Preliminary Draft
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Food Insecurity and the Great Recession: The Role of Unemployment Duration, Credit and Housing Markets

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Abstract

In this paper, we investigate the role of changes in unemployment duration, leverage, and housing prices in generating food insecurity during the Great Recession. Food insecurity increased during the Great Recession by 35 percent, from an average of 11.4 percent of households before to 15.4 percent of households during. This increase in food insecurity obtains even conditional on a household's income to poverty ratio. This fact suggests that households' access to resources that are not well captured by traditional income-to-poverty measures changed over this time period. Using data on food insecurity from multiple years of the Current Population Survey, we examine whether states that were particularly hard hit by unemployment duration, deleveraging, and house price collapse are the places where food insecurity rose the most, even controlling for income-to-poverty. We find that increases in unemployment duration and collapses in house prices play an important role in the rise in food insecurity; while point estimates are also supportive of a role for leverage, they are not statistically significant. Overall, our results are consistent with the interpretation that before the Great Recession, low-income households (those between 100-180% of the poverty threshold) were spending between 10 to 15 percent more than after, given their income-to-poverty ratios.

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I. Introduction

Food insecurity increased during the Great Recession by 35 percent, from an average of 11.4 percent of households before to 15.4 percent of households during. It is perhaps unsurprising that food insecurity – which is measured by a battery of questions designed to uncover whether households are struggling to pay for this most basic necessity – rose since incomes fell and poverty rose during the Great Recession. However, the increase in the fraction of households that are low-income can explain only a small part of the 35 percent increase in food insecurity. Rather, relative to households with similar income-to-poverty levels, food insecurity rose dramatically after the onset of the Great Recession. This fact suggests that households' access to resources that are not well captured by traditional income-to-poverty measures changed over this time period.

Prior to the Great Recession, labor markets were remarkably stable, credit was flowing freely and housing markets were booming. As a result, many households may have felt little need to save – either for precautionary reasons or for retirement. Chances of a lengthy unemployment spell may have seemed remote, and short spells of joblessness could always be financed on easily obtained credit cards. For homeowners, their most valuable asset was rapidly increasing in value, meaning home equity could always be tapped for current consumption and could also be considered a source of retirement savings. With the Great Recession, though, came potentially lengthy expected unemployment durations, a tightening of credit markets, and a crash in housing values, all of which could greatly influence the resources available to a household at a given income level. In this paper, we investigate the role of changes in unemployment duration, leverage, and housing prices in generating food insecurity.

Using data on food insecurity from multiple years of the Current Population Survey, we examine whether states that were particularly hard hit by unemployment duration, deleveraging, and house price collapse are the places where food insecurity rose the most, even controlling for income-to-poverty. We find that, indeed, increases in unemployment duration and collapses in house prices play an important role in the rise in food insecurity. However, there is less clear evidence on the role of leverage, although this may be due to our measure being too broad (a problem that we plan to correct in a future version).

Overall, our results are consistent with the interpretation that before the Great Recession, low-income households (those between 100-180% of the poverty threshold) were spending between 10 to 15 percent more given their income-to-poverty ratios than after. In other words, prior to the Great Recession, it seems households had access to resources – for example by relying on equity in their homes to substitute for savings – that were critically affected by the long unemployment duration, credit contraction, and housing price collapse that were the hallmarks of the Great Recession.

II. Food Insecurity and the Great Recession

Food security status is measured through a battery of questions asked during the December Current Population Survey as part of the Food Security Supplement (CPS-FSS).[1] There are 10 questions asked of all households, and an additional 8 questions asked of households with children. Table 1 shows the questions included in the battery (Coleman-Jensen et al. 2012). The battery starts with a series of questions reflecting moderate problems that households may be facing, such as worry over running out of food or

[1] Details on our use of the CPS data are given in the Appendix.

concerns about the types of foods that are affordable, but quickly moves to more serious issues such as skipping meals and losing weight, asking separately about adults and children. A household is designated as food insecure if they face at least three of the problems covered in the battery.

As seen in Figure 1, the unemployment rate rose in the Great Recession to levels not seen since the early 1980s, while unemployment durations reached unprecedented lengths, as median duration hit almost 6 months.[2] Given the severity of the Great Recession, it is perhaps not surprising that food insecurity increased when it arrived. The rate of food insecurity averaged 11.4 percent from 2001 to 2007, but then averaged 15.4 percent from 2008 to 2011. The increase was sudden when the Great Recession hit, as 11.8 percent of households were food insecure in 2007, and 15.4 were in 2008. Of course, food insecurity is more concentrated among poorer households. Thus, among households below 300 percent of the poverty line, food insecurity jumped from 21.5 percent in 2007 to 26.5 percent in 2008 (and averaged 20.5 in the 2001 to 2007 period and 25.9 in the 2008 to 2011 period).

Figure 2 illustrates the rate of household food insecurity pre- and post-Great Recession by state, as well as the change. Even prior to the Great Recession, food insecurity was quite high (above 15 percent) in some (mainly Southern) states. After the Great Recession, while the national rate averaged over 15 percent, the rate in individual states varied from below 7.5 percent in North Dakota to over 20 percent in Mississippi and Arkansas. This geographic pattern in food insecurity at first seems to just confirm the commonsense assumption that poorer households are more likely to be food insecure.

[2] Details on the sources of our macroeconomic indicators are also given in the Appendix.

Poorer states will have higher rates of food insecurity, and thus the drop in income that accompanies a recession will of course increase the incidence of food insecurity. As seen in the final panel, however, the largest increases in food insecurity over the Great Recession were not all in those poorer, Southern, states. Rather, Nevada stands out as the state with the biggest increase, followed by California and Florida (as well as Mississippi).

Figure 3 illustrates the main puzzle of food insecurity in the Great Recession. As can be seen, it turns out that the big increase in food insecurity during the Great Recession remains even conditional on household income. In this figure, households are grouped by 20 percentage point bins of household income to the poverty line, and food insecurity rates pre- and post-Great Recession are plotted for each bin.[3] We see an almost parallel shift up in the rate of food insecurity, until we reach over about 240 percent of the poverty line.[4] Thus, the important question to be answered is why households with similar income to poverty ratios pre- and post-Great Recession had such different food insecurity outcomes.

III. Lengthening Unemployment Durations

As seen previously, unemployment duration reached lengths during the Great Recession that were well above those seen in any previous recession, including during the early 1980s, when the unemployment rate exceeded those of the Great Recession. However, there was a large amount of geographic variation in unemployment durations. Figure 4 maps the state quintiles of the ratio of 2009 average unemployment duration to

[3] We match the December CPS-FSS data with the March CPS data on annual income. See Anderson, Butcher, Hoynes, Schanzenbach (2014) for more details.

[4] We have investigated the role of the changing composition of these bins (i.e. the fact that post-Great Recession more households will fall in the lower bins), but found this change to not be an important part of the shift in food insecurity. For this paper, we will mainly ignore this additional effect of the Great Recession.

2007 average unemployment duration, with the darker shading reflecting larger increases in duration. Here, we see the largest changes in duration mainly in the West, along with just a few Eastern states, such as Florida, while the lowest changes cluster mainly through the Midwest. Figure 5 now compares food insecurity over time for households from the highest and lowest quintile states, where food insecurity in 2006 is indexed to 1 for both groups.[5]

In this figure, we see that at the aggregate level, food insecurity jumped in 2008 in both the highest and lowest unemployment duration quintiles, but fell back in 2009 in the lowest quintile.[6] Of course, these graphs do not take into account income – Figure 5 may simply reflect that households in the highest quintile states are poorer. To the extent that lengthy unemployment durations result in lower household incomes, this would likely be true to at least some extent. Thus, we use a probit model to estimate whether a household is food insecure as a function of income/poverty bins, a Great Recession dummy, a highest state unemployment duration change quintile dummy, and the interaction, estimating the model both for the entire sample (i.e. the sample represented in the figure) and for the sample limited to households below 300 percent of the poverty line. Thus, we are simply estimating a difference-in-differences model where the marginal effect computed for the interaction term represents:

$$(FI\ post\text{-}GR - FI\ pre\text{-}GR)_{highest\ quintile} - (FI\ post\text{-}GR - FI\ pre\text{-}GR)_{lowest\ quintile},$$

[5] Note that we were inspired by related exercises presented on the "House of Debt" blog by Atif Mian and Amir Sufi (see, for example, http://houseofdebt.org/2014/04/14/the-consumer-as-a-shadow-of-its-former-self.html) .

[6] Recall that quintiles are defined based on average 2009/2007 duration – it is possible that there was less difference in duration across these states in 2008.

but where the rate of food insecurity is conditional on the household income to poverty ratio. Table 2 presents the results from these models, along with standard errors that are robust to both heteroskedasticity and correlation in the error term within states. For neither group does being in the top quintile have a significant effect on food insecurity. This result implies that there was nothing different about food insecurity in these states prior to the Great Recession. After the Great Recession, food insecurity increased in all states by 2.5 percentage points overall, and by 4.5 percentage points for households below 300 percent of the poverty line. For those states where unemployment duration increased the most (i.e. the highest quintile of 2009/2007 average unemployment duration), the increase in food insecurity was significantly greater. The probability of being food insecure increased another 1.6 percentage points overall for households from the highest quintile states, and 1.9 percentage points for the lower income households from these states. For the overall sample, that is a 64 percent (i.e. 0.016/0.025 = 0.64) increase in the probability of being food insecure during the Great Recession from being in a high duration increase state, conditional on income to poverty.

These results are consistent with the idea that lengthening unemployment durations affected food insecurity in ways beyond simply lowering the income of households with an unemployed member.[7] A potential explanation for why, even conditional on income, households in states where unemployment durations increased most over the Great Recession were more likely to be food insecure involves changes in household behaviors. For example, in a post-Great Recession world where losing one's job

[7] In other work, we have investigated the role of a household member's unemployment on food insecurity. While it increases the probability of the household being food insecure, aggregate unemployment measures remain important predictors.

may result in a period of joblessness of six months or more, saving for a rainy day becomes more prudent. Making a concerted effort to spend less and save more may result in the household being worried about having enough money for food, being unsatisfied with the food choices they are able to provide their children, or may even lead an adult to skip a meal – all indicators of food insecurity. Additionally, a household's informal support network (i.e. friends and family who may be able to help out with food when budgets are tight) may now be suffering from long spells of unemployment, which would also imply a reduction in available resources.

IV. High Rates of Household Leverage

Prior to the Great Recession, not only did labor market prospects look bright, but credit was flowing freely. Recent work by Mian and Sufi (2010) has shown that the geographical pattern in household leverage (i.e. debt divided by income) in 2006 is a good predictor of the severity of the Great Recession, explaining such things as house prices, unemployment, and durable goods consumption patterns. Basically, highly leveraged areas saw a greater decrease in aggregate demand since the recession resulted in a high degree of deleveraging by households. This change can be seen in Figure 6, which graphs revolving consumer credit outstanding as a percentage of GDP over our sample period. This outstanding credit averaged over 6.5 percent in the pre-Great Recession period, before falling sharply starting in 2008, reaching under 5.5 percent by 2011. While Mian and Sufi base their findings on county-level leverage and outcomes, we are only able to explore this idea at the state level, since that is the lowest level of geography consistently defined in the

CPS.[8] As can be seen in Figure 7, though, there is a good deal of variation in household leverage across states.[9] The map delineates quintiles of state leverage in 2006, with the most leveraged states appearing in the darkest colors. On the assumption that household credit was financing consumption, the deleveraging that occurred would reduce consumption. To the extent that consumption of food is similarly affected, pre-recession leverage may help explain the increase in food insecurity over the Great Recession.

