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Uninformed House Buyers and Foreclosures

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Working Paper 1503

UNINFORMED HOUSE BUYERS AND FORECLOSURES

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June 2015

Abstract. Uninformed buyers overpay. This is particularly so for home buying in which the inability to accurately quantify the asset value increase households' risk to overpay. The popular view is that poorly informed or financially unsophisticated households ended up with inappropriate mortgage products, ultimately increasing their risk of foreclosure. This paper considers another channel through which lack of information or market sophistication may influence foreclosure outcomes; uninformed buyers overpay for their homes. We study home buying by homeowners and investors and compare their ex-post foreclose outcome. Data from Orange County, Florida, over 2000-2012 reveal that homebuyers who ex-post foreclosed systematically overpay by approximately 2.7 to 4.6 percent in their pre-crisis purchases. This information effect increases closer to the peak of the market. The effect is strongest in low value market segments. Additional tests support our interpretation of the price premium as a penalty for lack of market sophistication since foreclosed local investors did not systematically overpay when buying while foreclosed owner-occupiers did overpay.

JEL code: G10**,** R21.

Keywords: uninformed buyers, foreclosure, price discovery, housing risk, pseudo panel models.

*We gratefully acknowledge Manish Bhatt, Denise Reyes and Rick Singh in the Orange County, Florida, residential tax assessment office. We appreciate comments by Elliot Anenberg, Kristopher Gerardi, Christian Hilber, Jos van Ommeren, 2014 AREUEA International participants in Reading UK and 2015 ASSA participants in Boston, MA. The authors are responsible for any errors. ** contact author.

1. Introduction

Uninformed buyers overpay, particularly when purchasing complex assets whose values are difficult to accurately quantify (Carlin et al., 2013). Uncertainty over value creates market environments that allow asymmetric information price effects to persist (Kelly and Ljungqvist, 2012). Information asymmetry[1] affects asset prices through various channels: the *amount* of information available to traders (Agarwal and Hauswald, 2010; Kelly and Ljungqvist, 2012), traders' sentiment and their *interpretation* of information (Baker and Wurgler, 2007), as well as their ability and financial sophistication to *use* information (Lusardi, 2008; Van Rooij et al., 20011a,b). Home buying is an area where the ability of households to gather and effectively use market information can have profound effects on housing decisions, through both the choice of mortgage product and the purchase transaction itself. Motivated by the recent housing market collapse in the US and the ensuing financial crisis, the popular press and much academic research focus on the first channel, the deleterious effects of poor household mortgage decisions that lead to subsequent foreclosure. In contrast, we focus on the second channel, the possible negative effects arising from household decisions in the initial purchase transaction itself; did uninformed buyers overpay for their homes?

Most homeowner financial risk studies address mortgage defaults and foreclosures and tend to focus on three concerns. First, some studies identify poor credit and adjustable mortgage rate resets as the major source of financial risk to home buyers. While widely discussed, adjustable mortgage rates offer important benefits to households (Cocco, 2013) and little evidence on the effect on foreclosures is present in the current literature (Haughwout et al., 2008). Second, other studies identify house price risk leading to negative equity as a primary source of financial risk to home ownership (Foote et al., 2008a,b; Haughwout et al.,

[1] Note that information asymmetry is difficult to measure. The existing empirical evidence is indirect (Kelly and Ljungqvist, 2013).

2008). Foote et al. (2008a) point out that, while a major source of risk, negative equity is a necessary but not a sufficient condition for foreclosure. Third, financial illiteracy has been identified as a source of financial risk to home ownership and is associated with a higher probability of default and foreclosure (Gerardi et al., 2013).

We argue, however, that the nature of the price discovery process during the run-up leading to the global financial crisis is also relevant to the foreclosure debate.[2] The important role of price discovery on asset prices is central to the efficient market hypothesis in finance (see Foucalt et al., 2013). Here we apply the efficient market theory for low-frequency, thin markets of single family housing (see Case and Shiller, 1989). More specifically, we address whether the nature of the price discovery process in housing leads to persistent mispricing during the run-up to the U.S. housing market collapse and the ensuing global financial crisis. As such, we draw on insights from the finance literature of trading in dealer markets for low frequency assets (for high frequency traded assets, see Boehmer and Wu, 2013).

This study identifies house buyers who subsequently lose their property through foreclosure during and after the crisis. Assuming that uninformed households are more likely to experience foreclosure during that period (Gerardi et al., 2013), the results show that these households systematically pay more than fair market value when purchasing their homes before the crisis. On the other hand, investors, who likely have greater market sophistication, do not exhibit the same pattern. Local investors who are subsequently foreclosed do not systematically pay more than fair market value for the houses they buy before the crisis. Therefore, the price premium appears to be associated with uninformed or unsophisticated buyers; uninformed households pay a penalty for their lack of knowledge or ability.

This research makes several contributions to the literature. First, it offers an empirical framework for decomposing pre-crises open market sales into a fair market value and a low

[2] Price discovery is fined in this paper as 'the speed and accuracy with which transaction prices incorporates information to market participants' (Foucault et al., 2013).

information penalty. We compare pre-crisis market sales of properties that are subsequently foreclosed and non-foreclosed post-crises. The results reveal a substantial and rising mispricing penalty for uninformed buyers in pre-crisis purchases. These new results add to our knowledge of the mortgage crisis by establishing that poorly informed borrowers clearly paid too much for their houses. This empirical result also suggests that the loan-to-value at mortgage origination is measured with error and helps explain the inconclusive results in the literature explaining defaults (see Gerardi et al., 2013).

Second, having established the empirical importance of households' ability to obtain and exploit market information, this paper also examines the buyer characteristics associated with low information or low financial sophistication. We exploit heterogeneity across buyers using homestead exemption information from local tax records to identify buyers who are owner occupiers and buyers who are investors in rental properties. We use the Case and Shiller (1989) approach for pseudo-repeat sales data constructed from repeated cross sections. The modeling techniques come from pseudo-panel data models as originally proposed by Deaton (1985) and further discussed in Verbeek and Vella (2005) and Inoue (2008), and recently applied to real estate by Guo et al. (2014). The results clearly indicate asymmetric information across owner occupiers and investors. Investors do not overpay while owner-occupiers do overpay. This pattern cannot be explained by the bad credit or bad economy arguments offered elsewhere in the literature. We also find a purchase price penalty for less informed, non-local buyers.

Third, motivated by redlining and spatial sorting in loan quality (Hanson et al., 2012; Chan et al., 2013), we also pursue meta-analysis of the illiteracy penalty on neighborhood socio-economic characteristics. The analysis yields evidence consistent with the notion that home owners exhibit such spatial sorting. Further, the penalty for low information appears to be highest in low-educated, low-income, and black neighborhoods.

