Beyond the Bricks: Investigating the Link between House Prices and Bankruptcy Rates in the US between 2000-2020

Adrian Seewald

Dissertation written under the supervision of Professor Geraldo Manuel Alves Cerqueiro

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Thesis by Adrian Seewald

Abstract

This study empirically analyzes the effect of house price changes on bankruptcy filings in the United States from 2000 to 2020. The main type of empirical analysis in this paper is done using a panel regression analysis with fixed effects and control variables on both a county and metropolitan statistical area (MSA) level data.

On a county level, house price increases are negatively associated with bankruptcy filings. However, this result is subject to endogeneity concerns. To combat this issue of endogeneity, the main part of paper uses data at an MSA level. An exogenous measure of local house price indexes was created using a combination of long-term average federal mortgage rates, and a local elasticity of buildable land supply following the workings of Chaney et e. When examining the data on an MSA level, this paper finds that the non-instrumented relationship between house prices and bankruptcy filings is similar to that of the county level, a negative correlation. However, when looking at the results of the exogenous measure, they are reversed: as house prices increase, bankruptcy rates also increase.

Overall, this study provides valuable insights into the complex relationship between housing prices and bankruptcy rates using real and predicted data and shows that the relationship is not as simple as previously thought.

Keywords: Financial Distress, Bankruptcy Proceedings, House Prices

Para além dos tijolos: Investigando a Ligação entre os Preços das Casas e as Taxas de Falência nos EUA entre 2000-2020

Tese de Adrian Seewald

Abstrato

Este estudo analisa empiricamente o efeito das alterações dos preços das casas nos pedidos de falência nos Estados Unidos de 2000 a 2020. O principal tipo de análise empírica neste estudo é feita utilizando uma análise de regressão de painel com efeitos fixos e variáveis de controlo tanto a nível de dados estatísticos de um condado como a nível de área metropolitana (MSA).

A nível de condado, os aumentos dos preços das casas estão negativamente associados aos pedidos de falência. Contudo, este resultado está sujeito a preocupações de endogeneidade. Para combater esta questão de endogeneidade, a parte principal do papel utiliza dados a nível de MSA. Foi criada uma medida exógena dos índices de preços locais de casas, utilizando uma combinação de taxas de hipotecas federais médias a longo prazo, e uma elasticidade local do fornecimento de terrenos para construção, seguindo o funcionamento de Chaney et e. Ao examinar os dados a nível de MSA, este documento conclui que a relação não intrumental entre os preços de casas e os pedidos de falência é semelhante à do nível do condado, uma correlação negativa. No entanto, ao olhar para os resultados da medida exógena, estes são invertidos: à medida que os preços das casas aumentam, as taxas de falência também aumentam.

Globalmente, este estudo fornece valiosos conhecimentos sobre a complexa relação entre os preços das casas e as taxas de falência, utilizando dados reais e previstos, e mostra que a relação não é tão simples como se pensava anteriormente.

Palavras-chave: Desespero financeiro, Processos de falência, Preços das casas

Introduction

How house prices affect bankruptcy filings is an empirical question. On the one hand, an increase in house prices improves the financial health of homeowners. On the other hand, rising house prices make it more difficult for individuals looking to purchase a home. Also, expensive property prices lead to higher rents, constraining the geographic mobility.
Both the residential housing market, as well as causes for bankruptcy filings have individually been subject to much economic and financial analysis for a long period of time. Especially in today's macroeconomic environment, individuals, firms, policymakers and governments are keeping a close eye on the development of house prices on a local and national level.

According to a mortgage originations report from Statista, the amount of mortgage originations in the US has increased significantly in the last 20 years. From 238 billion USD in Q1 of 2000, to over 1,357 billion USD in Q4 2020. This growth in origination volume reflects a major overall expansion of the mortgage market in the United States over the last 20 years. As another comparison to see how house prices have affected the US-wide financial markets, a look at the volume of mortgage-backed securities outstanding can be of use. The volume of mortgaged-backed securities (MBS) outstanding in the United States has grown significantly in recent years. In 2000, the value of MBS was approximately 4 trillion USD, but by 2020, it had grown to approximately 11 trillion USD. This growth in MBS volume reflects an overall expansion of the mortgage market in the United States.

The mortgage market, including mortgage-backed securities, play a crucial role in the US economy as it allows individuals to finance the purchase of a home, which is often the most significant investment they will make in their lifetime. A well-functioning mortgage market enables households to purchase homes, and in turn, creates demand for housing, which can drive economic growth. Furthermore, The MBS market plays a huge role in the stability of the US economy. The Federal Reserve can influence interest rates by buying or selling MBS, which can impact the overall level of interest rates and influence economic activity. Lower interest rates can encourage borrowing and spending, which can boost economic growth, while higher interest rates can have the opposite effect.

Furthermore, the government-sponsored enterprises Fannie Mae and Freddie Mac, which were created to ensure liquidity in the mortgage market, have played a critical role in the development of the MBS market by buying mortgages from banks and packaging them into securities that are then sold to investors. This provides a way for banks to free up capital that can be used to make more mortgages, which helps to keep the market functioning smoothly.

As the 2008 sub-prime mortgage crisis has shown mismanagement in the mortgage market can have devastating consequences on individuals and businesses on a country wide level. Owning a house is still considered the American dream and as Laurie Goodmann and Christopher Mayer have shown in their paper *Homeownership and the American dream*, the internal rate of return to homeownership since 2002 is favorable compared to other alternative investments, despite the housing market taking its largest hit during this time period since the great depression in 1929 (Goodmann & Mayer, 2018).

The housing and mortgage market is a constantly changing phenomenon that is relentlessly under observation, be it from a governmental level all the way down to an individual level. In a sense, it can be said that the housing market is different to a standardized model of a liquid asset with exogenous fundamentals. This means that other factors, not only simple demand and supply factors, but rather diverse exogenous measures influence house prices nationally (John Cambell et al., 2011). The list of exogenous measures is long, with a select few having a large impact on house prices.

On the other side of the equation, the ever-changing and dynamic macroeconomic landscape however makes it difficult to find a clear-cut answer as to why individuals and businesses file for bankruptcy. In a nutshell, it can be said that filing for bankruptcy is a financial decision for firms and individuals that should not be taken lightly, as a bankruptcy filing is a form of financial distress. Before the bankruptcy reform act (BAPCPA) put into place by President Bush in 2005, some researchers showed that households are more likely to file for bankruptcy when their financial benefit from filing for bankruptcy is higher (Scott Fay et al., 2002). This benefit to filers was evidently brought to the attention who signed off on the bankruptcy reform act, making it more difficult for private persons to file for chapter 7 bankruptcy.

In conclusion, it can be said that the ever-changing housing market provides a dynamic landscape for individuals and businesses with respect to filing for bankruptcy, with many

external factors that could possibly play a role. This paper aims to examine they key relationship between changes in house prices on a local level, and the effects of this on bankruptcy filings, and to have a look at the above-mentioned external factors affecting this relationship.

As a main reference point, the empirical workings in the paper of Chaney et al will be used to help understand the relationship and analyze the effects of changing house prices and bankruptcy rates. This paper follows similar quantitative procedures that can be found in the paper of Chaney et al, with different variables used in the calculations, which will be listed later on in the variable description section.

Taking the above-mentioned points into consideration, one can infer the primary objective of this paper. This paper looks at data for various counties and metropolitan statistical areas (MSAs) over a 20-year time period. As the heterogenous model used to calculate a predicted value of house prices on an MSA level, which is used in the main results section is based on the elasticity of buildable land available for 86 geographically diverse MSA's, the results reflect appropriate geographical deviations.

