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The Effect of Income Disparity on Housing Prices: Implications for Financial Fragility in the United States

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Abstract

This paper studies the effect of income disparity on housing prices in the United States through parametric and nonparametric analysis. Using Census information from 1967 to 2009, this paper adds to current literature on the origin of US debt levels and financial crises; suggesting growing income disparity increases housing prices which increase collateral values, easing access to debt. Both income disparity and housing prices reached an all-time high in the year preceding The Great Recession, and this paper proves a robust relationship between the two on a national and state basis. The results from this paper suggest redistributive practices may provide more stable debt levels and a more stable economy.

I. Introduction

Levels of income disparity and median housing prices in the United States were at an all time high in the year 2007 (Domhoff 2011), immediately prior to the credit collapse that resulted in The Great Recession. The research in this paper indicates that as income disparity increases, so do housing prices. Implications of this research are that as housing values increase, access to debt becomes easier as the value of collateral rises. Rising collateral levels explain the surges in home-equity lines of credit, which increased by 64.2% in the six years before 2007 (New America Foundation 2009). These types of debt surges are part of the reason that debt-to-income ratios were above 100% and likely contributed to the default rates that scourged the economy in the latter part of the last decade. Regardless of its implications on debt and financial fragility, rising prices of housing without comparable real income increases for the entire population places a disproportionate cost level on the lower-and-middle income earners for housing. It is a staple of American policy that housing be affordable to all, and if the United States is seeing both rising income inequality and housing prices, those less fortunate will face more difficulty in securing housing. Growing income disparity and housing prices is important for future consideration, not only for United States citizens, but also policy makers in the United States government. If housing becomes disproportionately expensive for the middle class and poor, they will have to either defer consumption or consume more debt to maintain their lifestyles, practices that could change demand or increase overall debt levels. Understanding that the effect of growing income disparity on housing prices has adverse and pervasive consequences on the United States' economy, this thesis seeks to answer the question: what is the effect of income disparity on housing prices in the United States of America?

The recent literature surrounding income disparity, housing prices, and United States debt levels has drawn connections between two of the variables, but not all three. No literature considers income disparity a factor in housing prices. Mian and Sufi (2009) examine household price levels and the effect it has on household debt, suggesting that household price levels are responsible for shifts in total and household debt. Their paper further suggests that the rise in this type of debt, and the demographic composition of those consuming it, led to the large number of defaults seen during the financial crisis. However, they do not include income disparity as a reason for the increase in housing prices. Kumhof and Ranciere (2011) suggest that rising levels of income disparity increase total debt in the United States because of the propensity for top-income earners to invest in the financial sector. Their paper breaks the population into two types of people: investors and wage earners. When investors control an increasingly greater amount of total wealth, debt levels also increase because of their propensity to invest in financial instruments. The rise in housing prices accounts in part for the rising debt levels, described by Kumhof and Ranciere (2011), because of the rapid increase of mortgage and home-equity loan levels between 2000 and 2007[1]. Therefore, the Kumhof and Ranciere (2011) suggested debt levels were a function of income disparity, Mian and Sufi (2009) suggested debt was a function of housing prices, and both suggested financial instability to be a function of debt levels. The addition this thesis makes to the existing literature is that housing prices are a function of income disparity. This function completes the syllogistic flow, incorporating the two aforementioned articles, by suggesting that income disparity drives up housing prices, increasing the value of the collateral, allowing people to consume more debt, leading to financial instability and defaults.

Using parametric and nonparametric modeling, regression analysis helps to determine exactly what the nature of the relationship is between income disparity and housing prices.

[1] Mortgage loans grew at 116% from 2000-2007 (US Census Bureau, Household Financial Assets and Liabilities).

Furthermore, an analysis for every state is conducted to determine where exactly the impact, if any, is located, and to uncover and analyze any similarities therein. The models used will show how growth in income disparity affects housing prices and the related elasticity, or percent change in income disparity in relation to percent change in median housing price, of the relationship. All national and state information is time-series data collected from the Census Bureau for the years 1967-2009. Data for the variables will be either national or state data, depending on the model, on median housing price and GINI coefficients[2].

Through the regression analysis and nonparametric modeling done for this thesis, the data describes a significant, positive correlation between income disparity and housing prices. The data suggests that a .1 percent shift in the GINI coefficient can increase median housing prices by $144,950 and that a 1 percent change in GINI would create a greater-than 6 percent change in median housing prices. Additionally, income disparity appears to be a driving factor in the individual states as well. The nonparametric approach yields house price elasticity coefficients for each individual state that show a strong correlation to said state's average GINI coefficient for the last forty years. The relationship also shows that the trend was not geographically linked. Current economic thought on the housing market suggests that Northeastern states and places like Texas and California would have higher elasticities due to their location and population densities (Glaeser and Gyourko 2002). Glaeser and Gyourko (2002) also maintain that Midwestern and Southern states housing price levels are primarily correlated to construction costs. The results show that where income disparity is highest, the elasticity of housing prices is also highest, implying income disparity's important, and possibly dominant, role in the fluctuations of housing prices.

[2] The GINI coefficient is a widely-used measure of income disparity and will be further explained in section three.

The rest of the paper serves to further illustrate the housing market, the current literature surrounding it, and the methodology, results, and implications of the findings. Section two will examine the research already done on the housing market, income disparity, and their effect on one another and on national debt levels. Section three will discuss the methodology including data sources, models, types of regression analysis, and an examination of the results. Section four will discuss the implications of the research and ways in which the model can be advanced.

II. Literature Review

Little research has been done on the effect of income disparity on the price of housing. Matlack and Vigdor (2008) propose that income disparity may have negative effects on lower-income families' ability to afford rental housing. It does not, however, consider housing prices on the aggregate level choosing instead to focus on prices in the low-rent category. Furthermore, Iacoviello (2007) and Kumhof and Ranciere (2011) suggest that income disparity leads to higher household debt levels. The Kumhof and Ranciere paper postulate that the relationship is caused by the tendency of the wealthy to engage in the financial marketplace, specifically purchasing stocks and bonds. This paper seeks to contribute housing prices, and their resultant home-equity based borrowing, as a major contributor to the debt levels. This assertion is supported by Mian and Sufi (2009) who hypothesize that the increase in housing values made debt consumption easier because the value of the house could be used as collateral. All three authors, using different debt measures, put forward that the level of debt in the United States contributed significantly to the financial crisis that began in 2008. This paper seeks to add income disparity as a driver for housing prices, which drives debt levels, making income disparity a factor in financial instability.

However, the first step in the process requires understanding of the intricacies of the housing market, the oftentimes disequilibrating demand and supply relationship, and its place in the financial marketplace.

The market for housing is complex and often in disequilibrium. This causes difficulty in the housing market reaching equilibrium. Housing characteristics differ from normal commodity characteristics, and thus make them difficult to examine. Purchasing a home is oftentimes the largest purchase a person will make in one's lifetime and usually done no more than once or twice. Likewise, a home is not purchased in the manner a typical commodity would be, because homes often require financing and long term payments, which make purchasing and price more complicated. Additionally, housing stock is a capital good with a long life, if properly maintained, meaning that it is a durable good with little depreciation value. Due to the durability of housing, construction of new homes has very little impact on stock. Lawrence Smith et. al. (1998) suggests that new home construction accounts for only about 1-3 percent increase in overall housing stock. Due to this, supply is relatively inelastic and some models suggest that in the short run supply is perfectly inelastic and therefore demand shifts alone affect price. Utility from housing consumption is also derived from household amenities such as location, size, land size, and household qualities. The uniqueness of each home, coupled with uniqueness of consumer preferences makes aggregated valuation or comparison difficult. As a result, housing prices are largely a result of the local market.

