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Honors Thesis

Priced-Out: The Impact of Home Prices on the Age of Homebuyers

Abstract

The collapse of the housing market in 2007-2008 and the ensuing financial crisis resulted in a

large sudden increase in the number of foreclosures in the United States. In response, California

passed the California Foreclosure Prevention Laws (CFPL) beginning in July of 2008, which

made it much more difficult for banks to foreclose on homeowners in California that were

delinquent on their mortgage payments. The neighboring states of Nevada and Arizona did not

pass any similar laws. As a result, home foreclosure rates in California were about half that of

Nevada and Arizona at the peak of the recession, and home prices declined much more sharply

in these latter two states. This difference in foreclosure rates can be interpreted as differing

supply shocks, which can be used to analyze how home prices affect the demographics of

homebuyers in a difference-in-differences analysis. This paper finds that a decline in home prices

has no statistically significant effect on the age of homebuyers.

I.   Introduction

The American economy in the years leading up to the Great Recession was characterized by a large bubble created in the housing market (Coughlin, McCorkell, & Hinkley 2018). Large banks, operating under the belief that the government would always be there to bail them out if they ran into significant financial trouble, issued many "subprime mortgages" to borrowers whom the banks knew were very risky and had a high chance of defaulting on these loans. This created a significant increase in the demand for housing, which in turn fueled a sharp increase in home prices in the years leading up to the recession.

When the recession began in late 2007, many borrowers of these subprime mortgages began to lose their jobs and were unable to make their mortgage payments. As a result, foreclosure rates increased dramatically, and home prices collapsed as this surge of foreclosed homes was suddenly placed on the market. As prices declined, many borrowers discovered that their mortgages were now "underwater", meaning that the value of the mortgage was now greater than the market value of the home itself. Mortgages that are underwater are unable to be refinanced, meaning that many mortgage borrowers during the recession who could not make their monthly payments were unable to negotiate more favorable payment plans and were forced to foreclose, creating a spiraling effect that worsened the crisis.
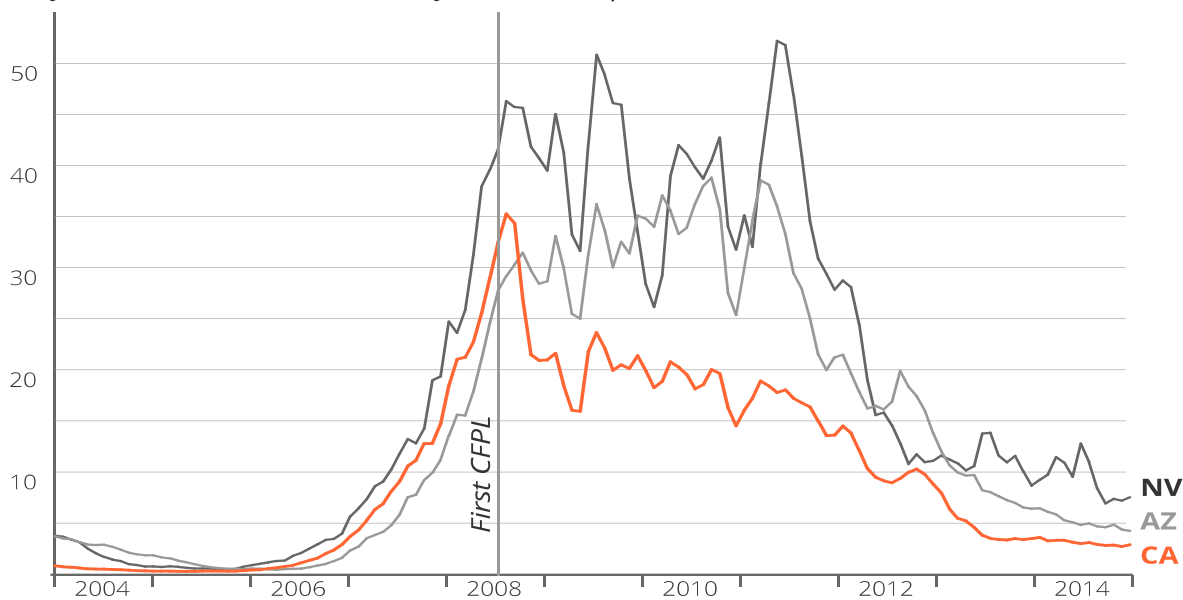
In response, California lawmakers passed Senate Bill 1137 on July 8th, 2008 (Yates & Young 2008). This law attempted to lower foreclosure rates by greatly increasing the burdens a bank must overcome in order to foreclose on a home and by providing homeowners with assistance to avoid foreclosure. Specifically, the law required mortgage lenders to contact borrowers at least 30 days via phone or in-person before filing a "default notice", which formally

begins the foreclosure process. The law also gave borrowers the right to schedule a meeting with the lender where the borrower's financial situation would be assessed and options to avoid foreclosure would be explored. Finally, the law required lenders to perform maintenance on foreclosed properties or face fines of up to $1000 a day. This law was expanded upon on February 20th, 2009 when Governor Schwarzenegger signed the California Foreclosure Prevention Act, which increased the time between the filing the default notice and foreclosure from three months to six months (California Department of Real Estate). The law also provided lenders with many incentives to modify existing mortgages rather than pursue foreclosure.