To that end, Figure 8 plots food insecurity over time (again indexed to 2006) by the highest and lowest state leverage quintiles. While we see an increase in food insecurity for both groups in 2008 at the start of the Great Recession, the jump up is larger and more persistent for households in states with the highest levels of leverage. While this graph is suggestive of an important role for leverage in worsening the impact of the Great Recession on household's food security status, it ignores the role of income. Thus, to further explore this issue, we again use a probit model to estimate whether a household is food insecure as a function of income/poverty bins, a Great Recession dummy, a highest state leverage quintile dummy, and the interaction. We estimate this model both for the entire sample (i.e. the sample represented in the figure) and for the sample limited to households below 300 percent of the poverty line. As before with the unemployment duration increase quintiles, this can simply be thought of as the difference-in-differences in rates of food insecurity, conditional on income.

[8] Technically, county is available in all years of the CPS, but the county FIPS code is suppressed for all but about 40% of households from the largest counties.

[9] We follow Mian and Sufi in defining leverage as the sum of per capita auto, mortgage and credit card debt for a state (from the New York Fed's Equifax data), multiplied by state population and divided by state adjusted gross income (from IRS tax files).

Table 3 shows the results of this exercise, presenting the marginal effects from the probit model, along with standard errors that are robust to both heteroskedasticity and correlation in the error term within states. Looking first at model (1), with results for the full sample, we see that even controlling for the income/poverty ratio, there is a significantly positive effect of the Great Recession on the probability that a household is food insecure, raising it by almost 3 percentage points. While the interaction with being in the highest leverage quintile state is positive, it is not significantly different from zero when performing a two-sided test. Our null hypothesis, however, is that the interaction term should be positive, making the effect significant at the 10 percent level for this one-sided test. Note that while this point estimate is relatively small, implying an additional increase in the probability of being food insecure over the Great Recession of 1 percentage point, relative to the main effect of the Great Recession it is an increase of over 35 percent.

Turning to model (2), which restricts the sample to less well-off households with incomes below 300 percent of the poverty line, we see a larger impact of the Great Recession. For this group, the probability of being food insecure increased by almost 5 percentage points. While the point estimate of the interaction effect is similar to that from model (1), the smaller sample size increases the standard error such that we cannot reject a zero impact with even a one-sided test. Note that while the point estimate of the additional effect of leverage in the Great Recession is similar across the columns, the larger main effect in model (2) implies a smaller percentage impact. In this case, a 1 percentage-point increase is under a 25 percent increase relative to the effect of the Great Recession in less leveraged states.

Since the power of our tests of the role of household leverage is low, we discuss below plans for future work that may allow us to better investigate the role of household leverage pre-Great Recession and the accompanying deleveraging that occurred post-Great Recession. Note that this deleveraging comes about in several ways. First, from households making conscious decisions to consume less and pay off debt, as was discussed above in terms of how the poor labor market performance may have provided incentives to invest in precautionary saving. Second, access to credit may have dried up. It simply may have become more difficult to accumulate debt as banks tightened credit score requirements for loans. Finally, households may have deleveraged by having their house foreclosed on. In the case of negative home equity, simply walking away from the debt may have seemed like the most rational response to having difficulty making mortgage payments. In the next section, we investigate the effect of falling housing prices more closely.

V. The Drop in Housing Prices

The Great Recession was marked by a steep decline in housing prices, although not all areas of the country were equally affected. Figure 9 shows this variation by creating a ratio of the 2006 HPI to the average state housing price index (HPI) post-2007 and mapping the state quintiles. Darker colors indicate sharper declines in housing prices. The map makes clear that the housing price crash was especially severe in states like California, Nevada, Florida and New Jersey. To the extent that homeowners may have been consuming out of their housing value, the decline in housing prices during the Great Recession may

have affected homeowners, and homeowners in these states, especially hard.[10] Figure 10 indexes food insecurity rates to 2006 for both homeowners and non-homeowners. The effect of the Great Recession is clearly seen for both groups, but food insecurity jumps by much more (an almost 50 percent increase) for homeowners than for non-homeowners.

An alternative way to think about the impact of the housing crisis is to focus on the impact of the HPI ratio on these homeowners. Thus, Figure 11 repeats the exercise of indexing food insecurity to 2006, but separately for the quintile with the biggest housing price decline and the smallest. Here we see that homeowners in states most affected by the housing crisis have about a 70 percent increase in food insecurity in 2008 relative to 2006, while homeowners in the less impacted states increase less than 50 percent. While this figure is restricted to homeowners, a similar figure for the full sample is qualitatively similar but somewhat muted, with only about a 30 percent increase in food insecurity for the most affected group, and a 25 percent increase for the least affected. Taken together, Figures 10 and 11 seem to indicate that the housing crisis may have had an important role to play in the increase in food insecurity over the Great Recession. However, these figures ignore the role of income.

To investigate whether the housing crisis remains an important predictor of changing food insecurity during the Great Recession, conditional on the income/poverty ratio, we estimate probit models similar to those presented for unemployment duration and leverage. Table 4 presents the marginal effects from these probit models, along with standard errors that are robust to both heteroskedasticity and within state correlation in the error term. Columns (1) and (2) use the full sample, while column (3) is restricted to

[10] Note that this consumption could be driven either by actual home equity loans, or simply from reduced savings rates based on the high value of housing assets.

homeowners. Similarly, columns (4) and (5) use all households with income below 300 percent of the poverty line, while column (6) is restricted to homeowners from this lower income group. Columns (1) and (4) investigate whether being a homeowner has a changing impact over the Great Recession on the probability of being food insecure, while the other columns focus on the role of being from a state in the quintile with the most severe housing price drop.

Looking first at columns (1) and (4), we see that conditional on income there is no significant change during the Great Recession in the impact of being a homeowner. However, being a homeowner is always very protective against being food insecure, reducing the probability by 8.3 percentage points overall, and by 12.8 percentage points for the lower income group. Additionally, the recession itself always increases food insecurity – by 2.8 percentage points overall and 4.9 percentage points for the lower income. Turning next to column (2), we again see the significant positive effect of the Great Recession on the probability of being food insecure, conditional on the household's income/poverty ratio. In this case, though, the main 2.5 percentage point increase during the Great Recession is augmented by another 1.6 percentage point increase for households from states in the biggest housing price drop quintile. Note that overall, though, being from such a state does not have a significant impact. Nonetheless, it implies a 64 percent increase in the probability of being food insecure during the Great Recession (i.e. 0.016/0.025 = 0.64) compared to a household not from a state with the largest quintile housing price drop .

Restricting the sample to homeowners adds an additional wrinkle. Now, not only do we find a significantly positive main effect of the Great Recession and its interaction with

the largest housing price drop quintile, we also find a significantly negative main effect of this housing price drop quintile. On the assumption that many of the states with the largest price drops also saw large increases pre-Great Recession, this result is consistent with the idea of households financing consumption with housing equity.[11] The point estimates of 0.015 for the main effect of the Great Recession and 0.014 for its interaction with the housing quintile implies the probability that a household is food insecure during the Great Recession increases by almost 100 percent if it is from a state in the quintile with the biggest housing price drop.

Home ownership is perhaps higher in the lower income group than might be expected, with over 50 percent of households with an income below 300 percent of the poverty line reporting home ownership. The significance pattern of estimates for this group, in columns (5) and (6) are identical to those for the overall group, while the point estimate are larger (in absolute value) than those for the group overall. Note, however, that the lower income group has a higher rate of food insecurity. In the pre-period it is 20.5 percent for the lower income group compared to 11.4 for the overall group, rising to 25.9 and 15.4 for each group respectively in the Great Recession. While homeowners have a lower overall rate of food insecurity, the pattern is similar. It is 6.9 percent for the overall group and 13.9 for the lower income group in the pre-period and rises to 9.4 percent and 17.8 percent for each group in the Great Recession.

The findings on the potential role of the housing crisis can be summarized as follows. While in the aggregate it appeared that the impact of the Great Recession on food insecurity was larger for homeowners than non-homeowners, this result does not hold

[11] Recall that it is not necessary to actually take out a home-equity loan, one may simply reduce savings and increase consumption given the rise in assets (i.e. housing value).

when conditioning upon income. However, it is true that even conditional upon income, being from a state where the housing price drop was most precipitous implied a much bigger increase in the probability of being food insecure during the Great Recession. For homeowners, though, living in such a state was protective against food insecurity pre-Great Recession, a finding consistent with consumption in that period being at least partially financed via home equity.[12] These results hold for both the overall sample and the sample restricted to households with income below 300 percent of the poverty line.

VI. Discussion and Future Work

As can be seen in the maps above, many of the same states were high leveraged in 2006, and saw large drops in housing prices and large increases in unemployment duration. Thus, it is worthwhile to estimate our base model controlling for income bins and allowing all three to have a differing impact on the probability of being food insecure over the Great Recession. Table 5 presents the results of this exercise. As before, column (1) presents marginal effects from a probit model estimating the probability of being food insecure using the full sample, while column (2) is restricted to households with incomes below 300 percent of the poverty line. While none of the interactions with the Great Recession are individually significant, they are highly significant in a joint test. Thus, a household in a state in the highest quintile of 2006 leverage, the quintile with the largest drop in housing prices, and the highest quintile of 2009/2007 average unemployment duration is predicted to be 2 percentage points more likely to be food insecure over the Great Recession than a household from a state that is in none of these quintiles. That

[12] It is important remember that there need not actually be a home equity loan – reductions in savings due to the "paper savings" inherent in rising home equity may be financing consumption.

household would simply be predicted to have a 2.3 percentage point higher probability of being food insecure over the Great Recession. Thus, being from a state that is most impacted by increasing leverage pre-Great Recession, dropping home values and increasing unemployment durations means being almost twice as likely to be food insecure during the Great Recession compared to households with a similar income to poverty ratio from a less-impacted state.

As noted above, despite the importance the literature has placed on high household leverage as an indicator for the severity of the recession, our simple measure of state leverage quintile did not have much power in our food insecurity models. Point estimates, however, were as would be expected. We plan to update this work based on information from an in-progress report by researchers at the Federal Reserve Bank of Chicago. Currently, Amromin and McGranahan (forthcoming) are working on a report that will aggregate leverage by both state and income. Using a finer measure of geography, such as Census tract, they plan to match Census income in that tract with average leverage, allowing them to report on state leverage by income bins. We will then be able to take the results of their tables and match them to our data by state and income bin, providing a better measure of our households' leverage status. To explore the potential value of this planned work, we carried out a simple test, which while not ideal, is suggestive. Starting with median county income, we assigned each county to an income decile. We then merged the county income decile to county leverage in 2006 (using the Mian and Sufi county leverage measure) and computed average state leverage by income decile. In our main data, we assigned each household to an income decile, and then merged on the leverage data by state and decile. We than ran a difference-in-difference model similar to those

shown, but using the average assigned leverage measure instead of being in the highest state quintile. For those households below 300% of the poverty line, the interaction term was 0.025 and significant.[13] The main Great Recession effect and the main leverage effect were also both significant, at 0.022 and 0.037, respectively.

