Heterogeneous Foreclosure Discounts of Homes*

Ralph Siebert (Purdue University and CESifo)

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Abstract

When the foreclosure crisis hit the U.S. housing market, there was little consensus on which homeowners were affected the most by home value impairment. The goal of this study is to flexibly estimate house-specific foreclosure discounts and to explore the merits of heterogeneous foreclosure discounts across market segments. I use a comprehensive dataset that encompasses home transactions from 2000 to 2020 in Florida and Indiana. Summary statistics show that foreclosures are realized across the entire home value and home size distributions. I estimate a structural model that builds on Rosen (1974) and Bajari and Kahn (2005) and estimates a price function using a weighted least squares regression approach. The estimation results show that foreclosure discounts in Indiana are higher than in Florida. In Indiana, foreclosed homes lost the most value at the lower part of the house value distribution. Moreover, owners of foreclosed large houses experienced immense value losses, and this applies to every city. In Indiana, houses at the lower part of the house size distribution also suffered from large foreclosure discounts, while Floridian houses lost significantly less value in this market segment. I also find that homes in neighborhoods with higher mortgages, urbanization, median incomes, and education rates realize higher foreclosure discounts. Neighborhoods with smaller Asian, Black, and Hispanic populations experienced higher foreclosure discounts.

JEL: R2, R3, C1, L1, L6, O3.
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Corresponding author: Ralph Siebert, Purdue University and CESifo, Krannert School of Management, Department of Economics, West Lafayette, IN, 47906, e-mail: rsiebert@purdue.edu

1 Introduction

The foreclosure crisis of 2006 was marked by a large number of home foreclosures, causing significant home value impairments.[1] Since housing accounts for a major fraction of household spending and wealth, the foreclosure crisis became a nationwide concern.[2]

In an attempt to limit further losses, policy makers and politicians agreed to support financially distressed homeowners (see also Harding, Rosenblatt, and Yao (2009)).[3] Policy makers and politicians proposed various policies, and there were many different views on which homeowners should be the financial beneficiaries. Some politicians associated foreclosures mostly with financially distressed homeowners at the lower segment of the house value and income distributions. They claimed that owners of lower-valued homes were the most affected by home value impairments and, therefore, were in greater financial distress. Other politicians argued that homeowners at the lower segment of the house value and income distributions were not the most affected. They argued that numerous wealthy homeowners in the upper housing segment had been struck by foreclosure as well.[4] According to an article published in The Wall Street Journal in 2010, houses with loans of $5 million or more were likely see a sharp rise in foreclosures.[5] Therefore, foreclosures are a potential threat to households across the entire home value and income distributions, enforced by geographic spillovers having an effect on non-foreclosed homes. As a consequence, several politicians proposed to also provide subsidies to wealthier homeowners.[6]

[1] In 2008, more than 4 million households lost their homes due to foreclosures; a house was foreclosed every eight seconds (see https://www.commonfloor.com/guide/safe-buying-of-foreclosed-property-4195.html).

[2] This nationwide concern has been enforced by the fact that foreclosures could affect non-foreclosed home values via geographical spillovers. Examples are Apgar, Duda, and Gorey (2005), Immergluck and Smith (2005, 2006), Leonard and Murdoch (2008), Harding, Rosenblatt, and Yao (2009), Lin, Rosenblatt, and Yao (2009), Rogers and Winter (2009), Frame (2010), Campbell, Giglio, and Pathak (2011), Ellen, Lacoe, and Sharygin (2013), Anenberg and Kung (2014), Gerardi, Rosenblatt, Willen, and Yao (2015), and Liu and Yezer (2019).

[3] In 2009, the Obama administration provided $275 billion to subsidize homeowners. More detailed information and examples of financial aid programs are provided later.

[4] Several articles report on some of America's wealthiest families losing their homes to foreclosure at a faster rate than the rest of the country (see https://money.cnn.com/2012/02/23/real_estate/million_dollar_foreclosures/index.htm).

[5] See https://www.wsj.com/articles/SB10001424052702304198004575172303998670976.

[6] See, for example, https://www.inman.com/2017/10/13, https://www.washingtonpost.com/news/where-

The design of effective policies requires a good understanding of which homeowners suffered from foreclosures and by how much. Today we know very little about heterogeneous price reductions due to foreclosures, also referred to as *foreclosure discounts* from now onwards. The aim of this study is to provide insights into heterogeneous foreclosure discounts and to evaluate how these discounts vary, especially across housing, neighborhood, and other market characteristics.

Housing is a heterogeneous commodity, and home values differ significantly depending on housing and neighborhood attributes as well as geographic regions. Heterogeneous home values naturally imply that foreclosure effects vary across homes, and the estimation of heterogeneous foreclosure discounts is the focus of this study.

This study concentrates on foreclosures as defined by the term "Real Estate Owned (REO) properties," which are reowned by the lender and offered on the market for sale. There are various reasons why houses are foreclosed. One main driver for foreclosure is that house prices have declined, creating negative equity (see Liu and Yezer (2019)). One further common reason is that homeowners experienced financial difficulties due to unforeseen circumstances, such as job loss, divorce, or large medical expenses that would make it difficult for owners to pay their mortgages.[7] A further reason is that neighborhood shocks (such as plant, interstate, and railroad construction, crime, reduced visual appeal of a neighborhood, etc.) can reduce the value of a house below the loan amount, also referred to as underwater mortgages.[8]

I consider foreclosures as being randomly assigned and forced by random unexpected events such as job losses. This consideration builds on findings by Mian, Sufi, and Trebbi (2015), who reject any significant correlations of foreclosure events with house and neighborhood and buyer attributes. Also, as shown later, the data descriptives confirm that foreclosure events occur along entire house size and home price distributions.

we-live/wp/2017/10/11, and https://www.brookings.edu/research/under-us-housing-policies-homeowners-mostly-win-while-renters-mostly-lose/.

[7]See Prohaska and Lichtenstein (2014).

[8]See also Cui and Walsh (2015), who show that foreclosures and crime rates are positive related.

It should be noted that there are various reasons why foreclosed houses sell for a discount.[9] Mian, Sufi, and Trebbi (2015) mention that isolating the causal effect of foreclosures is difficult because of omitted variables and reverse causality. I do not want to ignore any reverse causalities where house price reductions (caused, for example, by neighborhood shocks and underwater mortgages) affect foreclosures. This cautions me against interpreting estimates as causal and, therefore, I consider the total price discount effect associated with foreclosures (see also Campbell, Giglio, and Pathak (2011)).

I established a comprehensive database that includes residential housing transactions in Florida and Indiana from 2000 to 2020. Within these two states, I selected three city markets: Lafayette (Indiana), Fort Lauderdale (Florida), and Hollywood (Florida). The states and cities were selected based on data availability and sociodemographic differences, as well as differences in the evolution of house prices and foreclosure rates. The summary statistics show that homes across the entire value and size distribution faced foreclosures, but homes were more frequently foreclosed at the lower end of the home value and size distributions. The data descriptives confirm that foreclosed houses sell for a lower price. In Lafayette, the average foreclosed house sells for a price that is 52 percent below the sales price of non-foreclosed homes.[10] In Floridian cities, foreclosed houses sell for a lower sales price that ranges between 40 and 50 percent. The price reductions related to foreclosed houses are not necessarily related to foreclosure per se, but could also be stemming from the fact that foreclosed and non-foreclosed houses are different in their characteristics. Therefore, the aim and novelty of this study is to flexibly estimate house-specific foreclosure discounts and to explore their variation across house, neighborhood, and market segments.[11]

The empirical framework builds on the classic hedonic approach by Rosen (1974). I

[9] See https://leebankruptcy.com/bankruptcy_blog/foreclosures/top-7-causes-for-foreclosures/. More detailed information are presented in the next section.

[10] In Lafayette, the average foreclosed house sells for $\$94,925$ compared to the average non-foreclosed homes that sells for $\$199,024$.

[11] Earlier studies focused mostly on the estimation of average foreclosure discounts that are identical across houses.

estimate a structural model that builds on estimating a price function using a weighted least squares regression approach (see also Fan and Gijbels (1996) and Bajari and Kahn (2005)). The local regression is flexible in the sense that it allows me to flexibly retrieve house-specific coefficients and foreclosure discounts.

The estimation results show large heterogeneities of implicit prices for house and neighborhood characteristics across cities. For example, the estimation returns a square footage price that is up to two times higher in Fort Lauderdale and Hollywood compared to Lafayette. Our estimated foreclosure discounts show that foreclosed homes across cities suffered from drastic foreclosure discounts from 2005 to 2009.

I find that foreclosure discounts vary drastically across house attributes and geographic markets. The estimations return foreclosure discounts in Lafayette of $\$29,887$, which corresponds to 15 percent of the average house price in Lafayette. Lafayette homes experienced higher foreclosure discounts than Floridian homes, even though the houses sold for about half the price compared to the houses in Florida. While foreclosed homes across the entire home value distributions were affected by value losses, foreclosed houses in Lafayette lost the most value—51 percent of the house price—at the lower part of the house value distribution. This result suggests that the foreclosure discount may be related to local shocks and vandalism in bad neighborhoods or to neglected home maintenance (see, for example, Harding, Rosenblatt, and Yao (2009) and Campbell, Giglio, and Pathak (2011)). In Florida, the corresponding foreclosure discount is around 30 percent.

