. (2018).

The remainder of this paper is organized as follows. The next section provides a literature review and discussion of empirical issues. Section III describes our methodology and data. Section IV presents results and Section V summarizes our conclusions and discusses implications.

II. **Literature Review and Empirical Issues**

Historically, the single family residential market has been dominated by owner-occupiers. Rosenthal (2018) reports that while the overall homeownership rate has averaged just below seventy percent since 2000, the homeownership rate for single family detached structures has averaged more than eighty-five percent.[10] While rental of single family residences has long been a common practice, prior to the financial crisis, it was typically done

[9] Other recent foreclosure contagion papers include Li (2017), and Fisher et al (2015). Li (2017) considers average neighborhood foreclosures as an alternative identification strategy for the effects of nearby distressed properties on non-distressed property prices. Li (2017) also controls for capital expenditures, using a unique dataset for Milwaukee, WI. The major findings include that there is a 0.84% fall in price when there is a foreclosure within 300 feet of a property. A major contribution of Li (2017) is the finding of a "contagion" type of effect for capital investments. Fisher et al (2015) study the condominium market in Boston, MA, and find that properties within the same "association" of a foreclosure sell for approximately 2.5% less, while outside of the same association there is zero effect of foreclosures nearby. A key finding of Fisher et al (2015) is the significant contagion effect within the same condominium "association", but contrary to other contagion studies that have found significant contagion effects nearby, they find no contagion effect here when considering condominiums in the same neighborhood but in different "associations".

[10] Both ownership rates have declined since the financial crisis. The single family detached ownership rate was 87.5% in 2000 and approximately 84% in 2015. The overall national ownership rate was 67.1% at the start of 2000, peaked at 69.2% Q4 of 2004 and declined to 62.9% at the start of 2016. The ownership rate for single family attached structures is much lower—averaging between 50% and 60% since 2000. This is one reason that we restrict our sample to detached structures in this paper.

by individual owners on a small scale – often because the household was moving temporarily or as a temporary substitute for selling while waiting for better market conditions. The "business" of buying single-family detached homes in large numbers with the express purpose of generating rental income expanded significantly during and after the 2008 financial crisis. A 2013 "FED Note" (Molloy and Zarutskie, 2013) was one of the first studies to focus on the local effects of investor owned properties (opposed to others, such as Fisher et al (2015) who focus on foreclosures contagion effects). Molloy and Zarutskie (2103) describe an Amherst Holdings research report that estimated less than one percent of single-family homes were purchased by "business" investors in 2004, while more than six percent were purchased by such investors in 2012.[11] As a result, until recently, there was limited research into the role and effect of such investors in the single family market segment.

Several recent papers have studied the role of investors. Haughwout, Tracy and van der Klaauw (2011) document large increases in the share of purchases by real estate investors in markets that experienced large run-ups in home prices followed by sharp declines in prices ("boom/bust" markets). These authors define "real estate investors" as those who owned more than one property based on first mortgage liens reported on their credit report. Hansz and Hayunga (2014) focus on the purchase price negotiated by investors and found that investors paid roughly ten percent less compared to individuals purchasing at the same time and that the discount was larger for larger investors. Schnure (2014) looks at the role that investors played in facilitating the shift to lower rates of homeownership in the economy after

[11] Business investors were defined as any single person or entity that purchased more than three single family residences between 2000 and 2012.

the financial crisis and concludes that by providing capital and management expertise, investors helped mitigate housing disequilibrium. Bracke (2016) continued the focus on purchase prices paid by investors. He studied the behavior of "buy-to-rent" investors in the UK housing market during 2013, and reports that these investors paid roughly one percent less than other buyers for equivalent properties.

Three recent papers have studied the impact of investors on the single family housing market. Mills, Molloy and Zarutskie (2017), like Bracke (2016), focus on large firms that purchase homes with the intention of creating a portfolio of rental properties and generating a stream of rental income (buy-to-rent), and contrast those investors with investors assumingly more focused on short term price appreciation (what might be called "flippers"). The authors document several differences between the behavior of large buy-to-rent firms, other corporate investors and individual investors that are relevant to our work. For example, they observe that locations with larger increases in buy-to-rent purchases experienced greater price appreciation over the next two years. The authors conclude that buy-to-rent investors contributed positively to housing demand in those submarkets where they were most active and supported local housing market recovery. Allen, et.al. (2018) find that investors purchase homes at a discount of 9.5% compared to individuals. Like Hansz and Hayunga (2014) they find that the discount is larger for larger investors. They also document a positive house price effect associated with an increase in investor purchase activity. Finally, Smith and Liu (2018) examine institutional investors' purchases of single family dwellings in Atlanta, GA in the period subsequent to the most recent housing crisis, and find that investors purchase for a discount in the range of

approximately 6% to 11%.[12] They also find that owner-occupiers are facing greater liquidity constraints than institutional investors, which may be one possible explanation for the investor discount.

Identifying investors is a challenging empirical task. Different authors have used different approaches. One common approach is to identify investors by comparing the property address to the address to which the local taxing authority sends a property tax bill. Fisher and Lambie-Hanson (2012) use this approach as one of their metrics for determining investor-ownership. The underlying rationale is that owner occupiers will have their property tax bill sent to the property address, while investors will have the bill sent to their own address. This approach is subject to two error types: First (type 1), to the extent that owner occupiers choose to use a post office box for mail delivery, they will be misclassified as investors. Other legitimate owner occupiers may choose to have their tax-related correspondence sent to a different address because they are temporarily away from the home (e.g., occupancy is delayed until the end of a school year) or some other convenience-related factor.[13] The other potential error (type 2) is that investors may be classified as owner occupiers if they own a 2-4 unit property and occupy one of the units. In such cases, the addresses may coincide.[14] When using

[12] As described by Cohen et al (2012), Atlanta experienced a much larger run up in prices, as well as a much steeper "bust", than Denver. Therefore, the comparison between Smith and Liu (2018), who focus on Atlanta, and our research on Denver, should be viewed in somewhat different contexts.

[13] Another issue with using the tax authority mailing address is the common practice of mortgage lenders escrowing property tax payments. In most cases where taxes are escrowed, the tax bill is sent to the lending institution where the address will differ from the property address.

[14] The discussion of potential errors associated with identifying investors by differences in address fields is intended to be generally descriptive of previous analyses. By restricting our attention to single family properties, we avoid these type 2 errors.

this approach, it is likely that type 1 errors predominate: misclassifying owner-occupiers as investors and thus over-estimating the stock of investor-owned properties.

Another approach to identifying investors is to define "investors" by the number of properties they own or have financed (e.g. see Molloy and Zarutskie, 2013) during a specified period. This definition erroneously characterizes highly mobile owner-occupiers as investors.[15] It is also difficult to implement without data that spans an extended period in order to correctly flag those investors who operate at a small scale in any given year (e.g., an investor who buys a property every 18 months to rehab and resell). Finally, investors can be identified based on name. For example, Mills *et al*. (2017) use a master list of "buy to rent" investors[16] and compare the recorded buyer name to this list to identify buy-to-rent investors.[17]

We use a combination approach to identify investors. First, we use the name fields for each transaction to identify "professional" investors. The public deed transfer records for Denver, Colorado report both the buyer and the seller names and addresses.[18] Individual names can be distinguished from the names of corporations, partnerships, charitable organizations, political entities, banks and other agencies. We parse the names of the non-individuals to identify several major classes of investors including financial institutions, builders, corporations, partnerships, agencies, etc. This enables us to identify what we designate as

[15] In addition, it is likely that at least one of the multiple purchases by an individual investor is for the purpose of occupancy. Thus, some owner-occupier purchases will be classified as investor purchases.
[16] Mills et al (2017) obtain their "master list" based on properties that "appear frequently in media reports on buy-to-rent activity or that follow a business model that is known to be the same as the rest of the buy-to-rent investors…"
[17] We used the Mills et al list of names but found that those firms accounted for a very small fraction of the Denver, CO transactions during our study period.
[18] To assess bargaining power, it is necessary to identify the characteristics of both buyer and seller in a transaction, since bargaining power is estimated by comparing negotiated prices that result from different combinations of buyer type and seller type. Most previous research has focused solely on investors as buyers.

"professional" buyers and sellers based on their names, including limited partnerships, corporations and others. This distinction enables us to examine how the bargaining effects differ for professional vs. individual investors (defined below) – which is one of the key contributions of our work.

To flag individual investors, we use a combination of factors. First we compare the seller's reported address with the property address. If the two addresses differ, we flag the seller as an investor/seller. The same approach cannot be used to flag investor buyers since it is to be expected that their current address will differ from that of the property they are purchasing. However, we draw upon the fact that we have all transactions for a given house to partially address this problem. Consider a home that sells at t_0 and t_1. If we have flagged a seller at t_1 as an investor/seller, we assume that when the same person (or persons) bought the home in the previous transaction, they were an investor buyer at t_0. We acknowledge that this approach is not perfect. We will miss investor/buyers for the first transaction in the records for any given house. Further, we will incorrectly classify some buyers as investors if they originally occupy the property and subsequently move out and rent the property. However, as noted below, we augment this imperfect identification of buyer/investors by using the number of transactions for a given name.

In addition to using addresses to flag investor buyers and sellers, we search all transactions from 1986 through 2016 and identify individuals who are frequent buyers and sellers. We identify anyone who has bought more than five single family homes during that period as an investor/buyer for all transactions. Similarly, if the same individual sells more than five homes in the period, we flag all their sales as investor/seller transactions.

To our knowledge, we are unique in identifying the nature of both the buyer and the seller in this manner. As documented in Harding, Rosenthal and Sirmans (2003), when assets are traded in thin markets, the final price is the result of negotiations between the buyer and seller. If one party has more "bargaining power" than the other, the negotiated price will reflect the imbalance in negotiating skill and experience. For example, accepted wisdom is that buyers should look for a "motivated seller" (e.g. one who has already moved to take a new job and thus faces higher carrying costs) to get the best deal. It is inappropriate to estimate a discount attributable solely to a buyer characteristic such as being an investor without controlling for the characteristics of the other party to the negotiation. Further, without controlling for both the bargaining and demand effects of investors as discussed below, it is likely that the involvement of an investor is related to unobserved characteristics of the property which could bias the estimated purchase discount.

