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The price of ignorance: Foreclosures, uninformed buyers and house prices☆

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ABSTRACT

Uninformed buyers may pay more when purchasing complex assets, such as houses. This paper compares local house buyers who are later foreclosed with those not foreclosed for various buyer-types, namely, owner-occupier households, investor-companies, second-home buyers, and small-scale investors. Data from one of the foreclosure epicenters, Orange County, Florida, reveal that subsequent foreclosures are associated with higher prices for comparable housing at the time of purchase. The premium paid by buyers between 2000 and 2007 who experience foreclosure after 2007 is larger closer to the 2007 market peak, approaching 3 percent. We find considerable heterogeneity across buyer-types. In particular, foreclosed second-home buyers and small-scale investors systematically pay more, while investor-companies and owner-occupiers do not. The pattern is consistent with the hypothesis that the premium paid by foreclosed households reflects poor information or limited financial acumen.

1. Introduction

Uncertainty about market values during economic booms creates environments conducive to persistent asymmetric information price effects (Kelly and Ljungqvist, 2012; Kurlat and Stroebel, 2015). Information asymmetry affects asset prices through three channels: the amount of information available (Agarwal and Hauswald, 2010; Kelly and Ljungqvist, 2012; Agarwal et al., 2019), sentiment and the interpretation of information (Baker and Wurgler, 2007), and level of financial sophistication and ability to use information (Lusardi, 2008; Van Rooij et al., 2011b,a; Agarwal et al., 2010, 2017). Home buying is an area where information asymmetry can have profound effects on decisions, both through the choice of mortgage product and the purchase transaction itself. Motivated by the 2008 housing market collapse in the U.S. and the ensuing financial crisis, the popular press and much academic research focus on the deleterious effects of poor mortgage decisions leading to subsequent foreclosure. In contrast, we focus on whether the initial purchase decision reveals low levels of buyer information or financial sophistication. Specifically: did future foreclosed buyers pay more when they first bought their homes? And, if so, is the pattern associated with particular types of buyers?

Studies on mortgage defaults and foreclosures tend to focus on two explanations. First, some studies identify the bad economy and attendant house price risk that lead to negative equity and strategic default as a primary source of financial risk to home ownership (Foote et al., 2008a,b; Haughwout et al., 2008; Wu and Dorfman, 2018). Foote et al. (2008a) argue that, although a major source of risk, negative equity is a necessary but not sufficient condition for foreclosure. Bhutta et al. (2017) similarly argue that equity has to turn deeply negative before households default. This is confirmed by Gerardi et al. (2017) who find that while some do strategically default, many low equity households stay current. Second, other studies refer to the double trigger of negative equity and adverse financial shocks, which include negative income shocks and adjustable mortgage rate resets as a source of financial risk to home buyers. While widely discussed, the literature offers surprisingly little rigorous evidence concerning this effect on foreclosures (Haughwout et al., 2008).

In addition to these aforementioned explanations, we argue that the nature of the price discovery process during the run-up to the global financial crisis is also relevant to the foreclosure debate. During the run-up, house values were notoriously difficult to assess. The literature points to the interplay between price discovery, information spread and uncertainty in asset market values (Foucault et al., 2013). Uncertainty in asset values and information heterogeneity among agents creates asymmetric information price effects (Kelly and Ljungqvist, 2012; Kurlat and Stroebel, 2015). Ben-David (2011) asserts that during the run-up to the crisis, some home buyers were even able to inflate

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sales prices in order to draw larger mortgages, thereby understating the actual default risk. Other authors indicate that uncertainty in house values has led to many more home buyers having to pay higher prices for similar houses (see Carrillo, 2013; Chinco and Mayer, 2016; Anenberg, 2016; Wu and Rosenblatt, 2019), and constitutes a neglected source of risk in loan performance (Carrillo et al., 2021). Gao et al. (2020) and Bayer et al. (2021) point to other types of buyers entering the housing market, in which some households become novice investors. Some of these buyers may be misinformed (Chinco and Mayer, 2016; Mian and Sufi, 2022). As such, initial home buying represents a complementary channel for understanding foreclosures. Asymmetric information and lack of financial sophistication to use information are then a source of risk to home ownership and are associated with a higher probability of default and foreclosure (Gerardi et al., 2013; Carrillo, 2013).

This study identifies house buyers during the 2000–2007 economic boom market who subsequently lost their property through foreclosure between 2008 and 2016. We show how buyers who were later foreclosed associate with higher prices when purchasing their homes in the price run-up to the crisis. We also find heterogeneity across buyer-types. In particular, we find that owner-occupiers and investor-company buyers, who likely have greater market sophistication (either themselves or via real estate agents working on their behalf) do not exhibit the same pattern compared to second-home buyers and small-scale investors who are considered to be less informed buyers. The price premium therefore appears to be consistent with poorly informed or unsophisticated buyers, a penalty ill-informed buyers pay for their lack of knowledge or financial acumen.

This research makes two contributions to the literature. First, we contribute to a large and growing literature that examines information asymmetric pricing effects in housing markets (Turnbull and Sirmans, 1993; Chinco and Mayer, 2016; Stroebel, 2016). We offer an empirical framework for decomposing pre-crisis open market sales into a market value and a low information penalty. We compare pre-crisis market sales of two types of single-family houses: those that are subsequently foreclosed and those that are not foreclosed during the crisis. The empirical challenge here is to control for differences in property and neighborhood quality, and to find additional evidence of differences in financial acumen. We formulate an empirical model which includes property controls, tract and year interaction fixed effects to allow for local time trends, and an indicator for subsequently foreclosed properties for measuring the low information penalty. We find a substantial pricing penalty associated with future foreclosed buyers in their pre-crisis purchases. We find that the penalty rises as the market nears its peak, approaching 3 percent of the house value (approximately $6,500). We explore whether our findings are robust to unobservables and omitted variable bias using the approach proposed by Murphy and Topel (1990) and more recently Oster (2019). Tests of unobservable variables effects on coefficient stability do not alter our conclusions. We caution that these results do not imply any causal interpretation. We find that buyers who have foreclosed are also buyers who paid more for comparable housing in the run-up to the crisis. Our results suggest that the loan-to-value (LTV) at mortgage origination is measured with error for these buyers, and this might help explain the inconclusive results in the literature regarding the role of LTVs in defaults, as observed by Gerardi et al. (2013) and others.