2. The Housing Context

Homeownership comes with a variety of financial risks, including mispricing the asset, borrowing too much or with poorly structured loans, falling into negative equity and default or foreclosure. Regardless of the risks to households, it has been the long run policy of the U.S and state governments to promote homeownership as a means of improving the financial wealth of low- and moderate-income households. Homeownership is thought to be in the nation's interest as it brings about stability and wide spread prosperity (Bostic and Lee, 2008).

In the decades running up to the housing market peak in 2007, a range of federal and state policies successfully increased homeownership rates of some targeted groups with a history of lower home ownership rates. At the peak of the housing bubble growth rates in home ownership up to 2007 were highest among the poorest households in the first income decile (Bricker et al., 2012; Bucks et al., 2009; Bucks and Pence, 2008). According to census data (Census, 2012), the Asian American home ownership rate stood at 52.8% in 2000 and rose 15.0% over 2000-2006 while Hispanic American increased 7.3% over the same period. White American homeownership has historically been the highest category by race in the U.S.; the home ownership rate was 73.8% in 2000 and grew 2.7% over 2000-2006. The African American home ownership rate stood at 47.2% in 2000 and also increased significantly, about 2.1% over 2000-2006.

At the same time, the expansion of home ownership introduced new financial risks to a broader population, as subsequently revealed in the unprecedented levels of mortgage defaults and foreclosures over 2007-2012. Florida, a state with an above average home ownership rate, experienced one of the highest foreclosure rates in the nation. Nationally, by 2010 the home ownership rate fell back to the 2001 level. Not surprisingly, the lowest income

quartile experienced the greatest decline in ownership over 2007-2010 (FED, 2012; Bostic and Lee, 2008) and the foreclosure rates for nonwhites were twice those of white Americans (Bocian et al., 2010).

The US Department of Housing and Urban Development (HUD) recognizes potential problems arising from asymmetric information and low household financial sophistication in house buying decisions. As a result, HUD supports on-line programs to educate and counsel prospective home buyers about the home buying process, including house search strategies, mortgage and mortgage calculations, and even house maintenance issues. Pre-purchase counseling, mortgage delinquency and default resolution also are now part of home buyer education and foreclosure prevention programs. Agarwal et al. (2010) finds substantially lower mortgage default rates among buyers who participated in programs providing financial knowledge on budgeting and credit-management, results that support the view that the inability of some buyers to obtain and exploit market information can have profound long run impacts on their financial wellbeing. While the possibility of poor decision making when buying has been recognized, it remains unclear the extent to which low levels of information affect negotiation and transaction outcomes in the housing market.

The issue of uninformed house buyers or buyers with low financial sophistication and its impact on house buying behavior fits within a housing market characterized by asymmetric information and search costs as described by Arnott (1989) and Krainer (2001) among others. Potential buyers learn about the market price while searching among properties offered in the market, typically by searching internet sources and visiting neighborhoods and properties for sale. Search may take considerable time and effort because of the multi-dimensional heterogeneity in housing supply and idiosyncratic tastes of home buyers. Search costs in such thin markets are high, precluding endless information gathering. Potential buyers are unable to learn fully about the market price; "individuals have limited information, and know that

they have limited information, making inferences based on available information" (Stiglitz, 2000:1451). Information heterogeneity among potential buyers thereby may arise because of variation in financial experience or participation in previous housing market transactions, viz. the ability to gather and use knowledge and skills when buying a house. The housing market then consists of informed knowledgeable buyers and uninformed or unsophisticated buyers. Two questions need to be answered: why this lack of sophistication or information leads to higher transactions prices, and why subsequent foreclosures reveal uninformed buyers.

Home buying is a trading process in a search market in which potential buyers and a seller bargain over the price. A potential buyer faces uncertainty regarding the fair market value of the house and the number of competing buyers; whereas a seller faces uncertainty regarding the market acumen of the potential buyers. In bargaining, a potential buyer reveals information about themselves. The seller exploits any revealed information about buyer ability, keeping the potential buyer uninformed about the fair market value of the house, the number of competing buyers, and other relevant market information. The transaction price reflects the bargaining power of the buyer and the seller, and depends on the state of the credit market, the state of the housing market and the information sets of the buyer and seller (Ihlenfeldt and Mayock, 2012; Harding et al., 2003; Turnbull and Sirmans, 1993).

Han (2013) offers a different, but complementary, perspective. Buying a house draws upon both investment and consumption motives that can be explained using a consumption-based capital asset pricing model. The buyers' investment motives refer to buying and holding housing as a financial asset, while the asset pricing model for housing predicts lower prices and higher returns in riskier housing markets. The buyers' consumption motives reflect the notion that buying a house today provides a hedge for housing consumption risks. Han (2013) shows that hedging consumption risks leads to higher housing prices in riskier housing

markets when housing consumption hedge effects are sufficiently large – as in fast growing urban areas in which supply is constrained.

So why might low information translate into higher prices? In a market with asymmetric information, the poorly informed buyer signals the seller to exploit their bargaining power (basically, the 'selection problem' in the economics of information (Stiglitz, 2000)). Informed buyers will not pay above the fair market value in an efficient market.[3] So, a buyer that bids below the fair market value will be outbid by informed bidders. But while a buyer that bids the fair market value will no longer be outbid by informed bidders, he might be outbid by uninformed buyers (Turnbull and Sirmans, 1993). In this situation, uninformed buyers may outbid informed buyers and therefore systematically exhibit purchase price premia above fair market value. It does not matter whether the lack of information or sophistication reflects fundamental mispricing of the asset or over-optimistic expectations about future price appreciation (Turnbull and Sirmans, 1993) or the buyer's failure to correctly anticipate housing consumption risk (Han, 2013), the empirical result is the same—low information households pay more for a given house than do more sophisticated buyers.

Home owners may end up in foreclosure at time $(t + k)$ after their purchase. The channels toward foreclosure are bad credit, bad economy, and low levels of market information or low sophistication.[4] In the income theory of foreclosures, bad credit leads to foreclosure when home owners are no longer able to fulfill the financial burden (LaCour-Little and Malpezzi, 2003). The underlying notion is that interest-rate resets of adjustable-rate mortgages offering home buyers low initial interest rates start rising sharply afterwards, making it more difficult for income-constrained households to meet their rising obligations.

[3] Lower mortgage interest rates may raise market value. This is because for a given rent, lower mortgage interest rates lower the required capitalization rate, raising the market value. Note that this would affect all informed and uninformed buyers. Or as indicated elsewhere in the literature: 'any price that results from temporary credit shocks should be quickly arbitraged away in liquid markets' (Ling et al., 2011).