Foreclosure discounts also vary largely along house size distributions. Foreclosure discounts (in dollars and percentages) for large houses are immense, and this applies to every city. In Lafayette, houses at the lower part of the house size distribution also suffered from large foreclosure discounts (20 percent of the house value). In contrast, the foreclosure discounts showed a different pattern in Florida, where houses lost significantly less value (only 2 to 5 percent) at the smaller house size segment. In Floridian cities, however, the spread of foreclosure discounts across low and high market segments was especially large.

Finally, the results show that foreclosure discounts are related to sociodemographic

characteristics, such as income, family size, percentage of mortgage, unemployment, and below poverty rates in census tracts. Across all cities, homes in neighborhoods with higher mortgage, urbanization, median income, and education rates realized higher foreclosure discounts (in dollars). Neighborhoods with smaller Asian, Black, and Hispanic population experienced higher foreclosure discounts (in dollars and percentages). These results can have political relevance, and they can provide valuable insights into government interventions.

This study is organized as follows: Section 2 provides information about the foreclosure process and reviews closely related studies. Section 3 introduces the data sources and presents summary statistics. Section 4 introduces the housing model and presents the results. Section 5 concludes.

2 The Housing Market and Foreclosure Information

The financial crisis and the collapse of the real estate market caused many homeowners to lose their houses due to foreclosure. To help limit value destruction in the housing market, the U.S. Congress and regulators suggested various policies in the form of loan modifications and subsidies to support financially distressed homeowners (see Harding, Rosenblatt, and Yao (2009)). In 2008, Congress passed the Housing and Economic Recovery Act, which authorized the Federal Housing Administration to invest up to $300 billion in new 30-year fixed rate mortgages.[12] The purpose of the Act was to restore confidence in Fannie Mae and Freddie Mac (both of which are government-sponsored enterprises) and to inject capital into the two large U.S. suppliers of mortgage funding. Fannie Mae and Freddie Mac buy mortgage loans from lenders, thereby ensuring that mortgage money is available at all times in all locations around the country. At the end of 2009, the Treasury Department announced that it would be providing Fannie Mae and Freddie Mac unlimited

[12]See https://www.investopedia.com/terms/h/housing-and-economic-recovery-act-hera.asp.

financial support for the next three years.[13] In 2009, the Obama administration spent close to $300 billion, and the United States government, overall, allocated more than $900 billion to special loans and rescues related to the financial and housing crisis.[14] Various debates concentrated on which homeowners should be the beneficiaries.

A foreclosure is considered a necessary instrument to protect the investor's interest in the property and to salvage the borrower's equity. There are several reasons that can explain a foreclosure discount. 1) Foreclosed homeowners may have faced financial shortages and could not properly maintain and repair their houses, which reduces the quality of a house and diminishes home values. 2) Foreclosed houses could have been physically damaged by the owners during the foreclosure process, which also explains a loss in value (see also Campbell, Giglio, and Pathak (2011)). Relatedly, foreclosed homes often stay vacant for an extended period of time, and unoccupied houses suffer from poor maintenance and are particularly vulnerable to vandalism and crime. The degraded house quality can lead to foreclosure discounts. 3) Lenders do not receive much consumption value, utility, or interest from repossessing and keeping foreclosed houses. Rather, they miss out on potential interest earnings from investing the capital they would have received if they had sold the house. In order to minimize their losses from foregone investment opportunities, lenders of foreclosed properties are highly motivated to sell quickly, putting downward pressure on prices. In this regard, however, Harding, Rosenblatt, and Yao (2012) do not find much evidence that banks sell homes at fire sale prices.[15] 4) A transaction cost argument could explain possible price reductions of foreclosed homes such that buyers of foreclosed homes at auctions have to pay in cash.

Several empirical studies evaluate the foreclosure discount by applying regression analyses in which sale prices are regressed on housing characteristics and a foreclosure indicator.

[13]See https://www.reuters.com/article/us-fanniemae-freddiemac-credit/treasury-uncaps-credit-line-for-fannie-freddie-idUSTRE5BN2ZI20091224.

[14]See, for example, https://www.wsj.com/articles/SB10001424052748704751304575079260144504040 and https://en.wikipedia.org/wiki/American_Recovery_and_Reinvestment_Act_of_2009.

[15]In a related context, see also Shleifer and Vishny (1992) and Benmelech, Garmaise, and Moskowitz (2005).

The foreclosure indicator provides an estimated value of foreclosure discounts established by the difference between average expected prices of distressed and non-distressed properties, holding housing and neighborhood characteristics constant. The price discount is usually evaluated under the assumption that foreclosure exerts a homogeneous impact on home values across housing and neighborhood characteristics.[16]

Prominent empirical studies provide evidence that foreclosed properties sell at a discount of 20 percent and more (see Harding, Rosenblatt, and Yao (2012)). Pennington-Cross (2006) finds that distressed properties appreciate by 22 percent less. Campbell, Giglio, and Pathak (2011) find a 27 percent foreclosure discount. Sumell (2009) finds foreclosure discounts of up to 60 percent.[17] Some empirical studies show that foreclosure discounts can differ across geographic regions (see also Cohen, Coughlin, and Yao (2016)).

Aroul, Hansz, and Rodriguez (2020) estimate foreclosure discounts in a single-family residential market in Fresno, California, from 2003 to 2014. Their estimation results return foreclosure discounts that largely vary over time, across market price segments, and other market conditions. They find that foreclosure discounts are rather modest for the low-to-medium market price segments and quite substantial in high market price segments.

Mian, Sufi, and Trebbi (2015) evaluate the aggregate impact of foreclosure using observations across different states and cities and different judicial foreclosure systems. Campbell, Giglio, and Pathak (2011) find large foreclosure discounts for low-priced houses. Some foreclosure studies emphasize the relevance of accounting for neighborhood attributes. They provide evidence that the omission of neighborhood controls results in upwardly biased foreclosure discounts (see Forgey, Rutherford, and VanBuskirk (1994), William and Marvin (1996), Carroll, Clauretie, and Neill (1997), and Clauretie and

[16]Note that even though hedonic regressions control for housing and neighborhood attributes, the price discount is usually estimated as average effects across all foreclosed homes.

[17]Further evidence is provided in the studies by Shilling, Benjamin, and Sirmans (1990), Forgey, Rutherford, and VanBuskirk (1994), William and Marvin (1996), Carroll, Clauretie, and Neill (1997), Pennington-Cross (2006), Lin, Rosenblatt, and Yao (2009), Clauretie and Daneshvary (2009), Campbell, Giglio, and Pathak (2011), and Cohen, Coughlin, and Yao (2016), among others.

Daneshvary (2009)). Gangel, Seiler, and Collins (2013), Vernon-Bido, Collins, Sokolowski, and Seiler (2017) and Liu and Yezer (2019) focus on the fact that foreclosures can generate local externalities where foreclosed houses that can depress the sales price of nearby housing units. Liu and Yezer (2019) account for two effects: (1) the *investment effect*, where lack of maintenance imposes a physical externality on nearby housing (see also Gerardi, Rosenblatt, Willen, and Yao (2015)), and (2) the *appraisal effect*, in which comparable prices are formed while including appraisals of distressed homes. They provide evidence for the investment effect while addressing the relation between foreclosure, mortgage delinquency, and negative equity. Related studies (such as Annenberg and Kung (2014) and Gerardi, Rosenblatt, Willen, and Yao (2015)) show that real estate-owned sales within one-half mile have significant impact on sales price.

Both states, Indiana and Florida, follow judicial foreclosure procedures. The statutory judicial foreclosure processes are similar for both states, in that lenders have to retake property titles via the court system. Courts issue a judgment and public notice (lis pendens) of foreclosure.[18] After the property enters a public auction and if nobody enters a bid in excess of that opening bid, the bank obtains the property by default and it becomes "REO" by the lender. The servicer or bank then usually sells the property on the market using a real estate company.[19] Less than 10 percent of foreclosed houses are sold in auctions, and more than 90 percent of the houses are real estate owned and sold by real estate agents on behalf of banks.[20]

Florida and Indiana have a statutory right of redemption for a period of time after default, which provides an opportunity for the foreclosed party to reclaim the property.

[18] A judicial foreclosure is processed through the courts, beginning with the lender filing and recording a notice that includes the amount of outstanding debt and the reasons for foreclosure. Lis pendens refers to the initial document filed by an attorney or trustee that starts the foreclosure process after the occurrence of default under the deed of trust or mortgage.

[19] For further information on the role of banks in the foreclosure process, see, for example, Niedermeyer, Shneyerov, and Xu (2015).

[20] Liu and Yezer (2019) mention that approximately 94 percent of completed foreclosure proceedings are disposed by lenders through REO sales. See also https://www.policygenius.com/blog/6-ways-to-pay-for-a-foreclosure-that-arent-cash/. Since this study concentrates on REO foreclosures, transaction cost arguments—attending auctions and paying for foreclosed houses in cash—are not primarily important in this study.