Housing demand is complex and not necessarily dependent on price but nontraditional variables like location and financing options. The term housing here must encompass the house itself and the sources of utility derived from the home, which make the pricing model inherently complex. Housing consumption utility is derived from many factors; primarily location and

distance from desired locations, as well as the size of the land it is on, the amenities of the home, and also local government (Smith et. al. 1998). The terms listed above are referred to as *spacial fixity* and they also incorporate neighborhood characteristics such as land use in the surrounding area. There are also two competing ideas in the models surrounding housing demand and they are separated into urban and suburban. Urban households trade low population density for proximity to certain locations (resulting in decreased commuting time), and while they still desire space their marginal utility for location is higher. In these scenarios, housing values decrease at a decreasing rate the further away the homes are from the point of interest (Smith et. al. 1998). In suburban areas, marginal utility is greater for large plots of land and larger homes, meaning low density is the higher priority. Regardless of location, an increase in wealth correlates with an increase in desire for low density (Glaeser et. al. 2005). The final consideration has been government involvement, which is especially important to include considering how influential it is and has been to the housing market. Governmental tools include taxation policies, zoning, rent control, and affects mortgage policies. "Governments at all levels, from local to national, are heavily involved in housing markets" (Smith et. al., 1998). Government may be one of the strongest influences on housing prices, and many of its procedures have not been thoroughly examined, like its impact on wage and income disparity.

One of the unique qualities of housing demand is its relationship with the financial markets. Most products do not require special types of financing for purchase, but many different financial measurements are considered for home purchasing. The decision to buy a house begins with a down payment, which is a result of both income, savings rate, and the prevailing loan-to-value (LTV). It also affects future savings because the mortgage requires both interest and principle payments, which will both ultimately affect consumption levels (Smith et. al. 1988). As

a result, savings rates and homeownership are intrinsically linked. Likewise, in times of expected inflation the nominal interest rate rises which increases the rates on mortgages, affecting current demand. Different tax benefits also contribute to demand and it is usually derived from different government initiatives for homeownership. In the United States there have been many different housing initiatives that try to make housing affordable and they usually center on taxation benefits or mortgage practices. This means that politics and policy play a major role in demand as well, as they often affect the different types of financing available for homeownership (Goodhart and Hofmann 2007). Therefore, demand is not always determined by price, but by the accumulation of different financial indicators and speculation as well. Adding to the complexity, transaction costs are very high in housing purchases as well. Research must be done by both buyer and seller which results in opportunity costs, as well as brokerage and other types of fees. Due to transaction costs, financing costs, and durability there is usually disequilibrium in the market. "The housing response of households often occurs slowly, demand side adjustments are inhibited from instantaneously moving housing prices and vacancies to their long-run equilibrium" (Smith et. al. 1988). As complex as the demand for housing is, the fact that it affects supply inconsistently or in a limited fashion makes the relationship even more difficult to understand.

The supply of housing is generally affected by location, demand, cost of construction, and governmental policy (on both the state, local, and federal level). Recent research suggests, however, that the largest impact on the supply of housing and house pricing is local housing policies, specifically zoning laws (Glaeser et. al. 2002, 2004, and 2005). The level of zoning controls elasticity of supply, which is evident in the coastal states; mainly California, New England, and the Mid Atlantic (Glaeser 2004). Moreover, construction costs do not very greatly

from state to state and do not account for the differences in housing values between the areas (Glaeser 2004). It is hypothesized that two different factors contribute the inelasticity to parts of the United States; one theory is that there is high density in these areas and the scarcity of land creates excess demand leading to higher prices; the second is that land use regulation deters new construction and effectively controls supply. Glaeser (2004) suggests it is the latter that is true and not the former. This stand to reason as many of the areas with high housing values are not high density areas, census data suggests many of the counties with the highest mean home prices are located in low density areas of California and Texas (United States Census Bureau Department of Housing). Glaeser maintains that it is the increased regulation and zoning that contribute to the values of homes. The methodology pursued to confirm this hypothesis was an empirical one, examining 1) whether land values increase the price of housing, 2) whether high priced land are high or low density and 3) the correlation between measures of regulation and the value of housing prices. The first approach used hedonic methodology and supported their assumption that the value of land was not a price driver. “In general, hedonic estimates suggest that land is relatively cheap on this margin… the t-statistics reported still do not imply really high prices even at the top end of the 95 percent confidence interval” (Glaeser & Gyourko 2002). Hedonic modeling is used to create price indices for goods with widely varying prices. This type of modeling is used to value real estate because there are many different amenities that can affect the price of the home like location, size, and number of bedrooms. The research suggested that land prices affect housing prices only in areas where there is a substantial development tax, suggesting zoning is the cost driver and not the land itself. Their second hypothesis was also conclusive that the places with high prices also have large plots of land. Additionally, they found a robust correlation between high prices and land use regulation measures. This research

suggests that many housing markets in the United States follow regular supply and demand qualities, however, the areas with increased zoning are also likely to have prices far above cost of construction and far above comparable homes in other districts.

The phenomenon of increased zoning practices in some areas in the United States provides part of the link between increased home value and income disparity. Glaeser et. al. (2005) cites five reasons for restrictive zoning environment in some areas of the country; judicial tastes, impact of residents' groups, the efficacy of cash and time in influencing local decision makers, the value of amenities, and changes in the housing market. The judicial tastes aspect proposes that judges, as a result of national preferences, are more sympathetic to anti-development cases and there has been a rise in judicial involvement in land regulation policies. Their analysis of the impact of residential groups is purely anecdotal but suggests efficacy in residential group formation has increased since 1960. The third point made suggests a decline in corruption, but the authors admit that this is purely speculative. The final two points work in conjunction, stating that through empirical evidence that richer communities are less likely to build new housing units and that, overall, increasing housing prices leads to reductions in construction overall. These hypotheses prompted the focus of this paper, realizing that income disparity has an effect on the price of housing. Many of the reasons they cited for increased zoning are a result of the power of wealth. Increases in wealth usually lead to increases in desire for low-density neighborhoods (Glaeser 2004) and the power of wealth can allow the wealthy to try to preserve low density which would cause them to try to alter policy, specifically zoning laws. This research suggests that the desire of the wealthy to suppress construction in favor of larger land plots means supply in dense areas may be too low, which can have adverse effects on price. This suggests that as power shifts to the wealthy housing prices, overall may rise.

Additionally, with higher cost homes there is the added externality of property values experienced by the poor, making it even more difficult to afford housing. In order to completely understand how disparity arose, and why it would affect the housing market, a sound understanding of income disparity in the United States is required.