From the previous literature, as well as using the workings of Chaney et al, one can presume a research hypothesis that this paper will try to answer. Taking into consideration the information already mentioned above, one would assume that an increase in house prices leads to less bankruptcy. The reason being, is that more people would start businesses, as they have more equity they can put up as collateral.

On the contrary, if a decrease in house prices occurs, ceteris paribus, there is no reason to file for bankruptcy. If people decide to do so, it is for strategic reasons, with due to the relatively advantageous bankruptcy laws in the US incentivizing households or businesses to do so, as explained in the sections above.

Building up on this, the research question can be presented as: to what extent did changes in house prices affect bankruptcy filings on a local level, between the years 2000 and 2020.

The 20-year period encompassing the data includes various economic timeframes. However, for the purpose of simplification, this paper will not be specifically looking at the effects of

the subprime mortgage crisis and subsequent housing bubble crash of 2008, nor will the differences in bankruptcy filings pre and post BAPCPA be taken into consideration, as there are many previous studies that have been done on the 2008 financial crisis's impact on the housing market, and bankruptcy filings post BAPCPA, respectively.

This study empirically analyzes the effect of house price changes on bankruptcy filings in the United States from 2000 to 2020. The main type of empirical analysis in this paper is done using a panel regression analysis with fixed effects and control variables on both a county and metropolitan statistical area (MSA) level data. The results can be split into two sections, effects on a county level, and effects on an MSA level with added control variables on the MSA side.

Using county level data, this paper find that house price increases are negatively associated with bankruptcy filings. However, this result is subject to endogeneity concerns, since negative economic shocks such as firm failures can lead to steep increases in bankruptcy filings, and in parallel depreciate house values. In order to combat this issue of endogeneity, the main part of paper uses data at an MSA level. More specifically, an exogenous measure of local house price indexes was created using a combination of long-term average federal mortgage rates, and a local elasticity of buildable land supply following the workings of Chaney et al, who used this mechanism to measure real estate shocks on an MSA level. This exogenous equation was compared to raw data available at the MSA level. When examining the raw data on an MSA level, this paper finds that the non-instrumented relationship between house prices and bankruptcy filings is similar to that of the county level, a negative correlation. However, when looking at the results of the exogenous measure, they are reversed: as house prices increase, bankruptcy rates also increase.

Overall, this study provides valuable insights into the complex relationship between housing prices and bankruptcy rates and highlight the importance of considering spatial differences in the analysis of the relationship between housing markets and financial distress. These findings can have further implications for policymakers and stakeholders seeking to understand the drivers of bankruptcy and to develop targeted interventions to mitigate financial distress at the local county, or at a broader MSA level.

Review of Current Literature

The role of Bankruptcy and House prices

Effects of the BAPCPA act

Albanesi & Nosal were able to quantify the effects of the 2005 BAPCPA act, and found that the reform act caused a 50% drop in chapter 7 filings, a 25% rise of insolvency, but no effect on chapter 13 filings (Stefania Albanesi & Jaromir Nosal, 2018). This is important to keep into consideration, as the data used in this paper (2000-2020) passes through periods before (pre-2005) during, and after the BAPCPA act. As a potential avenue of further research, one could test the amount of bankruptcy filings before the BAPCPA act taking place in 2005, and after.

Relationship between filing for bankruptcy and house prices

Carroll & Li were the first researchers to publish a paper regarding the homeownership experience of households in bankruptcy. They measured how often they ended up losing their homes in foreclosure following chapter 13 bankruptcy proceedings. Furthermore, they measure the time between bankruptcy filings and foreclosure sales, as well as the loss rate the lenders occur. They gathered data from a county in Delaware between the years 2001-2002 from the time of their filing to October 2007. They found that roughly 28% of debtors who filed for bankruptcy lost their homes due to foreclosure, despite filing for personal bankruptcy. They also found that compared to debtors who did not file for bankruptcy, the debtors who did file, remained in their houses for an average of 27 additional months. Finally, the found that lenders suffered an average loss rate of 28%. As a conclusion, they found that filing for personal bankruptcy provides the debtors additional breathing room to help reorganize their finances, pay back their overdue mortgages and ultimately, keep their primary residence (Sarah Carroll & Wenli Li, 2011).

White & Li examine the relationship between homeowners' bankruptcy decisions and their mortgage default decisions and the relationship between homeowners' bankruptcy decisions and lenders decisions to foreclose. They argue that on a theoretical level, both the relationships could be substitutionary or complimentary. Their findings indicate that both relationships are complimentary, but as a reaction to the bankruptcy reform act of 2005 homeowners treated the relationships as substitutes. They find that higher neighborhood

bankruptcy rates raise the debtors probability of filing, higher default rates raise the debtors probability of defaulting, and higher foreclosure rates raise the debtors probability of foreclosing on their mortgages (Wenli Li & Michelle White, 2009). The authors also show a previously unnoticed and strong relationship between homeowners' decisions to default on their mortgages and their decisions to file for bankruptcy. They also show that the relationship between bankruptcy and default, as well as foreclosure and bankruptcy is complementary. They find that homeowners tend to file for bankruptcy after they default on their mortgage payments, with most homeowners filing for bankruptcy within a year after defaulting (Wenli Li & Michelle White, 2009). The main result found in the paper shows that defaulting on a mortgage is associated with a statistically significant increase in homeowners' probability of filing for either chapter 7 or 13 bankruptcy.

Furthermore, Kurt Mitman argues that bankruptcy and foreclosure are fundamentally linked by household behavior. BAPCPA reform only changed bankruptcy law, but it has also had a modest effect on foreclosure rates (Kurt Mitman, 2015).

Filing for bankruptcy is a disruptive financial decision which leads to a multitude of both financial and social consequences for the filer (Sumit Agarwal & Changcheng Song, 2015). Filing for bankruptcy may be due to strategic behavior (Scott Fay et al., 2002), due to miscellaneous negative shocks on the ability to repay the mortgage (Ian Domowitz & Robert Sartain, 1999) as well as access to high-interest credit (Diane Ellis, 1998) (Paige Marta Skiba & Jeremy Tobacman, 2010).

House Prices

Before analyzing the effects of changing house prices on bankruptcies, it is important to highlight the key macroeconomic drivers of house prices. the influencing factors of house prices have been subject to many studies over the years. Empirically, Gregory Sutton from the bank of international settlements undertook a study that showed that the three main factors influencing house prices in advanced economies are shocks to national income, stock prices and interest rates. He argues that some of the large gains in house prices in the late 1990's and early 2000's can be explained by positive economic developments captured by the above-mentioned variables (Sutton 2002). Further tests confirm that the three variables are statistically significant.

Another factor for house price increases is the amount of household debt. Lai et. Al analyzed household debt ratios (household debt to GDP) and showed that these household debt ratios were positively and significantly related to housing prices ((Fujun Lai et al., 2017).

Looking more specifically at interest rates, one would assume that the relationship between interest rates and house prices to be a simple one. If the federal funds rate increases, mortgage rates also increase, as interbank borrowing becomes more expensive. In response, banks will increase rates on various loan products to adapt to the higher cost of borrowing (Eagle, 2017). However, there may be some causal effects in this regard. What if the FED includes the value of house prices when setting targets for the federal funds rate? And to what extent do banks adjust their loan products, in this case the mortgage rates in response to changes in the federal funds rate? (Eagle 2017). The author argues that a net equilibrium result is influenced by both the demand and supply elasticity. This is a theme concurrent with that of this paper, and the relationship between demand and supply will be further investigated and taken into consideration in the analysis through the introduction of a heterogenous house price model that will take elasticity of supply and demand-side interest rates into consideration. This will be further investigated in the subsequent sections.