III. Methodology and Data

III.1 Methodology

Estimating the Bargaining Power of Investors

The Bargaining Model[19].

We begin the discussion of estimating an investor bargaining effect by working with the basic hedonic relationship in equation (1). [20]

$$ln(P)=s'C \qquad (1)$$

[19] The description of the bargaining model presented here is based on the more detailed development in Harding, Rosenthal and Sirmans (2003). That article provides more detail about the underlying assumptions and conditions under which their methodology is appropriate.

[20] The notation and derivation presented here draws heavily on the derivation in Harding, Rosenthal and Sirmans (2003). See Griliches, 1971, Rosen, 1974 and Epple, 1987 for additional background on the theory underlying the basic hedonic model specification used here.

In equation (1) above, P represents the property price, C is a vector of characteristics, and s is the vector of shadow prices.

When the bundled good trades in a deep, liquid market, the s values are revealed through trading of bundles that differ in attributes. Bargaining has no role in determining prices when the s is known to buyer and seller and neither buyer nor seller faces search costs associated with a failure to purchase or sell any particular bundle. However, as a good becomes increasingly heterogeneous, it trades in increasingly thin markets. Consequently, the "price" of the good becomes harder to ascertain, market participants gain a degree of market power, and search costs increase. All of these deviations from a perfect market create incentives for bargaining. Consider, as an example, a seller with the only four-bedroom house available for sale in a market where generally larger families are the potential buyers. This seller has a degree of monopoly power, which provides an incentive to attempt to negotiate a higher price than that given by equation (1).

If bargaining power enters the hedonic model as a fixed shift in prices, then we can write, for each individual asset:

$$ln(P_i)=s'C_i+ B_i, \qquad (2)$$

where B_i represents the impact of bargaining on the observed transaction price for house i. Negative values of B_i (lower prices) are realized when a strong buyer negotiates with a weak seller and vice versa.

Harding, Rosenthal and Sirmans (2003) (HRS) assume that B_i is a linear function of vectors of buyer and seller demographic characteristics, D, each with characteristic coefficients denoted by the corresponding vector b (dropping the subscript i to simplify notation):

$$B = b^{sell}D^{sell} + b^{buy}D^{buy} + e_B, \quad (3)$$

with the result that:

$$ln(P) = s'C + b^{sell}D^{sell} + b^{buy}D^{buy} + e_B. \quad (4)$$

There is a significant omitted variable problem with using equation (4) in practical applications. The vector C is known to buyer and seller but only partially observed by the analyst. Furthermore, the unobserved characteristics are likely to be correlated with the buyer and seller characteristics. To demonstrate, partition the vector C into the observed characteristics, C_1 and the unobserved characteristics C_2. We expect that:

$$s'_2C_2 = d^{sell}D^{sell} + d^{buy}D^{buy} + e_D, \quad (5)$$

where s_2 is the vector of shadow prices on C_2, D^k is the same vector of individual descriptive characteristics as in equation (3), and e_D represents idiosyncratic differences in preferences across individuals. Comparing equations (4) and (5), it is clear that if C_2 is omitted from (4) then the coefficients on D^k will yield biased measures of bargaining power: individual traits that affect bargaining outcomes also influence demand for unobserved attributes of the traded good. Substituting equation (5) into equation (4) gives:

$$ln(P) = s_1C_1 + (b^{sell} + d^{sell})D^{sell} + (b^{buy} + d^{buy})D^{buy} + \varepsilon, \quad (6)$$

where s_1 is the vector of shadow prices for C_1, and $\varepsilon = e_B + e_D$.

HRS use two assumptions to identify the separate bargaining and demand effects[21]:

(i) Symmetric bargaining power: $b^{sell} = - b^{buy}$

[21] The assumption of symmetric bargaining power can be thought of in terms of "experience". An experienced investor should be above average in negotiating both as a buyer and seller. The contrary assumption would imply that an investor was above average at negotiating as a buyer, but not so as a seller. Similarly, the symmetric demand assumption simply means that the investor's view of property attributes is the same when they act as a seller or a buyer.

(ii) Symmetric demand: $d^{sell} = d^{buy}$.

Using these assumptions results in:

$$ln(P) = s_1C_1 + b(D^{sell} - D^{buy}) + d(D^{sell} + D^{buy}) + \varepsilon \quad . \qquad (7)$$

Equation (7) can be readily estimated using ordinary least squares by including the sums and differences of the buyer and seller characteristics. In our analysis, the buyer and seller characteristic of interest is whether or not the participant is an investor[22].

Estimating the Contagion Effect of Investor Owned Properties

Our approach to exploring the impact of investor-owned properties on general housing values is motivated by Harding, Rosenblatt and Yao (2009) (HRY) who used a repeat sales analysis to quantify the impact of nearby foreclosures on the prices of non-distressed properties. Using a repeat sales approach provides excellent control for unobserved property and location characteristics and thereby reduces the potential for omitted variable bias in estimating the effect on price of selected locational attributes such as distressed properties or investor-owned properties. HRY considered the number of nearby distressed properties to be a locational characteristic for each non-distressed property that transacted. For example if there is a negative externality associated with having a nearby property in the process of foreclosure, then, *ceteris paribus*, a property with three nearby foreclosures should sell at a lower price than an identical house with only one. By using a repeat sales specification to assess the impact of nearby distressed properties, HRY are better able to justify the "*ceteris paribus"* assumption

[22] We consider different definitions of investors: professional investors, individual investors and both definitions combined. As discussed in the Results Section, when estimating equation (7), we control for location and time using tract by year fixed effects.

needed when comparing transactions that differ in terms of the number of nearby distressed properties but also may differ in terms of unobserved property and location characteristics. Further, by simultaneously estimating the general change in local house prices, HRY effectively control for the overall change in house prices between the two sales dates. A negative externality from an increase in the number of nearby properties between the two sales should be reflected in below average house price appreciation.

The repeat sales approach[23] begins with the standard log-linear hedonic house price specification – repeated here as equation (8) for convenience.

$$P_t = e^{[sC]} \quad \text{or} \quad \ln(\mathrm{P_t}) = s'C \tag{8}$$

The repeat sales model derived by Bailey, Muth and Nourse (1963) and Case and Shiller (1989) provides a way to estimate house price trends without fully observing the vector of house characteristics. Under the assumption that both the vector of characteristics and the vector of attribute prices is constant between two observed transactions, the inner product (s'C) differences out when one models the rate of price appreciation between two sales instead of the price at time t. For instance, we rewrite (8) as:[24]

$$P_t^i = e^{\gamma_t} e^{\left[s\,C^i\right]} e^{\eta_t^i} \quad \text{or}$$
$$\ln(\mathrm{P_t^i}) = \gamma_t + s\ C^i + \eta_t^i \tag{9}$$

[23] See Bailey, Muth and Nourse (1963) and Case and Shiller (1989) for the original derivation of the repeat sales model.

[24] The modification incorporates the assumption that prices of all homes rise and fall due to overall market forces. The current level of market forces is represented by γ_t

where C^i includes all (observed and unobserved) property characteristics related to the price of an individual property. The error term, η_t^i, is assumed to be independent and identically distributed and captures pure random shocks. The second sale occurs at time t +τ. Differencing equations (9) for the two time periods, and assuming C and s are time-invariant, leads to:

$$\ln\left(P_{t+\tau}^i / P_t^i\right) = \left(\gamma_{t+\tau} - \gamma_t\right) + \varepsilon_{t,t+\tau}^i \qquad (11)$$

The terms γ_t and $\gamma_{t+\tau}$ are readily estimated using a set of indicator variables showing both the original sale date and the second sale date.

HRY modified equation (11) by adding an additional characteristic that is observed to change between sales: N^i_t -- the number of distressed properties near property i at time t. In our analysis, we add a second additional changing locational characteristic: the number of nearby investor-owned properties, M^i_t. The resulting model for the appreciation between two sales dates becomes:

$$\ln\left(\frac{P_{t+\tau}^i}{P_t^i}\right) = (\gamma_{t+\tau} - \gamma_t) + a\left(N_{t+\tau}^i - N_t^i\right) + b\left(M_{t+\tau}^i - M_t^i\right) + \varepsilon_{t,t+\tau}^i \qquad (12)$$

With this specification, the impact of nearby foreclosures and investor-owned properties can be estimated using the OLS estimates of the parameters a and b. The definition of N^i_t and M^i_t is discussed in the Data Section.

III.2 Data

We use public records associated with real property transfers and tax assessment files from the city of Denver, Colorado. We combine assessor records describing property

characteristics with records describing deed transfers associated with Denver properties between 1986 and 2016.[25] Using the property address, we geocoded each property and assign each property to its associated census tract. The full file includes 593,378 transaction records encompassing all property types and all deed transfer instrument types. We restrict our attention to transactions for single family residential properties (excluding 2-4 unit structures) where the transfer was executed using a warranty deed. This reduces the sample to a total of 251,376 transactions. Because a single property can transact several times, the number of distinct underlying single family properties is approximately 100,000.

We utilize the raw data for several different purposes in this paper. First, we focus on estimating hedonic models for the negotiated sale price using the property characteristics as right hand side variables as well as the bargaining variables described above. To create the bargaining factor $(D^{sell} - D^{buy})$ and demand factor $(D^{sell} + D^{buy})$ used in equation (7), we have to identify each seller and buyer and determine whether each is an investor. The procedure we use to identify investors and non-investors is discussed in Section IV.1 below.

Next, to conduct the contagion analysis by estimating equation (12), we create a repeat sales sample. The repeat sales approach requires us to exclude all properties that transact only once. We also filter out repeat sales that have very short holding periods (*i.e.*, flips) and those

[25] The data reportedly includes all transactions subsequent to 1993, but also includes many transactions from earlier years. The full raw data (for all property types and deed types) include just less than 600,000 transaction records dating back to 1936. After restricting attention to single family residential properties with reasonable prices and characteristics, and transactions based on warranty deeds, we are left with 251,376 records. Within this restricted sample, 1986 is the first year with more than 3,000 transactions (e.g., 1985 has 157 transactions). Because the single family transaction records from years prior to 1986 appear to be sparse, we restrict our attention to 1986 and later. For some portions of the analysis, we use the full date range from 1986 through 2016, for other analyses we restrict attention to more recent data (e.g. 2003-2016). See separate discussions in the Results section.

where the overall annual rate of price appreciation suggests significant unobserved changes in the property or data errors. The full description of the creation of this data set is provided in Section IV.2 along with a comparison of the excluded homes relative to those that have repeat sales.

