The Impact of Income Inequality on Housing Stress in The United States

by

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This Project Report is submitted for assessment as part of the requirements of the Master of Applied Econometrics (Enhanced) at the University of Melbourne.

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Abstract

Rising income inequality is a concern throughout the world and can be seen in the rising disparity in the United States, punctuated by an increasing housing crisis. Wage stagnation has plagued the U.S. for decades, with real wages barely shifting for much of the population since the 1970s, while a small proportion reap immense benefits. Alongside this, prices for certain goods have risen at a pace which dramatically outstrips inflation, housing among them, as evidenced by the Case-Shiller U.S. National Home Price index rising 18.6% in just twelve months between September 2020 and September 2021, while CPI (Consumer Price Index) increased by 5.4% over the same period. To analyze the impact of this rising disparity, this paper will investigate the link between rising inequality and increased Housing Stress. Housing stress is a strong indicator for factors such as financial wellbeing, economic stability, and overall quality of life. It is shown that those most affected by inequality are households with an annual income between $35,000 and $49,999. Implying that rising inequality leads to increasing risk until sudden disaster may precipitate demographic crises and magnify the effects of such crises far beyond what would be realized in a more equal society.

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1. Introduction

Since 2010, income inequality has increased dramatically in the United States. Simultaneously, homeownership has been falling and Housing Stress rising, especially among young buyers, per census data. As established by Christian Dustmann et al. in “Housing Expenditure and Income Inequality” in 2021, homeownership is a key driver for wealth growth throughout an individual’s lifetime and an effective means of wealth transfer between generations. Thus, increasing rates of rentals, especially among the young and the poor, could have stark implication for future inequality. This may not only affect wealth but, even among those who own their home, could restrict opportunities for investment and education.

Due to this, the impact of inequality on home ownership and Housing Stress is of special interest to understanding long-term inequality and economic stability.

Education is expensive and is strongly correlated with income (Wolla and Sulivan, 2017). As such, diverting income from education to increasing housing expenditures may lead to more people falling into a poverty-trap from which escape is extremely difficult for both oneself and one’s descendants. As mandatory costs rise, the ability to invest in business, financial markets, or education falls, leading to a decrease in future income and wealth, generating a vicious cycle where the borderline demographic crosses into poverty. According to Parliament of Australia research (Holmes, 2013), the increase in poverty due to such a poverty-trap not only harms the poor, but reduces the productive capacity of low-income workers, decreasing output and slowing the economy as a whole. Additionally, the same work provides evidence that this would cause

economic instability as demand is reduced due to decreased spending power. This leads to government intervention to stimulate demand, which can result in increased inequality, as those who have resources are best suited to take advantage of the intervention.

For these reasons, this paper will address one critical question. What is the effect of rising inequality on Housing Stress in the United States?

To answer this question, fixed effects models analyzing the changes in housing security by income band as a seemingly unrelated regression across states will be utilized. To ensure the results are meaningful, the model likely to be the most downward biased will be utilized with other models serving as robustness checks. This ensures that whatever results are found represent the minimum impact of inequality.

2. Literature Review

This report is inspired by “Housing Expenditure and Income Inequality” by Dustmann, Fitzenberger, and Zimmermann’s 2021 work in Germany. The evolution of inequality between five income quintiles in Germany and how that impacted housing costs was studied and thus overall welfare inequality. Their findings indicated that for Germany and the control countries of the United Kingdom and the United States, housing expenditure share for renters and low-income individuals increased compared to high-income individuals, thus contributing to a rising perception of inequality.

The World Bank “World Development Report 2022: Finance for an Equitable Recovery” notes that the COVID-19 pandemic had stark effects on inequality around the globe, especially among those already disadvantaged. This trend emerged both within and between countries, with young, female, and low-education workers suffering the brunt of the loss of income. Similarly, smaller companies were impacted more substantially than large companies. According to the report, both effects likely contribute to rising inequality, of which the full impact has yet to be seen.

High inequality is linked to a variety of deleterious effects, both on an individual and systemic level. On the individual level, rising inequality contributes to worsening health and education outcomes (Anne Holmes, 2013). On the systemic level, high inequality contributes to a less resilient economy (World Bank, 2022). A major indicator of inequality, and the risks it poses, can be found in Housing Stress. A household is experiencing Housing Stress if 30% or more of their gross income is spent on housing, especially if the household is low-income (Robinson and Adams, Australian Institute of Family Studies,

2023). This metric is found in numerous bodies of research and is implicit in United States data. Households under such conditions demonstrably have poor mental health outcomes and difficulties affording necessities.

As shown by data from the Office of Policy Development and Research, PD&R (Ehrlich, McDonald, Vertz, 2023), Housing Stress can become a source of further economic hardship, especially in the wake of crisis. There was a significant rise in inequality following the 2007 global financial crisis. As much as $17 trillion of home equity may have been lost in the US. As the economy recovered, prior homeowners did not necessarily recover this lost value, especially among poorer homeowners. This recovery primarily benefited private-equity funds and investors who were positioned to take advantage of the situation. This fueled a surge in wealth inequality. Meanwhile, rising rental prices from this power disparity worsened inequality. For example, in 2022 the Dallas, Texas metro-area average household income has risen by 2.5% annually, while rental costs have risen by 4.4% annually. Those with the least disposable income were most affected by this disparity, leading to those who lost their homes due to crisis falling deeper into poverty and housing instability. These individuals, due to competition for low-priced rentals subsequently become less able to afford a home or escape poverty, reinforcing the cycle of rising inequality and housing instability: setting the stage for future disaster.

3. Rental and Housing Mechanisms in the United States

Before discussing the specific mechanisms used for measuring the effect of income inequality on Housing Stress, the rental and housing market in the United States must be understood.

In the United States, acquiring a mortgage, especially at favorable terms, can be difficult. The credit score needed for most mortgages is 620 or higher; more favorable mortgage terms are provided for higher credit scores (U.S. Bank, year unknown). The credit monitoring firm, Experian, shows 22% of individuals in the United States have a credit score at or below 620. Individuals in this demographic face higher fees and interest rates than those with higher credit scores, and 28% or more will become delinquent in their payments. Additionally, there is a positive correlation between income and credit score (Rachael et al., 2018). Those with low incomes are the most likely to have low credit scores, categorized as payment risks. Those risks are compounded by higher fees and interest rates. Considering these factors, lower-income individuals have more difficulty acquiring a mortgage and need to pay a higher monthly mortgage payment than high-income individuals for the same property.

A further consideration is that the rental market has grown increasingly predatory in the United States. The following data is all drawn from the Office of Policy Development and Research, PD&R, of the United States Department of Housing and Urban Development (Ehrlich, et al., 2023). Institutional investors play an increasing role in the rental market, especially for low price point homes, buying as much as 67% of all marketed single-family homes in some counties. In the first quarter of 2022, 28% of all single-family homes for sale were purchased by Institutional Investors. These investors prefer to buy

clusters of housing, especially single-family homes, either as a rental revenue stream or holding to resell later. Targeted neighborhoods frequently suffer from low average incomes or disrepair, but with a promise of economic expansion. As these investment groups operate at scale and can quickly acquire a large share of housing units in an area, they are able to exploit mechanisms to radically raise rental prices. Among these are the transfer of maintenance obligations onto tenants, aggressive price increases, and more aggressive eviction strategies to make space for higher-income tenants, forcing existing tenants to move further from their place of work. This type of investment is a major driver of inequality in certain regions.

The effect of high barriers to home ownership compared to renting compounded by increasing rental costs serve to increase Housing Stress. Home ownership may serve as an effective buffer against rising rental prices but depends on a financial reserve to continue to own a home despite economic shocks. Those with Housing Stress are more likely to lose their homes in the face of large shocks to the economy. As such, Housing Stress serves as an effective indicator for future economic risk which will fuel further inequality.

4. Data and Metrics

The data utilized is gathered from the *American Community Survey*, ACS, of the US Census Bureau. The ACS is an ongoing, yearly survey focused on population and housing characteristics and is utilized by the US federal government to assist in determining the allocation of funds. The state-based data also includes the District of Columbia and Puerto Rico. These are excluded as neither is a state. While the *American Community Survey* launched in 2005, yearly data is only available from 2010 onward. Additionally, 2020 data is unavailable, and the most recent year is 2022. Leaving a total of 12 years of data with fifty observations per year for a total of 600 data points to utilize at the state level. This data source was selected despite the relatively short time-horizon it provides, due to the detailed nature of its data, as well as being available at the state and county level for all counties with a population greater than 65,000. It also is significantly higher frequency data than the standard 10-year census data which makes it better-suited to addressing concerns in rapidly changing circumstances. While the *Federal Reserve Economic Database* also has high frequency data, it is not utilized as, depending on the metric, it is difficult or impossible to retrieve state level information, as data is primarily aggregated to the federal level.