Second, this paper examines buyer characteristics that have been associated with information asymmetries in real estate markets (Garmaise and Moskowitz, 2004). We exploit heterogeneity across buyers using homestead property tax information and other buyer information from tax records, and identify buyers as investor-companies, owner-occupiers, second-home buyers, and small-scale investors. We then merge information relating to buyer types and explore price differences across buyers. Buyer types with larger pricing penalties while controlling for property and neighborhood quality may provide suggestive evidence for the existence of low information or low financial sophistication in home buying. We adopt a two-step grouped-fixed effects approach in which we first generate groups using a k-means clustering algorithm, and then include group-fixed effects in our linear price model to allow for group-specific heterogeneity (Bonhomme et al., 2021). We find differences across buyer-types. Foreclosed owner-occupiers and investor-companies do not systematically pay more for comparable housing but second-home buyers and small-scale investors do. We find – based on samples matched on observables – that second-home buyers and small-scale investors who subsequently foreclosed pay on average 4.3 and 3.6 percent more, respectively. These results are robust to excluding recently built property that may come with warranty or specific benefits.

The remainder of the paper is organized as follows. Section 2 outlines the housing context and discusses why buyers who future foreclose are also buyers who pay more. Section 3 describes the data, Section 4 gives our results, and Section 5 concludes.

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. In the decades running up to the housing market peak in 2007, a variety of federal and state policies successfully increased homeownership rates for some targeted groups with a history of lower ownership rates. Home ownership growth rates up until 2007 were highest among the poorest households in the first income decile (Bricker et al., 2012; Bucks and Pence, 2008; Bucks et al., 2009). At the same time, however, the expansion of home ownership introduced new financial risks to a broader population, as was later revealed in mortgage defaults and foreclosures during the years after 2007. The U.S. Department of Housing and Urban Development (HUD) recognizes risks and the potential problems arising from low household financial sophistication in house buying decisions, and supports on-line programs to educate and counsel prospective home buyers about the buying process, including house search strategies, mortgage and mortgage calculations, and house maintenance issues. Pre-purchase counseling and mortgage delinquency and default resolution are also now part of home buyer education and foreclosure prevention programs.

As has become gradually evident, non-owner-occupied home buying also played an important role in the run up to the housing market peak (Gao et al., 2020; Bayer et al., 2021; I. García, 2022).[1] Florida, as one of the "sand states", experienced above average growth rates in non-owner-occupied home buying and above average house price appreciation in the boom (Bayer et al., 2021). The context of rising non-owner-occupied purchases, and rising homeownership rates among low income households may create environments conducive to persistent asymmetric information price effects among informed and uninformed buyers. Two questions arise, as to why lack of sophistication or information lead to higher transaction prices, and why subsequent foreclosures reveal uninformed or poorly informed buyers.

First, home buying is a complex process in which uninformed buyers pay higher prices for identical houses. Potential buyers, upon entering the market, learn about the price while searching among properties offered in the market, typically by searching internet sources and visiting neighborhoods and properties for sale. The search may take considerable time and effort because of the multi-dimensional heterogeneity in housing and the idiosyncratic tastes of home buyers. Search costs in thin markets can be high, thereby precluding continuous information gathering. Potential buyers are unable to gain complete knowledge about the market price. Information heterogeneity among potential

[1] In the literature, non-owner-occupied buying (Gao et al., 2020; Bayer et al., 2021) is also referred to as second-home buying (I. García, 2022) for acquiring nonprimary homes.

buyers may then arise due to differences in financial experience, participation in previous housing market transactions, and information about the neighborhood quality (Kurlat and Stroebel, 2015). In this case, the housing market comprises informed knowledgeable buyers and uninformed or unsophisticated buyers and fits within a housing market model characterized by asymmetric information and search costs as described by Arnott (1989) and Krainer (2001), among others.

A potential buyer faces uncertainty regarding the market value of the house and the number of competing buyers; whereas a seller faces uncertainty regarding the market acumen of potential buyers. In bargaining potential buyers reveal information about themselves. The seller exploits any revealed information about buyer ability, keeping the potential buyer uninformed about the market value of the house, 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 (Turnbull and Sirmans, 1993; Harding et al., 2003; Chinco and Mayer, 2016; Bayer et al., 2017; Goldsmith-Pinkham and Shue, 2022; Turnbull and Van der Vlist, 2022b). Han (2013) offers a different, but complementary, perspective. Buying a house draws on both investment and consumption motives that can be explained using a consumption-based capital asset pricing model. The buyer's investment motives refer to buying and holding housing as a financial asset, with the asset pricing model for housing predicting lower prices and higher returns in riskier housing markets. The buyer's consumption motives reflect the notion that buying a house today provides a hedge for housing consumption risk. Han (2013) shows that hedging consumption risk 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 the participation of low information buyers translate into higher prices? In a market with asymmetric information, the poorly informed buyer may inadvertently signal their status to the seller who can then exploit their bargaining power (basically, the 'selection problem' in the economics of information (Stiglitz, 2000). Informed buyers will not pay above the market value in an efficient market.[2] So, a buyer who bids below the market value will be outbid by informed bidders. However, a buyer who bids the market value will no longer be outbid by informed bidders, but rather might be outbid by uninformed buyers (Turnbull and Sirmans, 1993). In this situation, uninformed buyers will systematically exhibit purchase price premia. 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 or capital gains (Turnbull and Sirmans, 1993; Carrillo, 2013; Chinco and Mayer, 2016; Kurlat and Stroebel, 2015; Bayer et al., 2021) or the buyer's failure to correctly anticipate housing consumption risk (Turner, 2003; Sinai and Souleles, 2005; Han, 2013). The empirical result is the same: low information households pay more for a given house than do better informed or more sophisticated buyers.