While both states adopt judicial foreclosure proceedings, there can still be substantial variation in foreclosure procedures that affect costs and time. For example, both states grant a statutory right for deficiency judgment. In Indiana, a mortgage foreclosure provides the statutory right for deficiency judgment. In both states, a foreclosure procedure usually takes 150 to 200 days if the borrower does not contest or file for bankruptcy. In Florida, a deficiency judgment may be obtained post-sale action.[21]

3 The Data Sources and Summary Statistics

This study concentrates on residential housing in Indiana and Florida. In following insights from previous studies on the housing market, I account for the fact that housing markets differ considerably between cities, resulting in different equilibria (see, for example, Bajari and Kahn (2005)). Hence, this empirical study will define markets at the city level. For Florida, I focus on Fort Lauderdale and Hollywood. For Indiana, I concentrate on Lafayette.[22]

The states and cities were selected based on sociodemographic differences and data access granted by several data providers, as well as differences in the evolution of house prices and foreclosure rates. Florida is characterized by higher incomes (per capita and per household) and a lower poverty rate, and it is more diverse in terms of race and ethnicity. Florida was characterized by a strong surge in real estate prices during pre-foreclosure periods, a large number of foreclosures, and big price declines during foreclosure periods.[23] In 2007, Florida ranked second in foreclosure rankings in the United States.[24]

In Indiana, cities are more rural and less diverse in terms of race. In comparison to

[21]For further information on how statutory changes in the foreclosure process and the delay affect cost and foreclosure recovery in the housing market, see Liu and Yezer (2019) and Cordell and Lambie-Hanson (2016).

[22]In order to ensure that I have sufficient information on foreclosures and sociodemographics, I merged the cities of Lafayette and West Lafayette, which are referred to as Lafayette in this study.

[23]For example, Calomiris, Longhofer, and Miles (2008) mention that through 2009, Florida was among the states with the largest number of foreclosure filings.

[24]See https://www.sun-sentinel.com/real-estate/sfl-realtytrac-foreclosures-link-20130613-story.html, as well as a report published by the National Institute of Justice, "Mortgage Fraud, Foreclosures and Neighborhood Decline Meeting" March 31-April 1, 2009.

Florida, Indiana's foreclosure rates are more moderate, and real estate prices remained rather stable.[25] Lafayette residents achieve a high level of education and live mostly in suburban areas close to the university or research labs.

I gathered detailed information on foreclosures, home sales, housing characteristics, and neighborhood demographics from a variety of sources. Several sources—Home Junction, CoreLogic, and the Board of Realtors in Indiana and Florida—provided information from the Multiple Listing Service (MLS) system and the county assessor's office, which allowed me to retrieve house transaction information from 2000 to 2020.[26] The databases provide detailed information on house sales, such as the address of the houses, the transaction prices, the number of rooms, the number of bathrooms, and other demographic information. I also use information on real estate properties owned by the lender, such as the address of the foreclosed property as well as the date of foreclosure. Since I focus on residential housing, I eliminate houses without bedrooms and bathrooms from the database. Moreover, I extracted outliers and possible data entry errors by removing the bottom and top one percentile on the sales price, house size, room, and bathroom distributions. All prices are expressed in 2020 U.S. dollars using the consumer price index excluding shelter expenses. The data were taken from the Bureau of Labor Statistics. Socioeconomic data were taken from the U.S. Census Bureau and categorized at the census tract level. I also gathered information on the geographical areas in terms of the population's educational attainment, mortgage, income, commute times, unemployment, poverty, and racial and ethnic composition.

Table 1 provides an overview and description of the variables that I use in the study. Table 2 provides summary statistics of the city demographics. The table shows that Lafayette is the smallest city in terms of inhabitants and number of households. The median income per household is highest in Fort Lauderdale ($\$55,269$) and lowest in Lafayette

[25]For example, in 2006, Indiana was ranked fourth in the list of top states with the highest foreclosure rates (see Samavati, Dilts, Haber, and Gosnell (2007)).

[26]The MLS is a comprehensive database used by real estate agents, and it contains the characteristics of houses listed on the market.

($40,499). Lafayette holds the highest educational attainment, as 44 percent of the population has a bachelor's degrees. The higher educational attainment in Indiana is related to the fact that Lafayette and West Lafayette are populated by many Purdue University employees, as well as professionals from research labs, etc. The unemployment rate is rather similar across cities. In terms of racial composition, Fort Lauderdale and Hollywood are characterized by high Black and Hispanic populations.

Table 3 shows the summary statistics of house transactions across different cities. Concentrating on the non-foreclosed homes, as shown in the left columns of the table, the average final transaction price of non-foreclosed houses in Lafayette is $199,024, which is more than 30 percent lower than the average transaction prices in Floridian cities; they average $303,237 and $380,164.[27] In contrast, the houses are larger in Lafayette (2,041 square feet) than in Florida (they average 1,667 and 1,690 square feet). Consequently, the price per square foot is much lower in Lafayette than in the other cities. The average house in Lafayette is newer in age and the mortgage rate is higher. In general, a large portion of homeowners finance their homes with mortgages (between 47 and 67 percent). A closer look at the mortgage holders shows that households across all sociodemographic areas rely on mortgages (see, for example, the Census of Population and Housing). In summary, transaction prices, house, and demographic characteristics differ across cities.[28]

Table 3, right columns, shows the summary statistics of foreclosed homes. The upper panel displays the descriptives for Lafayette. Noteworthy is the fact that foreclosed houses sell for a price that is 52 percent below the price of non-foreclosed homes. More specifically, the average foreclosed house sells for $94,925 compared to the average non-foreclosed homes that sells for $199,024. The difference in prices for non-foreclosed homes and foreclosed homes in the Floridian cities is in the 40 to 50 percent range. Foreclosed houses are around 10 to 20 percent smaller than the non-foreclosed homes, and this

[27] I refer to the final transaction price simply as the sales price or price from now onward.

[28] For further information on how buyer demographic characteristics can affect house prices via search costs and other buyer characteristics, see Cheng, Lin, Liu, and Seiler (2015), He, Lin, Liu, and Seiler (2020), and Siebert and Seiler (2020).

applies to all cities. The average mortgage rates of foreclosed homes are less than those of non-foreclosed homes.

Noteworthy are the facts that foreclosed homes sell for a significantly lower price than non-foreclosed homes, and they are much smaller in size than the non-foreclosed houses in the same city. The characteristics of foreclosed homes also differ across cities.

I now provide insights into the evolution of foreclosure rates (as measured by number of foreclosures divided by total home sales) across cities and over time. Figure 1 shows that the foreclosure rates evolve similarly over time across all three cities. In general, the foreclosure rates take on an inverse U-shape. In Lafayette, the foreclosure rates started increasing moderately after 2003, while Floridian cities experienced a rather drastic increase after 2006. Foreclosure numbers across all cities reached their plateau between 2007 and 2009. Afterward, they slowly leveled back toward their original level in 2018.[29] Note that the foreclosure rates drastically increased from 0.01 in 2001 to about 0.08 at their peak.

Figure 2 shows the foreclosed and non-foreclosed home sales along the price distributions. The density of foreclosures is widely distributed across house prices, emphasizing the fact that houses across the entire price distributions (i.e., all market segments) were impacted by foreclosure. It should be noted, however, that the distributions of both types of houses are skewed to the right. While this pattern is certainly more pronounced for Lafayette, it also applies to Floridian cities. Therefore, the mass of the distributions is concentrated on lower and medium values houses. The highly skewed distribution of foreclosed homes provides evidence that relatively more foreclosed houses were sold for below average prices compared to non-foreclosed homes. Figure 3 shows similar patterns for the distribution of foreclosed and non-foreclosed homes along the house size distribution. Figures 2 and 3 show that foreclosure events occurred along the entire house size distribution. Yet, houses are more frequently foreclosed at the lower end of the house size

[29]This foreclosure pattern is consistent with the foreclosure descriptives as mentioned in Mian, Sufi, and Trebbi (2015).

distributions. They are not constrained to low value and small houses as is frequently assumed; the same applies to foreclosed homes along the home value distributions. In fact, foreclosures also occur at the intermediate and upper parts of these distributions, so they are a concern across different groups of society, independent of wealth and income.

Figure 4 illustrates the evolution of prices for non-foreclosed and foreclosed homes across time and cities. The dashed (solid) lines display the average prices of (non-) foreclosed homes. Several facts are standing out: First, the average home price is significantly higher for non-foreclosed homes than for foreclosed homes, which is in alignment with the descriptives as shown in Table 3. Second, both price series somewhat co-evolve over time and prices within each city and reach their minimum between 2009 and 2011. The spread increases slightly over time. In comparing the evolution of prices with the number of foreclosures, it is interesting to note that the peak in the number of foreclosures (between 2007 and 2011) is accompanied by drastically falling prices. Hence, the evolution of prices and foreclosures appears to be negatively correlated. Third, the price fluctuations over time are higher in Floridian cities than in Lafayette. The extent to which foreclosure affects sales prices per se and how foreclosure discounts vary with house, neighborhood, and market characteristics are empirical questions that are examined further in the remainder of the study.