There is no doubt that the income disparity in the United States has increased significantly. While nominal wages increased in the 1980s and 1990s; it seems real wages were stagnant in the middle class and declining for those of the lower while real wages soared for the rich. In fact, in the late 1970s there was not a single state in which the median income of families in the top quintile was greater than 2.7 times as great as the median income of those in the middle twenty percent. By the late 1990s there were thirty nine states that reported a gap of at least this wide (Bernstein et. al., 2000). Across the board, the top quintile has shown increases in income share, real wage, and income where the middle and lowest quintiles have seen decreases. "In nine of the 11 large states analyzed, the median income of the poorest fifth of the families declined or grew very little since the late 1980s, while the incomes of the top five percent of families grew by more than 15 percent" (Bernstein et. al., 2000). This means that while the rich are generating increasing excess funds, the poor are getting poorer. This has only gotten worse recently. A CNN report suggests that there has been a decline in average American income since 1988 despite the top 1% of earners having an income growth of over 33%.The reasons suggested for this disparity increase are globalization and outsourcing, overall decline in union membership (Censky 2011), and taxation policies that favor the rich (Bernstein et. al. 2000).

> "Virtually all state income taxes collect a larger share of the incomes of poor families than of high-income families. State taxes also generally absorb a larger share of the incomes of middle-class families than of high-income families…When states raised taxes over the past decade to meet recession-induced shortfalls, they predominantly raised those taxes that fall most heavily on low- and moderate- income households" (Bernstein et. al., 2000).

This suggests policy initiatives that support changes in taxation may help reverse the trend of rising income disparity in the United States. Rudimentary time series comparisons link increases in income disparity to growth in housing prices and, perhaps more importantly, debt servicing ratios and overall household debt levels.

Iacoviello (2007) and Kumhof and Ranceriere (2011) examine the relationship between household debt and income disparity. In the Iacoviello paper he tries to determine the cycle of household debt and determines that it cannot be fully explained by the business cycle, and the uncommon spikes are a result of rising income disparity. Household debt levels were relatively stagnant through the 1960's and 1970's in the United States, with sharp increases in the 1980's. Consumer debt levels rose, and mortgage debt levels went from 40% of disposable income to 75% between the early 1980's and late 1990's. Likewise, data shows that inequality growth was stagnant in the 1960's and 1970's with a spike in the 1980's as well (Iacoviello 2007). Iacoviello measured inequality by the standard deviation of log earnings, which was similar to other measures of inequality, but did not include the GINI coefficient, which will be used in this paper. "Had income inequality not changed from its baseline value, the debt-to-income ratio would not have increased" (Iacoviello pg 17). The Iacoviello paper provides substantial evidence that income disparity is well correlated with increase in household debt levels in relation to income, but does not explain fully why the relationship exists besides higher-income household's tendency to be engaged in the financial market.

The Kumhof and Ranciere paper focuses on the latter point of Iacoviello's; that disparity increases the need for financial intermediation between the rich and poor. The increase in financial intermediation resulted in the rapid growth of the financial industry in relation to GDP, which is what created such fragility in the market. Providing evidence of the shift of debt levels

from the rich to the poor, Kumhof and Ranciere theorize the importance of the financial sector. The data used showed that in 1983, the wealthiest sector was more indebted than the lowest earners. Using debt-to-income ratios, the wealthiest group's ratio was around fifteen percentage points lower than the lowest group. In 2007 the situation was dramatically different; debt-to-income ratios soared to around 140%, which was twice the ratio of the wealthiest group. This resulted in the financial sector growing by nearly two-hundred-percent since 1981. Their paper did not use regression analysis when testing their data, but used dynamic stochastic general equilibrium model (DSGE) instead. This type of modeling has become useful in contemporary economics because it seeks to understand business cycles and different macroeconomic fluctuations, without being subject to the problems associated with analyzing relationships between highly aggregated data (Buiter 2009). This type of modeling tries to explain macroeconomic events by examining many microeconomic ones (Buiter 2009). Their data is calibrated to mirror United States data in the ten years leading up to the two largest financial crises in the last century, the crashes of 1929 and 2008. They define a financial crisis by default probability, which they state is 95% when debt-to-income ratios are 150%. They examine relationships by changing the bargaining power of workers, which is their measure of income disparity. Kumhof and Ranciere (2011) define bargaining power as a function of real wage divided by the marginal productivity of labor. By decreasing bargaining power of workers, they examine how their other variables react, specifically the debt-to-income variables. While their results were conclusive, their modeling, while highly complex, has consequences. Using DSGE modeling has the side-effect of forcing a linear model on, oftentimes nonlinear data. According to Buiter (2009) this type of modeling can create results that are very polarized and, perhaps, hyperbolic. This thesis uses nonparametric modeling, which does not assume a functional form,

may be more appropriate. Kumhof and Ranciere (2011) acknowledges that asset price bubbles could be another cause of the crisis and that mortgage debt made up a substantial portion of the increased debt by the lower 95% of income earners. However, it did not make the connection between housing price inflation and the resulting increase in debt levels. This is precisely where this thesis seeks to add housing prices as the link between income disparity and debt levels. It stands to reason that the levels of income disparity (which could also be a result of capital gains revenue via size of financial sector) resulted in increased housing values, which accounted for the household debt levels (via collateral increases in relation to housing values) that destabilized the economy. Evidence (shown in appendix 1, Charts 1 and 2) suggests we need to examine the level of mortgage debt and home equity loans in the United States as a possible contributor to the 2008 financial crisis.

While Kumhof and Ranciere may be correct in asserting that the size of the financial sector grew considerably and possibly lead to financial instability, they underestimate important measures of debt. Specifically, the billions of dollars tied up in mortgages and home equity loans should be the focus of the rapidly increasing debt levels, and housing prices must also then be considered. Kumhof and Ranciere (2010) place emphasis on income disparity increasing debt levels, but this paper suggests there is an intermediate step, housing price increases, which explain the theory more completely.

The time periods of rapid increases in income disparity and household debt levels are also during times of rapid housing price increases and housing stock (United States Census Bureau Department of Housing). Matlack and Vigdor (2008) explain this in part by explaining the "trickle down" effect of income disparity, stating that rises in income disparity increase cost of living for the poor. It could be said that increased prices, specifically in the housing market,

increase cost of living for the low or middle income families, who would then turn to financial markets to maintain their lifestyle. Previous papers (Rodda (1994) and Vigdor (2002)) discuss the negative effect rises in income for the wealthy have on housing affordability for the poor, and the Rodda paper found significant correlation between the demand for higher quality housing and the movement of the best quality homes in low-cost unit pool out of the low-rent category. While rent is often considered a substitute for housing (Glaeser et. al. 2005) it is still affected by the same demand and supply fluctuations as the regular housing market and price and cost are very similar as well. That being said, there was a significant negative relationship found between income inequality and residual income as well as significant positive relationship between inequality and rent to income ratio. Both of the preceding conclusions lead one to believe that as income disparity increases cost of housing increases and as a result there is less residual income. "The point estimate on the GINI coefficient in the log rent per room specification, for example, indicates that a one-standard-deviation in inequality raises rents by between 3% and 4%" (Matlack and Vigdor 2008). This suggests that income disparity has negative effects on housing affordability. Coupled with its effect on household debt levels, this suggests that the increased levels of finance described by Kumhof and Ranceiere (2011) could be a result of debt consumption to offset increases in housing prices and also debt availability as a result of collateralization.