The core dependent variable is Housing Stress as defined by the *Australian Institute of Health and Welfare*. This is a standard measure described as the share of households that spend more than 30% of their gross household income on housing costs. Gross household income is defined as the amount of revenue earned by all income earners over 15 years of age before subtracting taxes or other expenses. Thus, households with more income

earners could have a higher household income even if these individuals have low incomes. Housing Stress can be further altered to include only households within a certain income range, usually those in the bottom 40% of income earners. This alteration is commonly utilized as it is believed those in the remaining 60% of the population are likely not under undue financial strain even assuming they spend the same share of their income on housing owing to increased spending power.

Being a proportion of the population, Housing Stress is measured between 0 and 1. Housing Stress serves an indicator for other risk factors, such as general financial strain, an increased chance to become homeless, increased risk for poor physical and mental health, and a general decline in quality of life (Okan Caliyurt, 2022). As Housing Stress is tied to other measures of financial stability, Steven Rowley and Rachel Ong in *Housing affordability, housing stress and household wellbeing in Australia* from 2012 suggest that while Housing Stress alone may not be indicative of financial problems, there is a strong correlation between Housing Stress and financial difficulty, implying it is best used as a risk metric. The World Bank in 2022 suggests that inequality and lack of purchasing power, such as may be associated with a large share of income going to housing, harms the overall economy, not just those suffering from lack of purchasing power. Societal effects include decreased expenditure on other necessities and luxuries due to a lack of financial freedom, which could lead to economic slowdown and reduced ability to recover from financial hardship. It may also lead to reduced productive capacity as those individuals who are the least housing secure are more likely to be forced to live far from their place of work.

In this analysis, only homeowners, those who own their home with or without a mortgage, will be investigated. Renters are excluded, as part of the motivation for this analysis is the risk of homeowners losing their homes, potentially affecting future wealth. This selection criterion introduces potential downward bias. It is possible those who lose their homes become renters under Housing Stress which is not captured. Those who lose their homes due to financial difficulties are likely forced to quickly find nearby accommodations regardless of price. This, combined with relative elasticity of rental prices, would be especially impactful in areas where rentals are in high demand, leading to areas with high levels of Housing Stress also having increased rental prices in the wake of a decline in homeownership.

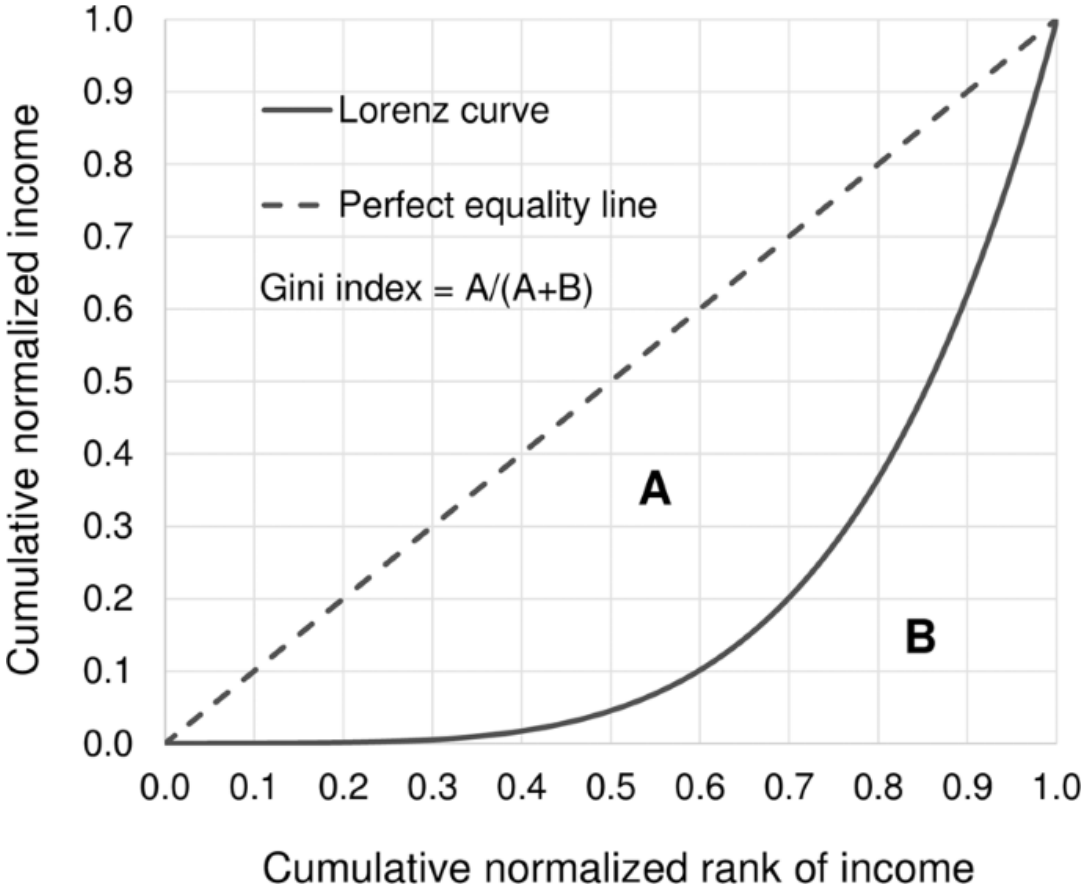
As a robustness check to determine if there is a significant change in the number of homeowners, the share of homeowners will be utilized. Even if the results of the main regression indicate there is a decline in the number of homeowners suffering from Housing Stress, it is possible that that is due to high-risk individuals losing their homes which would be reflected by a decrease in homeownership. Due to a lack of data on homelessness, the homeownership rate is measured as the number of homeowners divided by the number of homeowners plus renters.

Three methods of calculating income inequality will be utilized: the Gini coefficient, the 20/20 income ratio, and the 20/5 income ratio.

The Gini coefficient is a summary statistic of how equitable income distribution is compared to a hypothetical perfect distribution. According to Thititihep Sitthiyor and Kanyarat Holasut in “A Simple Method for Measuring Inequality”, “the Gini index can be calculated as the ratio of the area between

the perfect equality line and the Lorenz curve (*A*) divided by the total area under the perfect equality line (*A* + *B*).” This can be seen graphically in figure 1, taken from the same paper.

Figure 1



In effect, this creates a 0 to 1 measure with 0 representing perfect equality, while 1 represents perfect inequality. In practice, this measure is often multiplied by 100 for better readability. This alteration will be used in all future calculations. For reference, as of 2020, the country with the highest Gini coefficient is South Africa at 62.73 and the country with the lowest is Azerbaijan at 22.45 (Statista, 2020). State level Gini is provided directly by the *American Community Survey*.

One limitation of the Gini coefficient is that a single coefficient can represent a wide number of different income distributions, as such its primary use is in checking the effects of inequality, regardless of any specifics of the distribution. Additionally, it does not account for overall prosperity, only how the income is distributed amongst the population. A society with a higher Gini coefficient may enjoy a higher overall standard of living than one with a relatively lower Gini coefficient that has fewer resources. Another potential threat to interpretation is that the Gini coefficient is difficult to meaningfully interpret directly. It cannot be said what, exactly, is meant by an increase in the Gini coefficient from 44 to 45 other than some form of increase in inequality. Thus, it is better suited to being an indicator of if there is an effect than indicating anything specific about the magnitude of the effect.

The 20/20 and 20/5 income ratios are calculated similarly. The 20/20 income ratio is the annual income of the highest income quintile divided by the annual income of the lowest income quintile. The 20/5 income ratio is the annual income of the highest five percent of earners divided by the annual income of the lowest income quintile. Each of these are measured for each state independently. As incomes across states can vary wildly, this ensures that the coefficient estimates do not inadvertently capture simple differences between states. This provides two explicit measures of key types of income inequality. The advantage of this method is that there is no need to chain income to a specific year so long as the same year value is used for both parts of the calculation. Additionally, compared to a simple income gap measurement, it allows for the same size of income gap to have a variable effect. As an example, if the top quintile earns $100,000 per year and the

bottom quintile earns $10,000 per year, the 20/20 income ratio would be 10: the top quintile earns ten times as much as the bottom quintile. Meanwhile, a simple income gap measure would show an income gap of $90,000. However, if we then assume real income increases by $1,000 for each quintile, to $101,000 and $11,000 respectively, the 20/20 income ratio decreases to 9.18 while the income gap remains at $90,000. Clearly, the two groups are not affected in the same way despite both of their incomes rising by an equal amount. For those in the bottom quintile this represents a 10% increase in income while for those in the top quintile it represents a 1% increase. By utilizing the income ratio, this variable effect can be captured. The cost of this is that the results are less intuitively interpretable. However, interpretation is not unduly difficult, a one-unit increase is the multiplier increasing. In the above example, a one-unit increase would be the income ratio increasing from 10 to 11. Thus, holding all other factors constant, the income of the top quintile has now increased by the income of the bottom quintile. This fails to capture the effects of inequality between other income bands, for example the second quintile compared to the top quintile. Capturing the effects of other inequality distributions is the purpose of including the Gini coefficient as one of the key independent variables.