4 The Model

The goal is to flexibly estimate house-specific foreclosure effects and to explore the merits of heterogeneous foreclosure discounts across market segments. The empirical framework builds on the classic hedonic approach by Rosen (1974) and Epple (1987), and it adopts the extension by Bajari and Benkard (2005) and Bajari and Kahn (2005). I estimate a hedonic price function using a weighted least squares regression approach with a local polynomial linear kernel estimator, as described by Fan and Gijbels (1996) and Bajari and Kahn (2005). This flexible estimation approach returns a set of house-specific coefficients

and foreclosure discounts. This is different from the usual regression approach that relies on a global relationship between the dependent and independent variables and returns the same set of coefficients for every house.

I account for the fact that housing markets differ considerably between cities, and I define the housing markets at the city level. The model includes $m = 1, ..., M$ cities, and each city is characterized by $i = 1, ..., I_m$ individuals and $j = 1, ..., J_m$ housing units in period t.[30] A home is assumed to be a bundle of three types of attributes: First, the physical housing attributes include the house size, age, number of rooms and bathrooms, and a waterfront property indicator. Second, the community or neighborhood attributes include information on mortgage rates, median income, the time (in minutes) to commute to work, the percentage of college-educated households, unemployment and poverty levels, and the percentage of Asian, Black, Hispanic, and White households in the neighborhood. All physical housing and neighborhood attributes are summarized in the vector x_j. Third, the house-specific foreclosure discount is denoted by ξ_j. As mentioned earlier, foreclosures can impact home values via multiple channels, most of which are unobserved by the econometrician. For example, the foreclosure effect could be related to deterioration in house quality originated by poor maintenance and vandalism. Examples of quality deterioration in a neighborhood could be crime, reduced visual appeal of an entire neighborhood, construction of interstates or railroads, etc.

The equilibrium price (p_j) is determined by the interaction between buyers and sellers. The home price is characterized by a function p that maps the housing and neighborhood characteristics ((x_j) and the foreclosure discount (ξ_j)) into equilibrium prices

$$p_j = p(x_j, \xi_j). \tag{1}$$

The utility (u) that consumer i receives for house j is given by

$$u_{ij} = u_i(x_j, \xi_j, c), \tag{2}$$

[30]For the sake of simplicity, I suppress the subindices m and t in the remainder of this article.

which is a function of housing and neighborhood characteristics, the foreclosure discount, and a consumption of a composite commodity c with a price normalized to 1.

Households are rational utility maximizers who choose their preferred bundle of housing attributes given their income y_i. Product $j^*(i)$ is utility maximizing for individual i if

$$j^*(i) = \arg\max_j u_i(x_j, \xi_j, y_i - p(x_j, \xi_j)), \tag{3}$$

where the budget constraint is substituted into the utility function.

The price function satisfies

$$p_{j^*} = \sum_k \gamma_{k,j^*}(x_{j,k} - x_{j^*,k}) + \mathbf{1}\xi_{j^*} + \epsilon_{j^*}, \tag{4}$$

where k refers to a house or neighborhood characteristic and j^* indicates a household's optimal housing choice. The ξ_{j^*} represents a house-specific foreclosure discount, and the indicator function $\mathbf{1}$ refers to the set of foreclosed houses. The error term is denoted by ϵ_{j^*}, which captures unobserved amenities or measurement error. Note, the subscripts j^* emphasize that coefficients and foreclosure effects hold locally for each housing unit (that is, they are house specific).

Equation (4) shows that price is a function of the distance between product j^* and product j, which is approximately linear in a neighborhood of (x_{j^*}, ξ_{j^*}). Therefore, the estimates are local in the sense that a unique set of implicit prices is estimated for each house. This local regression approach provides more flexibility in this case than the usual globally linear assumption, as it returns hedonic gradients for every house such that house-specific foreclosure discounts can be flexibly recovered. In contrast, global estimates recover a single coefficient for all houses, which provides less flexibility to retrieve house-specific foreclosure discounts.

I specify the hedonic price function as

$$p_{j^*} = \gamma_{1,j^*}Size_j + \gamma_{2,j^*}Age_j + \gamma_{3,j^*}Rooms_j + \gamma_{4,j^*}Baths_j + \gamma_{5,j^*}Waterfront_j + \gamma_{6,j^*}Mortgage_j$$

$$+\gamma_{7,j^*} Income_j + \gamma_{8,j^*} Commute_j + \gamma_{9,j^*} Bachelor_j + \gamma_{10,j^*} Unemployment_j$$

$$+\gamma_{11,j^*} Poverty_j + \gamma_{12,j^*} Asian_j + \gamma_{13,j^*} Black_j + \gamma_{14,j^*} Hisp_j + \gamma_{15,j^*} Season_j$$

$$+\sum_s \gamma_{16,s,j^*} Y(2000+s)_j + \sum_l \gamma_{17,l,j^*} SE(l)_j + \mathbf{1}\xi_{j^*} + \epsilon_{j^*}. \quad (5)$$

Note that I add a season dummy variable to control for potentially higher demand around summer months. I also include year dummies (Y) to control for annual changes in real estate markets and spatial or regional fixed effects (RE) to control for neighborhood unobservables (those include school quality and proximity to shopping, restaurants, highways, or other local amenities).

4.1 Estimation

In the following, I describe the estimation of the hedonic price function, as shown in equation (5). I use a weighted least squares estimation approach (see also Fan and Gijbels (1996) and Bajari and Benkard (2005)):

$$\gamma_{j^*} = argmin_\gamma (p - X\gamma)' W (p - X\gamma), \quad (6)$$

where p is a vector of prices and X includes the regressors. The weight matrix is given by

$$W_{j^*} = diag[K_{j,j^*}(x_j, x_{j^*})], \quad (7)$$

where $W = diag[K_h(x_j - x_{j^*})]$ is the matrix of kernel weights. Note that the kernel weights W are a function of the distance between the characteristics of product j^* and product j. Since more weight is assigned to characteristics close to j^*, the estimates are referred to as local estimates. Local estimation allows for house-specific implicit prices, and it avoids the assumption that the sample average of residuals is zero, which provides opportunities to flexibly retrieve house-specific foreclosure effects.

In following Bajari and Kahn (2005), I use a local linear kernel method. The kernel density function is given by,

$$K(z) = \prod_k N(z_k/\hat{\sigma}_k^2), \tag{8}$$

$$K_h(z) = K(z/h)/h, \tag{9}$$

where K is a product of standard normal distributions, denoted by N. For the $k'th$ characteristic, the normal distribution is evaluated at $z_k/\hat{\sigma}_k^2$, where $\hat{\sigma}_k^2$ is the sample standard deviation of characteristic k and h is the bandwidth. I applied several robustness checks using bandwidths of $h = 3$, 2.15 (see Bishop and Timmins (2019)) and 2. I confirmed that different degrees of smoothness do not vary our results substantially. I also confirmed that using the identity matrix returns ordinary least squares estimates. One appropriate selection criterion for bandwidth choices is the reliability of negatively estimated hedonic gradients (see also Bishop and Timmins (2019)). For further information on choosing the bandwidth and the associated rule of thumb, see also Silverman (1986), Fan and Gijbels (1996), and Haerdle, Mueller, Sperlich, and Werwatz (2004).

Based on the local weighted least squares estimates of equation (5), I can flexibly retrieve the house-specific foreclosure discounts as

$$\xi_{j^*} = p_{j^*} - x_{j^*}\gamma_{j^*} - \epsilon_{j^*}, \tag{10}$$

where the residual effect of foreclosed homes is replaced with the counterpart of non-foreclosed homes. The estimated house-specific foreclosure discounts allow further exploration of how those discounts vary with house, neighborhood, and market characteristics.

4.2 The Results

Equation (5) is estimated separately for the three city-markets—Lafayette (IN), Fort Lauderdale (FL), and Hollywood (FL). I begin with reporting the average implicit prices

for specific home characteristics. Next, I turn to the estimated average foreclosure discounts and then report on the heterogeneous foreclosure effects.

Implicit Prices

Table 4 shows that almost all coefficient estimates are significant at the 99 percent level of confidence, and their magnitude appears reasonable and comparable to earlier studies on the housing market.[31] The implicit price per square foot in Lafayette takes on the lowest value ($80) across all cities.[32] An additional square footage costs $152 in Fort Lauderdale and $123 in Hollywood. The highest price per square footage is paid in Fort Lauderdale, which is reasonable, as this city is also characterized by the highest income per capita (see Table 2). The estimates show that the square footage price in Florida is up to two times higher than in Lafayette, confirming the notion that housing in Florida is significantly more expensive than in the Midwest. The estimation results coincide with the fact that the Midwest is ranked as one of the most inexpensive areas in the U.S. real estate market. The large differences in the implicit prices for square footage also support the relevance of treating cities as separate markets. Furthermore, the large degree of heterogeneity of the coefficient estimates across cities supports the fact that heterogeneous willingness to pay across buyers from different cities is a relevant factor that should be accounted for when evaluating sale price effects of foreclosures.

The estimation results also show differences in the implicit price for the age of the house. The estimated coefficients for *Age* are highly significant (at the 99 percent confidence level) and negative for all cities, indicating that older houses sell at lower prices. An additional year reduces the sales price by $481 in Lafayette and by slightly more than $200 in the Floridian cities. One reason homes in Lafayette quickly depreciate in age could be that there is high demand for newer suburban housing (with additional amenities), which leaves little demand for older houses in downtown areas.[33] This differs from the cities in

[31] Standard errors are reported in the table in parentheses below the parameter estimates with 99%, 95%, and 90% levels of significance.