Empirical evidence suggests that strong, steady house price appreciation accounts for expansion in household leverage. Mian and Sufi (2009) examined homeowner debt from 1997 to 2008 in the United States and suggest that borrowing against the increase in home equity accounted for the quick rise in debt levels from 2002 to 2006, and the increase in defaults in 2006 to 2008. The authors posit that because most of this borrowing was done by young

households or household with low credit scores, home-equity based borrowing accounted for 34% or more of the defaults from 2006 to 2008. These findings coincide with the Kumhof and Ranciere (2011) paper because it suggests debt usage by the lower-income families increased because those families' real earnings were dwindling as a result of increased income disparity and they required the debt to maintain their lifestyles. While this is information is backed up by some information, it does not tell the whole story. It is true that households in the lowest income quintile doubled their borrowing, however, it only accounted for 4% of total growth in housing debt. While the lowest income quintile held more debt in relation to income than the top quintile (19% of total income on average, 26.9% devoted more than 40% to debt payments, the top quintile drove rapid increases in the second-home market, which accounted for only 6.2% of total household debt in the US in 2001 and jumped nearly 63% to 10.1% in 2007 (New America Foundation 2009). This suggests that lending practices were getting more relaxed, allowing people to indebt themselves on such high levels, and allowing so much debt to be used for second homes, which are risky bank assets. The Mian and Sufi (2009) research goes further to state that between twenty-five and thirty percent of home equity borrowing goes to consumer goods and services spending, highlighting that the debt consumption creates larger aggregate demand and the effects of the housing market extend into other industries. The increase in risky assets coupled with the effect it has on consumer spending is what creates a risk for default that could dry up aggregate demand, which is what makes financial fragility tied to the housing market.

The implications of these relationships are clear; the most recent collapse of the housing market caused a financial crisis that spread to the industrialized and developing world. A lot of research has been dedicated to identifying the correlation between quickly rising housing prices

and credit bubbles that become dangerous to a nation's financial health. Due to the fact that houses are both the largest asset and source of equity for an individual as well as the largest part of most banks' balance sheets, the stability of the housing market is of utmost importance to the health of the nation. The focus of this paper is to show that policy decisions that try to correct the housing market are just trying to treat symptoms and not the cause. Policy should be focused on combating income disparity which is the cause of the types of problems we see in the housing market.

III. Methodology

Current research ties income disparity to rising household debt levels, but attributes this to income disparity increasing the size of the financial market. The research done by Kumhof and Ranciere (2011) suggests that the increase in the size of the financial market is due to lower-income families' need to consume more debt to maintain their lifestyles and the higher-income families' propensity to invest. The variable of income disparity must, therefore, be considered when examining the model of household indebtedness. Additionally, Matlack and Vigdor (2008) found a statistically significant relationship between income inequality and the upward cost movement of low-rent housing. The purpose of this paper is to determine if the reason for the substantive increases in household debt and increases in rent are symptomatic of the relationship between income disparity and median housing prices in the United States. Theoretically, rising housing prices caused by income disparity would cause increases in the financial sector (increased house value results in increased collateral value and therefore access to debt) and also the increased cost of living experienced by the poor. Therefore, the housing affordability issues and rapid growth of debt levels are indirectly caused by income disparity and directly caused by housing price growth. This paper constitutes the first attempt to model that relationship.

The Model

The basic population model is:

$$Houseprice_i = \beta_0 + \beta_1 IncomeDisp + \varepsilon_i$$

The model illustrates an unknown relationship between housing prices and income disparity where β_0 and β_1 are unknown parameters and ε_i is the unknown stochastic error which captures other factors affecting housing prices other than income disparity. The thesis will estimate this relationship with aggregate and state-level data. This model is constrained to the wage earners and homes located within the United States, as reported by the Census Bureau. The hypothesis of this paper is that income disparity will have a positive relationship with housing prices.

The first model will use parametric regression analysis, presuming a linear relationship between housing prices and income disparity. It will use the GINI coefficient (explained in detail below) as a measure of income disparity.

Model 1: $Houseprice_i = \beta_0 + \beta_1 GINI + \varepsilon_i$

Model two will also use parametric regression analysis. It will, however, use a double log function to determine the elasticity of house prices with respect to income disparity. Elasticity is percent change in one variable with respect to a one percent change in the other.

Model 2: $\ln(Houseprice_i) = \beta_0 + \beta_1 \ln(GINI) + \varepsilon_i$

Model three is a nonparametric estimation using state-level housing prices and state-level GINI coefficients. Nonparametric modeling will be further explained in the discussion of the third model.

Model 3: $Yi = E(HousePrice \mid GINI) + \varepsilon_i = \square(GINI) + \varepsilon_i$

All models use the GINI coefficient measure of income disparity, as it is the most common and widely accepted measure. The GINI coefficient ranges from zero to one, with zero representing perfect equality (every person has an equal share of aggregate income) and one representing perfect inequality (one person has all the aggregate income, everyone else has nothing). It is measured by the relationship between the Lorenz Curve and a line that represents zero inequality (see appendix 2, Chart 3 for model). Essentially, the further the Lorenz Curve deviates from zero inequality, the more unequal the distribution of income is. The Lorenz Curve represents the share of income held by the bottom x% percent of earners. This means every point on the curve states that the bottom y% of income earners hold z% of the aggregate wealth. The GINI coefficient is the relationship between A and B in the diagram above (Dorfman 1979). Using the GINI coefficient has both benefits and drawbacks. The primary benefit of using the GINI coefficient is that it is widely used and reported, so results from it can be compared to different states or countries, depending on how it is used. For this model it is useful because it reports income inequalities within a sector and can be used to evaluate changes over time. Problems with using the GINI coefficient are that it does not always accurately measure inequality because it does not take into account income mobility inhibitors such as class or race. Additionally, because it is based on net income and not wealth, investment factors, which may be significant, are excluded and they may be significant. For example, Sweden has a very low GINI coefficient for net income, but their wealth distribution is very unequal.

The regression analysis used in models one and two is essential to determining the relationship between housing prices and income disparity. This type of analysis will determine the coefficient of income disparity, β_1, which will illustrate the effect income disparity has on

housing prices. Further analysis will determine the significant, sign, and 'goodness of fit' of the model, which will be imperative in determining its efficacy.

The second model and third models are both double log functions, which will demonstrate the elasticity of the relationship between income disparity and housing prices. The third model will use the same census information on GINI and median housing prices in the United States used in model 1. The results of this model will show the percentage change in housing prices with respect to a one percent increase in income disparity.

The third model examines elasticity on a state-by-state basis using nonparametric estimation. Nonparametric regression allows analysis of data with presumption of functional form[3] (Das 2008). Using nonparametric analysis will allow examination of the relationship of housing prices and income disparity without the bias of presuming a functional form. For example: in this research where a linear function is presumed, if the distribution is not normal then the functional form is not normal, and the results could be biased (Das 2008). Additionally, the nonparametric approach is useful because it estimates regression coefficients for every data point (Das 2008). This is useful for this thesis because the information can be broken down by state and differences between their coefficients can be examined and interpreted. This is done by creating a window around every data point, and estimating a relationship in each window. Higher weights are given to data points closer to the window, and lower weights to ones further away, allowing for analysis on every data point (see appendix 3 Chart 6 for an illustration, the window sizes are labeled 'h'). Drawbacks to nonparametric analysis are that it is less efficient with models that include multiple independent variables and in data sets with small sample sizes (Das 2008). This model, however, has only one dependent variable and a sample size of 204, so there should not be a problem. Additionally, the standard errors were obtained via bootstrapping,

[3] Functional forms may be logarithmic, inverse, quadratic, or cubic.

which increases accuracy. The information for model four is aggregated by the decade from the Census Bureau using and individual states' median housing prices and an individual states' GINI coefficient. The results of this will give the elasticity of housing prices with respect to income disparity for each state. Comparing these numbers to the average GINI coefficient for the last forty years could provide insight as to whether higher income disparity is present in states with high elasticity of housing prices.