Second, home owners may end up in foreclosure after their purchase. The single trigger of foreclosures identifies house price risk (or bad economy) as a channel to foreclosure.[3] In this view, house price volatility is a source of strategic default as it creates a put option for borrowers. Guiso et al. (2013) provide evidence showing that people wait long, and until negative equity is large enough before banks foreclose. They find that the percentage shortfall (or negative equity) determines strategic default. A greater shortfall increases the risk of default and foreclosure. While so, Gerardi et al. (2017) reject ruthless default behavior. They conclude that negative equity is a necessary but not sufficient condition for default. Home owners 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, borrowers may become effectively judgment-proof and can strategically default.[4] The double trigger of foreclosures identifies negative equity combined with adverse financial shocks as a channel to foreclosure, when home owners are no longer able to fulfill the financial burden (LaCour-Little and Malpezzi, 2003). The underlying reason 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 low-credit or income-constrained households to meet their rising obligations. This is, certainly, exacerbated by poor underwriting or predatory lending (Braunstein and Welch, 2002). Demyanyk and Hemert (2011) find that the quality of loans deteriorated over the years 2001–2006.

The third reason for observed foreclosures, which is the focus of this study, is that some buyers have limited information, knowledge, or skills needed to successfully manage property. Only recently has the literature sharpened its focus on financial sophistication as an underlying factor in 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. They show how improving home owners' financial knowledge with money management classes and one-to-one counseling meetings have lowered their default rates. The authors 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. Their conclusion is reinforced 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 only the result of house price risk or a combination with income or mortgage interest-rate risk but they are also linked to limited knowledge and skills at managing household finances and property. Since house price risks are a necessary but not sufficient condition for foreclosure (Foote et al., 2012), it does appear that low information or market acumen plays a major role in foreclosure. At the same time, though, it is the less sophisticated or uninformed buyer who is more likely to pay more for comparable housing. If this nexus is valid, then houses foreclosed are associated with higher house prices when first bought; if not valid, then houses foreclosed will not exhibit systematic purchase price differentials. This is a testable proposition. We consider different types of buyers who arguably vary in degree of sophistication, which allows us to examine whether the price premium associated with subsequent foreclosure reflects poor information, low financial skills, or whether it captures something else. Investor-companies are more sophisticated participants in the housing market than the average household, and local buyers are better informed than non-local buyers (Garmaise and Moskowitz, 2004; Chinco and Mayer, 2016). This suggests a straightforward test of our maintained hypothesis; the price premia for properties that will be foreclosed in future will be greater for households than investors if our interpretation is correct.

[2] For a given rent, lower mortgage interest rates reduce the required capitalization rate, increasing market value. This affects all informed and uninformed buyers. Or, as argued elsewhere in the literature, the effects of temporary credit shocks in prices are likely to be arbitraged in liquid markets (Ling et al., 2016).

[3] The bad economy and bad credit terminology follows Haughwout et al. (2008).

[4] While debt forgiveness is considered taxable income to the individual in the U.S. income tax system, this particular provision was temporarily set aside in the aftermath of the foreclosure crisis examined here.

3. Data and empirical model

The data for our analysis cover single-family detached house transactions in Orange County, Florida. Orange County FL. is among the counties with the highest number of foreclosures in the nation. The data are gathered from Orange County property tax records and include information on all parcels. We gathered property tax records over each year for years 2000 to 2016, and include single-family detached house transactions.[5]

The property tax data comprise detailed information about property characteristics, ownership and property tax, and transactions. Information about property characteristics include property address, property type, size, number of bedrooms and baths, construction year, presence of a pool, and parcel size. Information about ownership and property tax includes name of the owners, mailing address, and homestead exemption details. Information about transactions include property deed or legal instrument to transfer title, and transaction date and price.

The property tax records allow us to identify foreclosed properties and regular arm's length transactions. Florida is a judicial foreclosure state which means that, once a household defaults, the lender seeking to foreclose must file a lawsuit and receive approval from the court. Upon approval, lenders then initiate a foreclosure auction, after which sale a certificate of title is issued to convey title. We use certificate of titles to identify foreclosed properties (see Turnbull and Van der Vlist, 2022a). Regular arm's length transactions or market sales use warranty deeds to convey title and are also in the property tax records.[6]

The great advantage of using property tax records for each year from 2000 to 2016 is that we are able to identify future foreclosed properties. A future foreclosed property is a single-family unit bought in the period between 2000 and 2007 (and registered as warranty deed), and subsequently foreclosed in the period 2008–2016 (and registered as certificate of title).[7] A dummy variable FF indicates a future foreclosure; FF equals one if a market transaction completed in 2000–2007 is followed by a foreclosure in 2008–2016, and zero otherwise. We allow for those market sales in 2000–2007 that foreclosed in 2008–2016 to exhibit property-specific uninformed buyer effects. The market sales over 2000–2007 are used for estimation purposes.

Property tax records allow us to identify the type of buyer.[8] We exploit the following features of the tax records: whether or not buyer receives a homestead exemption, name(s), and mailing address of the buyer(s). First we use the information on homestead exemptions to identify owner-occupiers (the exemption is valuable, so owner-occupiers have strong incentives to self-report their status). Second, we use the mailing address to determine whether buyers live inside or outside the Orlando-Kissimmee-Sanford Metropolitan Statistical Area (MSA) and combine this with the buyer's name to identify the type of buyer. These features enable us to distinguish between investor-companies and households (constituting owner-occupiers, second-home owners, and small-scale investors). See the Online Appendix for details.