The empirical model in this paper is based on that of the workings of Chaney, Sraer & Thesmar in their paper "The Collateral Channel: How Real Estate Shocks Affect Corporate Investment". In this paper, the authors strive to understand the impact of real estate prices on corporate investment. To compute the sensitivity of investment to collateral value, they use local variations in real estate prices as external "shocks" to the collateral value of real estate owning firms (Chaney, Sraer & Thesmar 2012). The authors find that real estate prices have a significant effect on corporate investment by influencing the value of collateral that firms use to secure their borrowing. The authors state that when real estate prices rise, the affected firms can borrow more against their real estate assets which can lead to more investment spending. On the other hand, when real estate prices fall, affected firms may find it more difficult to secure loans, or may need to provide additional collateral which may lead to a reduction of investment spending. However, the authors state that the impact of real estate shocks on aggregate investment to be nontrivial. This is however not necessarily the case, as when balance sheet shocks are heterogenous. The papers findings are instrumental in trying to delve deeper into real estate shocks, and their effects on a firm's investment. Taking this

methodology into account, this paper will also use a heterogenous model of measurement similar to the workings of Chaney, Sraer & Thesmar. The detailed methodology will be explained in a subsequent section

However, this paper focuses primarily on the macroeconomic estimates of real estate shocks, and according to the workings by Chaney, Sraer & Thesmar, the macroeconomic impact of these shocks remains unclear and demand further research into the topic.

Data & Methodology

Bankruptcy Filings

As this paper is looking at the effects of house prices on bankruptcies, it is important to first define a textbook definition of bankruptcy, and to go more in depth into the types of bankruptcy this paper will be looking at.

Overall, bankruptcy can be categorized as a type of financial distress, where an individual or a corporation has difficulties meeting its debt obligations.

In the US, the bankruptcy code was created so that creditors are treated on a fair basis, and consequently, the value of the assets, in this case real estate, is not unnecessarily ruined (P587, Jonathan Berk & Peter DeMarzo, 2017). For the purpose of this paper, the following types of bankruptcy will be examined: Chapter 7, 11 12 & 13.

Chapter 7 bankruptcy is a form of bankruptcy filing in the US bankruptcy code that is available to individuals (or those in a sole proprietorship) and businesses. In the case of a chapter 7 filing, also called a "liquidation" a trustee is appointed through an auction. Subsequently, the trustee gathers and sells the debtor's nonexempt assets and uses the proceeds of these assets to pay creditors, according to the bankruptcy code (Berk & DeMarzo page 587 & US Courts, 2022). It is important to note that according to the bankruptcy code, some property may be "exempt" from this liquidation process, however this varies on a case-to-case basis. For the purpose of simplicity, in this paper we assume that this exemption of property does not take place.

Chapter 11 bankruptcy, also known as "reorganization," is a common form of bankruptcy filing for large corporations. However, this plan is also available to individuals. With chapter 11, all pending debt collection attempts are suspended with immediate effect, and the business is given the opportunity to propose a plan to reorganize its finances. Whilst doing so, the business is allowed to continue normal operations, including acquiring new sources of debt through secured or unsecured credit lines. The plan that is put in place by the debtor usually dictates the specified treatment of each creditor to the debtor (US Courts, 2022).

Single asset real estate debtors are subject to special provisions of the bankruptcy code. In the interest of time and lack of space, these special provisions will not be further analyzed in this paper (*The Single Asset Real Estate Debtor*, 2022)

Chapter 12 bankruptcy is a special provision in the bankruptcy code that allows for debt adjustment for "family farmers" and/or "family fisherman". An interesting note to chapter 12 bankruptcy proceedings is that filing for chapter 12 bankruptcy eliminates some barriers that debtors would face if they were to file under chapter 11 or chapter 13 of the bankruptcy code. Chapter 12 is more specific, not as complicated and less cost-intensive than the chapter 11 equivalent, which is more adequately suited to larger corporations (US Courts, 2022).

Finally, Chapter 13 bankruptcy, or otherwise known as a "wage earners plan" allows for solely individuals, provided they have proof of regular income, to develop a plan to repay their debts over a period of 3 to a maximum of 5 years. The biggest advantage for filing for chapter 13 bankruptcy, is that unlike the "liquidation" filing of chapter 7, the debtors have the opportunity to save their homes for foreclosure by stopping the foreclosure proceedings for the time being. Furthermore, chapter 13 bankruptcy allows for individuals to reschedule their secured debts (other than their primary residence mortgage).

Filing for bankruptcy in the US & Europe

In the last few years, there has been an observed increase in bankruptcy filings in both the US and Europe. However, there is a vast difference between filing for bankruptcy between the two continents. As explained in previous sections, there are multiple ways for individuals and businesses in the US to file for bankruptcy. In Europe, the process becomes more complicated, as different countries have different bankruptcy filing procedures. Therefore, it is not entirely accurate to compare the bankruptcy filing process in the European Union as a whole, compared to the US.

Nevertheless, there are some key differences between filing for bankruptcy across the two continents. These differences can be summarized in one main sentence: in the US, the bankruptcy filing process aims to provide a fresh start for the filing party. However, in general, European insolvency regulation mainly aims to satisfy the claims of the creditors (Maria Gerhardt, 2009).

To elaborate, it is important to highlight some key differences in the bankruptcy filing process between the two continents.

The first, and perhaps biggest difference when comparing the bankruptcy laws of the two companies is the procedures taken place after the initial filing for bankruptcy. In the US, the procedures are standardized and regulated by federal law. In Europe, this differs on a country-to-country basis. Debt discharge also plays a central role when differentiating between US and EU bankruptcy proceedings. In the US, debt discharge is a central feature of bankruptcy and is intended to provide a fresh start for the debtor. In the EU, the discharge of debt is not as automatic and is often subject to the decision of the court or a government agency. Asset protection is also often taken into consideration when comparing bankruptcy filings between the two continents. In the US, certain assets, such as as persons primary residence may be protected from asset collection, which is not the case in the EU, as it differs from country to country.

A key talking point after the financial crisis of 2008 was that, although creditor's rights to recuperate outstanding loans were severely limited, due to the laws and regulations that helped protect the filing party, it did not stop lenders giving out easy credit. Post financial crisis however, the lending standards from a creditors point of view have tightened considerably (Maria Gerhardt, 2009).

The eligibility of filing for bankruptcy between the two continents is also different. In the US, individuals and businesses can file for bankruptcy under Chapter 7 (liquidation), Chapter 11 (reorganization), and Chapter 13 (individual reorganization). In the EU, the eligibility criteria and types of bankruptcy vary by country, but often only businesses can file for bankruptcy.

In the US, debt discharge is a central feature of bankruptcy and is intended to provide a fresh start for the debtor. In the EU, the discharge of debt is not as automatic and is often subject to the decision of the court or a government agency.

Creditors play a significant role in the bankruptcy process in the US and can object to the discharge of certain debts or the reorganization plan. In the EU, creditors often have less involvement in the process and their rights are more limited.