IV Results

IV.1 Estimating Bargaining Power

The objective of this section is to estimate the bargaining power of investors as reflected in single family transaction prices in Denver, Colorado during the period from 1986 through 2016. We use the bargaining specification of Harding, Rosenthal and Sirmans (2007) described in equation (7) above (repeated here for convenience):

$$ln(P) = s_1C_1 + b(D^{sell} - D^{buy}) + d(D^{sell} + D^{buy}) + \varepsilon \quad . \qquad (7)$$

We define D^{sell} to be an indicator variable that takes on the value of 1 is the seller in a given transaction is identified as an investor and zero otherwise. D^{buy} is defined analogously. Thus $(D^{sell} - D^{buy})$ takes on a value of 1 if an investor sells to a non-investor, -1 if a non-investor sells to an investor/buyer and zero if both buyer and seller are investors or non-investors. A positive coefficient on this term suggests that investors sell at higher prices and buy at lower prices than non-investors. If the term is zero, the buyer and seller are deemed equal in this attribute and thus equal in bargaining power. The term $(D^{sell} + D^{buy})$ controls for the demand effect. The component terms are defined as above and so the demand factor takes on values of 0, 1, or 2 depending on the number of investors involved in the transaction.

As noted in the data section, we begin with 251,376 single family residential transactions occurring between 1936 and 2017 executed via a warranty deed with reported

characteristics. To make sure that we have a sufficient number of transactions in each calendar year, we restrict the sample to the years from 1986 through 2016. This eliminates eight hundred and thirty-six transaction (.32% of the total). The year 1986 has the smallest number of transactions in the resulting data set—3,270. To eliminate non-arm's length transactions, we exclude all transactions with reported prices less than or equal to $100. To minimize outlier effects, we filter out transactions with prices or assessed values greater than one million dollars. These filters eliminate approximately fifty-seven thousand transactions. We then filter for complete and reasonable information on the property characteristics such as lot size, number of bathrooms, bedrooms, house size, etc. For estimating the base bargaining effects, we chose to eliminate transactions on new and very old homes.[26] We eliminate new home sales (defined as being sold in the year built or the year after the year built) because these transactions are almost always between a home builder and an individual and the purchaser is generally buying the right to at least partially customize the home interior and may receive certain guarantees from the builder/seller that do not apply to secondary market sales of homes. We chose to focus on secondary market transactions as more clearly reflecting the relative bargaining power of the parties to the transaction. We also eliminated transactions on homes reported to be older than one hundred years. We are concerned that there are unobserved characteristics associated with such properties (e.g., unique quality and design characteristics, historical designations, unique architecture, etc.) that would affect the observed transaction price. We are also concerned that such transactions may involve a special type of

[26] As a robustness check, we rerun the estimation including new home sales. The bargaining results are little changed. See the discussion below.

buyer and seller. These filters reduce the sample to approximately 163,000 transactions. Finally, we filter out all transactions where the previous transaction for that property was executed using a sheriff's deed, a deed in lieu of foreclosure or a public trustee deed because these are likely REO sales.[27] For similar reasons, we also eliminate all transactions where the seller is a mortgage company, bank, savings and loan association, the Federal Housing Administration, a Government Sponsored Enterprise (GSE) or similar entity. These transactions are likely to entail special circumstances or distressed properties where normal bargaining and pricing do not take place (e.g., short sales). These final filters reduce our sample to 126,351 single family warranty deed transactions between the years of 1986 and 2016 where buyer and seller were free to negotiate terms on a normal property.

Table 1 provides summary statistics for the full sample (first two columns) as well as three subsamples. The top rows of the table summarize the major house characteristics. The lower portion provides information about the parties to the transactions. The three subsamples correspond to the different definitions of investors discussed above and reveal differences in the type of property in which the specified investor type invests. The two columns labelled Individual Investors are based on just those transactions where an individual investor was involved in the transaction as either a buyer or seller (or both). The columns labelled Professional Investors report statistics for just those transactions where a professional investor was involved as either a buyer or seller (or both). Note that if a transaction involves both an individual investor (e.g., as a buyer) and a professional investor (e.g., as a seller), it will

[27] REO sales frequently have damage or deferred maintenance that is not captured by the reported structural characteristics.

be included in both subsamples so the sum of the observations in the subsamples exceeds the total number of transactions. Finally, the last two columns of the table describe the properties in transactions that did not involve an investor as either a buyer or a seller. These transactions have owner-occupiers as both buyer and seller.

The table shows that the average home size was 1,318 square feet of finished living area above ground and 419 square feet in finished basement space. The average transacting home had 2.67 bedrooms and 2.11 bathrooms. The average home age was 54 years, even after excluding homes that were more than 100 years old. Recall however, that we have excluded all new home sales. The average price for the sample period was $234,593. Looking first to the Non-Investor subsample (columns 7 and 8), we see that homes involved in transactions between owner-occupiers are slightly bigger than the full sample average, have somewhat larger lots and are slightly younger. The average transaction price is $10,000 higher than the full sample average. Individual investors (columns 3 and 4) are involved in transactions for smaller homes, smaller lots[28] and properties with fewer bedrooms and bathrooms. The average sale price is $50,000 less than the average for transactions between Non-Investors. The characteristics of the homes that involve Professional Investors fall between those involving individual investors and those involving just owner-occupiers, but the average transaction price is the highest of the three subsamples.

Turning to the lower portion of the table, we see confirmation that we have excluded all transactions that were identified as likely REO sales and sales by financial institutions and government related entities. Below those items we first see a breakdown of investor

[28] Smaller lots are likely associated with locations that are more densely developed.

involvement. Looking first at the full sample, the table reports that 28% of the full sample involved an investor seller and 13% involved an investor buyer. A portion of the difference in seller vs. buyer activity is due to the difficulty involved in using the address fields to flag individual investor buyers. However, excluding REO sales and financial institution sales also contributes to the difference. To the extent that investors tend to buy REO properties (either in auctions or individually) or are more comfortable buying from financial institutions and government agencies than are owner-occupiers, their participation in non-REO transactions will be skewed toward the seller role. Despite the imbalance, we have roughly 16,000 transactions involving investor buyers – a number sufficient to estimate their effect on negotiated prices.

The next four rows of the table provide summary data describing the transactions. For example, in the full sample, we see that 9.82% of the transactions involved investors as both buyer and seller. (For the full sample, an "investor" was defined to include both individual investors and professional investors). The next three rows show that 68.75% of the transactions involved non-investors (owner-occupiers) as both buyer and seller, 18.37% of the transactions entail the sale of a property by an investor to a non-investor, and 3.05% entailed a sale from an investor to an individual. The last two rows summarize the two bargaining power variables used in equation (7). The positive "bargaining difference", $(D^{sell} - D^{buy})$, reflects the excess of investor sellers over investor buyers. The average "bargaining sum" $(D^{sell} + D^{buy})$ of .41 reflects the fact that 31% of the transactions involved an investor as either a buyer or seller and an additional 10% of the transactions involve investors as both buyer and seller. As expected by the definition of the subsample, the breakdown for the subsample labelled Non-Investors shows that 100% of the transactions in the subsample involve non-investors as both buyer and

seller. The different breakdowns of seller/buyer roles for Individual Investors and Professional Investors is partly attributable to the fact that the definition of professional investors is not affected by the role (i.e., buyer/seller) the entity plays, whereas for individual investors, we expect an underestimate of investor buyers for the portion identified based on address fields. This likely contributes to the higher percentage of investors buying from non-investors (31.45%) for the professional investors compared with individual investor buying from non-investors (6.50%). The data also provide evidence that professional investors are much less likely to resell to another professional investor than is the case for individual investors (6.86% vs. 32.00%).[29]

Table 2a provides the results of estimating equation (7) using the different definitions of what constitutes an "investor". In estimating equation (7), the vector C of property characteristics includes the above ground finished living area, lot size, finished basement size, number of bathrooms and bedrooms and categorical variables describing the age of the property. In addition, to control for location and time effects, we include in each model a full set of census tract by year fixed effects. The estimated coefficients for the fixed effects are suppressed. We report estimates for the full sample period (1986-2016) and a shorter period restricted to the run-up before the housing crisis and the years that follow the crisis (2003-2016). The table reports all estimated parameters except for the fixed effects. The rightmost two columns ("All Investors") report the most comprehensive results using the broadest definition of an investor— the one that includes both individual investors and professional

[29] Any underestimate of investor buyers based on the address field would bias this difference downward, so this behavioral difference is robust to that error.

investors. The top rows of the table provide the estimated coefficients for the property characteristics. The estimated coefficients are reasonable estimates of the associated shadow prices, consistent with previous literature (e.g. approximately $40,000 for a quarter acre lot and a price/square foot around $100 square foot).[30] In general, the full sample models and the restricted sample models provide similar results.[31]

The last two rows of results in Table 2a (bolded) report the coefficients on the two bargaining factors in equation (7). Looking first at the results for all investors (the rightmost two columns), the estimated coefficient, b, on $(D^{sell} - D^{buy})$ is positive and highly significant. The positive bargaining estimate implies that *ceteris paribus*, investors sell for higher prices and buy at lower prices when negotiating with a non-investor. This favorable bargaining result could be attributable to greater experience, more specialized expertise or better market timing. The estimated coefficient on the demand factor, $(D^{sell} + D^{buy})$, is negative and significant. The negative sign indicates that investors tend to be active in a lower valued segment of the housing market (after controlling for observed characteristics). We saw a suggestion of this in Table 1 where we saw investors buying and selling somewhat smaller and older homes. However, the model for the estimated demand coefficient controls for all observed housing characteristics and so is attributable to unobserved characteristics (e.g., lower quality or poorer condition) or locational differences at a finer level than the census tract.

[30] The negative coefficient on the number of bedrooms is a frequently seen result. Recall, that the coefficient reflects the price per bedroom after controlling for total square footage of the home. A preference for larger bedrooms can be reflected as a negative coefficient for the number of bedrooms or total rooms after controlling for overall size.

[31] The estimated attribute prices are generally higher in the later time period. This could reflect the failure of the fixed effects to fully control for house price inflation. We experimented with using real 2016 dollars rather than nominal dollars and the results were qualitatively similar.