Sample descriptive statistics

Table 1 reports the descriptive statistics for all market sales during 2000–2007 in column (1). The table indicates a mean sales price of just above $206,000. With a median price of $173,000, the distribution is skewed to the right. We therefore use the natural logarithm of price in the empirical analysis. Structural property characteristics indicate type of building construction material (49.6 percent have stucco covered concrete block exterior walls versus wood frame construction), number of bedrooms (3.24 average), living area (2289 square feet average), number of bathrooms (2.06 average), presence of a private pool (27 percent), lot size (0.24 acre average), and actual age of the house (23.6 years average).

As a first pass to observe whether future foreclosed property is bought at a premium we consider house price dynamics over the observation period. House prices in Orange County experienced strong growth over 2000–2007. As the central county in the Orlando-Kissimmee-Sanford MSA, Orange County enjoyed long term population growth from 896,344 (2000 Census) to 1,145,956 (2010 Census). To address whether future foreclosed and non-foreclosed properties have different price dynamics we estimate log linear models of house prices on our set of structural property characteristics, and year fixed effects for the separate subsamples of future foreclosed and not-future foreclosed properties. Fig. 1 provides the house price indices for both subsamples. Perhaps most relevant to our question, is the widening spread for future foreclosed property relative to not-future foreclosed property as the market reached its peak. The price premium is largest for future foreclosed property in the years closest to the global financial shock. Two questions remain: first, to what extent does the premium reflect differences in the types of houses, and second, to what extent does it reflect differences in the types of buyers in each subsample? We consider these questions in turn.

A first explanation for higher prices is that future foreclosed houses are just different from other houses. To take a closer look at this possibility, Table 1 provides descriptive statistics for each subsample. Looking at property characteristics, Table 1 column (2) shows that the average property that foreclosed is bought at somewhat higher price with a mean price of $212,000 relative to $205,000 for not-foreclosed properties (notice the large standard deviations). Houses that end up foreclosed turn out to have been purchased late in the boom period, which may explain at least part of the difference in selling price observed between properties that ultimately fall into foreclosure and those that do not. Note that future foreclosed properties tend to be smaller (in terms of number of bedrooms, number of bathrooms, and living area). To reduce differences in observables, we also estimate models on matched samples using propensity score matching in the formal analysis that follows.

Buyers might also differ given the structural differences observed in future foreclosed property. Table 1 provides subsample descriptive statistics for each type of buyer in column (3). It turns out that buyers who end up foreclosed apply less often for homestead exemptions. Furthermore, the distribution of buyers varies over time. Fig. 2 reports shares of buyer types by year. Throughout 2000–2007, the share of owner-occupiers in total sales varies between 57 and 75 percent, with a trough in 2005. While the share of non-owner-occupiers peaked in 2005, owner-occupiers remained the majority of house purchases throughout the years.[9] Small-scale investors constitute the largest category of non-owner-occupied home buyers. The share of small-scale investors varies between 21 and 35 percent, with a peak in 2005. The share of second-home sales varies between 2.7 and 6.6 percent, while for investor-companies between 1.2 and 3 percent of total sales in Orange County, FL over 2000–2007.

Empirical model

The empirical approach makes use of a hedonic price function of the log of market price of property i at time t over 2000–2007 is a linear function of property characteristics and the uninformed buyer penalty FF:

$$lnP_{it} = \beta_X X_{it} + \beta_{FF} FF_i + \varepsilon_{it}, \quad (1)$$

[5] We include only single-family detached house transactions in order to reduce the risk of unobserved heterogeneity related to the dwelling type.

[6] Note that warranty deeds include short sales.

[7] One benefit of our long panel over 2000–2016 is that it allows us to track almost all future foreclosed property over 2000–2007, including those initially hidden in lenders' backlogs.

[8] See Chinco and Mayer (2016) who use property- and mailing address to classify buyers into owner-occupiers, local second-home buyers, and out-of-town second-home buyers. Bayer et al. (2021) use name(s) of owners to identify household-investors.

[9] While definitions of buyer types vary, these statistics are consistent with patterns reported by Chinco and Mayer (2016), and I. García (2022).

Table 1
Sample statistics, 2000–2007.

	(1) Pooled		(2) Future Foreclosed				(3) Buyer types							
			no		yes		Owner-occupier		Investor company		Second-home		Small-scale investor	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Sales price (current, $)	206,138	129,150	205,641	129,523	211,922	124,579	211,033	127,750	206,321	169,604	220,392	132,926	192,327	127,731
Future foreclosed (FF) (1=yes)	0.079						0.075		0.052		0.079		0.090	
Walls concrete stucco (1=yes)	0.496		0.497		0.476		0.544		0.292		0.571		0.384	
Number of bedrooms	3.235	0.736	3.236	0.737	3.226	0.720	3.288	0.712	3.030	0.923	3.276	0.730	3.119	0.761
Living area (in sq.ft)	2,289	827.2	2,296	829.9	2,201	789.3	2,375	828.4	2,036	886.1	2,312	815.5	2,101	787.6
Number of baths	2.060	0.630	2.063	0.631	2.028	0.610	2.124	0.610	1.817	0.790	2.117	0.616	1.917	0.639
Age of house (in years)	23.63	19.28	23.62	19.36	23.81	18.30	20.98	18.01	38.10	23.04	19.58	18.20	29.58	20.27
Pool (1=yes)	0.266		0.269		0.238		0.295		0.176		0.241		0.209	
Parcel (in acres)	0.237	0.166	0.239	0.167	0.224	0.148	0.238	0.163	0.261	0.214	0.231	0.168	0.237	0.167
Buyer types:														
Owner-occupier (1=yes)	0.652		0.655		0.619		1							
Investor company (1=yes)	0.017		0.018		0.012				1					
Second-home (1=yes)	0.049		0.049		0.049						1			
Small-scale investor (1=yes)	0.282		0.278		0.321								1	
Observations	96,677		89,026		7,651		63,065		1,684		4,702		27,226	

Note: Table shows descriptive statistics. Future foreclosed (1=yes) refers to purchases between 2000 and 2007 that foreclosed after 2007.