Furthermore, bankruptcy procedures can differ significantly from country to country in Europe, depending on the legal frameworks in place, and with respect to the current economic and political conditions of each country. In Germany for example, the bankruptcy laws in place are relatively strict, with a focus on debt restructuring and rehabilitation of the debtor, rather than liquidation (*Insolvency/Bankruptcy in Germany*, 2022).

Data Collection

For the purpose of organization, FIPS and MSA codes play a key role in setting up the data needed for further analysis. It is important to note that FIPS county codes are specific codes that uniquely identify geographic areas. A state level FIPS code has 2 digits, whereas a county level has a 5 digit FIPS code, with the first two digits of the FIPS code being the state to which the county belongs to (FCC Gov., 2022). According to the US Office of Management and budget, a Metropolitan Statistical Area is at least one urbanized area with a minimum population of 50,000 inhabitants. The respective MSA code is a 4-digit code for each MSA, preceded with the letter "C". When constructing the County-MSA crosswalk, the FIPS and MSA codes provide a concise way to organize the necessary data. Also, for further statistical calculations in Stata, it is important to categorize the counties and MSA levels accordingly to avoid computational mistakes.

Bankruptcy Data

In order to achieve a sizable dataset to empirically analyze the significance of house prices on bankruptcy filings, it is important to compile accurate data that is publicly available. For this paper, all datasets used are public information, and can be easily accessed online, as both bankruptcy filings and house prices are vital economic indicators for a country. Data regarding Chapter 7,11,12 and 13 filings are publicly available through the respective district area courts. However, a more complete overview of bankruptcy filings on a county, metropolitan statistical area (MSA) and state level is provided by the RAND corporation, which summarizes quarterly filings on a yearly basis (RAND State Statistics, 2022). The filings include those done by persons who reside outside their home state, and outside of the continental US.

For this paper, the main points of interest are total chapter 7,11,12 &13 filings on a county and MSA level, as well as the filing rate per 1000 inhabitants, which is used to control for the size of the respective county or MSA level. The source for population data used to calculate per capita rates is the RAND State Statistics, which are based on US Census data. Per capita rates for the last year are based on one-year prior population data. The per capita rates are not available for US territories (RAND statistics, 2022).

House Price Data

The Housing data in a raw format is also derived from publicly available data. More specifically the federal housing and finance agency (FHFA) is the source of this housing data. The data collected by the FHFA allows for an overview of an all-transactions house price index at a county level including calculations based on 2 base years (1990 &2000). It is important to note, that the FHFA considers this index to be developmental as revisions to the index may reflect the impact of new data or technical adjustments (FHFA 2022). The way the index is calibrated, is by using appraisal values and sales prices for mortgages bought or validated by Fannie Mae & Freddie Mac, which are publicly traded, government sponsored enterprises that provide liquidity and stability to the mortgage market. They provide liquidity to a countless number of banks and mortgage companies that create loans to finance personal housing commitments (FHFA 2022)

Other Data collected

The elasticity values for select MSA's is used as an instrument to create an exogenous predictor of house prices. The values and their calculations of these elasticities are provided by Saiz (2010). In his paper, Albert Saiz processes satellite-generated data on terrain elevation and presence of water bodies to estimate the amount of land left to develop in US metropolitan areas. It is important to note, that the elasticity values are only provided for 86 MSA's across the country, for which the original dataset for both bankruptcy rates and house prices must be adapted. The process behind this will be explained in the subsequent methodology section.

The interest rate, or rather the mortgage rate used later-on in the paper to instrument house prices with elasticity is provided by the federal home loan mortgage corporation, Freddie Mac. The values in the dataset are the 30-year fixed rate mortgage averages in the United States, with the years matching the dataset from 2000-2020.

Methodology

Data Structuring & Consolidation, Summary Statistics

County Level

Taking into consideration the fact that elasticity data is only available to 86 different MSA areas across the US, the first step to undertake is to clean the data to only depict counties and MSA's for which the elasticity was available. In order to facilitate the consolidation of the data, a "county-MSA" crosswalk was created, with the help of the MSA crosswalk available from the national bureau of statistics in order to correspond the FIPS codes on a county level to their matching MSA codes needed in order to complete the analysis from a county level to an MSA level (NBER, 2022).

After this data cleaning and consolidation process, the summary statistics can be depicted in the following tables:

To gather an overview of variables used for further analysis, table 1 depicts the variable name, description, and source.

Table 1- Variable overview

variable name	variable description	source
total filings	Bankruptcy filings on a county level per quarter, the sum of the counties in a certain MSA were then taken to obtain the value on a MSA level	Rand Statistics Bankruptcy Data
hpi	House Price Index on a county level regression. The sum of counties in a certain MSA were then taken to obtain the value on a MSA level	Federal Housing Financing Agency
lag hpi	hpi value from previous year	Own Calculations
ln hpi	natural logarithm for house price index	Own Calculations
annualchange	percentage change over last year HPI	Own Calculations
totafilings1000	bankruptcy filings per 1000 inhabitants	Rand Statistics Bankruptcy Database
elasticity	elasticity of supply for buildable land	Saiz (1996)
avgmortgagerate	Average mortgage rate 30 year	St Louis FED
incomepercapita	income per capita US	Bureau of Labour Statistics
ln incomepercapita	natural logarithm for income per capita	Own Calculations
elasticity of supply MSA level	same as the elasticity values	Saiz (1996)
hpipredicted	house price index predicted using Stata hpi predicted command	Own Calculations
in hpipredicted	natural logarithm for predicted hpi	Own Calculations

Table 2- County level summary statistics

Variables	Obs.	mean	sd	min	max
fipscode	10,983	30,974	14,91	1,007	55,133
totalfilings	10,983	5,57	12,376	0	286,217
annualchange	10,977	3.077	5.806	-45.25	53.47
hpi	10,983	389.1	227.9	98.64	2,117
totalfilingsper1000	10,906	16.46	9.495	0.657	83.50
mortgagerate	10,983	5.092	1.298	3.112	8.053
MSACode	10,983	43.11	24.60	1	86
County	10,983	217.5	123.5	1	428

**The various observational discrepancies in column 1 are due to omitted reporting of the data from either the FHFA dataset, or the RAND dataset. For the purpose of the regressions, omitted observations are automatically excluded through Stata*

Table 2 depicts the summary statistics on the variables used in the county level regressions, with a total number of 523 counties being included over the 20-year time period of the analysis, leading to a total of 10,983 observations.

Leading on to this, the counties and MSA's are depicted over multiple periods of time. Therefore, the appropriate type of analysis to be undertaken is panel data analysis. (Also known as cross-sectional time series data, or longitudal data). With respect to this paper, the entities observed are yearly bankruptcy filings and house price indexes in different counties and MSA's. Panel data allows to control for variables that you cannot observe or measure, as well as variables that change over time but not across entities. For these reasons, panel data accounts for individual heterogeneity (Badi H. Baltagi, 2005).

As stated previously, the main empirical analysis will be done on two levels, the county and MSA level. With the information above, we can now deduce preliminary regression equations on a county level, to get some preliminary results. As an important note, fixed effects regressions assume that the errors of the regression equation are independently and identically distributed, with the assumption of homoscedasitcy. For this reason, the option of robust standard errors in the regression models were assumed. Therefore, heteroscedasticity is not an issue in the results of the regression analysis.

Furthermore, in table 2 above, the natural log (ln) of some values in the summary statistics were calculated. In a panel regression analysis, taking the natural log of variables can be useful for several reasons.