The other two pairs of columns reflect the results of defining investors to be just those individuals flagged as investors either by address or frequency of trading or to those professional investors flagged by name.[32] These two restricted models provide some insight into possible differences in the operating practices of individual investors and professional investors. We first note that the estimated attribute prices are quite similar. However, the estimated bargaining related coefficients are quite different. The positive bargaining effect and negative demand effect are larger in magnitude for the professional investors than they are for the combined definition of investor. At the same time, the bargaining estimate for individual investors is a small negative number and is only marginally significant in the post 2003 sample. The estimated demand effect is negative and significant for both types of investors but is markedly smaller for individual investors than for professional investors. Taken as a whole, the bargaining results suggest that most of the pricing-related bargaining power of investors is attributable to the professional investors. We find little evidence that individual investors pay markedly lower prices or sell at higher prices than do owner-occupiers. Both types of investors tend to operate in a lower valued market segment (due to unobserved property and location characteristics) – but the differential is much stronger for the professional investors.

Table 2b presents the results of estimating equation (7), using natural log transformations for price and size characteristics. One advantage of the transformation is that

[32] Note that these restricted definitions imply that in the results using the definition of investor restricted to just individual investors, if an individual investor sells to a professional investor, the bargaining variable will be +1 not zero and the demand variable will take on the value of 1 because the professional investor is classified as a non-investor in this particular regression. Similarly, if a professional investor sells to an individual investor, the bargaining variable will take of a value of +1 and the demand variable will also be +1 in the regressions that use the definition of investor restricted to just professional investors.

the estimated bargaining and demand effects can be interpreted as percentage differences in price. Focusing on the bargaining effects and looking at the rightmost two columns, we see that the bargaining effect is estimated to be in the range of 10%-13%. Again, the positive sign indicates selling at higher prices and buying at lower prices. The estimated demand effect is in the range of -7% to -10%. The negative sign indicates investors are working in a lower value segment of the market, after controlling for the known characteristics and census tract by year fixed effects. Reviewing the models using narrower definitions of investors, we see the estimated bargaining effect is essentially zero for individual investors and the estimated demand effect is on the order of a 3-4% discount. In contrast, for professional investors, we observe an estimated bargaining effect of roughly 16% and a demand effect of -13%. These differences tell essentially the same story discussed above based on the regressions without log transforms.

To facilitate comparison of the various model results, Table 3 presents just the estimated bargaining coefficients from the twelve models presented in Tables 2a and 2b (identified here as models 1-4). In addition, Table 3 presents the results of three robustness checks. Recall that in Models 1-4, we exclude all transactions deemed to be likely REO sales and sales by financial institutions. In the first robustness check (Model 5), we include both categories of transactions.[33] Many of these added transactions are the sales of recently foreclosed or distressed properties by a financial institution to an owner-occupier or investor. In Model 5 with the expanded sample, we include indicator variables identifying likely REO sales

[33] All of the additional transactions in Model 5 relative to Models 1-4 were executed via a warranty deed and thus do not reflect the transfer of the property from a defaulted borrower to a foreclosing lender. Such transactions typically involve a deed type other than a warranty deed.

and sales by financial institutions as well as the full set of characteristics and bargaining related variables used in Models 1-4. For this exercise, we report only the bargaining results for the full time period (1986-2016) without log transforms and report just the bargaining effects so the best comparison is with Model 1. The results are quite similar. The largest differences arise with the professional investors where we see a somewhat smaller bargaining effect and demand effect. This is likely because the REO sales and financial institution sales generally entail a motivated "professional" investor as seller and because such sellers have less bargaining power in those types of transactions.

The second robustness check (Model 6) includes new home sales transactions but excludes REO sales and financial institution sales. As with Model 5, the sellers of new homes are categorized as professional investors. Because we include the full time period and use nominal sales prices, the best comparison is with Model 1. As with Model 5, Model 6 results for individual investors are essentially unchanged. The results for professional investors reflect larger bargaining and demand effects—but the signs are the same. We believe these results support the reasoning that led to the exclusion of new home sales in the first place. Negotiations for such sales are different than the back and forth negotiations typical in secondary market sales. Furthermore, buyers likely are willing to pay a premium for a house with features and finishes they have personally selected. Also, some new home buyers defer some options such as finishing the basement and adding landscaping to control the overall cost. We expect these tendencies would bias upward the estimated bargaining power of the builder. In Model 6, the results for the specification that pools all investor types are more affected by the inclusion of new homes than the similar bargaining and demand estimates in Model 5

which is consistent with the fact that there were more new home sales than there were REO and financial institution sales.

Finally, we report the bargaining effects estimated using real prices (expressed in 2016 dollars) as Model 7. Because dollar denominated coefficients in a model of real prices are not directly comparable to those of Model 1, we use the specification with log transforms and the best comparison is with Model 2. The results are nearly identical.

In summary, our results lead us to four major conclusions:

1. Investors have significant "bargaining power" – they sell for higher prices and buy at lower prices, *ceteris paribus.*
2. Investors tend to be involved with properties with lower market values after controlling for observed property characteristics as well as location by year fixed effects.
3. Individual investors seem to behave differently from professional investors in that they have less bargaining power and deal with properties with values closer to the market average.
4. The above results are not driven by our choices to exclude REO sales and new home sales.

IV.2 Estimating Contagion Effects

As described in the Methodology Section, we use a repeat sales approach to estimate the "contagion effect" of having nearby investor-owned properties when a property transacts.[34] We believe using a repeat sales approach is the best way to control for unobserved property and location characteristics. To the extent that the number of nearby investor owned properties is correlated with unobserved property or location characteristics, a hedonic model which adds a measure of investor activity to the right hand side variables will generate biased estimates of the contagion effect.

The repeat sales approach is costly in that it discards transactions from homes that sell only once during the observation period. We are fortunate to have both a long sample period (1986-2016) and a large number of transactions. Nevertheless, we are sensitive to the potential criticism that the excluded transactions are fundamentally different than the repeat transactions. In our full sample, we have transactions from 99,817 different single family properties. 31,347 of those homes have only a single transaction.[35] We further filter out transaction pairs that have short holding periods, transaction prices less than $5000 or more than $1,000,000 or unusually low or high average annual holding period returns. The resulting repeat sales sample includes 52,136 homes and 92,753 repeat sales pairs. Table 4, reports the frequency of repeat sales for this sample of homes. For example, 27,027 have exactly two transactions and thus provide a single repeat sales transaction; 14,603 homes have three

[34] In contrast to the analysis of bargaining effects, these neighborhood effects are based on the stock of investor-owned properties rather than a flow.

[35] Recall that, to the best of our ability, we exclude non-arms' length transactions and transactions that appear to have erroneous price data. If a home sells at t_0, t_1 and t_2, but we exclude the transaction at t_1, we treat the sale at t_0 as the original purchase and the sale at t_2 as the subsequent resale. Some homes that transact twice may be excluded if one of the two sales is excluded for violating the filters described earlier.

transactions and thus provide two repeat sales observations. The maximum number of repeat sales from a single home over thirty years is nine.

Table 5 compares the property characteristics for the full sample of 99,817 homes to the 52,136 homes with at least one repeat sale and the 47,681 homes excluded either because they had only a single transaction or because of other characteristics of the sales.[36] The repeat sales sample includes smaller and older homes with fewer bedrooms and bathrooms. The differences tend to be numerically small (< 100 square feet in finished area, < 700 square feet of lot size and approximately four years in age (on a base of 47 years[37]), but given the sample size, all (except the number of bathrooms) are statistically significant. In our opinion, the benefit of controlling for unobserved property and location differences outweighs these relatively small attribute differences.

Table 6 provides a different perspective on the data and the role of the different types of investors. In the repeat sales specification the dependent variable is the log of the ratio of prices ($\ln(P_1/P_0)$) and is reported to be .3337 for the full sample. This corresponds to an average change in price from first to second sale of 54.9%.[38] Using the time between sales as the holding period (measured in years), the total price appreciation can be expressed as an annual rate of price appreciation – assuming annual compounding.[39] For example, looking at the full

[36] The most significant filter restricted the sample to just those repeat sales pairs that exhibited less than a +/- 50% per year annual rate of price appreciation (depreciation). Other filters included eliminating all short term resales.
[37] Age of the house is measured at the time of the first sale in the sample and consequently differs from the average age reported in Table 1, which averages age at all transactions for each house.
[38] The short cut approximation that ln (1+r) is roughly equal to r only holds for r close to zero.
[39] Note that the rate of price appreciation is only one component of the total return from investing in the home. In addition, investors receive a stream of rental income and owner-occupiers receive a stream of housing benefits associated with living in the home. Furthermore, we do not observe maintenance and improvement expenditures which would offset a portion of the price appreciation. See Harding, Rosenthal and Sirmans (2007).

sample, given the roughly six year holding period, the average annual (annual compounding) rate of price appreciation per year is 7.73%.[40].

Table 6 provides a breakdown of the full sample into repeat sales pairs where the original buyer is an individual investor, a professional investor or an owner occupier (non-investor). This breakdown enables us to look at the question of whether investors earn a higher rate of return from price appreciation than do owner occupiers. Based on the bargaining results that showed investors pay less when purchasing and sell for more when selling, we expect that the rate of return from price appreciation should be greater.[41] The numbers in Table 6 are consistent with this prediction: On average, professional investors earn an annual rate of return from price appreciation of 12.42% compared with 7.20% for owner occupiers. Individual investors earn an intermediate rate of return from price appreciation of 9.86%. Professional Investors hold the property for a markedly shorter time than owner – occupiers (3.4 years vs. 6.1 years). Again, Individual Investors have an intermediate holding period of 5.1 years.

The lower portion of Table 6 describes the locational variables N^i_t and M^i_t that are included in the estimation of equation (12) (repeated here for convenience):

$$\ln\left(\frac{P^i_{t+\tau}}{P^i_t}\right) = (\gamma_{t+\tau} - \gamma_t) + a\left(N^i_{t+\tau} - N^i_t\right) + b\left(M^i_{t+\tau} - M^i_t\right) + \varepsilon^i_{t,t+\tau} \qquad (12)$$

The table reports that in the full sample, the average number of REO properties was approximately 1 unit within a circle of .2 km (roughly 1/8th mile) at the original purchase and

[40] The distribution of the annual return from price appreciation is skewed to the right. The median annual rate of return is 6.85%. The annual rate of price appreciation associated with a .3337 log ratio of price ratio is 6.26%.
[41] It is important to note that we are not able to control for maintenance and improvement expenditures made by buyers after the purchase. If investors invest additional funds for repairs after purchase, the calculated rate of return will overstate the investor's true rate of return.