The impact of these California Foreclosure Prevention Laws (CFPLs) was a dramatic reduction in California's foreclosure rate. Gabriel et al. (2017) compared California's housing market to those in neighboring Arizona and Nevada in the years before, during, and after the recession and found that the laws immediately reduced California's foreclosure rate compared to these other states, as shown in the graph below:

# Foreclosure Rates in Other States

California, Arizona and Nevada foreclosures per 10,000 homes

Source: Rosie Cima, UCLA Anderson School of Management

The same study also constructed a synthetic control group, composed of a weighted average of several other states, to estimate the exact impact of the CFPLs. Through this method, it was estimated that the laws prevented over 124,000 foreclosures statewide.

Foreclosure Rate without CFPLS

California foreclosures per 10,000 homes, historical and modeled

CA

CA without CFPLs (model)

First CFPL

40

30

20

10

2004   2006   2008   2010   2012   2014
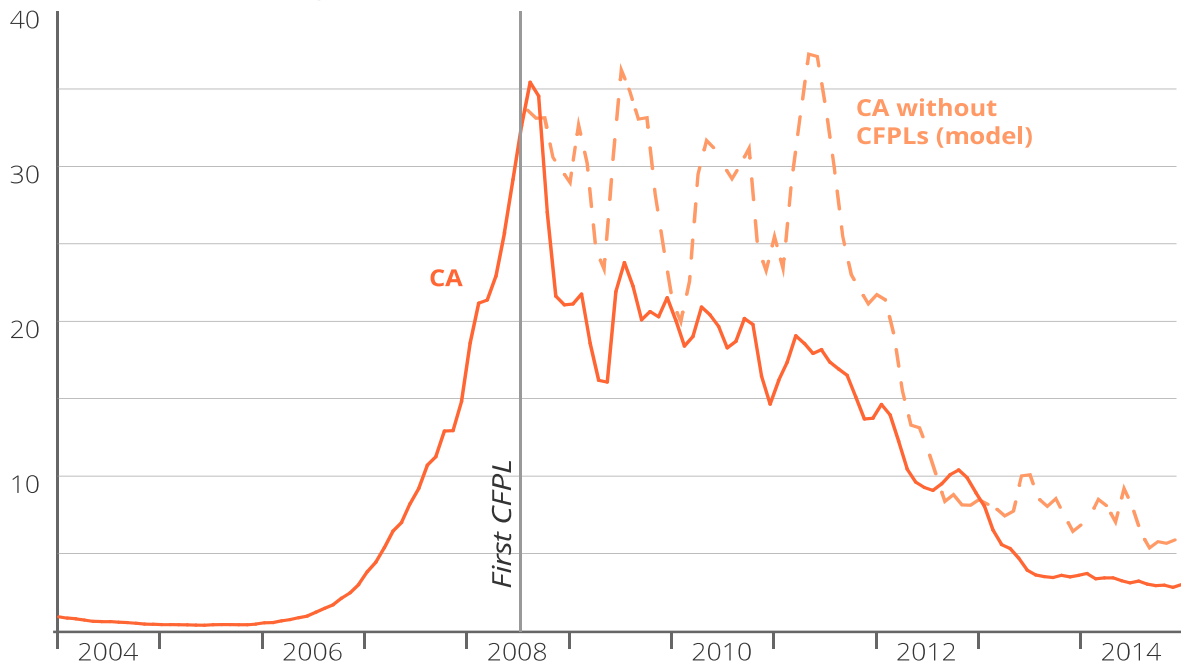
Source: Gabriel et al. (2017), A Crisis of Missed Opportunities?   Illustration by Rosie Cima

Source: Rosie Cima, UCLA Anderson School of Management

Because of these laws, home prices declined much more sharply in Nevada and Arizona than in California. Gabriel et al. (2017) estimates that these laws raised home prices in California by 6.2 percent compared to what they otherwise would have been. Median home value per square foot peaked in all three states in July of 2006 and reached a trough in December of 2011 ("Home Values", *Zillow*). This represented a 61.2% decline in home values in Nevada and a 53.8% decline in Arizona, but only a 43.2% decline in California.

These differences in foreclosure rates and home prices between California and its neighboring states of Nevada and Arizona offer a unique opportunity to examine the impact home prices have on the demographics of homebuyers.

The relationship between homebuyers and home prices has become an area of great policy concern. Many cities and regions believe that rising home prices have priced out many low-income workers and have resulted in acute labor shortages. For example, the San Francisco Municipal Transportation Agency has faced a shortage of bus drivers for the past several years, and the lack of affordable housing in the Bay Area has been cited as a primary factor for why the agency has struggled to find low-income workers to fill these positions (Swan 2018). Other jurisdictions believe that rising home prices have affected demographics in other ways. For example, the City of Thousand Oaks in Southern California currently faces a rapidly aging population; during the author's summer internship at the city, it was learned that many of the city's leaders believe the cause is that young people and younger families are no longer able to afford to live in the city and, partly for this reason, the city has approved the development of many new low-cost residential units (Harris 2018).