Recall the puzzle presented in Figure 3, which showed that food insecurity increased markedly over the Great Recession, even within narrow 20-percentage point income to poverty bins. Having investigated the role played by increased unemployment durations, deleveraging, and the housing bust during the Great Recession results in an alternate approach to thinking about the shift in food insecurity. Rather than considering it to be a pure shift *up*, conditional on income/poverty ratio, it might instead be thought of as a shift *over*. The motivation given for studying the role of unemployment duration, leverage and housing was that prior to the Great Recession, households were likely to see little need for any saving – labor markets were stable, credit was flowing and house prices were rising – but when the Great Recession hit there was a need to reevaluate. In fact, as can be seen in Figure 12, personal saving as a percentage of disposable income was quite low pre-Great Recession, but it rose markedly at the start of the Great Recession, peaked in 2009, and remained relatively high for the rest of the years in our sample. Thus, it is quite possible that consumption for a household in a given income/poverty bin pre-Great Recession was inflated due to this low personal saving rate, returning to "normal" during the Great Recession. Thus, if a household with, for example, income at 100 percent of the poverty line was consuming more like a household with income well above the poverty

[13] For this sample, the mean of the leverage variable was 1.1 with a standard deviation of 0.31 and a range of 0.63 to 2.43. Thus increasing leverage by a standard deviation would increase the probability of being food insecure by almost one percentage point.

line, the implication would be that the pre-Great Recession relationship between income and food insecurity from Figure 3 really should be thought of as being shifted further to the right, and thus closer to the post-Great Recession line.

By making some simplifying assumptions, we can simulate how much additional income a household would need to have for the pre-Great Recession food insecurity line to shift over completely to the post-Great Recession line. First, we limit our analysis to the downward sloping portion of Figure 3, which is fairly linear, and thus estimate a linear probability model predicting food insecurity as a function of income/poverty for the Great Recession Period.[14] We can now use this regression to shift the pre-Great Recession line to the right – we simply need to see what value of income/poverty would predict the observed rate of food insecurity pre-Great Recession, using the estimated regression. To translate the income/poverty bins from Figure 3 into incomes, we assume the 2014 poverty line for a family of four of $23,850. The result of this exercise is shown in Table 6, where we present the weekly increase in 2014 dollars that a family of four would have needed to shift the Pre-Great Recession food security line in Figure 3 to the right far enough to be equivalent to the Post-Great Recession line. The amount of income required to accomplish the shift varies by income-to-poverty, but around the poverty line it is about $170 per week. For households below about 180 percent of the poverty line, the implication is that households would need to be acting as if they had 9 to 15 percent more income than they actually did, while for the slightly better off households, it is only 1 to 7 percent.

[14] The regression estimated for households between 40 and 300 percent of the poverty line is Probability of food insecurity = 0.45 – 0.0012(income/poverty).

Recall that in Figure 12, saving as a percent of disposable income rose from a low of 2.8 in the third quarter of 2007 to a high of 7.1 in the second quarter of 2009, an increase of 4.3 percentage points. Thus, focusing purely on a change in consumption due to an increase in saving would account for about a half to a third of the increase for most income groups. Thus, it is clear that, for lower-income families, thinking of the rightward shift as being purely due to a change in the saving rate is generally not sufficient to move the pre-Great Recession line completely over to the post-Great Recession line.[15] It is important to realize, though, that this calculation ignores the possibility that a household can also no longer consume out of a home equity loan and/or by increasing credit card debt, since it focuses purely on the observed change in savings. Based on our findings on the role of changes in housing prices and leverage, though, these additional methods of increasing consumption are likely important considerations.

VII. Conclusions

There are many reasons why the Great Recession might be expected to have particularly high food insecurity. Most obvious is the fact that with hard times come increases in poverty. In particular, unemployment rates were high and unemployment duration was double what it was even in the deep recession of the early 1980s. However, we show that even controlling for a households income to poverty ratio, rates of food insecurity increased significantly during the Great Recession. We posit that with the onset of the Great Recession, households needed to adjust to a new economic reality. Thus, even if there was no job loss within the household, it became clear that long duration spells were

[15] Interestingly, though, for those at the higher end of the income/poverty scale, the implied shift in savings is actually more than enough to explain the change in food insecurity.

now possible, making it important to engage in precautionary saving for example. In addition, this potential may have encouraged highly leveraged households to begin the process of deleveraging. Even households that were not planning to deleverage may have been forced to, due to the reductions in credit availability. Also at this time housing prices fell precipitously, with many families losing their ability to tap into their housing equity. Again, incentives for saving increased as households could no longer count on simply spending down their home equity to finance retirement.

We investigated the role played by these factors in the increase in food insecurity during the Great Recession. In difference-in-differences style models, we find that households living in states with the highest quintile increase in unemployment duration had an almost 2 percentage point higher probability of being food insecure during the Great Recession. Similarly, households living in states in the highest quintile of leverage in 2006 were about 1 percentage point more likely to be food insecure during the Great Recession (although this effect was not always significant). Finally, households living in states with the highest quintile housing price drop were 1.5 to 2 percentage points more likely to be food insecure during the Great Recession. Because many of the same states were in all of the top quintiles, we also estimated models with all three interaction terms, which were always jointly significant. The combined effect of being in all three top quintiles is a 2 to 3 percentage point increase in the probability of being food insecure during the Great Recession. Importantly, effects of this size imply a 75 to 100 percent increase in this probability, providing strong evidence on the importance of credit and housing markets on food insecurity.

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Appendix: Data Sources

The Current Population Survey

Food insecurity is officially measured in the U.S. via a supplement to the Current Population Survey (CPS). Since 2001, this supplement has been part of the December survey. Since the questions refer to the past twelve months, we consider the food security measure to refer to the calendar year of the survey. In order to analyze food insecurity over the Great Recession, it is important to not only have data on the answers to the 18 food security questions, but also to have good information on the household's income. The March supplement to the CPS collects just this information, in reference to the previous calendar year. The CPS sampling frame allows us to match this March supplement to the December supplement for a subset of the sample. A CPS household is in the sample for four consecutive months, out of the sample for eight months, and then back in for four consecutive months. Thus, for households where December is the first one of their set of consecutive months, they will also be surveyed in March and the two surveys can be matched at the household level. Additionally, starting in 2002, the March supplement sample was expanded by asking the questions of the February and April sample households that were not also in the March sample, as well as some of the prior November sample. Matching on the household identifier across the months results in a sample of about 14,000 matched households per year. Our data cover the period from 2001 to 2011.

Macroeconomic Indicators

To investigate food insecurity over the Great Recession and the role of credit and housing markets, we need a range of macroeconomic indicators. Data in Figures 1, 6 and

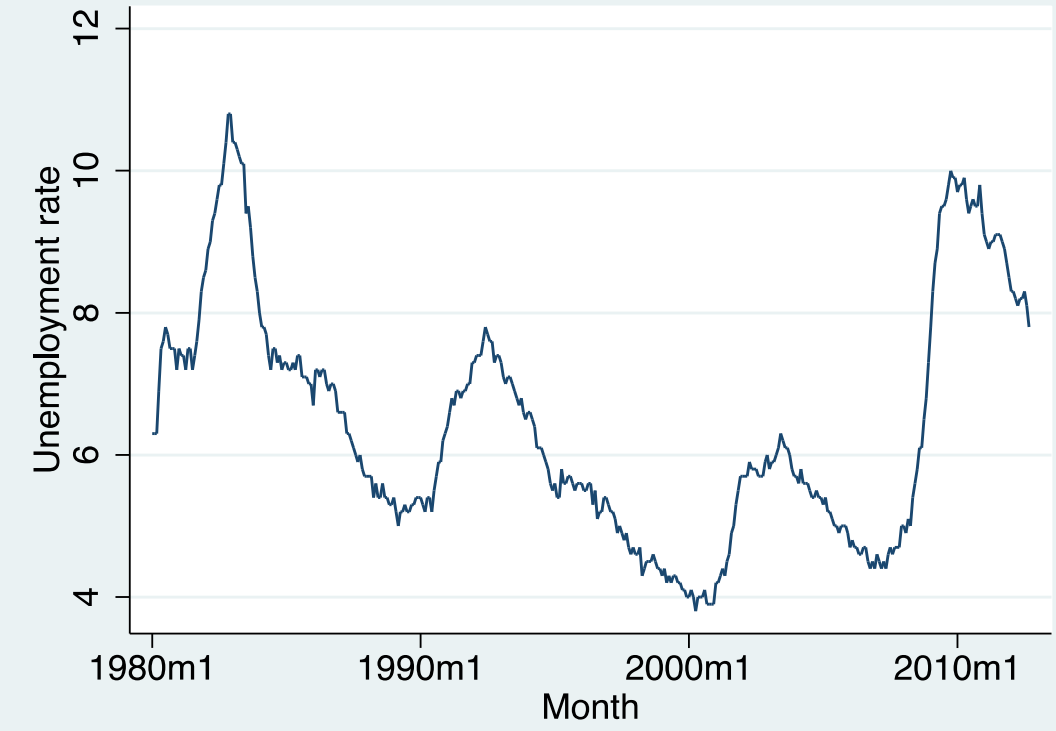
12 are obtained from the St. Louis Fed's Federal Reserve Economic Data (FRED).[16] The unemployment rate series is UNRATE, and the median duration series is UNEMPMED. The credit series is REVOLSL (averaged over the year and divided by the annual GDP series, GDPA), and the personal saving series is A072RC1Q156SBEA. State-level data come from a range of sources. The change in housing prices in Figure 9 is based on data from the St. Louis Fed's Geographical Economic Data (GeoFRED) All-Transaction House Price Index, where we divide the 2006 state index value by the state average of the post-2007 index values. The change in median unemployment duration in Figure 4 is based on data presented in Table 1 of Anderson (2010), where we divide median state duration in 2009 by that from 2007. Finally, the average 2006 household financial leverage by state in Figure 7 is based on Equifax data from Federal Reserve Bank of New York and Statistics of Income data from the Internal Revenue Service (IRS).[17] Following Mian and Sufi, we sum up credit card, mortgage and auto debt per capita from the Equifax data, multiply it by population (also in the Equifax data) and divide by state total adjusted gross income (AGI) from the IRS data.