The log of the income gap between the first and fifth quintile, as well as the first quintile and top 5 percent of earners will be utilized as a further robustness check. This is to ensure there is no significant difference between the two as that may be indicative of one or the other being ill-suited as a unit of analysis.

As additional controls, the housing to working age population ratio, unemployment rate, mean household size of owners, and mean household size

of renters will be utilized. The housing to working age population ratio can be directly calculated by dividing the number of housing units by the population between 18 and 65 years of age. This is done to exclude children and dependents who could not work, as well as those who are likely to have retired. While the over 65 population still consumes housing, they are more likely to live in care facilities or share housing with younger family members. This housing share metric is utilized as it is reasonable to assume that a low supply of housing stock relative to the overall population would naturally lead to higher housing prices, and thus less ability to afford housing, regardless of other factors. Unemployment rate, logically, could impact both Housing Stress and homeownership. According to the Federal Reserve Bank of St. Louis 2021, up to 52% of married households are dual income. Due to many households having more than one income earner, a high unemployment rate could reduce household income, thus leading to Housing Stress not associated directly with a change in inequality. This may have a greater effect on earners in the lowest income quintiles more due to decreased ability to deal with income shocks. Household size is accounted for separately for renters and homeowners. It is unclear what the relationship between household size and Housing Stress is as there are multiple effects that pull in contradictory directions. It is possible that larger households generally have more workers, increasing household income, but it is also possible that larger households indicate large family sizes where more housing is necessary but there are not more income earners. Equivalized household income characteristics are not available. As such it is impossible to tell with certainty which direction the effect of household size is likely to fall.

Interaction terms will also be included as it is likely that the magnitude of effects have changed to an extent in 2021 and 2022. It is well acknowledged that COVID-19 had a dramatic impact on the global economy and overall inequality (World Development Report 2022, 2022). Given the unprecedented nature of the pandemic, it likely also resulted in a high-volatility period as existing systems scrambled to adapt, and possible fundamental changes were made to the economy. As such, all measures of inequality, as well as the effects of unemployment, will be allowed to have their impacts fluctuate in the period after the beginning of COVID-19. Additionally, a chi-squared test will be run on the inequality measure without interaction added to those with interaction as it is possible that there are only effects after COVID-19. These effects may otherwise be obscured as the interaction effect only captures the size of the shift compared to the pre-COVID-19 period, not the overall effect after the beginning of COVID-19. An additional control group will be included where 2021 and 2022 are excluded as it is possible that COVID-19 had impacts which are not adequately captured by existing interaction terms.

Finally, year and state fixed effects will be utilized to control for other factors that could affect the regression results. Year fixed effects are included to account for changes which affect all states approximately equally, such as changes in federal policy or the business cycle. State fixed effects are utilized to account for discrepancies due to different state characteristics, such as housing price differences, state level policy, effects stemming from overall size, and so on. A key facet of this analysis is the assumption that state policy rarely changes and that the majority of the change will be captured by the control variables, anything not captured therein will go into the error term. The effect is

uncertain as this could lead results to be either upward or downward bias, such effects are believed to be minor. As the data utilized comes from 2010 onward, just after the Global Financial Crisis, and then includes data from 2021 and 2022, after the beginning of the COVID-19 pandemic, it is expected that there will be some strong year effects which could confound the results if not accounted for. The United States consists of fifty states, each with their own sets of laws, population characteristics, and economic circumstances. This must be accounted for to obtain accurate results. There is the possibility for bias if, for example, California and Arkansas are compared directly without accounting for how different the two states are on a fundamental level with large differences in size, mean incomes, and political climate.

5. Key Summary Statistics

The United States is divided into four major regions containing a total of 50 states, the Northeast, Midwest, South, and West. Each state falls into exactly one of these regions as defined by the United States Census Bureau. As the District of Columbia is not a state, it is excluded from the dataset. Nominally, it falls in the southern part of the United States but is likely to confound the results. Puerto Rico is excluded for similar reasons. While it is a U.S. territory and not a state, data for Puerto Rico is oftentimes included alongside state data in the Census database.

According to the Bureau of Labor Statistics as of 2022 an estimated 83.4 million households owned a home, either mortgaged or unmortgaged. Of these households, 7.5% had a total household income of less than $20,000 annually; 8.97% had an income between $20,000 and $34,999 annually; 9.67% between $35,000 and $49,999 annually; 16.24% between $50,000 and $74,999 annually; and the remaining 56.72% had a total household income greater than $75,000 annually. While the majority of households earn more than $75,000 annually, there remains a significant share of homeowners in all other income brackets, with a combined 44.38% of households earning less than $75,000 annually.

Due to income data not being reliably available for below the state level, and state incomes being shown only in quintiles or through the number of individuals who fall within a given income band, precise distribution of incomes cannot be discussed. However, some general inferences can be made. According to Figure 2, the first income quintile, those in the bottom 20% of the

income distribution, is only slightly above $20,000 when chained to 2010 dollars, and in the South it is lower.

While wages have increased for the bottom quintile, they have increased dramatically more for the top quintile. In 2010, the mean wage for the bottom quintile by state, not accounting for population differences, was $11,667 USD, by 2022 it had risen by close to 80% to $20,895. During that same period, the mean wage for the top quintile rose by 104% from $160,767 to $328,732. Increasing both the relative share of income for the top quintile, as well as increasing the income gap from $149,100 to $307,837.