One reason to take the natural log of a variable is to stabilize the variance of the variable over time. If a variable exhibits a trend or exhibits large changes in its variance over time, taking the natural log of the variable can help to stabilize the variance and make the variable more suitable for a regression analysis.

Another reason to take the ln of a variable is to linearize the relationship between the variable and the outcome. In some cases, the relationship between a variable and the outcome may be non-linear. Taking the ln of the variable can help to linearize this relationship and make it more suitable for regression analysis. For the application of this paper, the natural logs do not

play a significant role, however for cross-checking and validating results, they can be of significance.

MSA Level

Table 3- MSA level Summary Statistics

VARIABLES	Obs.	mean	sd	min	max
msacode	1,806	43.50	24.83	1	86
totalfilings	1,806	33,871	42,886	176	361,91
hpi	1,806	2,366	2,599	219.4	21,528
annualchange	1,806	18.70	48.70	-290.8	574.4
totalfilingsper1000	1,806	99.38	122.9	0	1,065
income_per_capita	1,806	42,169	11,099	14,246	120,805
hpipredicted	1,806	2,366	367.6	1,468	3,336
rescaled_income_per_capita	1,806	42.17	11.10	14.25	120.8

Table 3 depicts the summary statistics for the MSA-level data. As stated previously, there are 86 unique MSA's that are used in the dataset, each over a period of 20 years leading to a total number of 1,806 observations.

The variables in tables 1-3 form the basis for the quantitative analysis of the paper.

Main Results

County level regression

Following the information above, we can now deduce a basic, first-stage panel regression equation on a county level with the following properties:

$$Total\ filings\ per\ capita_{i,t} = \alpha_i + \beta HPI_{i,t} + income\ per\ capita_{i,t} + \varepsilon_{i,t} \qquad (1)$$

In equation (1) the dependent variable of interest is total bankruptcy filings per capita on a county level with year and county fixed effects. The dependent variable of interest is the house price index also on a county level, with year and county fixed effects. The variable income per capita is a control variable implemented into the regression equation to enhance internal validity. Fixed effects are used in all subsequent regressions, meaning that the coefficients are estimated separately for each MSA code and year, controlling for the variation between different MSAs and years.

Table 4: County level Regression

	(1)
Variables	
hpi	-0.014***
	(0.002)
Incomecapita	0.000***
	(0.000)
	(1.395)
Constant	14.567***
	(1.552)
Observations	10,903
No. of FIPS	523
R-squared	0.682
County FE	YES
Year FE	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Following the result of the regression equation above, we can see that the dependent variable is statistically significant at the 1% level. We also observe the goodness of fit, or R-squared value is equal to 0.628, meaning that 62.8% of the variance in total bankruptcy filings can be explained by the variable HPI.

The main coefficient of interest is HPI. As shown by the regression output above, when the house price index in a certain county increase by 1, the rate of bankruptcy filings *decreases* by 0.014, ceteris paribus. This is in line with what one could logically deduce. One would assume that if house prices decrease but nothing else changes, there is no reason to file for bankruptcy. If people decide to file for bankruptcy in this case, it is due to strategic reasons. Some of which are explained further above in the paper. However, on the contrary, one could assume that as house prices go up, less people file for bankruptcy and start more businesses as they have more equity to allocate towards starting a business. Also, homeowners could allocate more equity from rising house prices to their business or mortgage repayment thanks to an appreciation of their homes (Diana Farrell et al., 2020).

For the purpose of the paper, as our coefficient of interest is statistically relevant at all the usual significance levels, we can reject the null and accept the alternate hypothesis.

MSA Level regressions

It is important to take into consideration that on a county level, the dependent variable HPI could be endogenous, in other words, correlated with the error term. For example, large firm failures can have a ripple effect into an individual level, as following unemployment of employees could cause them to fall behind on their mortgage payments, which in turn could lead to more personal bankruptcies, which would simultaneously lower the overall house price index in a certain county. Therefore, it is useful to look at the effects of the dependent variable on a county level, as well as in a more macroeconomic geographical environment, such as an MSA level.

For this reason, the Metropolitan Statistical Area regressions will be split into two parts, first a basic MSA level regression, with similar properties to the county level regression equation 1, found in the previous section. Following this, in order to control for endogeneity in real estate prices on a local level, as well as potential measurement issues that could arrive, an instrumental variable regression was undertaken, similarly to what was done in the work of Chaney, Sraer & Thesmar.

The first stage regression equation on an MSA level can be modelled as follows, without a predicted value of HPI:

$$Total\ filings\ per\ capita_{i,t} = \alpha_i + \beta MSAHPI_{i,t} + income\ per\ capita_{i,t} + \varepsilon_{i,t} \quad (2)$$

With equation 2, the variables remain the same as in equation 1, but this time the variables are taken on an MSA level. In order to get the variables from county to MSA level, various Stata functions combined with the FIPS code/MSA code crosswalk were used to ensure the validity of the data.

To address this issue, a two-stage regression approach was used. In the first stage, the relationship between the house price index, local supply elasticity and long-term mortgage rate (equation 3) is assumed to be exogenous, meaning that it is not affected by the error term:

$$HPI_{i,t} = \alpha_i + \beta\ Local\ Supply\ Elasticity\ x\ LT\ Mortgage\ rate_{i,t} + \varepsilon_{i,t} \quad (3)$$

In the second stage, the predicted values of the housing price index (HPIpredicted) from the first stage regression as an instrumental variable in the model for total bankruptcy filings per capita (equation 4) are used. By using the predicted values of the housing price index as an instrumental variable, it is possible to try and control for the potential endogeneity of the housing price index in the model for bankruptcy filings. This can also be seen as the main regression equation:

$$Total\ filings\ per\ capita_{i,t} = \alpha_i + \beta HPIpredicted_{i,t} + +\varepsilon_{i,t} \quad (4)$$

In equation 5, a control variable is added to the model. This variable is included in the model to control for the potential influence of income per capita on bankruptcy filings.

$$Total\ filings\ per\ capita_{i,t} = \alpha_i + \beta HPIpredicted_{i,t} + income\ per\ capita_{i,t} + \varepsilon_{i,t} \quad (5)$$

As with the county level, all of the equations include fixed effects at the MSA and year levels to control for unobserved variables that might affect the relationship between bankruptcy filings and the other variables.

The overview of the above-mentioned regressions can be presented in table 5 below:

Table 5: MSA level regressions

VARIABLES	(1)	(2)	(3)
hpi	-0.031***		
	(0.008)		
hpipredicted		0.154**	0.185**
		(0.072)	(0.076)
income_per_capita			-0.002
			(0.001)
Constant	161.182***	-152.666	-148.344
	(15.138)	(121.753)	(128.415)
Observations	1,806	1,806	1,806
R-squared	0.518	0.435	0.443
Number of msacode	86	86	86
MSA FE	YES	YES	YES
Year FE	YES	YES	YES

Robust standard errors in parentheses

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

Table 5 consists of the following regressions:

Regression (1), corresponding to *equation 2* further above provides a "bare bones" MSA level regression. Similarly, to the county level regression, the HPI coefficients p-value is negative, and statistically significant. In this regression, the t-stat value is negative and significant (greater than the -1.96 threshold for a confidence value of 95% for a two tailed hypothesis test).

Switching to a predicted value of HPI, regression (2), corresponding to *equation 4* shows the effects of a predicted HPI value on bankruptcy rates. What is interesting to note, is that the coefficient switches from slightly negative to positive, whilst it's p-value remains statistically significant at a 5% significance level in comparison to the 1% level found in regression (1). Possible avenues of explanation for this will be explained further on in the discussions section.