The Information

All the information was gathered through the Census Bureau website and it is all in annual data from the year 1967 to 2009. The housing prices were determined by the median housing values as compiled by the Census Bureau. The Census Bureau defines "Income" as the combination of the algebraic sum of money wages and salary and net income from farm and nonfarm self-employment and the algebraic sum of all sources of money income except wages and salaries and income from self-employment. This does not include capital gains, money borrowed, tax refunds, gifts, or lump-sum inheritances. This is problematic because many of the top wage earners also make considerable amount of their money through capital gains, and so the level of income disparity could be underrepresented. While taxes are often higher for the wealthy and could, perhaps, offset the capital gains, the omission represents a fault in the model

Results

After running preliminary regressions on the first two models, the estimated coefficient of inequality turned out to be both positive and significant.

The results, however, showed signs of autocorrelation due to the high adjusted R^2 (0.8941) and P-value of 0.000. The adjusted R^2 represents goodness of fit of the model, on a range from 0 to 1 (with 1 being a perfect fit), and the P-values determine statistical significance[4]. Autocorrelation often exists in time series data, and is representative of correlation of the error terms, which happens when the former year has an effect on the current one. The effect of autocorrelation is to under represent p-values and overestimate the adjusted R^2. In order to determine presence of autocorrelation, a Durbin-Watson test was run, and the score of .47 for model 1suggested autocorrelation was present and the efficacy of the results was overstated. The problem lies with the error term being related to the past, that formula being: $\varepsilon_t = \rho\varepsilon_{t-1} + u_t$ In order to correct for this, you must multiply (1-ρ) through the original equation.

The results after correction suggest there is a positive and significant correlation between growth in income disparity and growth in median housing values. Correcting for autocorrelation makes the model account for growth in the dependent and independent variables. The first model shows a respectable adjusted R^2 of .5011 and is significant at a 1% level (see Appendix 4, Table 1 for full results).

The second and third models were models of elasticity and, while producing similar significant signs, their levels of elasticity were different. The results from the second and third models can be seen in Appendix 4, Tables 2 and 3.

The third model shows the highest level of adjusted R^2 (0.5727), which suggests it is more useful in explaining the effect of income disparity on median housing prices in the United States. According to this model, for every percentage increase in GINI there is a subsequent 6.361% increase in the median housing values. This model was also corrected for autocorrelation

[4] Results are generally considered significant if the P-values are less than .05

and is significant at the 1% level. The third model, using bootstrapped nonparametric results, showed that while GINI had a positive, significant effect on the price of housing; it was not as profound as the aggregate level. Results from the fifty states (Appendix 3, Table 4) are listed in descending by GINI coefficient, with their elasticity coefficients and the rank of their elasticity coefficients (1 representing the highest elasticity). Observing the relationship between the rank of states' elasticities and their related suggests the model is strong. However, their elasticities are much less than the one reported in model two. Nonparametric results are less biased than parametric, so the elasticity coefficients on the state levels are likely to be more correct, especially because the data does not suffer the lack of precision that nonparametric results can have. Additionally, with the standard errors bootstrapped, the accuracy is heightened.

Even with the positive results, there could still be a problem with the model related to its level of simplicity. In using just one independent variable in the model; it is probable that an omitted variable bias exists. However, as this paper is introducing a new idea it was thought best to keep the model incredibly simple. Additional variables could be added to enhance it, but to be the first to examine the effect of income disparity on the value of homes, it is important not to dilute the model. Additional models that included either interest rates or measures of population density could prove to be valuable. Interest rates are widely considered demand drivers in the housing market, and part of the assumptions in the literature of this paper suggest areas of high population density have more volatile housing prices.

IV. Conclusion

Results from the three models conducted for this paper show that income disparity has a profound effect on the price of median housing in not only the United States, but also on a state

level. Tables one and two (see Appendix 4) show the models based on the aggregate United States data, and table three contains the state-level data. The first model uses GINI data and shows that 1 unit growth in GINI would account for a $1.44 million increase in median housing price (let it be noted that GINI only ranges from 0 to 1, so the evidence should be used on units less than 1). The second model is a double log model used to represent elasticity, suggesting that a one percentage point increase in GINI would result in an over six percent increase in median housing value.

The third model (for results see Appendix 4, Table 3) ranks states from the highest GINI coefficient to the least, the resulting elasticity of housing prices with respect to GINI, and the rank. The numbers in the rank column were given based on housing price elasticity with respect to GINI, the highest rank had the highest elasticity and the lowest rank had the lowest elasticity. This, again, is a double log model suggesting that, for example, median home values in the District of Colombia would increase 1.2 percentage points with a one percentage increase in GINI. The top three highest GINI coefficients were also the top three with the highest elasticity of housing prices. The District of Columbia, Mississippi, and Louisiana with average GINI coefficients of 0.48, 0.43, and 0.43, respectively, also had the three highest elasticities of 1.20, 1.15, and 1.14. Additionally, the two states with the lowest average GINI coefficients, New Hampshire and Wisconsin, also had the lowest elasticity of housing prices, with average GINI's of 0.34 and 0.34 and elasticities of 1.03 and 1.04. Furthermore, this adds new evidence to housing price volatility. Income disparity's effect on housing price was supposed to be limited to states in the Northeast, Texas, and California because of their already high population density and proximity to major cities (Glaeser 2004). However, this evidence suggests that income disparity may have a larger effect on the elasticity of pricing by the presence of states not located

in those areas, but with larger relative GINI. Furthermore, the graph (see Appendix 2, Chart 4) shows the data points for all fifty states and the District of Colombia, suggesting a positive correlation between the two. The non linear shape of the trend line in Chart 4 suggests that increasing income disparity may lead to exponentially increasing elasticity of median housing values.

The first model suggests an aggregate relationship between income disparity and housing prices in the United States, and the second model suggests even stronger correlation between the elasticity of housing prices with respect to the GINI coefficient. This research ties the research and theory of Kumhof and Ranciere (2011) and Miran and Sufi (2009), whose articles speak individually about the relationship between household debt levels and financial instability, and the effect of housing prices on household debt levels, respectively. The results of this paper expound on the first paper by providing an alternate reason for the increase in household debt levels, and on the second paper by providing a symptom for the increases in housing prices and the subsequent home equity-based borrowing. Syllogistically speaking, the resulting flow is such: an increase in income disparity increases the price of housing, which increases the access to, and consumption of, debt, which can reach levels that increase the probability of financial instability. Therefore, income disparity changes on an aggregate level can have large effects on the health of the economy. This research exposes income disparity as a possible underlying cause of all these negative symptoms, implying it should be subjected to more political scrutiny.