Figure 2

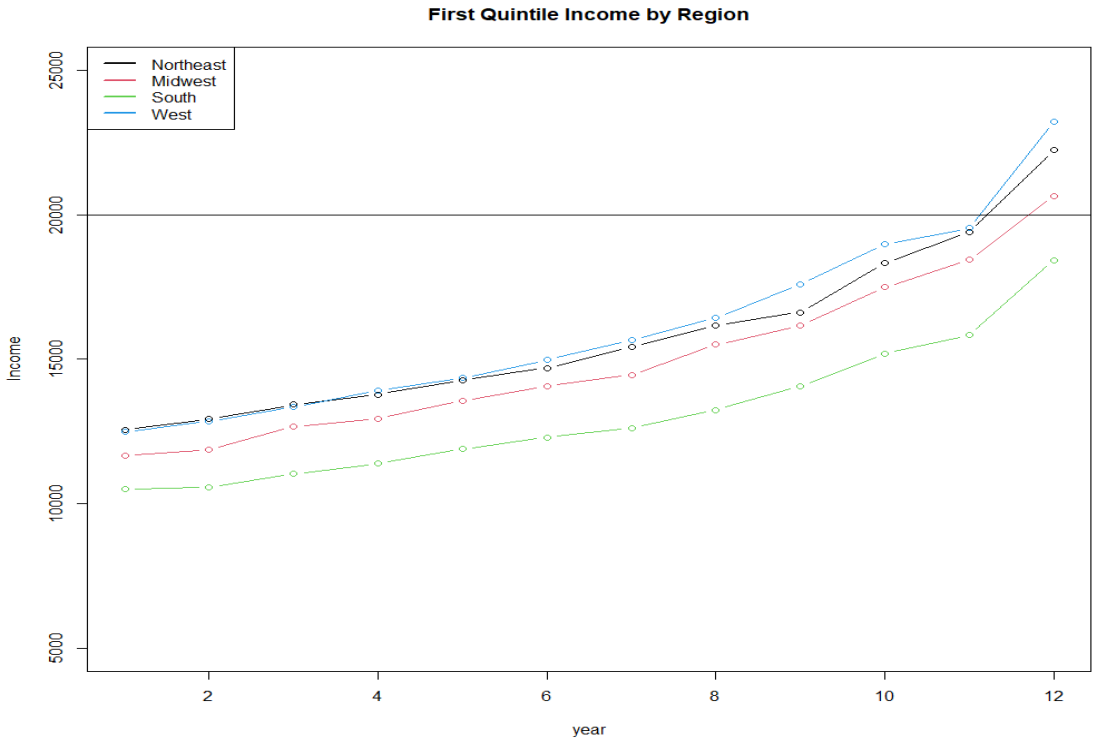
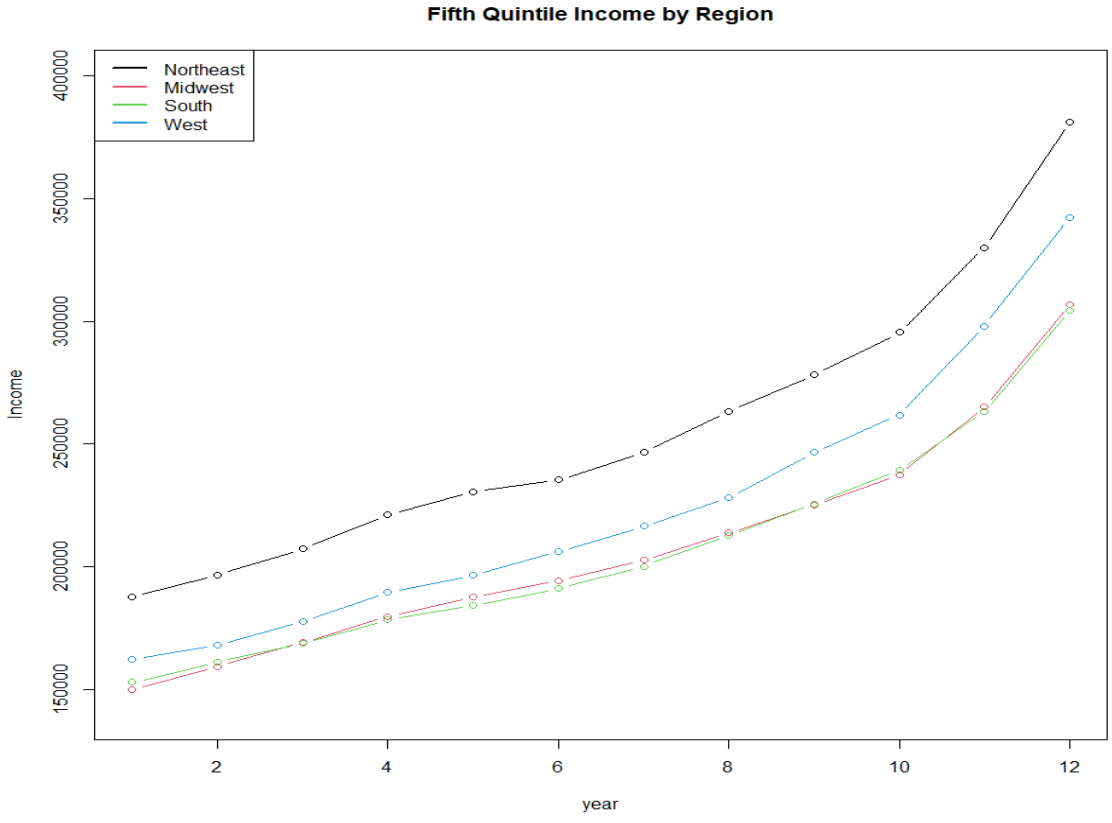


Figure 3



As can be seen in table 1B, based on the Gini coefficient, the Midwest and West are somewhat more equal than the Northeast and South. However, in all cases, the Gini coefficient has risen drastically throughout the period, especially in 2021 and 2022 during which it rose by an average of 7.0897 points compared to 2019, and 15.678 points since the beginning of the sample in 2010.

Tables 2B and 3B bear out comparable results to table 1B. The Midwest and West experience a generally lower level of inequality than the Northeast and the South, though all have experienced an upward trend in inequality for the 20/20 income ratio. This shows that, in spite of rising income among the first quintile, inequality has also been rising.

The 20/5 income ratio has fallen in all regions, indicating that the incomes of the lowest and highest earners have become more equal. Combined, tables 2 and 3 indicate that income among the top 5% of earners has stagnated relatively, but the remainder of the top income quintile has enjoyed an increase in income.

Table 4, against the expected results, indicates that Housing Stress has been falling overall, having decreased by nearly 9% in the Northeast. However, this includes all households, including those which have likely enjoyed the benefits of rising inequality. Additionally, a jump in Housing Stress can be observed in 2021 compared to 2019, indicating an impact on stress after the beginning of COVID-19.

After excluding households that make more than $50,000 USD annually, the picture changes. As shown in table 5, every region shows an increase in Housing Stress over time. This indicates that while Housing Stress may have

declined, those at the lower ends of income have not only not been seeing these benefits but have become less housing secure. This indicates that there is perhaps a causal link between greater levels of inequality and increased Housing Stress for the poor. An expected result since greater inequality would naturally harm those with the lowest incomes.

Figure 4

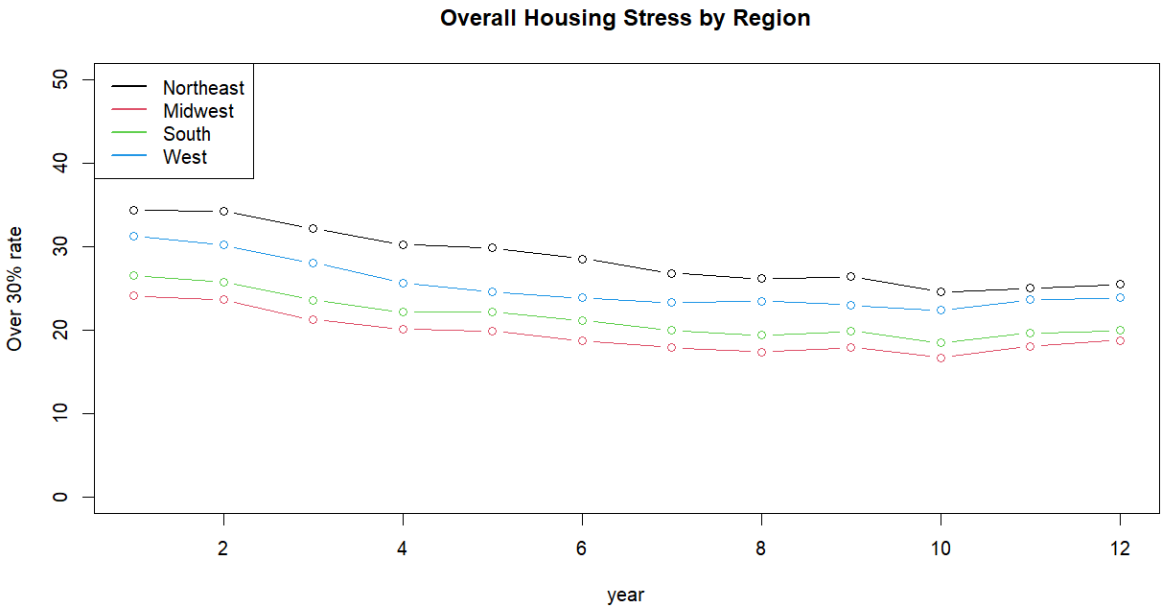
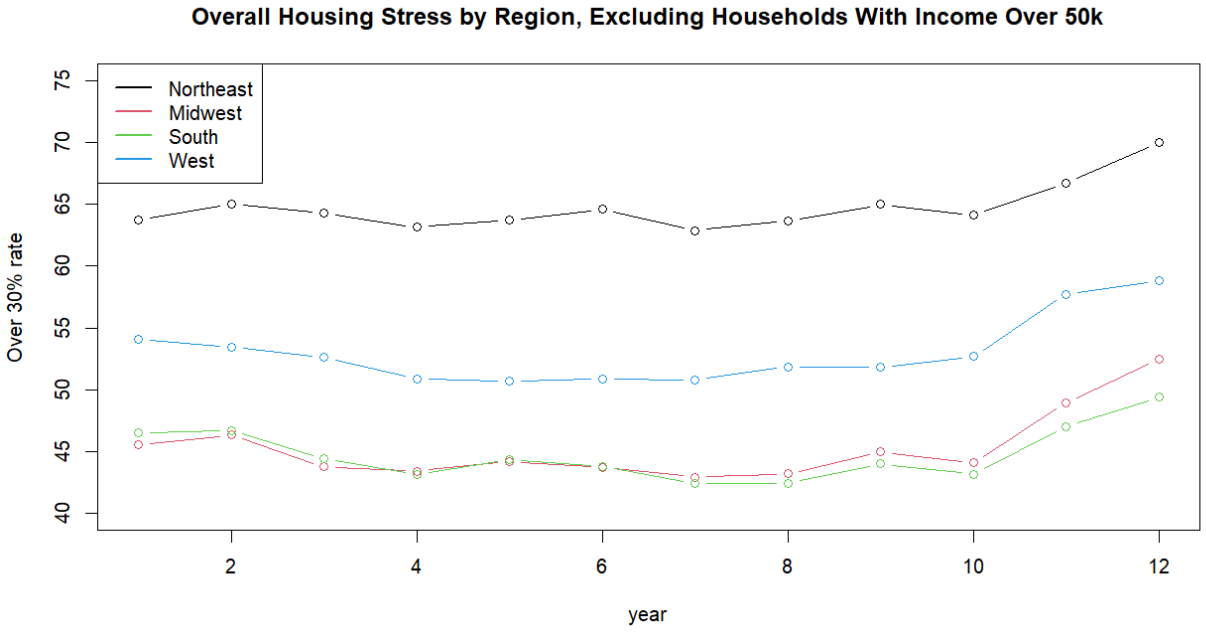