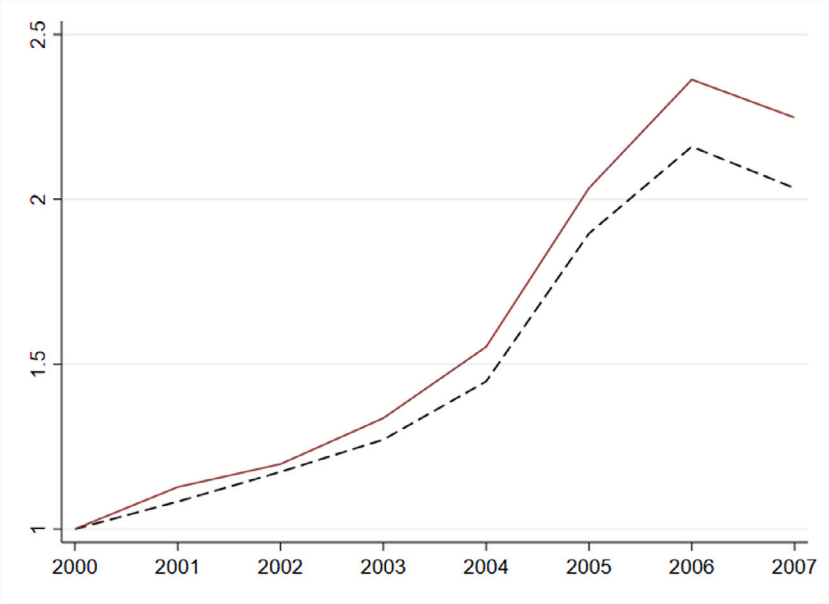

Fig. 1. Hedonic house price indices, 2000–2007.
Note: Figure graphs Orange County, FL. hedonic house price index for future foreclosed property (red solid line) and not future foreclosed property (black dashed line).

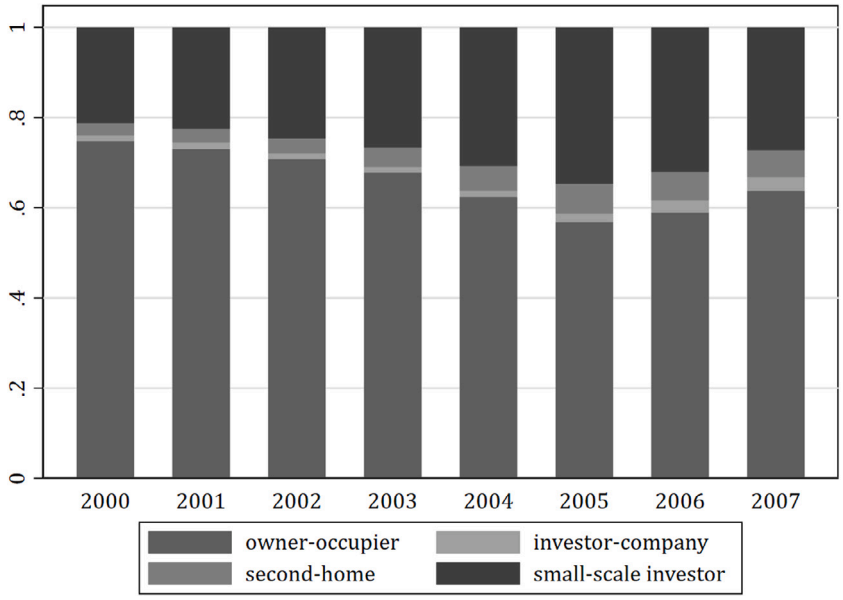

Fig. 2. Share of buyer types, 2000–2007.
Note: Figure gives share of buyer types per year. The bars stack shares of owner-occupiers, investor-companies, second-home, and small-scale investors from bottom to top, respectively.

where P is the selling price; X is the vector of relevant characteristics, including location and time fixed effects; and FF is an indicator of property foreclosed in the future over 2008–2016. The coefficient on the FF variable measures the possible penalty paid by uninformed buyers at the time of purchase over 2000–2007 because of buyers' limited financial acumen or limited knowledge about the market value. The last term ε_{it} in Eq. (1) is the stochastic error.

We first estimate a baseline model on the set of individual transactions and allow for clustered errors at the census neighborhood block-level (Angrist and Pischke, 2008). The coefficient FF will establish whether properties that foreclose in the future are associated with higher prices.

We next estimate the model with buyer-type interaction effects to compare prices across buyer-types. If financial acumen is important we may expect the coefficient β_{FF} to differ across buyer-types in systematic ways. We also estimate these models with group-fixed effects to reduce the effects of unobserved heterogeneity (Bonhomme et al., 2021). This approach entails a two-step procedure: in the first step, properties are classified based on a set of moments using a *kmeans* clustering algorithm. Then, in a second step, we estimate the model now including group-fixed effects in X. An attractive feature of this approach is its ability to exploit commonalities in situations with multi-dimensional heterogeneity.

Furthermore, we compare our results with an alternative approach using price markup, measured as the difference between the transaction

Table 2
Baseline results.