Policy Implications

Causes for the current levels of income disparity are as numerous as their theoretical solutions. Bernstein et. al. (2000) suggests income disparity growth in the 1990's was a result of

expansion in wage inequality and empirically illustrated that relative wages of the low and middle classes have either declined or stood stagnant, while wages for the wealthy have risen significantly. Reasons cited for this wage discrepancy phenomenon are: globalization, decline in the manufacturing sector, expansion of low-wage service jobs, immigration, and weakening of labor market institutions. It should be noted that the assumptions made in the Bernstein et. al. (2000) paper are theoretical, and its supporting empirical evidence is limited to discussion of income disparity; no attempt is made to create a testable function to examine the assumptions. Stock market earnings normally going to top wage earners and government policy favoring the wealthy are also factors driving income disparity that are unrelated to wage.

It is important to understand the factors that impact income disparity in order to examine the effect it can have on lowering median housing value and possibly economic instability. Bernstein et. al. (2000) suggests that a decline in the value of the federal minimum wage has contributed to wage discrepancies. The thinking being, that while many states have a higher minimum wage than the federal minimum, they normally benchmark to that level. Chart 5 (see appendix 3) supports Bernstein et. al. (2000) in showing that there was actually negative real wage growth in the 1980's and 1990's. Furthermore, this information only represents wages, which account for most of low and middle income earners' net income, but most top-earners also receive a substantial portion of their net income from capital gains. Therefore, the suggestion is that minimum wages should reflect the overall growth in total wages, which would mean the minimum wage would be related to the economy at large. A problem with this policy is that it would further hurt the manufacturing industry because it would make the United States less globally competitive for cheap labor, and therefore our cost of production (and the resultant prices) would not be competitive. This would ultimately hinder labor-intensive industries and

likely increase short-term unemployment. Policy issues concerning the welfare state also directly affect disparity issues. Bernstein et. al. (2000) suggests the decline in assistance to low-income families in regards to healthcare affordability and unemployment insurance have made it more difficult for low-income families to weather frictional unemployment. Suggestions range from longer time horizons for unemployment benefits and subsidized healthcare programs. The noticeable downside to this is increase in government expenditures and the associated changes in taxation. Taxation, however, is the hot-button issue that has the most profound and immediate effect on the redistribution of income. Its precision, however, is the reason why it is so feared to wield in the political sphere, because income redistribution efforts can be interpreted as socialist. While the federal taxing system is progressive and pro-income-redistribution, state taxation has not changed with the times. Specifically, expansions in the earned income tax credit have helped to increase the relative post-tax incomes of the lower and middle income families, where state tax laws have gone in the opposite direction. Specifically, states rely heavily on sales tax, which is a system that does not take into account different earning levels. In addition, state tax cuts normally favor those in the upper tax brackets. Ways to reform the taxation system would be progressive initiatives that, like the federal taxes, redistribute the after-tax income. This can be done by larger breaks for the poor or removing sales taxes from food items or other ‘necessary consumables”. This is obviously rife with political pressure from both political sides, but it gets especially difficult when considering the system of wealth supporting lobbyist efforts and campaign contributions. If however, states decide to be more progressive with their taxation, it may be possible to decrease the resulting income disparity. As this thesis has shown, by decreasing income disparity, or at least controlling its growth, housing values should decrease or

stabilize, which could have positive effects on financial stability of the current research on debt levels and financial fragility are correct.

Limitations of the Model

The model introduced in this paper was kept purposefully simple because of the novelty of the assumption. It could certainly be improved by increasing complexity. In supplementary models an interest rate variable was inserted, as predominant economic thought suggests it is one of the driving factors in demand for housing. After correcting for autocorrelation, the adjusted R squared was lower than it was without it, and the p-value associated with the interest rate variable was not significant. This is certainly against current economic thought, and it could represent problems with the model generated. Likewise, the fact that my nonparametric analysis showed that the elasticity related to housing prices was higher in states that were not in the northeast or coastal also defies current thought among demand drivers for housing costs. This either suggests that income disparity is a stronger driver of housing prices, or that the simplicity of the model failed to capture important variables.

Additional tests to the model would be including demand and supply drivers, especially since the data conflicted with prevailing theoretical writings on price-drivers in the housing supply market. Glaeser (2004) suggested that because location was such a demand driver for housing, houses in the Northeast, California, Texas, and other coastal states would experience more fluctuations in housing prices because of land scarcity. The land scarcity was defined more aptly as land in close proximity to locations that provide utility (cities, places of work, etc…). This prompted Glaeser (2004) to state that in Midwestern and other non-coastal areas construction costs were price drivers and supply, not demand, determined price. The research

provided in this paper suggests that levels of population density, or relative levels of population density in respect to utility-enhancing locations, has less effect on price elasticity than previously expected. It would seem the predominant driver of the elasticity would be income disparity as Mississippi, Louisiana, and New Mexico all were in the top five highest elasticity coefficients, and all of the top ten states with the highest levels of income disparity elasticity were also in the top ten for housing price elasticity. This model could obviously be improved with other variables, perhaps testing the difference between the effect of supply factors and demand factors on price levels. On a state-by-state basis this could provide information on what exactly drives prices along with income disparity, which could provide more information on the debate.

This type of modeling could also be done internationally, to see if the problem is inherently American and/or if the model is significant across different nations. Examining elasticities of income disparity and housing prices in other countries could show that other countries with high GINI coefficients could be susceptible to a more volatile housing market.

The Financial Crisis and Onwards

The advantage of the information gleaned from this thesis, in regards to debt levels, is that income disparity is much easier to control for than debt consumption, at least from a policy standpoint. In the years leading up to the financial crisis, lenders, betting on the increasing values of homes, allowed very high loan-to-value ratios, high loan-to-net-income ratios, and many loans secured on second mortgages. Likewise, with the development of complex financial instruments such as mortgage-backed securities, collateralized debt obligations, and credit default swaps, credit became very easy to get a hold of. With the ease of credit and the regulators' inability to correctly assess risk in the complicated financial instruments, debt soared to $13.8 trillion dollars

in 2007, which was 98% of GDP and 138% of disposable income (New America Foundation 2009). Even in these highly regulated industries, with the supposed 'best and brightest' minds in the world, they failed to correctly assess risk and created a global credit freeze and then recession. However, income redistribution practices can be much easier to implement than progressive regulation over all financial markets and instruments. For one, financial institutions have a very good track record of finding loopholes in regulation. Secondly, new financial instruments are being created all over the world, and their complexity makes it hard to police. Additionally, the effects of income redistribution can be seen much faster than financial regulation. Taxation policies, when passed, can immediately redistribute that year's earnings. The implication is that if income disparity was correctly controlled, the latest economic crisis may have been avoided entirely. Accessibility to debt was driven by price inflation in the most expensive asset, which was used for collateral. Income disparity was a factor in that price inflation. If volatility in prices of the most expensive asset, homes, could be controlled, it could slow down debt growth. The problem with this is that there is a tendency in the United States to regard income redistribution policies as 'anti-American' or 'socialist'. However, it is clear that wages for those in the lower and middle income earners have not grown nearly fast as others (see Chart 5). It is clear that there is disproportionate power given to the wealthy to determine the price of housing. Disparity is just another term for inequality, and it is equality that has been the cornerstone of American democracy since the Declaration of Independence.