Figure 5



6. Methodology

The linear regressions are for the equation:

(1) $Hstress_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 I_{it} * C_{it} + \beta_3 U_{it} * C_{it} + \boldsymbol{X}'_{it}\gamma + Year_t + S_i + \varepsilon_{it}$

Where $Hstress_{it}$ is the percent of households suffering from Housing Stress in state i at time t, I_{it} is the inequality measure utilized, $I*C_{it}$ is the inequality measure utilized with a check included for the period after COVID-19 began, $U_{it}*C_{it}$ represent the interaction of unemployment rate with the COVID-19 period, $\boldsymbol{X}'_{it}$ is a vector of other covariates, as described in Data and Metrics, $Year_t$ are year fixed effects, S_i are state fixed effects, and ε_{it} is a random error term. The coefficient of interest throughout this paper is β_1, the effect of inequality on Housing Stress. β_2 is of lesser interest as it still captures the effects of inequality but is potentially muddied by the effects of COVID-19.

Three measures of inequality are utilized, the Gini Coefficient, the 20/20 Income Ratio, and the 20/5 Income Ratio. Each of these will be utilized in separate regressions. This is to account for variation in effects that may be found when utilizing different measures of inequality.

The remaining covariates, owner household size, renter household size, the ratio of housing to working age population, and civilian unemployment rate, are used to capture other significant factors that may influence Housing Stress.

As it would be exceedingly difficult to accurately assess changes in state policy, policy is ignored and accounted for by state fixed effects. Federal level changes will be captured utilizing year fixed effects as they would be sweeping changes. Differences in average housing price by state are also accounted for by state fixed effects.

Similarly, crises like COVID-19 are captured with year fixed effects. While they may affect different states differently, it is presumed that these effects will be captured by a combination of year effects and accounting for other metrics which may change as a result at the state level, such as a decline in employment level or an increase in inequality. Due to the likelihood of structural changes in the wake of the COVID-19 pandemic, additional interaction terms are included for after the beginning of the pandemic, 2021 and 2022. This term is interacted with both the inequality measure, as well as civilian unemployment rate. This allows for the effect of both of these terms to vary in the wake of COVID-19.

As there is likely to be heterogeneity, multiple regressions focusing on distinct parts of the population will be utilized. This is sensible as those in the top income quintiles are likely beneficiaries of inequality and thus less likely to be under Housing Stress as their incomes rise, while those in the lowest income quantiles are likely to be significantly affected. For this reason, a seemingly unrelated regression, SUR, model will be utilized.

A SUR model is utilized when there are several linear equations where it is estimated that there is some correlation in the error terms. This model utilizes multiple linear equations which can contain either identical explanatory variables, different explanatory variables, or some combination of the two. The key is that each linear equation is a complete regression in its own right and can be estimated independently. While equation-by-equation estimation using OLS is consistent, it is generally not as efficient as the SUR model which generates a variance-covariance matrix to capture the relationship in error terms between the regressions. In the case of the exact same right-hand-side

explanatory variables between all equations, the OLS and SUR models are equivalent. In this case, the advantage of the SUR model is that it can support or refute the idea of there being an inverse relationship between the Housing Stress of the low- and high-income groups. This is done by allowing there to be correlation between incomes, with an increased income for the top earners, likely coming from a decreased income for the lowest earners.

At least one group must be excluded otherwise the shares would total to one, meaning at least one of the systems is undefined due to perfect multicollinearity. Due to the share of households earning less than $20,000 per year under Housing Stress being close to 1, or the entirety of the sample, with 97% of households with a mortgage and 56.8% of those without a mortgage under Housing Stress, this group will be omitted.

One possible concern with the SUR model being run only on homeowners, excluding renters and the homeless from the sample, is that there may be downward bias on the effects of Housing Stress due to sample selection and individuals falling out of the sample. In theory, those most likely to stop owning a home, thus leaving the sample, are those under the greatest degree of Housing Stress. This would introduce downward bias as the share of the population which owns homes under Housing Stress may be mitigated by this effect or even show a negative correlation if enough fall out of the sample. To attempt to test for the significance of this downward bias, a simple regression utilizing the same covariates on the percentage of households who own a home will be conducted. If this shows significant and meaningful correlation with any of the measures of inequality, it indicates that the key results are likely downward biased due to this sample selection issue.

7. Results

Table 6: Housing Stress Error Correlation Matrix When Using 20/20 Income Ratio

	$75,000+	$50,000-$74,999	$35,000-$49,999	$20,000-$34,999
$75,000+	1	0.5572	0.1453	-0.0369
$50,000-$74,999	0.5572	1	0.302	0.1511
$35,000-$49,999	0.1453	0.302	1	0.283
$20,000-$34,999	-0.0369	0.1511	0.283	1

Table 6 shows the correlation matrix between the error terms of the income bands using the 20/20 income ratio. Most of the groups show a positive correlation. This is sensible as most effects that would increase or decrease Housing Stress would be expected to cause a shift in a similar direction throughout the economy. For example, a general change in home prices or taxation would cause all homeowners to experience an increase or decrease of Housing Stress, with the primary difference being in magnitude based on where the change is focused. However, for the highest and lowest income groups, the error terms are negatively correlated.

In Table 7, the results for the analysis of the 20/20 Income Ratio are shown. The primary changes are found in column 1, the over $75,000 annual Household Income band, and column 2, the $35,000 to $49,999 annual Household Income band. As the 20/20 income ratio is a ratio, the coefficients are interpreted as an increase in the income of the top quintile equal to the income of the bottom quintile, holding all else constant. This one-unit change results in a 0.253 percentage point decrease in the share of households under Housing Stress among those which earn over $75,000 annually. A small effect overall, but that still corresponds to a change of almost 120,000 households. Of those in the lower income ranges, only those households which earn between $35,000 and $49,999 annually show a significant effect. In the pre-COVID-19

period the effect is a 0.604 percentage point decrease. In 2021 and 2022 the effect changed to an increase in Housing Stress of 0.963 percentage points per one unit increase in the 20/20 Income Ratio. Column 4 shows some possible effect at the 90% confidence level, a 0.348 percentage point increase in Housing Stress given a 1 unit increase in the 20/20 income ratio. However, this fails to meet the standard 95% confidence level.

Heterogeneity is supported by conducting a chi-squared test against the null hypothesis that the coefficient of the 20/20 Income Ratio is identical for all income bands. The test results indicate that, with a p-value of 0.00001, at greater than the 99.9% confidence level, the coefficients are not identical. Additional chi-squared tests do not detect any significant coefficients when combining the base income ratio effects with the change after the beginning of COVID-19.

Table 7

Panel A: 20/20 Income Ratio, Housing Stress Robust

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
20/20 Income Ratio	-0.253***	-0.176	0.604***	0.348*
	(0.089)	(0.172)	(0.172)	(0.177)
20/20 Income Ratio Covid	-0.059	-0.114	0.359**	-0.059
	(0.069)	(0.131)	(0.153)	(0.189)
Housing to Population Ratio	0.261***	-0.033	-0.086	-0.173
	(0.056)	(0.114)	(0.120)	(0.135)
Unemployment Rate	0.448***	0.996***	1.149***	0.770***
	(0.071)	(0.119)	(0.128)	(0.165)
Unemployment Rate Covid	-0.330***	-0.556*	-1.088***	-0.433
	(0.119)	(0.287)	(0.277)	(0.368)
Constant	-22.713***	-16.013	9.256	35.880*
	(6.416)	(15.360)	(16.032)	(19.848)
Observations	600	600	600	600
R2	0.954	0.977	0.978	0.974
Adjusted R2	0.954	0.975	0.976	0.970

Residual Std. Error (df = 532)	1.014	1.893	1.901	2.168
F Statistic (df = 67; 532)	165.936***	344.022***	358.493***	294.672***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01

When investigating the 20/5 income ratio, table 2C, only column 3, the $35,000 to $49,999 household income band, shows any effect. The effect is muted to a 0.277 percentage point increase before COVID-19 and a 0.567 percentage point increase after the beginning of the pandemic. The correlation matrix in table 1C bears out similar results to those found in table 6, with closer income ranges having more strongly correlated error terms and a negative correlation between the highest and lowest income ranges. The chi-squared test with null hypothesis that all of the coefficients of the 20/5 Income Ratio are identical rejects the null hypothesis with a p-value of 0.0035, providing more support for there being heterogeneity. Additional chi-squared tests do not detect any significant coefficients when combining the base income ratio effects with the change after the beginning of COVID-19.