1.63 at the time of resale. To provide perspective, there were an average of 88 single family residences in the same circumference and so the percentage of nearby properties that were in distress was about 1.1% at t_0 and 1.9% at t_1.The number of nearby investor owned properties is significantly larger—approximately 13 properties (15%) at both t_0 and t_1.[42] As shown in equation (12), the change in these counts is included in the repeat sales regression. The last two rows of Table 6 report these average changes—a small increase in nearby distressed properties and a small decrease in investor-owned properties.

There are differences in the counts of distressed properties and investor-owned properties when we sort by the type of original purchaser. Of note, professional investors buy properties with a substantially larger number of investor owned properties in the immediate vicinity (21 vs 13) and a larger number of distressed properties (1.29 vs 1.05). This suggests that these investors tend to cluster their purchases in areas where other investors are active. Also of interest is that the number of distressed properties declines (compared with an overall average increase) on average during the shorter holding period of these investors and the number of nearby investor-owned properties falls sharply during the holding period. This suggests that investors are buying in neighborhoods that improve during the holding period.[43] Owner-occupier buyers tend to buy properties in neighborhoods characterized by near average distressed properties and investor-owned properties. As before, individual investors fall between these two subgroups.

[42] Rosenthal (2018) reports that the national average for investor-owned single family detached properties is approximately 15%.

[43] In other words, the flow of investor buyer and seller houses is accompanied by an overall improvement in the quality of these houses. Thus, a larger stock of investor-owned properties appears to be correlated with price increases in the stock of all houses – both investor-owned and owner-occupied - in the neighborhood.

Figure 1 plots our estimated Denver price index from 1987 (the first year with Case Shiller data) through 2016. The figure compares our estimated price index with the Denver indices published by the Federal Housing Finance Authority (FHFA) and S&P CoreLogic Case-Shiller. It is important to note that the two published indices are for the full Denver metropolitan area whereas our data is restricted to the City of Denver. Further, the FHFA and Case Shiller indices include transactions for condominiums and 2-4 unit structures as well as the detached single family homes that comprise our index. Also, of interest, the FHFA index[44] is based on loans purchased by the GSEs (both purchase money loans and refinance loans where appraised value is used in lieu of the sale price). These loans are restricted in size because the GSE are required to focus on low to moderate income purchasers. The S&P CoreLogic Case-Shiller index is based solely on reported sales transactions.[45] For these reasons, our index does not exactly mirror the published indices. We plot two variations of our index: one that estimates just the price index without controls for changes in nearby homes (i.e. excludes the two rightmost terms of equation (12)) and one that includes those controls. The figure shows that our price index exhibits the same general pattern over time as do the other price indices – namely a long gradual ramp up of prices from the 1990s to the early 2000s followed by a relatively modest (compared with other MSAs such as Miami, Phoenix or Las Vegas) decline in the late 2000s. The major difference is that our index reflects a more rapid recovery post 2010

[44] We used the FHFA Annual HPI for CBSAs (All-Transactions Index) for CBSA #19740 (Denver-Aurora-Lakewood CO). The FHFA reports that these annual CBSA indexes should be considered developmental. As with the standard FHFA HPIs, revisions to these indexes may reflect the impact of new data or technical adjustments. Indexes are calibrated using appraisal values and sales prices for mortgages bought or guaranteed by Fannie Mae and Freddie Mac. For more information on the calculation of FHFA indexes, see: Bogin, Doerner and Larson (2018).
[45] CoreLogic collects sales data from various sources and verifies reported transactions using its own proprietary algorithms. See https://us.spindices.com/index-family/real-estate/sp-corelogic-case-shiller.

than do the other indices. Overall, we believe the figure supports the belief that our repeat sales sample is generally representative of the local house price movements. [46]

Table 7 presents the estimated coefficients on the change in nearby distressed properties (REO Effect) and the coefficient of the change in the number of nearby investor owned properties (Investor Effect). The table also reports the average annual rate of house price appreciation from 1987 through 2016 as a summary of the plotted indices in Figure 1. The table reports the results from four different model specifications. Models 1 and 2 exclude all repeat sales transactions where the sale at time 0 is deemed to be an REO sale (as was the case in the bargaining analysis). Models 3 and 4 include those 4,483 extra REO related transactions. For each pair of model specifications, we estimate equation (12) with and without the controls for nearby REO properties and nearby investor-owned properties. We first observe that the estimated REO Effect shows a negative contagion effect of approximately -1.3% in both Models 2 and 4. This order of magnitude is consistent with other credible published estimates. For example, HRY report an estimated REO effect of roughly 1%. The estimated effect from nearby investor owned properties is approximately +.5% -- opposite in sign and roughly 40% of the magnitude of the REO Effect. It is unlikely that the favorable correlation between the number of nearby investor owned properties and price is causal in the sense that people are willing to pay more for a property because there are nearby investors. Rather, it seems likely that the

[46] The overall price pattern exhibited by all indices in Figure 1 is distinctly different from the price pattern of markets such as Miami FL or Phoenix, AZ which show a dramatic rise in the early 2000s followed by a very sharp and deep decline. For instance, Cohen et al (2012) note that Denver had a 76.9% average price increase from 1998-2006, while only a 15.2% average decline in 2006-2012. In contrast, they indicate that Miami, Phoenix and Las Vegas experienced average increases of 264.9%, 182.5%, and 164.2% during the 1998-2006 time frame, respectively. On the other hand, their declines were much more dramatic than Denver's, with average decreases of 65.2%, 62.0%, and 70.0% between 2006 and 2012, respectively.

relationship is related to the ability of investors to pick properties and locations that are more likely to outperform the overall market. Recall from the discussion above, that investors seem to pick properties located in neighborhoods where the number of distressed properties was declining rather than increasing and in which the number of investor-owned properties are declining. Also, it is important to keep in mind that we do not control for post purchase investment by either investors or homeowners. Given that investors buy lower quality properties, it is likely that these investors spend more on maintenance and improvements. Li (2017) found that investment in property improvements is also "contagious" in that if one owner in a neighborhood invests in property renovations and improvements, the likelihood that other nearby property owners will also invest in improvements increases. This mechanism helps explain the positive price effect reported in Table 7.

V. Discussion & Conclusions

The surge in investor ownership of single family homes following the housing and financial crisis of 2007-2008 has triggered significant policy debate over the extent of Federal support for homeownership in the U.S. Traditionally, U.S. housing policy favored owner-occupancy through various means, including tax incentives and financing advantages. This policy was justified by two perceptions: First that homeownership was associated with a number of positive externalities including wealth creation from equity buildup, more community involvement and better school performance by children of homeowners. The second perception was that a high level of investor ownership was associated with negative externalities including lower property values and increased foreclosures. In this paper, we

focus on the latter perception by studying the behavior of investors and the effect of an increase in investor owned properties on local values. We find that the negative perception with respect to investors and property values is not supported in our data.

Because previous researchers have found that investors buy properties at a discount, we first study the bargaining power of investors relative to owner-occupiers. To control for the potential bias of estimates that do not control for the possibility that investor choices of properties are endogenous, we apply the bargaining framework developed by Harding, Rosenthal and Sirmans (2003). We find that investors are strong bargainers relative to owner occupiers. Controlling for observed house characteristics as well as time and location fixed effects, investors pay less when acting as a buyer and sell for more when acting as a seller. Interestingly, we find that there is a significant difference between professional investors (corporations and partnerships whose business is buying and renting single family properties) and smaller individual investors. The bargaining advantage of professional investors is far greater than that of individual investors – roughly 16% for professional investors compared with near zero for individual investors. We also find that investors operate in a lower valued segment of the market—even after controlling for observed characteristics and time and location fixed effects. This finding suggests that investors are more likely to purchase lower quality, poorly maintained properties and that estimates of "investor discount" that do not control for this fact are likely biased.

We next directly investigate whether there is a negative spillover effect associated with an increase in the number of investor-owned properties in a neighborhood. To control for unobserved property characteristics, we use a repeat sales framework where we directly

measure the change in foreclosed properties and investor owned properties between the two sales. Our results confirm previous findings of a significant negative externality from nearby foreclosed properties but also show that increased investor ownership in a neighborhood has a small positive effect on nearby house prices. Our results do not necessarily imply a direct causal effect. As noted in the discussion above, we observe that investors purchase lower quality properties and/or properties with deferred maintenance. Although, we do not observe the improvements made by investors, our findings strongly suggest that investors make above average investments in their properties.[47] Li (2017) finds that low neighborhood capital expenditure results in a less attractive neighborhood and adversely affects neighboring property investment and prices. We believe that the reverse argument applies to investors who invest in maintenance and improvements thereby triggering others in the neighborhood to improve their properties. While it may seem counter-intuitive that increased ownership by investors who buy at a discount to market value could have a positive effect on nearby prices, we believe the explanation lies in the combination of the investor's ability to select properties and neighborhoods ripe for improving values, the tendency to improve the purchased properties along with the tendency for nearby homeowners to also invest in their properties when they see others making improvements.

In summary, our analysis demonstrates that investors negotiate favorable prices on lower quality homes, invest to raise the quality sufficient to rent the property and eventually sell the property at a relatively higher price. When acting as sellers, investors can be more

[47] For example, our finding that professional investors earn an average annual rate of price appreciation of 12.42% compared with 7.2% for owner-occupiers suggests that a portion of the excess annual return is attributable to unobserved maintenance and improvement expenditures.

“patient” and wait for the neighborhood to improve and for the proverbial “motivated” buyer than an owner-occupier who must move to take a new job or obtain a larger home for a larger family. Our results show that investor activity in a market may be stabilizing and beneficial—supplying liquidity in downturns and supply in upturns. It appears that in Denver, investor purchase activity absorbed excess supply while their sales provided additional stock of housing when demand for owner-occupied housing improved. In other words, greater investor activity helped smooth the Denver housing cycle.