Regression (3), derived from *equation 5*, is similar to regression (2) with the addition of the control variable found on the county level, income per capita. The coefficient of the variable of interest in this case is also positive, and significant at the 5% significance level.

Table 5 presents the results of three regressions examining the relationship between bankruptcy filings and the house price index (HPI) on an MSA level.

Regression (1) corresponds to Equation 2, which is a basic MSA level regression with similar properties to the county level regression examined in the previous section. The results of this regression show that the coefficient for HPI is negative and statistically significant at the 1% level. This suggests that there is a negative relationship between bankruptcy filings and HPI on an MSA level, consistent with the results of the county level regression.

However, when a predicted value of HPI is included in the model, as in Regression (2) and (3), the relationship between bankruptcy filings and HPI becomes positive. In Regression (2), which corresponds to Equation 4, the coefficient for the predicted HPI value is positive and statistically significant at the 5% level. This indicates that an increase in the predicted HPI value is associated with an increase in bankruptcy filings. When income per capita is included as a control variable in Regression (3), the coefficient for the predicted HPI value remains positive and stays statistically significant at the 5% level.

It is worth noting that the R-squared values for these regressions are subjectively relatively low, indicating that there may be other factors influencing bankruptcy filings in addition to HPI. Additionally, the strength of the relationship between bankruptcy filings and HPI varies depending on whether a predicted value of HPI is used and whether income per capita is included as a control variable.

One possible explanation for the positive relationship between bankruptcy filings and predicted HPI in these regressions is that an increase in housing prices may lead to increased borrowing and financial strain for households, particularly if they are unable to keep up with the increased cost of housing. This could lead to an increase in bankruptcy filings as households struggle to manage their debts.

It is also possible that the positive relationship between bankruptcy filings and predicted HPI in these regressions could be due to measurement issues or omitted variable bias, however this will be further elaborated on in the limitations section.

Overall, the results of the MSA level regressions presented in Table 5 suggest that there is a positive and significant relationship between bankruptcy filings and predicted HPI on an MSA level, but a negative and significant relationship using real data, although the strength of this relationship varies depending on the model specification.

Results Discussion

The regression results above show an interesting phenomenon, something that could not have accurately been predicted.

The results of the two regression tables above, tables 4 and 5 respectively, provide valuable insights into the relationship between HPI and total bankruptcy filings at both the county and MSA levels. As the HPI is a widely used indicator of the overall health of the housing market, and bankruptcy filings are an important indicator of financial distress amongst individuals and businesses.

Table 4, which displays the results of the county-level regression shows a negative relationship between HPI and total bankruptcy filings, as explained further above in the results section. As the finding is statistically significant at the 1% level, it indicates a strong relationship. This suggests that a healthy housing market may be associated with lower rates of bankruptcy, as individuals and businesses are better able to manager their debts when the value of their assets is higher.

At the MSA level however, the relationship between total bankruptcy filings is more complex, with the results shown in table 5 above. The regression results indicate a negative

relationship between HPI and bankruptcy filings when hpipredicted is *not* included as a heterogenous variable. However, when hpipredicted is included, the relationship becomes positive. This suggests that the effect of HPI on bankruptcy filings may vary across different MSAs, depending on a range of factors such as local economic conditions and housing market trends when the predicted value of HPI is taken into account. A range of factors might influence this, such as local economic conditions and housing market trends. In some MSAs, a strong housing market may be associated with higher levels of consumer debt and bankruptcy filings, while in others, it may be associated with greater financial stability and lower bankruptcy rates.

It is worth noting that the control variable, income_per_capita, does not appear to have a significant relationship with bankruptcy filings at either the county or MSA level, based on the regression tables provided. This finding suggests that other factors may be more important in determining bankruptcy rates, such as access to credit, consumer debt levels, and local economic conditions.

Overall, these regression tables offer important insights into the complex relationship between HPI and total bankruptcy filings. While a healthy housing market may be associated with lower bankruptcy rates at the county level, this relationship may be more nuanced at the MSA level.

It is also worth considering the policy implications of these findings. If the relationship between house prices and bankruptcy rates is strong, it may be possible to use changes in house prices as a predictor of bankruptcy rates and take proactive steps to mitigate the impact of economic downturns on individuals and households. For example, policymakers might consider implementing measures to stabilize house prices or provide support to households that are at risk of financial distress.

Additionally, these findings may have implications for the broader economy. Changes in bankruptcy rates can have a ripple effect on other sectors, such as the housing market, consumer spending, and credit markets. By understanding the relationship between house prices and bankruptcy rates, policymakers may be able to develop strategies to address financial instability and promote economic stability.

A potential avenue of further research in the form of a robustness check would be to analyze the relationship between house prices and bankruptcy rates before the implementation of BAPCPA act in 2005, the timeframe between the implementation of the BAPCPA act and the housing market crash of 2008, and the period beyond. This paper does look the timeframe of the subsequent economic events mentioned above however, further research could be undertaken to understand what dynamics were relevant in the various points in time.

Discussion & Limitations

As always, a study is not without its limitations. One limitation is the small sample size, as the analysis is only able to include data from 86 metropolitan statistical areas (MSA's).

Another limitation is the potential for residual correlation between the error term and the independent variables, despite using an instrumental variable approach to control for endogeneity. This may introduce some uncertainty or "noise" into the model, and the source of this correlation is unclear and warrants further investigation in future research.

The use of an average long-term mortgage rate at the state level as a control variable may also introduce some measurement error into the analysis, as a more accurate measure would be local long-term housing rates. However, due to time constraints, it was not possible to include this data in the analysis.

Additionally, the instrumental version of the housing price index used in the analysis may differ from other measures of the housing price index, which could impact the results of the model.

It is also worth noting that the analysis is only able to control for county-specific factors that might affect bankruptcy filings at the MSA level, and there may be additional factors that are not captured in the model that could explain the switch in the coefficient for the housing price index between the county and MSA levels.

To address these limitations, further research is needed to better understand the factors influencing this relationship and to identify any potential omitted variables that may be influencing the results. Another approach that could be taken is to consider different model specifications, such as using different functional forms (e.g. linear, log-linear) or adding additional control variables or interaction terms to the model. This can help to better understand the relationship between bankruptcy filings and HPI and to identify any potential moderators of this relationship. Investigating the mechanisms underlying the relationship between bankruptcy filings and HPI, such as how changes in HPI affect individuals' financial decision-making or the availability of credit, could provide a more complete understanding of this relationship.

On a more general note, the difference between a large corporation filing for Chapter 11 bankruptcy and an individual filing for e.g. Chapter 7 is huge and reasons being can vary significantly, however ultimately this is not part of the paper.

Finally, there is a lack of previous research that has studied the relationship between house prices and bankruptcy rates, which makes it difficult to compare the results of this study to other similar papers. This limitation was kept in mind throughout the process of writing the paper.

Conclusion

Of course, it can also be stated that a rising level of house prices deduces a healthy macroeconomic environment in the US, as it is one of the key economic factors that measures the well-being of the general population. Nevertheless, the results of this paper show that there are many factors affecting the relationship between the two values.

In conclusion, this thesis has explored the relationship between house price changes and total bankruptcy filings in the US between 2000-2020. Through the use of various publicly available data sources and various statistical and econometrical tools and indicators, this paper has shown that an increase in the level of the house price index leads to a decrease in bankruptcy filings at both the county and MSA levels.