[32] The coefficient estimates for *Size* are significant for all cities at the 99 percent confidence level.

[33] Lafayette residents achieve high levels of education and live mostly in suburban areas close to the

Florida, where older houses lose less value, possible due to their attractive locations.

The implicit price for an additional room significantly increases the sales price by $\$1,788$ in Lafayette, by $\$10,378$ in Fort Lauderdale, and by $\$4,453$ in Hollywood. An additional bathroom adds $\$17,849$ to the house value in Lafayette, which is higher than in the cities in Florida. It should be noted that all coefficient estimates for additional rooms and bathrooms are significant (at the 99 percent confidence level) and positive, which supports the reliability and adequacy of our estimation results. Note that the implicit prices for extra rooms strongly vary across cities, similar to the willingness to pay for additional square footage. A waterfront property drastically increases the home prices in Florida. The highest value added is achieved in Fort Lauderdale, where buyers are willing to spend an extra $\$131,619$. Moreover, the estimation results show that higher mortgage rates further increase the money spent on houses.

The coefficient estimates on neighborhood characteristics show that the implicit prices largely differ across cities. For example, a reduction in commute time (from home to work) by one minute increases the house value by $\$1,097$ in Lafayette, by $\$1,715$ in Fort Lauderdale, and by $\$2,388$ in Hollywood. While neighborhoods with more highly educated residents increase home prices across all cities, their effect is quite different. For example, a one percentage point increase of homeowners with a bachelor's degree adds \$460 to the home value in Lafayette, while it increase the home price in Fort Lauderdale by $\$2,065$.[34]

In Lafayette and Fort Lauderdale, houses in Asian, Black, and Hispanic neighborhoods are less expensive compared to houses in White neighborhoods, the reference group. In Hollywood, home buyers are willing to pay more for houses in Asian and Hispanic neighborhoods. According to Table 2, Hollywood is the city with the largest Hispanic community, which is perhaps one reason why Hispanic home buyers are willing to spend more for

university or research labs that offer more amenities, such that houses in the older downtown area are not as popular as in other cities.

[34] All the above-mentioned neighborhood coefficient estimates are significant at the 99 percent confidence level.

houses located in Hispanic neighborhood houses. In general, racial demographics exert a significant effect on home values across all cities.

Finally, the estimation results show that houses are sold for higher prices in the summer, except in Fort Lauderdale, where the seasonal effect is not significant. The time and regional effects are significant, and the adjusted R-squares are 94 percent and higher, confirming a very good fit.[35] To summarize, the estimated implicit prices for housing and neighborhood characteristics can be quite different across cities. Next, I turn to a description of the estimated foreclosure effects.

Foreclosure Effects on Home Prices

In the following, I concentrate attention on the main focus of this study and evaluate how foreclosure discounts evolve with house, neighborhood, and market characteristics. Remember that the relationship between foreclosures and house prices can be affected by several factors that are unobserved to the econometrician and that can be specific to house, neighborhood, and market characteristics.

As described in the model section, I recover foreclosure discounts specific to every house. In a first step, I report the foreclosure discounts (in dollars) averaged across foreclosed houses and separated by cities (see the bottom of Table 4). The estimated average foreclosure discounts reveal the following interesting facts: The average foreclosure discount is highest in Lafayette ($\$29,887$), followed by Fort Lauderdale ($\$27,500$) and Hollywood ($\$22,063$). (Note that a higher positive number refers to a higher price reduction due to foreclosure, that is, a higher foreclosure discount.) Hence, all reported foreclosure discounts affect price negatively, providing evidence that foreclosed homes experience price reductions. The numbers also show that the impact of foreclosure varies across cities. Interestingly, Lafayette experienced the highest foreclosure discounts even though its houses sold for about half the price in comparison to the houses in Florida.[36]

[35]The high R-square is explained by the inclusion of time and regional dummies.

[36]It should be noted that the unexplained price deviations of non-foreclosed homes, as captured in the residuals, represent only a minor fraction of the sales price (around 1 percent), which confirms the good fit of our regression results.

I also track the evolution of foreclosure discounts for the different cities across time, as displayed in Figure 5. Homes in all cities experienced large foreclosure discounts after 2005/2006 and this lasted until 2008. From 2009 to 2011/2012, home values across all cities recovered and experienced rather small foreclosure discounts. After this, foreclosure discounts took another downturn.

Next, I examine the variation of foreclosure discounts across geographic regions within each city. Figure 6a displays the heatmap for Lafayette and Figure 6b displays the heatmap for Fort Lauderdale (upper part of the figure) and Hollywood (lower part). The heatmaps visualize the magnitudes of the foreclosure discounts where darker colors represent higher foreclosure discounts. Several aspects are noteworthy: First, all cities are characterized by a broad color spectrum, supporting the fact that foreclosure discounts largely vary not only across cities (as shown in Table 4), but also across regions within each city.

Figures 6a shows that Lafayette experienced the highest foreclosure discounts in the center (the historic downtown area) and in the northwestern area (close to Purdue University). Moreover, a large area in the northeast is affected by high foreclosure discounts; a region that is characterized by weaker economic and social factors.

Figure 6 b shows that Fort Lauderdale and Hollywood experienced large variations of foreclosure discounts. Those cities experienced high foreclosure discounts in the eastern regions that are close to the ocean where residential properties are typically more expensive.

Next, I further explore the heterogeneity of foreclosure discounts across specific housing, neighborhood, and market characteristics.

Heterogeneous Foreclosure Effects on Home Prices

I evaluate heterogeneous foreclosure discounts across housing and market segments. For distinguishing the lower from the upper market segment, I use the median of the corre-

sponding variables of different cities, as reported in Table 5.[37]

Table 6 reports the discounts in dollars and percentages for the four cities separated by the different market segments. For example, column 1 (2) shows the means and the foreclosure discounts in the low (high) market segments. The first row of Table 6 reports the means of the sales prices for the low and high market segments; the means are significantly lower in Lafayette compared to the other cities. The second row of Table 6 reports the foreclosure discounts measured in dollars. The discount in the low price segment lies in the neighborhood of $\$40,000$ for all cities, while the discount in the higher segment is much smaller and averages around $\$20,000$ (see also Figure 7(a)). The third row of Table 6 shows the foreclosure discounts as measured in percentages of the sales price. The foreclosure discounts in the low segments vary drastically across cities, ranging from 25 percent in Hollywood to 51 percent in Lafayette. The finding that foreclosed houses in the lower market segment experienced higher losses in Indiana than in Florida could be explained by cross-price elasticities at the lower market segment being larger in Indiana than in Florida. The third row of the table also shows that the foreclosure discounts for the high segments are much smaller and more equally distributed, ranging from 4 to 6 percent across cities. Therefore, while foreclosed homes across the entire home value distributions are affected by value losses, the relative foreclosure discounts are significantly higher in the low market segments (see also Figure 7(b)). We should remember that the foreclosure discounts are subtracted from the sales price, which is endogenous, so the foreclosure discounts certainly need to be interpreted cautiously.

To gain further insight, I evaluate the foreclosure discounts across house size segments. The means of the house sizes for the low and high segments are very similar across cities. It is noteworthy that foreclosure discounts (in dollars and percentages) are much higher in the high segments than in the low segments, and this applies to every city. The losses at the upper segments are immense. This is a strong finding, and it supports some opinions

[37]In comparing the relative magnitudes across cities, the medians closely resemble the descriptive summary statistics from Table 3.

that foreclosure discounts are not constrained to smaller houses but are also realized at the higher market segments. The spread of foreclosure discounts across low and high market segments appears to be especially large in Floridian cities. Overall, larger foreclosed houses across all cities experienced higher foreclosure discounts (as measured in dollars and percentages) than smaller houses in every city (see also Figures 7 (c and d)).

The high positive correlation between foreclosures and house size distributions could potentially be driven by confounded factors that are related to neighborhood and sociodemographic characteristics, such as income, education, suburbanization, etc. For example, suburban houses can offer several benefits to households, since they are newer and larger, which determines demand, prices, and foreclosure discounts.[38] Therefore, I examine whether differential foreclosure discounts are systematically associated with neighborhood and sociodemographic characteristics.

Table 6 shows that neighborhoods with high mortgage rates, high incomes, high education levels, and high urbanization rates suffer from the highest foreclosure discounts as measured in dollars, and this applies to all cities. We should also recognize that neighborhoods with lower unemployment, lower poverty rates—and, to some extent, neighborhoods with smaller Asian, Black, and Hispanic communities—experience higher foreclosure discounts (in dollars and percentages).

To summarize, foreclosure is a critical concern across multiple segments of the housing market. Households across the entire house value and size distribution are subject to foreclosure, but foreclosures more frequently occur with smaller and lower-priced houses. Foreclosure discounts (in absolute and relative magnitudes) are especially high for larger houses. Foreclosures also have strong differential effects across neighborhood market segments. Across all cities, homes in neighborhoods with higher mortgages, urbanization, median incomes, and education rates realize higher foreclosure discounts (in dollars). The results provide evidence that, beyond housing characteristics, demographic characteristics

[38]For further information on segregation, see also Cutler, Glaeser, and Vigdor (1999), Glaeser and Kahn (2004), and Bajari and Kahn (2005).

can have strong effects on foreclosure discounts.