[16] See [16] http://research.stlouisfed.org/fred2/

[17] See http://www.newyorkfed.org/research/national_economy/householdcredit/area_report_by_year.xlsx and http://www.irs.gov/uac/SOI-Tax-Stats-Historic-Table-2

Figure 1: Labor Market Indicators

Panel A: Unemployment Rate



Panel B: Median Unemployment Duration

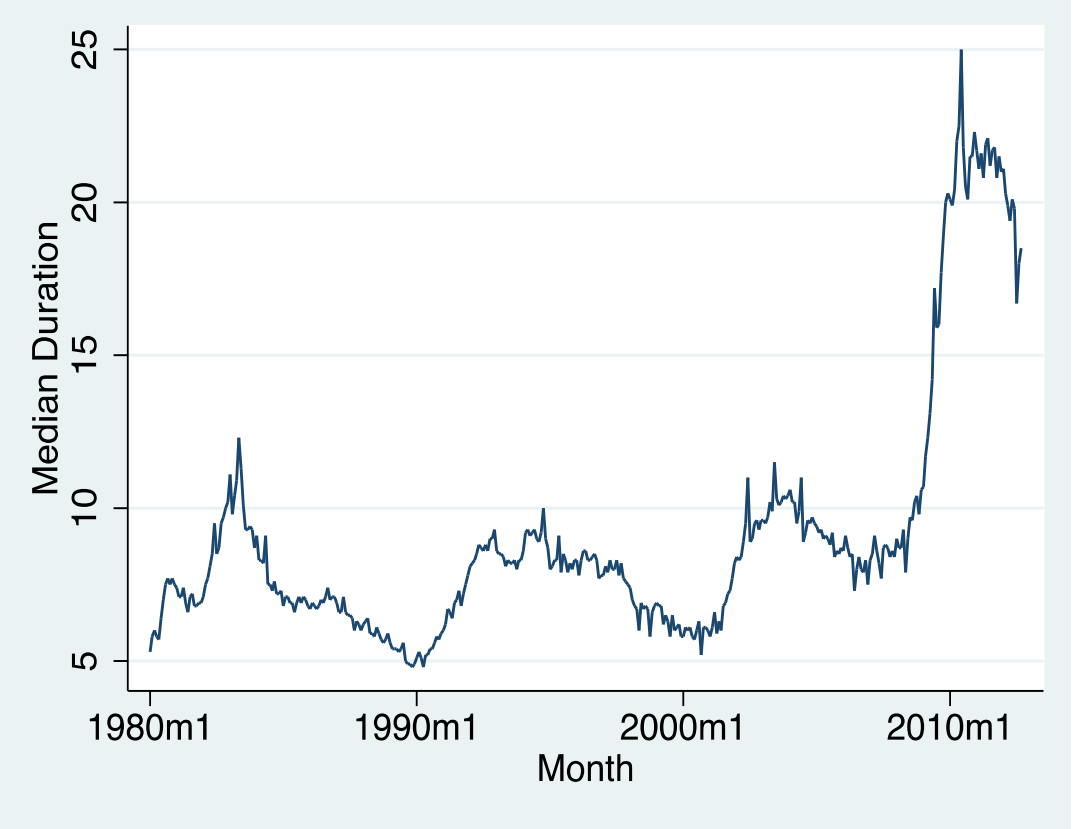
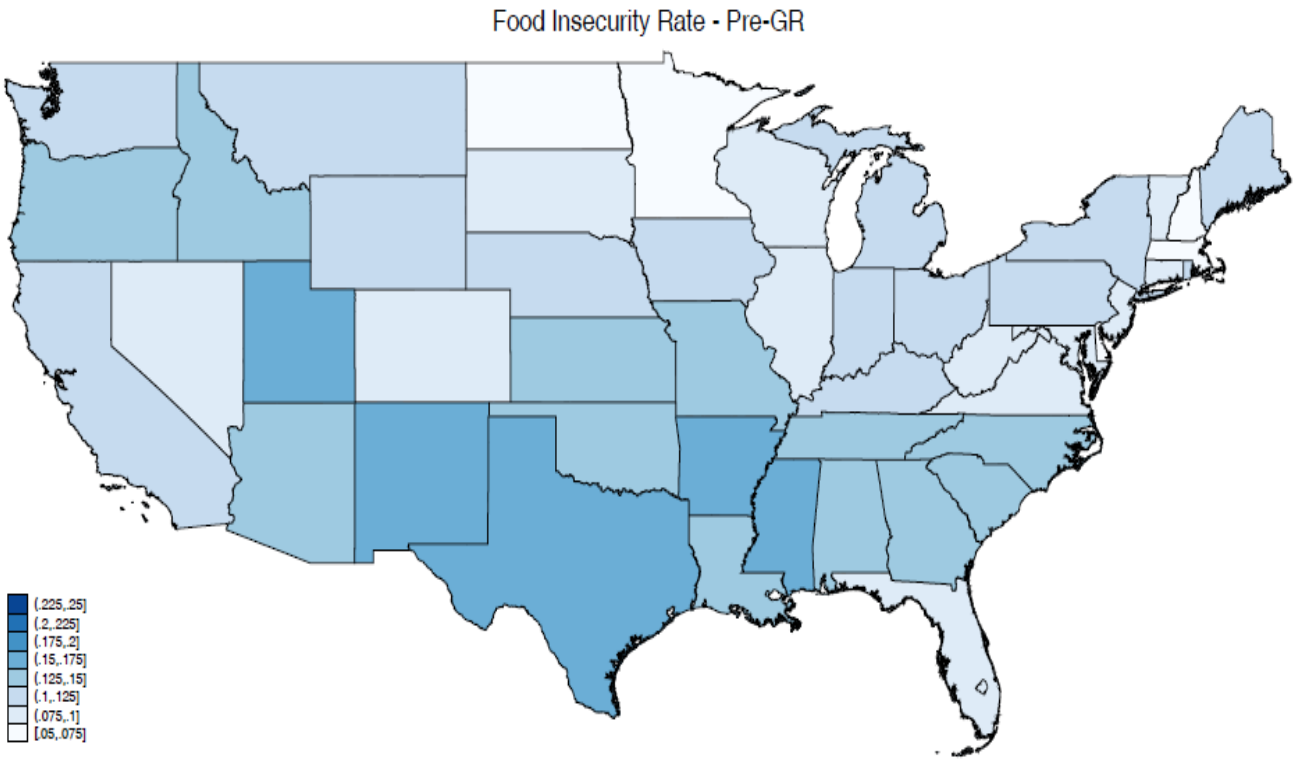
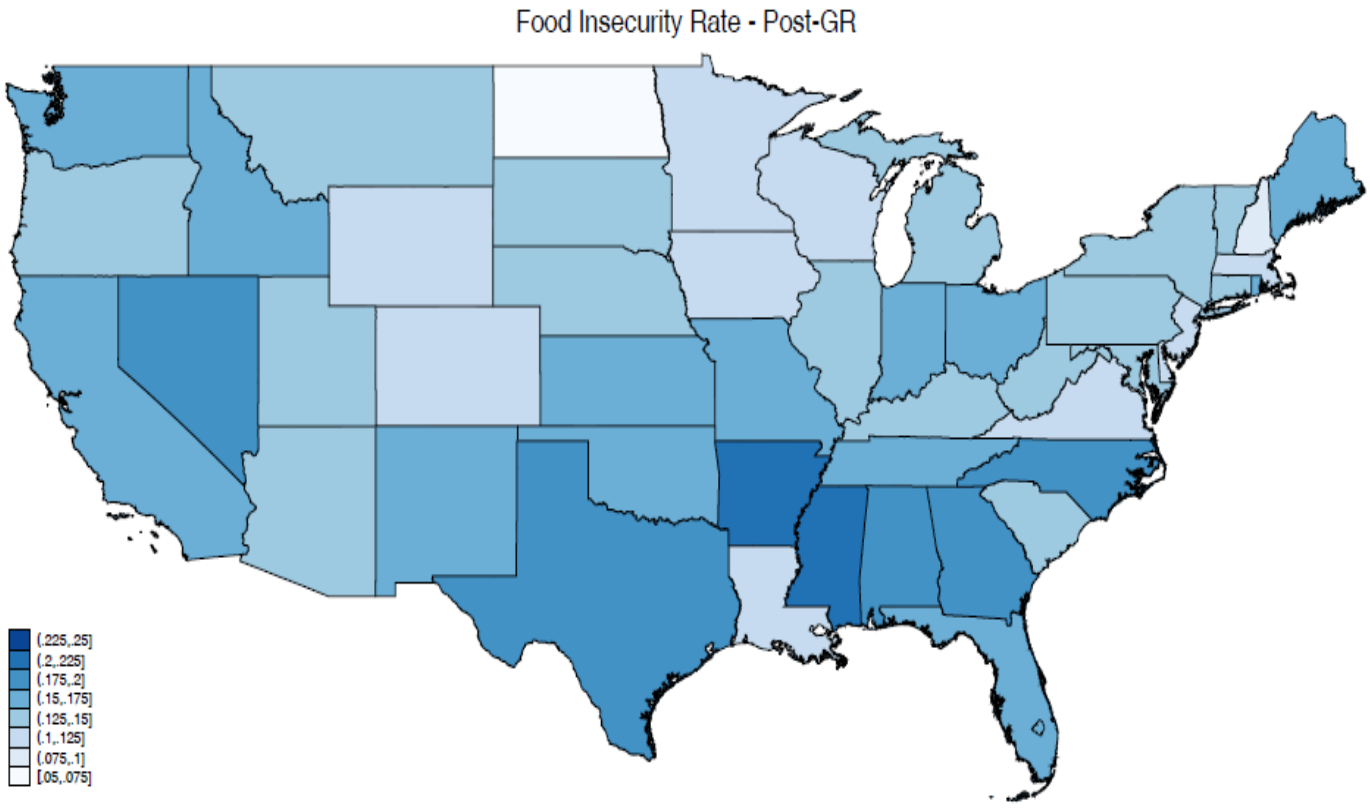


Figure 2: Food Insecurity Rates by State
Panel A: Food Insecurity Rates Prior to the Great Recession