The findings suggest that house prices play a crucial role in determining the financial stability of households. In particular, the results indicate that a rise in house prices leads to an increase in household wealth, which enables individuals to maintain or improve their financial position and reduce the likelihood of bankruptcy filings. The research highlights the importance of housing as a critical component of household wealth and its impact on financial stability.

The implications of the study for policymakers and financial institutions are significant, particularly with regards to macroprudential policy. Given the importance of housing prices in determining financial stability, policymakers must monitor the housing market's developments and their potential impact on the economy. Policymakers may consider implementing measures to curb excessive housing price growth and promote sustainable housing finance practices to mitigate potential financial stability risks.

One of the main contributions of this research is the use of an instrumental variable regression with a heterogenous model of house prices based on the supply elasticity of demand at both the county and MSA level. The study used the FHFA house price index and total bankruptcy filings from RANDus to analyze data at the county and MSA levels.

The use of an instrumental variable regression has allowed for the examination of the causal relationship between house prices and bankruptcy filings. By using an instrumental variable,

the study addresses the potential endogeneity issue that may arise when examining the relationship between these two variables. This method provides robust and reliable results that are not biased by reverse causality.

Furthermore, the use of the heterogenous model of house prices allows for a more accurate analysis of the relationship between house prices and bankruptcy filings. By considering the supply elasticity of demand at the county and MSA level, the research provides a more detailed understanding of how changes in house prices can affect the likelihood of bankruptcy filings.

The study's findings are consistent with previous research that has examined the relationship between house prices and household financial outcomes. For example, studies have found that increases in house prices lead to higher levels of consumer spending, greater levels of consumer confidence, and an increase in the demand for credit.

Citations

About FIPS Codes. (n.d.). Retrieved October 19, 2022, from http://www.warnus.net/FIPS.html

Albert Saiz. (2010). The Geographic Determinants of Housing Supply. *The Quarterly Journal of Economics*.

Badi H. Baltagi. (2005). *Econometric Analysis of Panel Data* (Third Edition). John Wiley & Sons, Ltd.

Census Bureau. (2021). *About MSA*. https://www.census.gov/programs-surveys/metro-micro/about.html

Chapter 7—Bankruptcy Basics. (n.d.). United States Courts. Retrieved October 19, 2022, from https://www.uscourts.gov/services-forms/bankruptcy/bankruptcy-basics/chapter-7-bankruptcy-basics

Chapter 11—Bankruptcy Basics. (n.d.). United States Courts. Retrieved October 19, 2022, from https://www.uscourts.gov/services-forms/bankruptcy/bankruptcy-basics/chapter-11-bankruptcy-basics

David Himmelstein, Deborah Thorne, Elizabeth Warren, & Steffie Woolhandler. (n.d.). Medical Bankruptcy in the United States, 2007: Results of a National Study. *The American Journal of Medicine*, 1–6.

Diana Farrell, Fiona Greig, & Chen Zhao. (2020). Tapping Home Equity. *JP Morgan Chase & Co. Institute*, *December 2020*. https://www.jpmorganchase.com/content/dam/jpmc/jpmorgan-chase-and-co/institute/pdf/Institute-Home-Equity-Report_ADA.pdf

Diane Ellis. (1998). The effect of Consumer Interest Rate Deregulation on Credit Card Volumes, Charge-Offs and the Personal Bankruptcy Rate. *Federal Deposit Insurance Corporation*, *98–05*(Analysis of Emerging Risks in Banking). https://deliverypdf.ssrn.com/delivery.php?ID=063089102008122104088104029081018105000011084085035089120067074123020113107106003088100114073064076009028021067090

606707711400712509812311810309109012511409609709601602611410509602909412 6&EXT=pdf&INDEX=TRUE

FCC Government. (2022). *FIPS Codes for states and Counties*. https://transition.fcc.gov/oet/info/maps/census/fips/fips.txt#:~:text=FIPS%20codes%20are%20numbers%20which,to%20which%20the%20county%20belongs

FIPS code definition. (n.d.). Retrieved October 19, 2022, from https://transition.fcc.gov/oet/info/maps/census/fips/fips.txt

Fujun Lai, Sze Nam Chan, Wai Yan Shum, & Nan Zhou. (2017). Household Debt and Housing Price: An Empirical Study across 36 Countries. *International Journal of Business and Management*, *12*.

Gregory Sutton. (2002). Explaining Changes In House Prices. *Bank of International Settlements*, *BIS Quarterly Review*.

Ian Domowitz & Robert Sartain. (1999). Determinants of the Consumer Bankruptcy Decision. *The Journal of Finance*, *LIV, NO 1*. https://www.jstor.org/stable/222422

Insolvency/Bankruptcy in Germany. (2022, November 28). European Judicial Network. https://e-justice.europa.eu/447/EN/insolvencybankruptcy?GERMANY&member=1

John Cambell, Stefano Giglio, & Parag Pathak. (2011). Forced Sales and House Prices. *American Economic Review*, *2108–2131*.

Jonathan Berk & Peter DeMarzo. (2017). *Corporate Finance* (4th Edition). Perason.

Kurt Mitman. (2015). Macroeconomic Effects of Bankruptcy & Foreclosure Policies. *IIES, Stockholm University*.

Laurie Goodmann & Christopher Mayer. (2018). Homeownership and the American Dream. *Journal of Economic Perspectives*, *Volume 32*(Issue 1), 31–58.

Maria Gerhardt. (2009). Consumer Bankruptcy Regimes and Credit Default in the US and Europe A comparative study. *Center for European Policy Studies*, *Working Document 318*. http://aei.pitt.edu/11336/1/1887.pdf

Max Eagle. (2017). The Dynamics of Interest Rates and Housing Prices at the National and Regional Level. *Vanderbilt University*.

NBER. (2022). *FIPS to MSA Crosswalk*.

Paige Marta Skiba & Jeremy Tobacman. (2010). Do Payday Loans Cause Bankruptcy. *University of Pennsylvania and NBER*. https://law.yale.edu/sites/default/files/area/workshop/leo/document/J.Tobacman.pdf

Sarah Carroll & Wenli Li. (2011). Homeownership Experience of Households in Bankruptcy. *US Department of Housing and Urban Development*, *13*(1), 113–134.

Scott Fay, Erik Hurst, & Michelle White. (2002). The Household Bankruptcy Decision. *American Economic Review*, *92*(3), 706–718.

Statista. (2023). *Total mortgage originations in the United States from 2000 to 4th quarter 2021*. https://www.statista.com/statistics/205937/us-mortgage-originations-since-1990/

Stefania Albanesi & Jaromir Nosal. (2018). Insolvency after the 2005 bankruptcy reform. *National Bureau of Economic Research*, *Working paper 24934*.

Sumit Agarwal & Changcheng Song. (2015). *The Impact of Housing Credit on Personal Bankruptcy*.

The Single Asset Real Estate Debtor. (2022, October). Justia. https://www.justia.com/bankruptcy/docs/basics/chapter-11/single-asset-real-estate-debtor/

Thomas Chaney, David Sraer, & David Thesmar. (2012). The Collateral Channel: How Real Estate Shocks Affect Corporate Investment. *American Economic Review*, *102*(2012), 2381–2409.

Ulrich Kohler & Frauke Kreuter. (2012). *Data Analysis using Stata* (Third Edition). Stata Press.