5 Conclusion

The foreclosure crisis of 2006 became a nationwide concern and received considerable attention among policy makers, homeowners, real estate associations, and scholars. Politicians and policy makers provided several suggestions to limit further destruction of home values and wealth. There were differing opinions, however, on which homeowners should be supported financially (see also Harding, Rosenblatt, and Yao (2009)). The design of effective policies requires a good understanding of which homeowners suffered most severely from value deterioration of foreclosed homes. While previous studies provided many insights into homogeneous foreclosure effects on price discounts, the aim of this study was to provide insights into the heterogeneity of foreclosure discounts across house, neighborhood, and market characteristics.

By using detailed buyer, housing, and neighborhood information, I established a comprehensive database. Summary statistics show that foreclosures are realized across the entire house value distribution. I estimate a pricing equation that returns house-specific foreclosure effects such that heterogeneous foreclosure effects can be captured across several market characteristics.

The regression results show that the extent to which homeowners were affected by foreclosure discounts differs considerably across house and neighborhood characteristics and geographic regions. For example, foreclosed homes in Indiana lost more value in the lower segment of the home value distributions. In all cities, owners of large foreclosed houses experienced the highest value losses, measured in absolute terms and in percentages relative to the sales price. This strong finding provides evidence that foreclosure discounts are not constrained to smaller houses but are also realized at the higher market segments.

Our results also show that foreclosure discounts are related to neighborhood and market characteristics. In all cities, neighborhoods with high mortgage rates, high incomes,

high education levels, and high urbanization rates experienced the highest foreclosure discounts. Moreover, neighborhoods with low unemployment rates and low poverty rates suffered from the highest foreclosure discounts across all cities. Finally, neighborhoods with smaller Asian, Black, and Hispanic populations experienced higher foreclosure discounts (in dollars and percentages).

To conclude, the study provides evidence that foreclosure discounts differ across geographic regions and also embody essential heterogeneity across house and neighborhood segments. While foreclosures frequently seemed to be associated with financially distressed homeowners at the lower segments of the housing and neighborhood attributes, this study shows that foreclosures also had significant price effects on upper market segments; the extent of the effects depends on geographic regions. This result could be useful and relevant to scholars, policy makers, and politicians when considering which types of homeowners should receive financial support.

Finally, we are aware that policy recommendations certainly go a long way in this important area and cannot be related solely to this study. However, our study provides some insights. One policy contribution would be that policies aiming to support financially distressed homeowners should not exclusively be related to federal authorities. Some jurisdiction should be devoted to local authorities so they can evaluate the harm of foreclosure along house and neighborhood characteristics.

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A Appendix: Tables

Table 1: Variable Descriptions

Variable	Description
P	Final transaction price measured in 2020 dollars
Size	Size of the house in square footage
Age	Age of the house
Rooms	Number of rooms
Baths	Number of full and half bathrooms
Waterfront	Dummy variable is one if waterfront property
Mortgage	Percentage of houses with a mortgage
Income	Median income in the (census tract) neighborhood
Commute	Median travel time to work in the (census tract) neighborhood
Bachelor	Percentage of residents with at least a bachelor's degree in the (census tract) neighborhood
Unemployed	Median percent of residents that are unemployed in the (census tract) neighborhood
Poverty	Median percent of residents that live below poverty in the (census tract) neighborhood
Black	Percentage of Black residents in the (census tract) neighborhood
Hispanic	Percentage of Hispanic residents in the (census tract) neighborhood
Asian	Percentage of Asian residents in the (census tract) neighborhood
Season	Seasonal dummy is one if house is sold between March and September
Y	Year dummies
CT	Census tract dummies

Table 1 shows the variable descriptions. Source: Multiple Listing Service, Census.Gov, and U.S. Bureau of Labor Statistics.

Table 2: City Demographics

Cities	Lafayette	Fort Lauderdale	Hollywood
Population	122,717	182,437	154,817
Households	44,776	74,160	56,542
Person per household	2.34	2.37	2.64
Median income	40,499	55,269	51,917
Income per capita	23,178	41,887	30,060
Poverty (in %)	27.64	17.80	13.30
Unemployment (in %)	8.4	8.9	8.9
Bachelor (in %)	44.11	36.50	26.70
Commute (in min.)	16.55	26.5	29.10
Asian (in %)	10.74	1.70	2.40
Black (in %)	6.66	31.30	18.00
Hispanic (in %)	9.27	18.50	37.50
White (in %)	77.58	62.20	69.50

Table 2 shows the city demographics. Source: Census.Gov and U.S. Bureau of Labor Statistics.

Table 3: Summary Statistics for Cities, 2000-2020

	Non-Foreclosed			Foreclosed		
Lafayette	Mean	Min	Max	Mean	Min	Max
P	199,024	29,617	973,767	94,925	29,219	579,462
Size	2,041	750	7,435	1,596	762	5,672
Age	32	0	120	43	0	116
Rooms	8	3	20	7	3	16
Baths	2	1	7	2	1	5
Waterfront	NA	NA	NA	NA	NA	NA
Mortgage (rate)	0.67	0	0.98	0.40	0	0.98
Season	0.71	0	1	0.61	0	1
Ft. Laud.	Mean	Min	Max	Mean	Min	Max
P	380,164	29,219	1,225,721	188,443	30,601	
Size	1,667	750	6,021	1,451	750	4,992
Age	58	0	120	58	0	94
Rooms	7	3	15	7	3	13
Baths	2	1	6	2	1	5
Waterfront	0.19	0	1	0.11	0	1
Mortgage (rate)	0.47	0	0.98	0.27	0	0.98
Season	0.63	0	1	0.62	0	1
Hollywood	Mean	Min	Max	Mean	Min	Max
P	303,237	31,267	1,191,034	178,422	30,818	799,126
Size	1,690	750	6,758	1,458	750	5,326
Age	56	0	96	57	2	96
Rooms	7	4	17	7	4	12
Baths	2	1	6	2	1	4
Waterfront	0.06	0	1	0.03	0	1
Mortgage (rate)	0.52	0	0.98	0.34	0	0.98
Season	0.63	0	1	0.63	0	1

Table 3 shows the summary statistics for the cities. Sources: Multiple Listing Service.

Table 4: Estimation Results of the Price Function

Endogenous Variable: P	Lafayette	Ft. Laud.	Hollywood
Variable	(1)	(2)	(3)
Size	80.05***	151.87***	123.29***
	(0.88)	(2.76)	(2.04)
Age	-480.66***	-207.24***	-218.41***
	(21.56)	(78.96)	(67.86)
Rooms	1,788***	10,378***	4,453***
	(313.05)	(1,599)	(1,242)
Baths	17,849***	7,578***	15,650***
	(901.46)	(2,909)	(2,256)
Waterfront	NA	131,619***	44,398***
	(NA)	(2,889)	(3,446)
Mortgage	2,699**	23,025***	28,912***
	(1,117)	(2,481)	(1,877)
Income	0.01	0.21**	-0.11
	(0.05)	(0.10)	(0.11)
Commute	-1,097***	-1,715***	-2,388***
	(293.31)	(320.61)	(322.81)
Bachelor	459.88***	2,065***	1,545***
	(52.05)	(167.43)	(151.29)
Unemployment	-1,507***	-1,216***	293.22
	(223.12)	(455.13)	(272.44)
Poverty	375.57***	2,314***	-1,721***
	(139.09)	(195.28)	(232.97)
Asian	-823.74***	-6,723***	2,943***
	(94.48)	(878.77)	(498.21)
Black	-1,429***	-1,594***	-1,049***
	(261.00)	(92.33)	(79.20)
Hisp	-292.06	-8,329***	493.63**
	(331.39)	(548.23)	(261.23)
Season	3,417***	-2,436	2,978**
	(878)	(2,010)	(1,561)
Year effects	YES***	YES***	YES***
Regional effects	YES***	YES***	YES***
Mean FC	-29,887***	-27,500***	-22,063***
Adj. R-Square	0.95	0.94	0.95
Observations	15,967	12,046	9,465

Table 4 shows the estimation results for the price function as shown in equation (5). The dependent variable is the house price. The coefficient estimates represent the average "implicit prices". The standard errors are shown in parentheses below the parameter estimates, and ***, ** and * denote 99%, 95% and 90% levels of significance, respectively.

Table 5: Medians for Variables by City

Variable	Lafayette	Fort Lauderdale	Hollywood
P	169,398	311,589	265,831
Size	1,804	1,526	1,536
Mortgage (rate)	0.8	0.6	0.74
Urban	2,347	2,175	2,020
Income	50,602	51,388	50,799
Bachelor (in %)	41.69	36.52	29.78
Unemployment (in %)	7.5	8.4	7.5
Poverty (in %)	8.3	7.9	8.8
Asian (in %)	1.70	1.28	2.11
Black (in %)	3.56	7.99	11.73
Hispanic (in %)	1.89	2.16	2.89
White (in %)	92.39	79.78	80.24

Table 5 shows the medians for relevant variables by city. Sources: Multiple Listing Service.