Lastly, the effect of general inequality as measured by the Gini Coefficient in table 4C shows simlar results to the measures above, with only column 3 returning significant results for the effect on inequality on Housing Stress. The coefficients here are not directly comparable to those above, but bear out much the same results. Column 3 shows that a one point increase in the Gini Coefficient results in a 0.593 percentage point increase in the share of households in that income range experieincing Housing Stress in the pre-COVID-19 period, and a 0.966 percentage point increase after the beginning of COVID-19. A chi-squared test with the null hypothesis that all of the coefficients

of the Gini coefficient are identical rejects the null hypothesis with a p-value of 0.00002. Additional chi-squared tests do not detect any significant coefficients when combining the base income ratio effects with the change after the beginning of COVID-19.

The first robustness check of log income gap as shown in tables 5C and 6C supports a stronger relationship between inequality and Housing Stress than is found in the main regression. A significant effect is shown at the 1% level for every income band above $35,000. A 1% increase in the log of the 20/20 income gap indicates a 0.064 percentage point increase in Housing Stress for those households making more than $75,000, a 0.139 percentage point increase in Housing Stress for those making between $50,000 and $74,999 and a 0.132 percentage point increase in Housing Stress for those making between $35,000 and $49,999. The 20/5 income gap shows a similar level of significance, though of lesser magnitude. For the same groups at the 1% level a 1% increase in log inequality increases Housing Stress by 0.044, 0.07, and 0.086 percentage points, respectively. This indicates that there is an effect on Housing Stress as a result of unemployment.

The second robustness check conducted on only the pre-COVID-19 data as shown in tables 7C, 8C, and 9C returns comparable results to tables 7, 2C, and 4C both in terms of coefficients and overall significance level. The primary difference is that table 9C suggests a significant negative relationship between inequality as measured by the Gini coefficient and Housing Stress for the above $75,000 income band.

The final robustness check in table 8 shows the influence of all covariates on the percentage of households who are homeowners. The inequality coefficients in the pre-COVID-19 period are not significant. However, even after accounting for year effects, all measures of inequality show a significant negative impact on homeowners after the onset of COVID-19. The positive coefficients for unemployment are likely due to stimulus payments and other measures to lessen the impact of unemployment. The significant impact of inequality indicates that there was likely attrition from the sample in 2021 and 2022, leading to those estimates being downward biased.

Table 8

Ownership Robustness Check

Dependent Variable is Percentage of the Population Who Are Homeowners			
	20/20 Income Ratio (1)	20/5 Income Ratio (2)	Gini Coefficient (3)
20/20 Income Ratio	-0.065		
	(0.063)		
20/20 Income Ratio Covid	-0.251***		
	(0.049)		
20/5 Income Ratio		0.02	
		(0.033)	
20/5 Income Ratio Covid		-0.158***	
		(0.027)	
Gini*100			-0.065
			(0.065)
Gini*100 Covid			-0.248***
			(0.047)
Housing to Population Ratio	-0.016	-0.036	-0.027
	(0.049)	(0.049)	(0.048)
civil.unemployment.rate	-0.078	-0.082	-0.089*
	(0.052)	(0.052)	(0.051)
civil.unemployment.rate.p.covid	0.553***	0.515***	0.497***
	(0.111)	(0.102)	(0.099)
Constant	70.120***	70.172***	72.121***
	(6.992)	(6.872)	(6.908)
Observations	600	600	600
R2	0.976	0.976	0.976
Adjusted R2	0.973	0.972	0.973
Residual Std. Error (df = 532)	0.729	0.73	0.726
F Statistic (df = 67; 532)	317.511***	316.580***	320.738***

Note: Each column is for one key inequality measure

*p<0.1; **p<0.05; ***p<0.01

While a county level robustness check would be ideal, due to missing data it is unable to be done with the original regression parameters. From a total of 9,576 observations for counties that appear every year, only 9,080 of these include the data necessary to compute the dependent variables. Of these, 7,980 are missing data for household size and housing to working age population and 3,231 do not contain the unemployment rate. As these appear to be missing for all counties in certain years with no discernable pattern, a meaningful robustness check with county data is impossible.

8. Extension

The models presented in this paper lack significant explanatory power as all relationships shown are relational, causality is not definitively established. It is possible some third factor impacts both inequality and Housing Stress in a way not captured by the model. Due to this, missing 2020 data, and data coming from a relatively brief time horizon, the results shown cannot be used for strict statistical inference. They can, however, be utilized for prediction and as such are potentially useful in guiding future policy. They are incapable of capturing long-term trend or cyclical effects, such as effects related to the business cycle. As such, to build a full statistical model, data for more periods is required. For a similar reason, the effects of inequality on Housing Stress for the lowest income individuals may be highly significant. The baseline share under Housing Stress at the start of the sample period was so high that it was impossible to capture this effect. Both of these could potentially be addressed via data spanning a longer time horizon. Other measures of inequality may also be well suited to capturing other facets of inequality not investigated here, such as the possibility that rather than inequality within a state being the most important, that the inequality between a state and its neighbors is of interest. Or the possibility that the level of urbanization is a significant factor in determining Housing Stress and that more highly urbanized areas tend to have higher incomes, thus a higher gap in absolute terms is expected.

9. Conclusion

Steadily rising inequality does not seem to have a significant impact on homeownership but does have an impact on Housing Stress for certain incomes. It is possible that inequality rather makes households more vulnerable to significant economic shocks. While rising inequality may not make a household lose their home on its own, it makes them more vulnerable to shocks. And then due to that inequality, they become less able to financially recover.

It is important to note that the described relationship is relational, not causal. Due to a lack of a micro level dataset and controls for policy, no direct causal link can be safely established as inequality results from a combination of factors. However, the results can be used to show that there is a link between inequality and Housing Stress. Additionally, the change in homeownership rate supports the theory that, while the effects of Housing Stress may not immediately manifest in a striking way, there is a possibility that increased inequality renders individuals more likely to lose their homes in the event of a major economic shock. At present, the group most under threat from rising inequality, by all metrics utilized, are those households which earn between $35,000 and $49,999 annually. As inequality continues to rise, it could leave a rising share of lower middle-class households vulnerable to losing their homes. Besides a decreasing quality of life, this could lead to an overall less resilient economy and slowed economic growth. As the economy is highly interconnected with effects on one demographic rippling to affect others, such

as decreased productivity or lack of purchasing power leading to a slowdown in growth for certain sectors of the economy. For this reason, it is important for governments to consider not only the immediate effects of inequality, but to consider how it could make the country increasingly vulnerable to negative shocks and slow the rate of recovery in the wake of these shocks.