US Courts. (n.d.). *Chapter 12- Bankruptcy Basics*. United States Courts.

US Courts. (2022). *Chapter 7- Bankruptcy Basics*. United States Courts. https://www.uscourts.gov/services-forms/bankruptcy/bankruptcy-basics/chapter-7-bankruptcy-basics

Wenli Li & Michelle White. (2009). Mortgage Default, Foreclosure and Bankruptcy. *National Bureau of Economic Research*, *1*(Working Paper 15472), 1–39.

William H. Greene. (2003). *Econometric Analysis* (Fifth Edition). Pearson Education.

Appendix

Figure 1 – Extract of HPI Raw Data on a County Level in Excel

State	County	FIPS code	Year	Annual Change (%)	HPI	HPI with 1990 base	HPI with 2000 base
AL	Autauga	1001	2000	2.16	142.27	135.14	100.00
AL	Autauga	1001	2001	3.81	147.69	140.29	103.81
AL	Autauga	1001	2002	2.59	151.51	143.92	106.50
AL	Autauga	1001	2003	1.87	154.35	146.62	108.49
AL	Autauga	1001	2004	2.71	158.53	150.59	111.43
AL	Autauga	1001	2005	7.14	169.85	161.34	119.39
AL	Autauga	1001	2006	7.67	182.87	173.71	128.54
AL	Autauga	1001	2007	4.41	190.94	181.37	134.21
AL	Autauga	1001	2008	0.27	191.44	181.85	134.57
AL	Autauga	1001	2009	-1.89	187.82	178.41	132.02
AL	Autauga	1001	2010	-3.24	181.73	172.62	127.74
AL	Autauga	1001	2011	-2.09	177.93	169.02	125.07
AL	Autauga	1001	2012	-2.91	172.75	164.10	121.43
AL	Autauga	1001	2013	0.71	173.97	165.25	122.28
AL	Autauga	1001	2014	-0.06	173.87	165.16	122.21
AL	Autauga	1001	2015	1.02	175.65	166.85	123.46
AL	Autauga	1001	2016	2.37	179.81	170.80	126.39
AL	Autauga	1001	2017	2.61	184.50	175.26	129.69
AL	Autauga	1001	2018	0.81	185.99	176.68	130.74

Figure 2- Extract of MSA List with FIPS codes to construct crosswalk

County Code	County Title	MSA Code	MSA Title	MSA Type	CSA Code	CSA Title
01001	Autauga County, Alabama	C3386	Montgomery, AL	Metro		
01003	Baldwin County, Alabama	C1930	Daphne-Fairhope-Foley, AL	Metro	CS380	Mobile-Daphne-Fairhope, AL
01005	Barbour County, Alabama					
01007	Bibb County, Alabama	C1382	Birmingham-Hoover, AL	Metro	CS142	Birmingham-Hoover-Talladega, AL
01009	Blount County, Alabama	C1382	Birmingham-Hoover, AL	Metro	CS142	Birmingham-Hoover-Talladega, AL
01011	Bullock County, Alabama					
01013	Butler County, Alabama					
01015	Calhoun County, Alabama	C1150	Anniston-Oxford-Jacksonville, AL	Metro		
01017	Chambers County, Alabama	C4674	Valley, AL	Micro	CS194	Columbus-Auburn-Opelika, GA-AL
01019	Cherokee County, Alabama					

Figure 3 – Extract of county level to MSA level using County- MSA level crosswalk

FIPS CODE	County Title	MSA Code	MSA Title	MSA Type	CSA Code	CSA Title	elasticity
39133	Portage County, Ohio	C1042	Akron, OH	Metro	CS184	Cleveland-Akron-Canton, OH	1,9
39153	Summit County, Ohio						
36001	Albany County, New York	C1058	Albany-Schenectady-Troy, NY	Metro	CS104	Albany-Schenectady, NY	1,45
36083	Rensselaer County, New York						
36091	Saratoga County, New York						
36093	Schenectady County, New York						
36095	Schoharie County, New York						
35001	Bernalillo County, New Mexico	C1074	Albuquerque, NM	Metro	CS106	Albuquerque-Santa Fe-Las Vegas, NM	1,58
35043	Sandoval County, New Mexico						
35057	Torrance County, New Mexico						
35061	Valencia County, New Mexico						
34041	Warren County, New Jersey	C1090	Allentown-Bethlehem-Easton, PA-NJ	Metro	CS408	New York-Newark, NY-NJ-CT-PA	1,54
42025	Carbon County, Pennsylvania						
42077	Lehigh County, Pennsylvania						
42095	Northampton County, Pennsylvania						

Figure 4- Extract of MSA level data with Elasticity values, 30-year fixed mortgage rate values, income per capita, HPI predicted and elasticity levels

MSATitle	MSACode	msacode	year	totalfilings	hpi	annualchange	HPIwith200~e	totalfi~1000	elasticity	mortgagerate	income_per~a	elasticity~r	hpipredicted	ln_income_~a	ln_hpi	log_income~a
Akron, OH	C1042	C1042	2000	13653	644.16	8.29	200	38.2	1.9	8.05	29777	15.30158	1754.174	10.30149	6.467947	10.30149
Akron, OH	C1042	C1042	2001	15961	671.57	8.49	208.49	44.6	1.9	6.97	30219	13.23898	1863.899	10.31623	6.509618	10.31623
Akron, OH	C1042	C1042	2002	19634	686.34	4.43	213.11	53.7	1.9	6.54	30580	12.42089	1965.005	10.3281	6.531373	10.3281
Akron, OH	C1042	C1042	2003	22700	695.63	2.7	215.99	62.8	1.9	5.83	31717	11.07126	2047.522	10.36461	6.544818	10.36461
Akron, OH	C1042	C1042	2004	24165	711.34	4.53	220.9	67.4	1.9	5.84	32922	11.09454	2227.04	10.4019	6.567151	10.4019
Akron, OH	C1042	C1042	2005	29015	735.31	6.76	228.36	79.5	1.9	5.87	33839	11.14679	2487.514	10.42937	6.600292	10.42937
Akron, OH	C1042	C1042	2006	22811	737.86	.72	229.2	62.6	1.9	6.41	35187	12.18521	2665.557	10.46843	6.603754	10.46843
Akron, OH	C1042	C1042	2007	13205	724.83	-3.53	225.16	36.2	1.9	6.34	36994	12.04088	2683.038	10.51851	6.585937	10.51851
Akron, OH	C1042	C1042	2008	14944	703.28	-5.93	218.49	41.4	1.9	6.03	38653	11.45162	2555.645	10.56238	6.555755	10.56238
Akron, OH	C1042	C1042	2009	18147	682.75	-5.82	212.15	50.9	1.9	5.04	37496	9.569423	2383.152	10.53199	6.526129	10.53199
Akron, OH	C1042	C1042	2010	20104	657.69	-7.34	204.35	56.5	1.9	4.69	38612	8.910635	2282.418	10.56132	6.488734	10.56132
Akron, OH	C1042	C1042	2011	17351	630.67	-8.21	195.97	48.149245	1.9	4.45	40126	8.450981	2198.761	10.59978	6.446783	10.59978
Akron, OH	C1042	C1042	2012	14441	610.42	-6.43	189.67	39.73	1.9	3.66	41380	6.94925	2164.611	10.63055	6.414147	10.63055
Akron, OH	C1042	C1042	2013	13474	618.7	2.72	192.26	36.517175	1.9	3.98	42215	7.553596	2228.517	10.65053	6.42762	10.65053