Table 6: Heterogeneous Foreclosure Discounts

City	Lafayette		Fort Lauderdale		Hollywood	
Segment	Low	High	Low	High	Low	High
Variables	(1)	(2)	(3)	(4)	(5)	(6)
P (Mean)	78,649	246,008	126,734	506,455	139,435	355,014
FC Discount (in $)	-40,053	-12,595	-44,368	-31,751	-34,468	-15,739
FC Discount (in %)	-50.93	-5.12	-35.01	-6.27	-24.72	-4.43
Size (Mean)	1,256	2,437	1,159	2,027	1,166	2,021
FC Discount (in $)	-16,229	-62,329	-5,692	-71,161	-2,642	-56,549
FC Discount (in %)	-20.63	-25.34	-4.49	-14.05	-1.90	-15.93
Mortgage (Mean)	0.23	0.90	0.02	0.85	0.06	0.89
FC Discount (in $)	-27,712	-31,314	-21,291	-38,907	-17,827	-26,255
FC Discount (in %)	-35.24	-12.73	-16.80	-7.68	-12.78	-7.40
Urban (Mean)	1,660	3,127	1,624	2,465	1,608	2,532
FC Discount (in $)	-23,698	-33,613	-31,049	-24,247	-14,748	-22,281
FC Discount (in %)	-30.13	-13.66	-24.50	-4.79	-10.58	-6.28
Income (Mean)	39,558	63,891	38,796	65,743	39,925	68,461
FC Discount (in $)	-23,368	-40,105	-7,405	-74,276	-16,188	-27,646
FC Discount (in %)	-29.71	-16.30	-5.84	-14.67	-11.61	-7.79
Bachelor (Mean)	24.89	55.78	17.82	50.77	19.37	38.75
FC Discount (in $)	-25,889	-42,336	-3,631	-85,939	-16,304	-32,695
FC Discount (in %)	-32.92	-17.21	-2.87	-16.97	-11.69	-9.21
Unemployment (Mean)	5.39	10.67	5.90	12.83	5.28	12.74
FC Discount (in $)	-38,325	-21,7852	-70,017	-6,959	-27,491	-18,799
FC Discount (in %)	-48.73	-8.86	-55.25	-1.37	-19.72	-5.30
Poverty (Mean)	3.76	15.81	4.35	19.22	4.44	12.42
FC Discount (in $)	-40,701	-23,035	-66,822	-10,547	-36,112	-14,572
FC Discount (in %)	-51.75	-9.36	-52.73	-2.08	-25.90	-4.10
Asian (Mean)	0.63	6.04	0.29	3.05	0.86	4.57
FC Discount (in $)	-26,118	-37,823	-18,472	-39,564	-28,261	-17,015
FC Discount (in %)	-33.21	-15.37	-14.58	-7.81	-20.27	-4.79
Black (Mean)	1.67	5.13	2.79	54.88	8.07	27.70
FC Discount (in $)	-29,007	-30,722	-81,405	-10,385	-31,819	-14,016
FC Discount (in %)	-36.88	-12.49	-64.23	-2.05	-22.82	-3.95
Hisp (Mean)	0.61	3.30	0.87	6.35	1.02	8.69
FC Discount (in $)	-41,619	-24,6212	-21,145	-33,147	-27,378	-20,757
FC Discount (in %)	-52.92	-10.01	-16.68	-6.54	-19.64	-5.85
White (Mean)	87.66	94.98	36.75	89.90	62.97	86.83
FC Discount (in $)	-31,191	-28,706	-10,616	-68,096	-15,029	-35,217
FC Discount (in %)	-39.66	-11.67	-8.38	-13.45	-10.78	-9.92

Table 6 shows the foreclosure discounts (in dollars and percentages), separated by city-markets and low and high market segments.

B Appendix: Figures

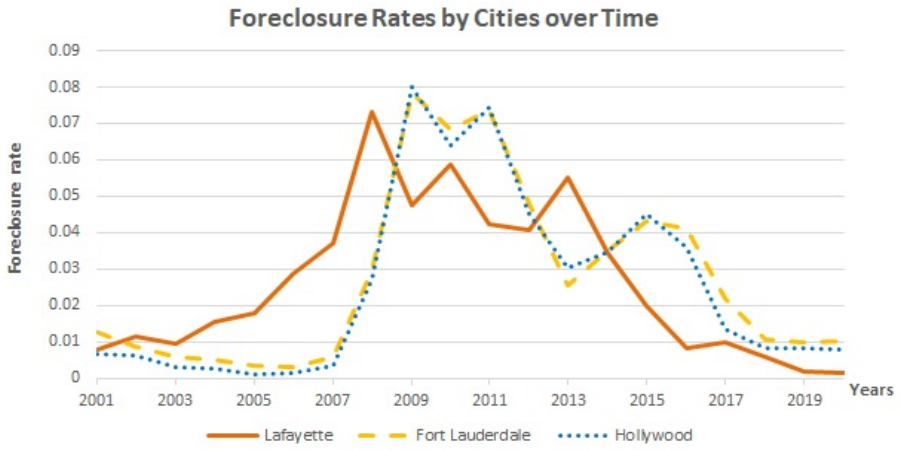
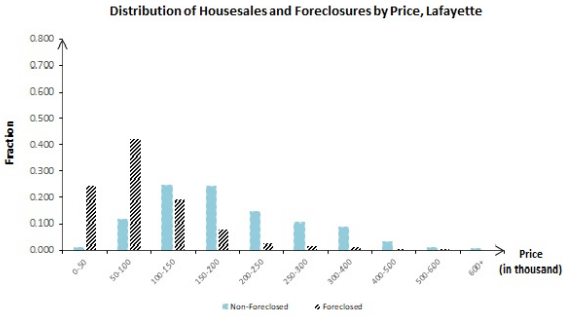
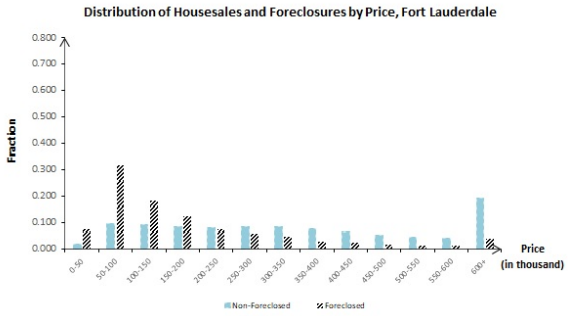


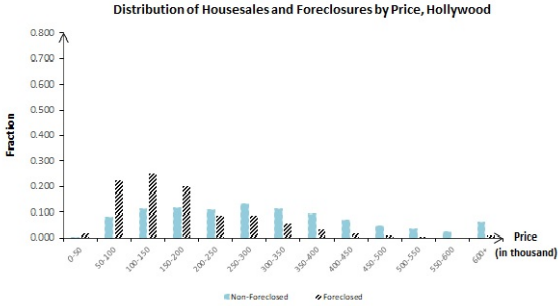
Figure 1: Foreclosure Rates by Cities over Time
Sources: Home Junction and Multiple Listing Services.



(a) (Non)-Foreclosure Sales, Lafayette

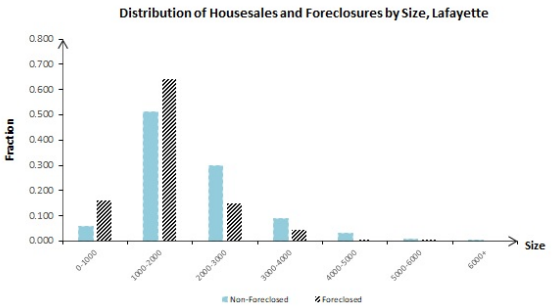


(b) (Non)-Foreclosure Sales, Fort Lauderdale

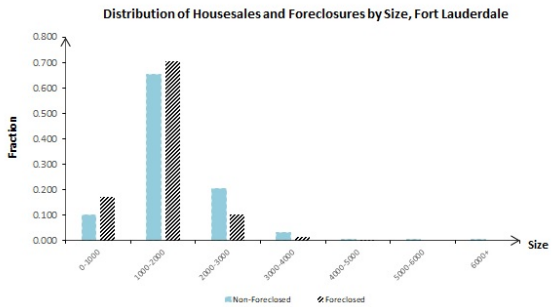


(c) (Non)-Foreclosure Sales, Hollywood

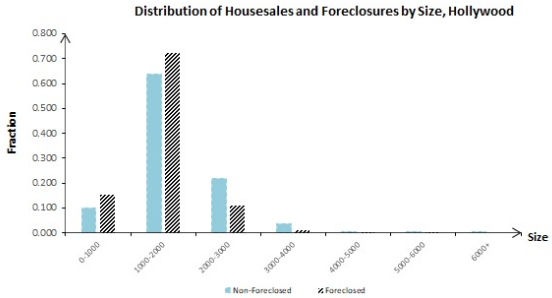
Figure 2: Distributions of Home Sales and Foreclosures along Price
Sources: Multiple Listing Service.