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11. Appendices

Appendix A: Regions

Northeast — Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont

Midwest — Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Noth Dakota, Ohio, South Dakota, Wisconsin

South — Alabama, Arkansas, Delaware, Florida, Georgia, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia

West — Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming

Appendix B: Summary Statistics

Table 1B

Gini Mean and Standard Deviation by Region by Year					
Gini, Northeast			Gini, Midwest		
Year	Mean	SD	Year	Mean	SD
2010	46.2	2.3617	2010	44.2667	1.1444
2011	47.2411	2.3783	2011	45.6153	1.2451
2012	48.7533	2.514	2012	47.0699	1.4079
2013	50.481	2.4336	2013	48.4902	1.2752
2014	51.277	2.6384	2014	49.1635	1.3417
2015	50.9372	2.68	2015	49.2348	1.3831
2016	51.6064	2.6814	2016	49.9534	1.2051
2017	53.121	2.6546	2017	50.9423	1.385
2018	54.4418	2.6185	2018	52.2452	1.511
2019	54.869	2.9331	2019	52.6447	1.5651
2021	57.4427	2.9043	2021	55.3648	1.356
2022	62.0005	3.3508	2022	60.0442	1.3143

Gini, South			Gini, West		
Year	Mean	SD	Year	Mean	SD
2010	46.1875	1.0475	2010	44.2308	1.6595
2011	47.6767	1.1811	2011	45.2044	2.426
2012	49.1302	1.4094	2012	46.7426	2.1378
2013	50.3124	1.1607	2013	48.0124	2.5055
2014	50.9785	1.3039	2014	48.8086	2.2598
2015	51.1365	1.2278	2015	49.0908	2.007
2016	51.9373	1.3443	2016	49.6025	2.3834
2017	53.3546	1.0517	2017	50.74	2.121
2018	54.6526	1.1685	2018	52.2901	2.1353
2019	55.0956	1.3001	2019	52.629	2.1084
2021	57.6103	1.2791	2021	56.0723	1.7626
2022	61.8561	1.594	2022	59.6964	2.5871

Table 2B

20/20 Income Ratio Mean and Standard Deviation by Region by Year					
20/20 Income Ratio, Northeast			20/20 Income Ratio, Midwest		
Year	Mean	SD	Year	Mean	SD
2010	15.0223	2.4038	2010	12.8785	1.0301
2011	15.307	2.5622	2011	13.4865	1.1938
2012	15.5263	2.6653	2012	13.4326	1.3563
2013	16.095	2.5576	2013	13.941	1.3642
2014	16.2766	2.8412	2014	13.8763	1.2882
2015	16.1857	2.9447	2015	13.8594	1.2756
2016	16.1403	2.8397	2016	14.0641	1.2236
2017	16.4164	2.806	2017	13.8415	1.3218
2018	16.7613	2.6745	2018	13.9703	1.3319
2019	16.2183	3.0761	2019	13.6365	1.3497
2021	17.2472	3.205	2021	14.4469	1.4083
2022	17.398	3.5909	2022	14.9106	1.272

20/20 Income Ratio, South			20/20 Income Ratio, West		
Year	Mean	SD	Year	Mean	SD
2010	14.6419	0.9696	2010	13.065	1.4148
2011	15.42	1.1355	2011	13.3241	2.131
2012	15.46	1.2454	2012	13.4827	1.8317
2013	15.7871	1.1822	2013	13.8674	2.0716
2014	15.603	1.1944	2014	13.9114	1.99
2015	15.6995	1.2206	2015	13.9672	1.788
2016	16.0226	1.2554	2016	14.035	1.8952
2017	16.1887	1.1718	2017	14.0584	1.8935
2018	16.1663	1.077	2018	14.2007	1.9655
2019	15.9099	1.3681	2019	13.9179	1.7457
2021	16.7692	1.2803	2021	15.4157	1.9006
2022	16.7513	1.4603	2022	14.9263	2.1816

Table 3B

20/5 Income Ratio Mean and Standard Deviation by Region by Year					
20/5 Income Ratio, Northeast			20/5 Income Ratio, Midwest		
Year	Mean	SD	Year	Mean	SD
2010	26.1899	5.2201	2010	21.8708	1.984
2011	26.2369	5.2908	2011	22.7505	2.1939
2012	26.0311	5.3517	2012	22.1455	2.489
2013	27.0776	5.2289	2013	23.0149	2.4092
2014	26.8608	5.6155	2014	22.4747	2.376
2015	26.6964	5.7936	2015	22.7911	2.3407
2016	26.3133	5.607	2016	22.8709	2.1456
2017	26.1938	5.3581	2017	21.8373	2.3384
2018	26.2016	4.993	2018	21.7421	2.2059
2019	25.014	5.7263	2019	20.7152	2.3367
2021	25.4689	5.3937	2021	21.2545	2.2064
2022	24.0426	5.8985	2022	20.5104	1.8804

20/5 Income Ratio, South			20/5 Income Ratio, West		
Year	Mean	SD	Year	Mean	SD
2010	25.0239	1.9763	2010	21.9108	2.66
2011	26.1458	2.1203	2011	22.1503	4.0975
2012	25.5568	2.4151	2012	21.6816	3.4068
2013	25.9475	2.2153	2013	22.3721	3.8432
2014	25.0938	2.2777	2014	22.0898	3.558
2015	25.7866	2.1619	2015	22.6752	3.0073
2016	26.0181	2.2933	2016	22.388	3.4939
2017	25.674	2.1037	2017	21.8892	3.1507
2018	25.2826	1.8083	2018	21.8856	3.3145
2019	24.3975	2.2339	2019	21.0148	2.9851
2021	24.6147	2.0756	2021	22.5681	2.8286
2022	22.9066	2.1707	2022	20.3003	3.2281

Table 4B

Total Housing Stress Percent Mean and Standard Deviation by Region by Year					
Housing Stress, Northeast			Housing Stress, Midwest		
Year	Mean	SD	Year	Mean	SD
2010	34.3726	4.616	2010	24.0973	5.015
2011	34.2758	4.3194	2011	23.6339	4.6486
2012	32.2115	4.0154	2012	21.2373	4.2165
2013	30.2762	3.504	2013	20.1137	3.6707
2014	29.8577	3.4112	2014	19.8921	3.4201
2015	28.5674	3.6064	2015	18.676	2.9037
2016	26.8143	3.4968	2016	17.9005	2.7261
2017	26.1745	3.4421	2017	17.3914	2.3938
2018	26.4114	3.1359	2018	17.9319	2.1813
2019	24.5948	2.9619	2019	16.6736	2.0585
2021	25.0042	3.4633	2021	18.0541	1.6221
2022	25.5108	2.4555	2022	18.777	1.6863

Housing Stress, South			Housing Stress, West		
Year	Mean	SD	Year	Mean	SD
2010	26.5623	5.2611	2010	31.2947	6.0718
2011	25.7964	4.5625	2011	30.1892	5.5403
2012	23.5872	4.3019	2012	28.0631	5.3484
2013	22.1561	3.6324	2013	25.6741	4.883
2014	22.2002	3.298	2014	24.6261	3.9962
2015	21.12	3.1873	2015	23.8533	3.9937
2016	19.9608	2.983	2016	23.2964	3.8773
2017	19.3641	2.797	2017	23.4488	3.8746
2018	19.8871	2.7267	2018	22.9999	3.8401
2019	18.4748	2.7382	2019	22.3572	4.0575
2021	19.6257	2.5059	2021	23.66	3.9662
2022	19.9521	2.752	2022	23.8552	3.7017

Table 5B

50k Or Less Housing Stress Mean and Standard Deviation by Region by Year					
50k Or Less Housing Stress, Northeast			50k Or Less Housing Stress, Midwest		
Year	Mean	SD	Year	Mean	SD
2010	63.7267	10.4462	2010	45.5311	7.2885
2011	65.0195	9.8035	2011	46.3034	6.8993
2012	64.3008	9.8192	2012	43.7323	6.6814
2013	63.1514	9.4189	2013	43.3976	5.8677
2014	63.749	9.8015	2014	44.1761	5.7979
2015	64.6042	10.3359	2015	43.7163	5.1336
2016	62.8836	10.4136	2016	42.9041	5.6459
2017	63.6567	10.9834	2017	43.1659	5.2138
2018	64.9974	10.6286	2018	44.9547	5.073
2019	64.1326	10.8151	2019	44.0701	4.5785
2021	66.7424	11.0336	2021	48.951	4.0593
2022	70.0169	9.3491	2022	52.4785	4.7134

50k Or Less Housing Stress, South			50k Or Less Housing Stress, West		
Year	Mean	SD	Year	Mean	SD
2010	46.4824	9.5281	2010	54.0615	7.6934
2011	46.6737	9.0522	2011	53.4699	7.2014
2012	44.3705	9.1855	2012	52.6167	7.5472
2013	43.1444	8.5855	2013	50.8905	7.2748
2014	44.3103	8.6671	2014	50.6783	6.3849
2015	43.7379	8.9615	2015	50.8705	6.1307
2016	42.381	8.4461	2016	50.7921	7.3018
2017	42.4346	8.9257	2017	51.8395	7.3975
2018	43.9865	8.437	2018	51.7809	7.2076
2019	43.1464	8.8396	2019	52.6736	7.195
2021	47.0138	8.6169	2021	57.7281	7.6129
2022	49.3902	8.9749	2022	58.85	6.744

Appendix C: Regression Results

Table 1C: Housing Stress Error Correlation Matrix When Using 20/5 Income Ratio

	$75,000+	$50,000-$74,999	$35,000-$49,999	$20,000-$34,999
$75,000+	1	0.5589	0.1314	-0.0456
$50,000-$74,999	0.5589	1	0.2941	0.1471
$35,000-$49,999	0.1314	0.2941	1	0.2921
$20,000-$34,999	-0.0456	0.1471	0.2921	1