Future work in this area is needed to better explore the role of maintenance and improvements made by investors after purchase. Our research was limited because we do not have data on such expenditures. Other research should be directed at determining whether the role played by investors in a market differs with the extent of the price variation. For example, our Denver results are based on a market that did not experience an extreme “boom/bust” market in 1998-2012. Under those conditions, we found investors played a stabilizing role. That role could be different in cities with markets that underwent more severe disruption.

Table 1

	Summary Statitics						
	Full Sample		Individual Investors		Professional Investors		Non-Investors	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sale Price ($)	$234,593	$150,270	$ 192,478	$121,680	$247,557	$159,817	$244,754	$153,948
Lot size (sq. ft.)	6693	2297	6539	2156	6707	2269	6734	2344
House Size (sq. ft.)	1318	554	1173	469	1277	567	1367	567
Finished Bsement (sq. ft.)	419	444	346	415	408	447	441	450
No. of Bedrooms	2.67	0.76	2.56	0.77	2.65	0.79	2.70	0.75
No. of Bathrooms	2.11	0.94	1.88	0.88	2.07	0.96	2.18	0.94
Full Bathrooms	1.87	0.76	1.70	0.76	1.87	0.81	1.92	0.75
Half Baths	0.24	0.44	0.17	0.39	0.20	0.41	0.26	0.46
House Age (yrs.)	54	26	54	25	59	23	53	26
New House (<= 1 yr.)	0.00%		0.00%		0.00%		0.00%	
House Age (1-5] yrs.	3.87%		2.98%		3.33%		4.18%	
House Age (5-10] yrs	4.20%		3.63%		2.24%		4.72%	
House Age (10-20] yrs	6.12%		5.33%		3.22%		6.88%	
House Age (20-50] yrs	28.75%		30.07%		19.23%		29.71%	
Older House (> 50 yrs.)	57.07%		58.00%		71.98%		54.52%	
REO Sale Indicator	0.00%		0.00%		0.00%		0.00%	
Financial Inst. Seller	0.00%		0.00%		0.00%		0.00%	
Investor Sellers	28.20%		93.50%		68.55%		0.00%	
Investor Buyers	12.87%		38.50%		38.31%		0.00%	
Investor to Investor(%)	9.82		32.00		6.86		0.00	
Individual to Individual (%)	68.75		0.00		0.00		100.00	
Investor to Individsual (%)	18.37		61.50		61.69		0.00	
Individual to Investor (%)	3.05		6.50		31.45		0.00	
Bargaining Variables								
Bargaining Difference	0.15		0.55		0.30		0.00	
Bargaining Sum	0.41		1.32		1.07		0.00	
Number of Observations	126,351		26,509		15,815		86,871	

Notes

1. The major column headings (Individual Investors, Professional Investors and Non-Investors) replect whether the indicated type of marlet participant was involved in the transaction as either a buyer or a seller (or both)
2. Transactions that involve Non-Investors (owner-occupiers) as both buyer and seller are classified as Non-Investor transactions
3. The columns titled Professional Investors include a Professional Investor (see def, in text) as buyer, seller or both.
   The other party to the transaction can be either an owner-occupier (Npn-Investor) or a party that could be deemed an individual investor
   In the portion of the Table that describes the type of transaction, Investor to investor transactions entail Professional Investors as both buyer and seller
   However mixed transactions (with buyer of one type and seller another), the "individua; category includes both owner-occupiers and non-Professional investors
4. The columns headed Individual Investors have an indivudal investor (see text) as buyer, seller or both.
   The other party to the transaction could be either an owner-occupier or a party that could be deemed a professional investor.
5. Because some transactions entail the sale between a Professional Investor and an Individual Investor, the sum of the three subsamples exceeds the total number of transactions in the Full Sample.
6. The columns headed Full Sample define "investors" to be both Professional and individual Investors as a single Investor market participant.

Table 2a

	Estimate of Bargaining Effects					
Dependet Variable						
Sale Price ($)						
	Individual Investors		**Professional Investors**		**All Investors**	
VARIABLES	Full Sample	2003-2016	Full Sample	2003-2016	Full Sample	2003-2016
Lot Size (sq. ft.)	3.55	3.74	3.59	3.76	3.57	3.80
	(34.21)	(23.52)	(35.32)	(24.41)	(34.80)	(24.45)
House Size (sq. ft.)	89.26	109.59	89.41	109.78	88.84	109.25
	(151.91)	(122.17)	(155.74)	(126.25)	(153.02)	(124.67)
Finished Bsement (sq. ft.)	36.42	41.33	35.91	40.52	36.06	40.58
	(70.28)	(51.46)	(70.82)	(51.99)	(70.39)	(51.71)
No. of Bedrooms	-5,258.06	-6,217.82	-5,208.23	-6,139.03	-5,182.17	-6,137.06
	(-16.62)	(-12.31)	(-16.82)	(-12.52)	(-16.57)	(-12.44)
Full Bathrooms	7,459.79	16,207.32	7,839.46	16,835.23	7,824.74	16,847.15
	(19.85)	(27.28)	(21.31)	(29.17)	(21.07)	(29.02)
Half Baths	4,775.21	6,098.24	5,094.00	6,566.82	4,888.37	6,405.74
	(9.54)	(7.82)	(10.40)	(8.68)	(9.88)	(8.41)
House Age (5-10] yrs	-10,656.72	-18,762.03	-9,991.75	-17,839.60	-10,305.50	-18,147.52
	(-7.50)	(-9.27)	(-7.18)	(-9.07)	(-7.34)	(-9.17)
House Age (10-20] yrs	-23,585.88	-30,627.37	-22,884.69	-29,772.14	-23,378.32	-30,375.12
	(-16.87)	(-14.26)	(-16.72)	(-14.28)	(-16.92)	(-14.48)
House Age (20-50] yrs	-53,357.72	-47,203.01	-51,857.74	-45,127.25	-53,100.05	-46,297.86
	(-37.01)	(-21.08)	(-36.75)	(-20.76)	(-37.27)	(-21.16)
House Age > 50 yrs	-61,620.80	-59,099.47	-59,295.26	-55,673.59	-60,765.23	-56,785.34
	(-41.87)	(-26.03)	(-41.16)	(-25.25)	(-41.78)	(-25.59)
Bargaining Effect	**-1,487.01**	**-1,604.51**	**34,186.72**	**38,475.28**	**19,362.83**	**28,669.60**
	(-2.81)	**(-1.81)**	**(65.85)**	**(57.64)**	**(46.73)**	**(47.87)**
Demand Effect	**-3,752.31**	**-7,950.33**	**-26,092.86**	**-28,817.74**	**-11,947.08**	**-21,162.17**
	(-11.23)	**(-12.20)**	**(-51.32)**	**(-44.10)**	**(-43.05)**	**(-47.08)**
Constant	130,392.92	144,555.36	128,402.08	141,975.31	130,196.46	143,602.82
	(79.94)	(56.94)	(80.67)	(57.78)	(80.72)	(57.88)
Observations	126,351	68,745	126,351	68,745	126,351	68,745
R-squared	0.407	0.464	0.432	0.495	0.420	0.489
Number of Fixed Effects	3,545	1,790	3,545	1,790	3,545	1,790

Notes:

1. All Models estimated using stata's xtreg command including tract by year fixed effects
2. Sample Excludes Transactions deemed to be REO sales and sales by Financial Institutions.
3. Bargaining Effect estimated using investor seller - investor buyer
4. Hosue Age at sale is measured as sale year less year built. New homes are defined as those with age 0 or 1 year.
5. New Homes are excluded from the estimating sample because they are generally sold by the builder.
6. The excluded house age category includes homes older than 1 year and <= 5 years.

Table 2b

	Estimate of Bargaining Effects					
Dependet Variable						
ln(Sale Price ($))						
	Individual Investors		**Professional Investors**		**All Investors**	
VARIABLES	Full Sample	2003-2016	Full Sample	2003-2016	Full Sample	2003-2016
Ln(Lot Size (sq. ft.))	0.13	0.12	0.14	0.12	0.13	0.12
	(33.38)	(20.82)	(34.48)	(21.77)	(33.88)	(21.73)
Ln(House Size (sq. ft.))	0.41	0.41	0.41	0.42	0.40	0.41
	(92.90)	(65.45)	(95.20)	(67.47)	(92.80)	(66.23)
ln(Finished Bsement (sq. ft.))	0.02	0.02	0.02	0.02	0.02	0.02
	(58.53)	(37.77)	(58.56)	(37.61)	(58.22)	(37.47)
No. of Bedrooms	-0.00	-0.01	-0.00	-0.01	-0.00	-0.01
	(-3.16)	(-3.77)	(-3.02)	(-3.74)	(-2.76)	(-3.66)
Full Bathrooms	0.03	0.05	0.03	0.05	0.03	0.05
	(18.20)	(19.46)	(19.65)	(21.26)	(19.52)	(21.13)
Half Baths	0.02	0.02	0.02	0.02	0.02	0.02
	(7.92)	(4.52)	(8.88)	(5.42)	(8.36)	(5.15)
House Age (5-10] yrs	-0.04	-0.05	-0.04	-0.05	-0.04	-0.05
	(-5.66)	(-5.64)	(-5.32)	(-5.36)	(-5.45)	(-5.47)
House Age (10-20] yrs	-0.09	-0.09	-0.08	-0.08	-0.09	-0.08
	(-12.92)	(-8.95)	(-12.62)	(-8.76)	(-12.85)	(-9.00)
House Age (20-50] yrs	-0.19	-0.15	-0.18	-0.14	-0.19	-0.15
	(-27.37)	(-15.25)	(-26.76)	(-14.71)	(-27.38)	(-15.17)
House Age > 50 yrs	-0.21	-0.18	-0.20	-0.17	-0.20	-0.17
	(-29.34)	(-18.19)	(-28.21)	(-17.12)	(-28.93)	(-17.52)
Bargaining Effect	**0.00**	**-0.00**	**0.16**	**0.17**	**0.10**	**0.13**
	(1.14)	**(-0.92)**	**(65.25)**	**(59.07)**	**(48.98)**	**(49.52)**
Demand Effect	**-0.03**	**-0.04**	**-0.13**	**-0.13**	**-0.07**	**-0.10**
	(-17.13)	**(-13.97)**	**(-54.08)**	**(-46.60)**	**(-49.32)**	**(-50.19)**
Constant	8.19	8.50	8.15	8.47	8.21	8.50
	(206.06)	(151.22)	(209.45)	(155.15)	(208.84)	(154.50)
Observations	127,152	69,125	126,585	68,745	126,585	68,745
R-squared	0.242	0.240	0.274	0.286	0.262	0.277
Number of Fixed Effects	3,627	1,790	3,625	1,790	3,625	1,790

Notes:

1. All Models estimated using stata's xtreg command including tract by year fixed effects
2. Sample Excludes Transactions deemed to be REO sales and sales by Financial Institutions.
3. Bargaining Effect estimated using investor seller - investor buyer
4. Hosue Age at sale is measured as sale year less year built. New homes are defined as those with age 0 or 1 year.
5. New Homes are excluded from the estimating sample because they are generally sold by the builder.
6. The excluded house age category includes homes older than 1 year and <= 5 years.