[4] The bad credit and bad economy terminology follows Haugwout et al., (2008).

This is, of course, exacerbated by poor underwriting or predatory lending (Braunstein and Welch, 2002). Demyanyk and Van Hemert (2009) find that the quality of loans deteriorated over the years 2001-2006. Loans were refinanced with cash-out in one half of refinancing requests, raising loan-to-value from 79.4 to 85.9 percent and raising debt-to-income from 38.0 to 41.1 percent. Their data on loan characteristics further indicate that borrowing credit quality rose so somewhat better quality borrowers were (re)financing increasingly over 2001-2006, with mean FICO credit scores rising from 601.2 in 2001 to 618.1 in 2006—improving, but nonetheless low and below the threshold of 620. While loan quality deteriorated, the authors do not find a clear relationship with default and foreclosure. This confirms what Foot et al. (2008a) and Haughwout et al. (2008) observed earlier; while bad credit has been widely discussed, empirical evidence for the impact of bad credit on the likelihood of foreclosure is rather limited. Keys et al. (2012) suggest that lender screening may play a role as better-quality loans just above the 620 benchmark with only low-documentation and screening default more frequently than marginally worse loans just below the 620 benchmark.

The equity theory of foreclosures identifies house price risk or bad economy as another channel to foreclosure. In this view, house price volatility is a source of strategic default as it creates a put option for borrowers to foreclosure. Guiso et al. (2013) provide evidence that people wait long and until negative equity is large before they foreclose. They find that it is the percentage shortfall (or negative equity) that determines attitude toward strategic default. A greater shortfall increases the risk of default and foreclosure. Other studies suggest a role for euphoria and price expectations in default (Archer and Smith, 2013). Guiso et al. (2013), however, do not find any significant evidence of euphoria effects. Borrowers prefer to wait for an improving market and postpone foreclosure because the associated costs of foreclosure are high. This is particularly so in recourse states like Florida, where banks are empowered to pursue borrowers directly for damages covering shortfalls when the foreclosed

property is finally resold. But when shortfalls are sufficiently large, borrows become effectively judgment-proof and strategically default. Guiso et al. (2013) also suggest that behavioral aspects like views about fairness and morality affect the willingness to strategically default. This is in line with Gerardi et al. (2010) rejection of ruthless default behavior. They conclude that negative equity is a necessary but not a sufficient condition for default.

A third reason for observed foreclosure is the risk of being uninformed and/or possessing limited ability to use knowledge and skills to manage homeownership. It is only recently that the literature has sharpened the focus on financial sophistication or literacy as a factor underlying mortgage defaults. Agarwal et al. (2010) provide empirical support for this notion, illustrating how default risk can be reduced with education and credit counseling for low- and moderate-income households. Raising the financial ability of home owners by providing classes on money management practice and one-to-one counseling meetings resulted in lower default rates among the treated home owners. They find the strongest effects among low-credit quality home owners with low FICO scores, suggesting that low financial literacy plays an important role in defaults. These results are confirmed by Agarwal and Mazumder (2013) and particularly Gerardi et al. (2013) who find that numerical ability has a significant effect on mortgage defaults.

Pulling these different perspectives together, foreclosures are not primarily the result of mortgage interest-rate risk but of house price risk combined with the limited ability to use knowledge and skills to manage household finances and homeownership. Since house price risks are a necessary but not a sufficient condition for foreclosure (Foote et al., 2012), it does appear that low information or market acumen does play a decisive role in foreclosure. At the same time, though, it is the less sophisticated or uninformed buyer who is more likely to pay more than fair market value for the house. If this nexus is valid, then houses foreclosed after

the crisis will be bought at premium before the crisis; if this nexus is not valid, then houses foreclosed after the crisis will not exhibit systematic purchase price differentials before the crisis. This is a testable proposition.

Finally, our data allow us to distinguish buyers who are owner-occupiers from investors. This offers an opportunity to directly test whether the price premium associated with subsequent foreclosure really reflects information or financial skills or whether it captures something else. It is reasonable to expect that local investors are more sophisticated participants in the housing market than the average owner-occupier. This suggests a straightforward test of our maintained hypothesis; the price premia for properties that will be foreclosed in the future will be greater for owner-occupiers than investors if we are interpreting the foreclosure variable coefficient correctly.

3. Data and Empirical Model

The data are drawn from property tax records of Orange County, Florida, covering all of the 426,021 parcels in the county as of August 24, 2012. Orange County is part of the Orlando-Kissimmee-Sanford MSA and has been experiencing long term population growth from 896,344 (2000 Census) to 1,145,956 (2010 Census). Orange County is among the counties with the highest number of foreclosures in the nation. Florida is a recourse state so that a bank can go after the home owner's wealth outside the house.

The local tax records include information on all parcels over 2000-2012 (see Appendix I for a description of the data and filtering). In order to separate fair market value and uninformed buyer effects, we first identify for each of the market sales in the period 2000-2006 which of the units foreclosed in 2007-2012. Those market sales in 2000-2006 that foreclosed in 2007-2012 are subject to a property-specific uninformed buyer penalty. The

future foreclosure dummy *FF* equals one if a market transaction completed in 2000-2006 is followed by a foreclosure in 2007-2012 and equals zero otherwise.

Table 1 reports the descriptive statistics for all sales over 2000-2006. The table indicates a median price of $168,000 and a mean of just above $205,000 reflecting a distribution skewed to the right. We therefore use the natural logarithm of price in the empirical analysis. Structural property characteristics indicate the type of building construction material (52% have walls made of stucco covered concrete block versus wood frame construction), number of bedrooms (3.28 average), living area (1,793 square feet average), number of bathrooms (2.12 average), presence of a private pool (28%), lot size (40,590 square feet average), structural quality (31% poor quality), and actual age of the house (22.98 years). Location controls include the quadratic distance to the Orlando CBD (8.18 miles linear distance average) and zip code fixed effects. Over 75 percent of the transactions lie within the City of Orlando, the largest and most populous municipality in Orange County.

The descriptive statistics reveal some differences between sales that end up in foreclosure over 2007-2012 and those that do not. Looking first at property characteristics, Table 1 columns three and four show that the average property that ends up foreclosed is bought at substantially higher prices with a median price of $180,000 relative to $166,000 for non-foreclosed properties. The property that ends up foreclosed turns out to have been purchased more recently, which may explain the substantial difference in selling price observed between properties that foreclosed and those did not. Note that these foreclosed properties are smaller (in terms of number of bedrooms, number of bathrooms, and living area) and are lower quality (below-average quality). Also, information on home buyers characteristics indicate that buyers who end up foreclosed apply less often for homestead exemptions—indicating that these buyers are investors. Figure 1 depicts the spatial

distribution of homestead on August 24, 2012. Note that homes held for investment purposes seem to be spatially clustered in south and southwest Orange County in the vicinity of Seaworld and Disney World, major recreational attractions in the metropolitan area. In the analysis we therefore distinguish between rental and owner-occupier neighborhoods based on the 2010 Census. The mean percentage rental units over neighborhoods is 29%, with p(25)=27% and p(75)=32%. We indicate census blocks with percentage rental units over 32% as rental neighborhoods and blocks with percentage rental units less than 27% as owner-occupier neighborhoods.