This paper studies the effects home prices have on the age of homebuyers. The hypothesis this paper proposes is that the median age of homebuyers is correlated to the median price of homes, meaning that a decline in home prices should lead to younger homebuyers. This is because younger people are usually not as wealthy as they will be later in their lives and are thus possibly more price sensitive when it comes to buying a home. Several "difference-in-differences" analyses are used by comparing bordering counties in California to those in Arizona and Nevada before, during, and after the Great Recession and the collapse of the housing market, in addition to comparing statewide data. Because these bordering counties are economically and demographically very similar and because foreclosure rates were much higher in Arizona and Nevada than in California due to the presence of California's CFPLs, the Nevadan and Arizonian counties act as a good control group when examining how a decline in home prices affects the

age of homebuyers. Data on home prices was collected from the real estate company Zillow, and demographic data was collected from the American Community Survey which is conducted by the U.S. Census Bureau.

The results of this paper suggest that there is no statistically significant relationship between median home prices and the age of homebuyers.

The rest of this paper begins by reviewing the existing literature related to this paper's topic and discusses how this paper contributes to the existing body of knowledge. Section 3 discusses the data used and how it was assembled. Section 4 describes the empirical framework that is to be used in producing this paper's results. Section 5 presents the results. Section 6 concludes and offers suggestions for future research.

II.   Literature Review

Much of the empirical framework of this paper takes inspiration from the famous study published by David Card and Alan Krueger that analyzed the impact of raising the minimum wage on low wage employment levels (Card & Krueger 1994). Both papers utilize a change in state law to study how two economic variables are related by looking at how conditions change across state borders. In Card and Krueger's case, the states were New Jersey and Pennsylvania, and the law was a sudden increase in the minimum wage in New Jersey. Card and Krueger popularized the "difference-in-differences" econometric technique that this paper relies on.

Stuart Gabriel, Matteo Iacoviello, and Chandler Lutz's research on the impact of California's CFPLs provides much of the theoretical backing that makes this paper possible (Gabriel et al., 2017). The researchers establish that the CFPLs had a strong influence on reducing foreclosure rates in California during the Great Recession and raised home prices by

6.2 percent. This meant that California's home prices were artificially higher compared to its surrounding states that lacked similar laws, which makes it possible to analyze what the demographic impacts would be if home prices were suddenly raised and all other factors remained the same.

There exists an extensive amount of research attempting to determine and to quantify the many factors that influence a property's price, but there is little research that attempts to explain how these prices affect other variables. For example, one study by Berkeley Professor Lucas Davis demonstrated how negative shocks to a property's surrounding environment, specifically the sudden presence of a large cancer cluster, can have a long-lasting negative impact on a property's price (Davis 2004). This literature helps to show that home values are not stagnant and that they respond to shocks in supply or demand.

One study by Professors John Hill and D'Ann Peterson examines how demographic shifts might impact the demand and thus prices of different housing units (Hill & Peterson 1994). For example, the paper predicts that, because the proportion of Americans in their twenties is expected to decline and the proportion of older Americans is expected to rise in coming decades, the demand and prices for homes suitable for younger people (such as smaller "starter homes") will decline while the demand and prices for homes more suitable for larger, older families will increase. In essence, Hill and Peterson's paper attempts to do the opposite of what this paper is attempting to do; Hill and Peterson attempted to show how demographics affect a home's price, while this paper will attempt to show how a home's price affects demographics.

This paper will attempt to fill a gap in the existing body of knowledge by establishing whether it is possible for the median home price in a geographical area to impact the

demographics of the people living there, particularly with regards to age. By doing so, the paper might lend support to future papers that seek to understand this relationship further or that investigate how home prices impact other variables.

III.   Data

The data used in this paper is derived from two sources.

The first source is the online real estate company Zillow. Zillow operates an online database that allows users to advertise their homes for sale as well as look at the prices of other homes and other housing market related information. Zillow also publishes an extensive array of historical data and market forecasts they collect and make that is freely available on their website for the public to use ("What is Zillow", *Zillow*).

 This paper collected information from Zillow concerning the median home value per square foot in a geographical area. These datasets divide the value of home by its square footage and then takes the median of all the modified home values in the geographical area. This paper chose to use median home values because this avoids problems created by potential outliers, creating a more accurate representation of what a "typical" home in an area would cost. This paper also decided to compare home values per square footage because this creates a baseline that makes comparisons across geographical locations easier. If home values alone were used, it could potentially be the case that home values in one area would appear to be higher than in another area, but in reality that first area simply has larger homes or more homes designed for larger families. Dividing home values by square footage allows this paper to avoid many complications that arise because not all homes are similarly sized and thus allows this paper to better compare the intrinsic value of homes in one area to another.