Table 3

	Investor Bargaining Power for Single Family Residential Homes Sales					
	Denver Cololrado					
	(t-statistics in prentheses)					
	Individual Investor Bargaining Effects		Professional Investor Bargainig Effects		Professional & Indivduals Pooled	
Model Description	**Bargaining Effect**	**Demand Effect**	**Bargaining Effect**	**Demand Effect**	**Bargaining Effect**	**Demand Effect**
	$D^{sell} - D^{buy}$	$D^{sell} + D^{buy}$	$D^{sell} - D^{buy}$	$D^{sell} + D^{buy}$	$D^{sell} - D^{buy}$	$D^{sell} + D^{buy}$
Model 1	**Models 1 Through 4 Exclude New Home Sales and REO Sales**					
Wirhout log transforms	-1,487.01	-3,752.31	34,186.72	-26,092.86	19,362.83	-11,947.08
Full Sample	(-2.81)	(-11.23)	(65.85)	(-51.32)	(46.73)	(-43.05)
Model 2						
With log transforms	0.00	-0.03	0.16	-0.13	0.10	-0.07
Full Sample	(1.14)	(-17.13)	(65.25)	(-54.08)	(48.98)	(-49.32)
Model 3						
Wirhout log transforms	-1,604.51	-7,950.33	38,475.28	-28,817.74	28,669.60	-21,162.17
2003-2016 Sales	(-1.81)	(-12.20)	(57.64)	(-44.10)	(-43.05)	(-47.08)
Model 4						
Wirh log transforms	-0.00	-0.04	0.17	-0.13	0.13	-0.10
2003-2016 Sales	(-0.92)	(-13.97)	(59.07)	(-46.60)	(49.52)	(-50.19)
Model 5	**Model 5 Excludes New Home Sales and Includes REO Sales - Compare with Model 1**					
Includes REO & FI Sales	-1,654.19	-4,010.15	29,378.94	-22,588.66	17,272.18	-11,357.61
Full Sample W/O ln tran	(-3.37)	(-12.64)	(62.61)	(-48.96)	(45.29)	(-43.32)
Model 6	**Model 6 Includes New Home Sales and Excludes REO Sales -- Compare with Model 1**					
Includes New Home Sales	-2,025.44	-4,564.39	43,331.11	-24,765.13	25,288.98	-12,342.64
Full Sample W/O ln tran	(-3.77)	(-13.22)	(84.30)	(-47.74)	(60.78)	(-43.02)
Model 7	**Model 7 Uses real (2016) Dollars and Excludes New Home Sales and REO Sales -- Compare with Model 2**					
Prices in 2016 $	0.00	-0.03	0.16	-0.13	0.10	-0.07
Full Sample With ln trans	(1.07)	(-17.14)	(65.42)	(-54.53)	(49.09)	(-49.57)

Notes

1 Table reports just the coeffcients for the bargaining and demand factors only. The full model specification includes the house and lot characteristcs and year by census tract fixed effects. See Tables 2 and 2a for full model specification and results

2 Models 1 -4 all exclude transactions deemed to be likely REO sales and all new home sales. The Full Sample for Models 1-4 includes 126351 records. For models 1-4, the 2003-2016 Sample includes 68,745 recrods

3 Models 5-7 are based on modified samples. Model 5 includes REO and Dinancial Institution Sales. For this model, the RHS variable list is expanded to include indicators for REO sales and financial institution sales. The model is run on for the full sample and includes 136,363 transactions.

4 Model 6 excludes REO and Financial institution sales but includes new home sales. The model specification is the sampe as that for models 1-4, but includes an indicator variable for homes 2-5 years old. The model is estimated for the Full sample and includes 138,291 transactions.

5 Model 7 is identical to Model 2 (uses log transaforms) except that prices are expressed in 2016 $. Model 7 is run on the Full sample of 126,351 transactions.

Table 4

Repeat Sales Frequency per House		
# of Repeat Sales Observations	**Number of Houses**	**Total Number of Repeat Records**
1	27,027	27,027
2	14,603	29,206
3	6,818	20,454
4	2,668	10,672
5	784	3,920
6	186	1,116
7	43	301
8	6	48
9	1	9
Total	**52,136**	**92,753**
	Homes	**Transactions**
Notes:		
1. Full Sample included 99,817 homes.		
2. 31,347 homes had a single transaction during the sample period.		
3. 16,434 were excluded as a result of filters on the transactions		
4. Filters excluded sales <$5000 or > $1,000,000		
5. Other filters excluded repeat transactions with >+/- 50% annual rate of return and repeat transactions that both occur in the same year.		

Table 5

Comparison of House Characteristics in Repeat Sales Sample										
									Difference	
	Full Sample			Repeat Sales Sample			Excluded Sample		Repeat-Excluded	
	mean	s.d.		mean	s.d.		mean	s.d.	mean	sig
House Size (sq. ft.)	1504	788		1458	705		1555	867	-97	***
Lot size (sq. ft.)	6769	3192		6460	2442		7108	3820	-648	***
Finished Bsement (sq. ft.)	398	482		403	470		393	496	11	***
House Age (yrs.)	47	32		50	32		46	32	3	***
No. of Bedrooms	2.79	0.84		2.79	0.84		2.83	0.86	-0.04	***
No. of Bathrooms	2.27	1.13		2.27	1.07		2.27	1.19	0.00	
Full Bathrooms	1.95	0.89		1.96	0.85		1.93	0.93	0.03	***
Half Baths	0.32	0.50		0.30	0.49		0.34	0.52	-0.03	***
No of Observations	99,817			52,136			47,681			
Notes:										
1. Table reports house characteristics. Characteristics are assumed to be fixed over time.										
2. The "Full Sample" includes all single family houses for which we have a sales transaction between 1986- 2016										
3. The Repeat Sales Sample includes only those houses that have at least one repeat sales transaction that meets criteria										
4. The Excluded Sample includes houses with only a single sale that meets our criteria										
5. Criteria include excluding "flips", excluding sales < $5000 or more than $1,000,000 , excluding new home sales and REO sales										
6. Significance is measured by a t-test assuming equal variances. Null is that there is no difference in means for the two subsamples.										
7. Not all characteristics are known for all houses because characteristics are not required for repeat sales estimates										

Table 6

	Summary Statitics for Repeat Sales and Contagion Estimation							
	Full Sample		Individual Investor Buyer		Professional Investor Buyer		Owner Occupier Buyer	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Purchase Price	$199,049	$133,419	$169,992	$112,599	$266,526	$180,103	$201,318	$133,362
Sale Price	$271,057	$164,735	$234,883	$140,072	$314,689	$205,592	$275,377	$165,771
Holding Period	5.86	4.29	5.10	3.95	3.40	3.48	6.08	4.33
$\ln(P_1/P_0)$	0.3377	0.4217	0.3619	0.3837	0.1788	0.5850	0.3396	0.4194
Avg Annual Return	7.73	10.09	9.86	10.27	12.42	21.81	7.20	9.23
# of Nearby Houses	88	31	88	32	87	35	88	30
# of Nearby REOs-- t0	1.05	3.01	1.06	3.02	1.29	3.27	1.05	3.00
# of Nearby REO - t1	1.63	4.06	1.24	3.32	1.19	3.03	1.72	4.20
# of Nearby Investor-Owneed - t0	13.36	11.73	15.54	12.20	21.33	27.03	12.69	10.49
# of Nearby Investor Owned - t1	12.84	9.99	15.58	11.16	18.25	20.92	12.18	8.97
Channge in # of nearby REOs	0.58	4.62	0.18	4.08	-0.10	3.90	0.67	4.73
Change in # of nearby Investors	-0.52	7.18	0.04	7.59	-3.08	11.39	-0.52	6.88
Number of Observations	92,753		12,877		2,864		76,743	