(a) (Non)-Foreclosures along Size, Lafayette

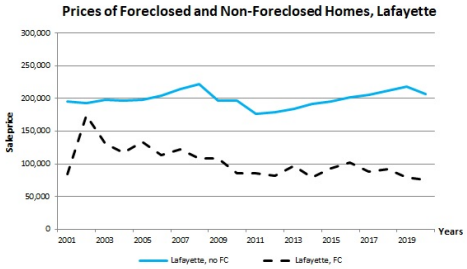


(b) (Non)-Foreclosures along Size, Fort Lauderdale

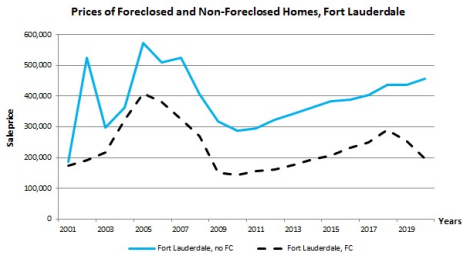


(c) (Non)-Foreclosures along Size, Hollywood

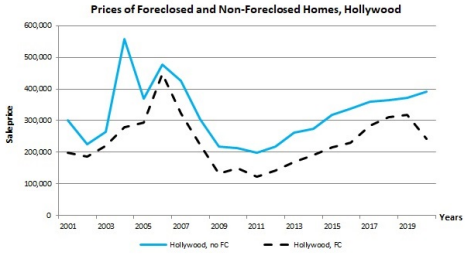
Figure 3: Distributions of Home Sales and Foreclosures along Home Size
Sources: Multiple Listing Service.



(a) Evolution of Prices, Lafayette



(b) Evolution of Prices, Fort Lauderdale



(c) Evolution of Prices, Hollywood

Figure 4: Evolution of Prices for Foreclosed and Non-Foreclosed Homes by Cities
Sources: Multiple Listing Service.

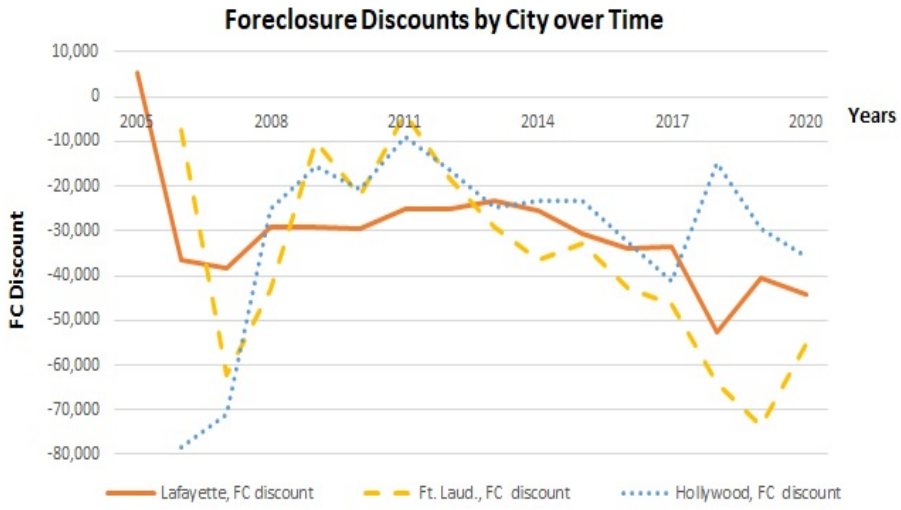
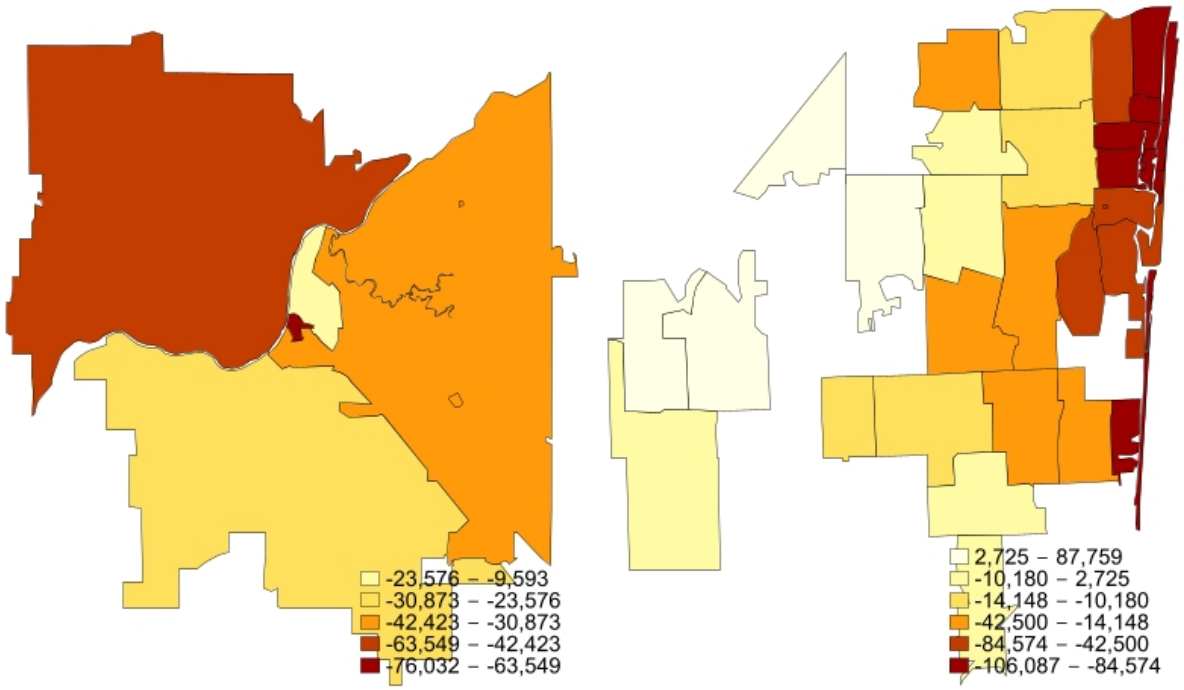


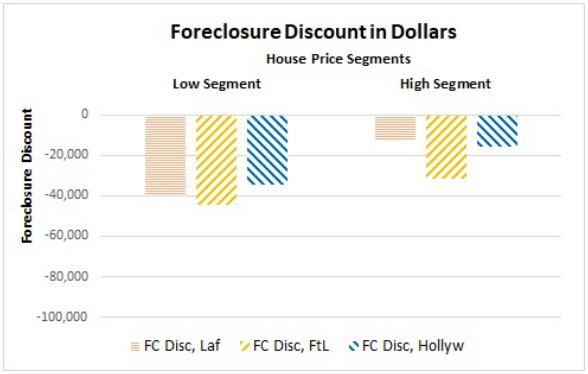
Figure 5: Foreclosure Discounts (in Dollars) over Time
Sources: Multiple Listing Service.



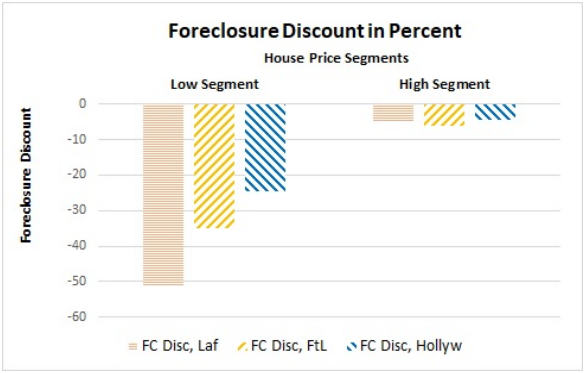
(a) Lafayette

(b) Fort Lauderdale and Hollywood

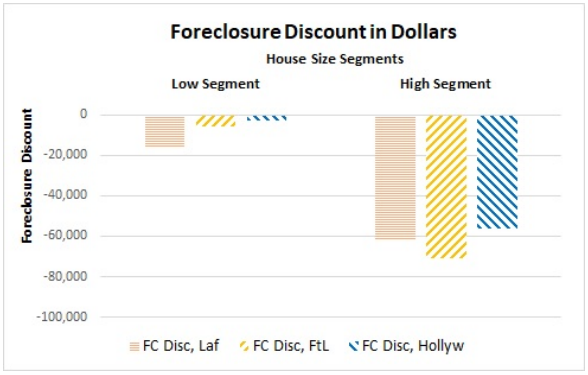
Figure 6: Regional Foreclosure Discounts by CitiesSources: Multiple Listing Service.



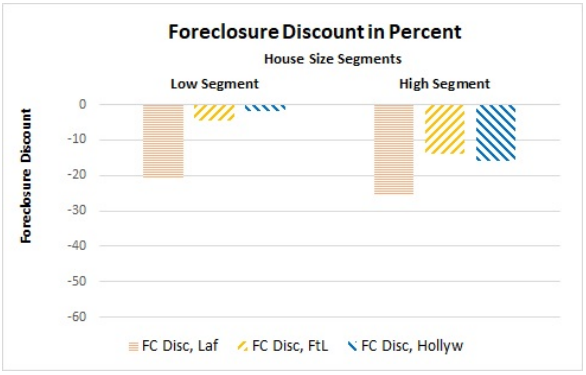
(a) FC Discount in Dollars by Price



(b) FC Discount in Percent by Price



(c) FC Discount in Dollars by Size



(d) FC Discount in Percent by Size

Figure 7: Foreclosure Discounts by Market Segments and Cities
Sources: Multiple Listing Service.