The second half of Table 1 reports neighborhood block group characteristics for sales in the sample. The pattern reveals relatively more foreclosed properties in the more populated, lower educated, poorer neighborhoods with higher percentages of blacks.

The first set of models are based on an hedonic price function of the log of market price of property *i* at time *t* over 2000-2006 as a linear of function of property characteristics, and the uninformed buyer penalty:

$$\ln P_{it} = \beta_X X_{it} + \beta_{FF} FF_i + \varepsilon_{it} \quad (1)$$
$$\text{for } i = 1, \dots, N \text{ and } t = 1, \dots, T$$

where *P* is the selling price; ***X*** the vector of relevant house characteristics, including location, year, and seasonal fixed effects; and *FF* the penalty associated with being foreclosed ex-post (over 2007-2012). The *FF* variable measures the possible penalty paid by uninformed buyers at the time of the sale over 2000-2006 because of limited financial ability or limited knowledge about the fair market value. The last term ε_{it} refers to the error term. The function is estimated on the set of individual transactions and allows for clustered errors at the

neighborhood block-level (for a discussion on clustered errors, see Angrist and Pischke, 2008).

A second approach constructs pseudo-panels of time series of cross sections. To do so, we define pseudo-panels of repeat sales based on neighborhood census block-level with fixed membership following Deaton (1985) to trace transactions over time. Basically, pseudo panels compare different homes within the same neighborhood block over time while measuring the effect of financial illiteracy. When compared with repeat sales approaches, pseudo-panels of repeat sales have the advantage of much larger samples in a relatively short time-period. The low frequency of pure panels of single family housing repeat sales, give pseudo-panels a higher degree of representativeness. Also, pseudo-panels to a great extent control for unobserved heterogeneity. Pseudo-panels on neighborhood-block level control for the omission of time-invariant neighborhood characteristics while allowing within-neighborhood changes across observations.

We model pseudo-panels of repeat sales in first differences on the neighborhood block-level *b* such that

$$\ln P_{itb} - \ln P_{jsb} = \tilde{\beta}_X(X_{itb} - X_{jsb}) + \tilde{\beta}_{FF}(FF_{ib} - FF_{jb}) + \varepsilon_{itb} - \varepsilon_{jsb} \quad (2)$$
$$\text{for } i, j = 1, \dots, N \text{ and } t, s = 1, \dots, T \text{ and } b = 1, \dots, B \text{ for all } i \neq j \text{ and } t \neq s$$

The model of first differences at the neighborhood block-level basically treats sales within the neighborhood block as repeat sales while accounting for observed structural differences. This model, too, allows for clustered errors at the neighborhood block-level.

4. Estimation results

Table 2 reports the estimated parameters for various model specifications. The models indicate joint significance for all of the specifications. The first column gives the baseline

model (1). The estimates on structural property characteristics are as expected and broadly identical to earlier findings over the post-crisis period 2007 - 2012 (Turnbull and Van der Vlist, 2013). Property value decreases with distance to the CBD but the effect is insignificant when including fixed effects in the model. As expected, structure quality and exterior construction matter. Lower quality structures sell for less than average or high quality structures. Also, applying the Kennedy (1981) adjustment, property with concrete block covered with stucco exhibits 9 percent higher market values relative to wood frame construction. In addition, larger property in terms of number of bedrooms, living area, and number of bathrooms are associated with higher property values. A pool has a significant positive effect on property value in this market as does parcel size.

The uninformed buyer result is reported in column (2). The Kennedy bias adjusted *FF* coefficient indicates that buyers who are later foreclosed paid a 2.7 percent premium for properties bought between 2000 and 2006. To see whether the premium is stable over time we also estimate the model for subperiods. The results for subperiods 2000-2004 in column (3), 2004-2005 in column (4) and 2005-2006 in column (5) support the earlier findings but also suggest that the greatest overpayment occurs in the years 2005-2006 closest to the global financial shock. Home buyers in 2005-2006 who ended up foreclosed in 2007-2012 paid an average 4.6 percent (see column (5)) above fair market value. Overall, these estimates reveal a strong and persistent correlation between home buyers' house prices and future foreclosures. Note that the models control for differences in property characteristics in order to assure that the premia are not being driven by heterogeneity across houses. It is clear that home buyers who end up foreclosed -on average- systematically pay above fair market prices. Now, since well-informed home buyers that have the ability to manage financial resources do not pay above fair market prices, the *FF* coefficient estimates indicate that foreclosed home owners are on average less informed home buyers. Interestingly, this is in line with earlier statistics

indicating that poorer households entered the (lower end of the) housing market strongly in 2005 and 2006. Drawing from the literature on mispricing and asset pricing discovery (Boehmer and Wu, 2013), we conclude that information asymmetry increased during the run-up to the global financial crisis. This is consistent with anecdotal evidence that the fair market value was notoriously difficult to ascertain in Florida in 2005 and 2006. In addition, this implies according to the consumption-based capital asset pricing literature that households will on the one hand require a higher return and lower prices because of the greater risk involved, and on the other hand require a lower return because the current home hedge future housing consumption risk (Han, 2013). Now, for Orange County FL, with urban growth and relatively elastic supply, following Han (2013), the latter effect must be rather weak. When households, however, have limited ability or knowledge they may falsely expect future housing consumption risk to be high, will overpay and homeownership rates will rise.

To examine how the effects vary across housing market segments, we estimate quantile regression models. Table 3 gives the results for the quantile regression model coefficients for *FF* for different quantiles and subperiods. The results show that the effect for *FF* is largest for the lower end of the housing market. This is evident from the last row of Table 3, which indicates that home buyers in 2005-2006 who ended up foreclosed paid up to 3.5 percent above fair market value in the lower end of the housing market while foreclosed owners paid a little over 1.0 percent more in the higher end of the housing market. The mortgage down payment and debt-to-income requirements imply the poorest households are naturally overrepresented in the lower end of the housing market. It appears that the poorest households experienced the greatest rise in home ownership rate between 2000 and 2006 (Bricker et al., 2012), which may have put additional upward pressure on house prices in this market segment. Even though we know neither home buyers' financial knowledge nor their financial numerical ability, our estimates appear to be consistent with established results that

the poorest home owners often have limited knowledge and skills to manage financial resources (Lusardi, 2008) and have the highest default rates (Gerardi et al., 2013).