Panel B: Food Insecurity Rates After the Great Recession



Panel C: Change in Food Insecurity Rates, After vs. Before the Great Recession

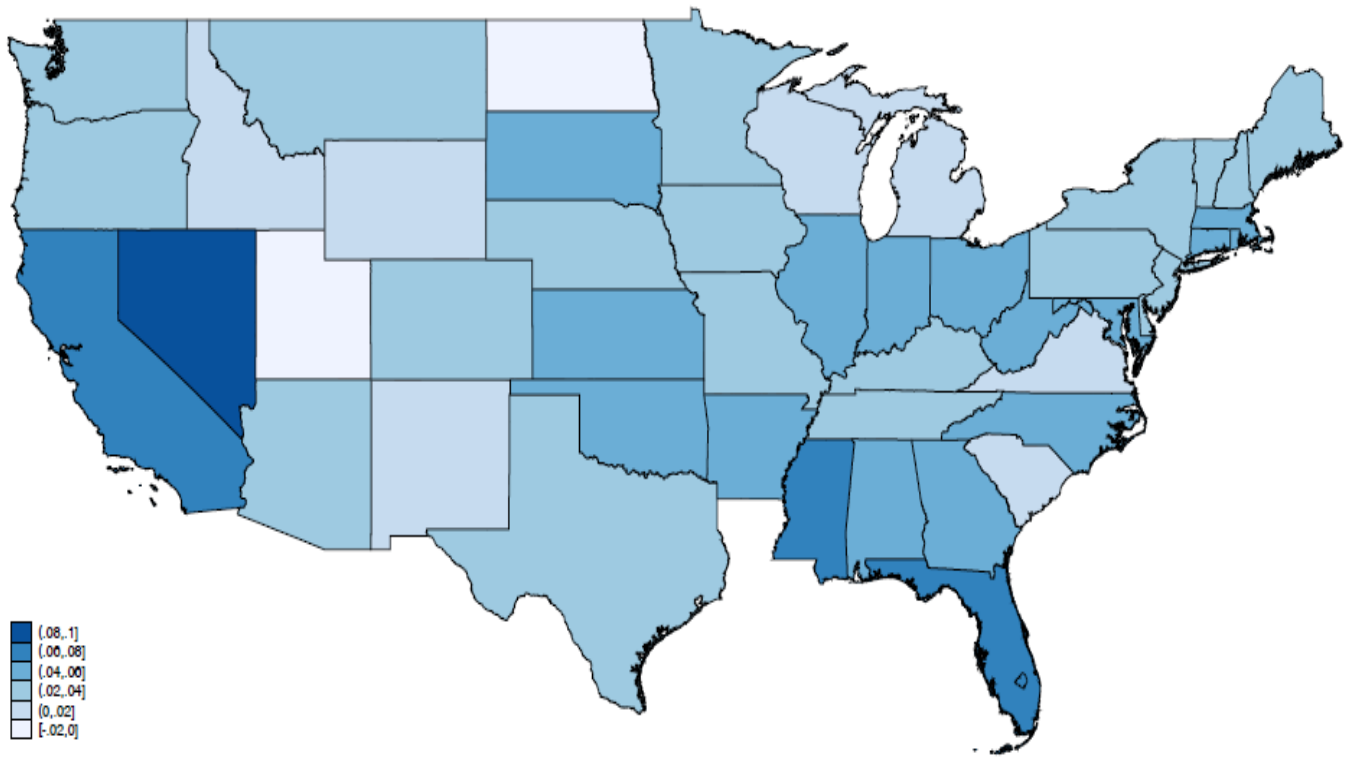


Figure 3: Rates of Food Insecurity by Income-to-Poverty Group,

Before and After the Recession

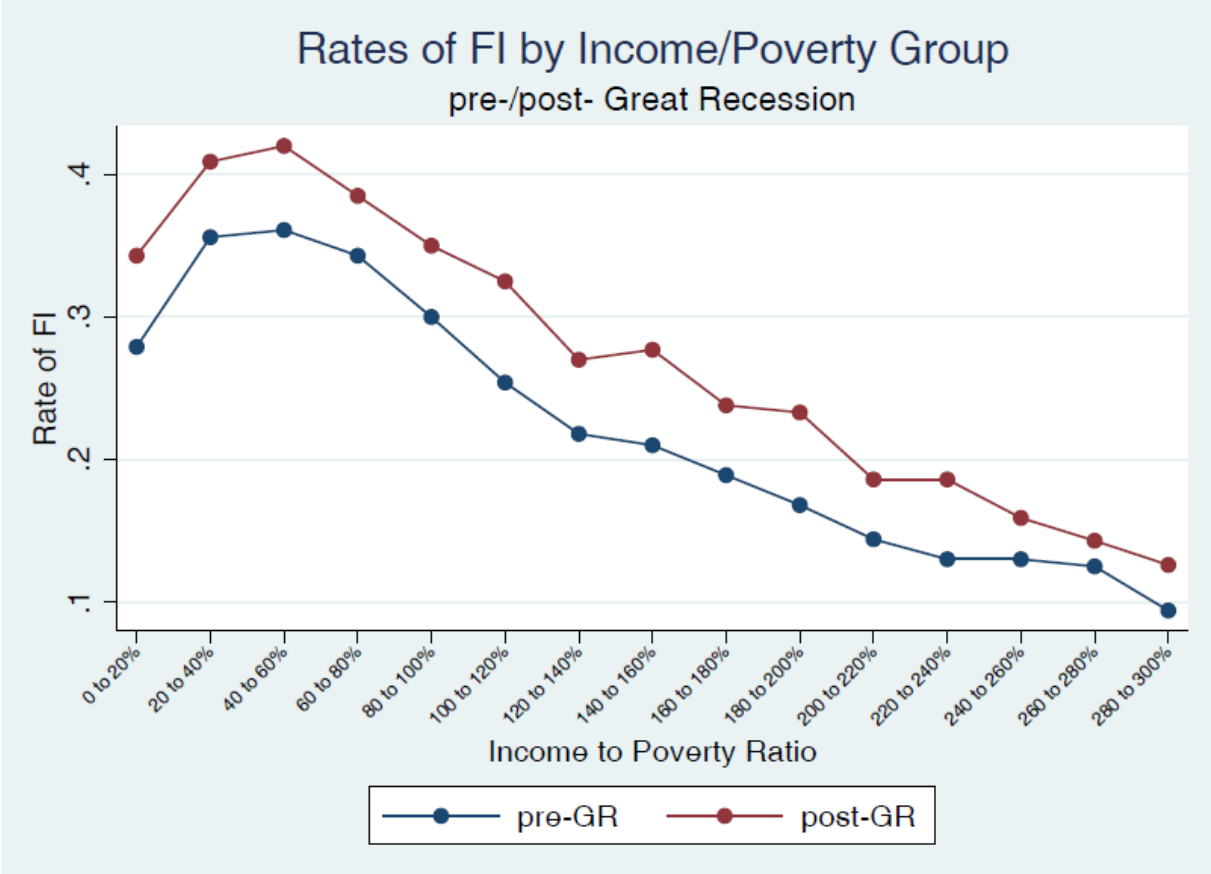


Figure 4: Increases in Unemployment Duration by State During the Great Recession

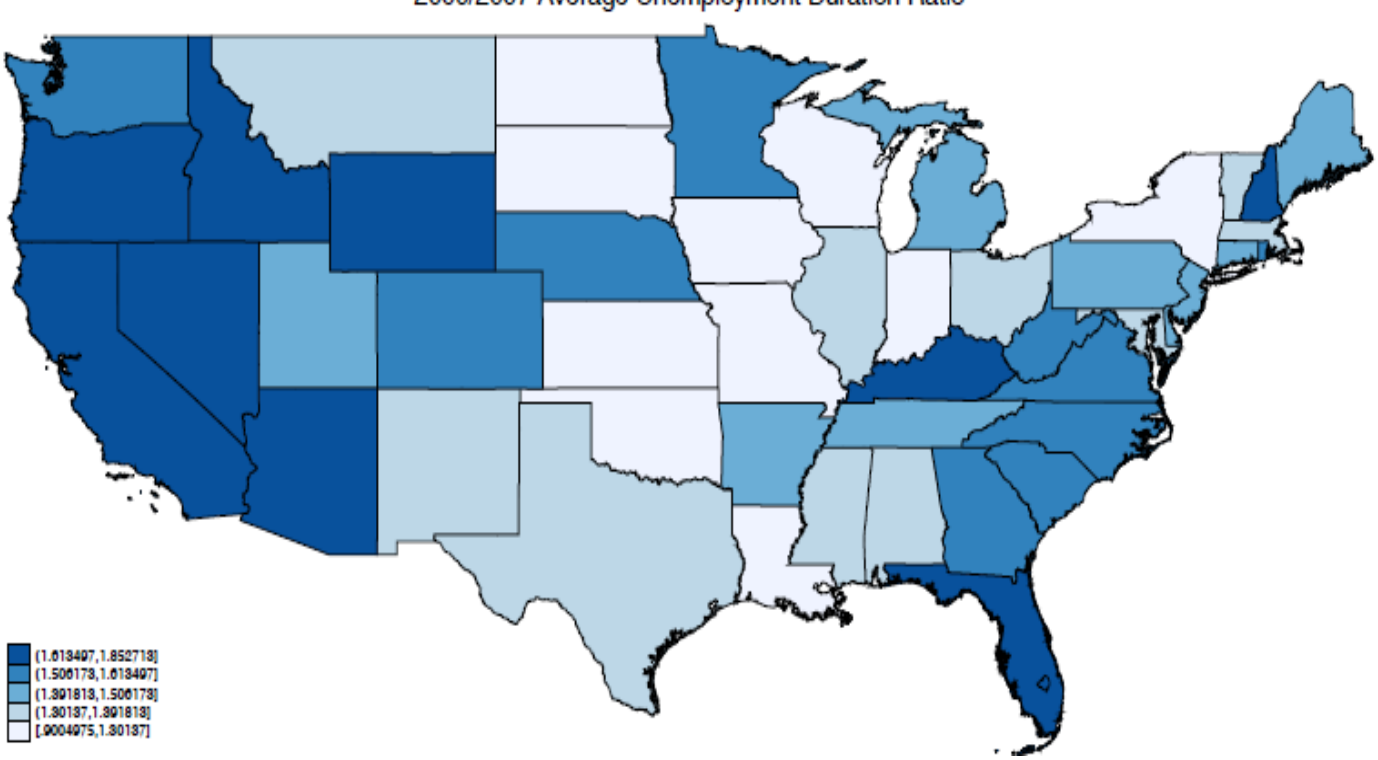