	(1)		(2)		(3)		(4)		(5)		(6)	
Future foreclosure (FF)	0.048	***	0.0065	**	−0.0311	***	0.0059	**	0.0094	***	0.0054	*
(1=yes)	(0.0072)		(0.0029)		(0.0116)		(0.0029)		(0.0028)		(0.0029)	
FF × 2001					0.0313	**						
(1=yes)					(0.0152)							
FF × 2002					−0.0036							
(1=yes)					(0.0160)							
FF × 2003					0.0255	*						
(1=yes)					(0.0141)							
FF × 2004					0.0433	***						
(1=yes)					(0.0129)							
FF × 2005					0.0458	***						
(1=yes)					(0.0134)							
FF × 2006					0.0451	***						
(1=yes)					(0.0131)							
FF × 2007					0.0599	***						
(1=yes)					(0.0152)							
Walls concrete stucco			0.0544	***	0.0543	***	0.0539	***	0.0371	***	0.0339	***
(1=yes)			(0.0036)		(0.0036)		(0.0035)		(0.0035)		(0.0037)	
Log bedrooms			−0.0306	***	−0.0306	***	−0.0298	***	−0.0185	**	−0.0236	***
(in number)			(0.0079)		(0.0079)		(0.0078)		(0.0074)		(0.0076)	
Log living area			0.673	***	0.673	***	0.673	***	0.627	***	0.626	***
(in sq.ft.)			(0.0084)		(0.0084)		(0.0084)		(0.0080)		(0.0084)	
Log baths			0.151	***	0.151	***	0.15	***	0.147	***	0.148	***
(in number)			(0.0063)		(0.0063)		(0.0063)		(0.0060)		(0.0061)	
Log age house			−0.0552	***	−0.0551	***	−0.056	***	−0.0573	***	−0.0629	***
(in years)			(0.0021)		(0.0021)		(0.0021)		(0.0020)		(0.0021)	
Pool			0.109	***	0.109	***	0.108	***	0.0993	***	0.0991	***
(1=yes)			(0.0028)		(0.0028)		(0.0028)		(0.0026)		(0.0026)	
Log parcel size			0.0887	***	0.0887	***	0.0878	***	0.0914	***	0.0935	***
(in acres)			(0.0051)		(0.0051)		(0.0052)		(0.0048)		(0.0049)	
(1=yes)			(0.0055)		(0.0055)		(0.0055)		(0.0114)		(0.0118)	
Controls			zip and year		zip and year		zip × year		tract × year		tract × year × month	
Observations	96,677		96,677		96,677		96,677		96,677		96,677	
R-squared	0.01		0.80		0.80		0.80		0.82		0.86	

Note: Dependent variable is log sales price. Robust standard errors clustered at census block group level in parentheses with *** , **, * indicating significance at 1%, 5% and 10%, respectively. Number of observations is 96,677.

price and the predicted price (Carrillo, 2013; Carrillo et al., 2021).[10] This approach entails a two-step procedure, to first estimate Eq. (1) excluding FF. Then, in a second step, regress the residuals on the FF variable and interaction terms with buyer types.

Last, we estimate Eq. (1) on matched samples using propensity score matching to control for any observed difference in future foreclosed property.[11]

4. Empirical results

Future foreclosure price differentials

We first establish whether properties that future foreclose are associated with higher prices. Table 2 reports the estimated parameters for our baseline model, by excluding controls in column (1) and including various controls in columns (2) - (6).

The models are significant and the property characteristics coefficients are as expected. We find that structure quality and exterior construction indeed matter. Low quality structures sell for less than average or high quality structures. Also, applying the Kennedy (1981) adjustment, properties with concrete block covered with stucco exhibit 6 percent higher market values compared to wood frame construction. In addition, larger properties 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, as does parcel size.

The future foreclosed effect FF is reported in column (2). We find that buyers who are foreclosed later paid an average premium of 0.7 percent for properties bought between 2000 and 2007. The estimates in column (3) show that the premium is largest in the years closest to the global financial shock. Home buyers in 2007 who ended up foreclosed paid an average premium of about 3 percent. Columns (4) - (6) add various location and time interaction fixed effects to Eq. (1). Overall, these estimates reveal a strong and persistent correlation between home buyers' prices and future foreclosures. Our finding is in line with Carrillo (2013) who relates 2006 house prices to early default and fraud. For detached units he reports a coefficient of 0.023 (with standard error of 0.010) and so our estimate falls within his 95 percent confidence interval.

The parameter β_{FF} may nevertheless be subject to possible unobservable selection and omitted variable bias as confounding socioeconomic variables are unobserved (Murphy and Topel, 1990; Oster, 2019). For example, some buyers may pay more but because they vary in unobserved net wealth they are not foreclosed in the future. Or, unobserved quality differences between properties may bias results (Levitt and Syverson, 2008). In such cases, the set of observables X might not fully capture omitted variable bias. To consider the extent to which these factors may be driving our results we also explore the sensitivity of our parameter β_{FF} to unobservables. As shown in the Online Appendix, it turns out that our main results are robust to omitted variable bias.

Heterogeneity across buyers

We now establish how these future foreclosure price differentials vary with buyer types using characteristics that have been associated with information asymmetries (Garmaise and Moskowitz, 2004;

[10] Carrillo et al. (2021) use repeat-sales data to determine price markups. Our data preclude using repeat sales.

[11] The matching is based on a logit function of future foreclosure on property characteristics. Then, a matched sample of properties is created on the basis of similarity in estimated probabilities of future foreclosure. Details are provided in the Online Appendix.

Chinco and Mayer, 2016). We exploit additional information in the tax assessment data to probe deeper into this relationship for investors-companies, and households as owner-occupier, second-home owner or small-scale investor. First, we interact buyer types with future foreclosure. We then implement a discrete approach to further narrow down the effects of unobserved heterogeneity (Bonhomme et al., 2021). In the first step, properties are classified based on a set of moments using a *kmeans* clustering algorithm. For our data, we find nine clusters in the classification step which we include as group-fixed effects in the second estimation step.