Clearly, home buyer characteristics do play a role in transaction pricing. We can exploit some additional information in the tax assessment data base to probe more deeply into this relationship. Owners must reside in their property to obtain a homestead exemption and reduce their property taxes. Therefore, properties with homestead exemptions have been purchased by owner-occupiers while those without have been purchased by investors. Portfolio and cash flow considerations of rental units may motivate investors to buy in different housing market segments than owner-occupiers who also have strong consumption motives. Although overlooked in recent studies[5], the heterogeneity in buyers as reported in the literature carries over to particular properties and also for particular neighborhoods as observed in Figure 2. To address this issue, we estimate separate models on samples partitioned across owner-occupier neighborhoods and rental neighborhoods. We apply the pseudo-repeat sales model at the neighborhood level to control for heterogeneity in houses as well as buyers' motives. Table 4 reports the estimates.

These estimates instead indicate that investors who ended up foreclosed in 2007-2012 did not outbid buyers with consumption motives; whether in owner-occupied or rental neighborhoods, investors who are later foreclosed pay no systematic price premium while owner-occupiers do. This pattern is consistent with our interpretation of the price premia paid by owner-occupiers as uninformed or unsophisticated buyer effects.

Motivated by the debate over the home-market bias puzzle in finance, we now take a closer look at whether local investors enjoy greater market knowledge than non-local investors (Van Nieuwerburgh and Veldkamp, 2009). The underlying notion is that

[5] We find that standard approaches mask geographical variation. The results that investors overpay found in earlier studies may no longer hold when greater effort is made to control for neighborhood and house heterogeneity.

information is in a sense immobile with faster and more accurate price discovery for local investors. To address this question, we exploit annual tax role information on owners' official correspondence addresses to identify local and non-local buyers, and estimate models by type of investor, viz. Florida (not Orlando), U.S. (not Florida), and outside the U.S. Table 5 reports the future foreclosure premium estimates derived from complete models.[6] Clearly, the point estimates indicate that non-local buyers pay higher prices than local buyers—a pattern consistent with the home-market bias and consistent with the notion that higher search costs for non-local buyers leads them to pay higher prices for identical homes (Turnbull and Sirmans, 1993; Ihlanfeldt and Mayock, 2012). The point estimates also indicate that the degree of overpayment increases with distance between the buyer's home and the local market. Not all of the non-local buyer cases lead to significant price effects, however, due to the larger standard errors. US owner-occupiers outside Florida and investors in Florida and the US exhibit significant price differentials. This is evidence that some non-local investors systematically overpay for homes in rental neighborhoods.

The results presented so far address micro-level effects of uninformed buyers. The literature on spatial sorting and loan quality, however, suggests neighborhood effects with foreclosures being more likely in some than in others. Hanson et al. (2012) show that household spatial sorting by credit quality arises endogenously in location equilibrium even without explicit redlining. To address possible meta neighborhood effects in financial illiteracy we estimate a simple logit model of *FF* on neighborhood characteristics. The results are presented in Table 6. Column (20) reports pooled results whereas column (21) and column (22) report results for black and white neighborhoods, respectively. Perhaps most important to this study, the observation that *FF* decreases with the percentage of high school graduates

[6] Non-local investors in this subsample include outside households buying second homes as well as buyers investing in rental properties. The former may be less sophisticated in general than the latter, regardless of their lack of local market knowledge.

suggests the type of interplay between overpayment and financial illiteracy or lack of market information examined above. These estimates are consistent with the causal observation that home ownership comes with substantial financial risks particularly for the poorest households in black neighborhoods.

5. Conclusion

This paper examined the consequences of low information for house buyers. House purchases typically involve residential mortgages, complex financial instruments that have been assigned a large share of the blame for the recent waves of foreclosures during and after the 2007 financial crisis. The basic notion is intuitively appealing; mortgages are hard to understand and therefore lead home owners into making costly mistakes ending in mortgage default and foreclosure. This study, however, shows that overpayment is also part of the story. The empirical results presented here indicate that buyers who are uninformed in the housing market end up paying more for houses than buyers who are not. And overpaying when purchasing a house negatively affects wealth accumulation over the household's lifetime whether or not overpayment leads to default and foreclosure.

This paper measures an overlooked financial consequence, the purchase price penalty experienced by foreclosed home owners. Our approach builds on recent contributions in the financial literacy literature and offers an empirical framework for decomposing pre-crises open market sales into a fair market value and a penalty paid by uninformed buyers. The data also allow us to exploit property-level homestead property tax exemption information to separate owner-occupiers from investors to test for differences in market acumen. We also examine differences between local and nonlocal home buyers.

Data from Orange County, Florida, over 2000-2012, reveal that home buyers who end up foreclosed overpaid by 2.7 to 4.6 percent when purchasing their property. The uninformed

buyer payment premium increases the closer the transaction is to the financial meltdown in 2007 and the effect is strongest in the lower price segment of the housing market.

These results have important policy implications. Promoting homeownership has been one of the long run policies of the U.S. but comes with a variety of financial risks including mispricing, borrowing too much or with poorly structured loans, falling into negative equity and default or foreclosure. The HUD now recognizes potential problems arising from household financial illiteracy in house buying decisions and supports on-line programs to educate and counsel prospective home buyers about the home buying process and pre-purchase counseling. These programs are known to substantially lower mortgage default rates among buyers who participated in programs providing financial knowledge on budgeting and credit-management. Our results suggest that like investors, those owner-occupiers that participate in such programs will no longer systematically overpay.

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APPENDIX I- DATA DESCRIPTION

The property tax parcel file (August 24, 2012) of Orange County Fl consists of 426,021 parcels. The single family detached (SFD) houses we are considering include 266,897 parcels. The data includes the five most recent transactions. Table A1 gives the number of transactions including Quit Claim deeds. From the first row of Table A1one observes that 4,469 properties did not sell at all, 34,379 properties sold once and 76,774 properties sold five times or more.

Note that as the property tax parcel data includes the five most recent transactions we are likely underreporting the number of transactions over 2000-2012. The probability of underreporting turned out to be small. Analyzing the data, we find that we have the full transaction history over 2000-2012 for 95.1 percent of the SFD properties. For the remaining 4.94 percent of the total 266,897 SFD properties, we have the fifth most recent observation and may possibly miss some of the transaction history (as we do not know whether there are more than five transactions). Now given the distribution of transactions the number of missing transactions is most likely less than two percent of the total number of SFD property sales over 2000-2012.