Figure 5: Food Insecurity Rates by Quintile of Unemployment Duration Increase

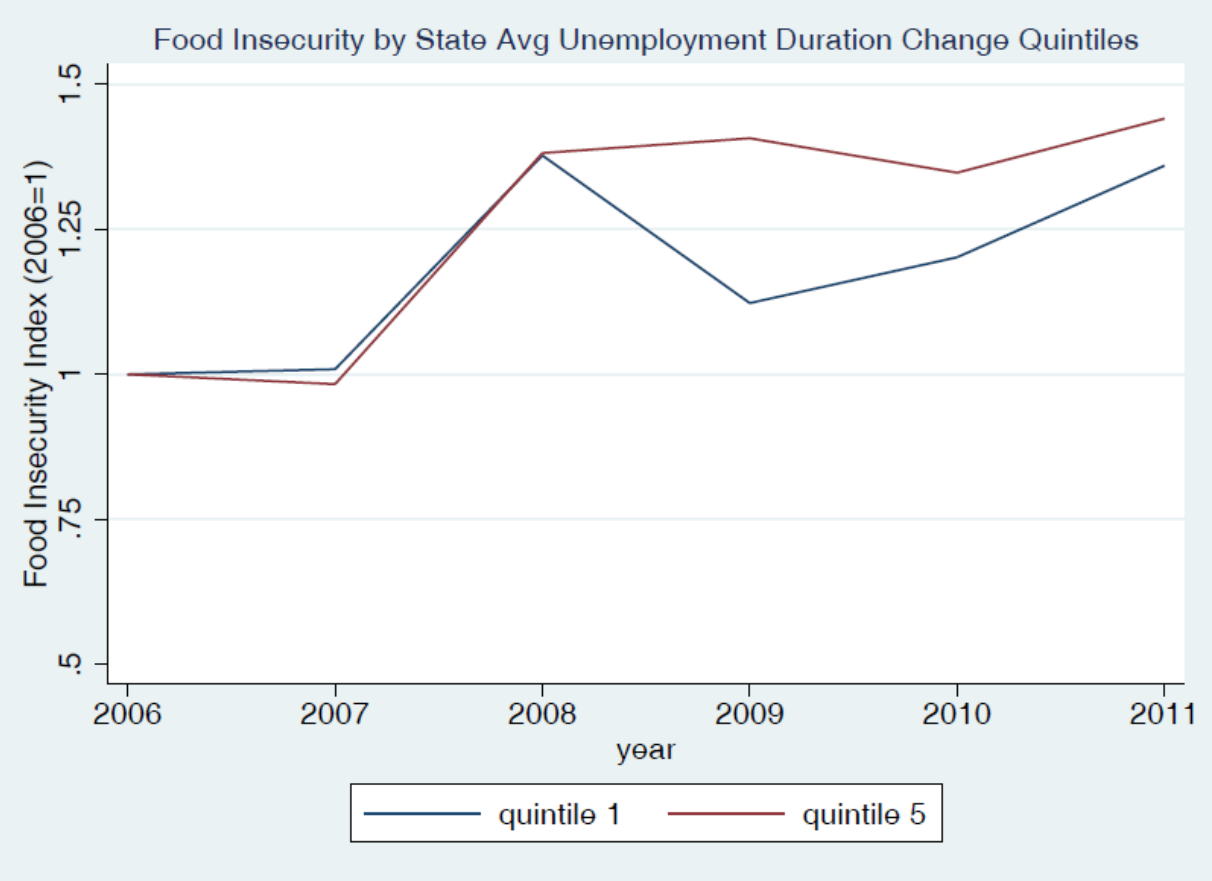


Figure 6: Change in Credit over the Great Recession

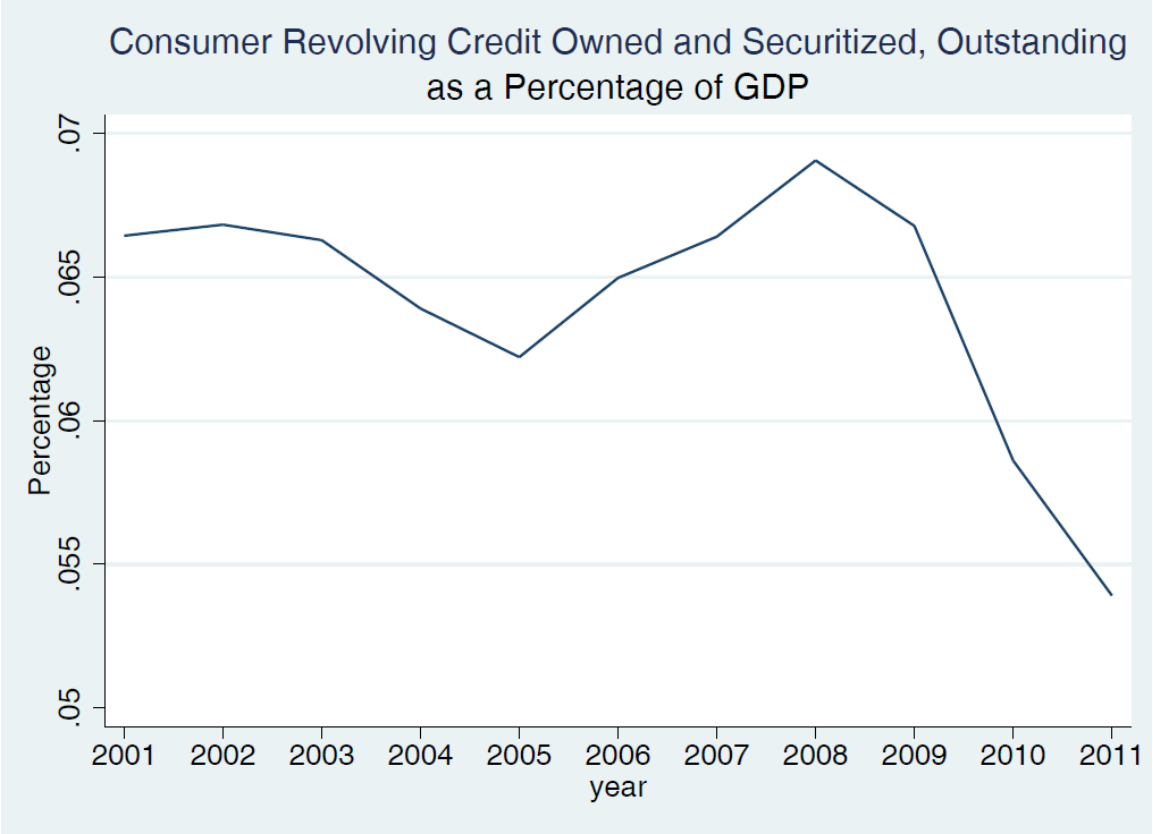


Figure 7: Household Financial Leverage in 2006 by State

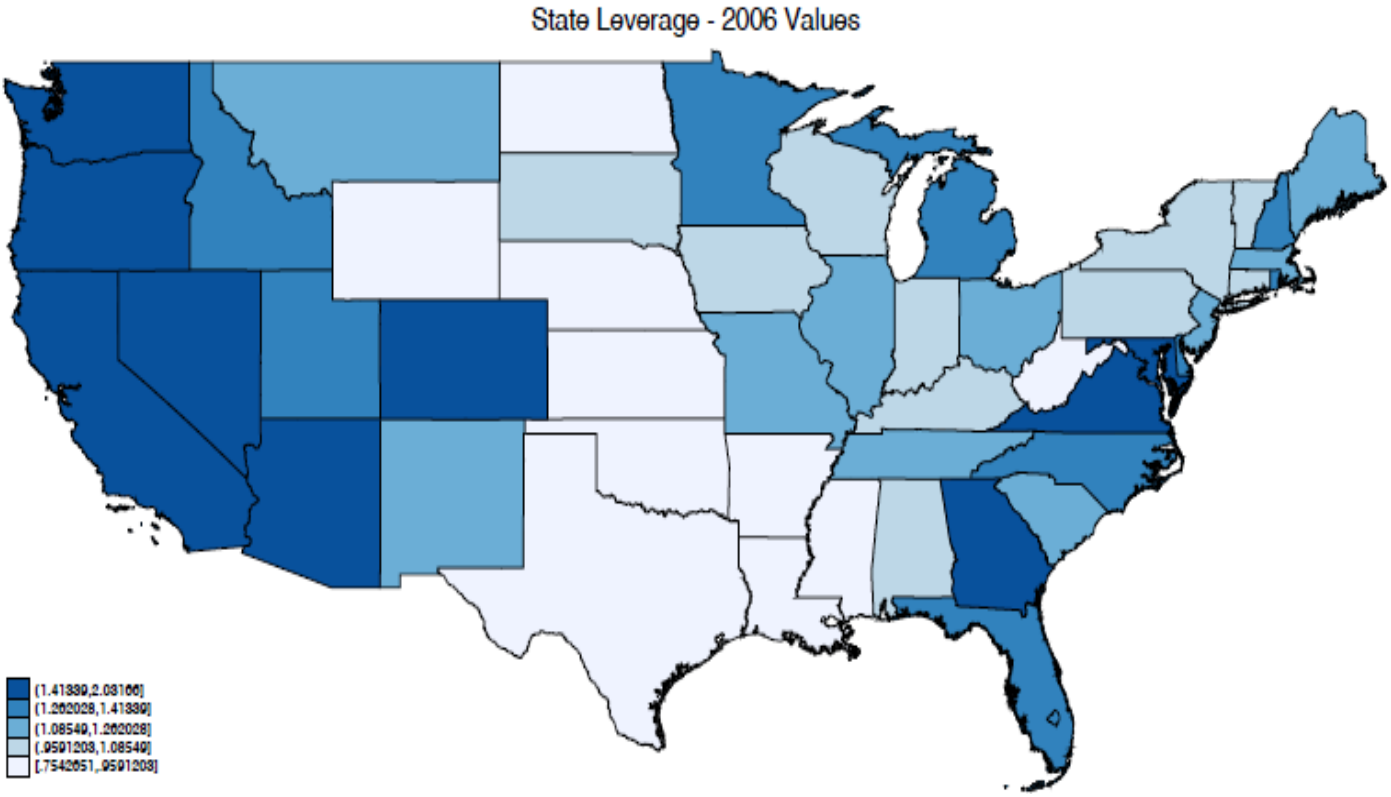


Figure 8: Food Insecurity Rates by State Leverage Quintiles

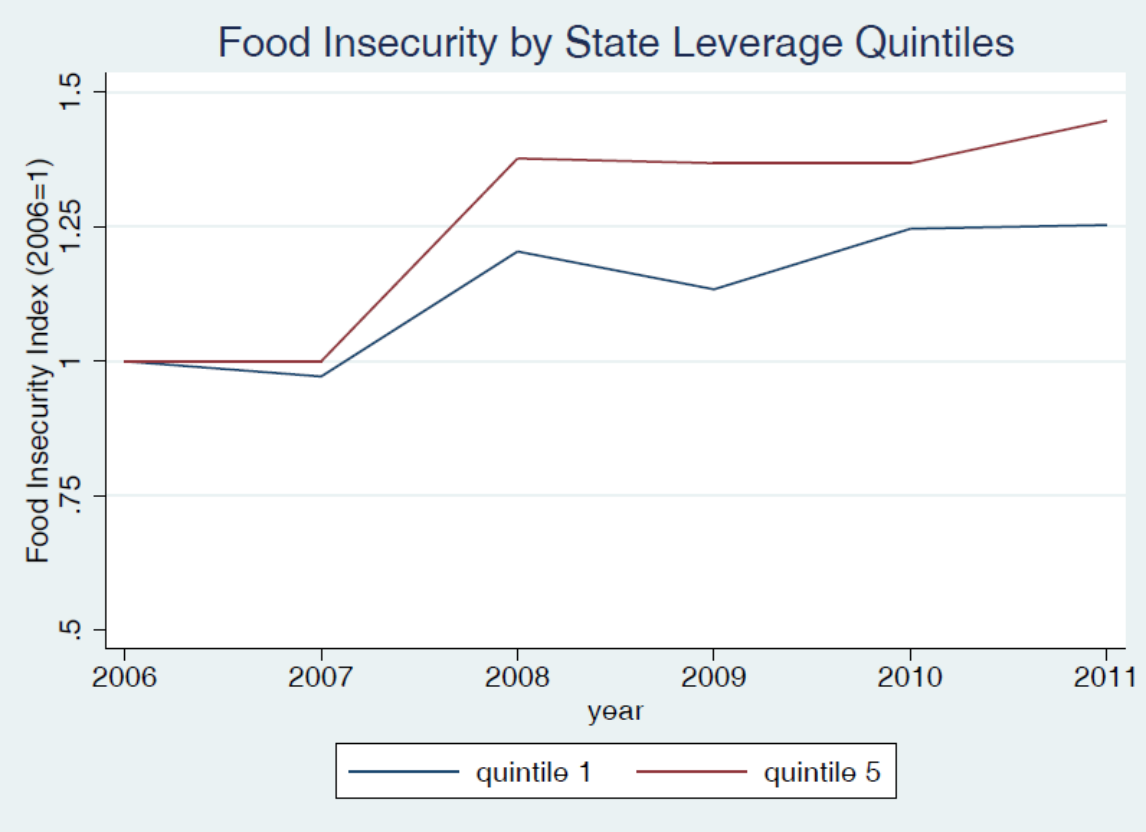


Figure 9: Changes in Housing Prices by State during the Great Recession