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Appendix A

Chart 1: Mortgage Debt in the United States Since 1940

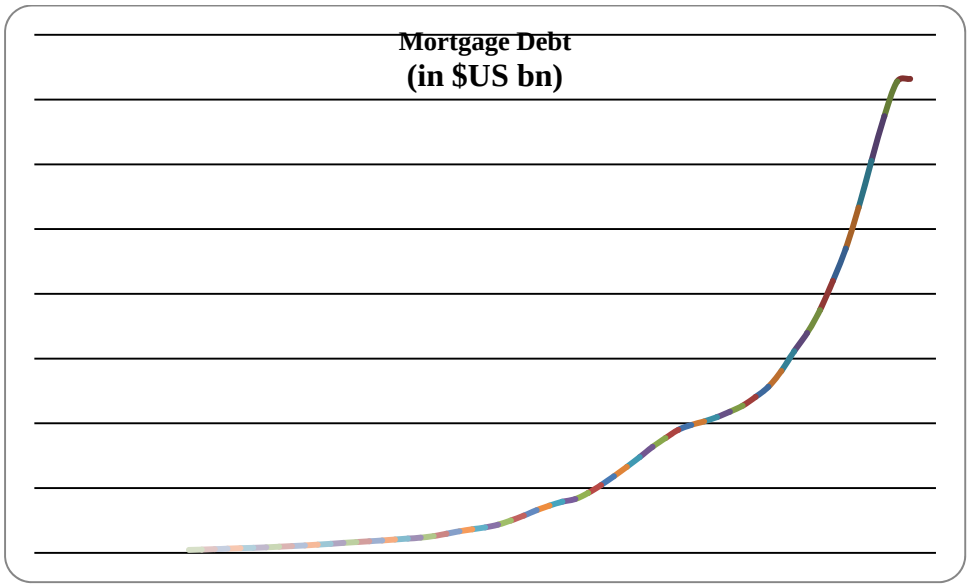
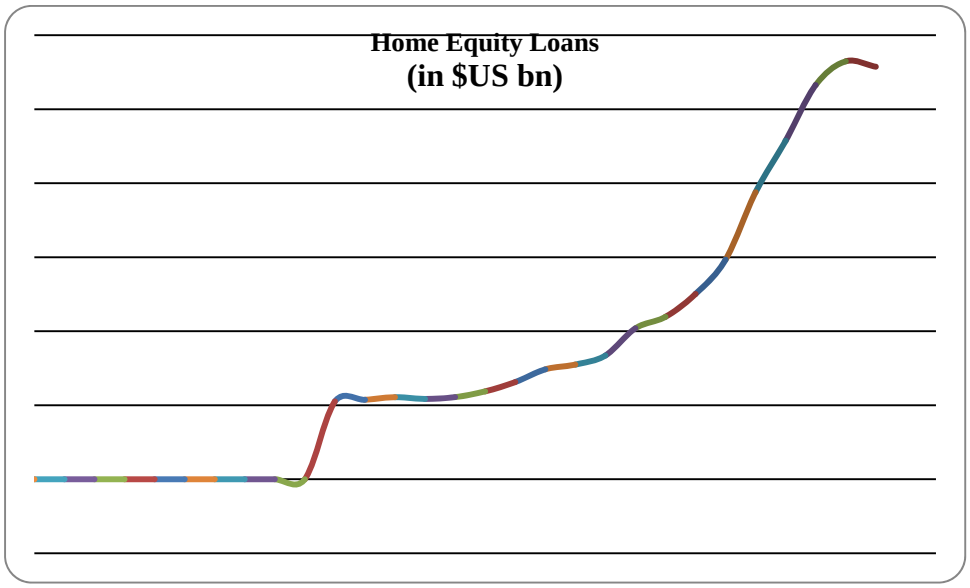


Chart 2: Home Equity Loans in the United States Since 1980



Appendix B

Chart 3: Model of the Lorenz Curve

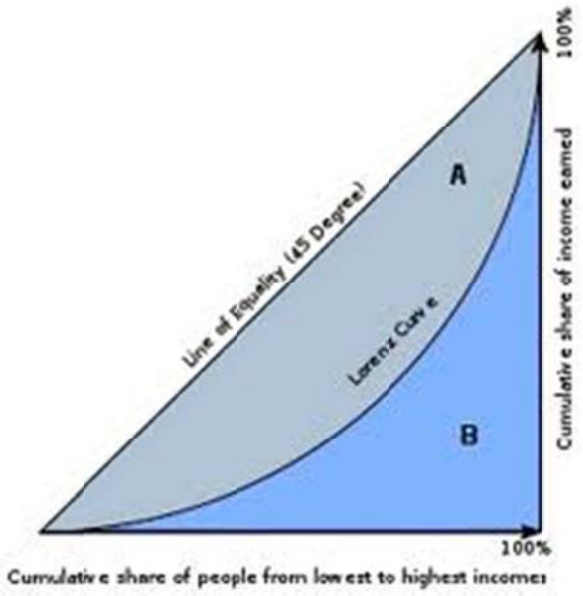
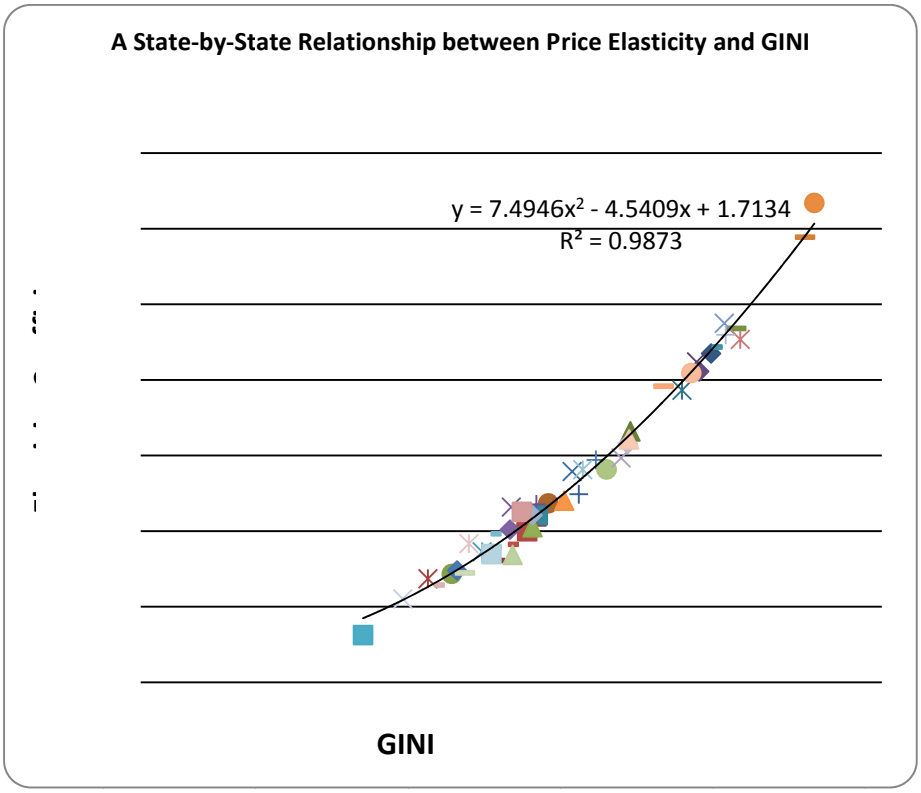


Chart 4: All the Observed Data Points for Each State's GINI and Elasticity Coefficient