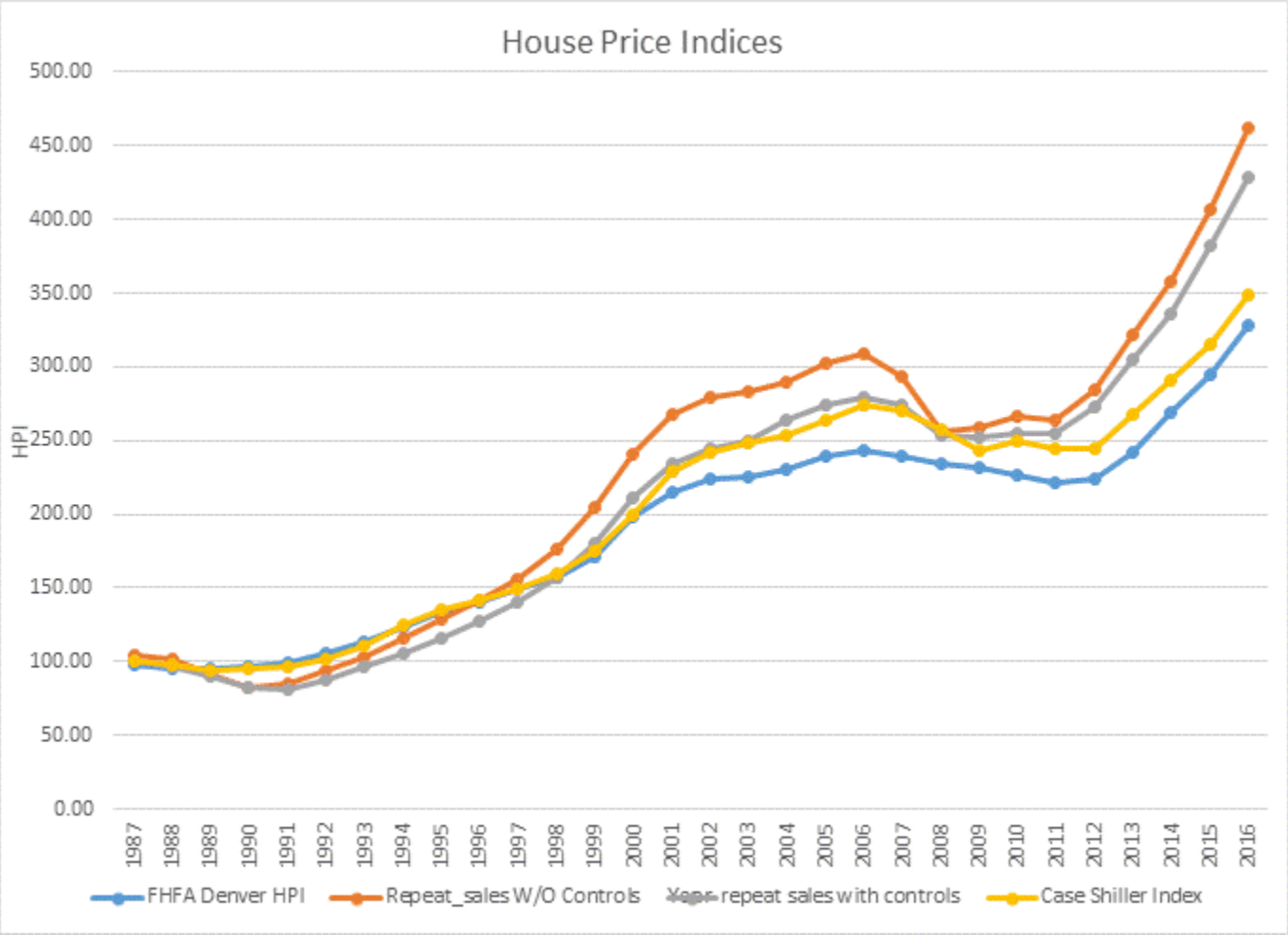
Notes

1. Table presents summary statistics used for the repeat sales and contagion effect estimation
2. Dependent varable is $\ln(price_1/price_0)$
3. Columns 3-8 present summary statsitcs based on the nature of the buyer at the first transaction in the pair
(No breakout is available based on the subsequent buyer at the time of resale)
4. The number of nearby houses, REOs and Investor Owned Properties are measured using a circle of radius .1 km or roughly .2 miles
The number is calculated at t0, the time the property was bought and t1, the time the property was resolld
5. The change in number of REOs and Investor Owned Properties are calculated as the number at the acquistion of the property less the number at the subsequent resale
6. The holding period is calculated in years as the year of sale minus the year of acquisition.
7. The repeat sale regression is run using annual year indicator variables defined in the standard manner is -1,0 or 1 depending on whether the property was bought or sold in the given ye

Table 7

	Contagion Coefficients (t-stats in parentheses)			
	REO Effect	**Investor Effect**	**Average Annual House Price App.**	**Number of Repeat Sales**
Model 1				
No Controls for Reo/Investors	--	--	5.23%	92,753
Excludes REO Related at t_0	--	--		
Model 2				
Controls for REO & Investor Contagion	-0.01256	0.00544	5.12%	92,753
Excludes REO Realted at t_0	(-46.71)	(23.16)		
Model 3				
No Controls for Reo/Investors	--	--	5.33%	97,238
Inckudes REO Related at t_0	--	--		
Model 4				
Controls for REO & Investor Contagion	-0.01291	0.00543	5.29%	97,238
Includes REO Realted at t_0	(24.35)	(-51.04)		
Notes:				
1. Contagion effects are estimated using the change in either nearby REOs or nearby Investor-Owned Properties as well as the standard repeat sales indicators for the years 1987-2016				
2. Models 3 & 4 include 4,483 records where the initial purchase at t0 appears to be an REO Sale				

Figure 1


House Price Indices
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
HPI
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
FHFA Denver HPI
Repeat_sales W/O Controls
repeat sales with controls
Case Shiller Index

References

Allen, M. T.; Rutherford, J.; Rutherford, R. and Yavas, A. 2018. "Impact of Investors in Distressed Housing Markets." *Journal of Real Estate Finance and Economics.* https://doi.org/10.1007/s11146-017-9609-0

Bailey, M. J.; Muth, R. F. and Nourse, H. O. 1963. "A Regression Model for Real Estate Price Index Construction." *Journal of the American Statistical Association,* 58(304), pp. 933-942.

Bogin, A., Doerner, W., & Larson, W. 2018. Local house price dynamics: New indices and stylized facts. *Real Estate Economics*.

Bracke, P. 2015. "How much do Investors pay for houses?" Staff Working Paper 549; Bank of England.

Case, K. E. and Shiller, R. J. 1989. "The Efficiency of the Market for Single-Family Homes." *The American Economic Review,* 79(1), pp. 125-137.

Case, K. E., and R. J. Shiller. 1990. "Forecasting Prices and Excess Returns in the Housing Market," *Journal of the American Real Estate & Urban Economics Association* 18:3, 253-273.

Cohen, J. P., Coughlin, C. C., & Lopez, D. A. 2012. The boom and bust of US housing prices from various geographic perspectives. *Federal Reserve Bank of St. Louis Review*, *94*(5), 341-67.

Coulson, N. E. and H. Li. 2013. "Measuring the external benefits of homeownership". *Journal of Urban Economics*. 77: 57-67.

Department of the Treasury and the Department of Housing and Urban Development. 2011. "Reforming America's Housing Finance Markets: A Joint Report to Congress. February, 2011.

Epple, D. 1987. “Hedonic Prices and Implicit Markets: Estimating Demand and supply Functions for Differentiated Products,” *Journal of Political Economy* 95:1, 59-80.

Fisher, L. M., Lambie-Hanson, L., & Willen, P. 2015. The role of proximity in foreclosure externalities: Evidence from condominiums. *American Economic Journal: Economic Policy*, *7*(1), 119-40.

Fisher, L. and L. Lambie-Hanson. 2012. “Are Investors the Bad Guys? Tenure and Neighborhood Stability in Chelsea, Massachusetts.” *Real Estate Economics*. 40(2): xx-yy..

Frame, W. Scott. 2010. “Estimating the effect of mortgage foreclosures on nearby property values: A critical review of the literature”, *Economic Review*, Federal Reserve Bank of Atlanta, ISSN 0732-1813.

Griliches, Z., (Ed.), 1971. *Price Indexes and Quality Change. (*Cambridge, MA: Harvard University Press).

Greenberg, J., R. S. Essene, and K. Lee. 2009. “The Myth of the Irresponsible Investor: Analysis of Southern New England’s Small Multifamily Properties.” *New England Community Developments,* Federal Reserve Bank of Boston. pp 8-11.

Hansz, J. A. and Hayunga K. 2014. “Cash Financing in Residential Real Property Transaction Prices. *Journal of Real Estate Research.*

Harding, J., E. Rosenblatt and V. Yao. 2012. “The Foreclosure Discount: Myth or Reality?”. *The Journal of Urban Economics. 71(2): 204-216.*

Harding, J., E. Rosenblatt and V. Yao. 2009."The Contagion Effect of Foreclosed Properties" *The Journal of Urban Economics* 66(3):164-178.

Harding, J., J. Knight and C.F. Sirmans. 2003. Estimating Bargaining Effects in Hedonic Models: Evidence from the Housing Market. *Real Estate Economics.* 31(4): 601-622.

Harding, J., S. Rosenthal and C.F. Sirmans. 2003. "Estimating Bargaining Power in Markets for Heterogeneous Products". *The Review of Economics and Statistics* 85(1): 178-188.

Harding, J., S. Rosenthal and C.F. Sirmans. 2007. Depreciation of Housing Capital, Maintenance and House Price Inflation: Evidence from a Repeat Sales Model. *Journal of Urban Economics.* 61(2): 193-217.

Haughwout, A. D.; Tracy, J.; and van der Klaauw. 2012 "Real Estate Investors, the Leverag Cycle, and the Housing Market Crisis. Federal reserve Staff Report 514.

Lampson, V.; G. McQueeen and B. Slade. 2004. "Do out-of-state buyers pay more for real estate? An examination of anchoring-induced bias and search costs." *Real Estate Economics.* 32(1):86-126.

Levitt, S. D.; and C. Syverson. 2008. "Market distortions when agents are better informed: The Value of Information in Real Estate Transactions". *Review of Economics and Statistics.*90:599-611.

Li, L. 2017. Why Are Foreclosures Contagious?. *Real Estate Economics*, *45*(4), 979-997.

Mills, J.; R. Molloy and R. Zarutskie. 2017. "Large scale buy-to-rent investors in the Single-Family-Housing Market: The emergence of a new asset class?" *Real Estate Economics.*

Molloy, Raven, and Rebecca Zarutskie. 2013. “Business Investor Activity in the Single-Family-Housing Market.” Federal Reserve Board of Governors FEDS Notes, December 5.

New York Times, June 27, 2014. “Investors Who Bought Foreclosed Homes in Bulk
Look to Sell” by Matthew W. Goldstein.

Poterba, J., and T. Sinai. 2008. "Tax Expenditures for Owner-Occupied Housing: Deductions for Property Taxes and Mortgage Interest and the Exclusion of Imputed Rental Income." *American Economic Review*, 98 (2): 84-89. DOI: 10.1257/aer.98.2.84

Rosen, S., 1974. “Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition,” *Journal of Political Economy* 82:1, 34-55.

Rosenthal, S. 2018. “Owned Now Rented Later? Housing Stock Transitions and Market Dynamics”. Working Paper.

Schnure, C. 2014. “Single-family rentals: Demographic, structural and financial forces driving the new Bbusiness”. NAREIT Working Paper, March 31.

Smith, P. S., & Liu, C. H. 2018. Institutional Investment, Asset Illiquidity and Post-Crash Housing Market Dynamics. *Real Estate Economics*. Forthcoming.

Turnbull, G. and C. F. Sirmans. 1993. “Information, Search and House Prices.” *Regional Science and Urban Economics* 23:4, 545-557.