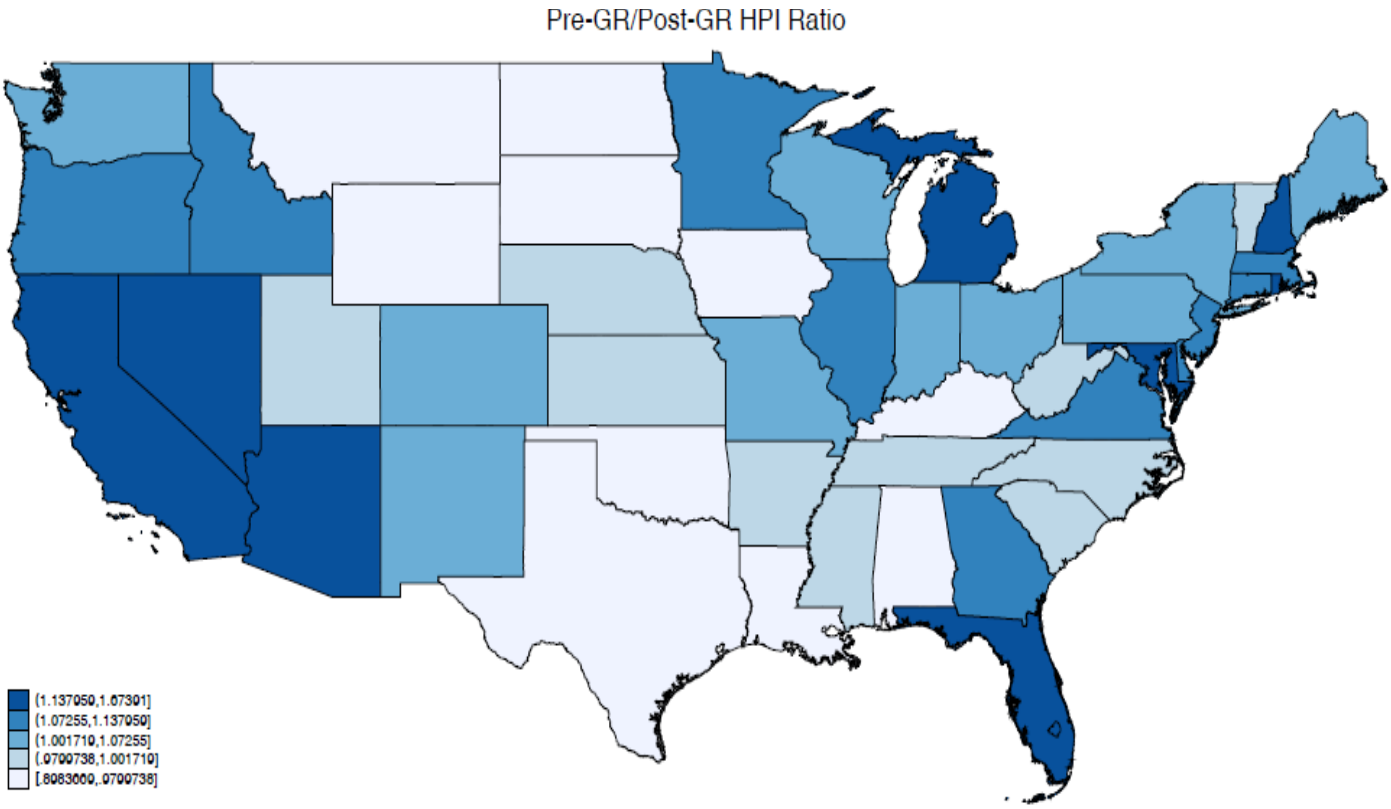


Figure 10: Food Insecurity Rates by Homeowner Status

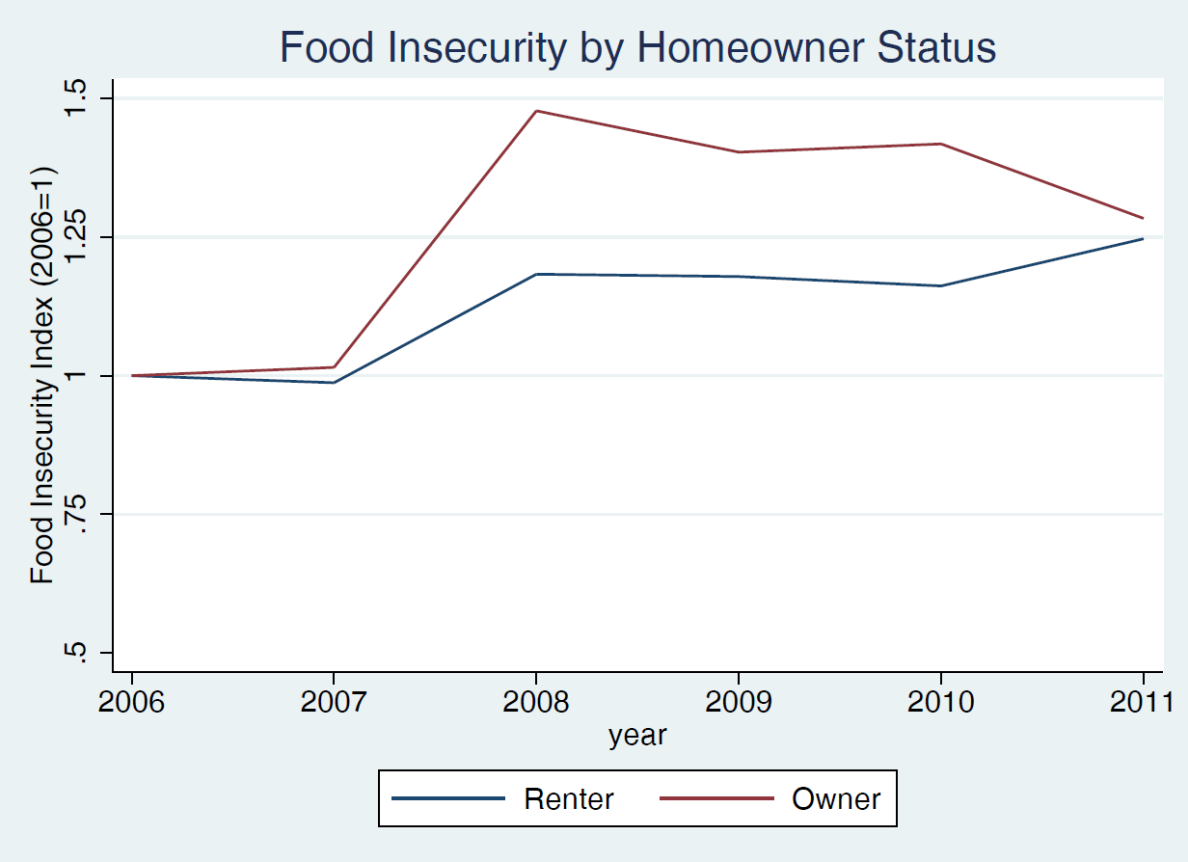


Figure 11: Food Insecurity Rates by Quintile of Housing Price Decline

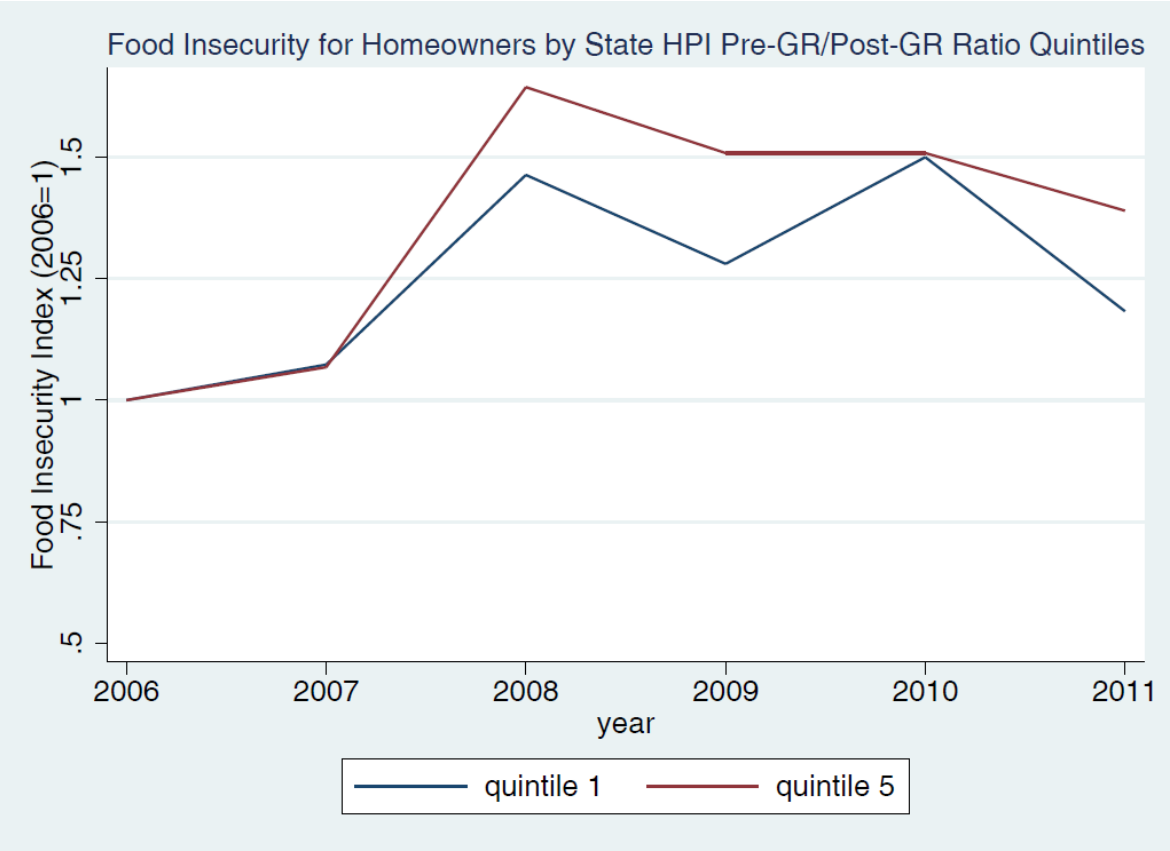

Food Insecurity for Homeowners by State HPI Pre-GR/Post-GR Ratio Quintiles
Food Insecurity Index (2006=1)
.5
.75
1
1.25
1.5
2006
2007
2008
2009
2010
2011
year
quintile 1
quintile 5