Parcel-split or parcel-combination forms another source of underreporting the number of transactions. To see this note that, as we are interested in whether the home owner receives homestead exemption we included only the parcels that did not change parcel identification number (PIN). A non-altered PIN allows us to track the parcels from 2000-2012.

We used GIS to add information on the exact geospatial coordinates. The exact location is used to merge neighborhood information from the 2007-2012 5-year American Community Survey.

We selected the properties with at least one transaction (not referring to legal administrative deeds) over 2000-2006 for which we have full information over 2000-2012. We used the transactions over 2007-2012 to construct our measure *FF*, the dummy variable indicating foreclosure during the post-crash period. In the empirical analysis we have 114,185 transactions over 2000-2006, of which 13,233 experience a foreclosure over 2007-2012.

For the regression model we then used the following selection rules regarding structural characteristics of the properties:

- transactions include LIVAREA > 300 & < 5130

- transactions include PRICE>6,700 (lower 1%) and PRICE < 2,000,000

- transactions include those with BUILDINGPERIOD before transaction date.

Prices are not deflated since we use seasonal and year fixed effects.

Table A1 – The gross number of transactions and foreclosures

Number of Transactions Registered	Number of parcels	%
0	4,469	1.68
1	34,379	12.9
2	57,958	21.7
3	50,802	19.1
4	42,241	15.8
5+	76,774	28.8
Total	266,897	100

Table A2 – Data sources

Data type	Type of information	Source
Parcel-level data	Transactions, housing characteristics, owner-address and HX	OCPA, 2000-2012 (August 24, 2012)
Block-level data	Population, and number of housing units	Census, 2010
Block-group level data	Median hh income, % white, % black, # vacant housing units, # without mortgage, # housing units, education level, population	American Community Survey 2007-2011 5 Yr estimate

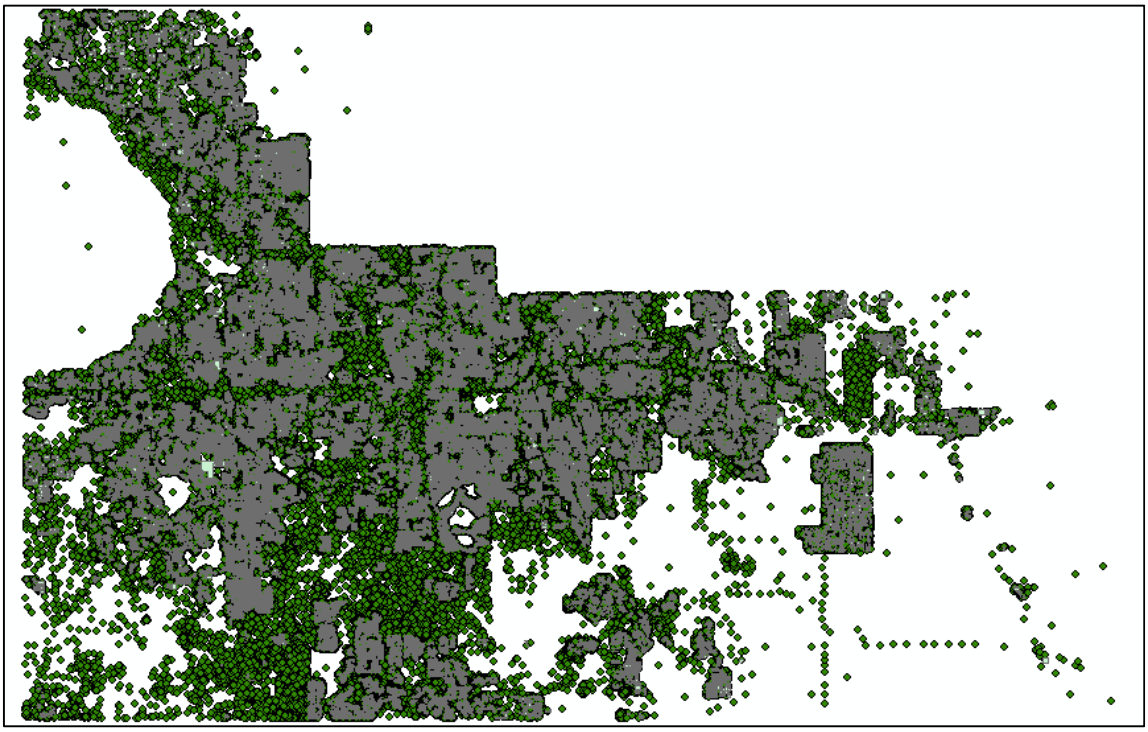

Figure 1: Spatial distribution of home owners with Homestead exemption (grey) and without Homestead exemption (green), August 24, 2012

TABLES – **Uninformed House Buyers and Foreclosures**

TABLE 1 DESCRIPTIVE STATISTICS

	All Sales over 2000-2006			Not Foreclosed in 2007-2012			Foreclosed in 2007-2012		
	Median	Mean	St.dev.	Median	Mean	St.dev.	Median	Mean	St.dev.
Property characteristics									
Price ($, current)	168,000	206,097	145,444	165,900	205,786	147,573	180,000	208,471	128,025
Foreclosed in 2007-2012		0.12			-			1.0	
Distance CBD * (miles)		8.18	3.77		8.14	3.79		8.44	3.64
Walls Concrete Block Stucco		0.52			0.53			0.51	
Number of Bedrooms:		3.28	0.74		3.29	0.74		3.26	0.71
less than 3		0.10			0.10			0.10	
3 rooms		0.56			0.56			0.59	
more than 3		0.34			0.34			0.31	
Living Area (sq.ft)		1,793	698		1,807	706		1,687	629
<1,500		0.40			0.39			0.47	
>= 1,500 & =<2,500		0.46			0.46			0.43	
> 2,500+		0.14			0.15			0.10	
Number of Bathrooms		2.12	0.67		2.13	0.67		2.06	0.61
1.00		0.11			0.11			0.12	
1.50		0.04			0.04			0.05	
2.00		0.59			0.59			0.61	
2.50		0.10			0.10			0.11	
3.00+		0.16			0.16			0.12	
Pool		0.28			0.28			0.23	
Parcel size (sq.ft)		40,590	48,041		42,322	49,977		27,374	25,747
Property quality									
below average		0.31			0.31			0.36	
average		0.36			0.35			0.39	
above average		0.33			0.34			0.25	
Age of property (years)		22.98	18.72		23.03	18.79		22,64	18.16