Table 3 reports results for the specification with buyer interaction effects in column (1), and for the specification with group-fixed effects also in column (2). We find significant coefficients for buyer effects. In Table 3, we also report marginal effects of buyer types relative to owner-occupier buyers. These marginal effects indicate that non-owner-occupied house buyers pay less for comparable housing relative to owner-occupier buyers.

We are specifically interested in the marginal effects of future foreclosure by buyer type. The bottom panel of Table 3 reports these marginal effects. Interestingly, the coefficients for future foreclosure show considerable heterogeneity across buyer-types. For example, we find that the coefficient is statistically insignificant for investor-companies, while significant for second home buyers. So investor-companies who end up foreclosed did not pay more at the time of purchase, and neither did owner-occupier buyers. Second-home buyers who end up foreclosed paid on average 2.7 to 2.9 percent more for comparable housing. Small-scale investor buyers who end up foreclosed also paid more at the time of buying. Our results show that these buyers who experienced foreclosure between 2007 and 2016 paid a premium of 2.2 percent. A penalty of 2.2 percent or about $5,000 on average, goes unnoticed at the time of purchase and mortgage origination, and falls within the uncertainty intervals that appraisals typically carry.

Table 4 reports results for the alternative approach using markup as the dependent variable. To do this, we estimate markup in a first step, and then in a second step regress markup on FF and interaction effects with buyer types. Columns (1) and (2) give average marginal effects for models with markup. Comparing these results with the earlier estimates using house price (reported in Table 3) one observes that coefficients for FF across buyer types are robust. We find that future foreclosed owner-occupiers and investor-companies did not pay more, while second-home and small-scale investor buyers pay more for comparable housing.

Table 5 presents average marginal effects for matched samples. We create matched samples as heterogeneity across particular properties and neighborhoods may correlate with future foreclosure. By estimating models on matched samples we control for some of these effects on the estimates. We first apply propensity score matching using future foreclosure as the treatment to create separate matched samples. We then re-estimate models using matched samples. Column (1) shows results for matched samples. We again find that second-home buyers and small-scale investors who subsequently experience foreclosure pay more for comparable housing than those who do not experience foreclosure. The findings are robust to excluding recently built houses. These results are in column (2) and exclude properties with age at most one year.

Discussion and interpretation

Pulling the results together, buyers identified as future foreclosed - on average- pay more for comparable housing. These price differentials may exist for several reasons, including differences in relative bargaining power (Harding et al., 2003), asymmetric information (Chinco and Mayer, 2016), discrimination (Bayer et al., 2017), and gender differences (Goldsmith-Pinkham and Shue, 2022). In addition, our measure of future foreclosure includes a lender effect as they decide to pursue a foreclosure auction rather than a short sale, depending on the likely outcome of the revenues. While we cannot isolate a single explanation, the estimates are consistent with our interpretation of the price premium paid by future foreclosed buyers as an information penalty. This offers a complementary channel to understanding foreclosures.

Our findings suggest that home buyers who end up foreclosed systematically pay more for comparable housing. Drawing from the literature on mispricing and asset pricing discovery (Boehmer and Wu, 2013), we conjecture that information asymmetry increased during the run-up to the global financial crisis. This is consistent with anecdotal evidence that the market value was notoriously difficult to ascertain in Florida between 2005 and 2007. Also, these results point to the uncertainty about the collateral value (Stroebel, 2016) when appraisals are biased towards the sales price (Carrillo et al., 2021). According to the consumption-based capital asset pricing literature, households will on the one hand require a higher return and lower prices because of the greater risk involved, and on the other hand will require a lower

Table 3
Results with buyer interaction effects.

	(1)		(2)	
Future foreclosure (FF)	0.0013		0.0021	
(1=yes)	(0.0033)		(0.0033)	
Investor company	−0.0887	***	−0.0891	***
(1=yes)	(0.0105)		(0.010)	
Second-home	−0.0143	***	−0.0136	***
(1=yes)	(0.0044)		(0.0043)	
Small-scale investor	−0.0324	***	−0.0320	***
(1=yes)	(0.0023)		(0.0022)	
FF × Investor company	0.0136		0.0159	
(1=yes)	(0.0355)		(0.0359)	
FF × Second-home	0.0256	**	0.0266	**
(1=yes)	(0.0126)		(0.0126)	
FF × Small-scale investor	0.0203	***	0.0198	***
(1=yes)	(0.0063)		(0.0063)	
Walls concrete stucco	0.0358	***	0.0121	*
(1=yes)	(0.0035)		(0.0065)	
Log bedrooms	−0.0176	**	−0.0029	
(in number)	(0.0074)		(0.0083)	
Log living area	0.624	***	0.623	***
(in sq.ft)	(0.0079)		(0.0081)	
Log baths	0.144	***	0.144	***
(in number)	(0.0059)		(0.0075)	
Log age house	−0.0564	***	−0.0490	***
(in years)	(0.0020)		(0.0019)	
Pool	0.0982	***	0.139	***
(1=yes)	(0.0026)		(0.0105)	
Log parcel size	0.0933	***	0.0658	***
(in acres)	(0.0048)		(0.0049)	
Controls	tract × year		tract × year, group-fixed effects	
Observations	96,677		96,677	
R^2	0.82		0.82	
Average marginal effects Buyers:				
Owner-occupier	–		–	
Investor company	−0.087	***	−0.088	***
	(0.010)		(0.010)	
Second-home	−0.012	***	−0.011	***
	(0.004)		(0.004)	
Small-scale investor	−0.031	***	−0.030	***
	(0.002)		(0.002)	
Average marginal effects FF:				
FF for owner-occupier	0.0013		0.0021	
	(0.0033)		(0.0033)	
FF for investor company	0.0149		0.0180	
	(0.0354)		(0.0359)	
FF for second-home	0.0270	**	0.0287	**
	(0.0122)		(0.0123)	
FF for small-scale investor	0.0216	***	0.0219	***
	(0.0054)		(0.0053)	

Note: Dependent variable is log sales price. Robust standard errors clustered at census block group level in parentheses with *** , **, * indicating significance at 1%, 5% and 10%, respectively. Standard errors of marginal effects are obtained using the delta method. Number of observations is 96,677.