Figure 12: Personal Saving as a Percentage of Disposable Income

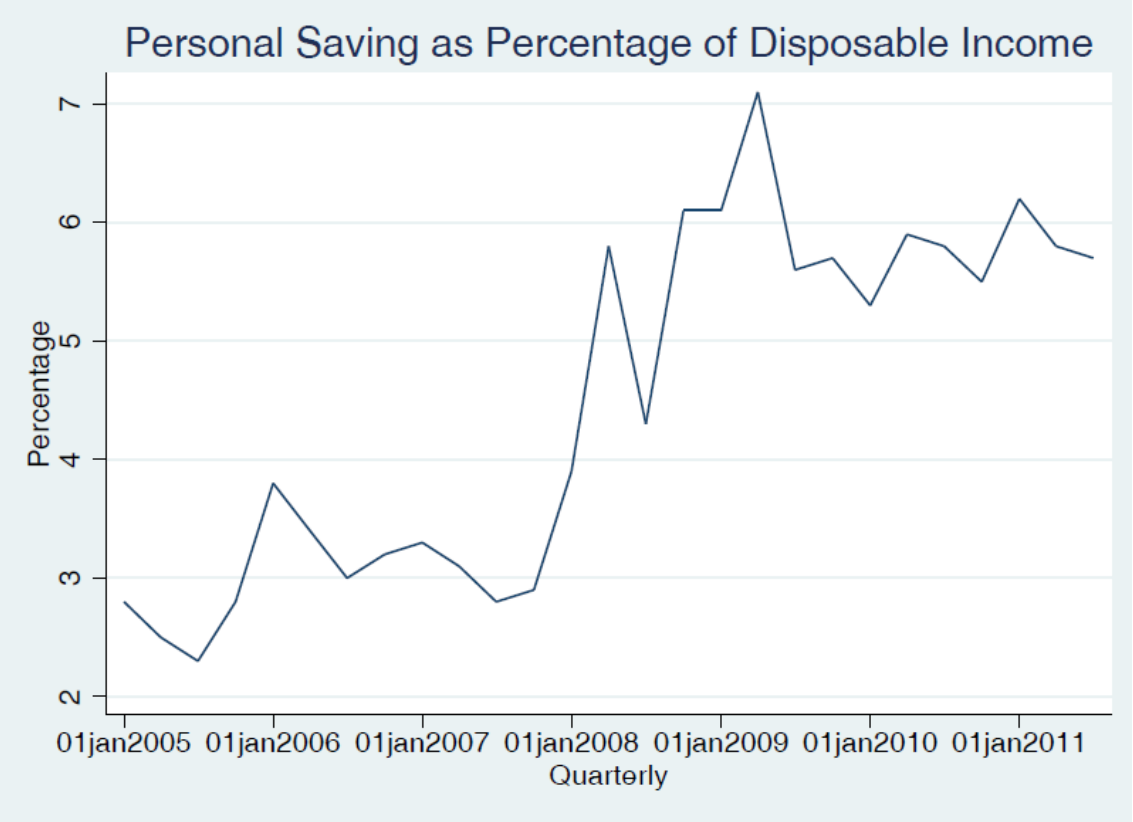


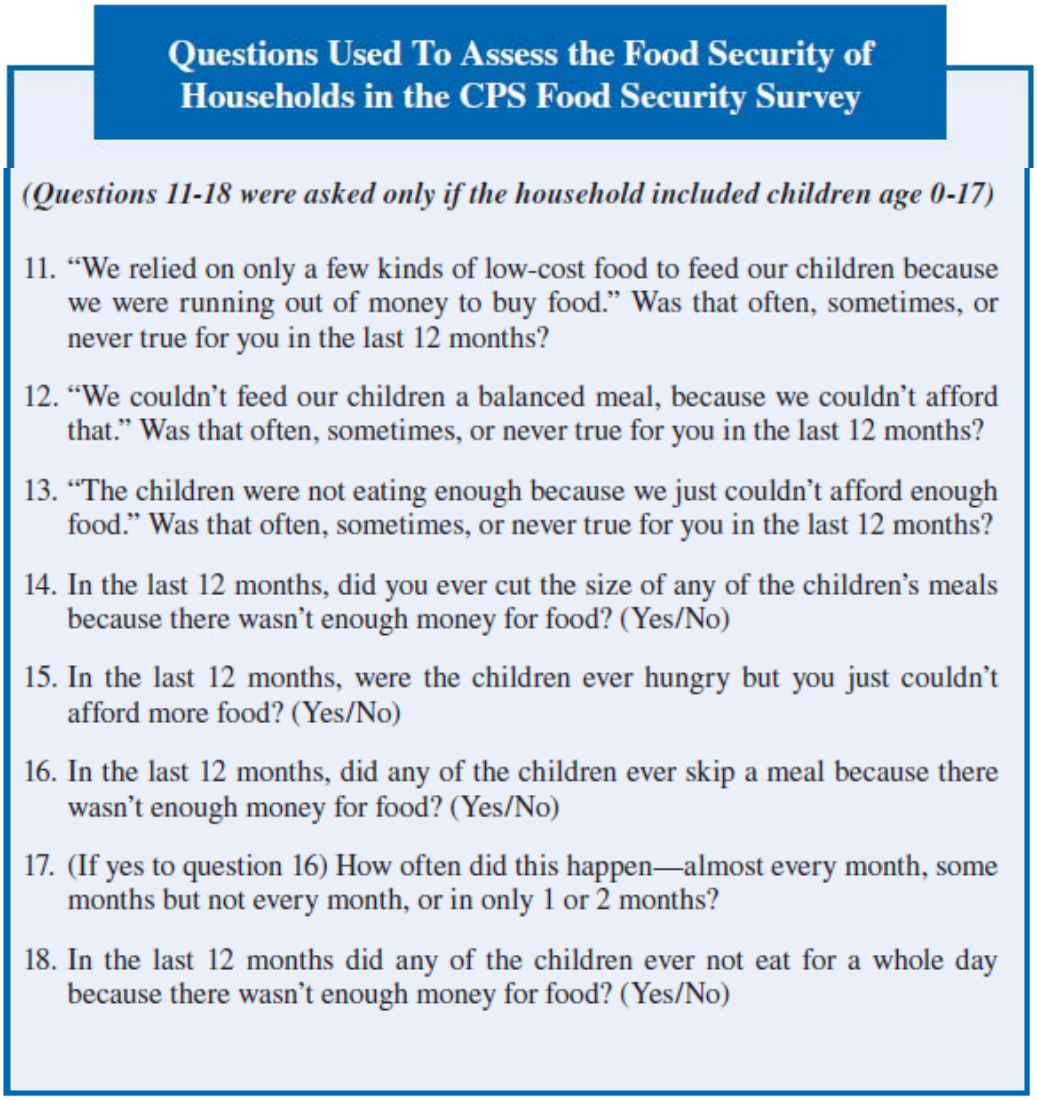
Table 1a: Questions Included in the Food Security Scale (all Households)

Questions Used To Assess the Food Security of Households in the CPS Food Security Survey

1. "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?
2. "The food that we bought just didn't last and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?
3. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?
4. In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)
5. (If yes to question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
6. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)
7. In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)
8. In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)
9. In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)
10. (If yes to question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

Source: *Household Food Security in the United States in 2011 / ERR-141.* Economic Research Service/USDA.

Table 1b: Questions Included in the Food Security Scale (Households w/ Children)



Questions Used To Assess the Food Security of Households in the CPS Food Security Survey

(Questions 11-18 were asked only if the household included children age 0-17)

11. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?
12. "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, sometimes, or never true for you in the last 12 months?
13. "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 12 months?
14. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)
15. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)
16. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)
17. (If yes to question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?
18. In the last 12 months did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

Source: *Household Food Security in the United States in 2011 / ERR-141.* Economic Research Service/USDA.

Table 2: Effect of Unemployment Duration on Food Insecurity Over the Great Recession

	(1)	(2)
Highest Quintile State for 2009/2007	-0.003	-0.002
Average Unemployment Duration	(0.005)	(0.012)
Great Recession	0.025***	0.045***
	(0.002)	(0.004)
Great Recession *	0.016***	0.019**
highest duration quintile state	(0.005)	(0.008)
Less than 300% of Poverty Line?		YES
Observations	150,736	68,397

Notes: Robust standard errors in parentheses, clustered at the state level. Model (1) includes 33 income/poverty bins – 20-point bins up 400% of the poverty line, 50-point bins up to 1000%, and one dummy for all higher-income households. Model (2) includes 15 income/poverty bins – 20-point bins up to 300% of the poverty line, and then excludes all higher-income households. Marginal effects from probit model shown.

Table 3: Effect of Leverage on Food Insecurity Over the Great Recession

	(1)	(2)
Highest leverage quintile state	0.006	0.012
	(0.005)	(0.009)
Great Recession	0.027***	0.047***
	(0.003)	(0.004)
Great Recession *	0.010	0.011
highest leverage quintile state	(0.007)	(0.011)
Less than 300% of Poverty Line?		YES
Observations	150,736	68,397

Notes: Robust standard errors in parentheses, clustered at the state level. Model (1) includes 33 income/poverty bins – 20-point bins up 400% of the poverty line, 50-point bins up to 1000%, and one dummy for all higher-income households. Model (2) includes 15 income/poverty bins – 20-point bins up to 300% of the poverty line, and then excludes all higher-income households. Marginal effects from probit model shown.

Table 4: Effect of Housing Crisis on Food Insecurity Over the Great Recession

	(1)	(2)	(3)	(4)	(5)	(6)
Great Recession	0.028***	0.025***	0.015***	0.049***	0.044***	0.031***
	(0.003)	(0.002)	(0.002)	(0.005)	(0.004)	(0.004)
Homeowner	-0.083***			-0.128***		
	(0.005)			(0.010)		
Great Recession*	-0.001			-0.003		
Homeowner	(0.004)			(0.007)		
Biggest Housing Price Drop Quintile State		-0.007	-0.011**		-0.010	-0.027**
		(0.005)	(0.004)		(0.012)	(0.011)
Great Recession*		0.016***	0.014**		0.020**	0.022*
Biggest Housing Price Drop Quintile State		(0.006)	(0.006)		(0.009)	(0.012)
Homeowners only?			YES			YES
Less than 300% of Poverty Line?				YES	YES	YES
Observations	150,736	150,736	107,794	68,397	68,397	39,244

Notes: Robust standard errors in parentheses, clustered at the state level. Models (1)-(3) includes 33 income/poverty bins – 20-point bins up to 400% of the poverty line, 50-point bins up to 1000%, and one dummy for all higher-income households. Models (4)-(6) include 15 income/poverty bins – 20-point bins up to 300% of the poverty line, and exclude all higher-income households. Marginal effects from probit models shown.

Table 5: Combined Effect of Leverage, Housing and Unemployment Duration on Food Insecurity Over the Great Recession

	(1)	(2)
Great Recession	0.023***	0.043***
	(0.002)	(0.005)
Highest leverage quintile state	0.011*	0.019*
	(0.006)	(0.010)
Biggest Housing Price Drop Quintile State	-0.010**	-0.018**
	(0.004)	(0.008)
Highest Quintile State for 2009/2007	-0.001	0.001
Average Unemployment Duration	(0.004)	(0.007)
Great Recession *	0.002	0.001
highest leverage quintile state	(0.004)	(0.008)
Great Recession*	0.009	0.012
Biggest housing price drop quintile state	(0.007)	(0.010)
Great Recession *	0.009	0.011
highest duration quintile state	(0.006)	(0.010)
Less than 300% of Poverty Line?		YES
p-value for test of joint significance	0.0006	0.0218
Observations	150,736	68,397

Notes: Robust standard errors in parentheses, clustered at the state level. Model (1) includes 33 income/poverty bins – 20-point bins up 400% of the poverty line, 50-point bins up to 1000%, and one dummy for all higher-income households. Model (2) includes 15 income/poverty bins – 20-point bins up to 300% of the poverty line, and then excludes all higher-income households. Marginal effects from probit model shown.

Table 6: Simulating Income Increase Necessary to Shift Pre-GR Food Insecurity Rate over to Post-GR Food Insecurity Rate

Income/Poverty Bin	Weekly Increase Needed	Percent Increase Needed
40 to 60%	$117	14.6%
60 to 80%	$94	8.5%
80 to 100%	$170	12.0%
100 to 120%	$254	14.7%
120 to 140%	$301	14.7%
140 to 160%	$240	10.2%
160 to 180%	$230	8.6%
180 to 200%	$219	7.3%
200 to 220%	$216	6.6%
220 to 240%	$180	5.0%
240 to 260%	$89	2.3%
260 to 280%	$16	0.4%
280 to 300%	$41	0.9%

Notes: See text for details of this calculation.