Table 2C

Panel B: 20/5 Income Ratio, Housing Stress Robust

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
20/5 Income Ratio	-0.05	-0.053	0.277***	0.045
	(0.040)	(0.085)	(0.089)	(0.090)
20/5 Income Ratio Covid	-0.055	-0.035	0.290***	0.005
	(0.040)	(0.079)	(0.098)	(0.111)
Housing to Population Ratio	0.239***	-0.056	-0.055	-0.148
	(0.055)	(0.113)	(0.120)	(0.134)
Unemployment Rate	0.438***	1.002***	1.148***	0.794***
	(0.070)	(0.119)	(0.127)	(0.165)
Unemployment Rate Covid	-0.351***	-0.667**	-1.037***	-0.452
	(0.108)	(0.271)	(0.269)	(0.352)
Constant	-23.624***	-14.919	9.481	38.238*
	(6.448)	(15.395)	(16.185)	(20.007)
Observations	600	600	600	600
R2	0.954	0.977	0.978	0.974
Adjusted R2	0.948	0.975	0.976	0.97
Residual Std. Error (df = 532)	1.021	1.896	1.9	2.175
F Statistic (df = 67; 532)	163.479***	342.806***	358.998***	292.811***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01

Table 3C: Housing Stress Error Correlation Matrix When Using Gini Coefficient

	$75,000+	$50,000-$74,999	$35,000-$49,999	$20,000-$34,999
$75,000+	1	0.5592	0.1352	-0.0412
$50,000-$74,999	0.5592	1	0.293	0.1503
$35,000-$49,999	0.1352	0.293	1	0.2875
$20,000-$34,999	-0.0412	0.1503	0.2875	1

Table 4C

Panel C: Gini, Housing Stress Robust

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
Gini*100	-0.151*	-0.141	0.593***	0.291
	(0.075)	(0.163)	(0.163)	(0.182)
Gini*100 Covid	-0.017	0.064	0.373***	-0.106
	(0.071)	(0.133)	(0.141)	(0.181)
Housing to Population Ratio	0.236***	-0.066	-0.052	-0.152
	(0.055)	(0.113)	(0.119)	(0.133)
Unemployment Rate	0.439***	1.013***	1.194***	0.778***
	(0.071)	(0.120)	(0.125)	(0.163)
Unemployment Rate Covid	-0.423***	-0.790***	-0.954***	-0.342
	(0.111)	(0.270)	(0.251)	(0.337)
Constant	-17.126**	-7.706	-10.69	24.932
	(7.133)	(16.140)	(17.266)	(19.497)
Observations	600	600	600	600
R2	0.954	0.977	0.979	0.974
Adjusted R2	0.948	0.975	0.976	0.97
Residual Std. Error (df = 532)	1.02	1.896	1.888	2.169
F Statistic (df = 67; 532)	163.803***	343.028***	363.634***	294.487***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01

Table 5C: 20/20 Log Income Gap

Panel A: 20/20 Income Ratio, Housing Stress Robust, Log Gap

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
20/20 Log Income Gap	6.491***	13.951***	13.212***	5.742
	(1.889)	(3.687)	(3.943)	(4.698)
20/20 Log Income Gap Covid	-4.316***	-3.116**	-0.291	1.023
	(0.625)	(1.364)	(1.501)	(1.753)
Housing to Population Ratio	0.251***	0.047	0.173	-0.070
	(0.055)	(0.112)	(0.126)	(0.131)
Unemployment Rate	0.517***	1.096***	1.197***	0.813***
	(0.066)	(0.116)	(0.128)	(0.177)
Unemployment Rate Covid	-0.311***	-0.602***	-0.497**	-0.456*
	(0.080)	(0.209)	(0.204)	(0.272)
Constant	-98.760***	-185.100***	-159.339***	-34.182
	(24.391)	(45.674)	(50.915)	(54.750)
Observations	600	600	600	600
R2	0.957	0.978	0.978	0.974
Adjusted R2	0.951	0.975	0.975	0.970
Residual Std. Error (df = 532)	0.985	1.861	1.922	2.169
F Statistic (df = 67; 532)	176.167***	356.183***	350.722***	294.504***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01

Table 6C: 20/5 Log Income Gap

Panel B: 20/5 Income Ratio, Housing Stress Robust, Log Gap

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
20/5 Log Income Gap	4.358***	7.005***	8.610***	0.336
	(1.178)	(2.412)	(2.735)	(2.941)
20/5 Log Income Gap Covid	-3.951***	-1.918	0.854	1.471
	(0.583)	(1.269)	(1.421)	(1.660)
Housing to Population Ratio	0.227***	-0.015	0.142	-0.120
	(0.053)	(0.110)	(0.125)	(0.130)
Unemployment Rate	0.503***	1.053***	1.165***	0.785***
	(0.066)	(0.117)	(0.125)	(0.1787)
Unemployment Rate Covid	-0.310***	-0.619***	-0.492**	-0.479*
	(0.080)	(0.212)	(0.202)	(0.272)
Constant	-75.201***	-104.188***	-108.724***	32.494
	(16.724)	(32.947)	(39.105)	(36.762)
Observations	600	600	600	600
R2	0.957	0.978	0.978	0.974
Adjusted R2	0.951	0.975	0.975	0.970
Residual Std. Error (df = 532)	0.987	1.878	1.921	2.173
F Statistic (df = 67; 532)	175.407***	349.701***	350.979***	293.242***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01

Table 7C: 20/20 No COVID

Panel A: 20/20 Income Ratio, Housing Stress Robust, No Covid

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
20/20 Income Ratio	-0.318***	-0.277	0.608***	0.163
	(0.094)	(0.172)	(0.195)	(0.195)
Housing to Population Ratio	0.272***	0.151	0.013	-0.268*
	(0.066)	(0.126)	(0.133)	(0.142)
Unemployment Rate	0.529***	0.966***	1.066***	0.535***
	(0.083)	(0.13)	(0.125)	(0.163)
Constant	-22.180***	-27.701*	-1.879	55.175***
	(7.598)	(16.129)	(17.202)	(20.391)
Observations	500	500	500	500
R2	0.960	0.982	0.980	0.978
Adjusted R2	0.954	0.979	0.977	0.975
Residual Std. Error (df = 532)	0.989	1.728	1.826	1.949
F Statistic (df = 67; 532)	164.399***	367.179***	341.238***	314.544***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01

Table 8C: 20/5 No COVID

Panel B: 20/5 Income Ratio, Housing Stress Robust, No Covid

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
20/5 Income Ratio	-0.063	-0.096	0.281***	-0.078
	(0.042)	(0.086)	(0.101)	(0.094)
Housing to Population Ratio	0.248***	0.138	0.028	-0.234*
	(0.065)	(0.126)	(0.132)	(0.139)
Unemployment Rate	0.524***	0.965***	1.062***	0.547***
	(0.082)	(0.13)	(0.125)	(0.16)
Constant	-24.084***	-28.899*	-0.046	57.396***
	(7.651)	(16.19)	(17.43)	(20.596)
Observations	500	500	500	500
R2	0.959	0.981	0.980	0.978
Adjusted R2	0.953	0.979	0.977	0.975
Residual Std. Error (df = 532)	0.999	1.731	1.830	1.949
F Statistic (df = 67; 532)	160.988***	366.014***	339.493***	314.504***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01

Table 9C: Gini No COVID

Panel C: Gini, Housing Stress Robust, No Covid

	Dependent Variable is Housing Stress			
	Over $75,000	$50,000 - $74,999	$35,000 - $49,999	$20,000 - $34,999
	(1)	(2)	(3)	(4)
Gini*100	-0.002**	-0.003	0.006***	0.0003
	(0.001)	(0.002)	(0.002)	(0.002)
Housing to Population Ratio	0.250***	0.143	0.032	-0.252*
	(0.065)	(0.125)	(0.134)	(0.139)
Unemployment Rate	0.514***	0.951***	1.100***	0.541***
	(0.083)	(0.131)	(0.125)	(0.163)
Constant	-17.681**	-18.502	-21.692	55.088**
	(8.014)	(16.605)	(18.776)	(21.333)
Observations	500	500	500	500
R2	0.959	0.982	0.980	0.978
Adjusted R2	0.953	0.979	0.977	0.975
Residual Std. Error (df = 532)	0.997	1.727	1.823	1.951
F Statistic (df = 67; 532)	161.740***	367.597***	342.601***	314.050***

Note: all column ranges are annual household income

*p<0.1; **p<0.05; ***p<0.01