Table 4
Average marginal effects for mark-up models.

	(1)		(2)	
FF for owner-occupier	0.0022		0.0030	
	(0.0032)		(0.0032)	
FF for investor company	0.0139		0.0159	
	(0.0418)		(0.0425)	
FF for second-home	0.0276	**	0.0289	***
	(0.0107)		(0.0108)	
FF for small-scale investor	0.0217	***	0.0219	***
	(0.0054)		(0.0053)	

Note: Dependent variable is markup, measured as the difference between the transaction price and the predicted price based on equation (1) excluding FF and buyer types. Columns (1) - (2) relate to the specifications in Table 3 Columns (1) - (2) respectively. Bootstrapped standard errors in parentheses with *** , **, * indicating significance at 1%, 5% and 10%, respectively. Number of observations is 96,677.

Table 5
Average marginal effects for matched sample.

	(1)		(2)	
FF for owner-occupier	0.0001		0.0025	
	(0.0049)		(0.0049)	
FF for investor company	−0.0101		−0.0214	
	(0.0505)		(0.0516)	
FF for second-home	0.0429	**	0.0424	**
	(0.0181)		(0.0188)	
FF for small-scale investor	0.0359	***	0.0351	***
	(0.0083)		(0.0085)	
Observations	15,302		14,868	

Note: Dependent variable is log sales price. The specifications include property controls, and tract × year, and group-fixed effects as in Table 3 column (2) now using matched samples. See Appendix for details regarding matched samples. Column (2) uses matched samples now excluding properties with age less than 1 year. Robust standard errors clustered at census block group level in parentheses with *** , **, * indicating significance at 1%, 5% and 10%, respectively.

return because the current home hedges future housing consumption risk (Han, 2013). Now, for Orange County FL, with its urban growth and relatively elastic supply, the latter effect is likely rather weak. Heterogeneity in expectations about future house price appreciation plays a role here as well. When households have limited ability or knowledge, they may falsely expect future housing consumption risk to be high and will pay more.

Price differentials may also exist because some buyers with timing constraints engage in less advantageous market timing, as suggested by Goldsmith-Pinkham and Shue (2022). These buyers then may knowledgeably pay more for comparable housing. While we cannot fully rule out this alternative explanation, one would expect future foreclosed owner-occupier buyers to pay more for comparable housing, as these buyers are perhaps most subject to timing constraints. Our estimates however do not find evidence that future foreclosed owner-occupiers did pay more for comparable housing.

What is perhaps most interesting is that our estimates point to heterogeneity among different types of foreclosed property owners as suggested elsewhere (Gao et al., 2020; Bayer et al., 2021; I. García, 2022). We find highest future foreclosure rates among small-scale investors and second-home buyers, and conjecture that these show greatest variation in market acumen. Furthermore, we interpret the fact that small-scale investors do not follow the usual (and low cost) practice of protecting their personal assets from their investment activities by using flow-through or corporate ownership entities for these properties as evidence that these investors are less sophisticated or knowledgeable than buyers in what we identify as the investor-companies subsample. We find that future foreclosed second-home and small-scale investors did pay more for comparable housing, while owner-occupiers and investor-companies buyers did not.

5. Conclusion

House purchases typically involve mortgages, those complex financial instruments which have been assigned a large share of the blame for the waves of residential 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 price differentials in housing market upswings is also part of the story. The empirical results presented here indicate that some buyers who end up in foreclosure pay more for houses than buyers who avoid foreclosure.

This paper examines an overlooked financial consequence, the purchase price penalty experienced by foreclosed home owners. Our approach builds upon recent contributions in the financial literature and offers an empirical framework for decomposing pre-crisis open market sales into a market value and a penalty paid by uninformed buyers. The detailed data also allow us to exploit property-level homestead property tax exemption information and buyer identification to separate investor-companies from households that are owner-occupier, second-home owner, or small-scale investor.

Data from Orange County, Florida, over 2000–2007, reveal that home buyers who end up foreclosed paid a premium of 0.7 to 3.0 percent when purchasing their property. The premium increases the closer the transaction is to the financial meltdown in 2007. We find heterogeneity across buyers: Second-home buyers and small-scale investors who subsequently experience foreclosure pay more for their houses than those who do not eventually experience foreclosure. However, the more sophisticated investor-companies and possibly better informed owner-occupier households whose properties are eventually foreclosed, do not pay more relative to their counterparts who successfully avoid foreclosure. This pattern is consistent with the notion that the price premium paid by buyers who ended up in foreclosure reflects low information or lack of financial sophistication.

The results of our study have some policy implications. Promoting home ownership has long been a central policy of the U.S., but ownership comes with a host of financial risks such as mispricing, borrowing too much, poorly structured loans, falling into negative equity, and risking default or foreclosure. HUD supports on-line programs to educate and counsel prospective home buyers about the home buying process. These programs provide financial knowledge on budgeting and credit-management and have helped to substantially lower mortgage default rates for participating buyers. Most programs specifically target owner-occupiers. However, data on single-family dwellings from Orange County, Florida reveal high future foreclosure rates for small-scale investors too. Furthermore, our findings suggest foreclosed second-home buyers and small-scale investors systematically paid more for comparable housing, while investor-companies and owner-occupiers did not. To the extent that small-scale investors and second-home owners vary in their sophistication, our findings suggest that it may be appropriate for these programs to target these type of buyers as well.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jhe.2022.101844.

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