Appendix C

Chart 5: Real Hourly Wages for Selected Percentiles

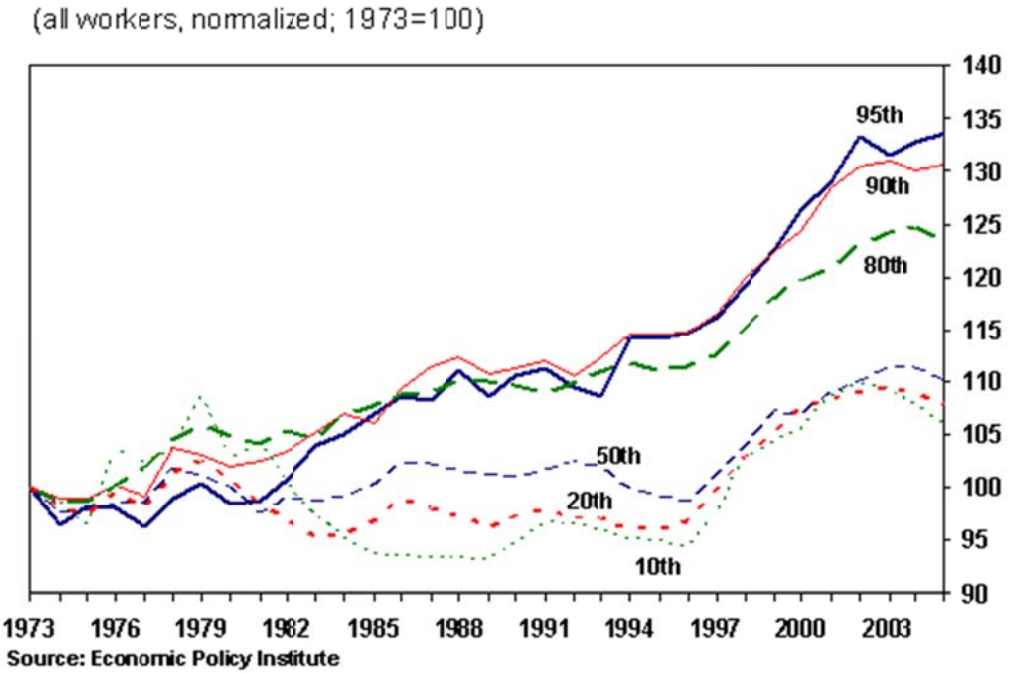
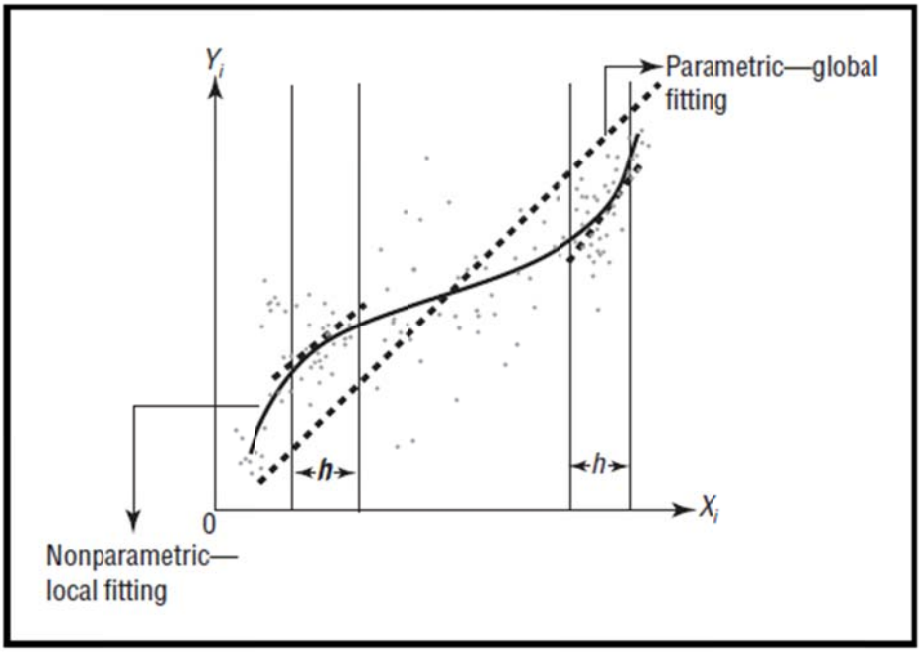


Chart 6: Model of Nonparametric Estimation



Appendix D

Table 1: Relationship between Housing Prices and Income Disparity
Dependent Variable: Housing Prices

	Coefficient	Adjusted R^2	N
Model 1	1,449,505*** (23183.90)	0.50133	42

***Denotes Significance on the 1% level
**Denotes Significance on the 5% level
*Denotes Significance on the 10% level

Table 2: Relationship between the Natural Log of Housing Prices and the Natural Log of Income Disparity
Dependent Variable: Natural Log of Housing Prices

	Coefficient	Adjusted R^2	N
Model 2	6.361*** (0.8503)	0.5727	42

***Denotes Significance on the 1% level
**Denotes Significance on the 5% level
*Denotes Significance on the 10% level

Table 3: States Listed in Descending Order of Average GINI

	Avg GINI	House Price Elasticity*	HP Elasticity Rank**
Dist of Colombia	0.4775	1.203535	1
Mississippi	0.42725	1.14681	2
Louisiana	0.4255	1.137775	3
New York	0.41325	1.11071	7
Florida	0.4125	1.11362	5
Texas	0.4105	1.111905	6
New Mexico	0.41025	1.114995	4
Kentucky	0.408	1.1087	8
Alabama	0.40775	1.106975	9
Georgia	0.4055	1.102225	11
Arkansas	0.405	1.104755	10
Tennessee	0.404	1.10183	12
California	0.40225	1.09724	14
Oklahoma	0.39875	1.09833	13
Arizona	0.3925	1.08638	15

West Virginia	0.39225	1.084265	16
Virginia	0.392	1.083085	17
South Carolina	0.39075	1.07935	18
North Carolina	0.388	1.07629	20
Missouri	0.386	1.07883	19
South Dakota	0.3835	1.07626	21
Connecticut	0.38275	1.06974	23
Illinois	0.3815	1.075755	22
New Jersey	0.38	1.06803	24
Colorado	0.377	1.067345	25
Hawaii	0.375	1.06418	31
Alaska	0.37475	1.063885	32
Kansas	0.37475	1.06707	26
Massachusetts	0.374	1.061025	34
Oregon	0.374	1.064235	30
Maryland	0.373	1.059955	36
North Dakota	0.37225	1.06507	29
Idaho	0.372	1.062075	33
Pennsylvania	0.372	1.06508	28
Rhode Island	0.37025	1.053695	43
Michigan	0.37	1.06634	27
Nevada	0.36975	1.060385	35
Montana	0.3695	1.056485	39
Delaware	0.367	1.05221	44
Ohio	0.36625	1.05928	37
Nebraska	0.36625	1.055855	40
Washington	0.36625	1.053905	42
Minnesota	0.3645	1.0545	41
Wyoming	0.362	1.056685	38
Vermont	0.36125	1.04894	46
Maine	0.35975	1.049575	45
Iowa	0.35875	1.048675	47
Utah	0.3555	1.04574	49
Indiana	0.35425	1.047375	48
Wisconsin	0.3495	1.042045	50
New Hampshire	0.342	1.032475	51

*All elasticities are significant on the 1% level, all standard errors were obtained by bootstrapping

**Rank of 1 given to highest elasticity of housing prices, rank of 51 given to least elastic.