In this paper, the data collected on home values is primarily used to make the argument that home values in California trended similarly to its neighboring states before the passage of the CFPLs, and afterwards home values diverge. This sudden difference in home prices allows California to act as a "treatment" group in conducting a difference-in-differences regression. A table of the home value data used in the paper is produced below:

Median home price($) per square foot				
Year	California	Nevada	Arizona	San Bernardino County, CA	Clark County, NV
2005	304	169	115	198	167
2006	341	187	158	239	184
2007	336	186	159	246	184
2008	295	159	142	209	157
2009	237	116	113	143	112
2010	216	88	94	120	83
2011	208	81	85	118	76
2012	195	73	80	110	69
2013	214	83	94	122	79
2014	256	104	107	151	100
2015	275	113	111	167	109
2016	297	122	120	181	116
2017	319	132	128	197	125

The second primary source this paper uses is the American Community Survey (ACS), which is produced by the American Census Bureau. The ACS is a survey sent out annually to 3.5 million Americans and asks a broad array of demographic questions, such as the respondent's age, family size, gender, income, and ethnicity, among other questions ("American Community Survey (ACS)", U.S. Census). Of particular interest to this paper is the information the ACS provides concerning the age of homeowners. This paper was unable to find reliable data concerning the age of people who bought a house in the past year, particularly at the county level. However, the ACS provides data concerning the proportion of homeowners who fall into certain age categories, such as below the age of 35. This will act as a good proxy for

homebuyers; if the proportion of homeowners below the age of 35 in a geographical area increases, it can be inferred that more homes are being bought by young people.

The advantage of using this data source is that it is provided by a well-trusted governmental organization, meaning that the data is unlikely to be intentionally biased. The organization is also very transparent about how the data is collected, and it provides an enormous wealth of information on communities both large and small, some of which private organizations may not find profitable to examine. The disadvantage is that it is ultimately a survey where people voluntarily provide information, so there is a chance of self-selection bias and it is not an actual tally of what the situation truly is. However, it can be assumed that people are unlikely to lie about their age on an anonymous governmental form, and the fact that over 3 million people fill out the survey every year shows that self-selection biases are likely small.

A table of the information gathered from the ACS is produced below:

| Year | % of homeowners less than 35 years old | | | | |
	California	Nevada	Arizona	San Bernardino, CA	Clark, NV
2005	11.3	15.2	14.7	14.7	16.5
2006	10.7	14.4	14.4	15.1	16.2
2007	10.2	14.1	13.2	14.5	15.6
2008	9.3	12.9	12.5	13.3	14.3
2009	8.8	12.6	12.1	11.2	13.5
2010	8.7	12.1	11.5	10.7	13
2011	8.3	11.1	10.4	10.8	12
2012	7.9	10.7	10.2	10.3	11.5
2013	8.1	11	10.1	10	11.6
2014	8	10.2	9.7	10	10.4
2015	7.9	10.3	9.5	9.6	10.7
2016	7.7	10.7	9.4	10	11.2
2017	7.8	10.9	9.9	10.4	11.2

Additionally, the above demographic data is also collected for the 24 bordering counties in California, Arizona, and Nevada. The following is a summary of that dataset:

Variable	Obs	Mean	Std. Dev.	Min	Max
average_Ag~c	249	7.960241	1.767155	6.734783	12.54

IV.   Empirical Framework

This paper uses a difference-in-differences regression in order to determine whether lowering home prices decreases the age of homebuyers.

A difference-in-differences analysis begins by identifying two groups that are trending similarly in regards to a particular area of interest. In this paper, the two groups are California and its neighboring states of Arizona and Nevada, and the area of interest is the percentage of homeowners under the age of 35. Then, one group receives a treatment while the other group does not; these groups are referred to as the treatment and control groups, respectively. In this paper, Nevada and Arizona are the control groups and California, which passed the CFPLs and thus had a substantially lower foreclosure rate, is the treatment group. It is assumed that the treatment group would have continued to trend similarly to the control group had it not been for the treatment. It is then compared how the two groups have changed before and after the treatment. Finally, the changes experienced by the control group are then subtracted from the changes experienced by the treatment group, since the treatment group would have experienced these changes had it not been for the treatment. Ideally, what is then left is the effect of the treatment.

The advantage of using a difference-in-differences regression is that it controls for changes that impact the variable of interest but aren't related to the treatment. For example, it was likely true in this time period that it became more difficult for young people to be approved for home loans, which would negatively impact their ability to buy a house. However, this would

be true in both California and the neighboring states of Nevada and Arizona, so the regression

controls for it and it is factored out of the final result.

This paper will analyze this difference-in-differences through the following regression:

$$Y_{it} = \beta_0 + \beta_1 * Post\_2008 + \beta_2 * Cali + \beta_3 * (Post\_2008XCali)$$

In this regression, Y_{it} represents the percentage of homeowners who are under the age of 35 in a

particular year and geographic area, Post_2008 is a "dummy variable" only equal to 1 if the year

is past 2008 (when the first CFPL was passed) and is otherwise equal to 0, Cali is a dummy

variable equal to 1 if the state is California, and Post_2008XCali is an interaction term that

multiplies the variables Post_2008 and Cali. It is equal to 1 when both the year is past 2008 and

the state is California.