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Table 1 continued	All Sales over 2000-2006			Not Foreclosed in 2007-2012			Foreclosed in 2007-2012		
	Median	Mean	St.dev.	Median	Mean	St.dev.	Median	Mean	St.dev.
Year of Transaction									
2000		0.11			0.12			0.05	
2001		0.12			0.12			0.06	
2002		0.12			0.13			0.08	
2003		0.15			0.16			0.11	
2004		0.17			0.17			0.15	
2005		0.19			0.18			0.28	
2006		0.14			0.12			0.27	
Municipality									
Apoka		0.08			0.08			0.08	
Christmas		<0.01			<0.01			<0.01	
Gotha		0.01			<0.01			<0.01	
Maitland		0.01			0.01			<0.01	
Mount Dora		<0.01			<0.01			<0.01	
Ocoee		0.04			0.04			0.04	
Orlando		0.77			0.76			0.80	
Windermere		0.02			0.02			0.01	
Winter Garden		0.03			0.03			0.03	
Winter Park		0.04			0.04			0.02	
Zellwood		<0.01			<0.01			<0.01	
Home owner characteristics									
Homestead exemption owner		0.60			0.61			0.53	
Registered owner lives in									
Orlando		0.68			0.68			0.71	
Florida, outside Orlando		0.26			0.27			0.24	
USA, outside Florida		0.04			0.04			0.05	
Outside the USA		<0.01			<0.01			<0.01	

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Table 1 continued	All Sales over 2000-2006			Not Foreclosed in 2007-2012			Foreclosed in 2007-2012		
	Median	Mean	St.dev.	Median	Mean	St.dev.	Median	Mean	St.dev.
Neighborhood block group characteristics									
Household income ($/yr, current)		59,654	23,856		60,316	24,258		54,559	19,810
Population (number)		5,931	5,460		5,883	5,486		6,302	5240
White population		0.68			0.69			0.63	
Black population		0.18			0.17			0.22	
Asian population		0.05			0.05			0.05	
Other population		0.09			0.09			0.10	
Owner-Occupier		0.61			0.61			0.59	
Median House price ($, current)		231,168	108,906		234,640	111,207		204,686	84,872
Education Degree less than high school		0.14			0.14			0.16	
Education Degree high school		0.27			0.26			0.29	
Education Degree above high school		0.59			0.60			0.55	
N		114,185			100,952			13,233	

* CBD relates to the Intersection of Central Blvd and Orange Av. Orlando Fl. The calendar year 2012 relates to: 01.01.2012 – 08.24.2012. Property characteristics come from the OCPA tax rolls. Neighborhood characteristics are at the block group-level from the 2007-2011 American Community Survey 5 Year estimates. Home owner characteristics are from the tax rolls.

TABLE 2 ESTIMATION RESULTS FOR HEDONIC MODELS

	(1) 2000-2006			(2) 2000-2006			(3) 2000-2004			(4) 2004-2006			(5) 2005-2006		
FI (D Foreclosure 2007-2012)				0.027	***	(0.003)	-0.002		(0.004)	0.039	***	(0.003)	0.046	***	(0.004)
Distance CBD	-0.008		(0.006)	-0.008		(0.006)	-0.009		(0.006)	-0.007		(0.007)	-0.003		(0.008)
Distance CBD squared	0.0006	**	(0.0003)	0.0006	**	(0.0003)	0.0006	***	(0.0003)	0.0007	**	(0.0003)	0.0006		(0.0004)
Walls Concrete Block Stucco	0.09	***	(0.004)	0.09	***	(0.004)	0.09	***	(0.005)	0.10	***	(0.004)	0.10	***	(0.005)
Number of Bedrooms: less than 3	-0.10	***	(0.005)	-0.10	***	(0.005)	-0.10	***	(0.006)	-0.10	***	(0.007)	-0.09	***	(0.008)
Number of Bedrooms: more than 3	0.03	***	(0.003)	0.03	***	(0.003)	0.02	***	(0.004)	0.03	***	(0.004)	0.04	***	(0.005)
Living Area <1,500 sq.ft	-0.12	***	(0.003)	-0.13	***	(0.003)	-0.12	***	(0.008)	-0.13	***	(0.005)	-0.13	***	(0.005)
Living Area > 2,500+ sq.ft	0.26	***	(0.006)	0.26	***	(0.006)	0.26	***	(0.007)	0.25	***	(0.007)	0.25	***	(0.008)
Number of Bathrooms: 1.00	-0.21	***	(0.005)	-0.21	***	(0.005)	-0.22	***	(0.007)	-0.20	***	(0.007)	-0.20	***	(0.008)
Number of Bathrooms: 1.50	-0.11	***	(0.006)	-0.11	***	(0.006)	-0.12	***	(0.008)	-0.11	***	(0.008)	-0.11	***	(0.009)
Number of Bathrooms: 2.50	0.08	***	(0.004)	0.08	***	(0.004)	0.08	***	(0.005)	0.07	***	(0.005)	0.07	***	(0.006)
Number of Bathrooms: 3.00+	0.15	***	(0.005)	0.15	***	(0.005)	0.15	***	(0.006)	0.14	***	(0.005)	0.14	***	(0.007)
Pool	0.11	***	(0.003)	0.11	***	(0.003)	0.12	***	(0.003)	0.10	***	(0.003)	0.10	***	(0.004)
Log Parcel size	0.27	***	(0.005)	0.27	***	(0.005)	0.28	***	(0.005)	0.26	***	(0.005)	0.25	***	(0.006)
Constant	9.18	***	(0.060)	9.17	***	(0.060)	8.68	***	(0.081)	9.25	***	(0.078)	9.64	***	(0.085)
R^2	78.2			78.3			74.3			74.4			70.8		
F-statistic	3,235			3,189			1115			1,369			864		
Root MSE	0.28			0.28			0.27			0.28			0.29		
N	114,185			114,185			57,357			56,828			37,730		

Note: Dependent variable is log of transaction price. The reference category include Number of Bedrooms equals 3, Living area of 1,500-2,500, and Number of Bathrooms equals 2,00. All models include fixed effects for year, quarter and location. Specification (1) includes the baseline specification. Specifications (2) – (4) vary in timeframes. Specification (2) includes all transactions over 2000-2006. Specification (3) includes transactions over 2004-2006. Specification (4) includes transactions over 2005-2006. Clustered standard errors (on neighborhood blocks) are in parentheses with *** , **, * indicating significant at 1%, 5% and 10%, respectively.

TABLE 3 QUANTILE REGRESSION MODEL COEFFICIENTS FOR FINANCIAL ILLITERACY

Period	N	0.25			0.50			0.75			0.95			0.99		
2000 – 2006	114,185	0.017	***	(0.002)	0.009	***	(0.002)	0.012	***	(0.002)	0.008	***	(0.003)	0.010	**	(0.005)
2000 – 2003	57,357	-0.007	***	(0.003)	-0.006	**	(0.002)	-0.014	***	(0.003)	-0.006	*	(0.004)	0.004		(0.006)
2004 – 2006	56,828	0.026	***	(0.003)	0.016	***	(0.002)	0.016	***	(0.002)	0.010	***	(0.004)	0.012		(0.008)
2005 - 2006	37,730	0.035	***	(0.003)	0.021	***	(0.003)	0.017	***	(0.003)	0.009	***	(0.003)	0.012		(0.104)

Note: the dependent variable is log transaction value. The reference category include Number of Bedrooms equals 3, Living area of 1,500-2,500, and Number of Bathrooms: equals 2,00. All models include fixed effect year and quarter dummies. Specification (5) relates to model (2). Standard errors are in parentheses with *** , **, * indicating significant at 1%, 5% and 10%, respectively.

TABLE 4 ESTIMATION RESULTS FOR NEIGHBORHOOD-LEVEL REPEAT SALE MODELS FOR ORLANDO CITY BY BUYER MOTIVE, RANDOM EFFECTS GLS ESTIMATES

	Investor (HX=0) in owner-occupier neighborhood			Owner-occupier (HX=1) in owner-occupier neighborhood			Investor (HX=0) in rental neighborhood			Owner-occupier (HX=1) in rental neighborhood		
ΔFI (D Foreclosure 2007-2012)	0.005		(0.008)	0.019	***	(0.007)	0.013		(0.012)	0.028	***	(0.008)
ΔDistance CBD (miles)	0.004		(0.008)	-0.001		(0.008)	0.004		(0.005)	-0.0005		(0.005)
ΔDistance CBD squared	-0.00003		(0.0004)	0.0003		(0.0004)	0.00009		(0.0003)	0.0003		(0.0003)
ΔWalls Concrete Block Stucco	0.082	***	(0.012)	0.092	***	(0.010)	0.081	***	(0.011)	0.090	***	(0.009)
ΔNumber of Bedrooms: less than 3	-0.103	***	(0.022)	-0.086	***	(0.020)	-0.108	***	(0.013)	-0.076	***	(0.011)
ΔNumber of Bedrooms: more than 3	0.032	***	(0.012)	0.030	***	(0.008)	0.031	***	(0.009)	0.027	***	(0.007)
ΔLiving Area < 1,500 sq.ft	-0.144	***	(0.011)	-0.127	***	(0.010)	-0.115	***	(0.012)	-0.118	***	(0.009)
ΔLiving Area > 2,500+ sq.ft	0.215	***	(0.015)	0.221	***	(0.016)	0.285	***	(0.021)	0.281	***	(0.014)
ΔNumber of Bathrooms: 1.00	-0.218	***	(0.024)	-0.210	***	(0.023)	-0.169	***	(0.014)	-0.186	***	(0.014)
ΔNumber of Bathrooms: 1.50	-0.124	***	(0.033)	-0.151	***	(0.027)	-0.088	***	(0.018)	-0.083	***	(0.017)
ΔNumber of Bathrooms: 2.50	0.086	***	(0.013)	0.069	***	(0.008)	0.104	***	(0.017)	0.062	***	(0.011)
ΔNumber of Bathrooms: 3.00+	0.134	***	(0.014)	0.146	***	(0.011)	0.143	***	(0.018)	0.146	***	(0.015)
ΔPool	0.093	***	(0.008)	0.093	***	(0.006)	0.119	***	(0.008)	0.106	***	(0.007)
ΔLog Parcel size	0.295	***	(0.011)	0.292	***	(0.012)	0.288	***	(0.007)	0.293	***	(0.007)
Constant	0.025	***	(0.008)	0.037	***	(0.006)	-0.004		(0.005)	0.023	***	(0.003)
R^2	66.5			65.7			68.5			67.7		
Wald-statistic	5,573			12,000			13,133			10,444		
N	5,773			10,221			7,799			11,958		

Note: the dependent variable is Δlog transaction value. The reference category include Number of Bedrooms equals 3, Living space of 1,500-2,500, Number of Bathrooms equals 2,00 and Average Property Quality. All models include Δyear. Rental neighborhoods are at least 32.3% rental. Owner-occupier neighborhoods have at most 26% rental units. Clustered standard errors are in parentheses with *** , **, * indicating significant at 1%, 5% and 10%, respectively.

TABLE 5 SUMMARY OF ESTIMATION RESULTS FOR ΔFI ON NEIGHBORHOOD-LEVEL REPEAT SALE MODELS OF HOME BIAS, RANDOM EFFECTS GLS ESTIMATES

	Owner-occupier neighborhood				Rental neighborhood			
	parameter		Se	N	parameter		se	N
Orlando city	0.005		(0.008)	5,773	0.013		(0.012)	7,799
Florida outside Orlando city	0.027		(0.021)	2,898	0.035	***	(0.014)	2,905
USA outside Florida	0.059	***	(0.026)	735	0.068	***	(0.028)	745
International	0.067		(0.046)	150	0.087		(0.133)	88

Note: the dependent variable is Δlog transaction value. The reference category include Number of Bedrooms equals 3, Living space of 1,500-2,500, Number of Bathrooms equals 2,00 and Average Property Quality. All models include Δyear. Rental neighborhoods with at least 32.3% rental. Owner-occupier neighborhoods have at most 26% rental units. Clustered standard errors are in parentheses with *** , **, * indicating significant at 1%, 5% and 10%, respectively.

TABLE 6 ESTIMATION RESULTS FOR THE LOGIT ESTIMATION OF FI (D FORECLOSURE 2007-2012) ON NEIGHBORHOOD CHARACTERISTICS

	Pooled Sample			Black Areas			White Areas		
logPRICE	-0.14	***	(0.02)	0.19	***	(0.07)	-0.20	***	(0.03)
High school graduates (%)	-0.70	**	(0.14)	-0.08		(0.34)	-1.09	***	(0.19)
Log Median Household Income	-0.41	***	(0.03)	0.03		(0.11)	-0.39	***	(0.04)
Constant	5.57	***	(0.30)	-3.47	***	(1.09)	6.40	***	(0.37)
Time Fixed Effects	Yes			Yes			Yes		
R^2 pseudo	5.1			4.0			5.0		
LR-statistic	4,143			422			3,042		
Loglikelihood	-38,882			-5,014			-28,670		
N	114,185			11,659			89,410		

Note: Dependent variable is D Foreclosure 2007-2012. Specification (18) is the pooled sample model. Specification (19) is for neighborhoods with percentage Black above 60 percent. Specification (20) is for neighborhoods with percentage White above 60 percent. Standard errors are in parentheses with *** , **, * indicating significant at 1%, 5% and 10%, respectively.