The coefficients β_0, β_1, β_2, and β_3 are the coeffects to be estimated in this regression. The

coefficient β_0 is a constant and represents the percentage of homeowners that are under the age of

35 on average if the state is not California and the year is not past 2008. The coefficient β_1

represents how many additional homeowners are under the age of 35 if the year is past 2008. The

coefficient β_2 represents how many additional homeowners are under the age of 35 if the state is

California. The coefficient β_3 represents how many additional homeowners are under the age of

35 if both the year is past 2008 and the state is California.

The coefficient on the interaction term, β_3, is the coefficient of interest in this paper.

Since β_3 measures the effect of both being inside the state of California and the year being past

2008, this coefficient captures the impact of the CFPLs and thus lower home prices on the age

distribution of homeowners. In order for the hypothesis that lower home prices results in a lower

age of homebuyers to be true, the coefficient β_3 should be negative and statistically significant.

This is because California's CFPLs artificially raised home prices in California by preventing foreclosures. Thus, all else being equal, if a geographical area is in the state of California after 2008 when the CFPLs have taken effect then the proportion of homeowners below the age of 35 should be lower because home prices are relatively higher.

This paper attempts to test this hypothesis by examining three different geographical scopes. The first scope is statewide, which looks at total trends across all of California, Arizona, and Nevada. The second scope looks at just two neighboring counties that are similar in size but each in a different state, one in California and the other in Nevada. The third scope examines all the bordering counties in California, Arizona, and Nevada.

These three scopes were chosen because they help provide enough data while also helping control for issues of statistical validity. Doing a statewide analysis provides the most data to work with, but it could also be affected by issues that are unique to the mega-regions of Los Angeles and the Bay Area, regions which because of their size and economic prominence may have a special relationship between home prices and homebuyers that is not normally found in other regions. Comparing counties across state lines helps control for economic and other compounding factors because counties that are closer together are more likely to be similar overall. Using these three different scopes also acts as a "robustness" check by allowing us to perform the same regression with three difference sets of data. If all three produce the same result, then the result is likely valid and not due to an error with the particular dataset, since it is unlikely all three datasets would have the same error or bias.

V.   Results

a. Statewide Analysis

This analysis begins by examining statewide data for California and its neighboring states of Arizona and Nevada. The following chart depicts median home prices per square foot for all three states over time:
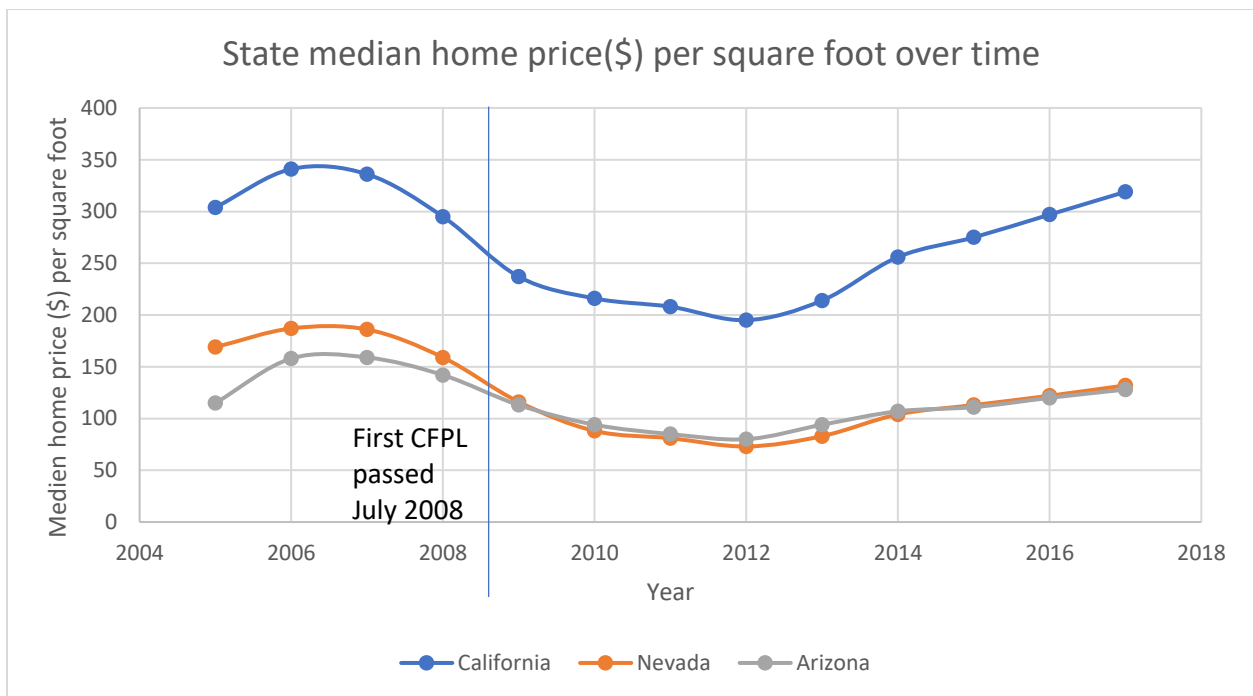
The above chart supports the notion that the CFPLs helped stop the decline of home prices in California and supported their eventual recovery. Before the CFPLs were passed beginning in July of 2008, Californian home prices trended very similarly to home prices in Nevada and Arizona. All three states had home prices that peaked in late 2006 and then sharply declined. While all states eventually stopped the decline in prices at about 2012, Californian prices began to recover at a much faster rate beginning in 2013. It's important to also note that the Californian prices were always much higher than the other two states, meaning that the drop

in prices from 2009 to 2012, while similar in absolute terms for both states, was a much bigger relative drop for Arizona and Nevada than it was for California.

The following chart depicts how the percentage of homeowners under the age of 35 has changed over time for all 3 states:
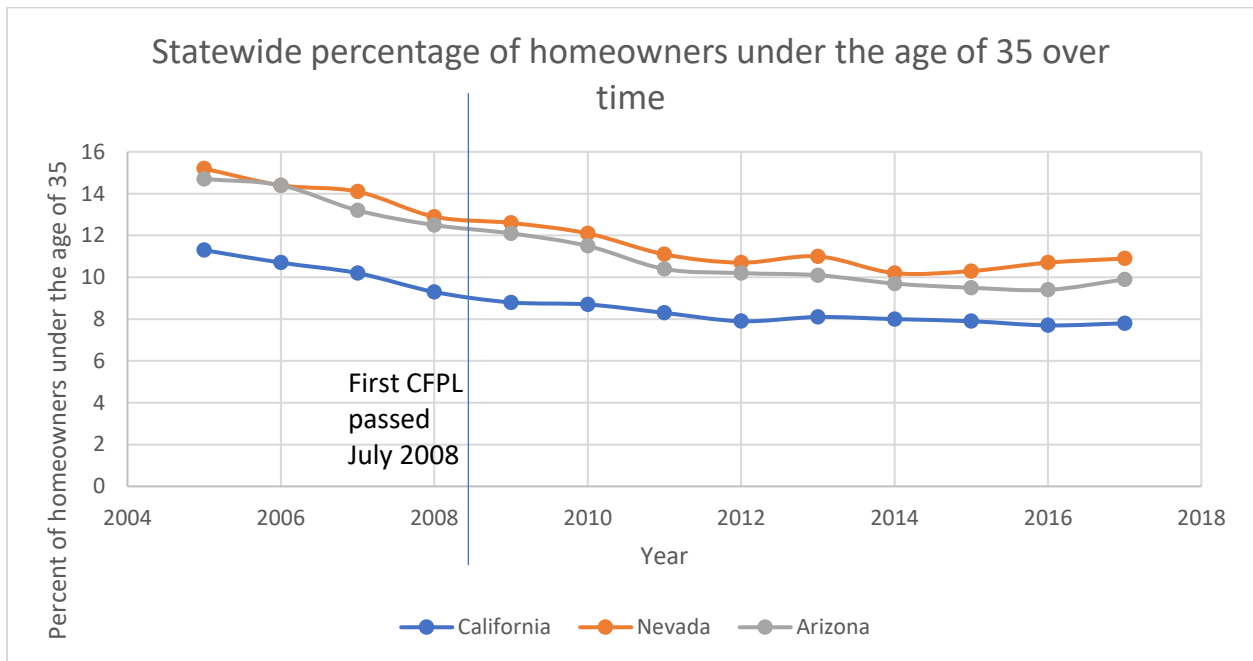
The above chart shows that all three states trended similarly before the first CFPL was passed, helping demonstrate that a difference-in-differences analysis is possible. After 2008, California's figure began to level off while Nevada's and Arizona's continued a more rapid decline all the way through 2016. If this paper's hypothesis that lower home prices leads to younger homebuyers is correct, we would expect the opposite to have occurred. Because Nevada and Arizona lacked laws like the CFPLs, their home prices declined more rapidly and stayed lower for longer than California's. Thus, the percentage of homebuyers under 35 should have at least declined more slowly in these two states than in California, but this was not the case.

Table 1 shows the results of regressing the percent of homeowners under the age of 35 onto the variables Cali, Post_2008, and Post_2008XCali:

Table 1: Statewide Regression

VARIABLES	(1) Percent of Homeowners Under 35
Cali	-3.550***
	(0.507)
Post_2008	-3.236***
	(0.352)
Post_2008XCali	0.994
	(0.610)
Constant	13.93***
	(0.293)
Observations	39
R-squared	0.856

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The coefficient of 0.994 on Post_2008XCali suggests that, on average, being in California after 2008 increased the percentage of homeowners under the age of 35 by almost one additional percentage point. This goes against this paper's hypothesis, as we would expect this coefficient's value to be negative as California's home prices were relatively higher than Nevada's and Arizona's post 2008. This coefficient is also not statistically significant even at the 10% level.

b. Two County Comparison

This paper will now analyze the neighboring counties of San Bernardino County, California and Clark County, Nevada. Both counties have a population approximating 2.2 million and, because they neighbor each other, they likely have similar economies, eliminating much of the risk of compounding factors and making a comparison between the two more valid (American Community Survey).
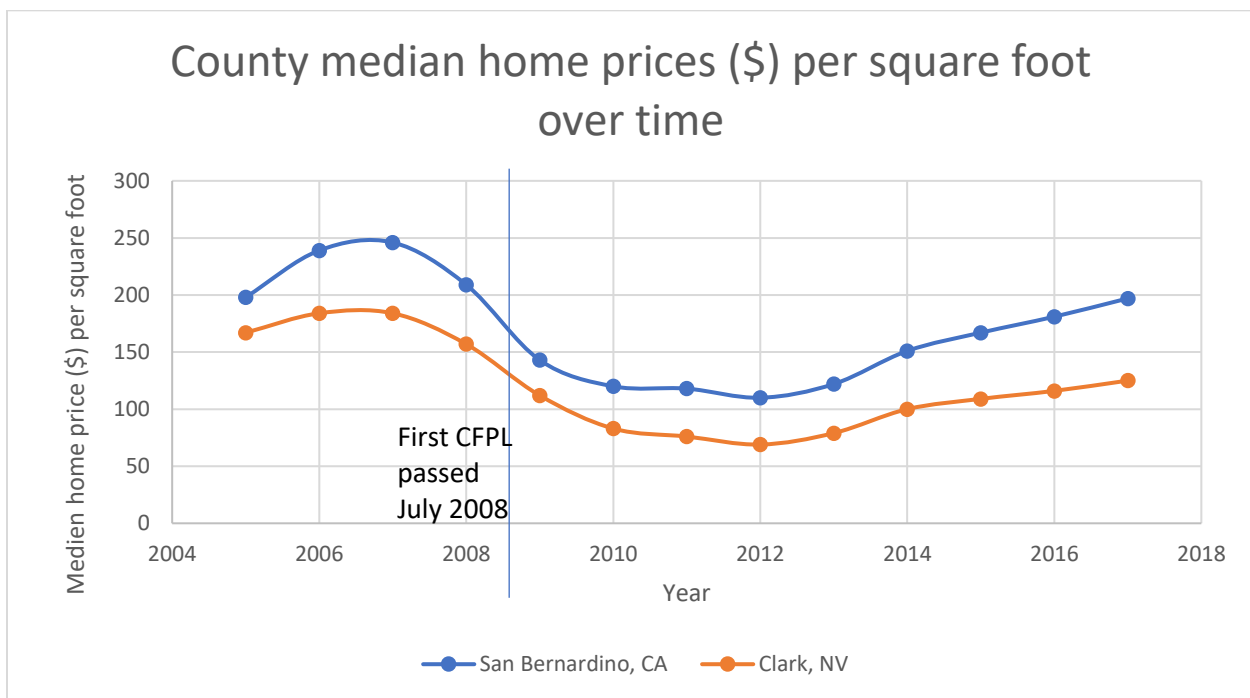
The above chart depicts median home prices per square foot in the two counties over time. Again, the chart depicts both counties trending similarly before and immediately after the crash. Home prices in both counties leveled off beginning in 2010, and then San Bernardino's prices rose more rapidly than Clark's beginning in 2014.

County percentage of homeowners under the age of 35 over time
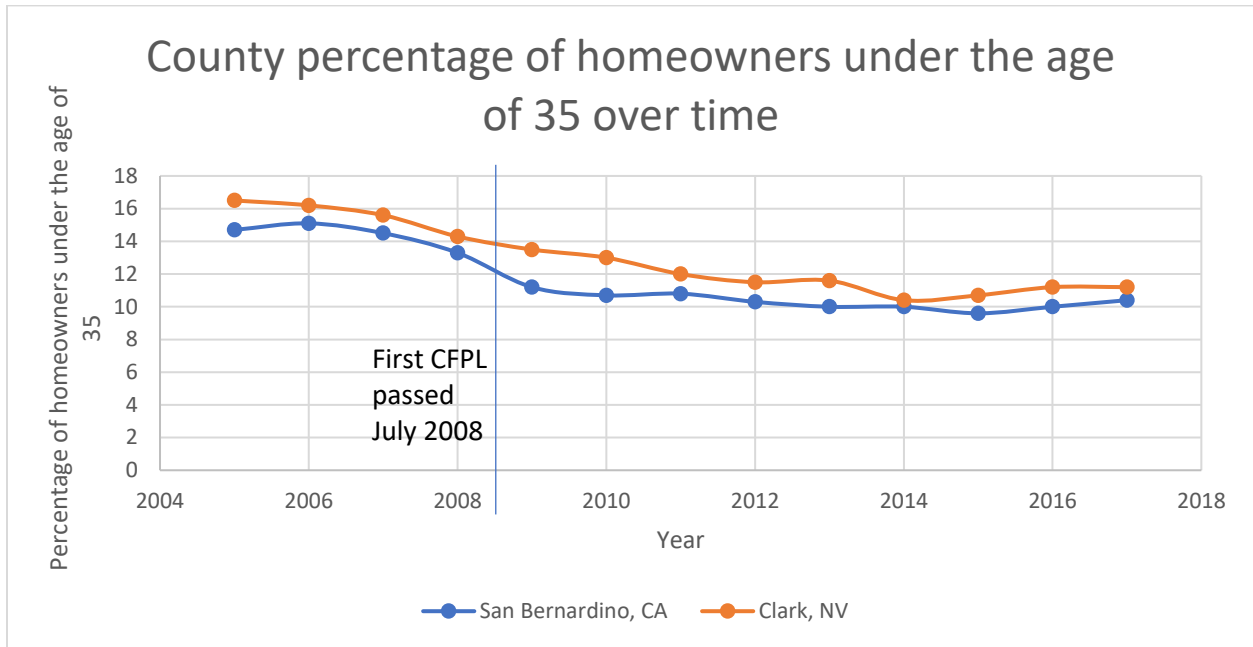
The above chart shows the percentage of homeowners under the age of 35 in each county. Similar to the statewide data, both counties trended similarly before 2008, but the Californian county leveled off soon after while the Nevadan county continued to decline for several more years. Beginning in 2014, when both counties' home prices were rising but San Bernardino's prices started rising at a faster rate, both counties also see an almost identical upward trend in the percent of homeowners under the age of 35. This is again the contrary to what we would expect to see. Clark's percentage should have been the one to level off first because Nevada saw a deeper relative decline in home prices, and San Bernardino's percentage should have rose faster beginning in 2014 because that county's home prices rose faster.

Table 2 depicts the same regression as in Table 1 but using data from just the two counties:

Table 2: Two County Regression

VARIABLES	(1) Percent of Homeowners Under 35
Cali	-1.250**
	(0.582)
Post_2008	-3.972***
	(0.494)
Post_2008XCali	-0.0944
	(0.699)
Constant	15.65***
	(0.411)
Observations	26
R-squared	0.871

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

This time the coefficient on the interaction term is negative, which suggests that a decline in home prices is correlated with a rise in younger homeowners. However, the value of -0.0944 suggests that the impact of California's CFPL on the percent of homeowners under the age of 35 was less than a tenth of a percent, and this value is also highly statistically insignificant.

c. Twenty-Three County Comparison

The final level of analysis this paper undertakes is comparing all bordering counties in California, Nevada, and Arizona, meaning that data is used from all counties in California that touch Arizona or Nevada and all counties in Nevada and Arizona that touch California. In total, this sums to 23 different counties. This dataset compares geographically close and thus likely economically similar counties while at the same time avoiding the regions of Los Angeles and the Bay Area, areas that could potentially be interfering with the analysis.

Table 3 presents the regression results when this data is inputted into the same regression as before:

Table 3: Bordering Counties Regression

VARIABLES	(1) Percent of Homeowners Under 35
Cali	-0.629
	(0.962)
Post_2008	-4.996***
	(0.815)
Post_2008XCali	0.639
	(1.050)
Constant	12.17***
	(0.757)
Observations	249
R-squared	0.249

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The above regression once again has a positive coefficient for the interaction term of Post_2008XCali, suggesting that higher home prices leads to younger homeowners. More importantly, the standard error for this coefficient is 1.05 compared to its value of 0.639, indicating an extremely high level of statistical insignificance far beyond even the 10% level.

VI.   Conclusion

This paper analyzed the collapse of the housing market in 2007-2008 and California's Foreclosure Protection Laws to determine if declining home prices had a noticeable impact on the age of people buying homes. It was hypothesized that younger adults, because they are typically less advanced in their careers and thus have less disposable income, are more price sensitive than older adults in regards to housing, and thus a decline in home values would result in an increase in the proportion of young people owning homes in a given area.

This paper ran three difference-in-differences regressions analyzing three different geographical subsets of California and its neighboring states, and all three of these regressions produced results that were highly statistically insignificant, suggesting that there is no relationship between a home's price and the age of a person buying the home.

One theory for why this is the case is that most people take out a mortgage to buy a home. These mortgages typically last decades, over which time one's income is likely to change significantly. Thus, homebuyers might not take their current income (and thus, by extension, their age) into much consideration when choosing to buy a house.

Future research on this topic might benefit from looking at the age of homebuyers directly, rather than using the proportion of homeowners of a certain age as a proxy. This paper

was unable to find reliable data on the demographics of homebuyers for the time and setting that was being analyzed, especially at the county level. Using proportions of homeowners as a proxy assumes that certain age groups in particular are not migrating out of the geographical areas studied, and it also assumes that the number of people aging into a certain age range equals the number of people aging out of it over the time period being studied. These are reasonable assumptions to make, especially for the bordering counties that are likely economically and demographically very similar, but analyzing the age of homebuyers directly would avoid the need to make such assumptions.

Future research might also want to take advantage of California's response to the housing market collapse to analyze the impact home prices have on other variables. For example, this paper did not analyze how home prices affect the size of a homebuyer's family, the homebuyer's income, or whether an increase in foreclosures has wider macroeconomic effects throughout the local economy. The context presented in this paper offers a great opportunity for research on these and other topics.

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